

Hungry Lion Resource Management Project Environmental Assessment



Lion Lake, Hungry Horse-Glacier View Ranger District



For More Information Contact:
Rob Davies – District Ranger
Sarah Canepa – Planning Team Leader
Hungry Horse – Glacier View Ranger District
10 Hungry Horse Drive, P.O. Box 190340
Hungry Horse, MT 59919
(406) 387-3800

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Contents

Chapter 1 – Purpose and Need	1
Chapter 2 – Alternatives	11
Chapter 3 – Affected Environment and Environmental Consequences	49
Forest Vegetation	59
Fire/Fuels.....	109
Threatened, Endangered, and Sensitive Plants.....	127
Invasive Plant Species	145
Soils	167
Aquatics.....	187
Threatened and Endangered Wildlife Species.....	273
Canada Lynx.....	273
Lynx Critical Habitat.....	295
Grizzly Bear	302
Wolverine	323
Sensitive Wildlife Species.....	333
Bald Eagle	335
Black-backed Woodpecker.....	339
Common Loon.....	344
Gray Wolf.....	347
Boreal Toad	352
Fisher.....	357
Analysis Summary for Sensitive Species with No Impact	366
Management Indicator Species: Big Game Species	371
Wildlife – Old Growth Associates and Bird Species of Concern.....	383
Recreation.....	401
Inventoried Roadless Areas	413
Scenery	417
Air Quality.....	435
Heritage Resource	443
Social and Economic Resource	449
Appendix A – List of Individuals who Received Notification	459
Appendix B – Literature Cited	461

List of Tables

Table 1. Alternative 2: Proposed vegetation treatments	16
Table 2. Alternative 2: Vegetation treatment units.....	19
Table 3. Alternative 2: Road management	24
Table 4. Alternative 2: Prescribed burning units	25
Table 5. Alternative 2: Aquatic improvements	25
Table 6. Alternative 3: Proposed vegetation treatments	27
Table 7. Alternative 3: Vegetation treatment units.....	28
Table 8. Alternative 3: Road management	30
Table 9. Alternative 3: Prescribed burning units	30
Table 10. Alternative 3: Aquatic improvements	31
Table 11. Alternative 4: Proposed vegetation treatments	32
Table 12. Alternative 4: Vegetation treatment units.....	33
Table 13. Alternative 4: Road management	36
Table 14. Alternative 4: Prescribed burning units	36

Table 15. Alternative 4: Aquatic improvements	37
Table 16. Comparison of alternatives by proposed activities.....	37
Table 17. Comparison of alternatives by measurement indicators.....	38
Table 18. Vegetative units requiring winter harvest.....	39
Table 19. Unit specific design features for scenic resource	45
Table 20. Past, Ongoing, Reasonably foreseeable activities in the Hungry Lion project area	51
Table 21. Acres and percent of forest cover types in the Hungry Lion project area	67
Table 22. Acres and percent of dominant forest size classes in the Hungry Lion project area	70
Table 23. Acres and percent of forest canopy cover in the Hungry Lion project area	71
Table 24. Successional stages and old growth forest in the Hungry Lion project area	72
Table 25. Western Montana Zone old growth type characteristics within habitat type groups found in the project area	73
Table 26. Comparison of historic and current estimations of late seral quantity	75
Table 27. Estimated levels of snag and down woody material in the project area	76
Table 28. Comparison of treatments.....	103
Table 29. Comparison of treatments.....	104
Table 30. Fuels categories found in the project area and fuels categories post treatment.....	113
Table 31. Expected fire behavior by fuel category under moderate and extreme fire weather conditions.....	114
Table 32. Fire regime condition classes definition (Schmidt et al. 2002)	114
Table 33. Cause of fire starts 1986 to 2016.....	117
Table 34. Existing conditions for the fire regime condition class within the Hungry Lion project area (percent of project area).....	118
Table 35. Acres treated by alternative	120
Table 36. Acres of fuels categories following treatments	121
Table 37. Factors contributing to weed movement in a project area.....	149
Table 38. Definitions of risk criteria based on contributing factors	149
Table 39. Non-native invasive plants found within the Hungry Lion project area (infested acres are rounded to the nearest integer; less than 0.01 acres = trace)	151
Table 40. Non-native invasive species found forestwide, on the Hungry Horse District, and in the Hungry Lion project area. T=Trace not included in sums	160
Table 41. Cumulative effects summary of light availability in the project area ¹	163
Table 42. Existing detrimental soil disturbance	170
Table 43. Alternative 2. Landtypes of treatment units	171
Table 44. Potential soil erosion – mechanical treatments.....	178
Table 45. Potential soil erosion – temporary roads	180
Table 46. Cumulative effects summary.....	181
Table 47. Detrimental soil disturbance and erosion by alternative	185
Table 48. Existing ECA summary for analysis area subwatersheds	192
Table 49. Road/stream connectivity and road/wetland interaction	193
Table 50. Road crossing density by subwatershed.....	195
Table 51. Estimated sediment delivery within analysis area subwatersheds.....	196
Table 52. Stream culvert work identified through field observations in 2015 and 2016	197
Table 53. Measured water quality parameters in project area streams relative to State standards.....	202
Table 54. Estimated ECA associated with alternative 2.....	209
Table 55. Road related attributes affecting hydrologic processes	210
Table 56. Potential sediment delivery associated with implementation of alternative 2.....	214
Table 57. Disturbed WEPP model outputs for sediment delivery (20 percent probability).....	215
Table 58. Estimated maximum sediment delivery (yield) associated with ISS and temporary roads.....	217
Table 59. Maximum estimated sediment delivery from proposed road reroute and associated reclamation	218

Table 60. Maximum estimated sediment delivery (yield) from hypothetical culvert failure and culvert replacement	220
Table 61. Aquatic habitat connectivity restoration through proposed AOP projects	230
Table 62. Cumulative sediment delivery within affected subwatersheds.....	233
Table 63. South Fork Flathead River subbasin cumulative sediment delivery	235
Table 64. Abbot Creek subwatershed cumulative sediment delivery.....	236
Table 65. Estimated ECA values associated with land use proposals under alternative 3	237
Table 66. Road related attributes affecting hydrologic processes	238
Table 67. Potential sediment delivery associated with implementation of alternative 3.....	240
Table 68. Estimated maximum sediment delivery (yield) from ISS and temporary roads	241
Table 69. Estimated maximum sediment delivery (yield) from hypothetical culvert failure and culvert replacement.	243
Table 70. Cumulative sediment delivery within affected subwatersheds.....	250
Table 71. Cumulative sediment delivery in the South Fork Flathead River subbasin.....	252
Table 72. Estimated ECA values relative to existing conditions and historic variability	254
Table 73. Potential sediment delivery associated with implementation of alternative 4.....	256
Table 74. Estimated maximum sediment delivery (yield) associated with hypothetical culvert failure, replacement, and removal.....	257
Table 75. Cumulative sediment delivery within affected subwatersheds.....	263
Table 76. Estimated maximum cumulative sediment delivery potential in the South Fork Flathead River subbasin	265
Table 77. Review of bull trout critical habitat PCE	268
Table 78. Threatened, endangered, and proposed species and critical habitat known or suspected to occur within the influenced area of project activities.....	273
Table 79. Comparison of effects to lynx foraging habitat across all project Lynx Analysis Units by alternative	273
Table 80. Existing condition of lynx habitat and successional stages in the Hungry Lion Project Lynx Analysis Units	277
Table 81. Alternative 2 changes to successional stages of lynx habitat in the Hungry Lion Project Lynx Analysis Units	279
Table 82. Alternative 2. Approximate acres of existing lynx habitat structural stage affected by treatments.	280
Table 83. Alternative 2. Effects to high quality denning conditions in the project Lynx Analysis Units ..	282
Table 84. Alternative 3. Changes to successional stages of lynx habitat in the Hungry Lion Project Lynx Analysis Units	284
Table 85. Alternative 3. Approximate acres of existing lynx habitat structural stage affected by treatments	285
Table 86. Alternative 3. Effects to high quality denning conditions in the project Lynx Analysis Units ..	286
Table 87. Alternative 4. Changes to successional stages of lynx habitat in the Hungry Lion Project Lynx Analysis Units	288
Table 88. Alternative 4. Approximate acres of existing lynx habitat structural stage affected by treatments	289
Table 89. Alternative 4. Effects to high quality denning conditions in the project Lynx Analysis Units ..	289
Table 90. Comparison of effects to critical habitat primary constituent elements for project alternatives	295
Table 91. Estimated existing stand conditions that contribute to PCE1a and PCE1d within Canada lynx critical habitat	297
Table 92. Estimated stand conditions that contribute to PCE1c within Canada lynx critical habitat.....	297
Table 93. Summary of effects to lynx critical habitat primary constituent elements (PCEs) by alternative and Lynx Analysis Unit.....	298

Table 94. Effects of action alternatives on the primary constituent elements for designated lynx critical habitat	299
Table 95. Amendment 19 existing situation	305
Table 96. Existing conditions within grizzly bear subunits potentially affected.....	306
Table 97. Summary of management situation lands within the project subunits	307
Table 98. During and post project percentage of subunit area with >1 mi/mi ² open motorized access density, >2 mi/mi ² total motorized route density and security core, alternative 2.....	311
Table 99. During and post project percentage of subunit area with >1 mi/mi ² open motorized route density, >2 mi/mi ² total motorized route density and security core, alternative 3.....	316
Table 100. During and post project percentage of subunit area with >1 mi/mi ² open motorized route density, >2 mi/mi ² total motorized route density and security core, alternative 4.....	319
Table 101. Sensitive wildlife species on the Flathead National Forest	333
Table 102. Comparison of vegetation treatment acres within 0.5 miles of eagle nesting habitat by alternative	337
Table 103. Acres of potential fisher habitat treated by Hungry Lion alternatives.....	361
Table 104. Summary of effects to potential fisher habitat by action alternative	361
Table 105. Acres of potential fisher habitat treated by Hungry Lion alternative	363
Table 106. Summary of effects to important fisher denning/resting habitat by treatment prescription ...	363
Table 107. Sensitive species analysis summary – species with no impact.....	366
Table 108. Existing condition of thermal cover on winter range in the Hungry Lion project area.....	372
Table 109. Effects to hiding cover within the project area.....	376
Table 110. Approximate increase in ungulate high quality forage areas by alternative.....	377
Table 111. Effects to thermal cover and post project percentage.....	377
Table 112. Effects to existing elk security areas by alternative	378
Table 113. Observations on the Flathead National Forest of neotropical migratory birds listed that have conservation concerns	385
Table 114. Birds of conservation concern in the Flathead basin (BCR10)	387
Table 115. Effects of regeneration units adjacent to old growth	391
Table 116. Acres of potential goshawk habitat affected by alternative.....	394
Table 117. Summary of travel-way/use area based observer points and their visual quality objectives, distance zones to project units and concern levels	422
Table 118. Summary of impacts with views of moderate concern from intermediate harvest treatment	429
Table 119. Summary of impacts with views of high concern from regeneration harvest treatment	430
Table 120. Units impacting high concern viewsheds by alternative	432
Table 121. Alternative 2 air quality emissions.....	439
Table 122. Project feasibility and financial efficiency summary	455
Table 123. Economic impacts - employment and labor income, total and annual (Thousands of 2014 \$)	456

List of Figures

Figure 1. Vicinity map.....	2
Figure 2 Year 2080. Stand Conditions after 70 years of growth in an un-thinned sapling stand.....	81
Figure 3. Year 2010 Existing stand conditions in a sapling stand.....	81
Figure 4. Year 2080. Stand conditions after 70 years of growth in an un-thinned sapling stand.....	88
Figure 5. Year 2080. Stand conditions after 70 years of growth in a thinned sapling stand	88
Figure 6. Passive crown fire behavior (torching)	112
Figure 7. Active crown fire	112
Figure 8. Total road mileage vs. infested road mileage in the Hungry Lion project area. NA=Non-NFS ownership.	155
Figure 9. Increase in light availability by alternative	158

Figure 10. Visibility and observer point location map. Immediate foreground (IFg) and foreground (Fg) distance zones from the concern level 1 & 2 roads and concern level 1 reservoir are also indicated	424
Figure 11. Treatment units by management area and visual quality objective relative to observer points.	426
Figure 12. Montana/Idaho airshed group map, airshed 2	436

List of Abbreviations

A19	Amendment 19
AOP	aquatic organism passage
ASCC	Adapted Silviculture for Climate Change
ATV	all-terrain vehicle
BCR	bird conservation regions
BE	biological evaluation
BMP	best management practices
BNSF	Burlington Northern Santa Fe
BO	biological opinion
CFR	Code of Federal Regulations
CCF	hundred cubic feet
CLIGEN	(Database in aquatics)
CMP	corrugated metal pipe
CRB	Columbia River Basin
d.b.h.	diameter at breast height
DEQ	Department of Environmental Quality
DNA	deoxyribonucleic acid
DPS	distinct population segment
DSD	detrimental soil disturbance
DWD	Down woody material
EA	Environmental Assessment
ECA	equivalent clearcut area
EIS	environmental impact statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
EHHSRP	Eastside Hungry Horse Recreation Site Renovation Project
FACTS	Forest Service Activity Tracking System
FEIS	Final Environmental Impact Statement
FIA	Forest Inventory and Analysis
FMO	Foraging, Migratory and Overwinter
FONSI	finding of no significant impact
FRCC	Fire Regime Condition Class
FRSS	regional forester's sensitive species
FVS	Forest Vegetation Simulator
GIS	geographic information system
HRV	historical range of variation
HUCs	Hydrologic Unit Codes
ID team	interdisciplinary team
IGBC	Interagency Grizzly Bear Committee
IMPLAN	Impact Analysis for Planning
INFISH	Inland Native Fish Strategy
INFRA	Infrastructure for the National Database

IRA	inventoried roadless area
ISS	intermittent stored service
LAU	Lynx Analysis Unit
LCAS	Lynx Conservation Assessment and Strategy
LRMP	Land and Resource Management Plan (Forest Plan)
MA	management area
MAPS	Monitoring Avian Productivity and Survivorship
MDEQ	Montana Department of Environmental Quality
mi	mile
MIS	management indicator species
ML	maintenance level
mmbf	million board feet
MFWP	Montana Fish Wildlife and Parks
MNHP	Montana Natural Heritage Program
MOU	Memorandum of understanding
MP	milepost
mph	miles per hour
MS	management situation
NAIP	National Agriculture Imagery Program
NEPA	National Environmental Policy Act
NFMA	National Forest Management Act
NFS	National Forest System
NHD	National Hydrography Dataset
NRCS	Natural Resources Conservation Service
NRLMD	Northern Rockies Lynx Management Direction
NRM	Natural Resource Management database
OHVs	Off-highway vehicles
OMAD	Open Motorized Access Density
PACFISH	Pacific Fish Strategy
PCE	Primary Constituent Elements
PIBO	PACFISH/INFISH Biological Opinion
PM	particulate matter
R1-VMP	Region 1 Vegetation Map Product
RHCA	riparian habitat conservation area
RMRS	Rocky Mountain Research Station
RNA	research natural area
ROD	Record of Decision
SMS	Scenery Management System
SR	Spawning and rearing
TAP	Travel Analysis Process
TES	Threatened and Endangered Species
TMAD	Total Motorized Access Density
TMDL	total maximum daily load
TSS	total suspended solids
USDA	United States Department of Agriculture
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
VMap	Vegetation Mapping Project
VMS	Visual Management System
VQO	Visual Quality Objective
WEPP	Water Erosion Prediction Program

WUI..... Wildland-urban interface

Chapter 1 – Purpose and Need

Introduction

The Hungry Lion Resource Management Project (Hungry Lion) was developed to address multiple resource objectives in an area on the Hungry Horse-Glacier View Ranger District of the Flathead National Forest.

This Environmental Assessment conforms to 40 CFR 1500-1508. It is a public document that serves to provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding that the action will not have a significant effect on the human environment. It includes a discussion of the need for the proposal, the environmental impacts of the proposed action and alternatives in accordance with section 102(2)(E) of the National Environmental Policy Act, and a listing of agencies and persons consulted.

Additional documentation is located in the project file at the Hungry Horse-Glacier View 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 specialist's analysis. These records are available for public review.

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

Location of the Proposed Project Area

The Hungry Lion project area is approximately 37,090 acres in size and is bounded to the northwest by the communities of Hungry Horse, Martin City, and Coram, to the south by Hungry Horse Reservoir and to the east by the Great Bear Wilderness (refer to Figure 1). Approximately 32 percent (12,122 acres) of the project area is located within the wildland-urban interface (WUI) and has been identified as a high priority for treatment. The project area includes the 7,500 acre Coram Experimental Forest and Coram Research Natural Area www.fs.fed.us/rmrs/experimental-forests-and-ranges/coram-experimental-forest . The project area also includes approximately 6,563 acres of the Bear-Marshall-Scapegoat-Swan Inventoried Roadless Area (IRA) on its eastern boundary, adjacent to the Great Bear Wilderness. This project area is within the Coram Lake Five and Emery Firefighter grizzly bear subunits, an area that approximates the size of a female home range and is commonly used to analyze the status of habitat security for grizzly bears. Figure 1 below shows the location of the Hungry Lion Project in Northwest Montana.

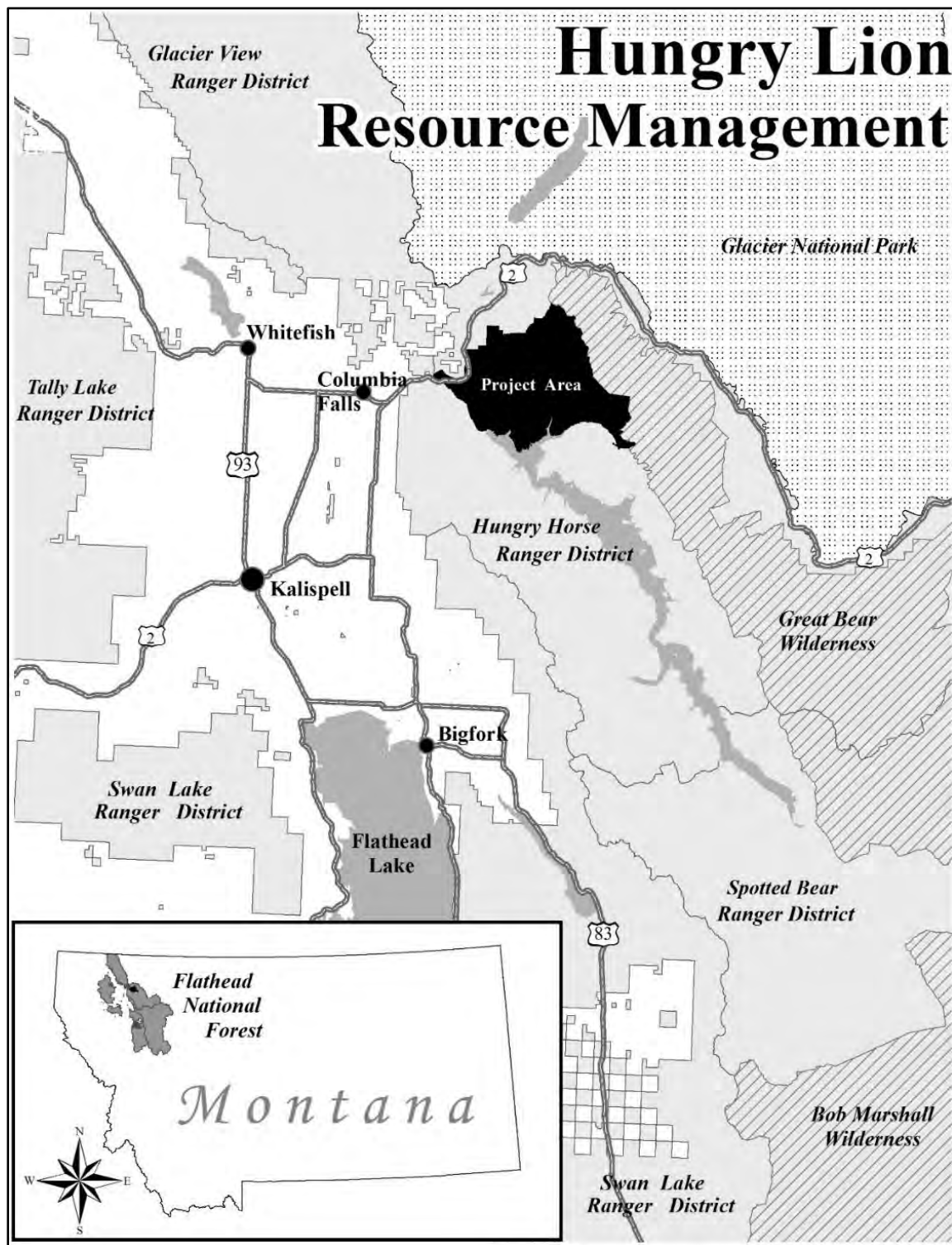


Figure 1. Vicinity map

Purpose and Need for Action

The need for the Hungry Lion Resource Management Project was derived from the differences between the existing condition of specific resources in the project area and the desired landscape condition. The Flathead National Forest Land and Resource Management Plan (forest plan) provides the primary management direction related to the goals/desired condition of these resources. The following purposes for the proposed project addresses these differences:

Maintain or improve the diversity and health of forest vegetative communities by:

- a. Increasing forest structural and species diversity, including the restoration of western white pine and ponderosa pine as a major member of forest communities;
- b. Improving the resistance of forest vegetation to potential future disturbances (wildfire, disease or insect infestations) and climate change; and
- c. Reducing tree densities and improving growth on remaining trees;
- d. Promoting mid-seral stands into old growth habitat; and
- e. Restoration of whitebark pine through the use of prescribed fire and planting.

Reduce the risk to wildland firefighters and residents of the wildland urban interface should a fire occur by:

- a. Creating forest stand conditions that lower the risk of future high-intensity and high-severity wildfire.
- b. Creating defensible space along open system roads by creating shaded fuel breaks to improve firefighter safety and effectiveness of suppression tactics in the face of longer and hotter fire seasons.

Maintain or improve timber productivity on suitable lands and provide a variety of wood products to the local economy.

Maintain, improve, or restore hydrologic processes, water quality, and aquatic habitat throughout the project area by reducing road/stream interaction by:

- a. Improving aquatic organism passage (AOP) in Abbot Creek, South Fork Abbot Creek, an unnamed tributary to Emery Creek, and Hungry Horse Creek.
- b. Improve flow capacity at stream crossings by replacing culverts and rerouting roads where necessary.

Increase recreational opportunities and improve visitor safety at developed and dispersed recreation sites by:

- a. Increasing recreational opportunities and improve traffic flow at the North Lion Lake Day Use Area.
- b. Add historical trails back to the National Forest System (NFS) trail system to aid in responsible resource management.

These purposes are discussed in more detail below.

Maintain or improve the diversity and health of forest vegetative communities

The purpose and need for the Hungry Horse project is based on direction in the Flathead National Forest Plan (1986) and the guiding concept of ecosystem-based management. The overall desired condition for the forest resource in the project area is to create and/or maintain ecologically healthy and sustainable vegetative conditions while providing for compatible levels of human use (Wood, 1994). These forests should be resilient in the face of future change and uncertainties. This means that the forests should be in a condition that allows them to adapt to and tolerate inevitable fluctuations in climate, insect or disease populations, fire events, and other unknown factors without experiencing socially unacceptable or severe “unnatural” levels of impacts. By managing forests within this concept of sustainability, they should be able to provide for a wide variety of resource and social benefits now and into the future. These benefits would include forest product outputs, recreational opportunities, wildlife habitat, watershed protection, and scenic values.

The historical range of variation (HRV) analysis conducted on the Flathead National Forest presented an evaluation and comparison of existing vegetation conditions against historical conditions within the landscape that includes the project area. Historical conditions (or historical range of variation) of a resource can provide a context, or reference point, for determining what an ecologically healthy and sustainable condition might look like. A premise of this approach is that native species (plants and animals) are adapted to the range of vegetation patterns resulting from historical disturbance events over many thousands of years and biodiversity and long term stability of the ecosystem, as well as species survivability, will be better maintained if we manage within the historical range of variation (Duncan, McComb, & Johnson, 2010; Alan E Harvey et al., 1994; Swanson, Jones, Wallin, & Cissel, 1993).

Though understanding the historical range of variation is important, it is also important to recognize that humans have been and will continue to be major drivers of change in this landscape and meeting the needs and desires of society is paramount. Society may desire conditions that differ greatly from historical conditions, such as a desire to avoid large scale fire events. Attempts to precisely recreate some historical resource condition are not necessarily wise or even feasible in most situations (Duncan et al., 2010; Paul F. Hessburg et al., 1999; E. D. Reinhardt, Keane, Calkin, & Cohen, 2008; Swanson et al., 1993). Strategies to develop sustainable forest conditions and devise treatment plans must be based on the acceptance and anticipation of the inevitability of future change - much of it human driven - as well as the historical range of variation and the dynamic nature of ecosystems (Hobbs & Cramer, 2008). Based on the concepts described above and Flathead National Forest Plan (1986) management direction, the proposed treatments are designed to move the forest resource towards a more resilient, sustainable and desired condition.

Vegetative treatments are designed to increasing forest structural and species diversity by reducing the predominance of spruce, subalpine fir which became established in the absence of regular disturbance. Both harvest and prescribed burning will help to restore western white pine and ponderosa pine as a major member of forest communities and will promote multiple species within a stand or between stands.

Some of the vegetative treatments are designed to promote mid-seral stands into old growth habitat by improve growth and vigor in stands (through a reduction in tree densities), and improve subsequent tree sizes, productivity and species compositions in the future stand. Treatments also seek to protect existing old growth where it is relatively “stable,” and promote development

(short and long term) of old growth forest structures where feasible in both dry- and moist-site forest types.

There is poor growth and vigor in many stands due to high tree densities. These stands are both older (80 plus years old) and have had high density throughout their development, and younger (less than 45 years) and originate from past timber harvest. In these younger stands the favored species, such as larch, is often being overtopped and outcompeted by less disturbance resilient species.

Treatments seek to promote western white pine and whitebark pine species by conserving healthy mature trees where they exist; reducing densities of young western white pine stands; and planting improved whitebark and western white pine on appropriate sites. Restore health and desirable species compositions of forests affected by white pine blister rust. Regeneration harvest and planting will be used to restore western white pine in lower elevations, where prescribed burning will be used to create suitable conditions where whitebark regeneration can be successful and planting can be considered.

Vegetation management is also seeking to create and maintain diverse patterns of forest composition and structural components across this landscape. Though the youngest forests in this landscape (less than 45 years old and originating from past regeneration harvesting) are mostly healthy and diverse in species, they are lacking in some forest structural components, such as multiple tree layers or amount of snags and down woody material, that would add to their value as wildlife habitat and contribute towards the diversification of forest conditions across the landscape.

Reduce the risk to wildland firefighters and residents of the wildland-urban interface should a fire occur

The NFS lands located in the western edge of the project area are interspersed with private property in the communities of Hungry Horse, Martin City, and Coram. Although past projects conducted in this area, such as Hungry Horse West Glacier (2003) and Belton Fuels Reduction Project (2008) began the process of reducing hazardous fuels adjacent to private lands, there are still untreated stands that have high crown density, with very little space between tree crowns, or have dense vegetation in the understory, creating ladder fuels.

Stands with dense vegetation in the understory are described as having ladder fuels that will allow a fire start on the ground to climb the “ladder of fuels” that allows it to move into the crown of the forest stand (J. K. Agee & Skinner, 2005). Once the fire is in the crown of the forest, the high density of tree crowns allows fire to spread through the stand because there is a continuous bed of fuel found in the tree crowns that are touching each other. Both ladder fuels and high crown density can result in a high-severity wildfire that is difficult to suppress and becomes particularly concerning on NFS lands intermixed with private lands, known as the wildland-urban interface (WUI).

Vegetation treatments in the WUI can reduce the understory fuels that would allow a fire to move into the tree crown. Thinning or regeneration type treatments will serve to increase crown spacing between trees, thereby breaking up the potential fuel bed in the event of a crown fire (R. T. Graham, McCaffrey, & Jain, 2004). Vegetative treatments can reduce both the intensity and the severity of a fire effects in the event of a wildfire and improve the success of fire suppression tactics in these areas. The public comments received indicate and interest from local residents to

see the forest stands adjacent to their private property thinned out to reduce fuels and increase space between tree crowns.

Treatments along NFS Road 38 are designed to create defensible space along open system roads where indirect fire suppression attacks can be employed (J.K. Agee et al., 2000). These fuel breaks can improve firefighter safety and effectiveness of suppression tactics when trying to manage a wildfire such that it will confine fires or break up the landscape into small fuel beds. The fuel breaks and harvest units located along Road 38 help to reinforce a break up of fuels on the landscape so that it is less likely for the fire to move across the landscape unchecked, when used in combination with other firefighting tactics. Such a fuel break could confine a wildfire to lands where the values at risk are much lower.

Maintain or improve timber productivity on suitable lands and provide a variety of wood products to the local economy

Forest plan management direction permits tree harvest on all the sites proposed for treatments. Most units are on lands considered suitable for timber management, where the scheduling of harvests is allowed and maintaining the timber productivity of the land is an objective. Many treatments would also provide a benefit to a society that relies on wood products.

Timber productivity would be maintained or enhanced by utilizing harvest prescriptions and practices that create healthy, resilient stand conditions, while protecting soil water and residual tree components. Conditions that promote regeneration of resilient tree species would be created. Thinning in existing dense sapling stands would occur to allow young trees to release and grow more freely, as well as favor the more desirable species compositions. Thinning would comply with current direction for lynx and forest plan standards. All management activities would be designed to be compatible with other resource values, such as recreation, soil, water, grizzly bear habitat, and big game habitat.

Maintain, improve, or restore hydrologic processes, water quality, and aquatic habitat throughout the project area by reducing road/stream interaction

The project area demonstrates a history of timber management with a current and historical road network. This road network has been updated and improved over the years to accommodate 100-year flood events, but field work has identified additional opportunities to upgrade culverts and realign them with stream crossings so that they can accommodate high water events in an area that receives 30 to 100 inches of precipitation annually.

In the upper Emery Creek drainage, two areas have been identified for proposed road rerouting to increase distance between the road bed and Emery Creek. This will build upon the past work that was done in the lower section of the drainage to reroute road 546 away from the stream bed.

The forest plan also provides direction to improve and maintain aquatic organism passage (AOP) in fish bearing streams. Field work identified certain culverts on Abbot Creek, South Fork Abbot Creek, an unnamed tributary to Emery Creek, and Hungry Horse Creek that need improved AOP.

Increase recreational opportunities and improve visitor safety at developed and dispersed recreation sites

The project area's proximity to local communities and the U.S. Highway 2 corridor has resulted in a high level of recreation use throughout the project area. Some of this recreation occurs at the developed sites in the project area, such as the North and South Lion Lake Day Use Areas, Abbot Boat Launch, and the Emery Bay Campground. Other users prefer dispersed recreation opportunities, with frequent use occurring along the Hungry Horse Reservoir in areas such as FK&L. Past decisions such as the Eastside Hungry Horse Recreation Site Renovation Project (2011) analyzed potential changes to campsite capacity and configuration, but did not address vegetation management. The changing nature of forest stands and human safety has led to a need for the development of vegetation management plans for these recreation sites. These plans will help managers determine how vegetation influences the recreation experience and how to manage vegetation for public safety and recreational experiences in the future.

The North Lion Lake Day Use Area has demonstrated increasing use of the area for fishing, picnicking, and road and trail use by hiker, horse, and bike traffic. The current configuration of the parking area does not accommodate this increasing use or use of horse trailers. The project proposes to improve parking and traffic flow and the North Lion Lake Day Use Area to reduce congestion. The South Lion Lake Day Use Area provides opportunities to improve recreational accessibility through the installation of an accessible fishing pier and enhancements to the Lion Lake trail to accommodate a diverse user group.

Field review of the trail network in the Lion Lake area is showing use of historic trail #611 to access Lion Hill (Project File Exhibit O-14) and use of other existing travel ways to access the area. The district is proposing to manage these existing routes as national forest system trails to provide nonmotorized recreational opportunities close to communities, while using design and education to minimize the potential for conflict between user groups or potential conflict between users and wildlife. The Coram Experimental Forest has also identified historic trails, known as Trail #44 and Trail #250, portions of which are receiving nonmotorized use (Project File Exhibit O-13). After much discussion with the Hungry Horse-Glacier View Ranger District, the Coram Experimental Forest has asked that the upper portion of Trail #44 and the lower portion of Trail #250 be managed again as a NFS trail to reduce the potential for resource damage to occur through un-managed use. The district has been unable to determine the reasons why or when these trails were taken off visitor maps and forest service maintenance ceased.

With the increasing visitation to the U.S. Highway 2 corridor, which serves as a gateway to Glacier National Park, public comments and community discussion has indicated that there is a desire to have more managed trails along this corridor. The district and the public identified the trails at Lion Lake and the Coram Experimental Forest as an opportunity to manage popular, historic trails for current use in a way that minimizes the potential for resource damage, conflict between users, and potential conflict between recreationists and wildlife.

Proposed Action

To meet the purpose and need for action, the Hungry Lion Resource Management Project proposes the following management activities:

- Approximately 3,243 acres of commercial harvest activities. Activities would be accomplished through tractor and skyline logging systems.

- Eleven of the proposed harvest units would create openings over 40 acres in size, with openings ranging from approximately 42 to 198 acres in size. The creation of larger openings requires 60 day public review and regional forester approval (Forest Service Manual 2471.1), which began with scoping on November 19, 2016.
- Approximately 176 acres of harvest activities will take place in grizzly bear security core with winter harvest during the denning season (Dec 1 to March 31).
- Approximately 1,542 acres will be treated within the WUI, encompassing about 1,264 acres of commercial harvest and 278 acres of understory removal to create forest stand conditions that lower the risk of future high-intensity and high-severity wildfire.
- Approximately 6.7 miles of temporary road will be constructed to facilitate harvest activities and 7.6 miles of historic road template would be reconstructed for harvest activities and then placed into intermittent stored service (ISS) following project completion.
- Prescribed burning without timber harvest is proposed on approximately 759 acres to reduce conifer encroachment into the shrub dominated areas, rejuvenate wildlife browse by stimulating re-sprouting of fire adapted shrubs and grasses, create a more diverse mosaic of vegetation conditions across this landscape, reduce down fuel accumulations, and promote whitebark pine.
- Shaded fuel breaks are proposed along open roads on 49 acres in the project area to provide points of access to facilitate control in the event of a wildfire.
- Two historic trails, approximately 12 miles in length, will be added back to the system for maintenance and management as nonmotorized trails.
- The construction of an accessible fishing pier on the south side of Lion Lake would facilitate improved access to Lion Lake. As would parking lot improvements at North Lion Lake Day Use Area to accommodate increasing public use and horse trailers at the day use area.
- Two road reroutes totaling 1.4 miles are proposed on NFS Road 546, the Emery Creek Road, to relocate the existing road out of the floodplain away from Emery Creek.
- Up to 18 aquatic improvements are proposed, with 6 aquatic organism passage (AOP) structures and 12 upsized culverts.

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. This project does propose a project specific amendment to the forest plan to allow for motorized work to occur within grizzly bear security core for the purposes of replacing or removing undersized culverts on NFSR 1614.

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, Table 2 displays the management area for each proposed vegetation treatment:

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

MA 4 - Consists of all campgrounds, picnic areas, boat launches, and other developed recreation sites.

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

MA 9 - Consists of timberlands capable of providing white-tailed deer winter habitat.

MA 10 - Consists of lands designated as Administrative Sites.

MA 12 - Includes riparian areas consisting of aquatic, riparian, and a portion of terrestrial ecosystems.

MA 13 - Consists of timberlands capable of providing mule deer and elk winter habitat.

MA 13A - Consists of nonforest lands capable of providing mule deer and elk winter habitat.

MA 14 - Consists of land designated as the Coram Experimental Forest

MA 15 - Consists of timberlands where timber management with roads is economical and feasible.

MA 16 - Consists of timberlands where timber management is feasible through the use of aerial logging systems.

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.

Decisions to be made

Based on findings in this EA, the Deciding Official would decide whether and how to improve the diversity and health of forest vegetative communities; reduce the risk to wildland firefighters and residents of the wildland urban interface; improve timber productivity on suitable lands and provide a variety of wood products to the local economy; restore hydrologic processes, water quality, and aquatic habitat throughout the project area by reducing road/stream interaction, and increase recreational opportunities and improve visitor safety at developed and dispersed recreation sites. The decision would consider the following:

- Does the selected alternative meet the purpose and need for action?
- Does the selected alternative meet laws and regulations governing natural resource management activities?
- Whether a project-specific forest plan amendment is required, the nature of the amendment, and whether the amendment would be a significant change to the forest plan.
- The deciding official may choose any of the alternatives analyzed in this document, including the no-action alternative, or some combination of the elements of the action alternatives analyzed in detail.

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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, four alternatives are carried forward and analyzed in detail in chapter 2 by resource. Table 16 and Table 17 display an alternative comparison of proposed activities and measurement indicators for key issues, providing a clear comparison for the decision maker and the public. Chapter 2 also includes project design features that were developed to protect resources under the alternatives studied in detail.

Public Involvement

This section summarizes public involvement for the Hungry Lion Resource Management Project. More detailed information, including mailings, legal notices, and public comment received can be found in the project file.

Request for information

On August 31, 2016, the district sent out a letter and map of the project area, requesting information from landowners in the project area and other interested members of the public, to share information about the project area and identify what types of management activities they would like to see in the project area. This mailing was sent to approximately 879 individuals, organizations, businesses, and agencies (Project File Exhibit A-22). The district received 18 responses to this request for information, which were used to develop management proposals for the project area (Project File Exhibit A-1 through A-19).

Proposed action

On November 18, 2016, the district sent out the proposed action for the Hungry Lion Resource Management Project to local landowners and interested members of the public to ask for site-specific comments on proposed management activities (Project File Exhibit B-1). The district sent out approximately 612 packets of maps, project information, details about a public open house, and instructions on how to comment (Project File Exhibit B-1). The district met with several landowners in person to discuss their concerns and received 134 written comments on the proposed management activities (Project File, Folder C).

Open house

The district held a public open house on December 8, 2016, at the Hungry Horse Ranger Station, from 4:00 – 7:00 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 Hungry Lion Project. Approximately 22 individuals attended the open house to discuss the project area and proposed activities (Project File Exhibit D-2).

Summary of comments received during scoping

Trails: The majority of comments received were focused on the proposal to add historic trails back to the National Forest System (NFS) for nonmotorized use. Many commenters expressed support for adding these trails to the system for nonmotorized use, with the majority of comments specifically mentioning mountain bike use. Some commenters expressed concern about potential

conflict between user groups, specifically mountain bikes and other user groups. Other commenters expressed concern that by adding the trails to the system it would lead to more conflicts between recreationists and wildlife.

Fuels reduction activities near private property: Private property owners in the area provided comments regarding vegetation management activities proposed near private property for the purposes of fuels reduction. Some commenters expressed concern about how these activities might affect the aesthetics of their property and expressed concerns about public safety during big game hunting season or during logging operations. Some commenters expressed desire to see additional management near their property than what was originally proposed to improve forest health and reduce the intensity and severity of potential wildfire effects. Some commenters asked that some proposed activities be dropped to provide increase wildlife hiding cover in the WUI.

Road management: Comments were received from nearby landowners and forest users asking how culvert replacements and AOP installations might affect their use of the area. Some commenters were concerned about dust generated from logging operations. Other commenters expressed concerns about the proposal to add historic roads back to the road system and asked that the project identify and implement a minimum road system. Some comments were received that expressed concern regarding the potential effects of temporary roads to wildlife, watershed function and soil compaction.

Issues

The interdisciplinary team (ID team) 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.

Key Issues that Drove Alternative Development

The interdisciplinary team (ID team) identified the following key issues, for which an action alternative was developed:

- Potential conflict between wildlife and recreationists;
- Potential effects of culvert replacement or removal on NFS Road 1614 in grizzly bear security core;
- Potential effects of vegetation management to wildlife habitat;
- Potential effects of temporary roads and historic road templates;

These issues were used to develop alternative 3 and 4, which makes modifications to address each issue

Conflict between wildlife and trail users recreating at 'high speed'

Public comment expressed a concern that adding historic trails to the NFS 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

1. Miles of historic trail returned to national forest trail system.

Effects of replacing culverts on NFS Road 1614 in grizzly bear security core

Public comment expressed a concern about the proposal to replace culverts in grizzly bear core during the non-denning season and the potential effects that this might have to grizzly bears.

Measurement indicator

1. Percent of core affected during non-denning season in the Emery Firefighter Subunit

Effects of temporary road construction and reconstruction of historic road templates

Public comment expressed a concern that temporary roads and historic roads reconstructed and placed into intermittent stored service would have negative effects to watersheds and wildlife habitat.

Measurement indicators

1. Number of miles of temporary roads constructed
2. Number of miles of historic template reconstructed and placed in intermittent stored service

Effects of management activities to wildlife

Public comment expressed a concern that vegetation management activities and related actions would negatively affect wildlife habitat.

Measurement indicator

1. Acres of influence to old growth stands
2. Acres of lynx foraging habitat treated
3. Acres of potential fisher habitat affected

Range of Alternatives

The range of alternatives presented in this chapter were determined by evaluating public comments, addressing internal comments, key issues, and the purpose and need for the project. Other influences include the existing and desired conditions for the project area; Forest Plan goals, objectives, standards and guidelines; Federal laws, regulations, and policies; and economic viability.

Alternatives Developed but Not Studied in Detail

This section discusses alternatives that were considered, but not given detailed study. These alternatives were proposed in public comment, but the team determined that they did not need to be studied in detail for the reasons explained in the following narrative.

Include an alternative that does not require approval for clearcuts over 40 acres in size that will negatively affect wildlife

Public comment asked that an alternative be developed that did not propose regeneration harvest units greater than 40 acres in size or propose vegetation management in grizzly bear security core during the denning season. The team considered these comment and developed alternatives to look at effects to wildlife from the proposed activities. Alternative 3 eliminated vegetation management units that affected potential habitat for fisher, lynx foraging habitat, and reduced the influence to old growth stands, but determined that units 30, 32, and 59 (which are over 40 acres in size) had minimal effects to the measurement indicators identified for wildlife habitat. Design features were also developed to ensure that no point in the unit would be greater than 600ft. to cover to provide adequate hiding cover for grizzly bears and other wildlife species. The team determined that Alternative 3 and the design features implemented across all action alternatives would meet the public comment received and that the effects analysis would show how these units greater than 40 acres would affect wildlife and wildlife habitat.

Add trails to NFS trail system, but prohibit mountain bike use

The majority of public comment received on the Hungry Lion Proposed Action was related to mountain bike use of the proposed system trails. Some commenters wanted to see the trails managed and maintained but asked that the district consider prohibiting mountain bike use on these trail to reduce conflicts between different user groups such as hikers and equestrian users. The district recognizes that the potential for conflict between user groups can exist on many NFS system trails, but is proposing to design the Desert Mountain and Lion Hill trails to improve sight distances and to conduct outreach and education efforts at trailheads to raise awareness to recreationists of the potential for wildlife conflicts and conflicts between user groups.

Trail design changes that increase sight distances, will reduce the potential for surprise conflicts between user groups. Educating people about the importance of making noise while they recreate will allow both wildlife and other users to hear recreationists on the trail. The design features discussed at the end of chapter 2 provide more information about efforts to reduce the potential for conflict related to the proposed system trails. The district will conduct these changes in partnership with user groups, to help design trails that will reduce conflict between user groups. For these reasons, the line officer did not want to propose the prohibition of any specific nonmotorized user groups from the proposed trails in this project.

Decommission road 1614, instead of replacing culverts

Public comment asked that instead of proposing to replace culverts on Road 1614, in grizzly bear security core, that the district instead decommission this road. The district bermed this road in the Firefighter Decision Notice (2009) to create grizzly bear security core habitat, but chose to leave the road on the system with culverts in place to allow the continued use of an existing groomed snowmobile trail system that was analyzed under the Amendment 24 (2006) decision addressing over the snow vehicle use. The Fire Fighter DN addresses this issue multiple times in response to

comments (Project File Exhibit V-2) and it is not the purpose of this project to revisit the decisions made about snowmobile use in the project area.

In its bermed status, the road provides secure grizzly bear core habitat during the non-denning season and continues to be part of a groomed snowmobile system that was approved under Amendment 24 to the Flathead Forest Plan. Maintaining this road on the system will also allow for future vegetation management on lands included in the suitable timber base. Alternative 4 proposes to remove the undersized culverts versus replacing the culverts to reduce the need for long term maintenance on a bermed road. This alternative would have similar effects to decommissioning the road for wildlife and snowmobile grooming over time. For these reasons, the line officer determined that the best course of action would be to leave the road on the system but to analyzed different alternatives to address the concerns related to undersized culverts.

Decommission more roads in the project area

Public comment asked that the Hungry Lion project propose to decommission more roads in the project area. When the Hungry Lion project was being developed, the need for further road decommissioning or reclamation was not identified because other past projects such as Paint Emery (1999) and Firefighter (2009), which are located within the same Emery Firefighter grizzly bear subunit as Hungry Lion, included road decommissioning to improve security for grizzly bears. The decisions for the Paint Emery and Firefighter projects involved approximately 113 miles of road decommissioning. The road decommissioning included in the Paint Emery project has been completed and when the Firefighter decision is fully implemented, the Emery Firefighter subunit will meet motorized access densities and security core objectives from Amendment 19 to the Forest Plan (this amendment provides management direction for maintaining or improving security for grizzly bears in a portion of the Flathead National Forest). The Hungry Lion project also occurs in the Coram Lake Five grizzly bear subunit which has less than 75 percent national forest ownership (about 69 percent) and the Amendment 19 objectives for open and total motorized access density and security core do not apply and therefore no road reclamation or decommissioning is required to meet forest plan direction. Since the Emery Firefighter subunit will meet all of the Amendment 19 objectives shortly, the Responsible Official did not see the need to include road decommissioning in Hungry Lion. He believes there is an appropriate balance in the project area with the existing road system providing access to the public and future vegetation management opportunities and the existing well-functioning habitat for wildlife, fisheries, and other species.

Alternatives Studied in Detail

Alternative 2

Alternative 2 was designed to meet the purpose and need for the project and is similar to the proposed action that was scoped with the public in December 2016. As described in chapter 1, this alternative proposes several different types of management activities including: vegetation management, trails management, aquatic improvements, recreation management, and road management. This alternative was modified based on public comment and additional field review by specialists, these modifications include the following:

- Removal of a temporary road accessing Unit 11 that appears to pass through private property.
- Drop Unit 21 and the associated temp road.
- Drop Unit 50B due to high detrimental soil disturbance.

- Drop temporary road to access Unit 71 and 71A, incorporate management access into the proposed reroute.
- Add an additional AOP structure to NFS Road 546 at Oliver Creek.
- Drop temporary road to Unit 78 from NFS Road 1048.
- Add unit 93 at landowner request to address hazardous fuels adjacent to private property.
- Add unit 501 to provide post and pole opportunities.

Alternative 2 proposes several different types of vegetation management activities to achieve the purpose and need. These treatments include: silviculture prescriptions for commercial harvest and non-commercial harvest; prescribed burning without harvest activities; system road rerouting to improve aquatic habitat; maintaining, and/or replacing several road culverts by reducing road stream interaction; adding historic trails back to the system for maintenance and management; and improving recreational facilities at Lion Lake Day Use Area. The vegetation management activities are described in greater detail below, followed by the road management activities associated with alternative. Then there is a description of the aquatic and recreation activities proposed in alternative 2.

Table 1. Alternative 2: Proposed vegetation treatments

Proposed Vegetation Treatments	Acres
Total Proposed Commercial Harvest	3,243 acres
Seedtree	1,319 acres
Shelterwood	76 acres
Group Selection Cut	53 acres
Total Regeneration Harvest	1,448 acres
Commercial Thin	1,659 acres
Shaded Fuel Breaks	49 acres
Special Cut (Recreation Areas)	77 acres
Total Proposed Non-Commercial Harvest	893 acres
Sapling Thin	608 acres
Understory Removal	278 acres
Public Use Post & Pole	7 acres

Vegetation treatments

In order to improve the diversity and health of forest vegetative communities; reduce the risk to wildland firefighters and residents of the wildland urban interface; and maintain timber productivity on suitable lands that provide a variety of wood products to the local economy, several different silvicultural prescriptions have been proposed:

Seedtree (ST): This treatment would remove all but a few trees per acre to create the open stand conditions required for successful regeneration of a healthy new stand of desired species such as western white pine or western larch. Trees removed would be of all sizes, with many providing a commercial wood product. About 5 to 15 trees per acre of the larger overstory trees, usually western larch or Douglas-fir, would be left on the site to provide a seed source for regeneration and long term structural diversity. A seedtree harvest is proposed in stands that are currently not meeting desired conditions, commonly due to poor stand growth, insect or disease activity, or

lack of preferred tree species. Regeneration harvests will also be planted with desirable species. There are about 1,319 acres of seedtree harvest in alternative 2.

Shelterwood (SW): As with the seedtree harvest, this treatment is proposed where stands are not currently meeting desired conditions, but where it is preferable to leave greater numbers of trees for seed or other resource reasons, and to provide a more sheltered environment for seedling regeneration and growth. Trees of all sizes, including commercial size, would be removed, leaving about 20 to 30 trees per acre of the larger overstory trees. This would create a two-storied semi-open stand condition where sufficient light would exist to maintain health and growth of the new seedlings. Leave trees would typically be western larch or Douglas-fir. As with a seedtree harvest, these leave trees would be reserved to provide long-term stand structural diversity. There are about 76 acres of shelterwood in alternative 2.

Group selection (GS): This treatment is an uneven-aged regeneration method in which trees of all sizes are cut in small groups. The groups will be 2-4 acres in size and located throughout the unit. Additionally, the area between these groups will be commercially thinned as described above. Alternative 2 includes about 53 acres of group selection cuts in two separate units.

Commercial thin (CT): This treatment removes a portion of the existing trees, but retains sufficient numbers to leave a relatively well-stocked forest. The purpose is not to regenerate a new stand of trees, but rather to improve or maintain the health and growth of the existing stand by enlarging the growing space of desired trees, reducing competition for limited site resources and removing insect or disease infested trees. Trees removed would be of all sizes, with some providing a commercial wood product. Leave tree stocking after treatment would typically range from about 75 to 120 trees per acre. Western larch and Douglas-fir would be favored for retention, as they are typically among the larger and more long-lived trees on the site, and are resistant to fire. The proposed action includes about 1,669 acres in alternative 2.

Special cuts (SpecCut): These treatments would occur at recreation sites (campgrounds and dispersed sites). Treatments would be unique to the individual site. Generally, treatments would entail a relatively light and very selective removal of trees of all sizes, focusing on hazard trees, insect or disease infested trees, viewing and screening opportunities, long-term desired forest health and species compositions, and other site-specific features related to the recreational objectives. Alternative 2 would treat 4 recreational sites, totaling about 77 acres.

Sapling thin (PCT): This treatment, also called precommercial thinning, is similar to the commercial thin except it occurs in young stands less than 35 years old where trees are small and do not provide a commercial product. A portion of the existing trees are removed, leaving a relatively well-stocked forested condition. The main purpose is to maintain or improve current and future stand health, growth, species compositions and tree sizes. Alternative 2 includes about 608 acres of sapling thinning.

The units outside of the WUI would focus on removal of competing trees in the immediate vicinity of selected western white pine trees. Trees would be cut around the western white pine trees in a radial pattern, commonly called “daylight thinning,” with the treatment affecting no more than 20 percent of the stand area. This would comply with the Northern Rockies Lynx Management Direction (NRLMD), which limits thinning in stands that provide winter snowshoe hare habitat.

Shaded fuel breaks (SFB): A shaded fuel break is a forest management strategy used for mitigating the threat of wildfire in areas where natural fire regimes have been suppressed, leading

to a dangerous buildup of combustible vegetation. Constructing a shaded fuel break is the process of selectively thinning and removing more flammable understory vegetation while leaving the majority of larger, more fire tolerant tree species in place. These stands may remain forested or be regenerated depending on species composition. Fuel breaks are not expected to control a fire in themselves, but provide points of access to facilitate control of the flanks and provide possible backfire ignition points in the face of an advancing fire front. The shaded fuel breaks along NFS Road 38 will also increase sight distances and reduce road hazards in the areas where shaded fuel breaks are created. Alternative 2 includes about 49 acres of shaded fuel breaks in six separate units along NFS Road 38.

Understory removal (USR): This treatment is similar to the commercial thin except the trees removed are small and do not provide a commercial product. A portion of the existing trees are removed, leaving a relatively well-stocked forested condition. The main purpose of this treatment is to reduce ladder fuels. About 278 acres of understory removal is proposed in alternative 2.

Public use post and pole: This treatment removes a portion of the existing trees, but retains sufficient numbers to leave a relatively well-stocked forest. The purpose is to improve or maintain the health and growth of the existing stand by enlarging the growing space of desired trees, reducing competition for limited site resources. Trees removed would include live and dead trees (primarily lodgepole pine), up to 6 inches diameter as measured 4.5 feet from the ground. Alternative 2 includes up to 7 acres of public use post and poles along NFS Road 497.

Adapted silviculture for climate change research

Six vegetation treatment units within the proposed action will be treated as part of an Adapted Silviculture for Climate Change Research (ASCC) research project. The ASCC project represents an effort to establish a series of experimental silvicultural trials in 4-5 distinct forest types across the eastern and western United States. Each trial will serve as part of a multi-region study focused on understanding long-term ecosystem responses to several broad-spectrum climate change adaptation options. The research units include three treatment types: seedtree, commercial thin, and group selection as described above. The ASCC project within the Hungry Lion project area is focused on ecosystem responses in the western larch forest type.

Post-harvest fuels and site preparation method

All proposed harvest units would have post-harvest treatments designed to reduce forest biomass that is generated either through harvest activity or is naturally occurring in high amounts. In the case of all regeneration harvest units (seed tree and shelterwood) these post-harvest activities would also prepare the site for reforestation by reducing competing vegetation and creating favorable seed bed conditions. Traditional post-harvest treatments may be used, which include hand, mechanical methods, and the use of prescribed fire. Hand methods would include lopping and scattering of the slash/fuels or hand piling. Mechanical treatments may include one or a combination of the following: whole tree yarding (or possibly yarding of tops alone), excavator piling, or chipping/mastication of fuels across the unit. Fuel accumulations at log landings may be addressed through pile burning, chipping/masticating, and/or removal. Prescribed fire treatments within harvest units to reduce forest fuels could include broadcast burning, pile burning and/or jackpot burning.

Reforestation method

Where regeneration harvest treatments are proposed (seedtree or shelterwood), a combination of natural and artificial (planting) reforestation is planned. Planting would occur where insufficient

natural regeneration of desired species is anticipated, due to lack of seed source or inadequate seedbed conditions, or where restoring ponderosa pine or rust-resistant western white pine is an objective. Western white pine is an important, but declining species in this area, and it will be planted wherever feasible. In addition to western white pine, other species that might be planted include western larch, Douglas-fir and ponderosa pine.

Treatment methods

Methods of tree removal for units with commercial products would be ground-based mechanized or skyline. Ground based mechanized harvest methods would occur across approximately 2,705 acres, utilizing equipment such as clippers, rubber-tired skidders, and forwarders. Skyline harvest methods would be used on about 539 acres of steeper ground, utilizing cables to yard woody material up to a landing at the top of a unit. Thinning in the young sapling units with no commercial products would occur by hand (chainsaws). Fuels reduction in the understory removal units may occur by hand or with mechanized equipment on 278 acres.

No harvest would occur within riparian habitat conservation areas, inventoried roadless areas, or within old growth habitat. The regeneration harvest will create openings ranging from 4 to 198 acres, all of which will maintain 600 feet to cover from any point in the unit. Eleven openings will be created that are greater than 40 acres in size and will request approval from the regional forester prior to a decision being signed.

There are 176 acres of vegetation treatment proposed within grizzly bear security core. These five units are proposed for treatment with winter harvest during the denning season (Dec 1 to March 31), to be consistent with the amendment 19 of the Flathead Forest Plan. No motorized activities would occur in grizzly bear security core outside of the denning season, except for the limited work for AOP and culvert upgrades on NFS Roads 546 and 1614.

Table 2 displays the unit number, acres proposed for treatment, type of silviculture treatment, reforestation method, logging method, fuels treatment, and management area for each proposed unit in alternative 2.

Table 2. Alternative 2: Vegetation treatment units

Unit	Acres	Silviculture Treatment	Reforestation Method	Logging Method	Fuels Treatment	MA
1	11	commercial thin	n/a	winter tractor	wty	12
2	26	commercial thin	n/a	winter tractor	wty	15
3	74	seed tree	nr	tractor	mech	14/15
4	48	commercial thin	n/a	tractor	wty	15
5	148	commercial thin	n/a	tractor	wty	14/15
6	33	commercial thin	n/a	tractor	wty	12/15
7	18	shelterwood	plant pp	winter tractor	bb	15
8	11	seed tree	plant pp	skyline	bb	15
9	34	commercial thin	n/a	tractor	wty	15
11	495	commercial thin	n/a	tractor	wty	10/12/14/15
12	13	shelterwood	nr	tractor	mech	12/15
13	53	commercial thin	n/a	tractor	wty	4/9/12
14	63	commercial thin	n/a	tractor	wty	15

Unit	Acres	Silviculture Treatment	Reforestation Method	Logging Method	Fuels Treatment	MA
16	17	seed tree	plant pp	skyline	bb	7/12
16A	4	seed tree	plant pp	tractor	bb	7
17	35	seed tree	nr	skyline	bb	7/14
18	10	commercial thin	n/a	tractor	wty	4/7/2012
19	83	commercial thin	n/a	tractor	wty	7/12/15
20	13	commercial thin	n/a	tractor	wty	7/12/15
22	4	seed tree	nr	tractor	mech	7
22A	8	seed tree	nr	skyline	bb	7/15
23	13	special cut for recreation site	n/a	tractor	wty	4/7
25	53	special cut for recreation site	n/a	tractor	wty	4/7/12/15
26	9	commercial thin	n/a	tractor	wty	7/12/13/15
27	4	commercial thin	n/a	tractor	wty	15
29	26	commercial thin	n/a	tractor	wty	13/15
30	127	seed tree	plant wp	winter tractor or forwarder	mech	7/13
31	12	seed tree	plant wp	tractor	mech	15
32	84	seed tree	plant wp	tractor	mech	13/14/15
33	51	commercial thin	n/a	tractor	wty	14/15
34	19	seed tree	plant pp	skyline	bb	15
34A	3	seed tree	plant pp	tractor	bb	15
35	13	seed tree	plant wp	tractor	mech	15
35A	19	seed tree	plant wp	skyline	wty	7/15
35B	20	seed tree	plant wp	winter tractor	mech	7/13
37	18	seed tree	nr	skyline	bb	7/13
37A	5	seed tree	nr	tractor	mech	7/13
38	20	shelterwood	plant pp	skyline	bb	7/13
39	37	commercial thin	n/a	tractor	wty	7/13/15
40	29	seed tree	plant wp	tractor	mech	7/13/15
41	18	seed tree	plant pp	skyline	bb	13
41A	15	seed tree	plant pp	tractor	bb	13/15
43A	1	seed tree	plant pp	tractor	bb	7/13
45	16	commercial thin	n/a	tractor	wty	7/15
46	17	seed tree	plant wp	tractor	mech	12/15
50	10	seed tree	nr	skyline	bb	14/15
50A	2	seed tree	nr	tractor	mech	14
51	19	seed tree	plant wp	tractor	mech	12/15
52	9	seed tree	plant wp	tractor	mech	12/15
54	34	seed tree	plant wp	skyline	bb	12/15
55	53	seed tree	plant wp	skyline	bb	12/15

Unit	Acres	Silviculture Treatment	Reforestation Method	Logging Method	Fuels Treatment	MA
56	51	seed tree	plant pp	skyline	bb	15
56A	9	seed tree	plant pp	tractor	bb	15
57	51	seed tree	plant pp	skyline	bb	12/15
58	28	commercial thin	n/a	tractor	wty	12/15
59	99	seed tree	plant wp	winter tractor	mech	12/15
60	22	commercial thin	n/a	tractor	wty	12/15
61	15	commercial thin	n/a	tractor	wty	15
62	18	commercial thin	n/a	skyline	wty	15
62A	6	commercial thin	n/a	tractor	wty	15
63	6	seed tree	plant wp	tractor	mech	14/15
66	19	commercial thin	n/a	tractor	wty	12/15
68	71	seed tree	plant wp	winter tractor	mech	12/15
71	16	seed tree	plant wp	skyline	bb	12/15
71A	6	seed tree	plant wp	tractor	mech	15
73	42	seed tree	plant wp	tractor	mech	12/15
75	35	seed tree	plant wbp	skyline	bb	12/13A/14
76	30	commercial thin	n/a	tractor	wty	12/15
77	81	commercial thin	n/a	tractor	wty	12/15/16
78	119	commercial thin	n/a	tractor	wty	12/15/16
80	4	special cut for recreation site	n/a	tractor	wty	2C/4/12
81	6	special cut for recreation site	n/a	tractor	wty	4/12
82	69	commercial thin	n/a	winter tractor	wty	12/15
83	30	commercial thin	n/a	winter tractor	wty	15/16
84	18	seed tree	nr	winter tractor	mech	13/15
85	44	seed tree	nr	winter tractor	mech	12/15
86	24	shelterwood	plant pp	tractor	bb	7/12/15
87	60	seed tree	nr	skyline	bb	12/14
87A	14	seed tree	nr	tractor	mech	14
88	45	seed tree	nr	skyline	bb	12/14
88A	4	seed tree	nr	tractor	mech	14
89A	12	shaded fuel break	n/a	tractor	mech	12/14
89B	5	shaded fuel break	n/a	tractor	mech	12/14
90	10	shaded fuel break	n/a	tractor	mech	12/15
91A	2	shaded fuel break	n/a	tractor	mech	12/13
91B	8	shaded fuel break	n/a	winter tractor	mech	12/15
92	11	shaded fuel break	n/a	tractor	mech	12/15
93	7	commercial thin	n/a	winter tractor	wty	14
100	22	understory removal	n/a	mech	mech	12/15
101	27	understory removal	n/a	hand	non-mech	15

Unit	Acres	Silviculture Treatment	Reforestation Method	Logging Method	Fuels Treatment	MA
102	101	understory removal	n/a	mech	mech	15
103	55	understory removal	n/a	mech	mech	14/15
104	73	understory removal	n/a	mech	mech	15
200	84	sapling thin	n/a	hand	lop and scatter	12/15
201	31	sapling thin	n/a	hand	lop and scatter	15
202	96	sapling thin	n/a	hand	lop and scatter	15
203	72	sapling thin	n/a	hand	lop and scatter	12/15
204	5	sapling thin	n/a	hand	lop and scatter	15
205	10	sapling thin	n/a	hand	lop and scatter	7/13
206	12	sapling thin	n/a	hand	lop and scatter	7/13
207	24	sapling thin	n/a	hand	lop and scatter	7/13
210	14	sapling thin	n/a	hand	lop and scatter	15
211	5	sapling thin	n/a	hand	lop and scatter	12/15
212	16	sapling thin	n/a	hand	lop and scatter	13
213	46	sapling thin	n/a	hand	lop and scatter	4/7/12
214	11	sapling thin	n/a	hand	lop and scatter	12/15
215	13	sapling thin	n/a	hand	lop and scatter	13
216	3	sapling thin	n/a	hand	lop and scatter	7/12
217	34	sapling thin	n/a	hand	lop and scatter	12/15
218	16	sapling thin	n/a	hand	lop and scatter	14/15
220	8	sapling thin	n/a	hand	lop and scatter	12/15
221	19	sapling thin	n/a	hand	lop and scatter	14/15
224	13	sapling thin	n/a	hand	lop and scatter	15
225	5	sapling thin	n/a	hand	lop and scatter	15
226	25	sapling thin	n/a	hand	lop and scatter	15
227	14	sapling thin	n/a	hand	lop and scatter	12/15
228	20	sapling thin	n/a	hand	lop and scatter	15
229	13	sapling thin	n/a	hand	lop and scatter	12/15
401	32	seed tree	plant pp, wp	winter tractor or forwarder	mech	9/15
402	35	commercial thin	n/a	tractor	mech	15
403	28	commercial thin	n/a	tractor	mech	15
404	36	seed tree	plant wp, pp	winter tractor or forwarder	mech (winter only) or non-mech	15
405	25	group selection	plant pp	tractor	mech	15
406	28	group selection	plant pp	tractor	mech	14/15
501	7	public use post & pole	n/a	hand	n/a	14

*Abbreviations used in the table are as follows:

Logging Method: tractor = ground-based mechanical treatment, winter tractor = winter required ground-based mechanical treatment, forwarder = required use of cut-to-length or forwarder equipment.

Fuel Treatment: mech = excavator piling or chipping/mastication, wty = whole tree yarding, bb = broadcast burning.

Reforestation: n/a indicates not applicable (planting only occurs if the treatment is seed tree or shelterwood), nr = natural regeneration, pp = ponderosa pine, wl = western larch, wp = western white pine, wpb = whitebark pine.

Road management to facilitate harvest

Temporary roads

Approximately 6.7 miles of temporary roads may be built in order to access some of the units in alternative 2. Temporary roads would be constructed to the minimum standards necessary for log hauling on National Forest System roads. Temporary road surface width would be limited to truck bunk width plus 4 feet. Temporary roads would be rehabilitated following use, such that they would cease to function as roads.

Historic roads to be stored

Alternative 2 proposes to reconstruct approximately 7.6 miles of historic road templates (see Table 3) to access proposed harvest units. Following project activities, these roads will be added to the road system and classified as intermittent stored service (ISS) roads. These historic roads proposed for storage were identified by the interdisciplinary team (ID team) because they would facilitate harvest activities and long-term resource management in the suitable timber base. Since re-construction of these roads is proposed on historic road templates, construction activities would only involve brushing, best management practices (BMP) work, surface reconditioning and ditch cleaning. There would not be any excavation of new road prisms.

The historic road template that would be re-constructed on is a road surface that was once a system road used for forest management in the suitable timber base but is not currently a part of the National Forest Road System. The majority of the historic road templates proposed for use in this project were decommissioned as part of the Paint Emery project (1999). These road templates have an existing template that has not been recontoured and is in a state that is impassible to full-sized motor vehicles due to waterbars, culvert removals and/or closure by vegetation, or earth berm. Specified road would be designed only to a level to allow for log haul and would meet BMPs.

Following project activities, roads placed in intermittent stored service will be thoroughly treated so that they are in a hydrologically inert state and are impassable to motorized vehicles. They will meet the minimum criteria for a “reclaimed road” as defined by forest plan amendment 19 and will no longer function as roads, yet these intermittent stored service roads will retain a road number and stay on the road system.

Best management practices

Approximately 58.7 miles of road being used for haul routes under alternative 2 will receive road maintenance in accordance with best management practices (BMPs) prior to use. The objectives of road maintenance would be to reduce the concentration of subsurface 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. 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 blading to restore drainage efficiency of the road surface. These actions would bring the roads up to current BMP standards, better accommodate traffic, and reduce deferred maintenance. Best Management Practice activities are typically completed prior

to use or required in timber sale contracts prior to hauling of timber over these roads, and are often funded as part of the timber sale package.

Table 3. Alternative 2: Road management

Proposed Road Management	Miles
Roads to receive best management practices (Haul routes)	58.7 miles
Historic roads to be added to the system in intermittent stored service	7.6 miles
Temporary Roads	6.7 miles

Proposed prescribed burning (Ecosystem Burns)

There are six proposed prescribed burn units covering approximately 759 acres under alternative 2. The units are all located west of the Great Bear Wilderness and within the Bear-Marshall-Scapegoat-Swan Inventoried Roadless Area. They focus primarily on south or southeast aspects and range from about 4,800 feet in elevation near the bottom of the units, to nearly 7,400 feet elevation at the upper portions of some units. They have been specifically located to take advantage of natural barriers and to prevent undesired fire spread. These barriers include rocky areas near the ridgetops, and north aspects that are less prone to burn in the spring and fall. Details outlining implementation strategies and desired weather conditions for prescribed burning would be described in a future site-specific prescribed fire burn plan. This plan would include an analysis of risks and identify mitigation methods to avoid an escaped fire.

Heavily forested conditions exist across most of the area on the more northern and eastern aspects near the prescribed burn units. More open forest and shrub-dominated openings exist in some portions of the burn units, typically on the drier southerly aspects. The prescribed fire treatments would be designed to target the shrub dominated areas of the burn units. The objective of the prescribed burning would be to reduce conifer encroachment into the shrub dominated areas, rejuvenate wildlife browse by stimulating re-sprouting of fire adapted shrubs and grasses, create a more diverse mosaic of vegetation conditions across this landscape, reduce down fuel accumulations, and promote whitebark pine. Whitebark pine occurs at the highest elevations of these prescribed burns and an assessment would be made before prescribed burning to determine any healthy areas of whitebark pine. Efforts will be made to avoid causing mortality from prescribed fire in areas of healthy whitebark pine. Following implementation whitebark pine may be planted where suited for the site conditions.

Implementation of the prescribed burns could extend for several years into the future depending on the occurrences of desirable prescribed burning weather opportunities.

Table 4 provides a listing of the proposed prescribed burning units.

Unit Number	Acres	Treatment Method	Forest Plan Management Area
301	73	helicopter	2A
302	156	helicopter	2A/12/16
303	78	helicopter	2A
304	137	helicopter	2A/16
305	155	helicopter	2A/16
306	160	helicopter	2A
Total Prescribed Burn Acres	759	--	--

Table 4. Alternative 2: Prescribed burning units

Unit Number	Acres	Treatment Method	Forest Plan Management Area
301	73	helicopter	2A
302	156	helicopter	2A/12/16
303	78	helicopter	2A
304	137	helicopter	2A/16
305	155	helicopter	2A/16
306	160	helicopter	2A
Total Prescribed Burn Acres	759	--	--

Aquatic improvements

Alternative 2 seeks to improve or restore hydrologic processes, water quality, and aquatic habitat throughout the project area by reducing road/stream interaction. This would be accomplished by maintaining or replacing several road culverts within the project area. Culvert replacement within fish bearing stream reaches would utilize structures allowing for aquatic organism passage (AOP).

Table 5 displays the culvert work that is proposed under alternative 2.

Table 5. Alternative 2: Aquatic improvements

NFS Road	Culverts Replaced	AOP structures	Creek Name(s)
38	--	1	Hungry Horse Creek
546	--	2	Oliver Creek, Unnamed tributary to Emery Creek
590A	--	1	Abbot Creek
590B	1	--	Unnamed tributary to Abbot Creek
590G	--	1	South Fork Abbot Creek
1614	10	--	Remington Creek, Strife Creek, and eight unnamed tributaries
10129	1	--	Unnamed tributary to South Fork Abbot Creek
10805	--	1	Abbot Creek
Total	12 culverts	6 AOP structures	--

Alternative 2 proposes two road reroutes totaling 1.4 miles on NFS Road 546, the Emery Creek Road, to relocate the existing road out of the floodplain away from Emery Creek. The reroutes would reduce road/stream interaction with Emery Creek an important cutthroat trout stream. This would provide improvements to floodplain and riparian functions in these areas.

Project specific forest plan amendment

Alternative 2 proposes a site-specific forest plan amendment to allow for aquatic improvement activities (culvert work) to occur on NFS Road 1614, the Oliver Margaret Creek Road, most of which is located within grizzly bear security core and serves as a groomed snowmobile route in the denning season for grizzly bears. This amendment would allow a 30 day, one-time window of

motorized access in grizzly bear core habitat outside of the denning season from July 1 to November 30 for aquatic structure replacement when conditions and funding allow.

Nonmotorized trail

Alternative 2 proposes to add historic trails in the project area back to the National Forest Trail System as nonmotorized trails for management and maintenance. This alternative proposes to add approximately 12 miles of trail back to the NFS trail system. Approximately 6 miles of trail would be added to the system in the Lion Hill area and approximately 7 miles of trail would be added to the system in the Desert Mountain area, within the boundaries of the Coram Experimental Forest.

The Desert Mountain trail would occur in close proximity to grizzly bear security core and its level of use now and in the future is unknown and could have the potential to affect security core for grizzly bears (see chapter 3 – Threatened and Endangered Wildlife Species). To offset these potential effects, the Hungry Lion Project proposes to create replacement acres of security core at the end of NFS Road 590A by placing a berm at approximately milepost 2.7 when project activities are completed. This berm will be left in place at a minimum of 10 years to provide grizzly bear core habitat security. At the end of project activities there will be no net decrease in grizzly bear security core within project subunits.

Recreation site improvement

The North Lion Lake Day Use Area is used for picnicking, fishing, swimming, hiking, and other activities. Alternative 2 proposes to improve parking and traffic flow at the North Lion Lake Recreation Site to accommodate increasing use and the site. The district is also proposing to install an accessible fishing pier on the South Lion Lake Recreation Site and improve accessibility on the Lion Lake trail in order to provide increased recreational opportunities for the public at this site.

Alternative 3

Alternative 3 was designed to address concerns about effects to wildlife from proposed management activities. Specifically, alternative 3 proposes to rehabilitate nonmotorized trails and does not conduct aquatic improvements in grizzly bear core. Alternative 3 modifies activities in the WUI to address concerns about travel cover for elk movement in the area. Alternative 3 also drops units that could influence old growth habitat, provide lynx foraging opportunities, and provide potential fisher habitat.

Alternative 3 proposes the same types of activities as described in alternative 2. Where these descriptions of these activities are use similar techniques, they will not be described again in this section. Where different techniques or activities are proposed, they will be described in detail.

Alternative 3 includes: silviculture prescriptions for commercial harvest and non-commercial harvest; prescribed burning without harvest activities; system road rerouting to improve aquatic habitat; maintaining or replacing several road culverts by reducing road stream interaction; and improving recreational facilities at Lion Lake Day Use Area.

The vegetation management activities are described in greater detail below, followed by the road management activities associated with alternative 3. Then there is a description of the aquatic and recreation activities proposed in alternative 3.

Table 6. Alternative 3: Proposed vegetation treatments

Proposed Vegetation Treatments	Acres
Total Proposed Commercial Harvest	2,226 acres
Seedtree	780 acres
Shelterwood	58 acres
Group Selection Cut	53 acres
Commercial Thin	1,258 acres
Shaded Fuel Breaks	0 acres
Special Cut (Recreation Areas)	77 acres
Total Proposed Non-Commercial Harvest	433 acres
Sapling Thin	241 acres
Understory Removal	192 acres

Vegetation treatments

In order to improve the diversity and health of forest vegetative communities; reduce the risk to wildland firefighters and residents of the wildland urban interface; and maintain timber productivity on suitable lands that provide a variety of wood products to the local economy, several different silvicultural prescriptions have been proposed which are similar to the types of prescriptions proposed in alternative 2. Table 6 above shows the acres of each proposed prescription in alternative 3.

Adapted silviculture for climate change research

Alternative 3 includes six vegetation treatment units within the proposed action will be treated as part of an Adapted Silviculture for Climate Change Research (ASCC) research project, same as alternative 2.

Post-harvest fuels and site preparation method

All proposed harvest units would have post-harvest treatments designed to reduce forest biomass that is generated either through harvest activity or is naturally occurring in high amounts, using the same technique as described in alternative 2.

Reforestation method

Where regeneration harvest treatments are proposed (seedtree or shelterwood), a combination of natural and artificial (planting) reforestation is planned, using the same techniques as described in alternative 2.

Treatment methods

Methods of tree removal for units with commercial products would be ground-based mechanized or skyline. Ground based mechanized harvest methods would occur across approximately 2,020 acres in alternative 3. Skyline harvest methods would be used on about 207 acres of steeper ground, utilizing cables to yard woody material up to a landing at the top of a unit. Thinning and fuels reduction techniques will be the same as described in alternative 2.

No harvest would occur within riparian habitat conservation areas, inventoried roadless areas, or within old growth habitat. The regeneration harvest will create openings ranging from 1 to 127 acres, all of which will maintain 600 feet to cover from any point in the unit. Alternative 3 will

create three openings greater than 40 acres in size and will request approval from the regional forester prior to a decision being signed.

Alternative 3 does not propose any activity in grizzly bear security core.

Table 7 displays the unit number, acres proposed for treatment, type of silviculture treatment, reforestation method, logging method, fuels treatment, and management area for each proposed unit in alternative 3.

Table 7. Alternative 3: Vegetation treatment units

Unit	Acres	Silviculture Treatment	Reforestation Method	Logging Method	Fuels Treatment	MA
3M	33	seed tree	nr	tractor	mech	14/15
5	148	commercial thin	n/a	tractor	wty	14/15
6M	14	commercial thin	n/a	tractor	wty	12/15
8	11	seed tree	plant pp	skyline	bb	15
11	495	commercial thin	n/a	tractor	wty	10/12/14/15
12	13	shelterwood	nr	tractor	mech	12/15
13	53	commercial thin	n/a	tractor	wty	4/9/12
17	35	seed tree	nr	skyline	bb	7/14
18	10	commercial thin	n/a	tractor	wty	4/7/2012
19	83	commercial thin	n/a	tractor	wty	7/12/15
20	13	commercial thin	n/a	tractor	wty	7/12/15
23	13	special cut for recreation site	n/a	tractor	wty	4/7
25	53	special cut for recreation site	n/a	tractor	wty	4/7/12/15
26	9	commercial thin	n/a	tractor	wty	7/12/13/15
27	4	commercial thin	n/a	tractor	wty	15
29	26	commercial thin	n/a	tractor	wty	13/15
30	127	seed tree	plant wp	winter tractor or forwarder	mech	7/13
32	84	seed tree	plant wp	tractor	mech	13/14/15
35	13	seed tree	plant wp	tractor	mech	15
35A	19	seed tree	plant wp	skyline	wty	7/15
35B	20	seed tree	plant wp	winter tractor	mech	7/15
37	18	seed tree	nr	skyline	bb	7/13
37A	5	seed tree	nr	tractor	mech	7/13
38	20	shelterwood	plant pp	skyline	bb	7/13
39	37	commercial thin	n/a	tractor	wty	7/13/15
40	29	seed tree	plant wp	tractor	mech	7/13/15
41	18	seed tree	plant pp	skyline	bb	13
41A	15	seed tree	plant pp	tractor	bb	13/15
43A	1	seed tree	plant pp	tractor	bb	7/13
45	16	commercial thin	n/a	tractor	wty	7/15

Unit	Acres	Silviculture Treatment	Reforestation Method	Logging Method	Fuels Treatment	MA
46	17	seed tree	plant wp	tractor	mech	12/15
51	19	seed tree	plant wp	tractor	mech	12/15
52	9	seed tree	plant wp	tractor	mech	12/15
54	34	seed tree	plant wp	skyline	bb	12/15
58	28	commercial thin	na	tractor	wty	12/15
59	99	seed tree	plant wp	winter tractor	mech	12/15
60	22	commercial thin	n/a	tractor	wty	12/15
61	15	commercial thin	n/a	tractor	wty	15
63	6	seed tree	plant wp	tractor	mech	14/15
66	19	commercial thin	n/a	tractor	wty	12/15
71	16	seed tree	plant wp	skyline	bb	12/15
71A	6	seed tree	plant wp	tractor	mech	15
73	42	seed tree	plant wp	tractor	mech	12/15
75	35	seed tree	plant wbp	skyline	bb	12/13A/14
77	81	commercial thin	n/a	tractor	wty	12/15/16
78	119	commercial thin	n/a	tractor	wty	12/15/16
80	4	special cut for recreation site	n/a	tractor	wty	2C/4/12
81	6	special cut for recreation site	n/a	tractor	wty	4/12
86	24	shelterwood	plant pp	tractor	bb	7/12/15
100	22	understory removal	n/a	mech	mech	12/15
101	27	understory removal	n/a	hand	non-mech	15
102M	56	understory removal	n/a	mech	mech	15
103	55	understory removal	n/a	mech	mech	14/15
104M	33	understory removal	n/a	mech	mech	15
200	84	sapling thin	n/a	hand	lop and scatter	12/15
203	72	sapling thin	n/a	hand	lop and scatter	12/15
205	10	sapling thin	n/a	hand	lop and scatter	7/13
206	12	sapling thin	n/a	hand	lop and scatter	7/13
207	24	sapling thin	n/a	hand	lop and scatter	7/13
210	14	sapling thin	n/a	hand	lop and scatter	15
211	5	sapling thin	n/a	hand	lop and scatter	12/15
212	16	sapling thin	n/a	hand	lop and scatter	13
216	3	sapling thin	n/a	hand	lop and scatter	7/12
401	32	seed tree	plant pp, wp	winter tractor or forwarder	mech	9/15
402	35	commercial thin	n/a	tractor	mech	15

Unit	Acres	Silviculture Treatment	Reforestation Method	Logging Method	Fuels Treatment	MA
403	28	commercial thin	n/a	tractor	mech	15
404	36	seed tree	plant wp, pp	winter tractor or forwarder	Mech (winter only) or non-mech	15
405	25	group selection	plant pp	tractor	mech	15
406	28	group selection	plant pp	tractor	mech	14/15

*Abbreviations used in the table are as follows:

Logging Method: tractor = ground-based mechanical treatment, winter tractor = winter required ground-based mechanical treatment, forwarder = required use of cut-to-length or forwarder equipment.

Fuel Treatment: mech = excavator piling or chipping/mastication, wty = whole tree yarding, bb = broadcast burning.

Reforestation: n/a indicates not applicable (planting only occurs if the treatment is seed tree or shelterwood). nr = natural regeneration, pp = ponderosa pine, wl = western larch, wp = western white pine, wbp = whitebark pine.

Road management to facilitate harvest

Temporary roads

Approximately 2.8 miles of temporary roads may be built in order to access some of the units in alternative 3 and uses the same techniques as described in alternative 2.

Historic roads to be stored

Alternative 3 proposes approximately 4.2 miles of historic road templates to access proposed harvest units and uses the same techniques as described in alternative 2.

Best management practices

Approximately 51.9 miles of road being used for haul routes under alternative 3 will receive road maintenance in accordance with best management practices (BMPs) prior to use and uses the same techniques as described in alternative 2.

Table 8 describes the road management that is associated with proposed vegetation treatments.

Table 8. Alternative 3: Road management

Proposed Road Management	Miles
Roads to receive best management practices (Haul routes)	51.9 miles
Historic roads to be added to the system in intermittent stored service	4.2 miles
Temporary Roads	2.8 miles

Proposed prescribed burning (Ecosystem Burns)

There are six proposed prescribed burn units covering approximately 759 acres under alternative 3 as is described in alternative 2.

Table 9 provides a listing of the proposed prescribed burning units.

Table 9. Alternative 3: Prescribed burning units

Unit Number	Acres	Treatment Method	Forest Plan Management Area
301	73	helicopter	2A
302	156	helicopter	2A/12/16

Unit Number	Acres	Treatment Method	Forest Plan Management Area
303	78	helicopter	2A
304	137	helicopter	2A/16
305	155	helicopter	2A/16
306	160	helicopter	2A
Total Prescribed Burn Acres	759	--	--

Aquatic improvements

Alternative 3 to improve or restore hydrologic processes, water quality, and aquatic habitat throughout the project area by reducing road/stream interaction. Alternative 3 only includes aquatic improvements outside of grizzly bear security core and does not propose a site-specific forest plan amendment to conduct motorized activities in core.

Table 10 displays the culvert work that is proposed under alternative 3.

Table 10. Alternative 3: Aquatic improvements

NFS Road	Culverts Replaced	AOP structures	Creek Name(s)
38	--	1	Hungry Horse Creek
546	--	2	Oliver Creek, Unnamed tributary to Emery Creek
590A	--	1	Abbot Creek
590B	1	--	Unnamed tributary to Abbot Creek
590G	--	1	South Fork Abbot Creek
1614	1	--	Unnamed tributary to Emery Creek
10129	1	--	Unnamed tributary to South Fork Abbot Creek
10805	--	1	Abbot Creek
Total	3 culverts	6 AOP structures	--

Two road reroutes totaling 1.4 miles are proposed on NFS Road 546, the Emery Creek road, to relocate the existing road out of the floodplain away from Emery Creek as described in alternative 2.

Nonmotorized trail

Alternative 3 proposes to rehabilitate the 12 miles historic trail beds in the project area and will not need to create replacement acres of security core at the end of NFS Road 590A by placing a berm at approximately milepost 2.7.

Recreation site improvement

The North Lion Lake Day Use Area is used for picnicking, fishing, swimming, hiking, and other activities. Alternative 3 proposes to improve parking and traffic flow at the North Lion Lake Recreation Site to accommodate increasing use and the site. The district is also proposing to install an accessible fishing pier on the South Lion Lake Recreation Site and improve accessibility on the Lion Lake trail to provide increased recreational opportunities for the public at this site.

Alternative 4

Alternative 4 was designed to address public comment that asked us to consider an alternative that does not construct temporary roads or use historic road templates to conduct project activities. Alternative 4 eliminates all units that would require the use of temporary roads or historic road templates.

Alternative 4 proposes the same types of activities as described in alternative 2. Where these descriptions of these activities use similar techniques, they will not be described again in this section. Where different techniques or activities are proposed, they will be described in detail.

Alternative 4 includes: silviculture prescriptions for commercial harvest and non-commercial harvest; prescribed burning without harvest activities; system road rerouting to improve aquatic habitat; maintaining or replacing several road culverts by reducing road stream interaction; and improving recreational facilities at Lion Lake Day Use Area.

The vegetation management activities are described in greater detail below, followed by the road management activities associated with alternative 4. Then there is a description of the aquatic and recreation activities proposed in alternative 4.

Table 11. Alternative 4: Proposed vegetation treatments

Proposed Vegetation Treatments	Acres
Total Proposed Commercial Harvest	1,333 acres
Seedtree	799 acres
Shelterwood	38 acres
Group Selection Cut	53 acres
Commercial Thin	317 acres
Shaded Fuel Breaks	49 acres
Special Cut (Recreation Areas)	77 acres
Total Proposed Non-Commercial Harvest	886 acres
Sapling Thin	608 acres
Understory Removal	278 acres

Vegetation treatments

In order to improve the diversity and health of forest vegetative communities; reduce the risk to wildland firefighters and residents of the wildland urban interface; and maintain timber productivity on suitable lands that provide a variety of wood products to the local economy, several different silvicultural prescriptions have been proposed which are similar to the types of prescriptions proposed in alternative 2. Table 11 above shows the acres of each proposed prescription in alternative 4.

Adapted silviculture for climate change research

Alternative 4 includes six vegetation treatment units within the proposed action will be treated as part of an Adapted Silviculture for Climate Change Research (ASCC) research project, same as alternative 2.

Post-harvest fuels and site preparation method

All proposed harvest units would have post-harvest treatments designed to reduce forest biomass that is generated either through harvest activity or is naturally occurring in high amounts, using the same technique as described in alternative 2.

Reforestation method

Where regeneration harvest treatments are proposed (seedtree or shelterwood), a combination of natural and artificial (planting) reforestation is planned, using the same techniques as described in alternative 2.

Treatment methods

Methods of tree removal for units with commercial products would be ground-based mechanized or skyline. Ground based mechanized harvest methods would occur across approximately 1,152 acres in alternative 4. Skyline harvest methods would be used on about 183 acres of steeper ground, utilizing cables to yard woody material up to a landing at the top of a unit. Thinning and fuels reduction techniques will be the same as described in alternative 2.

No harvest would occur within riparian habitat conservation areas, inventoried roadless areas, or within old growth habitat. The regeneration harvest will create openings ranging from 1 to 127 acres, all of which will maintain 600 feet to cover from any point in the unit. Alternative 4 will create three openings greater than 40 acres in size and will request approval from the regional forester prior to a decision being signed.

Alternative 4 proposes one unit, approximately 44 acres in size, in grizzly bear security core. These activities will follow the same operating parameters as described in alternative 2.

Table 12 displays the unit number, acres proposed for treatment, type of silviculture treatment, reforestation method, logging method, fuels treatment, and management area for each proposed unit in alternative 4.

Table 12. Alternative 4: Vegetation treatment units

Unit	Acres	Silviculture Treatment	Reforestation Method	Logging Method	Fuels Treatment	MA
1	11	commercial thin	n/a	winter tractor	wty	12
6	33	commercial thin	n/a	tractor	wty	12/15
12	13	shelterwood	nr	tractor	mech	12/15
13	53	commercial thin	n/a	tractor	wty	4/9/12
17	35	seed tree	nr	skyline	bb	7/14
18	10	commercial thin	n/a	tractor	wty	4/7/2012
19	83	commercial thin	n/a	tractor	wty	7/12/15
20	13	commercial thin	n/a	tractor	wty	7/12/15
22	4	seed tree	nr	tractor	mech	7
23	13	special cut for recreation site	n/a	tractor	wty	4/7
25	53	special cut for recreation site	n/a	tractor	wty	4/7/12/15
26	9	commercial thin	n/a	tractor	wty	7/12/13/15

Unit	Acres	Silviculture Treatment	Reforestation Method	Logging Method	Fuels Treatment	MA
27	4	commercial thin	n/a	tractor	wty	15
30	127	seed tree	plant wp	winter tractor or forwarder	mech	7/13
31	12	seed tree	plant wp	tractor	mech	15
32	84	seed tree	plant wp	tractor	mech	13/14/15
35B	20	seed tree	plant wp	winter tractor	mech	7/15
37	18	seed tree	nr	skyline	bb	7/13
37A	5	seed tree	nr	tractor	mech	7/13
40	29	seed tree	plant wp	tractor	mech	7/13/15
43A	1	seed tree	plant pp	tractor	bb	7/13
45	16	commercial thin	n/a	tractor	wty	7/15
51	19	seed tree	plant wp	tractor	mech	12/15
52	9	seed tree	plant wp	tractor	mech	12/15
54	34	seed tree	plant wp	skyline	bb	12/15
55M	16	seed tree	plant wp	skyline	bb	15
57M	29	seed tree	plant pp	skyline	bb	15
59	99	seed tree	plant wp	winter tractor	mech	12/15
60	22	commercial thin	n/a	tractor	wty	12/15
68	71	seed tree	plant wp	winter tractor	mech	12/15
71	16	seed tree	plant wp	skyline	bb	12/15
71A	6	seed tree	plant wp	tractor	mech	15
75	35	seed tree	plant wbp	skyline	bb	12/13A/14
80	4	special cut for recreation site	n/a	tractor	wty	2C/4/12
81	6	special cut for recreation site	n/a	tractor	wty	4/12
85	44	seed tree	nr	winter tractor	mech	12/15
86	24	shelterwood	plant pp	tractor	bb	7/12/15
87A	14	seed tree	nr	tractor	mech	14
88A	4	seed tree	nr	tractor	mech	14
89A	12	shaded fuel break	n/a	tractor	mech	12/14
89B	5	shaded fuel break	n/a	tractor	mech	12/14
90	10	shaded fuel break	n/a	tractor	mech	12/15
91A	2	shaded fuel break	n/a	tractor	mech	12/13
91B	8	shaded fuel break	n/a	winter tractor	mech	12/15
92	11	shaded fuel break	n/a	tractor	mech	12/15
100	22	understory removal	n/a	mech	mech	12/15
101	27	understory removal	n/a	hand	non-mech	15
102	101	understory removal	n/a	mech	mech	15
103	55	understory removal	n/a	mech	mech	14/15
104	73	understory removal	n/a	mech	mech	15

Unit	Acres	Silviculture Treatment	Reforestation Method	Logging Method	Fuels Treatment	MA
200	84	sapling thin	n/a	hand	lop and scatter	12/15
201	31	sapling thin	n/a	hand	lop and scatter	15
202	96	sapling thin	n/a	hand	lop and scatter	15
203	72	sapling thin	n/a	hand	lop and scatter	12/15
204	5	sapling thin	n/a	hand	lop and scatter	15
205	10	sapling thin	n/a	hand	lop and scatter	7/13
206	12	sapling thin	n/a	hand	lop and scatter	7/13
207	24	sapling thin	n/a	hand	lop and scatter	7/13
210	14	sapling thin	n/a	hand	lop and scatter	15
211	5	sapling thin	n/a	hand	lop and scatter	12/15
212	16	sapling thin	n/a	hand	lop and scatter	13
213	46	sapling thin	n/a	hand	lop and scatter	4/7/12
214	11	sapling thin	n/a	hand	lop and scatter	12/15
215	13	sapling thin	n/a	hand	lop and scatter	13
216	3	sapling thin	n/a	hand	lop and scatter	7/12
217	34	sapling thin	n/a	hand	lop and scatter	12/15
218	16	sapling thin	n/a	hand	lop and scatter	14/15
220	8	sapling thin	n/a	hand	lop and scatter	12/15
221	19	sapling thin	n/a	hand	lop and scatter	14/15
224	13	sapling thin	n/a	hand	lop and scatter	15
225	5	sapling thin	n/a	hand	lop and scatter	15
226	25	sapling thin	n/a	hand	lop and scatter	15
227	14	sapling thin	n/a	hand	lop and scatter	12/15
228	20	sapling thin	n/a	hand	lop and scatter	15
229	13	sapling thin	n/a	hand	lop and scatter	12/15
401	32	seed tree	plant pp, wp	winter tractor or forwarder	mech	9/15
402	35	commercial thin	n/a	tractor	mech	15
403	28	commercial thin	n/a	tractor	mech	15
404	36	seed tree	plant wp, pp	winter tractor or forwarder	mech (winter only) or non-mech	15
405	25	group selection	plant pp	tractor	mech	15
406	28	group selection	plant pp	tractor	mech	14/15

*Abbreviations used in the table are as follows:

Logging Method: tractor = ground-based mechanical treatment, winter tractor = winter required ground-based mechanical treatment, forwarder = required use of cut-to-length or forwarder equipment.

Fuel Treatment: mech = excavator piling or chipping/mastication, wty = whole tree yarding, bb = broadcast burning.

Reforestation: n/a indicates not applicable (planting only occurs if the treatment is seed tree or shelterwood), nr = natural regeneration, pp = ponderosa pine, wl = western larch, wp = western white pine, wbp = whitebark pine.

Road management to facilitate harvest

Temporary roads

No temporary roads will be built to access units in alternative 4.

Historic roads to be stored

No historic road templates will be proposed to access harvest units.

Best management practices

Approximately 48.8 miles of road being used for haul routes under alternative 3 will receive road maintenance in accordance with best management practices (BMPs) prior to use and uses the same techniques as described in alternative 2.

Table 13 describes the road management that is associated with proposed vegetation treatments.

Table 13. Alternative 4: Road management

Proposed Road Management	Miles
Roads to receive best management practices (Haul routes)	48.8 miles
Historic roads to be added to the system in intermittent stored service	0 miles
Temporary Roads	0 miles

Proposed prescribed burning (Ecosystem Burns)

There are six proposed prescribed burn units covering approximately 759 acres under alternative 4 as is described in alternative 2.

Table 14 provides a listing of the proposed prescribed burning units.

Table 14. Alternative 4: Prescribed burning units

Unit Number	Acres	Treatment Method	Forest Plan Management Area
301	73	helicopter	2A
302	156	helicopter	2A/12/16
303	78	helicopter	2A
304	137	helicopter	2A/16
305	155	helicopter	2A/16
306	160	helicopter	2A
Total Prescribed Burn Acres	759	--	--

Aquatic improvements

Alternative 4 seeks to improve or restore hydrologic processes, water quality, and aquatic habitat throughout the project area by reducing road/stream interaction. Alternative 4 proposes to remove the culverts on NFS Road 1614 instead of replace as proposed in Alternative 2.

Table 15 displays the culvert work that is proposed under alternative 4.

Table 15. Alternative 4: Aquatic improvements

NFS Road	Culverts Replaced or Maintained	Culverts to be Removed	AOP Structures	Creek Name(s)
38	--	--	1	Hungry Horse Creek
546	--	--	2	Oliver Creek, Unnamed tributary to Emery Creek
590A	--	--	1	Abbot Creek
590B	1	--	--	Unnamed tributary to Abbot Creek
590G	--	--	1	South Fork Abbot Creek
1614	--	10	--	Remington Creek, Strife Creek, and eight unnamed tributaries
10129	1	--	--	Unnamed tributary to South Fork Abbot Creek
10805	--	--	1	Abbot Creek
Total	2 culverts	10 culverts	6 AOP structures	--

Two road reroutes totaling 1.4 miles are proposed on NFS Road 546, the Emery Creek Road, to relocate the existing road out of the floodplain away from Emery Creek as described in alternative 2.

Nonmotorized trail

Alternative 4 proposes to add historic trails in the project area back to the National Forest Trail System as nonmotorized trails for management and maintenance, as is proposed in alternative 2. This would include the creation of replacement core by berming a portion of NFS Road 590A.

Recreation site improvement

The North Lion Lake Day Use Area is used for picnicking, fishing, swimming, hiking, and other activities. Alternative 4 proposes to improve parking and traffic flow at the North Lion Lake Recreation Site to accommodate increasing use and the site. The district is also proposing to install an accessible fishing pier on the South Lion Lake Recreation Site and improve accessibility on the Lion Lake trail to provide increased recreational opportunities for the public at this site.

Comparison of alternatives

Table 16 shows a comparison of alternatives by proposed activities.

Table 16. Comparison of alternatives by proposed activities

Proposed Activities	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Proposed Vegetation Treatments				
Seedtree	0	1,319 acres	780 acres	799 acres
Shelterwood	0	76 acres	58 acres	38 acres
Group selection cut	0	53 acres	53 acres	53 acres
Commercial thin	0	1,669 acres	1,258 acres	317 acres
Shaded fuel breaks	0	49 acres	0 acres	49 acres

Proposed Activities	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Special cut (recreation areas)	0	77 acres	77 acres	77 acres
Total proposed commercial harvest	0	3,243 acres	2,226 acres	1,333 acres
Total estimated volume	0	18,100 CCF 9 MMBF	12,400 CCF 6.2 MMBF	8,700 CCF 4.3 MMBF
Sapling thin	0	608 acres	241 acres	608 acres
Understory removal	0	278 acres	192 acres	278 acres
Public use post & pole	0	7 acres	0 acres	0 acres
Total proposed non-commercial harvest	0	893 acres	433 acres	886 acres
Prescribed burning (ecosystem burns)	0	759 acres	759 acres	759 acres
Proposed Road and Recreation Management				
Roads to receive best management practices (haul routes)	0	58.7 miles	51.9 miles	48.8 miles
Historic roads to be added to the system in intermittent stored service	0	7.6 miles	4.2 miles	0 miles
Temporary roads	0	6.7 miles	2.8 miles	0 miles
Historic trail added back to system	0	12.1 miles	rehabilitate all	12.1 miles
Accessible fishing pier on Lion Lake	0	1 pier	1 pier	1 pier
Road reroute to improve aquatic habitat	0	1.4 mile	1.4 mile	1.4 mile
Aquatic improvements on NFS roads	0	18 activities	9 activities	18 activities
Culverts to be replaced	0	12 culverts	3 culverts	2 culverts
Culverts to be removed	0	0 culverts	0 culverts	10 culverts
AOP structures to be installed	0	6 Structures	6 Structures	6 Structures

Table 17 shows a comparison of alternatives by measurement indicators.

Table 17. Comparison of alternatives by measurement indicators

Key Issues	Management Indicators	Alt 1	Alt 2	Alt 3	Alt 4
Conflict between wildlife and trail users	Miles of historic trail returned to NFS trail system	0	12 miles	0	12 miles
Effects of replacing culverts on NFS Road 1614	% of core affected during non-denning season (Emery Firefighter Subunit)	0	11%	1%	11%
Effects of temporary roads and road reconstruction	Miles of temporary Roads	0	6.7 miles	2.8 miles	0 miles
Effects of temporary roads and road reconstruction	Miles of historic template reconstructed and placed in ISS	0	7.6 miles	4.2 miles	0 miles
Wildlife habitat	Acres of influence to old growth stands	0	189 acres	101 acres	92 acres
Wildlife habitat	Acres of lynx foraging habitat treated	0	758 acres	345 acres	520 acres

Key Issues	Management Indicators	Alt 1	Alt 2	Alt 3	Alt 4
Wildlife habitat	Acres of potential fisher habitat affected	0	803 acres	563 acres	269 acres

Design Features

Many concerns expressed during the public involvement processes are best addressed through development of design features specific to action alternatives (alternatives 2, 3, and 4) 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.

Duration and timing of activities

Tree harvest activities, along with associated temporary road construction, BMP activities, slash reduction and planting, may begin as early as fall/winter 2017/2018. Due to the infrequency of achieving the desired combination of weather and fuel/vegetative conditions, implementation of the prescribed burning in Burn Units 301-306 may take up to 10 years before completion.

Winter harvest

The following units require winter harvest to meet resource concerns:

Table 18. Vegetative units requiring winter harvest

Unit	Harvest Requirement	Resource Rationale
1	winter tractor	protect soil productivity
2	winter tractor	grizzly bear security core
7	winter tractor	protect soil productivity
30	winter tractor or cut to length/log forwarder system	protect soil productivity
35B	winter tractor	protect soil productivity
59	winter tractor	protect soil productivity
68	winter tractor	protect soil productivity
82	winter tractor	grizzly bear security core
83	winter tractor	grizzly bear security core
84	winter tractor	grizzly bear security core
85	winter tractor	grizzly bear security core
91B	winter tractor	protect soil productivity
401	winter tractor or cut to length/log forwarder system	protect soil productivity
404	winter tractor or cut to length/log forwarder system and manual treatment of activity fuels	protect soil productivity

Soil productivity

All existing roads and skid trails would 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.

All mechanized units that remove commercial products would 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 in all tractor harvest units and 40 feet in all Cut to Length/Forwarder designated 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.

Use of Cut to Length/Log Forwarder system would be allowed as an alternative to winter logging in units 30 and 404 during the summer, dry period. Use of Cut to Length/Log Forwarder alternative in unit 404 would also require manual treatment of activity fuels.

All temporary roads and extended log skidding corridors constructed for this project will be rehabilitated by any site-appropriate combination of the following:

- Removing any installed culverts or temporary bridges
- Recontouring the entire template to natural ground contour
- Where recontouring is unnecessary, scarify with excavator teeth to a depth equal 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

Logging would occur when soils are dry as determined by the hand feel method (Project File Exhibit L-21).

Forest Service will monitor soil moisture conditions prior to allowing equipment to begin operations in summer. This monitoring must be documented.

All mechanical fuel reduction will be accomplished with tracked equipment, which will to the extent feasible, remain on skid trails.

Prescribed burning prescriptions would be prepared and implemented to not exceed moderate soil burn severity conditions.

Winter logging requires that there be enough snow to prevent muddy water from mixing into the snow where equipment operates. This would require about 10 inches of snow. Appropriate depth of snow varies with the snow water equivalence. It takes more dry powder snow than wet dense snow to protect the soil surface.

Roads

Public use of NFS Road 38 should be maintained during harvest operations between May 15th and November 30th.

Remove all debris from existing 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. On intermittent and perennial streams within harvest and burn units, remove downed debris from stream channels that could plug stream aligned culvert inlets.

Provide access to local residents during replacement of culvert on NFS Road 10805 at Abbot Creek to maintain access to private property during construction.

Dust abatement will occur if needed on NFS Road 38 during active hauling to improve safety of traffic near private property.

Rehabilitate old portions of NFS Road 546 (Emery Creek Road) following construction of road reroutes by removing all installed culverts and recontouring the entire template to natural ground contour. Seed with native plant mix as specified by the Forest Botanist and place woody material and soil inoculum on road template.

Best Management Practices will be utilized on all NFS roads identified for haul prior to timber harvest. Best management practices are defined by Soil & Water Conservation Practices in Forest Service Handbook 2509.22.

Best Management Practices for temporary roads shall follow the National Core BMP Technical Guide Volume 1: Standard Road-5. This does not require advanced engineering design prior to construction. Temporary roads shall be built with erosion and stormwater controls as necessary. Roads shall be regularly inspected to be sure erosion and stormwater controls are functional and properly maintained. Temporary stream crossings will be installed as needed. Unless otherwise approved by the designated soil scientist, engineer and/or hydrologist, construction activities shall avoid winter operations and periods of substantial precipitation.

Wildlife

Most project activities would not occur between April 1 and June 30, to minimize effects to grizzly bears during the critical spring use period. Exceptions to this restriction 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.

Contractors working under contract on Forest Service lands are prohibited from hunting, transporting hunters, or transporting game on roads closed to public motorized use.

Provisions will be included in the contract to cease activity or otherwise protect populations and individuals of threatened, endangered or sensitive species. This allows for modification of the project should an unforeseen issue(s) be identified during operations. Standard contractual requirements used in all contracts provide for modification or termination of the contract to avoid impacts and protect threatened, endangered, and sensitive species.

Purchaser shall comply with the Northern Continental Divide Grizzly Bear Food Storage and Sanitation Order.

In alternatives 2 and 3, no motorized activity for units 2, 82, 83, 84 and 86 would occur in grizzly bear security core outside of the denning season (December 1 to March 31). In a single year activity in security core on NFS Road 1614 for culvert upgrades would occur between July 15 and November 1 and would not exceed 30 days.

To the extent possible, retain visual screening along open roads for units 30, 30B, 35, 35A, 37, 37A, 38, 40, 59, 68, and 102.

BMP and road reroute activities may occur during the spring season on open and seasonal roads. BMPs and road reroute activities on restricted roads would occur after July 1 to minimize displacement effects on grizzly bears. Exceptions to this BMP activity restriction on closed or temporary roads may be granted, in consultation with the wildlife biologist, if deemed necessary to reduce potential soil erosion and protect water quality or other resource values.

Public motorized access will be prohibited on roads and skid trails currently closed to public motorized use.

If berms are removed for access to treatment units, temporary gates will be installed. Berms will be reinstalled at the conclusion of project activities. Vegetation and/or rock barriers will be retained around berms and gates, where needed, to maintain closure effectiveness.

Intermittent stored service roads will be thoroughly treated so that they are completely impassable to motorized vehicles and meet the minimum criteria for a “reclaimed road” as defined by forest plan amendment 19. The intent will be that intermittent stored service treatments will no longer function as roads, yet these roads will retain a road number and stay on the road system. Intermittent stored service roads will continue to have a legal closure order. Intermittent stored service 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 50 feet above grade or near existing cross drains.
- The first portion of the road (200 to 600 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 a travel way and preclude motorized or nonmotorized use on the remainder of the first portion of road (first 200 to 600 feet).
- Beyond the first portion of the road (200 to 600 feet), the roadway will be treated to discourage use including sporadic placement of natural debris where available and seeding or planting to encourage re-vegetation.

Regeneration units will be designed so that no point in the unit is more than 600 feet from cover; in other words, an animal in the unit would be able to find cover anywhere in the unit within 600 feet or less. Cover in units 30, 32, 59, and 68 will be dictated during unit layout to adjust for site specific unit conditions. When harvest units are located adjacent to natural or manmade openings, hiding cover will be maintained on approximately 75 percent of the openings perimeter.

Where available within intermediate treatment units, retain and protect all hardwoods and/or live sub-merchantable trees in patches/clumps on approximately 10 percent of unit acreage. Favor

subalpine fir, Engelmann spruce, or Douglas-fir. Patches should be evenly distributed across the unit where feasible.

Vegetation

Hardwood trees would not be targeted for removal and would be left intact to the extent possible, considering operational feasibility.

In treatment units, where available, a minimum average of six snags per acre that are 12 to 20 inches d.b.h. would be left, and all snags greater than 20 inches would be left. If existing snag densities are below these densities, substitute live trees would be left. If existing large snag (greater than 20 inches d.b.h.) are below two per acre, substitute five live replacement trees (greater or equal to 12 inches d.b.h.) for each large snag. All standing dead western larch, ponderosa pine, and Douglas-fir trees 16 inches d.b.h. or greater would be retained. Generally, snags to be left would be further than 150 feet from open roads and private land boundaries. Snags that pose a safety hazard to the contractor's operation would be felled and left on site.

The minimum retention for down woody material will be approximately 10 tons per acre, where available. To achieve the tonnage required, retain (where it exists) down woody material in the longest material available (e.g., 16 feet long or longer) and retain the woody debris in the largest diameters available (e.g., 15 inches d.b.h. or greater), sufficient to achieve the tons per acre.

No harvest or thinning treatment would occur within old-growth forest.

Threatened, endangered, and sensitive plant species

Rare plant surveys and weed inventories will be completed prior to implementation (Summer 2017).

All healthy and reproducing populations (cone-bearing or mature trees) of whitebark pine are to be avoided during vegetation management activities. In the ecosystem burning units, site-specific measures will be taken around selected whitebark pine trees or groups of trees to avoid burning those trees. Some damage is expected to occur as whitebark pine is thin-barked and not adapted to fire.

If undocumented populations of sensitive plants are found during project implementation, they will be evaluated and protected as necessary to retain population viability. A contract clause would incorporate this into any timber sale contract and would specify that the contract would be modified to protect these plants if located.

Rare plant populations occur in some of the fens in the project area. Avoid all wetlands with all ground disturbing activities, including lakes, ponds, marshes, fens, and streams. Establish buffers around wetlands (150 feet for areas greater than 1 acre and 50 feet for areas less than 1 acre). Generally buffers should begin where riparian vegetation ends. Fens in the project area (Lion Lake Fen, Hungry Horse Lake Fen) as well as other wetlands identified in aerial photos shall be specifically buffered (depending on size) from ground-disturbing activities. Units 11, 13, 18, 19, 20, 25, 27, 86, 92, 210, and 211 are all near fens/wetlands, which will require buffering.

Control of non-native invasive plant species (noxious weeds)

Reestablish vegetation on bare ground created by timber harvest activity. Seed landings, intermittent stored service roads, temporary roads (new and historic), and disturbed roadsides with a certified grass ground cover (seed mix of native plants will be specified by the Forest

Botanist), either in the spring or the late fall to enable the best chance of success, after disturbance to provide for site protection until native species are established.

Equipment associated with timber harvest and road maintenance (excluding pickups and trucks used to remove forest products) would be power scrubbed or steam cleaned on the undercarriage and chassis before transport to the project area. 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 to the project area shall be treated in the same manner as the initial entry. "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. Contractors will be required to adhere to C6.351# - Washing Equipment, or similar contract provision which specifies the above washing criteria.

As funding allows, survey and monitor for weeds in all ground disturbed areas in treatment units (slash piles, exposed soil from excavator tracks, skid trails), roads, and temporary roads. Monitoring would occur at least one year after implementation. Surveys and monitoring shall be conducted by the Forest Botanist, Botany Technicians, the Noxious Weed Specialist, or Weed Technicians.

Spray weeds along designated Forest Service road haul routes (prism) and disturbed areas pre and post-treatment. Existing roads within the project boundary would be identified for noxious weed treatment. Specific roads and mileage to be treated would be prepared in consultation with the Forest Weeds Coordinator. Road prism is the road and associated toe of the fill to the top of the cut slope, including the running surface and turnouts. However, when a contiguous patch of weeds extends beyond the road prism, the area beyond the road prism shall be treated via force account or other means. Spraying of appropriate herbicides would occur pre and post-haul, during the periods from June 1 to July 15 or September 1 to September 30. Pre and post-haul treatment shall be the responsibility of the contractor and specified in contract clause C6.27# - Noxious Weed Treatment. Roads would be monitored after initial treatment, and additional treatments would be the responsibility of the Forest. Treatment of invasive plants would be consistent with the strategy outlined in the Noxious and Invasive Weed Control Environmental Assessment (March 2001).

The Invasive Species Manager or Forest Botanist will, if necessary, provide noxious weed material to sale administrators and contractors identifying the Forest's target species and recommended control measures.

Scenic quality design features

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, to the extent feasible (economically and technically), 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.

Table 19. Unit specific design features for scenic resource

Objective	Task	Units
Reduce IFg and Fg scenery impacts	No more than 12 ton per acre of slash (favoring course material) will remain within 50' of concern level 1 roads (US Hwy 2, NFS Road 38, NFS Road 895), concern level 1 use areas (Lion Lake day-use area, Emery Bay Campground), concern level 1 waterbodies (Hungry Horse Reservoir) and private properties. Slash, root wads, and other debris will be removed, buried, burned, chipped or lopped to a height of 2' or less.	1-9, 11-13, 16, 16a, 18, 22, 22a, 23, 25, 26, 30, 35, 35a, 35b, 37, 37a, 38, 40, 43a, 46, 76-78, 80, 81, 86, 89a, 89b, 90, 91a, 92, 93, 100-104, 205-207, 210-213, 217, and 229
	Retain vegetative screening to the extent possible and/or create openings to mimic the natural openings of the area within 50' of concern level 1 roads (US Hwy 2, NFS Road 38, NFS Road 895), concern level 1 use areas (Lion Lake day-use area, Emery Bay Campground), concern level 1 waterbodies (Hungry Horse Reservoir) and private properties. Saplings, brush and other vegetation within 20-50 feet of the route are often the most effective screening to soften visual impacts of harvest openings. Where understory vegetation does not exist, retain larger trees within a strip (~50 ft. wide) along the route at a density where their boles would provide some visual screening.	1-9, 11-13, 16, 16a, 18, 22, 22a, 23, 25, 26, 30, 35, 35a, 35b, 37, 37a, 38, 40, 43a, 46, 76-78, 80, 81, 86, 89a, 89b, 90, 91a, 92, 93, 100-104, 205-207, 210-213, 217, and 229
	Maintain 8" or less stumps (flush cut if feasible) within 150' of concern level 1 roads (US Hwy 2, NFS Road 38, NFS Road 895), concern level 1 use areas (Lion Lake day-use area, Emery Bay Campground), concern level 1 waterbodies (Hungry Horse Reservoir) and private properties.	1-9, 11-13, 16, 16a, 18, 22, 22a, 23, 25, 26, 30, 35, 35a, 35b, 37, 37a, 38, 40, 43a, 46, 76-78, 80, 81, 86, 89a, 89b, 90, 91a, 92, 93, 100-104, 205-207, 210-213, 217, and 229
	To the extent feasible (economically and technically) mask (black out) any painted boundary trees or leave tree marking that is clearly visible (within 50') of concern level 1 areas. Other options to mitigate this visual impact include: use cut tree marking to designate leave or boundary trees.	1-9, 11-13, 16, 16a, 18, 22, 22a, 23, 25, 26, 30, 35, 35a, 35b, 37, 37a, 38, 40, 43a, 46, 76-78, 80, 81, 86, 89a, 89b, 90, 91a, 92, 93, 100-104
	To the extent possible (technically and economically) landing clean up should be sufficient to ensure no poorly burned, unsightly condition remains within 100' of concern level 1 roads (US Hwy 2, NFS Road 38, NFS Road 895), concern level 1 use areas (Lion Lake day-use area, Emery Bay Campground), concern level 1 waterbodies (Hungry Horse Reservoir) and private properties. Use existing landings as much as possible.	1-9, 11-13, 16, 16a, 18, 22, 22a, 23, 25, 26, 30, 35, 35a, 35b, 37, 37a, 38, 40, 43a, 46, 76-78, 80, 81, 86, 89a, 89b, 90, 91a, 92, 93, 100-104
	As seen from concern level 1 roads (US Hwy 2, NFS Road 38, NFS Road 895) concern level 1 use areas (Lion Lake day-use area, Emery Bay Campground), concern level 1 waterbodies (Hungry Horse Reservoir) and private properties, apply a transition zone along the	3, 7, 12, 16, 16a, 17, 22, 22a, 30, 34, 35, 35a, 35b, 37, 37a, 38, 40, 41, 43a, 46, 55, 80, 86, 87, and 88

Objective	Task	Units
	edge of the unit where tree retention creates a more gradual visual transition of the treated stand to the adjacent stand and softens the unit edges. This may mean progressively decreasing the leave tree density in this zone (such as next to an existing opening) or progressively increasing the leave tree density in this zone (such as if next to a dense uncut forest).	
	All slash shall be removed within 50' of any campsite or day-use site.	23, 25, 80, and 81
Meet requirements of MA 7 for regeneration harvest units	The Forest Landscape Architect will complete a visual analysis of all units within MA 7 before implementation of the project. Units may change as a result of this analysis.	16, 16a, 22, 22a, 35a, 35b, 37, 37a, 40, and 86
	Even-aged regeneration harvest units will generally not exceed 10 acres in size.	16, 35b, 37, 40 and 86
Meet Partial Retention VQO for units in MA 7, MA 9, and MA 12	Match the scale, shape, edges and texture of the surrounding landscape. The landscape architect shall work with the silviculturist and presale forester to design these units.	16, 16a, 22, 22a, 35a, 35b, 36, 37a, 40, 51, 52, 59, 68, and 86
Meet Retention VQO for prescribed burn units	To the extent possible (technically and economically) 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.	301-306

Abbreviations: VQO=Visual Quality Objectives, IFg = Immediate foreground, Mg = Middle foreground, Fg = Foreground

Aquatics

For all prescribed fire polygons, avoid ignition within a minimum 150 feet of generated stream centerlines depicted in Project File Exhibit M-24. Fire will be allowed to burn into the areas, but they will be avoided during ignition.

In burn units 301, 302, 303, 305, 306, and 307 ignition will be implemented so that not more than three units are burned in a single year.

Manage prescribed fire through time to create desired conditions over the maximum area within ignition polygons. 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.

No harvest or fuels reduction activities are permitted within site appropriate Inland Native Fish Strategy (INFISH) riparian habitat conservation area (RHCA) buffers.

All proposed culvert replacement or removals would occur during low flow conditions. Such work outside of the Abbot Creek subwatershed shall be restricted to the operating period July 15 through November 1 to protect spawning westslope cutthroat trout. For culvert removals, reshaped newly exposed channels to match their historic shape. Road spoils would be placed outside of the floodplain. The area would be seeded and mulched. Water will be diverted with a coffer dam into bypass channel/pipe during work. When bypass channel/pipe is no longer needed, water shall be reintroduced to the stream gradually over the period of several hours. Activities would follow typical engineering design practices as show in Project File Exhibit M-20

Implementation of culvert work on NFS Road 1614 should be temporally separated (at least one year) from similar work on NFS Road 546.

All new stream aligned culverts on system roads shall be designed to pass 100 year flow events and shall be correctly aligned with natural channels.

Fire/fuels

Implementation of the prescribed burns may extend for several years into the future depending on desirable burning weather opportunities. Prescribed burns would generally be ignited using helicopters and could occur in the spring, summer, or fall when suitable burn and air quality conditions exist. Most burn units would be ignited by helicopter and take several days to complete; some units may be hand ignited.

Prescribed burning would be applied in the spring, summer, or fall, and would target the treatment of the existing shrub/grass dominated openings. Fire would be of low to moderate intensity, and would result in a mix of openings, semi-open forest, and dense forest patches. Douglas-fir, larch, lodgepole pine, spruce, subalpine fir and whitebark pine would all exist in various amounts.

Fuel reduction activities would be accomplished primarily by ground-based mechanized equipment such as feller-bunchers, rubber tired skidders, excavators, log processors, and chippers/masticators, with some work carried out by hand. Private contractors and Forest Service crews would be used for tree removal, prescribed burning, and slash disposal work. Small sawlogs, posts, poles, pulpwood, firewood, and biomass fuel are potential commercial materials that may be removed from the mechanical treatment units because of the fuel reduction treatments.

Pile burning would be dependent on weather and fuel conditions identified in a prescribed fire burn plan.

Air quality

On the Flathead National Forest, prescribed burning is generally accomplished when dilution, dispersal, and mixing conditions are considered fair to excellent. Prescribed burning requires a permit from the Montana/Idaho Airshed Group 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.

Recreation

Contour culvert replacements or removals on Road 1614 to accommodate the snowmobile groomer and snowmobile use.

Temporary closure of Trail #388 should be implemented during ignition of prescribed burn units 301, 302, 303, 304, 305, and 306 to protect public safety during burning operations.

Trail #388 running through Unit 59 will be shown as a protected improvement.

The timber sale contractor shall protect and/or reconstruct all designated trails and improvements to the condition they were in prior to implementation, including the proposed NFS system trail that runs through Units 87 and 88. Project administrators would ensure protection of trails during project implementation.

Special cut units – 23 (FK&L), 25 (Emery Creek Campground), 80 (South Lion Lake), and 81 (North Lion Lake) are located around developed and popular dispersed recreation sites. Ideally, implementation in these units would occur outside of the busy season of use from July 4th through Labor Day, as much as possible. The recreation representative and the silviculturist will work closely to determine appropriate levels of planting after hazard tree removal to add separation to camp sites. Managing the slash from these units by chipping, mastication, or removal is preferred over burning in piles in these areas.

Unit 18 – is adjacent to Abbot Bay Boat Launch site. Tree removal and associated activities should occur outside of the primary recreation season, July 4th through Labor Day, if possible. Access to the boat launch should be maintained during operations.

A temporary closure order will be put in place for over the snow use on NFS Road 38, NFS Road 546, and NFS Road 497 during winter harvest operations. The closure order will allow for public use on specified days and restrict use on days when log hauling will occur.

Will work with a USFS landscape architect and Montana Fish Wildlife and Parks on design features of the accessible fishing pier/pad at South Lion Lake and enhancements to the Lion Lake trail to improve accessibility.

During project activities, activities on temporary road H, running through Coram Pasture, will require a temporary fence to be constructed if livestock are present.

Trails added to the NFS system at Desert Mountain and Lion Hill will be designed using the following USFS design parameters (Project File Exhibit O-15):

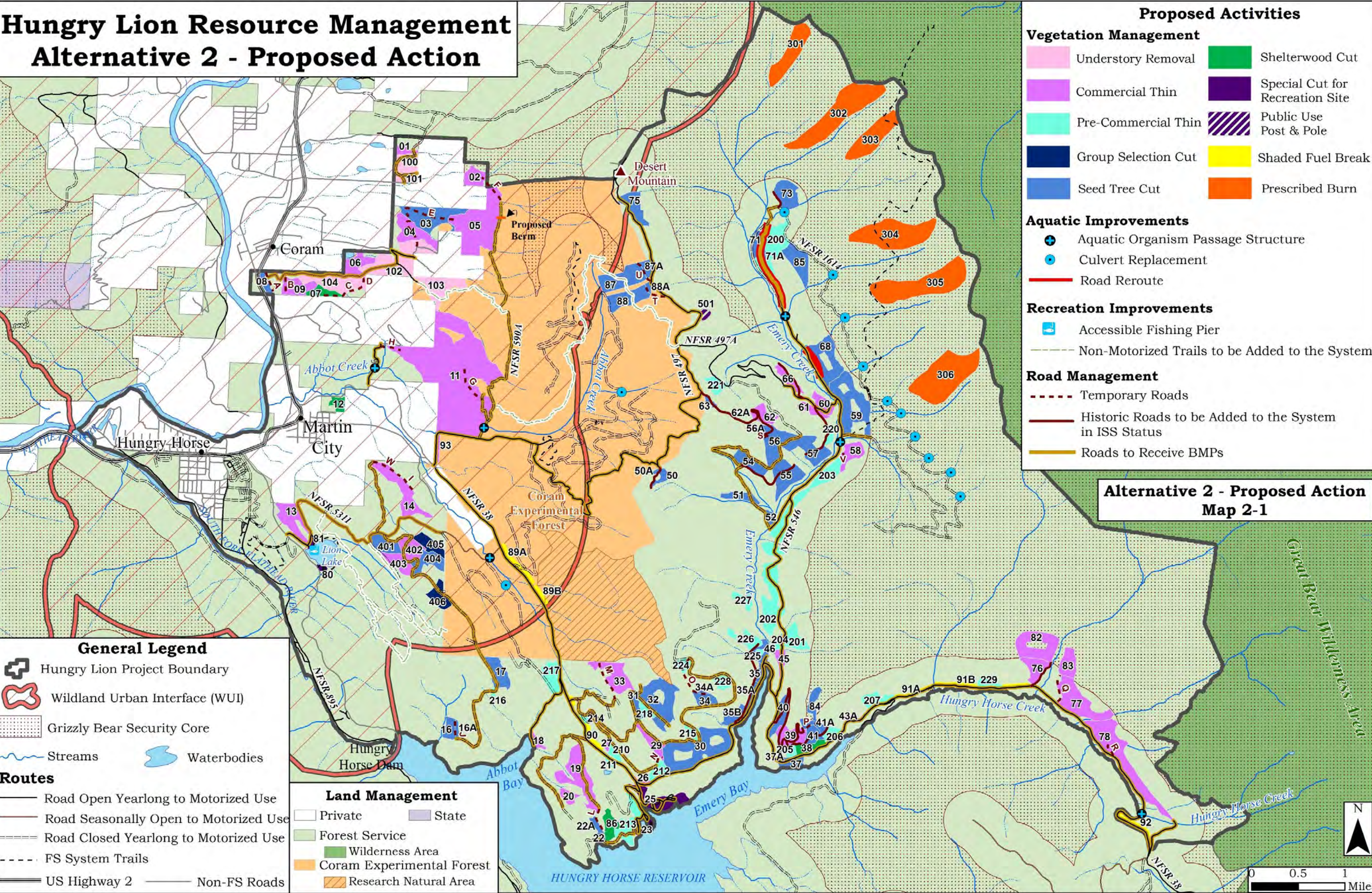
- Pack and Saddle – Non-wilderness (single lane)
- Trail class 3 tread width 18 to 48 inches
- Managed uses to include pack and saddle, hiking/pedestrian, and bicycle.
- Motorized travel would be prohibited.
- A sign plan and education plan will be developed by the district for the multiple user groups providing information about designated uses allowed on individual trails, as well as trail etiquette.
- Information would be provided through trail signage and at trailhead bulletin boards.

The nonmotorized trails would include signage providing recommendations for avoidance of human-wildlife conflict for hikers, horseback riders and bicyclists (for examples see Project File Exhibit H-7).

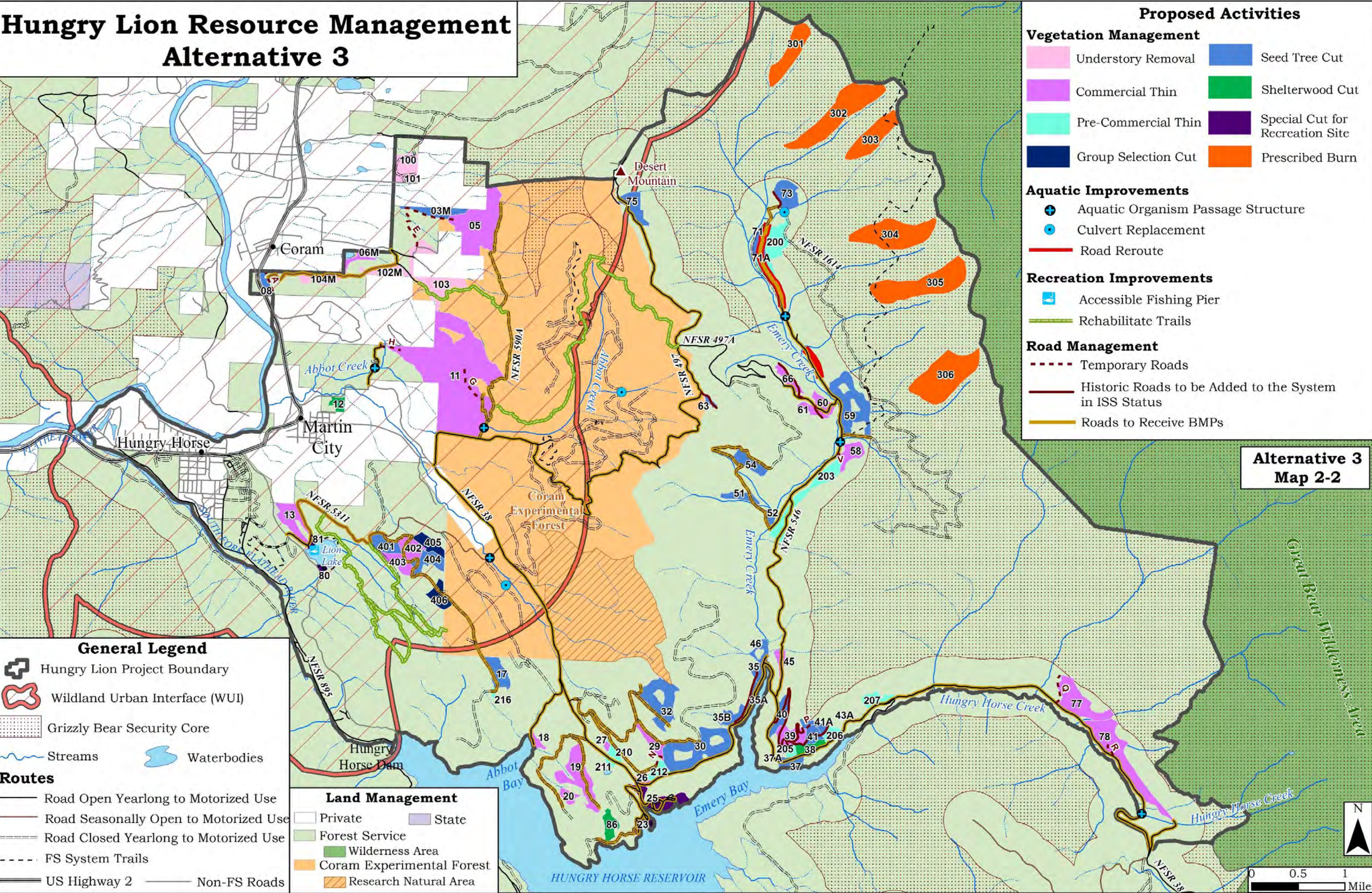
In alternative 2 and 4, the barrier on Road 590A will be constructed to create security core following the completion of project activities.

The Desert Mountain trail will be designed for pack and saddle use. The trail will be managed to maintain 50 meter (164 feet) sight distance down the length of the trail wherever feasible. Understory vegetation will be cleared where feasible, to improve sight-distance along winding parts of the trail where sight distance may be limited.

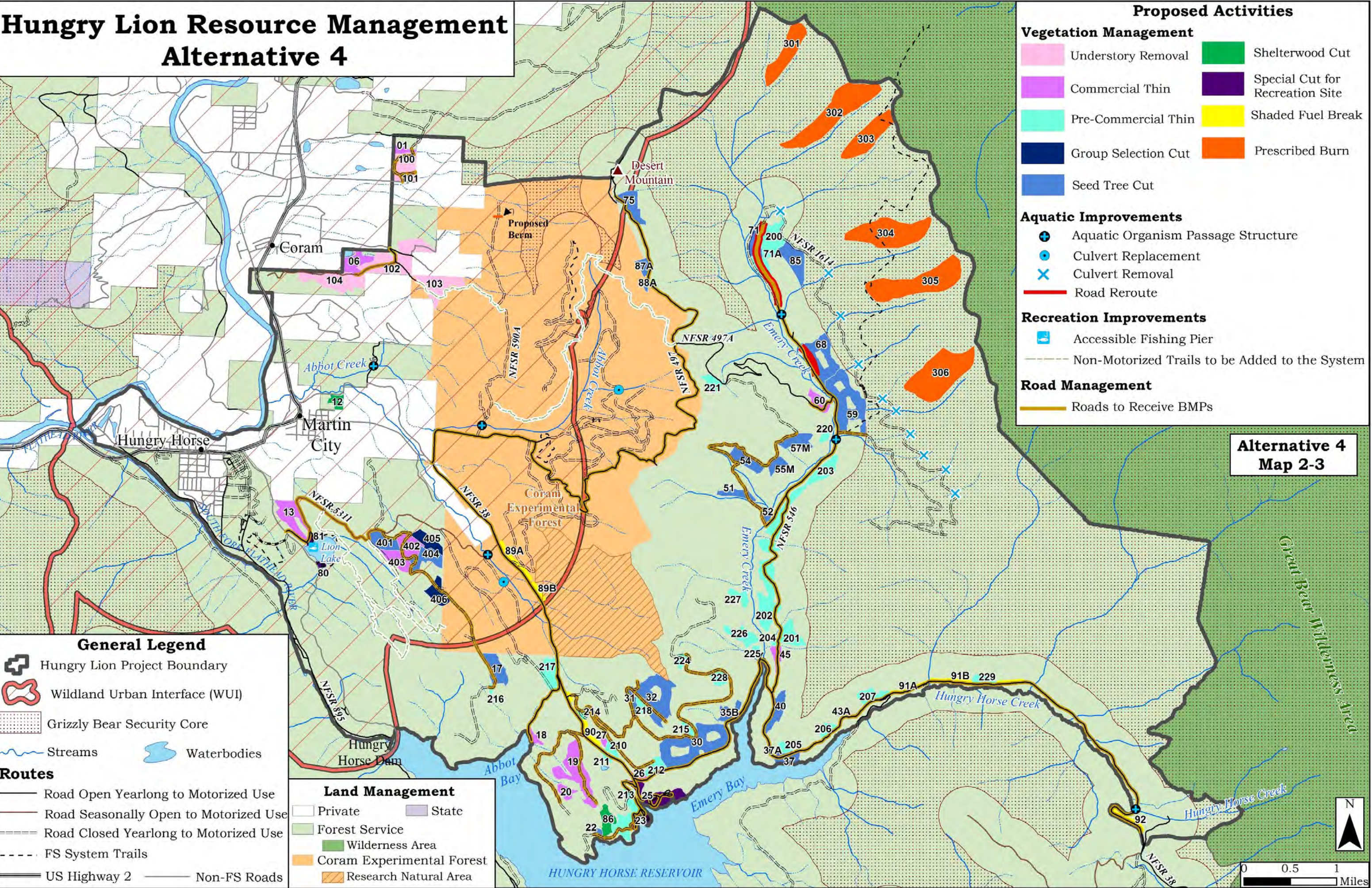
Hungry Lion Resource Management Alternative 2 - Proposed Action



Hungry Lion Resource Management Alternative 3



Hungry Lion Resource Management Alternative 4



Chapter 3 – Affected Environment and Environmental Consequences

Introduction

This chapter presents the existing environment of the Hungry Lion Resource Management 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 on National Forest System (NFS) in 1980, which harvested 150 acres of forest and constructed 2 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 2 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 2 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

Table 20. 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, 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 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.

Table 20 provides a summary of the actions considered in the cumulative effects analysis for the Hungry Lion Resource Management Project. 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.

Table 20. Past, Ongoing, Reasonably foreseeable activities in the Hungry Lion project area

Activity	Past	Ongoing	Reasonably Foreseeable
Timber Harvest	Past timber harvest by decade: 1940s = 1,364 acres 1950s = 2,128 acres 1960s = 2,857 acres 1970s = 2,294 acres 1980s = 2,745 acres 1990s = 650 acres 2000s = 511 acres 2010s = 248 acres Total = 12,797 acres Recent Sales Completed: 2011 Desert View Stewardship (part of the Belton Fuels Project)	Ongoing Timber Sales within project area boundary: 2014 Firefighter Timber Sale 2012 Belton Fuels Stewardship (part of Belton Fuels Project) Some hauling of timber products may occur through the project area for timber sales occurring on the Hungry Horse Reservoir.	
FNF Precommercial Thinning Project	Decision included 7 acres of precommercial thinning in the project area and 50 acres total of precommercial thinning in the Lake Five Lynx Analysis Unit (LAU)		
Hungry Horse to West Glacier Fuels Reduction Project (Decision Memo - June 2003)	Decision included: 198 acres of treatment to meet desired fuel profile objectives. Treatments included free thinning, slashing of shrubs and understory, selective pruning, cutting and piling, chipping, and pile burning.		
Paint Emery Resource Management Project (Decision Notice - May 1999)	Decision included: 633 acres of commercial harvest, 8,700 acres of prescribed burning, 855 acres of structure protection and fuels reduction, 100-200 acres of western whitepine planting, 116 miles of road reclamation within the Emery Firefighter grizzly bear subunit.		

Activity	Past	Ongoing	Reasonably Foreseeable
Firefighter Project (Decision Notice - August 2009)		Decision included: 518 acres of commercial harvest, 8 acres of thinning in a Douglas Fir test plantation, 28.7 miles of road decommissioning or berming, and 1.3 miles of road gating within the Emery Firefighter grizzly bear subunit.	
Belton Fuels Reduction Project (Decision Notice - October 2008)		Decision included: 908 acres of harvest, 197 acres of planting, 916 acres of prescribed burning to reduce the intensity and severity of future wildland fires, and to improve wildlife habitat in the Coram Lake Five grizzly bear subunit.	
Adaptive Silviculture for Climate Change – Trout Lake Site			Outside project area boundary: This project proposes to study 303 acres of forest stands, including 230 acres of harvest and 73 acres of control stands to assess climate change impacts and vulnerabilities on the Western Larch Forest Type. The Hungry Lion Project includes a second study site. Some hauling of timber products may occur through the Hungry Lion project area on NFS Road 38.
Non-Native Invasive Plant Species (Noxious Weed)		Weed spraying has been ongoing in the project area. The Eastside Reservoir Road (NFS Road 38), area campgrounds, Coram Pasture, and trailheads are all routinely sprayed.	Spraying is expected to continue in these areas and others as needed in the foreseeable future.
Hazard Tree/ Blowdown Removal		Ongoing at trailheads and campgrounds.	

Activity	Past	Ongoing	Reasonably Foreseeable
Forest Product Gathering		Personal use firewood cutting, Christmas tree harvesting, bough and cone collection, and huckleberry picking are all past, current and reasonable foreseeable activities in the project area.	
Tree Planting	Tree planting occurred on approximately 2,568 acres in the project area from the years 1950 through 2005. Activities planned after 1999, are listed as part of the above projects.		
Sapling (Precommercial) Thinning	Sapling thinning occurred on approximately 5,218 acres between 1967 and 2013. Activities planned after 1999, are listed as part of the above projects.		
Prescribed Burning (e.g. for wildlife habitat, whitebark pine restoration or other ecosystem objectives)	Prescribed burning occurred on approximately 5,385 acres between 1991 and 2006. Activities planned after 1999, are listed as part of the above projects.		
Wildfire History	(Within Project Boundary) The last recorded wildfires in the project area occurred in 1988, totaling 210 acres in size. Some small <2 acre fires have occurred in the project area due to human activities. (Outside Project Boundary) Large wildfires occurred in 2003 in areas surrounding the Hungry Horse Reservoir but outside the project area. In 2015, Bear Creek and Trail Creek fires occurred within the Spotted Bear District, outside the project area.		

Activity	Past	Ongoing	Reasonably Foreseeable
Public Recreation		Sightseeing, hiking, camping, boating (Hungry Horse Reservoir), hunting, biking, fishing, driving, OHV use, and dispersed recreation. There is an OHV track located behind the Hungry Horse Ranger station open to public use. There is one concessionaire campground in the project area (Emery Bay Campground), two day use sites (Abbot Bay and Lion Lake), and one boat launch (Abbot Bay) in the project area.	
Eastside Hungry Horse Recreation Site Renovation Project (2011)		Reconfigures campsites, designates day and overnight use, installs vault toilets, installs bear-resistant food lockers, replaces picnic tables and fire grills at four recreation sites: Riverside Boat Launch, Murray Bay Campground, Emery Bay Campground, Abbot Bay Boat Launch, and FK&L dispersed site.	
Anna Creek Cabin Rental	A Decision Memo signed in September 2015 closed the road that accesses five dispersed campsites at the Abbot Bay Boat Ramp.		
Recreation Special Use		There are two snowmobile outfitters operating in the project area. Each outfitter has been permitted 1,000 service days of snowmobiling for an area that includes groomed routes on Desert Mountain (within the project area) and Canyon Creek (outside the project area). One outfitter is permitted for Horse Day Riding for 3,177 service days, a portion of which is located in the project area.	

Activity	Past	Ongoing	Reasonably Foreseeable
Gravel Pit		An active gravel pit on NFS Road 11007A periodically provides gravel and rip rap for roads in the general area.	
Road Maintenance		Road maintenance is a past, current, and reasonably foreseeable activity in the project area. Various culverts along NFS Road 38 have been upsized in the past along with blading and re-graveling portions of the road.	
Culvert Replacement	Emery Creek NFS Road 546, Milepost (MP) 6.039 culvert was replaced Fall of 2016.	Routine road maintenance will replace culverts on an as needed basis within and outside the project area boundary.	
Road Relocation	Approximately 1.6 miles of NFS Road 546 was relocated out of Emery Creek riparian area to further away in 2001 in order to restore fish habitat.		
Road Decommissioning	Approximately 46.4 miles of road have been decommissioned in the project area since 1999.		
Hungry Horse Dam Construction		Construction of the Hungry Horse Dam, creating the Hungry Horse Reservoir and inundating the South Fork Flathead River, completed in 1953. This facility does not provide fish passage.	
Coram Experimental Forest and Research Natural Area https://www.fs.fed.us/rmrs/experimental-forests-and-ranges/coram-experimental-forest	History: Coram Experimental Forest and Natural Research Area was established in 1933 for researchers to study western larch regeneration and management. Completed long term studies: Natural regeneration following methods of site preparation, 1949-1960.	Continuing studies: -Evaluation of alternative timber harvesting practices ("forest residues") on regeneration, vegetation, stand development, and soil water use, 1974-present, last measured in 2012.	

Activity	Past	Ongoing	Reasonably Foreseeable
	Shelterwood and seed tree cutting, site preparation methods, and natural regeneration of conifers, 1950-1984. Clearcuttings, site preparation, seed dispersal, and natural regeneration of conifers, 1954-1974. Strip clearcutting, site preparation, growth of unmerchantable understory trees, and natural regeneration of conifers, 1954-1974. Group seed tree cutting, site preparation, and natural regeneration of conifers, 1956-1968.		
Coram Pasture		Grazing of horses and mules at this administrative site.	
Hungry Horse – Glacier View and Spotted Bear Ranger Station in Hungry Horse		Ongoing activities and maintenance will continue to occur at this administrative site within the project area.	
Non-Recreation Special Use permits		Special use permits have been issued for the project area for the following types of activities: telephone line, fiber optic cables, powerline, BNSF activities, communications towers, driveway and road use, recurring recreation events, oil and gas pipelines, water lines, Snotel sites, and other non-ground disturbing activities. A list of special use permits can be found in Project File Exhibit V-1, V-2, and V-3. Potential effects to resources from these permitted activities will be discussed in the chapter 3 analysis for each resource.	

Activity	Past	Ongoing	Reasonably Foreseeable
Fish Stocking	Montana Fish Wildlife and Parks has annually stocked rainbow trout in Lion Lake and is likely to continue to do so. Illegal (unauthorized) introductions of perch, pike and other species has also taken place in Lion Lake and these populations are now self-sustaining. Abbot Creek has been colonized by non-native brook trout, although it is unclear how these fish were introduced. No fish stocking has taken place in Emery or Hungry Horse Creek watersheds.		

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Forest Vegetation

Introduction

The following section documents the review and analysis of forest vegetation in the Hungry Lion project area. This information is used to address issues associated with potential effects of the proposed action on the forest resource. It also provides the vegetative information necessary for analysis of habitat for various wildlife species (see chapter 3, Wildlife sections).

In an effort to focus and streamline this EA a summary of the data or conclusions will be presented in this section, with detailed information on the existing condition of forest vegetation provided only where most pertinent to the purpose and need and to the issues associated with the forest vegetation. Complete documentation of all analyses on the existing condition of the forest vegetation are located in the Hungry Lion project file (see Project File Exhibit I-3 for silviculture diagnosis report), which will be referenced in this Environmental Analysis (EA) as appropriate.

Summary of Findings

The short and long term resilience and sustainability of forest conditions in the Hungry Lion project area would be improved under all action alternatives (alternative 2, 3, and 4), with alternative 2 providing the most benefit for the vegetative resource. Forests would be less vulnerable to potential deleterious effects of any future disturbance such as fire, insect or disease infestation, and drought conditions, due to their improved structure, density, species compositions, and heterogeneity across the landscape. Tree stress from ongoing diseases and crowded growing conditions would decline. Stand structures and continuity of stand age, size, and species composition would be decreased across the landscape. The ability of the forest to provide desired resource outputs and social benefits consistently into the future would be improved.

Analysis Area

Depending on the forest vegetation attribute being analyzed, the analysis area boundary may be either the project area or the forest stand and its immediate surroundings. The project area, at about 37,090 acres, provides a well-defined region where meaningful evaluation of trends, patterns and ecological functioning of the forest vegetation can occur. It is made up of many forest stands, which are contiguous group of trees of relatively uniform age classes, structure and composition. In the Hungry Lion Project there are approximately 1,400 stands ranging from one to 405 acres in size, with an average of 24 acres. Lands within the project area are primarily National Forest System (NFS) lands but some are privately owned, proposed management activities will only occur on NFS lands. Within the project area, approximately 3,128 acres are privately owned; these acres are not included in the vegetation analysis acreages summarized in subsequent sections. In general, these private lands are adjacent to town and have developments (homes, outbuildings, etc) with Douglas-fir or lodgepole pine dominated forest intermixed. A list displaying all Forest Service stands associated with the proposed activities is located in the Project File Exhibit I-1.

Temporal bounds of the analysis vary depending upon the effect or forest vegetation attribute of interest. Effects to forest vegetation from historical activities extend back 70 to 130 years. This is because reliable records of past fire history extend to about the 1880s and of past human disturbance (specifically timber harvest and roading activities) to the 1940s. Site-specific

mapping of past insect and disease activity extend to about the 1960s. The temporal bounds for effects to forest conditions into the future will extend out 100 or more years. This is because of the long lives and persistent nature of forest vegetation.

Methodology

This section provides a brief description of the sources of information used in the forest vegetation analysis, and the process for development of the forest vegetation databases for the Hungry Lion EA.

A large portion of the project area has had some type of field exam within the past 10 years. These exams provide site-specific information on forest conditions, such as tree species composition, density, age and size classes, insect and disease presence, and habitat types. Exam information was used to build the existing forest vegetation conditions database, and to identify stands where treatment opportunities may exist. In addition to stand exam data, all the harvest units in the proposed action have been visited in the field within the last two years to provide the up-to-date site-specific information necessary for determining the proposed treatment prescription and conducting this environmental analysis.

The Region 1 Vegetation Map Product (R1-VMP) vegetation database was used to attribute vegetation data for stands with no stand exam. R1-VMP was developed and approved by the northern region Vegetation Council in 2004. It was updated in 2012 for the Flathead National Forest. This database includes information on tree canopy cover, species, tree diameter classes, forest vertical structure, and physical site information, such as aspect and elevation. For the Hungry Lion analysis, R1-VMP polygons were further refined and modified extensively based on field review and photo interpretation. This increases the accuracy of R1-VMP for purposes of this site-specific project analysis.

The Forest Vegetation Simulator was utilized to project stand growth out into the future and to portray effects to vegetation from proposed activities. Forest Vegetation Simulator is a model used for predicting forest stand growth that is used extensively by various government agencies, state agencies, educational institutions and private landowners.

In addition to the field gathered information described above 2013 digital color imagery acquired through the National Agriculture Imagery Program (NAIP) was utilized to help verify existing forest conditions for every stand within the project area. See Project File Exhibit I-2 for a description of the development of the vegetation layer.

Existing Condition/Affected Environment

This section discloses the current condition of the forest vegetation within the analysis area. Conditions at the broader landscape level as well as the site-specific forest stand level are covered. Factors that have the greatest influence on forest vegetation characteristics are discussed, including physical site conditions (such as habitat type), natural ecosystem processes (such as wildfire, insect and disease activity), and human activities (such as timber harvesting).

Physical site - habitat types

Habitat types are a classification of a forest or grassland site based upon its potential natural vegetation, also called the “climax” forest community, which would occur eventually as a result of natural succession. Succession is the change in plant communities over time. A habitat type reflects the presence of certain site conditions, such as soil type and depth, aspect and

precipitation that influence the diversity, growth, and abundance of grass, forb, shrub, and tree species. A certain habitat type may support a variety of plant communities, depending upon disturbance history and the particular stage of succession of the forest. Habitat types are combined into habitat groups based on similarities of site conditions. A brief description of the habitat type groups within the Hungry Lion project area is provided in this section. More detailed descriptions of habitat types can be found in the publication "Forest Habitat Types of Montana" (Pfister, Kovalchik, Amo, & Presby, 1977). Project File Exhibit I-4, Map 1 illustrates the location of habitat type groups within the project area.

About five percent of the lands in the project area are classified as a non-forest habitat type. These are grass, forb, shrub, rock, meadow and/or water dominated areas. Most occur at the upper elevations, where tree cover is sparse due to cold site and shallow soils; along the reservoir; and/or in low lying areas where there is standing water or moist grasses.

Over 70 percent of the forested lands in the project area are forest habitat type group 7, of which nearly all is the subalpine fir/clintonia habitat type. This type is characterized by cool/moist conditions where subalpine fir is the indicated climax species. A wide range of tree and understory plant species currently occupy these sites, varying in proportion depending upon a number of factors, including the initiating event (i.e. fire, past harvest) and the successional stage of the forest. Common tree species include western larch, lodgepole pine, Douglas-fir, western white pine, subalpine fir and Engelmann spruce. Understory vegetation is very diverse, supporting a wide variety of moist-site forb species and shrubs. Timber productivity is moderate to high on this habitat type.

About eight percent of the forested lands in the project area are within forest habitat type group 9. This is the subalpine fir/beargrass habitat type, a cool forest type but somewhat drier than the group 7 subalpine fir habitat types. It typically occurs on more steeply sloped lands and drier southerly/westerly aspects. Common tree species include lodgepole pine, Douglas-fir, subalpine fir, Engelmann spruce, and on some sites western larch. Beargrass and blue huckleberry are two of the most common understory vegetation species. This habitat type group is considered of moderate timber productivity.

About eight percent of the forested lands in the project area are within forest habitat type group 2. Group 2 are the warmest and driest sites in the project area, dominated by Douglas-fir and sometimes ponderosa pine, and are located on the southerly aspects.

The remainder of the forested lands in the project area are within habitat type groups 10, 11, and 1, all of which occupy a relatively small portion of the landscape at 2, 1, and 1 percent respectively. Group 10 is a cold and moderately dry group that occurs at the higher elevations, typically above 6,000 feet. Subalpine fir is the indicated climax species and common at all stages of succession. Engelmann spruce, lodgepole pine and whitebark pine also may be common, though whitebark pine is currently much rarer than historical conditions due to its decimation by blister rust and mountain pine beetle in recent decades. Due to the cold sites and short growing season, this habitat type group is considered of low timber productivity. Group 11 are the highest elevation, coldest sites in the project area and occur along some of the ridges above 6,200 feet in elevation. Subalpine fir currently dominates these sites, though whitebark pine historically was a dominant species. Group 1 is a warm and dry group that occurs on southern aspects at low elevation within the project area. Ponderosa pine and Douglas-fir are dominant tree species with snowberry and/or Idaho fescue common in the understory.

Natural disturbance processes - fire

Fire has historically been a primary disturbance factor influencing vegetation in Northern Rocky Mountain ecosystems. Fire recycles nutrients; regulates succession; maintains diversity both within stands and across the landscape; reduces woody biomass; controls or affects insect and disease populations; affects the interrelationship between vegetation and animals; and maintains biochemical processes (R. Keane et al., 2002). Therefore changing fire regimes or patterns can have substantial and long lasting effects on forests and the ecosystems.

Historically, large fires occurred relatively infrequently across the Hungry Lion landscape, but when they did occur, they were most often of high severity and sometimes very large in size. This lethal/infrequent fire regime is typical in landscapes where cool, moist habitat and forest types prevail. The moist site conditions lessen the chance of a fire starting, but they also allow for lush, dense plant growth that provides abundant fuel for a fire when it finally does occur.

Reliable fire history records extend back to the early 1900s, and to a lesser degree back to about the 1880s. These records indicate that very few wildfires occurred in the Hungry Lion project area since 1885. Seven thousand seven hundred and sixty one acres of the project area burned between 1910 and 1929. Reconnaissance and evaluation of forest age classes and structures within the project area confirm these fire history records. Refer to Map 3-2 for locations of historical fires and the Fire and Fuels section of this document for additional information.

Natural disturbance processes - insect and disease

Insects and diseases can exert major influence on forest conditions over time, though they are generally less noticeable than fire or timber harvesting. Their influence on a year-by-year accounting can appear deceptively inconsequential, but over time, they can cause major shifts in species composition, stand structure, and other characteristics by causing mortality to selective stand components. Sometimes their effects can be quick and dramatic, such as during a mountain pine beetle epidemic. Though native insects and disease are a natural component of the ecosystem, their effects, particularly at epidemic population levels may not be a desired condition from a resource management or social perspective.

Aerial insect and disease detection flights conducted every year across the Northern Region since the early 1970s, and site-specific field exams are the primary source of data for the following summary of insect and disease conditions in the recent past and presently within the project area. The pathogens of greatest interest in the Hungry Lion project area and that this project analysis will focus on are white pine blister rust, spruce budworm, Douglas-fir beetle, and root diseases. A brief summary describing these pathogens and their presence in the project area is included in this section. For further details refer to the insect and disease information in the project file (Project File Exhibits I-5 and I-4 Maps 3-6).

White pine blister rust

White pine blister rust (blister rust) (*cronartium ribicola*) is a fungal disease that affects all five-needled pines. Western white pine and whitebark pine are the species that have been affected in the Hungry Lion project area. Blister rust is a non-native disease that was introduced into western North America from Europe in 1910. The fungus typically infects nearly all individuals of the host species, from seedling to very old trees, causing branch and stem cankers in trees that weakens and eventually kill most trees. By the 1940s, extensive infection of western white pine by blister rust was noted throughout its range in the West. Since then, blister rust, along with mountain pine beetle and associated logging of infected trees, has killed over 90 percent of the

western white pine in the Inland Northwest (Neuenschwander et al., 1999). In regards to whitebark pine, in 1993, Keane and Arno (R. E. Keane & Arno, 1993) reported that 42 percent of whitebark pine in western Montana had died since 1973, and 89 percent of remaining trees were infected with blister rust. Most of these trees have undoubtedly also died since 1993. Because blister rust is not a disease that these species have evolved with, little natural resistance exists in the affected species in this country.

White pine blister rust is considered one of the most damaging diseases of forests in the Northwest and has had a major impact on ecosystems, shifting large areas once dominated by western white pine or whitebark pine forest types to forests dominated by different species and different forest structures. Because of the important role these species play in the forests they inhabit, this has dramatically changed the functioning of the ecosystem from one of wider adaptability and tolerance for endemic insects, pathogens and fire, to one of more narrow adaptive capacities, more pre-disposed to stress, and more susceptible to detrimental impacts from insects, disease, and fire (Harvey, Byler, McDonald, Neuenschwander, & Tonn, 2008; Schwandt, 2006).

Western white pine has historically been a major species in the moist mid and lower elevation forests of the Hungry Lion project area. It was mostly found in forests of mixed species, along with western larch, subalpine fir, Engelmann spruce and Douglas-fir. Very large, old white pine trees commonly occupied the tallest upper forest canopy layer alongside large, old western larch. Large numbers of younger white pine often grew in the mid and lower canopy layers. Over the past several decades the vast majority of western white pine trees were infected and died, sometimes due to a combination of blister rust and mountain pine beetle attack, sometimes through associated salvage logging of dying trees. Today, the remaining live trees consist of scattered mature and older individual trees that are infected with blister rust but have not yet died, and younger sapling or small pole sized trees that have naturally regenerated into openings created by the death of overstory trees or by harvesting. These naturally regenerated trees have minimal to no resistance to blister rust, some are already infected with the rust, and most are not expected to survive to maturity. Genetically improved rust resistant western white pine seedlings became available in the early 1980s and have a far better chance of surviving to maturity. Approximately 386 acres of genetically improved rust resistant western white pine seedlings were planted in previously harvested areas (Project File Exhibit I-6 has more information about rust resistant trees planted in the project area).

Whitebark pine, the other host of blister rust in the project area, has historically been a major species in the highest elevation forests, typically above 6,200 feet in elevation. It was most common on the more exposed, drier slopes where it competed more successfully against associated species, such as subalpine fir. As with western white pine, blister rust has had a devastating impact on the whitebark pine forests, infecting and killing the vast majority of trees over the past few decades, often assisted by mountain pine beetle. Whitebark pine is a much less common species in the upper elevation forests in the project area. Where it is present, it is most often relatively young sapling sized trees that have regenerated over the past few decades. Very few of the mature and older trees are still alive.

Douglas-fir bark beetle and root disease

Douglas-fir bark beetle (*Dendroctonus pseudotsugai*) and root diseases of Douglas-fir (*Armillaria* spp., *Phaeolus schweinitzii* and *Phellinus weirii*) will be discussed together in this section because they are attracted to stands with similar conditions and their actions are often closely connected. Douglas-fir bark beetle is the primary species of bark beetle that attacks Douglas-fir,

its main host, in this region. Beetles are attracted to slash, stumps, windthrow, and trees weakened by fire, drought, defoliation, or disease (such as root disease or dwarf mistletoe). Populations expand rapidly in such material and in subsequent generations beetles attack and kill surrounding green trees. Susceptibility of stands to Douglas-fir bark beetle is based on the proportion of Douglas-fir in the stand, its density, size and age. The most vulnerable stands "high hazard" are relatively densely stocked, where Douglas-fir comprises at least 50 percent of the stocking, and trees are mature, with the average diameter of Douglas-fir greater than 14 inches d.b.h. (C. Randall, Steed, & Bush, 2011; C. B. Randall & Tensmeyer, 1999; Weatherby & Thier, 1993).

Root diseases are fungi that cause wood decay, growth reduction and mortality in host trees. All tree species are susceptible to one root disease or another, though some are especially vulnerable. Douglas-fir is particularly susceptible to a whole host of root diseases, with the main species and the most aggressive being *Armillaria ostoyae*, followed by *Phaeolus schweinitzii* and *Phellinus sulphurascens*. These species are often associated with each other and act similarly on a tree, and it can be difficult to tell which disease occurred first or has caused the most damage. The fungus colonizes the roots or root collar, kills the cambium in the tree, and eventually may kill the tree directly through excessive decay or girdling, or indirectly by beetle attack or windthrow. Root diseases also can weaken trees and make them more susceptible to Douglas-fir bark beetle attack. In turn, they are attracted to trees weakened by other factors such as competition, insect infestation, other diseases, or climatic factors. However, unlike Douglas-fir bark beetle, healthy young trees will also be readily invaded and killed on sites where the root disease pathogen exists at high levels.

Mature Douglas-fir dominated stands cover about eight percent (approximately 3,000 acres) of the Hungry Lion project area, concentrated on the mid-elevation, sloped, west and south facing slopes. These stands are of the age and size class that places them at moderate to high hazard for Douglas-fir bark beetle infestation. Aerial surveys and ground reconnaissance indicate that some mortality of Douglas-fir has been present nearly every year over the past two decades in the mature stands, weakening and killing small groups and individual trees. Both Douglas-fir bark beetle and root diseases are probably to blame. However, for the most part beetle populations and extent of Douglas-fir mortality has been relatively low.

Spruce budworm

The forest insect causing the most damage in Flathead County in 2015¹ was the western spruce budworm. The area defoliated by western spruce budworm (in Flathead County) decreased three-fold from 2014 to 2015 but is still considered high and scattered (USDA Forest Service, 2015b). This insect is native, but not common in the Hungry Lion project area historically. Populations in the Hungry Lion project area however, have been elevated for years with a height of infection in 2009 (with more than 15,000 acres affected). Since then, infection levels have been fairly steady until 2016 when the infection rate dropped by 90 percent. Spruce budworm larvae eat needles and buds of most conifer trees; their preferred hosts are Douglas-fir and true firs. Generally defoliation does not result in tree mortality, but can if the attack is intense and prolonged enough. Spruce budworm outbreaks are cyclic. In most of western Montana, there are usually long periods between outbreaks when no defoliation is detected. Outbreaks generally last longer and are more

¹ At the time of this analysis the 2016 insect and disease report was not yet available; 2015 was the most recent data.

severe in Douglas-fir dominated forest and multi-storied fir forests which are prevalent in the Hungry Lion project area.

Human disturbances

Timber harvesting, and associated road development in support of these activities have had a major impact on forest vegetation in the area within and surrounding the Hungry Lion project area. A total of about 11,384 acres have been harvested since 1943, which equates to about 31 percent of the project area.

Sixty four percent (7,270 acres) of harvest within the project area was regeneration cuts – clearcut, seedtree or shelterwood harvests, which remove the majority of the trees on the site, creating an opening and converting the mature forest back to a young seedling stage of development. These stands were reforested either through planting or natural regeneration and are now well stocked with vigorous young trees. About one third (2,477 acres) of these regeneration harvests were planted to conifer seedlings between the years 1950 and 2012. Another 503 acres were certified as seeded with western larch in the late 1970s. Western larch, Douglas-fir, ponderosa pine, and Engelmann spruce were the most common species planted, along with rust-resistant western white pine seedlings once they became available in the mid to late 1980s. The remaining third of past harvesting (4,114 acres) was with a partial cut method (or intermediate harvest type), which removes only a portion of the trees in the stand leaving a moderately or fully stocked forest. These treatments are done for a variety of reasons, including salvage of dead or dying trees (sanitation/salvage), thinning to improve vigor of remaining trees (commercial thin), or removing primarily smaller sick or suppressed trees (improvement cut) (Map 3-1 shows past harvest activities).

Additional past forest management activities include sapling thinning (thinning of young sapling trees), reforestation, and prescribed burning (the intentional and controlled application of fire to wildland fuels). Approximately 3,296 acres of sapling thinning has occurred in the project area, beginning in 1968. Most thins were done in stands that had been harvested and regenerated 15 to 25 years earlier, with the objective of reducing density of the young sapling trees and improving growth and vigor on remaining trees.

Within the Hungry Lion analysis area, reforestation in previously harvested stands has been successful. The National Forest Management Act (NFMA) of 1976 included requirements to assure forestlands meet reforestation objectives within five years after final harvest. 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. Flathead National Forest monitoring report, Item #39, indicate stands are certified stocked an average of 2.9 years after harvest (Project File Exhibit I-7).

There have been 5,218 acres of prescribed burning in the Hungry Lion project area, nearly all of which was associated with the Paint Emery Project, designed to improve wildlife habitat and to reintroduce fire into the ecosystem. Most of the burning occurred on the west slope of Emery Creek.

Historical vegetative patterns

Historical Range of Variation is a term used to describe the natural fluctuation of ecosystems over time. It refers to the range of conditions and processes likely to have occurred prior to settlement of the region by Euro-Americans (about the mid-1800s), and serves as a reference point for understanding ecological conditions that would occur under low levels of human influence and

technology. This can provide clues for designing management strategies that maintain ecological integrity. Healthy ecological systems are essential to maintain or create current and future social and economic opportunities.

Because fire (and large scale fire in particular) is such a dominant process affecting vegetation in our Northern Rocky Mountain ecosystem, historical range of variation is best discussed and analyzed at the broad scale, such as a watershed, which provides a well-defined, ecologically based and suitable sized analysis unit. Various forest surveys provide maps and descriptive information about forest conditions at historical points in time.

There are three commonly used systems for evaluating historical conditions within project areas on the Flathead National Forest; The mapping completed by H.C. Ayres, the Columbia River Great Basin Scientific Assessment, and amendment 21 from the forest plan.

- The earliest survey records located on the Flathead National Forest are a timber survey conducted in 1898-1899 by H.G. Ayres, when the Forest Reserves were established. This inventory was designed to prepare a map of commercial timber volume, considering tree species and merchantability standards at that time. Later surveys were conducted in 1916, the 1930s, and the 1950s (Project File Exhibit I-4, Map 8).
- In March of 1999, the midscale historical range of variation (HRV) vegetation analysis was completed for the Flathead National Forest by the Wenatchee Forestry Sciences Laboratory (Paul F. Hessburg et al., 1999). The methodology used for this forest-level historical range of variation analysis was exactly the same as that used to analyze historical and current vegetation conditions for the Interior Columbia River Basin (CRB) Ecosystem Management Project, which has been documented in several publications (USDA Forest Service, Pacific Northwest Research Station) and subsequently applied to the Upper Columbia River Basin Draft Environmental Impact Statement (May 1997). Project File Exhibit I-4, Map 9 shows the location of Ecological Subregion 3, which includes the Hungry Lion project area.
- In January of 1999, the Flathead adopted amendment 21 of the Forest Plan (1986). This amendment altered vegetative and wildlife goals, standards, and objectives related to the management of old-growth forests. Multiple sources of historical information were compiled to formulate the amendment including both of Hessburg's historical range of variation publications and Ayres data inventory, as well as the 1930s timber inventory and Losensky's fire history data (B. Losensky, 1993).

The historical range of variation for each vegetative attribute (cover type and seral stage) will be discussed in subsequent sections. Refer to Project File Exhibit I-3 and I-8 for more detailed information about the systems (and results) used to evaluate historical conditions on the Flathead National Forest.

Existing forest vegetation condition

This section describes existing forest cover types (species mixes), size classes, density, and structures within the Hungry Lion project area. The diversity, or variation, in these vegetative conditions provides important information for evaluating the values a landscape may hold for different elements, such as wildlife or timber production, and how that landscape may respond to different pressures or disturbances, such as fire or drought. It helps us determine how resilient the forests may be, whether they are in a condition that allows them to adapt to and tolerate inevitable fluctuations in climate, insect or disease populations, fire events, and other unknown factors, without experiencing socially unacceptable or severe, "unnatural" levels of impacts.

Forest cover types

Nearly all stands are composed of more than one tree species in a myriad of different proportions. To facilitate the analysis process, forest cover types reflect only the more dominant species or vegetation type within the stand. Table 21 displays the cover types on lands within the Hungry Lion project area. A description of these cover types follows (Project File Exhibit I-4, Map 10 show these cover types).

Table 21. Acres and percent of forest cover types in the Hungry Lion project area

Forest Cover Type ¹	Total Acres in Project Area	Percent of Project Area
Subalpine fir/Engelmann spruce	5,315	14
Douglas-fir	16,759	45
Western larch	6,428	17
Non-forest (water/grass/rock)	716	2
Whitebark pine	285	1
Lodgepole pine	2,177	6
Intolerant Mix	2,168	6

¹Species listed comprise at least 40 percent of the stand canopy cover, basal area or trees per acre.

Douglas-fir

Douglas-fir is the most common species in the project area, dominating on nearly half (45 percent) of the area and present in many more stands as a more minor species. The stands where Douglas-fir dominates are typically the somewhat drier and steeper south and west aspects where Douglas-fir is particularly well adapted to survive. Compared to associated species, such as western larch, Douglas-fir has relatively high tolerance of drought, especially at the early seedling stage of development. However, it is more vulnerable to fire damage and mortality than western larch due to its low branching habit (particularly in more open grown conditions), relative lack of self-pruning, small buds, denser more flammable foliage, and shallow rooting habit (Harrington, 1991).

Douglas-fir also competes well with associated species under the conditions created by past disturbances or lack thereof (e.g. partial cutting, mixed-severity wildfire and fire suppression activities). Though not as tolerant as subalpine fir to shade, it is more shade tolerant than other early successional species, such as western larch and ponderosa pine. It can successfully regenerate under conditions of partial canopy cover, as well as on deeper litter or duff layers with competing grass or other vegetation.

Western larch

Western larch is the second most dominant species in the project area, dominating on 17 percent of the area and, as with Douglas-fir, present in many of the remaining stands. It is the most common species in the young forests in the project area, i.e. the stands that were regeneration harvested over the past 50 years. It also is the most common species in the oldest age class of trees, consisting of large, old (i.e. greater than 200 years) trees scattered across portions of this landscape. The western larch plant community is considered at risk in the Northern Rockies Zone (USDA Forest Service, 1998b). Fire suppression and the decline in regeneration harvests have contributed to the potential for future loss of this cover type.

Fire plays a primary role in establishment and perpetuation of the western larch communities. Since western larch is less drought tolerant than ponderosa pine or Douglas-fir, it is restricted to

somewhat more moist sites, which historically had a more mixed or lethal severity fire regime. It is one of the most fire resistant species across its range, due to its thick bark with low resin content, high and open branching habit, low flammability of its foliage and low duff/litter volumes. It is very long lived, and tolerant to most insects and diseases. Thus it is able to maintain its presence within a stand and on the landscape for many years, often centuries. However, it is very shade intolerant and requires high amounts of light to survive and grow. It is readily outcompeted in situations with even light tree or shrub cover, such as would occur in undisturbed or only lightly or moderately disturbed forest conditions. It also is more dependent than other species, particular Douglas-fir, subalpine fir and Engelmann spruce, on mineral soil conditions for seed germination and seedling establishment. It is no coincidence that western larch is the most common species in the past regeneration harvest units, and in the large, old overstory tree component. The very open conditions, bare mineral soil seedbed, and presence of fire-resistant, large diameter seed-producing overstory western larch are precisely what are created by a moderate or high severity fire or after a regeneration harvest.

Subalpine fir and Engelmann spruce

Subalpine fir and Engelmann spruce, are the next most common stand type in the project area, dominating on about 14 percent of the area and present, though not the most dominant species, present across much of the remaining area. These species compete very well on the cool, moist sites that prevail in the project area and in the higher elevation forested sites. They are very shade tolerant and relatively slow growing, compared to associated conifer species such as western larch. They are very intolerant of fire, due to their thin resinous bark and dense crowns that often extend to the ground. Even low severity fires will readily kill trees of all sizes. However, once established on a site, their tolerance of shade allows them to persist for many decades growing slowly under neighboring western larch, Douglas-fir, western white pine or lodgepole. If and when the overstory trees die due to disease, insects, removal for products, etc., they are ready to capitalize on the increased light and grow into the upper canopy layers. This has happened in many of the stands that were partially cut in the past, specifically removing the diseased/dying/dead western white pine. Subalpine fir and spruce are now the dominant species in most of these stands. This progression is also evident in much of the high elevation forest stands that have lost the whitebark pine overstory to disease.

Lodgepole pine

Stands where lodgepole pine dominates are sparse across the project area, occurring on only about six percent of the area. Most of these stands are young forests (less than 60 years old) originating after previous regeneration harvests.

Lodgepole pine is adapted to a wide variety of site conditions and can survive and compete well at higher elevation, colder sites than either western larch or Douglas-fir. Similar to western larch, lodgepole pine is very well adapted to fire disturbances. Not only can it sometimes survive low intensity ground fires, it also can produce serotinous cones (sealed by a resinous bond). These cones persist on a tree for decades, opened only by intense heat such as produced in a fire, and then seeds cover the site by the millions, often overwhelming any other tree species that may be present. Like western larch, lodgepole pine is shade intolerant, needing abundant sunlight to survive and grow, such as would be available after a fire. It is relatively short lived, though, compared to western larch or Douglas-fir.

Intolerant species mix

The intolerant species mix are those stands that are a fairly even mix of species. Intolerant species within the project area include Douglas-fir, western larch, lodgepole pine, ponderosa pine, and western white pine. In intolerant species mix stands intolerants comprise more than 50 percent of total stocking with no one species comprising more than 40 percent of stocking. Stands where intolerant species mix is dominant are sparse across the project area, occurring on only about 6 percent of the area. Most of these stands are located in the low lying areas adjacent to private property.

Whitebark pine

Whitebark pine is an important species of the high elevation, cold forest type across the northern Rocky Mountains, where its cold tolerance, superior hardiness on the harsh microsites that may exist after a fire, unique method of seed dispersal, and resistance to lower intensity fires allow it to compete successfully in the upper subalpine zone. Its long life (many centuries is not unusual) allows it to be a very persistent species in the upper subalpine forests. Whitebark pine is an important ecological component of these higher elevation forest communities, providing a valuable food source and shelter to squirrels, bears and other animals (its cones contain large, highly desirable seeds), aiding in the protection of soil and water quality in the sensitive high basins where it grows, acting as a “nurse tree” for the establishment of other conifers around it, and undoubtedly filling a host of other roles in these harsh, cold environments (Tomback, Arno, & Keane, 2001).

Whitebark pine is considered at high risk in the Northern Rockies Zone. It has experienced dramatic population decline throughout this area, primarily due to the effects of white pine blister rust (an exotic, introduced disease) and mountain pine beetle. Fire exclusion and suppression have also contributed to the decline of whitebark pine in some ecosystems, primarily by allowing spruce and subalpine fir to increase in dominance and gain competitive advantage on whitebark pine sites (Tomback et al., 2001).

The whitebark pine cover type occupies only an estimated one percent of the project area, as isolated small patches at the highest elevations. There has been high past and continuing mortality of the whitebark pine in these areas and throughout the upper elevations of the project area. Many of the stands that now classify as subalpine fir/spruce cover types were probably a whitebark pine cover type several decades ago. There is approximately an additional 1,500 acres of subalpine fir dominated stands above 5,800 feet where whitebark pine is suitable, likely occurs, and/or was once there but has been converted to subalpine fir stands.

Non-forest sites

Non-forest sites include areas currently dominated by vegetation other than trees. This may be a relatively permanent condition, including areas dominated by water, rock, or shallow soils that do not support tree growth. Or they may be areas capable of growing trees but have recently experienced some disturbance that removed the trees, such as a high severity fire or regeneration harvest, and trees are still too small or too few to detect for classification purposes. Only two percent of the Hungry Lion project area is classified as non-forest at the current time. Most of this area are sites that support no or limited tree growth, due mainly to poor growing conditions, such as low elevation water/meadows, high elevations or rock.

Forest size classes

Age and size of trees are obviously interconnected closely; as trees get older they also grow larger in height and diameter. However, it is not always a tight correlation. Height is influenced primarily by site and soil productivity, but diameter growth is more strongly affected by stand density and degree of competition for limited water, nutrients and light. Very old trees (greater than 170 years old) may be quite small diameter (less than 9 inch d.b.h.) if they have been growing in high density stand conditions for much of their life. Vice versa, trees may reach large sizes at relatively young ages if they are on productive sites and have low level of competition with other trees for available water, nutrients and sunlight. See Project File Exhibit I-4, Map 11 for a map of size classes.

Table 22. Acres and percent of dominant forest size classes in the Hungry Lion project area

Dominant Forest Size Class	Total Acres in Project Area	Percent of Project Area
Seedling and Sapling (<5" d.b.h.)	2,268	6
Small Tree (5-9" d.b.h., typically 35-70 feet tall)	7,357	20
Medium Tree (10-15" d.b.h., typically 60-80 feet tall)	17,859	48
Large Tree (>15" d.b.h., typically 70-90 feet tall)	5,650	15
Non-forest	716	2

Almost all stands in the 40 to 75 year old classes originated from regeneration harvest activities over the last 60 years. Nearly all stands less than 40 years old are considered to be in an early successional stage of development. These young forests less than 40 years old total about 2,268 acres, or six percent of the project area.

Most of the project area is composed of stands from 80 to 120 years old. These are mature forests, meaning that they are at or beyond their maximum rate of yearly growth and have attained most of their potential height growth. They are usually composed of small to medium tree sizes. Some are very dense forests with closed forest canopies, where trees are of small diameter due to growth suppression over many decades. This age class of trees regenerated after fires in the late 1800s and early part of the 19th century. Fires burned at moderate to high severity, killing most trees over sizable chunks of the landscape. Some of the larger overstory trees survived these fires, mainly western larch, Douglas-fir and western white pine.

Stands where most of the trees are over 125 years old occupy less than a quarter of the landscape. These are large tree stands that the fires over the past 150 years either missed entirely or burned very lightly, and most of the trees survived. They are often located in the more wet areas, such as along streams, or at higher elevations. As mentioned earlier, these are not always stands with trees of large diameter. Dense forest conditions or poor growing sites may have limited growth of trees.

Forest canopy cover

Table 23 below and Project File Exhibit I-4, Map 12 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 helpful when assessing tree densities and 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. Generally, stands with greater than 40 percent canopy cover would be considered relatively closed canopy, with most of the tree crowns touching each other, but some small openings and breaks in the canopy and crowns not deeply intertwined. A very dense forest canopy would typically be greater than 60 canopy cover percent, where only diffuse sunlight or small rays of direct sunlight would reach the forest floor. Stands in the 10 to 25 percent range are very open canopied forest, where substantial distance exists between tree crowns and a high amount of sunlight is able to reach the forest floor. Stands in the 26 to 40 percent canopy cover range would appear semi-open to moderately dense, sometimes with clumpy distribution of trees interspersed with small openings, with substantial sunlight still reaching the understory vegetation.

Table 23. Acres and percent of forest canopy cover in the Hungry Lion project area

Tree Canopy Cover	Total Acres in Project Area	Percent of Project Area
<10% Canopy cover or non-forest	716	2
10-25% Canopy cover	701	2
26-40% Canopy cover	3,764	10
40-59% Canopy cover	17,064	46
>60% Canopy cover	11,605	31

The vast majority of the project area is in a well forested condition at greater than 25 percent canopy cover, with most stands moderately or densely stocked with trees (greater than 40 percent canopy cover). Most of the open canopy forests (less than 25 percent canopy cover) are those in high elevation or harsh growing sites that support less dense tree cover, or they are very young forests in a seedling or class.

Successional stages

At its simplest, succession can be defined as the basic ecological process of change in the composition, structure, and function of plant communities over time. For simplification in this project analysis, there are three stages of forest succession that will be classified and defined: early, mid, and late. The earliest stage of forest succession usually follows a disturbance (e.g. fire), which kills all or a portion of the existing trees and other plants while leaving the physical environment intact. This stage is characterized by abundant shrub, grass and forb vegetation with the tree component in a seedling or sapling size class, normally younger than 35 years old, less than 5 inch d.b.h., and usually less than about 35 feet tall. There may be older, larger trees present in the overstory of these early successional forests, but the young seedling or sapling trees are the dominant component.

The series of intermediate stages of forest development that follow the early successional stage are referred to as mid successional. Forests in a mid-successional stage are highly variable in tree and understory vegetation species composition and density, tree size classes, number of canopy layers, and stand structures; all of which may change through time. They are generally dominated by trees between about 40 and 160 years old and greater than 5 inch d.b.h., on average.

The final stage of succession is referred to as late successional forest. This stage, as well as old growth forest, is discussed in the next section.

Stands within the project area were evaluated and classified in several categories based upon certain stand structural characteristics, age classes and the successional stage of development. Table 24 below displays the acres of forests in these categories. Project File Exhibit I-4, Map 13 displays the location of these successional stages.

Table 24. Successional stages and old growth forest in the Hungry Lion project area

Forest Stage	Total Acres in Project Area	Percent of Total Acres
Old growth	1,226	3
Late successional forest	4,424	12
Mid successional forest (>~40 years old)	25,216	68
Early successional forest (<~40 years old)	2,268	6
Non-forest	716	2

Late successional and old growth forests

Definition and description of old growth and late successional forests

Though age and stage of forest development is a defining factor, old growth forests are also defined by a specific forest structural condition. All stands age through time and have the potential to achieve an older age class or late successional status (barring any stand replacing disturbance). However, not all stands have the capability of attaining the specific forest structural characteristics that enable them to function or be defined as old growth, nor of sustaining these conditions over time. Many factors influence development of large tree sizes and other structural components associated with old growth. These include soil types and site potential; stand densities in earlier stages of development that affect diameter growth of individual trees; insect or disease activity that reduce growth or cause mortality, and frequency/severity of wild fires and subsequent tree mortality.

Late successional forests, as defined for this project, may contain trees of a variety of age or size classes, but at a minimum the forest would need to be moderately to well stocked with mature or older trees. On the sites characteristic of the Hungry Lion project area, these older trees would need to be 18 to 20 inches or more d.b.h. and 170 or more years old, and comprise roughly 10 percent or more of the stand stocking. If these large, old trees are of sufficient density, the stand may qualify as old growth. In addition to these tree size and age class stipulations, late successional or old growth forests would typically have more diverse stand structures, which may include two or more tree canopy layers and higher levels of stand decadence (dead standing or downed trees, especially large diameter material). Table 25 below displays the characteristics that would occur in old growth forests for the sites found in the project area.

Table 25. Western Montana Zone old growth type characteristics within habitat type groups found in the project area

Old Growth Type Code ¹	Habitat Type Group ²	Min. Age of Large Trees	Min. Number TPA/ d.b.h.	Min. Basal Area	d.b.h. Variation ³	% Dead/ Broken Top ⁴ (range)	Probability of Down Wood ³	% Decay ⁴ (range)	#Canopy Layer ⁵	Snags/ Acre ⁴ (range)
1 - Ponderosa pine, Douglas-fir, western larch, lodgepole	Warm & Mod warm/dry (PP types; DF/Syal; DF/Phma; DF/Caru; DF/Vaca)	170	8 ≥21"	80	M	12 (3-23)	L-M	5 (0-11)	single	6 (0-22)
2 - Douglas-fir, western larch, ponderosa pine, subalpine fir	Mod cool/dry (DF/Vagl; DF/Libo, DF/Caru-caru)	170	8 ≥21"	80	H	11 (0-21)	M	5 (2-12)	single or multi	7 (2-37)
4 - Subalpine fir, Douglas-fir, western larch, ponderosa pine	Cool/moist to wet (AF/Clun; AF/Mefe; AF/Libo; AF/Luhi-Mefe)	180	10 ≥21"	80	H	9 (0-19)	H	9 (1-31)	single or multi	15 (2-43)
5 - Subalpine fir, Douglas-fir, western larch, ponderosa pine	Mod. cool/moist & Cool/mod. dry (DF/Libo; AF/Xete; AF/Vaca)	180	10 ≥17"	70/80 ₆	M	9 (1-18)	H	6 (0-12)	multi	12 (3-36)
6 - Subalpine fir, Douglas-fir, western larch; whitebark pine	Cold/ mod. Dry (AF/Vasc; AF-WBP/Vasc; AF/Luhi)	180	10 ≥13"	60	M	11 (2-31)	M	10 (2-17)	multi	25 (5-38)
8 - Subalpine fir, whitebark pine	Cold (AF-WBP types)	180	20 ≥13"	80	M	12 (10-14)	M	5 (0-8)	single or multi	37 (33-44)

¹Because of the great variation in old growth structures and the uncertainties that sampling and statistics introduce, the minimum criteria presented in this table are intended to be used as a screening tool and as a guide for identifying old growth. It is recognized that some stands that meet the minimum numbers or criteria may not be suitable old growth due to their lack of other defining characteristics. Alternately, some stands that do not quite meet the tree size or density criteria or other structural components may be suitable as old growth. The basic concept is that old growth should represent "the late stages of stand development distinguished by old trees and related structural attributes" (P. Green et al., 2011, errata 2005, 2007, 2008, 2011).

²Habitat Groups: Habitat groupings for determination of old growth are different than the Biophysical classifications discussed earlier in this chapter. Refer to section I of the project file.

³These are not minimum criteria. They are low (L), moderate (M), and high (H) probabilities of abundant large down woody material or variation in diameters based on stand condition expected to occur most frequently.

⁴These values are not minimum criteria. They are the range of means for trees ≥9" d.b.h. across plots within forests, forest types or habitat type groups.

⁵Not a minimum criteria. Number of canopy layers can vary within an old growth type with age, relative abundance of different species and successional stages.

⁶In Old Growth Type 5, 70 ft sq basal area applies to habitat type group H (cool/mod dry) for sub-alpine fir; 80 ft sq basal area applies to all other habitat types.

Current and historical proportions of old growth at the landscape scale

Current proportion of old growth forest can be assessed at several spatial levels, from a large, broad landscape perspective down to the watershed or project-level scale. A USFS Northern Region-wide analysis using Forest Inventory and Analysis (FIA) data was conducted in 2014 to estimate the percentage of old growth on National Forest lands; the Flathead National Forest was estimated to have about 11.3 percent old growth forests (not including protected areas such as roadless, wilderness, etc). At the scale of the entire Flathead National Forest (FNF), and using other field exams, satellite imagery, as well as FIA plots, the old growth analysis conducted in the FEIS for the Flathead National Forest Plan amendment 21 (USDA Forest Service, 1998b) estimated about 15 percent of Flathead National Forest lands were old growth. This analysis found that current levels of late seral forest were below the historical range of variation (at 75 percent around the mean) in the South Fork Flathead Subbasin, which includes the Hungry Lion project area.

Stepping down to a major watershed level (6th code Hydrologic Unit Codes, or HUCs), and using an entirely different methodology to determine current and historical conditions, the historical range of variation analysis conducted for the Flathead National Forest in 1999 (see earlier section on Historical Vegetative Patterns) determined the current percentage of land in ecological subregion 3 which includes the Hungry Lion project area (Project File Exhibit I-4, Map 9) in an old forest multi story or single story stage to be nearly zero (0.6 percent), as was the historical amount. This low percentage is a result of the definition used for the old forest multi story and single story structural stage, which requires a substantial component of trees over 25 inch d.b.h. to be present. Forests on the Flathead National Forest dominated by trees of those sizes are rare. Old growth in this area is composed of smaller trees (i.e. 20 inch d.b.h.) and they don't have to be particularly abundant for the stand to still be considered old growth (i.e. 10 trees per acre minimum) (see Table 25). In regards to the historical range of variation analysis, this old growth would most typically fall within the young forest multi-story structural stage - a multi-story forest with varying densities of larger overstory trees and younger/smaller trees in lower canopy layers, as would be common in a landscape with low- and mixed-severity fire regimes.

The Flathead National Forest historical range of variation analysis determined that ecological subregion 3 currently has about 14.4 percent of the land area in this young forest multi-story structure class (at 80 percent of historic range around the mean). Some unknown portion of this class would undoubtedly meet the regional definition of old growth forest (see Table 25). This proportion lies well within the range of the historical range of variation of 5.9 to 27.6 percent. One could assume that since old growth stand structures typically fall within the young forest multi-story class, the current proportion of old growth forest in the Hungry Lion landscape is also, at the least, within the historical range of variability. However, the Flathead National Forest historical range of variation analysis also found that the landscape was substantially more fragmented than historical conditions. This means that the size of the old growth patches are probably smaller – likely substantially smaller – than historical conditions. This has implications mainly for the wildlife that utilize this habitat (refer to Wildlife section of the EA). The next section discloses the analysis and determination of old growth forest specifically for the Hungry Lion project area. See Table 26 for a comparison of current and historical quantity of old growth.

Project level analysis of old growth, late successional, and potential old growth forests

This section summarizes the old growth analysis conducted specifically for the Hungry Lion project area to provide the updated, project level, site-specificity necessary for the proposal.

An estimated 1,226 acres (three percent) of the Hungry Lion project area has been determined to be in an old growth forest condition, as defined by regional definitions (see Table 25). The old growth occurs in 28 different patches ranging in size from 5 to 238 acre patches. Old growth has been confirmed via field exams taken between 2006 and 2015, with additional photo interpretation and field verification by trained personnel. These stands are characterized by an adequate stand basal area (tree stocking level) and sufficient numbers of old (greater than 170 years) large (greater than 17 to 21 inch d.b.h., depending upon habitat type) trees. They have variable levels of the other attributes associated with old growth, such as amount of snags, decaying wood, or number of canopy layers. The oldest trees in the stand are almost invariably western larch and/or Douglas-fir, which are best adapted to survive the low to moderate intensity fires that historically occurred in this area. An additional 630 acres of the project area is potential, but unconfirmed old growth. These stands are field verified but do not have a stand exam to confirm number of large trees per acre (see Project File Exhibit I-4, Map 14 for a map of verified Old growth).

An additional estimated 4,705 acres (13 percent) of the Hungry Lion project area is determined to be in a late successional stage of development. These stands contain some of the structural elements of old growth forest, specifically a good representation of large diameter, old, overstory trees, but in insufficient quantity to fully qualify as old growth. However, they do provide some of the valuable functional role as old growth forests do for wildlife habitat, social and recreational values, and landscape vegetative diversity.

Together, the late successional, unconfirmed old growth and old growth forests comprise about 18 percent (about 6,561 acres) of the project area. When current conditions within the Hungry Lion project area are compared to the historical range of variation of ecological subregion 3, they too are within the range of the historical range of variation of 5.9 to 27.6 percent.

The value and use of late successional, old growth, and potential old growth forests to specific old forest associated wildlife species is discussed in the Wildlife section in chapter 3 of this EA. However, it should be noted that the terminology and associated meanings or definitions of late successional, old forest, or potential old growth in the wildlife analysis may differ to some degree from those in this forest vegetation analysis.

Table 26. Comparison of historic and current estimations of late seral quantity

	Historic Estimations (%)			Current Estimations (%)	
	Ayres	Amendment 21 ²	HRV ³	HRV (1999)	Current
Late Seral	19%	0-20%	16%	15%	18%

¹ Estimation generated from analysis for the Hungry Lion Project

² Historical range of combined terrestrial groups within the South Fork subbasin

³ Historical mean for ecological subregion 3, which includes the Hungry Lion project area. (Includes "old forest" and Young Forest Multi-Story)

Dead standing trees (snags) and down woody material (DWD)

Dead wood, both snags (standing dead trees) and down woody material, is an important structural component of the forest, influencing soil productivity and providing values as wildlife foraging and nesting habitat and hiding cover. This section summarizes the snag and dead/down wood analysis conducted for the Hungry Lion Project. This analysis was completed to provide a more focused, project-level picture of the existing dead wood component in this area and to develop site-specific prescriptions for snag and down wood management. It employed direct methods, such as from field reconnaissance and stand exams, and indirect methods by evaluating the forest

successional stage and species distribution and the effects of insect, disease, inter-tree competition, and other factors on tree mortality.

The forestwide Flathead National Forest historical range of variation indicated that in ecological subregion 3 (containing the project area subwatersheds) the current mean percent of dead trees/snags is higher than the historical average, though still within the historical range of variability. This could reflect the changes in stand structures and the associated effects of insects and disease in this landscape. Small diameter, dead, woody material (less than 10 inch diameter) is most abundant and widespread in this forested landscape, produced continually by natural mortality throughout the different stages of successional development and accelerated by high tree densities, insect, disease, windfall, or other factors. Historically, under the mixed-severity fire regime of the Hungry Lion landscape, many of the more fire-resistant, larger-diameter trees would survive a fire, and persist as an overstory component within the developing stand. As the stand ages, and when these overstory trees eventually die, they become the valuable larger diameter snags and down wood component. The late successional and older stands are therefore the most likely to produce this large diameter dead wood material, especially the large western larch, ponderosa pine, white pine, or Douglas-fir snags. Though a general evaluation of all dead woody material will be provided, it is the larger snags and dead/down material (greater than 12 inch d.b.h. and greater than 9 inch diameter respectively) that will be the focus. These are the size classes for which forestwide management direction is provided in the forest plan (USDA Forest Service, 1986), due to their relatively higher value for wildlife habitat and long-term soil productivity. Special emphasis will also be given to the largest diameter (greater than 20 inches d.b.h.) western larch, white pine, ponderosa pine and Douglas-fir snags, as they tend to be more favored by many species of wildlife, rare on this landscape, and usually remain standing longer than smaller snags or other species. Refer to wildlife section of this chapter for more detail on wildlife use of snags and dead wood components in the Hungry Lion project area.

Table 27 displays the results of the general assessment of snags and down woody material, followed by a summary discussion of the analysis. Project File Exhibit I-4, Map 15 displays location of these snag/dead wood classifications.

Table 27. Estimated levels of snag and down woody material in the project area

Description of Area	Estimated Acres	Snag and Dead/Down Wood – Estimated abundance ¹ , existing and future potential		
Past regeneration harvest units (not including open roads)	6,728 Acres	Minimal dead/down wood and snags, existing or short-term future potential, due to harvest activity, post-harvest slash treatment and young age of current stands.		
Non-forest	716 Acres	Minimal dead/down wood and snags, existing or future potential, due to lack of canopy cover.		
Within 200 feet of open road	1,844 Acres	Minimal dead/down wood and snags, or future potential, especially larger material and Douglas-fir, western larch, lodgepole pine, due to firewood cutting.		
No public road access and not within past regeneration harvest areas	24,902 Acres	Late successional	4,728 Acres	Moderate to high amount of snags/dead down wood of all sizes, existing and potential, particularly larger diameter material (>12" diameter) and Douglas-fir/western larch/western white pine.

Description of Area	Estimated Acres	Snag and Dead/Down Wood – Estimated abundance ¹ , existing and future potential		
		Mid successional >80 years old	19,710 Acres	Low to moderate amount of snags/dead down wood, primarily smaller size (<12" diameter). Increasing abundance over time.
		Mature lodgepole pine stands	464 Acres	Moderately high to high amount of snags/dead down wood, existing and into the future, due to past and continuing mountain pine beetle mortality. Localized areas of very heavy concentrations. Mostly smaller sizes, <12" diameter.

¹ Numeric values associated with the qualitative terms for snag abundance:

Minimal = <1 snag/acre; Low = 1-3 snags/acre; Moderate = 4-8 snags/acre; High = >8 snags/acre

As the table displays, it is estimated that about 25 percent of the Hungry Lion project area (about 9,288 acres) have minimal to no down wood and snags greater than 12 inch d.b.h. These are the stands that have had past harvest or are within 200 feet of open roads. Past regeneration harvests usually “cleaned up” the majority of the slash and removed or felled most of the snags; dead trees near open roads (particularly the larger Douglas-fir and western larch) have usually been removed by firewood cutters. About 53 percent of the project acres are estimated to have relatively low abundance of down wood, mainly because of their age class and stage of development (i.e. relatively young mid successional stands with no known severe insect/disease issues). The remaining 14 percent (about 5,200 acres) of Forest Service lands are likely to be currently functioning at or above their full potential for snag production. Older stands (those greater than 130 years old), tend to contribute more of the larger diameter dead woody material and snags than the younger 80 year old stands. The estimates represent an average condition within these land areas. As is normal with the snag component, it is assumed that snag abundance, size, species and distribution is highly variable between individual stands within these broader landscape areas, and any one stand may have substantially higher or lower levels of snags than the overall average.

Because of the relatively moderate level of insect and disease activity in this landscape, current snag densities are believed to be towards high end of the historical range of variability in those areas that are not past regeneration harvests or close to open roads. At a landscape scale, these areas of abundant snags contrast most starkly with the past regeneration harvest stands currently composed of sapling trees and where for the most part there are no snags, especially greater than 12 inch d.b.h. Past regeneration harvests cover about 18 percent of the area, located primarily at the lower elevations, vary widely in shape and size, and are the primary controller of the existing pattern of snag and dead/down wood. Overall, the moderate level of snags/down wood across much of the area that was not harvested in the past probably balances out the lack of snags in the past harvest areas to the degree that at a landscape scale, the abundance of snags and down wood is likely within the historical range of variability. The current irregular distribution of the snags and down wood is also normal and acceptable from the ecosystem health perspective; however the lack of any live tree overstory and vertical stand structure in most of the past harvest areas is a notable difference when compared to a landscape that is less influenced by human activities.

Site-specific (treatment unit) conditions

There are a total of 1,442 stands within the Hungry Lion project area, averaging 24 acres and ranging from one to 405 acres in size. All stands have been evaluated and classified based on the following components: tree species (cover types), tree size class (d.b.h. refers to the diameter of a tree at “breast height” = 4.5 feet from ground level), tree age class, forest canopy cover (a measure of density), successional stage, and habitat type. In addition, activities of insects and disease, and presence of forest structural features such as snags and dead/down woody material are noted. All these components are important measures of vegetative character and diversity, and key indicators for assessment of resiliency of the forest landscape. Project File Exhibit I-1 provides a data table that documents and summarizes the vegetation conditions within all stands in the project area.

Desired Condition

The purpose and need for the Hungry Lion project proposal and the development of the proposed action was based on direction in the Flathead National Forest Plan and the guiding concept of ecosystem-based management. Our overall desired condition for the forest resource in the project area is to create and/or maintain ecologically healthy and sustainable vegetative conditions while providing for compatible levels of human use (Wood, 1994). These forests should be resilient in the face of future change and uncertainties. This means that the forests should be in a condition that allows them to adapt to and tolerate inevitable fluctuations in climate, insect or disease populations, fire events, and other unknown factors without experiencing socially unacceptable or severe “unnatural” levels of impacts. By managing forests within this concept of sustainability, they should be able to provide for a wide variety of resource and social benefits now and into the future. These benefits would include forest product outputs, recreational opportunities, wildlife habitat, watershed protection, and scenic values.

The Flathead National Forest historical range of variation analysis presented an evaluation and comparison of existing vegetation conditions against historical conditions within the landscape that includes the Hungry Lion project area. Historical conditions (or historical range of variation) of a resource can provide a context, or reference point, for determining what an ecologically healthy and sustainable condition might look like. A premise of this approach is that native species (plants and animals) are adapted to the range of vegetation patterns resulting from historical disturbance events over many thousands of years and biodiversity and long term stability of the ecosystem, as well as species survivability, will be better maintained if we manage within the historical range of variation (Duncan et al., 2010; Alan E Harvey et al., 1994; Swanson et al., 1993). Though understanding the historical range of variation is important, it is also important to recognize that humans have been and will continue to be major drivers of change in this landscape and meeting the needs and desires of society is paramount. Society may desire conditions that differ greatly from historical conditions, such as a desire to avoid large scale fire events. Attempts to precisely recreate some historical resource condition are not necessarily wise or even feasible in most situations (Duncan et al., 2010; E. D. Reinhardt et al., 2008; Swanson et al., 1993). Strategies to develop sustainable forest conditions and devise treatment plans must be based on the acceptance and anticipation of the inevitability of future change - much of it human driven - as well as the historical range of variation and the dynamic nature of ecosystems (Hobbs & Cramer, 2008).

Based on the concepts described above and Flathead National Forest Plan (1986) management direction, the following briefly describes the current concerns in the Hungry Lion project area relevant to the forest conditions and the recommended actions within this landscape which would

begin to move the forest resource towards a more resilient, sustainable and desired condition. The recommended actions listed below serve to guide the development of the proposed action, and provide the framework for the disclosure of environmental effects that follow:

- Increase species diversity within stands and across the landscape, generally reducing the predominance of Engelmann spruce, subalpine fir, and Douglas-fir, raising the proportion of other species, primarily whitebark pine, western white pine, western larch, and ponderosa pine. Apply treatments that promote multiple species within a stand or between stands.
- Improve growth and vigor in stands (by reducing tree densities), and improve subsequent tree sizes, productivity and species compositions in the future stand. There is poor growth and vigor in many stands due to high tree densities. These stands are both older (80 plus years old) and have had high density throughout their development, and younger (less than 45 years) and originate from past timber harvest. In these younger stands the favored species, such as western larch, is often being overtopped and outcompeted by less desirable species.
- Protect existing old growth where it is relatively “stable,” and promote development (short and long term) of old growth forest structures where feasible in both dry site and moist site forest types.
- Promote western white pine and whitebark pine species by conserving healthy mature trees where they exist; reducing densities of young western white pine stands; and planting improved whitebark and western white pine on appropriate sites. Restore health and desirable species compositions of forests affected by white pine blister rust.
- Decrease tree mortality from root disease pathogens. Favor root disease tolerant species where present; avoid intermediate harvest within areas with high incidence of root disease; and plant resistant species, such as western larch or western white pine following regeneration harvest.

Environmental Consequences

Introduction

In this section the direct, indirect, and cumulative effects of the proposed treatments on the forest resource are discussed. To focus the analysis and describe relevant effects, this section is formatted around the major objectives for the project and the desired forest condition. To determine how well our proposed action and its alternatives meet project objectives or address issues, several indicators have been identified to measure effects and compare alternatives.

Vegetation-Related Goals of the Project:

1. Maintain or improve the diversity and health of forest vegetative communities by:
 - a. Increasing forest structural and species diversity, including the restoration of western white pine as a major member of forest communities;
 - b. Improving the resistance of forest vegetation to potential future disturbances (wildfire, disease or insect infestations) and climate change; and
 - c. Reducing tree densities and improve growth on remaining trees.
 - d. Promoting mid-seral stands into old growth habitat; and
 - e. Restoration of whitebark pine through the use of prescribed fire and planting.

2. Reduce the risk to wildland firefighters and residents of the wildland urban interface should a fire occur by:
 - a. Creating forest stand conditions that lower the risk of future high-intensity and high-severity wildfire.
 - b. Creating defensible space along open system roads by creating shaded fuel breaks to improve firefighter safety and effectiveness in the face of longer and hotter fire seasons.

Maintain or improve timber productivity on suitable lands and provide a variety of wood products to the local economy.

Measurement Indicators:

- Forest health, vigor, structure, species composition and resilience
- Sustainability of outputs
- Old and late successional forest

Note that the acre calculations within this section are close but sometimes do not add up perfectly to the acres of treatments disclosed for the alternatives in chapter 2 of this EA. This is due to the small variations that are inevitable when combining or splitting different data tables and GIS layers and the rounding of numbers.

Alternative 1 (No-Action Alternative) – Direct & Indirect Effects

Forest vigor, species composition, and resilience

With no treatments of any kind proposed for stands within the project area, no change to the current forest conditions, as described in the existing condition section of this EA, would occur under alternative 1. Forests would continue to develop under their natural trajectory. In all stands, increasing tree density would increase competition among individual trees for light and moisture. The cumulative effect would be a reduction in growth rates and tree/stand vigor over time. There would be no opportunities to reduce the proportion of spruce, subalpine fir or Douglas-fir, and this proportion would increase into the future. This is because of the abundant seed source of these species, their ability to perpetuate themselves in conditions of partial shade and vegetative competition, and the lack of suitable site conditions for the regeneration and perpetuation of other desired species, such as larch, white pine, and ponderosa pine. In the white pine stands, western white pine would continue to decrease in proportion as it is picked off by white pine blister rust and mountain pine beetle, and subalpine fir/spruce would increase as it responds to the increased growing space with elimination of the pine. Other species, such as western larch, would be unable to establish on these sites.

Since there would be no sapling thinning, no change in species composition, tree vigor, future tree sizes and densities would occur in the young forests in the project area. Lack of thinning would result in the planted improved western white pine being overtopped and crowded by the naturally regenerating shade tolerant species, reducing their growth and vigor. Species diversity in these stands would be reduced. Under the high densities that will exist in these stands, tree crowns would diminish in size, reducing the growth rate of the tree and its capacity to respond to thinning treatments that might occur in the future. Reduced growth of trees would result in higher

mortality and smaller tree sizes in the future forest. Existing and future stand diameters are displayed in Figure 3 and Figure 2. Figures later in this section display the changes that would occur in thinned stands and discuss the differences. These changes also have impacts related to wildlife, old growth development, fire behavior, timber productivity, and stand resilience to insects, diseases, and other disturbances. These impacts are discussed in their respective sections of this EA.

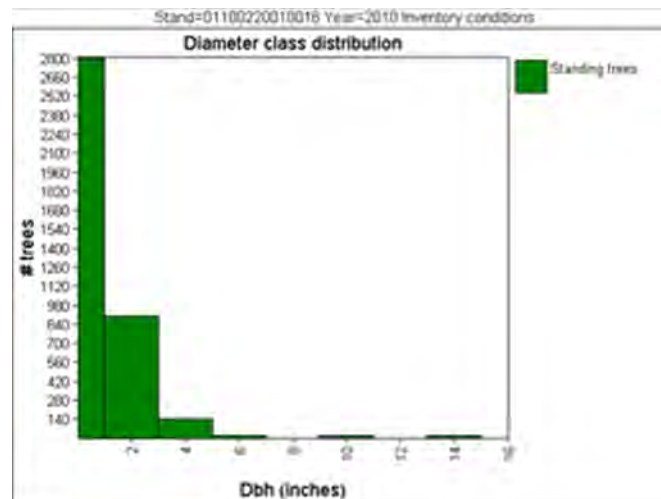


Figure 3. Year 2010 Existing stand conditions in a sapling stand

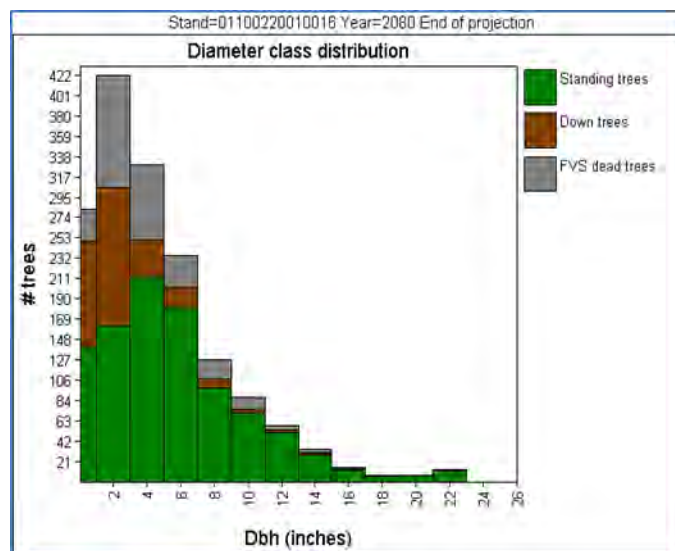


Figure 2 Year 2080. Stand Conditions after 70 years of growth in an un-thinned sapling stand

Forest health, structure, and sustainability of outputs

Forest health would continue on its decline in much of the mature forests in this landscape as white pine blister rust and root diseases intensify and spread within and between the stands. Continued decline in tree growth and vigor would occur in overstocked stands, which would have particularly large impact in the young sapling stands.

No improvement of timber productivity would occur; productivity and timber values would continue to decline across much of the project area due to declining stand growth and increasing mortality, both in young sapling stands and in mature forest.

With no treatments, existing stand/landscape structural diversity would remain. No further decrease in current levels of mature stands would occur, which would maintain this declining class at current levels within this landscape. The mature class includes most of the current late successional or old growth forest, which would also see no decrease in the short term in the project area under the no-action alternative. Large, live, overstory trees would remain at their current densities, with risk of loss limited to insect or disease factors but not to harvest activities. No increase in the proportion of young seedling or sapling stands would occur (assuming no wildfires occur), which would cause no further fragmentation of this landscape. Also under alternative 1, increasing numbers of snags of all sizes would occur as trees succumb to insect and disease. With this mortality, abundant down woody material would also exist.

In summary, the short and long term resilience and sustainability of forest conditions in the Hungry Lion project area would remain poor and no improvement would occur. Forests would continue to be highly vulnerable to potential deleterious effects of any future disturbance such as fire, insect or disease infestation, and drought conditions, due to their current structure, density, species compositions, and homogeneity across the landscape. Tree stress from ongoing diseases and crowded growing conditions would continue. Stand structures and increasing continuity of stand age, size, and species composition would occur across the landscape. The ability of the forest to provide desired resource outputs and social benefits consistently into the future would be reduced.

Old forest and late successional forest conditions

No existing or potential old growth or late successional forest would be harvested. Existing conditions for these components, as described earlier under the existing condition section, would not be changed.

In some of these forests, death of the larger overstory trees to high levels of disease or insects would continue at increasing rates. This would add to the snag and large downed woody components in the stand which could improve the late successional or old growth values for associated wildlife species (refer to Wildlife section of this chapter). High tree densities over most of the life of these stands has severely retarded growth of the trees, limiting their potential to develop into the large size classes as the existing overstory trees die out. In many of the stands currently classified as late successional or old growth forest, as the existing larger diameter overstory trees die off, there are fewer trees that would be able to replace them. Over time this would reduce the amount and quality of old growth and late successional forests in the project area. Stands currently identified as potential old growth in the project area have more favorable stand densities and the greatest chance of continuing on at a decent pace towards an old growth forest condition in the not-too-distant future.

Existing young sapling stands may have the best potential to develop into old growth forest in the future in the Hungry Lion landscape, depending upon their current tree densities. Those that have already been thinned in the recent past and where trees are more free to grow to their full potential are on a very favorable trajectory to reach large tree sizes relatively early in their lives (i.e. at 80 to 100 years old). They are very likely to become high quality old growth forest once they reach sufficient age (greater than 170 years old). Those that are of high density and not thinned will progress along a similar development pattern as the currently mature forests did after

their initiation over 100 years ago after a fire event. The tree density will greatly inhibit tree growth and reduce their potential to develop into high quality late successional or old growth forest structures.

Alternative 1 - Cumulative Effects

Since there would be no treatments that alter forest conditions, alternative 1 would not add cumulatively to the changes in forest species, size and age classes, successional stage, or densities resulting from past harvesting and thinning or historical wildfires across the landscape. Forest successional processes would continue without human interference. Fire would be allowed to play its historical role as a primary agent of change in this forest landscape—altering forest age, size classes, densities, species mixes, or removing diseased trees and enabling the forest to “start over.”

Increasing stand densities would continue to reduce stand growth and vigor. White pine blister rust, root disease, and bark beetles would continue to cause stress and mortality in affected species. Increasing mortality would add to the current snag and down woody materials, which would benefit some wildlife species but would also increase the expected severity of a fire should it occur in the future.

Over the next several decades, the early successional young sapling stands (stand initiation structure class) would progress into the mid-successional stage of development; canopies would become more closed (stem exclusion structure class); growth would slow considerably due to high stand densities; and the understory shrubs, grasses, and forbs characteristic of the more open young sapling forests would decline in abundance and vigor. This would influence future species composition, size class, health, and structure of these stands, which in turn have impacts on other resource, such as wildlife habitat and fire behavior.

Potential old growth and some late successional forests would continue to progress towards old growth conditions. Other late successional forests would decline in these values as they lose the old overstory trees to disease or insects and have no potential replacement trees. Stands currently at high densities, particularly the sapling stands, would have small chance of ever developing the necessary tree sizes and complex stand structures of an old growth stand.

The growth of the young stand initiation stands into mid-successional structural stages will increase the size of these mid-successional forest patches. High levels of mortality in many stands will increase within stand structural diversity, potentially increasing the proportion of young forest, multi-story structural stages. However, these changes come at the cost of a landscape increasingly vulnerable to large scale and high intensity wildfire, and increasing loss of trees to insect and disease. Stressed trees would also be less resilient in the face of drought and other unforeseen weather and climate changes in the local area. The ability of the forest to provide desired resource outputs and social benefits consistently into the future would be reduced.

Action Alternatives

A description of the action alternatives (alternatives 2, 3, and 4), and the issues they were designed to address are found in chapter 2 of this EA. Also included in that chapter are detailed descriptions of the proposed treatment methods (seedtree, sapling thinning, special cut, etc), and a list of all proposed treatment units by alternative. Treatment unit locations and the unit number remain mostly the same between alternatives 2, 3, and 4, with the exception of five units where

the shape was modified in alternative 3, these have an M added to their unit number. In addition, a specific unit retains the same treatment type and method no matter which alternative it is in.

The difference between alternatives lies in which units are dropped or included, in order to address the particular issue(s) driving that alternative. Therefore, the type of effect to the forest resource resulting from a particular treatment method does not differ between alternatives, but the scale or intensity of that effect would change, based on which units were included in the alternative and the number of acres treated. A full and comprehensive discussion of the type of effect that occurs due to a particular action is provided under alternative 2 below. To avoid unnecessary repetition, this full discussion is not reiterated under alternatives 3 and 4. Instead, the focus under those alternatives will be any differences from alternative 2, such as in the scale or degree of the effect. See Project File Exhibit I-10 for a summary of modeling outputs from the Forest Vegetation Simulator (FVS).

Alternative 2 – Direct & Indirect Effects

Forest vigor, species composition, and resilience

Regeneration harvest (seedtree, shelterwood, and group selection): 1,448 acres are proposed for regeneration harvest under alternative 2. Regeneration harvest is the most effective treatment method for altering current species compositions and establishing desired forest conditions. All regeneration harvests are designed to lower tree densities and create an open forest condition where desirable tree and understory vegetation species are able to establish and grow vigorously. Douglas-fir, Engelmann spruce, and subalpine fir, are overwhelmingly dominant in this landscape particularly within the proposed treatment stands. These harvests are designed to establish greater diversity of species, primarily by allowing establishment of western larch, ponderosa pine, and/or western white pine. This diversification of species and restoration of ponderosa pine and western white pine ecosystems are the primary objectives and would be accomplished through both natural regeneration and planting. Shade tolerant species are not expected to be eliminated and will seed in naturally on most sites due to the abundance of adjacent seed sources. Establishing other species on these sites is critical to achieve the diversity of species necessary to improve health, resilience, and long-term sustainable forest conditions. Western larch and ponderosa pine are long-lived species and are much more tolerant of insect, disease, and fire than Douglas-fir, Engelmann spruce, or subalpine fir. They are more likely to endure for long periods of time once established within the stand. The improved species diversity and healthy conditions created by the treatments increase the probability that the stand can adapt to whatever changes and disturbances the future may bring, including climatic changes.

Regeneration harvests are focused in mature stands and/or stands in declining condition due to insect, disease, or high densities where potential growth has peaked. These stands would be replaced with a new generation of young trees, free to grow with limited insect or disease, and species that are well adapted to the site. This substantially improves stand growth, productivity, and health for many years into the future. Even the mature trees that remain on the site (the seed or shelterwood trees) would be healthier individuals subject to much less competition for limited water and nutrients. The expected result at the least is less physiological stress to these overstory trees, with subsequent improved tree health and resistance to insects, disease, drought, and other assaults. At the best, some of these leave trees would also experience increased growth rates, raising their potential to achieve large diameter tree sizes and persist within the stand as an overstory component for many more decades.

Intermediate harvest (commercial thin): 1,659 acres are proposed for intermediate treatment under alternative 2. This type of treatment would not appreciably alter the current species composition of the stand because, though they reduce tree densities, they still leave a large portion of the existing stand intact.

Thinning treatments reduce tree densities and increase the amount of limited resources (light, moisture) available to individual trees. At the least, this allows the trees to maintain their current growth rates and condition; at the best, it greatly improves tree growth and robustness, allowing substantial increase in tree diameter, crown, and vigor over time. The degree to which tree or stand growth is affected by thinning depends upon several factors, including the following:

- a. Response to thinning is dependent on the ability of the tree's crown to expand laterally or become more efficient in the use of water and light. Thus stands near or beyond maturity respond slowly, if at all, to these increased resources due to the negligible height growth and thus crown expansion potential of older trees.
- b. Stands where tree crowns are of poor condition or comprise a small percentage of the total tree height also respond very slowly, if at all. There simply is not enough photosynthetic material relative to the tree size to provide the additional energy required to increase growth in the bole, roots, or other parts of the tree to any large degree. This condition commonly occurs in stands where high tree densities have existed for many decades, stunting tree growth.
- c. Some tree species are physiologically adapted to more readily and rapidly respond to improved growing conditions. They may have greater ability to retain crown biomass under lower light conditions (e.g. shade tolerant species) or more efficient photosynthetic processes.

The majority of the proposed commercial thinning is within stands dominated by immature trees, mostly between 40 and 75 years old. Substantial growth response and improvement of overall stand vigor is expected to result from the thinning in these stands due to their younger age and greater ability to respond to improved growing conditions, their healthy crowns, the mixed species compositions including fast growing early successional species, and moderate existing stocking levels.

Special cut: 77 acres of this treatment are proposed under all alternatives. This treatment would occur at recreation sites (campgrounds and dispersed sites). Generally, because treatments would entail a relatively light and very selective removal of trees of all sizes, the species composition would not be substantially altered. Tree removal will focus on hazard and insect or disease infested trees. Vigor may be improved as densities are lowered, therefore improving the resilience of the recreation site.

Shaded fuel breaks (SFB): 48 acres of this treatment are proposed under alternative 2. Constructing a shaded fuel break is the process of selectively thinning and removing more flammable understory vegetation while leaving the majority of larger, more fire-tolerant tree species in place. These stands may remain forested or be regenerated depending on species composition. Species composition will be altered to be dominated by fire tolerant species including western larch, Douglas-fir, or ponderosa pine. Growth and vigor will be increased in the remaining trees, though more so in the younger stands than in the mature trees.

Understory removal (USR): 278 acres of this treatment are proposed under alternative 2. This treatment is similar to the commercial thin except the trees removed are small and do not provide

a commercial product. A portion of the existing trees are removed, leaving a relatively well-stocked forested condition. Although the main purpose of this treatment is to reduce ladder fuels, growth and vigor of the remaining trees would be improved due to increased growing space. This treatment would not appreciably alter the current species composition of the stand because, though they reduce tree densities, they still leave a large portion of the existing stand intact.

Sapling thinning: After a major disturbance event in a forest, such as a regeneration harvest treatment or stand replacement fire, reestablishment of vegetation typically occurs relatively quickly, with the growing space soon fully occupied with trees, shrubs, forbs, and grasses. This earliest successional stage is a defining point in the development of a forest where tree species' presence and composition is established, as well as tree density which will affect future growth and associated tree sizes, stand health, and vigor. Though many different tree species may regenerate onto a site, over time those that grow the fastest or are more numerous eventually dominate. Other species are often relegated to understory layers where they either are able to persist for long periods, though with low growth rates, or where they eventually die. Manipulation of stand conditions at this early stage of successional development provides the greatest opportunity to affect species compositions, tree size classes, forest structure, and health and vigor of the future mature stand.

Thinning is proposed for approximately 608 acres (25 units) of densely stocked sapling stands that originated from harvesting over the past 20 to 40 years. Trees in these stands are young and typically up to about 30 feet tall, with current densities of 400 to about 2,000 plus trees per acre. Most of the thinning (16 units, or about 440 acres) would be what is referred to as "daylight" thinning. This type of thinning focuses on removal only of competing trees in the immediate vicinity (i.e. within 10 feet) of selected leave trees, which in the case of this proposal are primarily western white pine trees. Only a limited number of leave trees would be selected within each unit, and the rest of the stand would remain densely stocked and un-thinned. Daylight thinning is necessary to adhere to the management direction related to the retention of snowshoe hare habitat for the Canada lynx, a threatened species (refer to the wildlife section of this chapter). Thinned trees may also be pruned to improve their blister rust resistance. Approximately 168 acres (nine units) of more traditional thinning would occur within stands where this would not conflict with lynx management direction. This form of thinning would space trees out more or less evenly, selecting trees of desirable species and condition, to leave typically from 200 to 400 trees per acre.

A resilient forest is one that has the ability to withstand and maintain normal function in the face of inevitable future disturbance, such as fire, insects or climate change. The effects to forest resilience and health from thinning and pruning in sapling stands are closely linked to the effects to timber productivity. These treatments would allow more room for individual trees to grow, increasing their vigor, lowering their stress, and therefore improving tree and forest health and resistance to deleterious effects of pathogens through time. Survival potential of western white pine, an important and disappearing component of forests in the zone where it grows, would be improved through thinning and pruning. Favoring leave trees of longer-lived early successional species, and/or those more resistant to fire or insects and disease (such as western white pine) recognizes that this is a species that has naturally persisted in these fire-dependent ecosystems over long periods and preserves their role in the ecosystem. By creating the desired stand conditions that would naturally occur under historical disturbance regimes, we are more assured that forests would be resilient, adaptable and sustainable over time, providing for the full array of ecosystem functions and processes.

Though mature stands are not likely to see a substantial growth response, young sapling stands are at a critical point in forest successional development where treatments are most likely to have very notable and “life-long” impact on stand character. The most important in regards to the Hungry Lion project objectives are described below. Following this are illustrations that provide a visual display of how thinning affects diameter growth of the future stand.

- a. At less than 40 years old, young sapling stands are at an age of rapid growth potential. The increased light, water, and nutrients after thinning allow the crowns to expand both out and up as the tree continues to grow in height. Through photosynthesis, the crown of the tree is literally the means by which trees obtain their food. Increased crown (i.e. needle) biomass means increased photosynthetic production, which enhances growth rates. This effect has long lasting effects on tree diameter and health.
- b. Thinning allows trees to grow at or near their full potential for longer periods of time, with the resulting opportunity to develop much larger diameters at maturity and beyond as compared to no thinning (refer to Figure 5 and Figure 4).
- c. The increased sunlight reaching the forest floor and lower canopy layers after thinning can greatly improve growing conditions for the understory tree layer, which would last for many decades. Conditions are also more favorable for establishment of new conifers in the stand, which add to the understory tree density as time goes on, and thus to the future stand structural diversity.
- d. Increased sunlight to the forest floor provides benefits growth and abundance of shrubs, forbs and grasses. This would result in more lush ground vegetation in thinned stands that would last for many decades, as compared to un-thinned stands where dense forest canopies would develop sooner, inhibiting growth of understory vegetation.
- e. Overall survival of both individual trees and stand as a whole is improved through thinning at a young age. Reducing competitive pressure for limited light, nutrients and water; developing healthy full crowns; maintaining vigorous growth rates; and favoring diverse species compositions and disease/insect resistant species all contribute towards a lowering of individual tree stress, improvement in overall stand health and greater resilience and ability to withstand future disturbances, such as insect epidemics, and environmental stressors, such as drought.

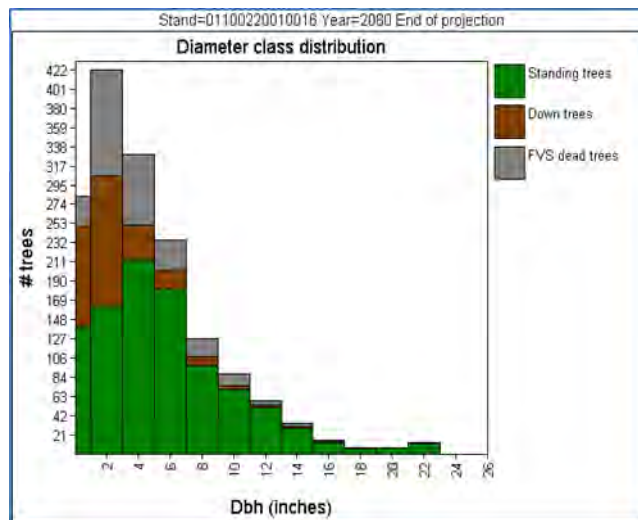


Figure 5. Year 2080. Stand conditions after 70 years of growth in a thinned sapling stand

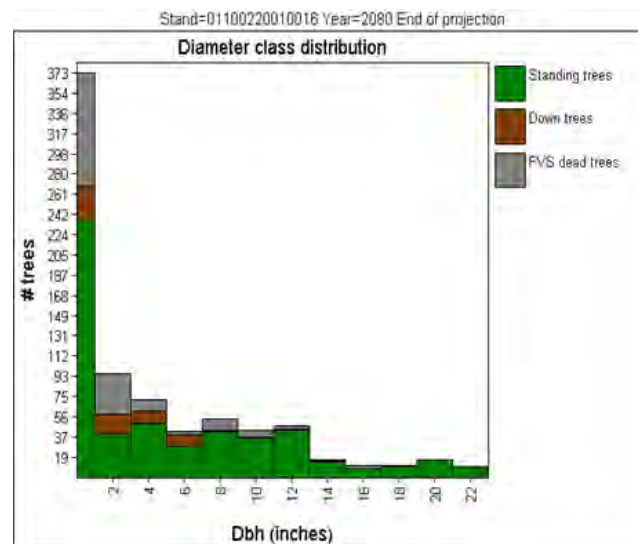


Figure 4. Year 2080. Stand conditions after 70 years of growth in an un-thinned sapling stand

Post and pole: Seven acres are proposed for post and pole removal under alternative 2. This type of treatment is similar to the sapling or commercial thin. The treatment would not appreciably alter the current species composition of the stand because, though it reduce tree densities, it still leaves a large portion of the existing stand intact. Removing post and poles would decrease the proportion of lodgepole pine, allowing for more seedling/sapling Douglas-fir to grow into the canopy and would increase growing space for all remaining trees. At the least, this allows the trees to maintain their current growth rates and condition; at the best, it greatly improves tree growth and robustness, allowing substantial increase in tree diameter, crown, and vigor over time.

Ecosystem burns: There are about 759 acres (six units) of prescribed burning in alternative 2. This treatment is proposed within stands on south or southeast aspects representing some of the

drier sites in the project area. They are dominated by Douglas-fir and subalpine fir up to about 120 years old at varying densities, with small openings of shrubs, rock, and grasses dispersed across the stand. A low to moderate intensity controlled burn is proposed, designed to mimic the effects a wildfire might have on these forests, diversifying stand density and structure, and enhancing understory vegetation development. The burn treatment would result in a mix of vegetative conditions within the unit, including openings in the forest canopy where grasses, forbs and shrubs that provide food for wildlife would proliferate; under-burned mature forested areas, where smaller understory trees would be killed but larger diameter overstory trees would survive; and un-burned areas with no change in existing forest condition.

In the upper elevations where whitebark pine are or were present, the burns would create freshly burned, open and exposed areas. These sites are often used by Clark's nutcracker for the caching of whitebark pine seed. By creating desirable germination and growing sites where initiation of a new generation of whitebark pine trees can occur, the process of natural selection is allowed to occur or even be accelerated. Blister rust resistant genes from surviving cone-producing trees have the opportunity to be incorporated into future generations of trees (McDonald & Hoff, 2001). Increasing the level of genetic resistance to blister rust is one of the few options available to reverse the severe loss of whitebark pine in the ecosystem.

Whitebark pine competes most successfully on higher elevation sites, particularly on the more exposed or drier sites that are less favorable to spruce and subalpine fir. These also tend to be the kind of sites that Clark's nutcracker seems to favor for seed caching. The prescribed burning would target the portions of the units above 6,000 feet in elevation. This approach would increase probability of success in the objective of improving whitebark pine viability and survival, while retaining tree cover in other areas where it is not likely that whitebark pine would compete successfully anyway. Parts of all the proposed spruce/subalpine fir burn units contain conditions favorable for whitebark pine regeneration and competitive success.

The burns would target stands where Douglas-fir and subalpine fir are the primary species (sometimes lodgepole pine), where site conditions are relatively moist and would promote optimum growth rates, and where live cone producing whitebark pine is absent or very scarce because of recent mortality. Because of the very high value of any remaining live whitebark pine in this ecosystem – and particularly any remaining mature, cone bearing trees – burning of these trees would be avoided. If these trees burned, it would be a detrimental effect and result in the loss of an existing and potential future whitebark pine seed source.

The presence of an adequate supply of seed is an important component of any plan to restore whitebark pine. If there are few surviving, cone-producing whitebark pine, the Clark's nutcracker may consume the limited supply of unripe seeds long before cone ripening (Tomback et al., 2001). The seed for natural regeneration could come from whitebark pine many miles away, though most seed is cached within a few hundred meters of its source. Though field observations have noticed live immature and mature whitebark pine in the Hungry Lion project area, there is no comprehensive inventory of just how many surviving, cone producing trees there might be within the vicinity of the proposed burn units. Due to the uncertainty of adjacent adequate seed source, improved whitebark pine will be planted where suited for site conditions and access allows.

Forest health

The major insect and diseases of concern in the Hungry Lion project area are whitepine blister rust in western white and whitebark pine; root disease and Douglas-fir beetle in Douglas-fir; and

spruce budworm. The proposed action was designed to focus on stands with higher levels of pathogens to better meet the purpose for the project of developing healthier, more resilient, and sustainable forest conditions now and into the future.

The risk of tree mortality due to insects and disease would be reduced in all units. This would be due to the improved tree vigor that would occur after reducing stand density; the removal of the more susceptible, less vigorous trees; and the shift to more diverse tree species composition through regeneration of a new, young stand of conifers. The larch and Douglas-fir trees left in the units would have a greater potential for improved growth and vigor with the reduction of competition. However, some of the most aggressive organisms, including bark beetles and *Armillaria* root disease, could still overcome a healthy tree's natural defenses; treatments would not remove all risk of mortality from these elements.

Root diseases: Regeneration would be the primary treatment method used in root disease infested units. Treatment objectives would include the reforestation of the stand to species that are less vulnerable or unaffected by the root disease organism. This is a very effective treatment to reduce the impacts of root disease on these sites, because it removes host species and establishes resistant species.

Regeneration is preferred because *Armillaria*-afflicted stands may not respond favorably to thinning if susceptible species are left (Hagle, 2008). Where Douglas-fir remains a substantial portion of the leave tree component after thinning, there may be an increase in the intensity of root disease infection with subsequent reduced growth and health of trees and, over time, an increase in mortality of the Douglas-fir within the stand after treatment. This is because the increased food supply from the stumps and roots of infected trees that are cut provides an increased food source and means of spread for *Armillaria* root disease. Mortality rates vary greatly by location and through time. It is expected there will be some mortality in the future from *Armillaria*, but it is impossible to predict the timing, intensity, and extent of the loss. If the residual trees do succumb to *Armillaria* the dead trees will positively contribute to the snag and down woody component of the stand.

White pine blister rust: Loss of most of the mature western white pine and whitebark pine stands has occurred due to white pine blister rust and mountain pine beetle mortality over the past 30 years. This affects stand health, diversity of species, fuel loadings, and stand structures across the landscape. Regeneration harvest in formerly western white pine dominated stands would create a new forest and a favorable environment for planting of rust resistant seedlings. This would contribute to the restoration of western white pine across the landscape. A wealth of studies indicate that restoration of western white pine would help maintain forest resilience and ecosystem services in the face of uncertain climate change in Interior Northwest ecosystems (Hines, Klopfenstein, Richardson, Warwell, & Kim, 2013).

Douglas-fir beetle: Currently Douglas-fir beetle is at low population levels within the project area. There is the potential for a localized increase in beetle population and subsequent mortality to the larger diameter and older Douglas-fir both within and surrounding the burn units as a result of the ecosystem burn treatments. This response is common after low intensity underburning in Douglas-fir stands. This increase in both beetle populations and Douglas-fir mortality is not expected to be substantial or widespread due mainly to the relatively small diameter of the Douglas-fir in the proposed burn units and the small acreage that is being affected by the actual burning.

Most Douglas-fir dominated stands would be treated with regeneration harvest. Forest health would be substantially improved, both in the short and long term, by removing the Douglas-fir and establishing a new age/size class of young, vigorous seedlings. Regeneration to a stand of more mixed species would occur. This action not only removes present potential breeding habitat for the beetle, but also creates forested areas that would not be susceptible to beetle infestation for many decades due to the young age of the newly established trees. These treatments would not “control” beetle population levels nor alter its role and function in this ecosystem. Douglas-fir beetle has and will be present wherever there are Douglas-fir of suitable size, age, and condition. However, by creating stands and a landscape with a diversity of species, size classes, age classes, and patch sizes, beetle populations have less ability to build up to epidemic levels, causing high levels of mortality and potentially undesirable impacts.

The largest healthiest Douglas-fir trees will be retained in all cutting units. There is still a risk to these individuals, but due to the reduction of Douglas-fir composition the stand hazard is substantially reduced.

Spruce budworm: Although spruce budworm has had a major impact within the project area, none of the vegetative treatments are expected to affect presence or intensity of the disease. Budworm causes defoliation but generally does not cause mortality, so treatments targeted at lowering its presence are not desired. Trees defoliated by budworm can recover fully by growing more foliage.

Abiotic factors: There is increased risk of windthrow after harvest within all the proposed commercial thin, understory removal, and shaded fuel break treatments due to the sudden loss of the support and shielding from wind that adjacent trees provide in a dense forest. Degree of loss to windthrow is very difficult to predict, but it is expected to claim at least some (five percent up to perhaps 25 percent) of the leave trees within many thinned units. Windthrow is influenced by species compositions, prevailing wind direction, density of the stand prior to treatment, terrain, and soil types. Lodgepole pine and spruce, shallow rooted species, are most susceptible to windthrow; larch, ponderosa pine, and Douglas-fir are less susceptible. A forest that has been at high density since its earliest successional stages and where trees are small in diameter with low crown ratios and “top heavy” are particularly vulnerable to windthrow upon opening up of the canopy. However, stands in better condition, containing trees with large, full crowns, can also experience increased risk because their crowns present a larger target for winds.

Based on recent reconnaissance, windthrow does not appear to be a major disturbance event historically in the project area, though it has been observed to some degree within many of the thinning or shelterwood harvests in the past. It is likely there could be windthrow in the stands with root disease due to the change in canopy density and weakened roots. These trees, if windthrown, are not expected to be a large portion of the stand so the canopy should be mostly intact and the windthrown trees will contribute to large down woody debris.

There is always the chance, in any part of the forested environment, that unforeseen unusual weather events can happen and trigger localized, heavy pockets of windthrow. Over time, risk of windthrow in the thinned units will decrease as the trees develop more windfirmness in response to the open conditions, by growing more roots and supporting wood in the bole.

Forest structure

The horizontal and vertical distribution of the components in a forest stand is referred to as its structure. This includes elements such as the height, diameter, number of canopy layers, and

density of the trees, shrubs, and dead standing (snags) or down woody material. The forest vigor, species composition, and resilience section discusses tree age, size classes and tree density. Additional structural elements of interest in the forests of the Hungry Lion project area include snags, dead/down woody material, number of canopy layers, and understory vegetation (shrubs, herbaceous). These components will be discussed in this section.

Snags and dead/down woody material

Based on the analysis of existing dead standing and down wood in the project area, the portions of the landscape where past regeneration harvests are most dominant are considered of highest importance for retention of adequate forest structural components in any newly created harvest openings. Proposed treatments in areas where surrounding stands have relatively abundant snags and down wood due to insects, disease or other factors are of relatively less importance. The capacity of the existing stand to provide for snag and down wood habitat now and in the future also influences the prescription. Some proposed units have few or no larger snags (i.e. greater than 12 inch d.b.h.) and/or poor or no suitable replacement snags in these size classes. Other units would be readily accessible to future firewood cutters and the likelihood of snags remaining intact in these areas is poor – at least those snags desirable for firewood.

A site-specific snag and down wood prescription for the Hungry Lion vegetation management proposal was developed based on the project level snag/dead wood analysis (refer to affected environment above). Following this prescription, project implementation would provide snag and down wood structural components at levels that adequately provide for wildlife habitat, soil productivity and stand/landscape diversity. The following are elements of this site-specific prescription:

1. All standing dead western larch, ponderosa pine, western white pine, and Douglas-fir trees 20 inches d.b.h. or greater would be retained within all treatment units, except in the following situations:
 - a. They lie within 300 feet of the uphill side or 150 feet of the downhill side of a road open to motorized public access;
 - b. They create a safety hazard during logging operations; or
 - c. They must be felled to allow harvest access.

If these snags must be felled for safety reasons, they would not be removed from the site. They would remain to then provide valuable large diameter down, rotting wood. This prescription element would provide the best assurance of maintaining the current level of this structural component on the landscape. See discussion in the Wildlife section of chapter 3 for the interpretation of the effects of snag retention on wildlife for feeding and nesting.

2. Prescriptions and marking guides will require designating live leave trees in all harvest units, ranging from 5 to 15 trees per acre in seedtree harvests, 20 or more trees per acre in shelterwood harvests, and 75 or more trees per acre in commercial/noncommercial thinning units. Western larch and western white pine is usually favored over Douglas-fir, lodgepole pine, and other species. Larger, healthier trees are selected over smaller or diseased trees. These live leave trees will be future snag replacements.
3. No snag retention requirements would exist for portions of units that lie within 150 feet (downhill side) to 300 feet (uphill side) of a road open to motorized public access. Because of their proximity to the open road they would be easily accessible to future firewood cutting. Snags can still be left if desired at implementation, but because they are not likely to remain

for long (depending on species, size and condition, which affects their attractiveness to firewood cutters) this analysis will assume that these areas would not provide present or future snag habitat.

4. Because of the value of large rotting wood to both wildlife and soils, the existing 12 inch and larger diameter dead/down wood within units would be left, with removal occurring only if necessary to meet fire hazard or site preparation (i.e. for planting or natural regeneration) objectives. The minimum retention for down woody material would be approximately 10 tons per acre, where available. To achieve the tonnage required, retain (where it exists) down woody material which includes the longest material available (e.g., 16 feet long or longer) and retain the woody debris with the largest diameters available (e.g., 9 inches d.b.h. or greater), sufficient to achieve the tons per acre. The maximum retention for down woody material would be approximately 20 tons per acre.

Current snag and down wood conditions and the potential for future replacement snags and down wood would remain relatively unchanged from the existing condition under alternative 2. Short and long-term snag and coarse woody material recruitment would continue along a relatively natural successional trajectory for these areas. Snag and down wood abundance will continue to increase in these stands over time, and essential soil processes and diversity of wildlife habitat would be well met.

Canopy layers

Prescriptions for all harvest units would require retention of live, overstory trees, the amount depending upon the specific treatment. In seedtree harvests, these trees would be of low density, typically from 5 to 15 trees per acre. In shelterwood harvests, overstory leave tree density would be higher, usually about 20 to 30 trees per acre. The special cut harvests (recreation sites) would also leave a higher number of trees per acre, estimated around 50 plus trees per acre. In commercial/sapling thin and understory removal units, leave tree density would be relatively high, ranging from about 75 to 250 trees per acre, dependent upon tree size and species. Gap selection units would have openings created, but would have tree densities similar to a commercial thin between the gaps. Shaded fuel break units would have varying tree densities left, but all would have at least the residual tree density of the seedtree harvest.

In all harvest units, western larch, western white pine, and ponderosa pine would be the favored leave tree species. To reach the desired leave tree density, trees of other species may also be chosen, such as Douglas-fir or lodgepole pine. In all cases, healthy trees would be selected over those in poorer condition, and larger trees over smaller. These overstory trees would form an upper canopy layer, sometimes lightly stocked, sometimes more abundant. Lower canopy layer(s) of trees would develop, consisting of either newly regenerated conifers (as within a seedtree or shelterwood harvest) or already existing trees that would be freer to grow with the increased light (as within a commercial /sapling thin). Barring any substantial loss of trees in the overstory (to disease, windthrow, etc), this two (or more) storied forest structure would persist for many decades, conceivably throughout the life of the stand until the next future major disturbance. Additional canopy layers may form over time as shade tolerant species seed in or get “left behind” by more rapidly growing neighboring trees.

All sapling thinning units require retention of trees that are less than 2 feet tall. If trees in this lower canopy layer exist in these sapling stands, they are predominantly the slower growing, more shade tolerant species (subalpine fir, grand fir, spruce) and sometimes Douglas-fir. Most of the sapling thin units have a relatively low density of these understory trees. Thinning of the

overstory sapling tree layer would allow more light to reach whatever understory layer may exist and growth of all trees should improve substantially. This would create a two-storied stand condition, becoming more pronounced as the young stand matures.

All these proposed treatments would help facilitate development of more diverse stand structural conditions pertaining to the forest canopy layers across the Hungry Lion landscape and into the future, while still promoting improved forest health and vigor.

Understory vegetation

In general, the reduction in tree density resulting from the proposed harvest activities would increase the cover and production of understory plant species (Bartuszevige & Kennedy, 2009; Metlen & Fiedler, 2006). Disturbance through harvest or ecosystem burning increases available light to existing understory plants. This condition stimulates growth of plants. The diversity of understory species can also increase, with different species contributing to this diversity at different points in time. For example, short lived annual or biennial plants may be most abundant in the years immediately following treatment, but some shrubs may take longer to recover and regain their pre-treatment cover (Bigelow & Manley, 2009). Shade intolerant species would find more favorable conditions for establishment and growth in a regeneration harvest where the canopy is very open, whereas shade tolerant species would be less favored. And vice-versa, more shade tolerant conifers would find conditions more favorable in treatments that retain a greater portion of the overstory trees, such as a thinning or heavy shelterwood cut. Tree skidding and removal operations may damage the above-ground plant parts in portions of the treatment units, but plants would resprout from roots and underground plant parts. In areas of more intense mechanical operations such as skid trails and landings, reseedling the disturbed soils with native grasses would occur. Logging operations also may also disturb upper litter and organic layers and expose mineral soil. Some disturbance such as this is desirable across those units where natural regeneration of conifers is the objective. All conifers native to the project area regenerate and establish themselves most successfully on bare mineral soil, though some can also be successful on sites that are more vegetated or with more duff. In any case, those areas more disturbed by the logging are expected to quickly revegetate with both conifer seedlings and shrubs or herbaceous plants.

Thinning treatments in the sapling stands would prolong the existing character of the early successional understory plant community and the increased light would stimulate growth of understory plants. It is not likely that any new plants would colonize these sites, as there would be little to no damage to the current plants or soil disturbance where new plants may establish. Shrubs that are common in these young stands and would continue to thrive and even increase in growth rates include maple, serviceberry, and willow.

Sustainability of outputs

The Flathead Forest Plan identifies approximately 50 percent of the lands in the Hungry Lion project area as suitable for timber management, with the vast majority within management area 15. Cost-efficient production of timber and protecting the productive capacity of the forest are primary goals in this management area.

Timber productivity is influenced by both site and forest conditions. All proposed treatment units are on relatively productive soils with moderate to high timber productivity and capable of providing a sustainable supply of timber products through time.

Regeneration harvest

The stands proposed for regeneration harvest treatments are mature, where growth rates have peaked. Current timber productivity and value in most stands is lower than the site potential due to a variety of factors, such as: overstocked forests, declining growth, and heightened mortality levels due to insects, disease, or high densities. In units with high degree of pathogens and mortality, some of the economic value of the timber has been lost already. Mortality will only get greater over the next few decades in many of the stands with bark beetles and root disease.

In stands that have not yet experienced high levels of mortality, harvest is a proactive approach to avoid potential loss of trees and timber values. It would capture the value and volume of trees while they are at their highest, rather than waiting until trees are older, slow growing, deteriorating, or dead. In many stands proposed for harvest where trees are already dead or infested with pathogens of various sorts, harvesting would capture wood product value and volume before it is lost entirely. Refer to the Economic section of chapter 3 for further discussion of economic effects of proposed activities and the expected wood products produced.

Regeneration harvesting would replace stands of relatively poor condition, overstocked mature slow growing stands, and stands in decline due to beetles, disease, and other factors with a fully stocked new stand of young, vigorous, and rapidly growing trees. It essentially starts the stand over again. Establishing desired species compositions, improving stand health, and creating conditions where the trees can maintain their full growth potential, better utilizes the full productivity potential of the site. Desired species compositions may differ depending on the site, but diversity within and between stands would be the objective, as well as establishment of species capable of long term survival and growth in the face of an uncertain future environment. For example, western larch would be a featured regeneration species in many stands because it has a rapid growth rate, longer life span, and greater resistance to many insects or disease than Douglas-fir or lodgepole pine. To ensure that the desired species establish in the regeneration units and important project objectives are met, it may be necessary to plant after harvest if there is insufficient natural seed source or inadequate site preparation.

Reforestation

The regeneration units proposed for treatment are all of moderate to high productivity for tree growth and development. All of the seedtree, shelterwood, and group selection harvest units would be regenerated to a new stand of young, conifer seedlings; survival of seedlings would be expected to be high on these sites. Primarily western larch, ponderosa pine, and/or western white pine seedlings would be planted because adequate seed sources are not available to ensure natural regeneration of these desired species. These species require full or nearly full sunlight to grow well, and increased sunlight would be a result of the regeneration harvest treatments. Regeneration of a mix of species, planting where necessary, would ensure that desired future conditions would be met. Desired conditions include a dramatic improvement in tree species diversity, stand growth, and vigor for the benefit of a variety of resources, including wildlife habitat and timber production. These treatments would increase the proportion of long-lived, early seral species that have a high potential to develop into forests with large trees and more resistance to the effects of future disturbance events (e.g. fire, windthrow, & insects).

Planting would occur on approximately 974 acres of the total 1,327 acres of regeneration harvest units. The remaining 352 acres of regeneration harvest would regenerate naturally to Douglas-fir, western larch, ponderosa pine and/or lodgepole pine as these units would have adequate seed sources and site conditions to assure this result.

Commercial thinning, understory removal, post and pole, shaded fuel break and special cut units

These are all partial cut treatments where a substantial portion of the stand would remain on the site after harvest. Effects to timber productivity vary, depending on the existing condition of the stand and the expected response after thinning. Some of the stands treated are mature forests and are not expected to experience much growth response, as described earlier under the section regarding improvement/maintenance of tree growth and vigor. The treatment would effectively remove some of the growing stock and timber value from the stand, and that loss would not likely be regained through any improvement in stand growth. The remaining growing stock and timber value would be removed at some future date, with little loss in overall productivity. However, there may be a loss of overall productivity and timber values if a substantial portion of the remaining growing stock dies due to blowdown, disease (i.e. rot disease), or other mortality factors.

In those thinning units where substantial growth response is expected in the residual stand, timber productivity would be improved due to better growth on the remaining trees in the stand. These units are those that originated from past harvest in the 50s and 60s.

Sapling thinning

In the sapling thin units, the moderate to high tree densities and associated competition for limited resources are either already inhibiting growth of individual trees or will certainly suppress growth in the near future before the stand matures. This reduces the ability of the stand to achieve its full timber value and productivity. Thinning would reduce tree densities, greatly improving the growth potential of the remaining trees on the site. The positive effects of thinning on individual tree size, vigor, and probability of survival have associated positive effects on timber productivity. Thinning would improve timber productivity of the stand and value of the wood product by concentrating growth on selected trees of desired species and form; maintaining a fully occupied but not overstocked stand; promoting healthy trees; and creating conditions where trees are capable of achieving large sizes over relatively shorter periods. These effects are somewhat reduced in the daylight thinning units (see above for description of daylight thinning), but individual western white pine would still be released and free to grow. The improved forest health and reduction in stress on individual trees would enhance stand resilience and adaptability to potential future environmental changes or disturbances. A healthy and resilient stand has higher probability of persisting and maintaining integrity over time, widening the treatment options of future forest managers to meet the needs and desires of society.

Ecosystem burns

The stands within the boundaries of the ecosystem burn units are located within Inventoried Roadless Areas and have been judged to be unsuited to manage for timber production. Prescribed burning allows achievement of some of the objectives for this project by improving health and resiliency of the affected stands. The burns are designed to be of low- to moderate-severity, to mimic the effects a wildfire might have on these forests, diversifying stand density and structure, and enhancing understory vegetation development. The burn treatment would result in a mix of vegetative conditions within the unit, including openings in the forest canopy where grasses, forbs and shrubs that provide food for wildlife would proliferate; under-burned mature forested areas, where smaller understory trees would be killed but larger diameter overstory trees would survive; and un-burned areas with no change in existing forest condition. Regeneration of new conifer seedlings within any openings created by the burn has the potential to improve stand

conditions and productivity. In any case, the prescribed burn actions would not preclude management options in the future if harvesting of these stands were determined to be feasible.

Old forest and late successional forest conditions

Effects to old growth forest

No existing old growth or potential old growth forest would be affected by harvest, thinning, or burning treatments in all alternatives.

Indirect effects to old growth may occur where openings are created through regeneration harvest in stands that are immediately adjacent to old growth forest. The untreated forest edge adjacent to these openings is more exposed and vulnerable to windthrow. There is likely to be some limited blowdown of trees adjacent to newly created openings, and if these stands are old growth there is a concern that windthrow may reduce the old growth qualities through loss of large diameter overstory trees. The following 17 regeneration harvest units (total of 422 acres) lie immediately adjacent to identified old growth or potential old growth stands: 16, 16a, 17, 32, 34, 34a, 35b, 37, 37a, 38, 40, 46, 54, 56, 56a, 57, and 63.

How much, if any, blowdown of trees might occur in these adjacent old growth stands is difficult to predict. High winds and notable blowdown events do not appear to be a common occurrence in this area, based on extensive field reconnaissance conducted during the course of project development. In the event there is increased winds and subsequent blowdown of trees in stands adjacent to openings, it is unlikely that large numbers of the valuable live old overstory trees or the integrity of the old growth forest would be lost. These trees are primarily western larch, one of the most windfirm species in these forests. The large trees are spread widely throughout the stand. If some do blow down, they would continue to contribute to the old forest values in the stand, adding to the large dead and down woody component.

Openings adjacent to old growth stands also creates high contrast forest edge habitat, which may have effects to wildlife species. Refer to the Wildlife section of this chapter for information on these effects related to wildlife.

Development of late successional and old growth forest structure

Many of the mature stands proposed for regeneration treatments are infected with white pine blister rust and root diseases. Overstocked stand conditions over many decades have also severely retarded growth of the trees, limiting their potential to develop into the large tree size classes that are an important component of late successional and old growth forests. In many of the stands currently classified as late successional or old growth forest, as the existing larger diameter overstory trees die off, there are fewer trees that would be able to replace them. In other words, many of the stands in the Hungry Lion project area have very limited potential to develop into old growth forests along their currently trajectory. Some are currently declining in late successional or old forest values due to high rates of mortality in the older overstory component.

Regeneration treatments have the potential to create the growing conditions, species composition and stand structures that allow stands to develop into high quality late successional and old growth forest conditions – faster and with far better structural elements (such as very large tree sizes) than the untreated stands. This is because treatments would leave some or all of the existing old overstory component (i.e. in a seedtree or shelterwood harvest) while also regenerating to a diverse mix of seedlings including western larch, western white pine, and ponderosa pine, which are long lived and fire/disease/insect resistant species. The overstory leave trees would be left on

the site indefinitely and are very likely to survive for 100 or more years, barring any substantial loss due to insects or windfall. Large downed woody debris would be retained on the site as well (refer to following section on retention of forest structural components). As the stands grow, thinning could be done, maintaining high growth rates in the young stand, larger tree diameters, and healthy forest conditions over time. This would greatly improve their likelihood of eventually developing into desirable late successional forest conditions or old growth forest.

Also, as discussed earlier under the section on forest vigor, thinning in the young sapling stands also maintains high growth rates on trees into the future, allowing them to grow very rapidly into the necessary large diameter sizes to function as high quality late successional or old growth forests in the future. Preferential selection of long-lived and more disease resistant species such as western larch, western white pine, and ponderosa pine also leads to higher quality old forest conditions in the future.

Because of wildlife, social, and other resource values assigned to old growth and high-quality late successional forests, as well as the recognition that these forest types don't last forever, it is desirable to retain as much as possible of the forest structural components characteristic of old growth within the proposed treatment units. It takes a long time for old growth to develop, and the current conditions of many stands within the project area are such that they will never achieve a late successional or old growth forest structure. Treatment prescriptions can influence the future structural characteristics of the stand and the possibilities for development into desirable old forest structures. At the very least, retaining these structural elements in the unit enhances the stands value at all stages of development for wildlife species and/or improvement of visual appearance. As described under the earlier section regarding improvement/maintenance of stand/landscape structural diversity, the treatment prescription for all harvest units would include requirements to retain large snags and large diameter down woody material.

Additionally, our objective within regeneration harvests is to reforest to diverse species mixes including long-lived western larch, western white pine, and ponderosa pine in addition to Douglas-fir, lodgepole pine, Engelmann spruce, and subalpine-fir. This contributes to the quality of future potential old forest stands. That future may be 100 or more years from now, but that is the time frame one must consider when managing for late successional or old growth forests, and recognizes the dynamic and ever changing nature of vegetation conditions.

Alternative 2 – Cumulative Effects

The proposed activities in these alternatives would add cumulatively to the change in forest cover type, size, age, densities, and successional stage or structure class from past harvesting and thinning actions within the forest vegetation analysis area. Regeneration harvest would convert mature forest stands currently in a mid or late successional stage of development into an early successional young forest dominated by seedlings, as well as alter forest species compositions. Thinning would lower tree densities and in some stands (mainly those proposed for sapling thinning) change species compositions, but have relatively little immediate impact on forest age, size, or successional and structural stage.

All action alternatives begin to move the Hungry Lion landscape more towards the desired condition, which is where stands are healthy and resilient in the face of inevitable future change. There will be an increase in the western white pine and ponderosa pine cover types and overcrowding will be reduced in all action alternatives. There will be an increase in species diversity to some degree under all action alternatives. Improvement in stand growth, and subsequent short and long term stand health and vigor, also occurs to some degree under all

action alternatives by regeneration and thinning treatments. The proposed harvest and thinning activities would add cumulatively to the acres harvested in the past towards meeting forest plan objectives to maintain or improve timber productivity and forest health.

There would be a short term increase in the amount of young seedling/sapling forest across the landscape under all action alternatives, due to the regeneration harvesting. However, all forest changes through time through the process of natural succession. Many stands are currently in the latter stages of the early successional period and will soon (i.e. within 10 years) move into a stem exclusion, mid-successional stage of development (at about 40 years old). These forests will typically be dense, mostly single story stands (stem exclusion structural stage) with or without an older, larger overstory component.

Further fragmentation of the landscape would occur under the action alternatives to the degree that regeneration harvesting would not lie adjacent to already existing early successional forests.

Some, but not all, of the mid-successional forests will develop into late successional or old growth structural forests, as described under direct and indirect effects earlier. With the aging of the stand, mortality to insects, disease, overcrowding, windthrow, and other disturbances will create openings in the dense forest canopy within some stands, allowing understory tree layers to develop more fully.

The potential for development of future old growth or late successional stand structures is higher under all action alternatives than under the no-action alternative. Sapling thinning in particular would create a stand condition far more conducive to old growth development. The increased growth rate on an individual tree basis would allow development of large tree sizes and trees with more full crowns and at a faster rate than if not thinned. If not thinned, many of the stands would have slim chance of ever achieving the tree sizes or structures that comprise old growth forest, due to their high current densities.

Under the action alternatives, wildfire in this landscape would likely be allowed to burn naturally. The treatments proposed in the action alternatives are designed to address some of the undesirable impacts that exclusion of fire has had in this landscape in the past and place the treated stands on a more healthy and desirable developmental trajectory. The changed stand conditions that would result from the treatments would improve the ability of the stands to survive future disturbances, such as wildfire should one occur.

The proposed activities would have some cumulative impact on the amount of snags and dead/down woody material in this landscape. No roads are proposed to be reopened, so there would be no increased removal of snags to firewood cutting. Some of the proposed harvest units have large amounts of dead material due to many years of insect, disease, or overstocked conditions. Treatments would reduce this material overall, though the most valued large diameter snags and down wood would be retained as described under the direct and indirect effects section. However, there are many acres in this landscape that would remain untreated and that have high amounts of dead, dying trees. These would continue to add to the abundance of this forest structural component across this landscape.

In all regeneration harvest units, the live (and dead) leave trees are not planned for removal in any future entry and thus would remain on the site indefinitely. They would increase the structural diversity in the stand and across the landscape over the long term. They would provide a continuous source of seed for potential regeneration of a new generation of trees now and in future years. They would continue to grow, persisting in the stand, with many potentially

becoming large, old legacy trees themselves. Eventually they would die and become large snags and ultimately large downed wood. At all these stages, they provide a number of benefits to the ecosystem and resources, such as habitat for wildlife, contributions to soil productivity, and attractive visual appearance.

Forest products gathering is expected to continue in the project area at current levels. This includes firewood cutting (discussed earlier), as well as Christmas trees, boughs, post and pole and other miscellaneous material. These activities (with the exception of the post and pole unit) would be limited to areas within about 300 feet of open roads.

Noxious weed spraying has been occurring in the project area and is expected to continue to occur indefinitely into the future. It has improved the potential for development of desired understory plant species in the treatment areas by reducing the risk of noxious weed establishment and spread. The proposed activities would include measures to mitigate potential establishment or spread of noxious weeds into treated areas which, along with the ongoing spraying, would add cumulatively to the goal of reducing noxious weed populations and preventing spread into currently non-infested areas.

Temporary road construction would occur under action alternatives 2 and 3. Temporary roads on existing (historic) templates result in essentially no new change to the existing forest vegetation – the change occurred in the past, when the road was originally built. The main effect would be the removal of shrubs, small trees and other vegetation that may be growing within the road template, with little to no additional disturbance of soils and adjacent vegetation. Temporary roads that are new construction would result in removal of existing trees and other forest vegetation, and disturbance of soil surface layers and plant roots within the road template. This would be a temporary impact, and these roads would be reclaimed after use, restoring the natural contour of the land and allowing native vegetation to re-establish. Temporary roads typically can be narrower and require less clearing of vegetation than a specified road, thus fifteen feet wide will be used for purposes of this analysis. Assuming this width, new temporary road construction would affect approximately 12 acres of forest in alternative 2.

The Adapted Silviculture for Climate Change (ASCC) Research Project includes six Hungry Lion units; these units are in all action alternatives. Direct effects of these units are as described above under the respective treatment (commercial thin, group selection, and seed tree). Cumulative effects are also addressed above. The difference between the research units and the other (same treatment) units within the project is monitoring. The ASCC units will be heavily and frequently monitored. Monitoring plots will be installed pre-treatment and will be re-measured post-harvest. These plots will also be measured at regular intervals through the life of the stands (50 plus years), to determine effectiveness of the treatment and plant response to changes that may occur with the climate.

Climate change and forest carbon balances

Recent and projected changes in climate are likely to substantially stress many forest communities and tree species (Breshears et al., 2005; Fields et al., 2007; Parry, Canziani, Palutikof, van der Linden, & Hanson, 2007; Soja et al., 2007). At the regional scale, warming average annual temperatures, declining mountain snowpacks, and earlier spring runoff have been noted for the Pacific Northwest, which includes western Montana (P. Mote, Salathé, & Peacock, 2005; Stewart, Cayan, & Dettinger, 2004). The Intergovernmental Panel on Climate Change (Intergovernmental Panel on Climate Change, 2007) states that the global average surface temperature has increased 0.74 degrees Centigrade from 1906 to 2005. By 2100, increases of 1.1

to 6.4 degrees Centigrade are projected over the 1990 level (Intergovernmental Panel on Climate Change, 2007). Temperature increase is a predisposing factor causing stress in forest ecosystems of western North America by exacerbating negative water balance (Littell, Peterson, & Tjoelker, 2008; Stephenson, 1998). Productivity in water-limited forests will decrease in a warmer climate because negative water balances will reduce photosynthesis. Precipitation changes are expected to be more modest; some precipitation models indicate slightly increased winter precipitation while others indicate decreasing winter precipitation (Fields et al., 2007; P. Mote et al., 2005; Westerling, Hidalgo, Cayan, & Swetnam, 2006). In either scenario, moisture regimes have been altered, including more precipitation falling as rain instead of snow and earlier snowmelt (Knowles, Dettinger, & Cayan, 2006). The intergovernmental panel concluded that as a result of climate change, it is very likely that North American forest will experience increased stress from insects, diseases, and increased risk of wildfire (Fields et al., 2007).

Climate change and modeling occur on a large scale; it is not possible to analyze at a site-specific stand level. Utilization of a toolbox of approaches is needed in the face of uncertainty; strategies include resistance, resilience, response and mitigation (Millar, Stephenson, & Stephens, 2007). We should prepare the ecosystem for disturbance by increasing its resistance to disturbance (minimize the impact) or enhance its responsive capability via increased resilience (Millar et al., 2007). Enabling forests to respond to climate change could be enhanced by mitigating stress in plantation and forest trees, and promoting diverse age classes, species mixes and stand/landscape structural diversity (Millar et al., 2007).

The climatic trends described above suggest that forests in the Hungry Lion project area may continue to experience increased drought stress in future decades, much as has occurred in the recently passed decade. As discussed at length in other portions of this chapter, this stress is exacerbated by increasing tree densities and competition for limited water which weakens the trees even further, making them more susceptible to mortality from insects, disease, and water stress. In addition, climate trends in the Pacific Northwest and indeed throughout much of the western U.S. suggest that the risk of high intensity wildfires may continue to increase (Running, 2006; Westerling et al., 2006), again intensified by the increased tree density and fuel loadings in the forest stands.

All action alternatives include a component of western white pine restoration. Western white pine is a great species to plant from a climate change and forest health perspective. Western white pine has substantial physiological plasticity, and seed from a specific ecotype acts as a generalist within that ecotype; because of this plasticity, western white pine will be better able to adjust to climate change than many other species. In addition to its physiological plasticity, it is a keystone ecological species that is capable of sequestering large amounts of carbon (Hines et al., 2013).

Forests can help mitigate the effects of greenhouse gas emissions by removing carbon from the atmosphere and sequestering it in biomass. The proposed treatments would remove some carbon currently stored within live and dead trees. A portion of the carbon removed would remain stored for a period of time in wood products (Depro, Murray, Alig, & Shanks, 2008; United States Environmental Protection Agency, 2009). Harvest of live trees could temporarily convert some stands from a carbon sink that currently removes more carbon from the atmosphere than it emits to a carbon source that emits more carbon through biomass decomposition than it absorbs through tree growth. Regeneration harvest units would experience the greatest change. Thinned and prescribed burn units would experience the least and perhaps would retain enough biomass to still remain a net carbon sink. These stands would remain a source of carbon to the atmosphere until carbon uptake by new and remaining trees again exceeds the emissions from decomposing dead

organic material. As stands continue to develop the strength of the carbon sink would increase until peaking at an intermediate age and then gradually decline but remain positive (Pregitzer & Euskirchen, 2004). Carbon stocks would continue to accumulate, although at a declining rate, until impacted by future disturbances. Over the long-term (centuries) net carbon storage is often zero if stands regenerate, because re-growth of trees recovers the carbon lost in the disturbance and in decomposition of trees killed by the disturbance (Kashian, Romme, Tinker, Turner, & Ryan, 2006).

Management actions designed to maintain or restore forests to healthy and productive conditions would help maintain carbon stocks and sequestration rates. Increases in disturbance events such as wildfires and insect outbreaks can release large amounts of carbon to the atmosphere (short- and long-term) and reduce carbon stocks (Fields et al., 2007). Carbon sequestration could be enhanced by promoting reforestation, manipulating stocking to favor more rapid growth, and sequestering carbon in wood products (Millar et al., 2007). These approaches include maintaining vigorously growing trees, minimizing severe disturbance and promoting diversity. Birdsey (Birdsey, Pregitzer, & Lucier, 2006) indicate that forest management technologies that may reduce CO₂ emissions or increase productivity include nutrient management, residue management and utilization, thinning and better utilization of the resulting wood products, low-impact harvesting, and species or genotype selection.

The potential for future disturbances (insect, disease, and fire) and the expected severity of those events for the Hungry Lion project area have been disclosed under the direct and indirect effects sections for the action and no-action alternatives. Also refer to the fire and fuels section of chapter 3. Though the proposed prescribed burning and pile burning in the Hungry Lion Project would reduce standing carbon stocks and result in atmospheric emission of carbon, this would certainly be far less when compared to the amount of carbon likely to be released due to future fire disturbance (Finkral & Evans, 2008).

Ultimately, it is not possible to specifically determine the cumulative impact on global carbon sequestration and atmospheric concentrations of CO₂ from the proposed project activities. What is apparent is that these effects would be miniscule, particularly in the context of the 66,600 teragrams of carbon currently contained in U.S. Forests. The short-term change in carbon stocks and sequestration rates resulting from the proposed action are imperceptibly small on global and national scales, as are the potential long-term benefits.

Alternative 3 – Direct & Indirect Effects

As explained at the beginning of this section and to avoid repetition, the comprehensive discussion of the type of direct or indirect effect that occurs due to a particular action is documented under alternative 2. The effects disclosed below for alternative 3 highlight only the differences in scale or degree of effect compared to alternative 2.

Forest vigor, species composition, resilience, and sustainability of outputs

Table 28 displays a comparison of acres treated between alternative 2 and 3. The nature of the effects (i.e. how different treatments affect species compositions, growth rates, etc.) is the same as described under alternative 2, though may occur over less acres under alternative 3.

Table 28. Comparison of treatments

Treatment	Total Acres - Alternative 2	Total Acres - Alternative 3
Ecosystem burns	759	759
Commercial thin	1,660	1,248
Sapling thin	608	241
Regeneration harvest	1,458	902
Special cuts	77	77
Post and pole	7	0
Understory removal	278	192
Shaded fuel break	49	0

As compared to alternative 2, alternative 3 drops many units of all types of treatment due to concerns about effects to wildlife. Sapling thin units outside of the wildland-urban interface (WUI) would not be treated under this alternative. This alternative also modified units within the WUI to address effects to elk movement. Effects for the dropped units (or portions of units) would be the same as alternative 1. The species composition would remain the same, growth would continue to decline, and resilience or outputs would not be improved. The units dropped from this alternative include 1, 2, 4, 7, 9, 14, 16, 16A, 22, 22A, 31, 33, 34, 34A, 50, 50A, 55, 56, 56A, 57, 62, 62A, 68, 76, 82, 83, 84, 85, 87, 87A, 88, 88A, 89A, 89B, 90, 91A, 91B, 92, 93, 201, 202, 204, 213, 214, 215, 217, 218, 220, 221, 224, 225, 226, 227, 228, and 229.

Forest health

The nature of the effects of different treatments on the spread or intensity of these pathogens is the same as described under alternative 2, though would occur over less acres under alternative 3. There would be no improvement to stand health in units dropped from this alternative.

Old forest and late successional forest conditions

Effects to old growth and potential old growth

Effects to old growth forest in alternative 3 are exactly the same as described under alternative 2. No harvest, thinning or burning is proposed in old growth.

Alternative 3 drops seven of the 17 units in alternative 2 that lie immediately adjacent to old growth or potential old growth, leaving the following adjacent regeneration harvest units: Units 17, 32, 35b, 37, 37a, 38, 40, 46, 54, and 63. As described under alternative 2, there is some potential for blowdown of trees along the edges of the old growth stands adjacent to these harvest units. However, this risk is expected to be low and the integrity of the old growth stand is expected to remain intact.

Development of late successional and old growth forest structure

As explained under alternative 2, the design features applied to treatment units would be retaining some of the important structural elements for potential development of future old growth/late successional forest conditions. These include retention of large snags and live, long lived, overstory trees (larch, western white pine, Douglas-fir). The sapling thinning treatments and some of the commercial thinning treatments would also maintain or improve tree growth rates and accelerate the development of the large, old trees characteristic of old growth forests. Additionally, regeneration harvests would establish diverse species mixes including long lived

western larch, western white pine, and ponderosa pine which would contribute to the development and quality of future potential old forest stands.

Alternative 3 – Cumulative Effects

The cumulative effects are described above, under alternative 2. The only difference is the scale of effect is lessened, due to less acres are treated.

Alternative 4 – Direct & Indirect Effects

As explained at the beginning of this section and to avoid repetition, the comprehensive discussion of the type of direct or indirect effect that occurs due to a particular action is documented under alternative 2. The effects disclosed below for alternative 4 highlight only the differences in scale or degree of effect compared to alternative 2.

Forest vigor, species composition, resilience, and sustainability of outputs

Table 29 displays a comparison of acres treated between alternative 2 and 4. The nature of the effects (i.e. how different treatments affect species compositions, growth rates, etc.) is the same as described under alternative 2, though may occur over less acres under alternative 4.

Table 29. Comparison of treatments

Treatment	Total Acres - Alternative 2	Total Acres - Alternative 4
Ecosystem burns	759	759
Commercial thin	1,660	308
Sapling thin	608	608
Regeneration harvest	1,458	902
Special cuts	77	77
Post and pole	7	0
Understory removal	278	278
Shaded fuel break	49	49

As compared to alternative 2, alternative 4 drops many of the commercial thin and regeneration units due to lack of access. Units that need temporary roads for access would not be treated under this alternative. Effects for the dropped units (or portions of units) would be the same as alternative 1. The species composition would remain the same, growth would continue to decline, and resilience or outputs would not be improved. The units dropped from this alternative include 2, 3, 4, 5, 7, 8, 9, 11, 14, 16, 16A, 22A, 29, 33, 34, 34A, 35, 35A, 38, 39, 41, 41A, 46, 50, 50A, 56, 56A, 61, 62, 62A, 63, 66, 73, 76, 77, 78, 82, 83, 84, 87, 88, and 93.

Forest health

The nature of the effects of different treatments on the spread or intensity of pathogens is the same as described under alternative 2, though would occur over less acres under alternative 4. There would be no improvement to stand health in units dropped from this alternative.

Old forest and late successional forest conditions

Effects to old growth and potential old growth

Effects to old growth forest in alternative 4 are exactly the same as described under alternatives 2. No harvest, thinning or burning is proposed in old growth.

Alternative 4 drops nine of the 17 units in alternative 2 that lie immediately adjacent to old growth or potential old growth, leaving the following adjacent regeneration harvest units: Units 17, 32, 35b, 37, 37a, 40, 54, and 57. As described under alternative 2, there is some potential for blowdown of trees along the edges of the old growth stands adjacent to these harvest units. However, this risk is expected to be low and the integrity of the old growth stand is expected to remain intact.

Development of late successional and old growth forest structure

As explained under alternatives 2, the design features applied to treatment units would be retaining some of the important structural elements for potential development of future old growth/late successional forest conditions. These include retention of large snags and live, long lived, overstory trees (larch, western white pine, Douglas-fir). The sapling thinning treatments and some of the commercial thinning treatments would also maintain or improve tree growth rates and accelerate the development of the large, old trees characteristic of old growth forests. Additionally, regeneration harvests would establish diverse species mixes including long lived western larch, western white pine, and ponderosa pine which would contribute to the development and quality of future potential old forest stands.

Alternative 4 – Cumulative Effects

The cumulative effects are described above, under alternative 2. The only difference is the scale of effect is lessened, due to less acres are treated.

Regulatory Framework and Consistency

The National Forest Management Act of 1976 (NFMA)

National Forest Management Act 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 at 1921.12 (USDA Forest Service, Forest Service Manual).

Appropriateness of even-aged management and optimality of clearcutting

The National Forest Management Act 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.” No clearcutting is proposed in the Hungry Lion Project; other even-aged methods are proposed, as they are most compatible with the disturbance regimes found in the analysis area and the adapted silviculture of desired shade intolerant species.

Suitability for timber production

The National Forest Management Act 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 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, and applicable BMPs would be used to protect these resource values.
- There is reasonable assurance that lands can be restocked within five 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 I-7).
- None of the areas considered for harvest have been withdrawn from timber production.
- As stated earlier, all areas proposed for treatment are within MAs where timber harvest is allowed per forest plan direction. Refer to the silviculture report exhibit I-3 and Table 2 for the list of management areas of each unit and the forest plan direction for each management area.

National Forest Management Act 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 five years.** Previous regeneration harvests in the analysis area have been successfully stocked within five 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 I-7).
- **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 chosen after considering the effects on residual trees and adjacent stands.** The effects to residual trees and adjacent stands were considered and are disclosed in the analysis of forest vegetation. Residual tree protection measures are included in the design features section of this report.
- **Be selected to avoid permanent impairment of site productivity and to ensure conservation of soil and water resources.** The Soil and Water resource sections of this EA

and the design features for the selected 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 interdisciplinary team (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 the interdisciplinary team to be practical and cost efficient to the extent possible.

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 Forestwide 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 Forestwide and management area direction.

Northern Region Guidelines

Forest Service Manual 2471.1 of the Northern Region clarifies and describes the restrictions on the size of harvest openings created by even-aged silvicultural methods (group selection, seedtree and shelterwood harvests), as required by Forest Service Manual 1921.12. Alternative 2 in Hungry Lion would create up to 13 openings on the landscape from even aged harvest methods. They would range from 42 to 198 acres. Two units, (73 and 85) are included in this analysis, but will likely be less than forty acres once implemented due to the application of riparian habitat conservation areas. Many units are very irregularly shaped or elongated, which reduces the potential impact of the opening to wildlife or visual appearance. Project File Exhibit I-9 lists the twenty nine proposed harvest units that form these openings and the rationale for the unit design, as well as a map of their location. These openings and the units involved can also be ascertained by looking at the Alternative maps and unit lists in chapter 2 of the EA. A brief summary of the rationale for the larger opening sizes follows.

The majority consist of stands heavily infected with white pine blister rust. The units have been designed to restore western white pine at a landscape level; retaining any mature, live white pine while regenerating the stand and planting desired species. All of the stands proposed for white pine restoration were previously dominated by western white pine before they succumbed to white pine blister rust and/or mountain pine beetle decades ago. Most of these stands also have a high incidence of root rot, which is slowly causing mortality to the subalpine and Douglas fir. These stands are also located in such a way that they would effectively create stand conditions that lower the risk of future high-intensity wildfire.

The remaining acres consist of forests formerly dominated by ponderosa pine that have been impacted by fire suppression and subsequent encroachment of Douglas fir. These stands also have high incidence of root disease and some dwarf mistletoe present. They are deteriorating and restoring a vigorous new stand of ponderosa pine on the site is desirable to meet project objectives.

One unit consists of lodgepole pine that have been impacted by mountain pine beetle or are at risk of infestation. This stand is deteriorating and restoring a vigorous new stand on the site is desirable to meet project objectives. This stand is adjacent to private land and concerns with excessive fuel loadings and fire hazard have also influenced the design of the unit.

A map with a list of units and their acres was provided in the scoping letter to the public (November 2016). This EA also provides clear disclosure of the openings greater than 40 acres. Thus the required minimum of 60-day public notice of openings over 40 acres in size will be complete by the time the decision notice is signed. The required approval from the regional forester will also be completed by the time of the decision.

Fire/Fuels

Introduction

The Hungry Lion Resource Management Project area includes areas designated as wildland-urban interface (WUI) according to the Flathead County Community Wildfire Protection Plan 2011 (CWPP) (Project File Exhibit K-14). The WUI portion of the Hungry Lion project area was ranked as a high priority area for fuel reduction by the Flathead County CWPP (p. 49, 69, 70, 83, and 84). Hazardous fuels in the project area have resulted in large part to a lack of fire in these fire-adapted ecosystems, causing increased fuel loadings, changes in species composition, and forest structure. The potential fire behavior associated with hazardous fuels in the project area not only threatens WUI values, but also key ecosystem components such as old growth stands and wildlife habitat.

In the past, fire was a common and influential force in shaping the fuels and vegetation in the project area. Fire influenced species composition, age structure, fuel loading and potential fire behavior. However, wildfire has been effectively excluded from the project area for over 100 years, and prescribed fire has not been applied comparable to historic wildfire levels. As a result, fuels have increased at both the stand and landscape scales.

The WUI designation is defined as that area of NFS lands with forest fuels within 1.5 miles of residential structures, developments, or private properties suitable for development or for residential use. Individual features include power transmission lines, communications sites, and primary escape routes for people to use during emergencies. The Hungry Lion project area includes the communities of Hungry Horse, Martin City, and Coram. A large fire in the project area would affect and likely threaten these communities and surrounding rural residences. In addition, firewood cutting, berry picking, hiking, ATV riding, biking, camping, and hunting bring many visitors to the area during fire season. It is impossible to predict when a large fire would threaten the many values in the project area, but the existing fuel conditions could support such a fire in the near future.

Uncontrolled fires in the project area would not only threaten the nearby structures, but would also threaten the safety of the residents who could be trapped in a life-threatening situation. Fire behavior outside the natural fire regime could jeopardize key ecosystem components and natural resources such as old growth, air quality, water quality, forest cover, soil productivity and wildlife habitat. Fire behavior is influenced by the interaction of fuel, weather, and topography, with the fuel being the only factor that managers can change.

Indicators used in this analysis fall into two categories: fire behavior indicators and ecological indicators. The fire behavior indicators show the effects of the activities on fuel loading and associated fire behavior, while the ecological indicator shows departure from the natural fire regime, and how vegetation management activities restore fire adapted ecosystems.

Summary of Findings

Alternative 1 (no-action) would not address the purpose and need to reduce fuels in the wildland-urban interface and within the project area to improve public and firefighter safety, as well as make communities, infrastructure and natural resource values less vulnerable to impacts from wildfire. It does not reduce surface, ladder or crown fuels. The no-action alternative allows the continued threat of uncontrolled wildland fire to exist, with no proactive management to protect

forest resources and wildland-urban interface values. Alternative 1 allows an increased risk of a more intense, faster spreading fire that could approach nearby homes and threaten lives, homes, infrastructure, and air quality. The no-action alternative maintains an increased potential for running crown fires and an increased likelihood of severe fire behavior with respect to flame length, probability of torching and crowning index. Wildland fires would be less controllable and more of a threat to life and property.

Alternative 2 would have the most extensive treatments of all of the alternatives. It effectively responds to the purpose and need to reduce fuels and improve the resiliency of the landscape to fire. The intermediate and regeneration harvests (followed by fuel reduction treatments) would result in a dramatic decrease in fuel loads and potential fire behavior, allowing more successful fire management and fewer threats to nearby resources. The proposed prescribed burning would reduce surface and ladder fuels in key locations across the project area, and would reintroduce fire onto high elevation landscapes. Alternative 2 slows potential fire spread across the landscape, considerably reducing the threat of uncontrolled wildfire to hundreds of structures in the cumulative effects analysis area.

None of the action alternatives completely resolve the fuels and fire issues that have developed after 100 years of fire exclusion, but all action alternatives respond to the purpose and need to reduce the risk to wildland firefighters and residents of the wildland urban interface should a fire occur creating forest stand conditions that lower the risk of future high-intensity and high-severity wildfire; creating defensible space along open system roads by creating shaded fuel breaks to improve firefighter safety and effectiveness of suppression tactics in the face of longer and hotter fire seasons; and to improving the resistance of forest vegetation to potential future disturbances.

Alternative 2 best responds to the purpose and need, and does the most to reduce fuels and fuel continuity across the project area.

Analysis Area

The fire/fuels analysis completes analyses at different scales. Stand-level fire behavior indicators are used to portray the direct, local effects of vegetative treatments on fire and fuel characteristics, and are reported at the stand level. These stand-level effects are modeled for approximately 40 to 100 years into the future. The analysis looks at conditions before treatment compared to after the treatment. The Fire Regime Condition Class analysis is completed at the project area scale, and displays conditions for only a snapshot in time; it does not show how Fire Regime Condition Class will change in the future under the alternatives. The cumulative effects area for the fire fuels analysis area is the Hungry Lion project area.

Methodology

Several sources of information were used to assess the existing conditions in the Hungry Lion project area. The fire history of the Hungry Horse-Glacier View Ranger District, including Hungry Lion, has been recorded and mapped by the Forest Service since its inception. This fire history map was used to make assumptions as to when effective fire suppression began (Map 3-2 and Project File Exhibits K-4 and 5).

Records of fire ignitions are compiled by the Forest Service (1986 to 2016); these records include the year, size, location, and cause of each fire reported. These records differ from the fire history map in that they are more recent, the fires are generally much smaller, and since they are smaller

they are recorded only as points rather than polygons. Records for fire ignitions in the Hungry Lion project area were used in this analysis (Map 3-3 and Project File Exhibits K-2, 4, and 5).

The Forest Vegetation Simulator, which is widely used by forest managers throughout the United States and Canada to predict the effects of various vegetation management actions on future forest conditions, was used for this analysis. The Fire and Fuels Extension to Forest Vegetation Simulator integrates Forest Vegetation Simulator with elements from existing models of fire behavior and fire severity. Model output displays fuels, stand structure, snags, and potential fire behavior over time and provides a basis for comparing proposed fuel treatments (Reinhardt and Crookston 2003, p. 12).

The Fire and Fuels Extension to Forest Vegetation Simulator was used in this analysis to describe the existing conditions of the forest stands in the Hungry Lion project area, as well as to compare the effects of proposed treatments to stands within each alternative. The model will compare current predicted fire conditions in stands to post treatment stand fire conditions. Moderate conditions are generally considered to be when fuel and weather conditions in the 50th percentile of conditions experienced in that stand. Severe and Extreme conditions are generally considered to be below or above the 90th percentile. Site-specific data gathered from field exams were used in the Fire and Fuels Extension to Forest Vegetation Simulator model.

The Fire and Fuels Extension to Forest Vegetation Simulator was also used to assess the risk of fire to a stand with indicators such as potential flame length, the probability of torching, and the critical wind speeds required to initiate and sustain a crown fire. This model is not intended to predict the probability of fire or the spread of fire between stands (Reinhardt and Crookston 2003). It is used solely to assess the potential fire behavior and fire effects possible considering current and future stand conditions.

As with all models, those used in this analysis are based on simplifying assumptions and all have limitations which are explained in the respective model description in the project file (Project File Exhibit K-6).

Fire behavior indicators

There are three primary fire indicators used to evaluate changes to fire behavior, flame length, probability of torching, and crowning index.

Flame length

Surface fuel loading and arrangement is directly related to flame length, which is the first indicator of the fire/fuels analysis. Suppression tactics are directly related to flame lengths. For example, flame lengths less than four feet can be effectively attacked using hand crews constructing direct fire line, while flame lengths greater than four feet will likely have to be attacked using dozers, engines, and retardant aircraft (National Wildfire Coordinating Group, 1993, pp. B-59).

In addition, as surface fuels and flame lengths increase across the landscape, the likelihood is greater that the fire will climb into the canopy and become a crown fire. Crown fires have the largest immediate and long-term ecological effects and the greatest potential to threaten human settlements near wildland areas (R. T. Graham et al., 2004, p. 20).

Probability of torching

The second indicator measures ladder fuels with an indicator called probability of torching. The probability of torching measures the probability of finding a torching situation in a forest stand, or in simpler terms, the proportion of the stand where there are enough ladder fuels for fire to climb up into the trees (E. Reinhardt & Crookston, 2003, p. 159). A torching situation is generally defined as one where tree crowns of large trees are ignited by the flames of a surface fire or flames from burning crowns of small trees that reach the larger trees (Figure 6).



Figure 6. Passive crown fire behavior (torching)



Figure 7. Active crown fire

Crowning index

Crown fuels are measured with the crowning index, which is the wind speed 20 feet above the canopy at which active crowning is possible (J. H. Scott & Reinhardt, 2001, p. 17). The crowning index reflects the density of canopy fuels. Active crown fire, also called a running or continuous crown fire, is one in which the entire surface/canopy fuel complex becomes involved, but the crowning phase remains dependent on heat from the surface fuels for continued spread. As depicted in Figure 7, active crown fires are characterized by a solid wall of flame extending from the fuel bed surface through the top of the canopy (J. H. Scott & Reinhardt, 2001). The higher the crowning index, the lower the crown fuel loading and the lower the crown fire hazard.

Fuels

Fire behavior are influenced by the interaction of fuel, weather, and topography, with the fuel being the only factor that managers can change. There are three different kinds of fuels: surface, ladder and crown fuels. The abundance and distribution of these fuel types can be separated into fuel categories.

Fuel category 1, 2, and 3

Fuel categories 1, 2, and 3 illustrate pretreatment stand conditions which have similar expected fire behavior characteristics and are addressed together in this analysis. The fuel categories were created by the district silviculturist and district fuels planner to enable a comparison of stands before and after treatment using the FVS Fire and Fuels extension model. The models predicted surface fires under moderate conditions and crown fires under extreme conditions. Firefighters can only engage wildfires that are surface fires less than four foot flame length.

Total flame lengths would be 15, 60, or 72 feet in extreme conditions which is well beyond the acceptable limit of four foot flame length for handcrews and eight foot flame lengths for mechanized firefighters to safely engage a wildfire. The models indicate that it would only take a

14, 37, or 12 mph wind speed to cause crowning and once crowning occurs firefighting efforts become too dangerous to continue (National Wildfire Coordinating Group, 1993).

Fuel category 4, 5, and 6

Fuel categories 4, 5, and 6 illustrate post-treatment conditions of fuel categories 1, 2, and 3. Fuel category 1 changes to 4, 2 changes to 5, and 3 changes to 6. In extreme conditions the fire type is changed from a crown fire to a surface fire in all categories, meaning ground based firefighting crews could engage a wildfire.

Total flame length greatly improves in all fuel categories. Flame length changes from 60 foot flame lengths in category 1 to 3.9 foot flame lengths in category 4. Category 2 show flame lengths reduced from 15 feet to only one foot lengths in category 5. Finally, category 3 moves from 72 foot flame lengths to 6 foot lengths in category 6 which would be a significant improvement. These changes are due primarily to large reductions in the amount and density of tree crowns after treatment. The Crowning index jumps from a relatively common wind speed of 14 and 12 mph in fuel Category 1 and 3 to wind speed of 25 and 172 mph in Fuel Category 4 and 6. These numbers represent wind conditions that are unlikely to ever occur. Category 2 and only slightly improve in this fire behavior category.

Table 30 below describes the different fuels categories found in the project area and the types of fuels categories found post treatment. The Fuel Categories were created to be able to illustrate differences in stand conditions before after treatments.

Table 30. Fuels categories found in the project area and fuels categories post treatment

Fuel Category	Existing Conditions	
1	This consists of immature stands dominated by primarily western larch. A closed canopy with little understory vegetation and a high amount of timber litter fuel load characterize this category. Compact timber litter and needles are the primary fuels modeled for surface spread calculations.	
2	This fuel group consists of mixed conifer stands with a closed canopy and a fairly high load of understory vegetation and timber litter. This fuel model considers both the timber litter and understory vegetation when performing surface spread calculations.	
3	This fuel group consists of older Douglas-fir or mixed conifer stands with a closed canopy and a fairly high load of understory vegetation, timber litter and down woody debris. Both the timber litter and understory vegetation are used when performing surface spread calculations.	
	Following Proposed Treatments	Treatment Type
4	This category is descriptive of areas that have been piled after harvest, or had no fuels treatment other than whole tree yarding. The primary fuel for a surface fire is timber understory vegetation with little down woody fuel contributing to fire spread.	CT-Commercial Thin
5	This category covers areas that have been harvested, and slash treatments are expected to significantly reduce understory vegetation. The primary fuels are residual woody fuels left after the treatment and light timber litter that slowly accumulates following the treatment.	UR-Understory Removal
6	This category describes the fuels remaining after regeneration harvest activities. Slash treatment are expected to significantly reduced understory vegetation and down woody debris using excavator piling or under burning.	ST-Seed Tree SW-Shelterwood

The types of fuels present can be used to predict the type of fire behavior that is expected to occur in the fuel type as is shown in Table 31 below.

Table 31. Expected fire behavior by fuel category under moderate and extreme fire weather conditions

Fuel Category	Fire Type		Total Flame Length (ft)		Torching Index (mph)	Crowning Index (mph)
	Moderate	Extreme	Moderate	Extreme	Severe	Severe
Existing Conditions						
1	Surface	Conditional Crown Fire	1.7	60	82	14
2	Surface	Passive	2.1	15	8.7	37
3	Surface	Conditional Crown Fire	0.47	72	283	12
Following Proposed Treatment						
4	Surface	Surface	1.6	3.9	232	25
5	Surface	Surface	0.47	1	917	36.5
6	Surface	Surface	2.1	6	209	172

Ecological indicators

Fire regime condition class

The Fire Regime Condition Class analysis is not an analysis of fire hazard, but a classification of the amount of departure from the natural regime (Hann & Bunnell, 2001). Fire Regime Condition Class includes three condition classes for each fire regime. The classification is based on a relative measure describing the degree of departure from the historical natural fire regime. This departure results in changes to one or more of the following ecological components: vegetation characteristics, species composition, structural stages, stand age, canopy closure, and mosaic pattern; fuel composition; fire frequency, severity, and pattern; and other associated disturbances such as insect and disease mortality, grazing and drought. The three classes are based on low (Fire Regime Condition Class 1), moderate (Fire Regime Condition Class 2), and high (Fire Regime Condition Class 3) departure from the central tendency of the natural (historical) regime. Low departure is considered to be within the natural or historical range of variability, while moderate and high departures are outside of the natural range of variability. For details and maps of the Fire Regime Condition Class analysis, see Project File Exhibits K-3, K-11, and K-12.

Table 32. Fire regime condition classes definition (Schmidt et al. 2002)

Condition Class	Attributes	Example Management Options
1	Fire regimes are within or near a historical range. The risk of losing key ecosystem components is low. Fire frequencies have departed from historical frequencies by no more than one return interval. Vegetation attributes (species composition and structure) are intact and functioning within a historical range.	Where appropriate, these areas can be maintained within the historical fire regime by treatments such as fire use.

Condition Class	Attributes	Example Management Options
2	Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components has increased to moderate. Fire frequencies have departed (either increased or decreased) from historical frequencies by more than one return interval. This result in moderate changes to one or more of the following: fire size, frequency, intensity, severity, or landscape patterns. Vegetation attributes have been moderately altered from their historical range.	Where appropriate, these areas may need moderate levels of restoration treatments, such as fire use and hand or mechanical treatments, to be restored to the historical fire regime.
3	Fire regimes have been significantly altered from their historical range. The risk of losing key ecosystem components is high. Fire frequencies have departed from historical frequencies by multiple return intervals. This result in dramatic changes to one or more of the following: fire size, frequency, intensity, severity, or landscape patterns. Vegetation attributes have been significantly altered from their historical range.	Where appropriate, these areas may need high levels of conversion restoration treatments, such as hand or mechanical treatments. These treatments may be necessary before fire is used to restore the historical fire regime.

The Fire Regime Condition Class analysis was completed according to the procedures in the Interagency Fire Regime Condition Class Guidebook (2010) which uses the LANDFIRE modeling tool. The LANDFIRE Program produces maps of simulated historical fire regimes and vegetation conditions using the LANDSUM landscape succession and disturbance dynamics model. The LANDFIRE Program also produces maps of current vegetation and measurements of current vegetation departure from simulated historical reference conditions. These maps support fire and landscape management planning outlined in the goals of the National Fire Plan, Federal Wildland Fire Management Policy, and the Healthy Forests Restoration Act. (Project File Exhibit K-1).

Fire Regime Condition Class was analyzed using the Fire Regime Condition Class software and direction outlined in the Interagency Fire Regime Condition Class Guidebook (Project File Exhibit K-3).

These indicators, flame length, probability of torching, crowning index, and acres of changed Fire Regime Condition Class show the effectiveness of the alternatives to reduce the risk of fire to life, property and resource values.

Management Framework

Fire management includes all of the activities undertaken for the purposes of firefighter safety, public safety and community protection. Fire management also includes the protection of resources and other values from wildfire, and the use of prescribed and wildland fire to meet land and resource management goals and objectives. Forest Service fire management activities always put human life as the single, overriding priority. Forest Service fire management activities shall result in safe, cost-effective fire management programs that protect, maintain, and enhance NFS lands, adjacent lands, and lands protected by the Forest Service under cooperative agreement (Forest Service Manual 5100).

Existing Condition (Affected Environment)

The Hungry Lion project area is comprised mostly of National Forest System (NFS) lands, approximately 92 percent of the area. However, private ownership is intermixed with the NFS lands. Most of the private land occurs along the western portion of the project area near Martin City and Coram. Homes are scattered throughout the private land adjacent to NFS Lands.

Historically, large fires occurred relatively infrequently across the Hungry Lion landscape, but when they did occur, they were most often of high-severity and sometimes very large in size. This lethal/infrequent fire regime is typical in landscapes where cool, moist habitat and forest types prevail. The moist site conditions lessen the chance of a fire starting, but they also allow for lush, dense plant growth that provides abundant fuel for a fire when it finally does occur.

Since there is a mix of habitat types in the Hungry Lion project area, there has been a mix of low-, mixed-, and high-severity fires in the past. The entire project area could be characterized as a mixed-severity to stand replacement-severity fire regime, with a higher frequency of low-severity fires on the dry sites, and moist sites seeing more mixed and high-severity fires (Schoennagel, Veblen, & Romme, 2004). A fire regime describes the frequency, predictability, and severity of fire in an ecosystem based on habitat type. Because fire regimes cannot be modified through management, they will not be discussed further as part of this fire/fuels analysis. See Project File Exhibit K-18 for a descriptions of fire regime groups in the project area, and the Forest Vegetation section for more detailed discussion on forest habitat types.

Site-specific inventories of surface fuels in the Hungry Lion project area show that high fuel loadings are common, especially in sites affected by storm damage, beetle mortality and white pine blister rust. Since these sites with high fuel loadings are usually unharvested, fully stocked stands, they have the potential for extreme fire behavior, including crown fires, and even more fuel accumulation in the future if left unmanaged. Although high concentrations of heavy fuels are not necessarily uncommon or askew on some sites, these heavy fuels contribute to longer residence times, meaning they burn longer, leading to higher levels of soil heating and higher fire severity. Even though high fuel loads may be ecologically appropriate on some sites, the Hungry Lion project area contains wildland-urban interface values which may be threatened by widespread high fuel loadings.

Reliable fire history records extend back to the early 1900s, and to a lesser degree back to approximately the 1880s. These records indicate that large wildfires occurred in the Hungry Lion project area in 1910, 1926 and 1929 (Map 3-2). These fires together affected less than 20 percent of the project area. The remainder of the area has had no known fires since 1885. Reconnaissance and evaluation of forest age classes and structures within the project area confirm these fire history records. Since 1986, there have been eighty-seven fire starts in the project area, 66 of which were human caused. Map 3-3 shows the fire starts in the project area from 1986 to 2016 and the approximate location of structures on private property. All of these fires were extinguished when small and only one exceeded 10 acres. Because of the project area's close proximity to private property and the numerous developed and dispersed recreation areas in the project area, human caused fires are much more common as is displayed in Table 33.

Table 33. Cause of fire starts 1986 to 2016

Cause of Fire Start	Project Area Fire Starts
Lightning	21
Human	66
Total	87

Past management activities

The removal of fire from the fire-dominated ecosystems of the Rocky Mountains, through active fire suppression in the past 100 years, has caused a plethora of cascading effects that has permeated nearly every part of this rugged landscape (R. Keane et al., 2002). Stand-level effects include increases in woody fuel loading, canopy cover, vertical fuel distribution, canopy stratum, and fuel continuity. Managers have attempted to return fire to the landscape through limited amounts of prescribed burning, but these controlled burns are very limited in the scope and scale and which they can return fire to a landscape that was shaped by fire.

There have been 5,218 acres of prescribed burning in the Hungry Lion project area, nearly all of which was associated with the Paint Emery Project 1999, designed to improve wildlife habitat and restore ecosystem prescribed fire (Project File Exhibit K-10). This level of prescribed burning is not likely equivalent to what would have burned under the natural fire regime during the same time period, especially since we know there have been at least 21 lightning-caused fires in the project analysis area within the last 28 years. Not only is this level of prescribed burning not equivalent to what may have burned under the natural regime, it was not distributed over the landscape as natural fire would have been. Dry sites would have burned with more frequency than moist sites, while timber harvesting has been focused on the more productive moist sites. Almost all of the prescribed burning has been located in high elevation habitats.

A total of 87 wildfires have burned 210 acres within the project area within the last 31 years, 21 of these fires were caused by lightning. All of these fires were fully suppressed. If the lightning-caused fires had been allowed to burn, each would have burned under different weather conditions, and would have burned with different severities, intensities, and spatial extent. Under natural conditions, some of these fires could have burned for one to three months during the fire season, growing unchecked until fall rains finally extinguished them. Under these conditions, each fire had the potential to burn several hundred, if not several thousand acres. Additionally, records for lightning-caused fires prior to approximately 1986 are not available, and it is highly likely that there have been many more lightning ignitions in the Hungry Lion project area that have been suppressed.

Fire exclusion has likely had considerable effects on the vegetation in the project area. When fire is excluded, ponderosa pine loses competitive advantage relative to Douglas-fir (MacKenzie, DeLuca, & Sala, 2004). With fire exclusion, forests that historically experienced mixed-severity fire regimes have developed a more homogenous forest structure across the landscape, resulting in larger areas of continuously dense forest and perhaps in larger patches of crown fire than were witnessed historically.

Fire exclusion and other changes in disturbance processes in Inland Northwest forests have led to:

- Elevated fuel loadings and increased connectivity of high fuel loading.
- Increased potential for running crown fires.

- Increased vulnerability to many insect and disease disturbances of fire-intolerant tree species.
- Increased likelihood of severe fire behavior in forest stands or patches with respect to flame length, rate of spread, and fireline intensity.
- Increased contagion or spatial aggregation of vulnerability to severe fire and insect and disease disturbances. (P. F. Hessburg, Kuhlmann, & Swetnam, 2005)

The most recent fires in the Hungry Lion project area large enough to be mapped occurred in 1910, 1926, and 1929. (Map 3-2). A wildfire in 1988 burned 210 acres in the project area.

Existing condition of the fire regime condition class

Fire Regime Condition Class analysis reflects variation from the landscape conditions that existed under the natural (historical) disturbance regime. Fire Regime Condition Class shows changes in structural stage and species composition, which are both key components of the purpose and need. Details of the Fire Regime Condition Class analysis are in the project file (Project File Exhibits K-3, K-11, and K-12.).

Table 34 shows the percentage of each condition class in the project area and the percentage of the existing condition class that each alternative will affect.

Table 34. Existing conditions for the fire regime condition class within the Hungry Lion project area (percent of project area)

	Existing Condition of Fire Regime Condition Class				
	Project Area (37,090 ac.) ¹	Alternative 2 (4,137ac.)	Alternative 3 (2,660 ac.)	Alternative 4 (2,221 ac.)	Burn Units (759 ac.)
FRCC 1	76%	81%	81%	84%	55%
FRCC 2	19.6%	18%	18%	15%	44%
FRCC 3	<1%	0%	0%	0%	0.3%

¹Remaining area not classified under Fire Regime Condition Class (water, rock, etc.)

Environmental Consequences

Alternative 1 (no-action alternative) – Direct, indirect, and cumulative effects

Direct and indirect effects of taking no-action

Alternative 1 does not respond to the purpose and need to reduce fuels in the WUI and within the project area by creating forest stand conditions that lower the risk of future high-intensity and high-severity wildfire. Under alternative 1, management actions would not create defensible space along open system roads by creating shaded fuel breaks to improve firefighter safety and effectiveness of suppression tactics in the face of longer and hotter fire seasons. There would be not activity taken to improve the resistance of forest vegetation to potential future disturbances (wildfire, disease or insect infestations) and climate change. Alternative 1 would not improve Fire Regime Condition Class.

Indirect effects of alternative 1 include the persistence of many areas of heavy surface, ladder and crown fuels within Hungry Lion project area. These heavy fuels could support active crown fire

behavior, which consumes the entire tree canopy and causes complete mortality of the forest stand.

Table 31 displays the indirect effects of alternative 1 on flame length, probability of torching, and crowning index. All show that alternative 1, the no-action alternative, leaves the potential for high-intensity, severe fires compared to treated stands for many years to come.

Successful fire suppression in the absence of prescribed fire has caused an increase in amount and continuity of the living and the dead material that fuels fires (Saveland 1998, p. 4). The continued loss of species such as ponderosa pine and western larch would continue to lead to forests that are less resilient to fire, meaning that they could experience more pronounced fire effects and an increased amount of mortality associated with a wildfire.

The presence of multi-layered or continuous canopies and dense crowns in parts of the project area increase the chance of crown fires that are difficult to control. This could increase the harm to people who own the property and the firefighters who try to protect it (R. Keane et al., 2002). Brackebusch (1973) stated that wildland fires simply cannot be kept out of fire-prone vegetative types indefinitely. During any period of fire exclusion, the hazard usually continues to build and the probability of a disastrous fire increases correspondingly (Brackebusch, 1973).

Cumulative effects

Cumulative effects result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.

The cumulative effects of alternative 1, the no-action alternative, would be that fuel loads would continue to increase within the WUI and increase the risk of a high severity fire event that could affect private property and public safety. Alternative 1 would not include any timber management or prescribed burning to address the fuels build up on the landscape.

Under alternative 1, use of the project area for firewood cutting, berry picking, hiking, ATV riding, biking, camping, hunting, and other activities would continue to occur. As is shown on Map 3-3, human caused fire starts are common in the project area and would continue to be into the foreseeable future.

Although the past harvest activities that have occurred in the project area provided a benefit towards fuels reduction, this vegetation is returning over time and will provide additional fuel for wildfires. Past timber harvest in the project area includes 12,797 acres between 1940 and 2010. More recently the Belton Fuels decision included 908 acres of harvest, some of the units were within the project area. In addition, 916 acres of prescribed burning are planned to be implemented directly north of the project area to reduce intensity and severity of future wildfires.

One way to resolve the question of whether past harvest has offset the effects of fire exclusion over the years is to compare the acres that were harvested and/or prescribed burned with the acres that could possibly have burned if fires were not suppressed. There is no way of knowing exactly how many acres would have burned under natural conditions – this must be inferred from other evidence. We know that 5,385 acres of prescribed burning has been completed in the Hungry Lion cumulative effects area. We also know that there have been 21 lightning-caused fires in the cumulative effects analysis area since 1986 of which all were effectively suppressed and there were likely many more in the years before records were kept. As explained in existing conditions, each suppressed fire had the potential to grow to several hundred or even several thousand acres

in size over the fire season. If even one of these fires reached this potential, it would have affected more acres than all of the harvest and prescribed burning that has been completed in Hungry Lion since 1940. For these reasons, it is reasonable to believe that past harvest has not offset the cumulative effects of fire exclusion in the Hungry Lion project area because prescribed fire and harvest have affected far fewer areas than would have burned without wildfire suppression.

The Fire Regime Condition Class analysis confirms the conclusion that past harvest and prescribed burning have not offset the effects of fire exclusion. The Fire Regime Condition Class analysis measures departure from the natural (historical) regime, and as such, is an indicator of cumulative effects on the landscape. The Fire Regime Condition Class analysis establishes the natural fire regime based on the area's biophysical settings, and takes into account the effects past activities have had on existing conditions. The Hungry Lion project area as a whole is in Fire Regime Condition Class 1 (76 percent) and Fire Regime Condition Class 2 (20 percent), which means that the risk of losing key ecosystem components is low to moderate and fire frequencies have departed by one or more return intervals, resulting in moderate changes in fire and vegetation attributes. This is to be expected with regimes described by long fire return intervals (35 to 200 years) and mixed to high severity fires.

The cumulative effect of suppressing each small fire in the project area has been individually minor but collectively important, and has not been offset by past timber harvesting and prescribed burning.

Environmental Consequences

Alternative 2, 3, and 4 - Direct and Indirect effects

Alternative 2, 3, and 4 have very similar effects to fire behavior, the difference between the alternatives is the degree of changes to fire behavior based on the acres of fuels categories. Alternative 2 has the most extensive vegetative/fuel treatments of all the alternatives – it treats a total of 4,137 acres, through commercial harvest, understory treatment, and sapling thinning. All of the alternatives propose 759 acres of prescribed burning.

Table 35 shows the differences between the action alternatives by the amount of fuels treatments.

Table 35. Acres treated by alternative

	Alt. 1 (acres)	Alt. 2 (acres)	Alt. 3 (acres)	Alt. 4 (acres)
Fuels treatment within the WUI	0	1,542	1,166	611
Fuels treatment within the project area	0	4,136	2,659	2,220
Prescribed burns	0	759	759	759

Effects to fuels categories

Acres treated do not directly indicate changes to fire behavior unless they can also be correlated to changes in fire behavior, which is done in this report through fuel categories. Table 36 compares the no-action alternative with vegetation management activities under the action alternatives in terms of fuels categories. Alternative 1, the no-action alternative, represents the fuels categories found in the project area today, also known as the existing condition for fuels.

Table 36. Acres of fuels categories following treatments

Proposed Treatment Units	Pre-Treatment							Post-Treatment						
	Fuel Category	Flame Length		Fire Type		Torching Index	Crowning Index	Fuel Category	Flame Length		Fire Type		Torching Index	Crowning Index
		Moderate	Extreme	Moderate	Extreme	Severe	Severe		Moderate	Extreme	Moderate	Extreme	Severe	Severe
Commercial thin 1,2,4,5,6,9,11,13, 14,18,19,20,26,2 7,29,33,39,45,58, 60,61,62,62A,66, 76,77,78,82,83,9 3,402,403	1	1.7	60	Surface	Conditional Crown Fire	82	14	4	1.6	3.9	Surface	Surface	232	25
Understory 100,102,103,104	2	2.1	15	Surface	--	8.7	37	5	0.47	75	Surface	Surface	917	36.5
Seedtree Shelterwood 3,7,8,12,16,16A,1 7,22,22A,30,31,3 2,34,34A,35,35A, 35B,37,38,40,41, 41A,43A,46,50,5 0A,51,52,54,55,5 6A,57,59,63,68,7 1,71A,73,75,86,8 7,87A,88,88A,40 1,404,405,406	3	0.47	72	Surface	Conditional Crown Fire	283	12	6	2.1	6	Surface	Surface	209	172

As shown in the measurement indicator section of this report, three fire behavior indicators (flame length, probability of torching and crowning index) are related to the fuels categories. The fire behavior figures describe one representative stand, and effects vary somewhat between stands depending on site conditions and other factors, but the general trends would be the same (refer to Project File Exhibit K-6 for all modeling results). All figures show fire behavior under extreme fire danger conditions, which could be expected nearly every summer.

The difference in fuels categories across the alternatives show that the vegetative treatments in alternative 2 have largest impact fire progression across the landscape. For example, a fire progressing across the project area would be influenced by many of the treatments, resulting in altered spread patterns and a slower spread rate. Maintaining natural openings with prescribed fire and regenerating some stands in the project area would create a mosaic of vegetation (Brackebusch, 1973). This mosaic would create fuel interruptions that reduce the potential for conflagrations or serious fast spreading fires. Fuel mosaics can result in delayed fire spread or fire build-up, reducing the risk of escaped fires. The spatial arrangement of vegetation influences the growth of large fires. Patches of vegetation that burn relatively slower or less severely than surrounding patches can reduce fire intensity, severity, or spread rate, or may force the fire to move around them by flanking (at a lower intensity), which locally delays the forward progress of a fire (R. T. Graham et al., 2004).

Recent research has shown that fuel reduction treatments can alter fire behavior and severity both in treated areas and for a limited distance downwind of treated areas (Finney, Mchugh, & Grenfell, 2005). Fuel reduction treatments have also been shown to be effective at altering fire spread across a landscape, especially when placed in a repeated and overlapping pattern (Finney, 2001). Ager (2010) found a substantial reduction in risk to highly valued large trees and structures well outside of treatment areas (approximately 3 to 6 miles) and thus the restoration strategy in the wildlands reduced wildfire probability and intensity to structures in the WUI, even at the low range of area treated (Ager, Valliant, & Finney, 2010). A slower moving fire would allow more effective fire suppression, resulting in fewer acres burned, reduced threats to human life and property, community infrastructure, air quality, water quality, and forest cover.

Under the action alternatives, fuels would be reduced through several different strategies. First, timber harvesting would result in reductions in surface (in most cases), ladder and crown fuels. Fuel reduction treatments such as grapple piling, slashing, or broadcast burning would be completed in harvest units adjacent to private property, in some cases, where structures are immediately adjacent to National Forest System (NFS) lands. Creating breaks in fuels would reduce the potential for structure ignition during a wildfire, and would allow for safe access/egress in the event of a wildfire. Second, prescribed burning would be used to reduce surface and ladder fuels, to modify stands to create more early seral conditions, favor fire resistant species such as ponderosa pine, and reduce stocking of fire intolerant species such as grand fir.

Harvest, whole tree yarding, and yarding of un-merchantable material, combined with slashing ladder fuels/excavator piling/burning, group selection, daylighting and precommercial thin treatments, would continue to reduce fuels and the associated risk of wildland fire. Sapling thinning would help to create healthy, vigorous stands of trees composed of a desirable mixture of tree species. These stands would be more resistant to insects and disease, be able to better withstand low to moderate intensity wildland fires over time, and could be machine, hand piled, or masticated as needed. The overall cumulative trend would be a continued improvement in forest health conditions as management moves stands towards desired future conditions.

Direct and indirect effects of intermediate cuts under the action

Intermediate harvests such as improvement and thinning harvests remove ladder fuels and decrease tree crown density. When followed by prescribed fire or piling and burning of fuels, or other mechanical treatments that reduce surface fuel amounts, this approach reduces canopy, ladder, and surface fuels, thereby reducing both the intensity and severity of potential wildfires (R. T. Graham et al., 2004). Thinning and harvesting can reduce vertical and horizontal continuity of the tree canopy and limit initiation and spread of crown fires, especially when done in conjunction with prescribed burning (Finney et al., 2005). Crown fuels would also be reduced throughout the entire modeling period (approximately 70 years) compared to no action. The total effect of the proposed activities is a dramatic, long-term reduction in potential fire behavior, which would also result in less tree mortality in the event of a fire (Forest Vegetation Simulator modeling results Project File Exhibit K-6).

Increasing the proportion of fire-resistant tree species such as western larch and ponderosa pine, where site appropriate, would increase the survivability of trees because they have thicker bark, taller crowns, and a higher canopy base height (R. T. Graham et al., 2004). Proposed improvement cuts would promote early-seral, fire resistant species which are more likely to survive even intense fires, reducing future potential fire severities. Improvement cuts would result in more open stands where early seral species such as western larch and ponderosa pine are abundant, so these stands would result in Fire Regime Condition Class 1 after treatment.

Direct and indirect effects of regeneration harvesting under the action alternatives

The action alternatives include regeneration harvesting (seed tree and shelterwood, which reduce surface, ladder and crown fuels. The reduction in the density of crown fuels caused by a regeneration harvest is reflected in Table 36. A major direct effect of regeneration harvest is the almost complete reduction in crown fuels in the treated stands. This reduction results in a disruption in the continuity of crown fuels. Because regeneration harvests remove almost all crown fuels, they act as a barrier to crown fire spread. Any crown fire that encounters a regeneration harvest will be forced to the ground because of the lack of crown fuels. This effect is not permanent; however, as the regenerated stand grows and is restocked with saplings in accordance with the National Forest Management Act (NFMA), it once again builds crown fuels.

Although regeneration harvests and the accompanying fuel treatments have the similar effects as intermediate treatments on surface and crown fuels, their effect on ladder fuels is different. Regeneration harvests remove most of the canopy and initiate the establishment and growth of small trees, which generally have their branches lower to the ground than larger trees. This growth causes an increase in ladder fuels, and thus an increase in the probability of torching. This increase in ladder fuels is not a concern, especially in the short-term, primarily because the canopy has been removed and there is nowhere for the fire to climb. Ladder fuels remain low for approximately 20 years post-treatment, and then increase.

Projections of stand growth and associated fire behavior show that the crown fire hazard in regenerated stands will immediately decrease after treatment (see Table 36). Over time, the crown fire hazard in the stand would slowly build. Regeneration harvests may need treatments in 20 to 30 years, such as sapling thinning and/or underburning to maintain and perpetuate the conditions of reduced fire hazard.

Regeneration harvesting would result in Fire Regime Condition Class 1 because the stands would change from a late-seral to an early-seral structural stage and ponderosa pine, western larch, and/or white pine would be re-established.

Direct and indirect effects of prescribed burning under the action alternatives

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 will reduce and break up the continuity of fuel at a landscape level. Prescribed fire will be ignited within the areas identified. These treatments should be implemented over at least two years 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. Other benefits include improved wildlife winter/spring range and improved whitebark pine habitat. Aerial ignition will be limited to those areas greater than 150 feet from surface water, adjacent to stream buffers. 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. Burn plan(s) and complexity analysis will be completed prior to prescribe fire implementation.

Direct and Indirect effects of shaded fuel breaks in alternative 2 and 4

Constructing a shaded fuel break is the process of selectively thinning and removing more flammable understory vegetation while leaving the majority of larger, more fire-tolerant tree species in place. These stands may remain forested or be regenerated depending on species composition. Species composition will be altered to be dominated by fire tolerant species including western larch, Douglas-fir, or ponderosa pine. Growth and vigor will be increased in the remaining trees, though more so in the younger stands than in the mature trees.

The primary reason for shaded fuelbreaks, as well as any other type of fuel treatment, is to change the behavior of a fire entering the area where fuels reduction activities have occurred. Fuelbreaks may also be used as points of anchor for indirect attack on wildland fires, as well as for prescribed fires. We can define the ways that forest fire behavior is altered by modification of fuels, and these principles apply to all forests where fuel treatments are applied and maintained (J. K. Agee & Skinner, 2005). The strategic location of the shaded fuel breaks along roads will give firefighters additional areas to safely engage an approaching wildfire.

Shaded fuelbreaks along roads and high fire risk areas will give firefighters places where fire suppression tactics will be more effective and improve the safety of firefighters. Fuelbreaks will not be stand-alone treatments in the Hungry Lion project area. An appropriate combination of fuels treatments including shaded fuelbreak will help to reduce unwanted wildland fire effects and the related ecosystem effects such fires often cause.

Creating shaded fuelbreaks along roadways is a common firefighting tactic used in preventing the spread of wildfires. Building these fuelbreaks now instead of when a wildfire is approaching an area allows planners to properly construct shaded fuelbreak and help mitigate any negative effects that could be caused. We are planning on building the shaded fuelbreak along roads and in areas that would have a high volume of public present during the wildfire season. Shaded fuelbreaks would allow the public a safer route to escape an approaching wildfire with flames dropping from tree crowns to a surface fire along the roadway.

Effects of road management to fire suppression in alternative 2, 3, and 4

Road management activities affect fire suppression effectiveness. In general, the more access in an area, the more effective fire suppression is in that area. The existing Hungry Lion road system provides reasonable access for wildland fire suppression. Mixes of gates, berms, or rocks are used as road closure devices on most of the roads. Gates on maintained roads allow emergency vehicles to respond to a wildland fire without any time delay, thus expediting the suppression process. Barriers that do not allow administrative vehicle access, such as roads placed into intermittent stored service, negatively impact fire suppression efforts by reducing the areas accessible by vehicular firefighting equipment. Alternatives 2, 3 and 4 include different amounts of reclamation; the roads scheduled for this activity would limit accessibility to areas during fire suppression activities.

Cumulative effects alternative 2, 3, and 4

Cumulative effects are those that would result from the action alternatives in addition to the incremental impacts of past, ongoing and reasonably foreseeable actions. In the cumulative effects discussion of alternative 1 (no-action), it was established that past timber harvesting and prescribed burning has not offset the effects of fire exclusion on the Hungry Lion landscape. The inherent effects wildland fire has on forest characteristics such as species composition, age, structure, and spatial pattern have been missing from the Hungry Lion project area for nearly 100 years.

As discussed in the analysis of the no-action alternative, fire exclusion, timber harvesting and prescribed burning are the past activities that contribute to cumulative effects. Forest products use such as firewood cutting, Christmas tree cutting, post and pole gathering, bough and cone collecting, and huckleberry picking have had and should continue to have little effect on fire and fuels in the area. With any removal of woody material such as dead trees or small understory trees, there may be a reduction in the potential fire behavior for that exact area. This reduction would be very minor and have little or no effect on the overall fire behavior for the area. With increased use, there may be increased potential for human caused fires. This could come from equipment such as vehicles and chainsaws or recreational campfires. Once again, this increased risk is minimal and the Forest Service typically mitigates the potential for human caused fires during high fire danger periods by placing restrictions on use. Recreation in the area also falls under the previous description of increased use and potential for human caused fires. In some cases, more people may allow for detection of small fires by private parties. The effect of this is also minimal.

Alternative 2 treats 4,895 acres in the Hungry Lion project area with harvesting, sapling thinning, understory removal, shaded fuel breaks, and prescribed burning, while alternative 3 would treat 3,418 acres and alternative 4 treats 2,979 acres. A fundamental question in the cumulative effects analysis is whether this amount of treatment, when considered together with past actions, would offset the effects of fire exclusion over the past 100 years. As discussed in alternative 1, there is no way of knowing exactly how many acres would have burned under natural conditions – this must be inferred from other evidence. We know that there have been 21 lightning-caused fires in the cumulative effects analysis area since 1986 (all of which were effectively suppressed), and that there were likely many more in the years before records were kept. Each suppressed fire had the potential to grow to several hundred or even several thousand acres in size over the fire season. It is almost certain that lightning-caused wildfires would have burned far more acres than either action alternative combined with past activities. Given this rationale, it is reasonable to

believe that the action alternatives makes progress in counteracting the effects of fire exclusion, but do not compensate for the effects of 100 years of effective fire exclusion.

Summary of Effects

While none of the action alternatives (alternative 2, 3, and 4) completely resolve the fuels and fire issues that have developed after 100 years of fire exclusion; all action alternatives respond to the purpose and need to reduce the risk to wildland firefighters and residents of the wildland urban interface should a fire occur creating forest stand conditions that lower the risk of future high-intensity and high-severity wildfire; creating defensible space along open system roads by creating shaded fuel breaks to improve firefighter safety and effectiveness of suppression tactics in the face of longer and hotter fire seasons; and to improving the resistance of forest vegetation to potential future disturbances. Alternative 2 best responds to the purpose and need, and does the most to reduce fuels and fuel continuity across the project area and transition stands towards fuels categories that display more manageable fire behaviors.

Regulatory Framework and Consistency

Alternative 1 does not address the objectives of fire management (Forest Service Manual 5140) or the goals of the National Cohesive Wildland Fire Management Strategy ('Strategy').

Action alternatives 2, 3 and 4 in the Hungry Lion Project are consistent with the following Forest Fire Management Plan Direction (USDA Forest Service, 1986) 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.

The action alternatives addresses all five of the objectives of fire management (Forest Service Manual 5140), in addition to responding to two of the three factors identified in the National Cohesive Wildland Fire Management Strategy (Strategy). The action alternatives would use prescribed fire to help meet the goals of the management areas within the project area, consistent with the forest plan. They would help develop cost-effective fire programs by making substantial progress toward reducing potential intensities of wildfire in areas affected by past fire exclusion. By inference, the more area treated to restore and maintain stands toward historical species composition, the better the alternative meets the forest plan goals.

Threatened, Endangered, and Sensitive Plants

Introduction

This document analyzes the potential effects of the proposed Hungry Lion Project on Federally listed plants and regional forester sensitive plants occurring or potentially occurring on the Hungry Horse 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 2670.

Under provisions of the Endangered Species Act (ESA) (USA, 1973), 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.

In accordance with section 7(c) of the Act, the U.S. Fish and Wildlife Service has determined that the following threatened or endangered listed species may be present on the Flathead National Forest (FNF): water howellia (*Howellia aquatilis*) and Spalding's catchfly (*Silene spaldingii*) (USDI Fish and Wildlife Service, 2017). In that determination, it is stated that the range of Spalding's catchfly includes the upper Flathead River System, and that areas below 5,000 feet are considered within the range of water howellia.

Water howellia (*Howellia aquatilis*), a vascular plant species in the family Campanulaceae, was initially 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 was finalized. Recently, the U.S. Fish and Wildlife Service has released a five 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 Fish and Wildlife Service, 2013c).

Spalding's catchfly (*Silene spaldingii*), a vascular plant species in the family Caryophyllaceae, was initially 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 Fish and Wildlife Service, 2007b). The FWS completed its five year review in 2009 and will maintain Spalding's catchfly's current status due to threats (USDI Fish and Wildlife Service, 2009c).

Whitebark pine (*Pinus albicaulis*), a tree species in the family Pinaceae, was initially listed as a candidate species under the ESA by the USFWS on July 19, 2011 [FR 76(138):42631-42654]. Whitebark pine was analyzed by the USFWS in 2010 as a candidate for listing. Their 12-month finding states that whitebark pine as a species is declining based on synergistic threats from habitat loss due to climate change, past and ongoing fire suppression, predation by mountain pine beetles, and the deadly pathogen, white pine blister rust (USDI Fish and Wildlife Service, 2011b). Timber harvesting was analyzed as a possible threat although it was dismissed due to the minimal amount of harvesting of whitebark pine, which is not a commercial species. However, the USFWS states in their finding that the entire range of whitebark pine is not threatened by extinction and that there are many other species ahead of whitebark pine waiting for Federal listing. They cite budgetary and personnel constraints preventing them from listing the species.

The 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, the U.S. Forest Service Northern Region added whitebark pine to the regional forester's sensitive species (FRSS) list, effective December 24, 2011 (USDI Fish and Wildlife Service, 2011b). Since it is listed as a regional forester's sensitive species, it is analyzed with the other regional forester's sensitive species plants.

Forest Service Sensitive Species Policy Forest Service Manual 2670 (USDA Forest Service, Forest Service Manual) 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 2670.5 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 Flathead National Forest also has an obligation to protect Montana State plant species of concern.

Summary of Findings

Federally listed plant species

It is my determination that the Hungry Lion Project would have no effect on water howellia (*Howellia aquatilis*) or Spalding's catchfly (*Silene spaldingii*), its habitat, or potential habitat for these species. This determination is based on the lack of documented occurrences within the project area, and the lack of suitable habitat within the treatment area.

Regional forester's sensitive plants

The proposed Hungry Lion Project may affect whitebark pine individuals and habitat but would not lead to federal listing as Threatened or Endangered (currently listed as a Candidate species) in all action alternatives due to the proposed prescribed burning. Burning may impact individuals but would benefit habitat. Individuals or groups exhibiting rust-resistant properties would be selected for protective measures in an effort to keep them living on the landscape.

The proposed Hungry Lion Project will affect a western moonwort (*Botrychium hesperium*) population on NFS Road 1615 in all action alternatives but would not lead to federal listing or impact species viability. Road blading would be prohibited in the population. Weed control measures will be altered in the rare plant site to accommodate western moonwort. Post-implementation field visits will occur at this site to determine the condition of the population.

The proposed Hungry Lion Project would not affect the documented populations of English sundew or pod grass due to project design features protecting wetlands from ground-disturbing activities. The project would not affect the population of ascending moonwort due to no project activities nearby.

There would be direct, indirect and cumulative effects to suitable habitat; however some guilds such as wetlands and riparian areas would be protected from project activities. Upland and lowland suitable habitat would presumably recover in 10 to 50 years after implementation.

Determination: This project would impact individuals but would not result in a trend towards federal listing or loss of viability for sensitive plant species.

Analysis Area

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 are suitable habitat.

Methodology

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

A preliminary habitat suitability evaluation was conducted to evaluate the potential for additional sensitive plants occurrences within the action areas (Project File Exhibit J-1). Sensitive and rare plant species are grouped in habitat guilds (Project File Exhibit J-1). Known vegetation types and elevation ranges of the project area were considered in evaluating suitable habitat for rare plants. All proposed units and prescribed burn areas were evaluated for potential habitat. Those areas that were identified as suitable habitat will be surveyed for Threatened, Endangered, and Sensitive (TES) plants, Montana Natural Heritage Program's species of concern, and invasive species. Areas of proposed mechanical implementation will be prioritized for surveys above manual harvest treatments and prescribed burning. Project effects and design features for invasive species management will be analyzed separately.

Existing Condition (Affected Environment)

Federally listed plants

The USFWS Montana Field Office web page currently lists two species as threatened for the Flathead National Forest: water howellia (*Howellia aquatilis*) and Spalding's catchfly (*Silene spaldingii*) (USDI Fish and Wildlife Service, 2017). There are no documented occurrences for Spalding's catchfly in the Montana Natural Heritage Program's rare plants database or the Natural Resource Management database on the Hungry Horse Ranger District or on the rest of the Forest. There are 220 populations of water howellia located in the Swan Valley of the Swan Lake Ranger District; none occur in the project area or on the Hungry Horse Ranger District.

Water howellia (*Howellia aquatilis*)

Occurrence and surveys

There are no documented occurrences of water howellia, or potential habitat, within the project area. Wetlands were identified in aerial photos in the project area and will be surveyed in 2017. However, wetlands in the project area have very low potential for water howellia since the species has not been found on the forest outside of the Swan Valley.

Further analysis can be found in Project File Exhibit J-1.

Spalding's catchfly (*Silene spaldingii*)

Occurrence and surveys

There are no known occurrences of Spalding's catchfly within the project area or within the Flathead National Forest.

In 2000, aerial photos of the entire Flathead National Forest were reviewed to locate large expanses of grassland with potential habitat for Spalding's catchfly (Mantas, 2000). Grassland openings were delineated from aerial photos in areas along the North Fork of the Flathead River floodplain from the Canadian border to Polebridge and at Danaher, Horse Hill, and Bar Creek Meadows within the Bob Marshall Wilderness. Spalding's catchfly was not located during focused surveys for this species in the above areas. These grassland habitats were determined to be unsuitable for Spalding's catchfly.

In addition, no grassland habitat with potential for Spalding's catchfly was identified in aerial photos in the project area. Surveys will be conducted in 2017.

Further analysis can be found in Project File Exhibit J-1.

Regional forester's sensitive species

Little is known about the historical condition for sensitive plants in the Flathead National Forest and in the project area. Botanical surveys were not initiated in the area before the onset of the Forest's Botany program in 1991. There are 51 recognized regional forester's sensitive plant species for the Flathead National Forest (USDA Forest Service, 2011b); Project File Exhibit J-1). The Montana Natural Heritage Program's and Natural Resource Management databases were queried to determine known sensitive plant occurrences within the analysis area. There are a few documented populations for regional forester's sensitive species plants within the project area which are not in proposed treatment areas. Whitebark pine was observed during cursory surveys in the ecosystem burn units in fall of 2016, but the area will be surveyed more extensively in 2017, prior to the issuance of a decision or implementation.

Whitebark pine

Whitebark pine is an important species of the high elevation, cold forest type across the northern Rocky Mountains, where its cold tolerance, superior hardiness on the harsh microsites that may exist after a fire, unique method of seed dispersal, and resistance to lower intensity fires allow it to compete successfully in the upper subalpine zone. Its long life (many centuries is not unusual) allows it to be a very persistent species in the upper subalpine forests. Whitebark pine is an important ecological component of these higher elevation forest communities, providing a valuable food source and shelter to squirrels, bears and other animals (its cones contain large,

highly desirable seeds), aiding in the protection of soil and water quality in the sensitive high basins where it grows, acting as a “nurse tree” for the establishment of other conifers around it, and undoubtedly filling a host of other roles in these harsh, cold environments (Tomback et al., 2001).

Whitebark pine is considered at high risk in the Northern Rockies Zone. It has experienced dramatic population decline throughout this area, primarily due to the effects of white pine blister rust (an exotic, introduced disease) and mountain pine beetle. Fire exclusion and suppression have also contributed to the decline of whitebark pine in some ecosystems, primarily by allowing spruce and subalpine fir to increase in dominance and gain competitive advantage on whitebark pine sites (Tomback et al., 2001).

There are approximately 290 acres of whitebark pine dominated stands within the project area. There has been high past and continuing mortality of the whitebark pine in these areas and throughout the upper elevations of the project area. There are about 1,500 acres of subalpine fir dominated stands above 5,800 feet elevation where whitebark pine could occur or had occurred but has converted to subalpine fir.

Western Moonwort

A western moonwort (*Botrychium hesperium*) population occurs on NFS Road 1615 that is to be used for access to proposed units 51-56. Individuals occur on the roadside and in the two track. The population also includes other species of moonwort such as lanceleaf moonwort (*Botrychium lanceolatum*), which is also a state species of concern. The road is in good condition and does not require any construction activities. Roadside brushing may be necessary, which would not affect the population. Road blading or removal of the road surface over the population would be prohibited. Project activities will be restricted to vehicles and equipment on the two track running surface.

Soil disturbance would both provide habitat for the western moonwort as well as spread the existing weed infestations in the road corridor. Since western moonwort is currently thriving alongside the weeds, it is expected that western moonwort would continue to co-exist with the existing infestations. Weed control measures will be altered in the rare plant site to accommodate western moonwort. Post-implementation field visits will occur at this site to determine the condition of the population.

Suitable habitat

The project area contains habitat types for sensitive plants associated with riparian, seeps, springs, fens, fen margins, moist cliffs and mossy talus slopes, rocky outcrops and slides, moist coniferous forest and margins, mid-montane and subalpine grasslands and forest openings, subalpine and disturbed habitat groups listed in Project File Exhibit J-1.

Environmental Consequences

Federally listed plant species

Alternative 1 (no-action alternative), Alternative 2, 3, and 4 – Direct, indirect and cumulative effects

Water howellia

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

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

Determination: No effect.

Spalding's catchfly

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

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

Determination: No effect.

Regional forester's sensitive species

There would be no direct, indirect, or cumulative effects to regional forester's sensitive species plants as a result of this project.

Determination: No effect.

Alternatives 2, 3, and 4 – Direct and indirect effects

Known occurrences

There are three documented occurrences of regional forester sensitive plant species within the project area, and one directly on the project boundary – ascending moonwort, English sundew, and pod grass. These occurrences are not located within proposed harvest units; however they are close to activity units. English sundew and pod grass occur in fens, which will not be directly affected by project activities due to project design criterion specifying a no-ground-disturbance buffer. There would be no new temporary roads built near these populations. Existing roads occur near these populations; the wetlands appear intact from aerial photos. Surveys conducted in summer of 2017 will confirm this assessment. Ascending moonwort occurs at the side of NFS Road 2861, which is in the project area but not within any proposed units or near haul routes. It would not be impacted by project activities.

Whitebark pine individuals and habitat also occur in the project area. Prescribed burns are proposed higher in elevation than the treated stands and will likely burn into whitebark pine

habitat. Those areas will likely benefit whitebark pine habitat by opening the understory and impeding the encroachment of shade-tolerant species. Individuals may be burned due to encroachment of other vegetation creating ladder fuels near whitebark pine individuals. If mature, cone-producing whitebark pine trees are found in timber treatment areas during operations, they will be avoided. In the prescribed burn units, ignition will not occur below or adjacent to selected whitebark pine trees or selected groups of trees to avoid burning those trees. Some damage is expected to occur as fuel loading is high and whitebark pine is thin-barked and not adapted to fire.

If any other rare plant populations are identified during project implementation, they would be protected as specified in the contract clause and in the project design features.

Suitable habitat

The project area contains habitat guilds for many sensitive plant species. From previous surveys in the project area, these habitat guilds are documented: mid-elevation moist conifers and margins of mid-elevation moist conifers, riparian, wetlands, fens and fen margins, rocky outcrops and slopes, mid-montane grass and forb openings, subalpine forests and openings, and disturbed. Undocumented occurrences of regional forester's sensitive species plants may be affected by soil disturbance and compaction, competition from invasive species, roadside dusting, increased light availability from opening up the canopy, and hydrology alteration due to project activities.

Timber harvesting: Timber harvesting in upland forests 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 regional forester's sensitive species individuals. Impacts include wilting from increased temperature and decreased humidity, as well as sunburn from increased light levels. These changes to the habitat can also make these areas more suitable for invasion by invasive species.

Timber harvesting can also alter the hydrologic processes for sensitive plants of wetland-associated habitat groups such as the riparian, wet meadow, and moist coniferous forest groups. Changes to the hydrologic processes of wetlands may result in both a decrease and increase of wetland water levels and alter species diversity (Chadde et al., 1998). Tree harvesting often decreases canopy cover and consequently may decrease overall evapotranspiration rates of surrounding landscape. This may result in increased inundation of wetlands from runoff. In addition, increased canopy openings near wetlands may increase evaporation of the wetlands, effectively reducing water levels earlier in the growing season. Project design features would buffer wetlands from ground disturbing activities.

Methods of tree removal would be a combination of mechanized (tractor, winter tractor) or skyline. Mechanized harvesting, which includes clippers, skidders, forwarders, etc., creates soil disturbance, which removes native vegetation from the landscape and alters suitable habitat. Skyline harvesting, which utilizes cables to yard woody material up to a landing at the top or bottom of the unit, is lighter on the land, but still disturbs soil and removes native vegetation when trees are dragged across the units and when landings are created.

Regeneration harvests (seedtree and shelterwood) create soil disturbance and increase light availability to the forest floor, leaving behind little to no canopy cover. These conditions stress the native vegetation and alter habitat by increasing light, temperature, wind and reducing humidity. While other harvest types may leave some canopy cover reducing these effects, regeneration

harvests can dramatically change the unit, moving it from a shaded, protected site to an open site with soil disturbance and the risk of weeds. It could take up to 50 years for the canopy to recover. Alternative 2 proposes the most acreage of regeneration harvests, which is higher than alternatives 3 and 4 (Table 16).

Special cuts would occur at recreation sites (campgrounds and dispersed sites). Treatments would be unique to the individual site. Generally, treatments would entail a relatively light and selective removal of trees of all sizes, focusing on hazard trees, insect or disease infested trees, viewing and screening opportunities, long-term desired forest health and species compositions, and other site-specific features related to the recreational objectives. Tractor implementation and whole tree yarding would disturb the soil and remove native vegetation from those tracks. Each action alternative proposes the same 77 acres of special cuts.

Commercial thinning removes between 30 and 70 percent of the canopy, retaining a more forested appearance, yet still disturbing the soil and removing native vegetation and altering microhabitat. Alternative 2 has the most commercial thinning proposed, followed by alternatives 3 and 4, respectively.

There are several units proposed for winter harvest to conserve soils (Table 18). This method of harvest would not have the same impacts to native vegetation as non-winter harvest, due to snow on the ground and frozen ground conditions. There would be little to no soil disturbance, which in turn means less damage to native vegetation and rootstock. Above-ground parts may still be removed or damaged but most species would resprout from roots and remaining stems.

Reforestation would occur in regeneration harvest units either by planting or natural regeneration in all action alternatives. These are units where inadequate natural regeneration of desired tree species is predicted or where different species are desired. Desired species to plant include western white pine, western larch, Douglas-fir and ponderosa pine. The remaining acres not proposed for planting would naturally regenerate with on-site seed and adjacent leave trees, usually lodgepole pine, larch, ponderosa pine or Douglas-fir. Planting areas that would otherwise not naturally regenerate would help recover canopy cover and provide for suitable habitat again.

Alternative 4, followed by alternative 3 and 2, would have the least amount of timber harvesting and soil disturbance, affecting the least amount of regional forester's sensitive species plant habitat.

Sapling thin: Thinning treatments reduce tree densities within stands with the objective of promoting healthier and more resilient forest conditions now and into the future, as well as improving timber productivity. Thinning also removes ladder fuels and reduces fire hazard. Increased light and water resources would be available to the leave trees and to the understory vegetation, improving growth and vigor of these components. Western white pine would be selected for daylight thinning; trees around western white pine would be removed, providing more light and space for western white pine. In general, these units are densely stocked, do not allow light to reach the ground, and generally do not support suitable habitat for regional forester's sensitive species plants. Reducing the density of these units and allowing some light to the forest floor may have a beneficial effect to unsuitable habitat, and perhaps change it enough to provide suitable habitat for regional forester's sensitive species plants. The native vegetation is often lacking or reduced due to lack of light and water. Opening up the canopy promotes shrub and forb growth in these densely stocked stands.

Sapling thinning would be conducted by hand treatments, which creates little soil disturbance and virtually no removal of native vegetation. Saplings that are cut during the thinning would be scattered and left on the ground to decompose. Alternative 2 and 4 propose the same amount of sapling thinning, while alternative 3 proposes much less (Table 16).

Burning activities and fuels treatment: Suitable habitat in the proposed burn areas may be affected for a brief period due to burn over of the sites. 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 likely remain intact and experience temporary temperature increases in the soil. These direct 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. Fire activities can also increase exposed mineral soil and increase the risk of these areas to invasive species establishment, which may affect the integrity of suitable habitat.

The same amount of ecosystem burning on the landscape is proposed in each of the action alternatives (Table 16). These units occur in stands of the cool and moderate dry; cold and moderate dry; and cold; as well as non-forested habitat types. The proposed areas would target the drier, open forest and shrub-dominated openings. The objective of the prescribed burning would be to reduce conifer encroachment into the shrub dominated areas, rejuvenate wildlife browse by stimulating re-sprouting of fire adapted shrubs and grasses, create a more diverse mosaic of vegetation conditions across this landscape, reduce down fuel accumulations, and promote whitebark pine. Although burning generally benefits native vegetation, it carries the risk of changing suitable habitat to unsuitable habitat if the burn severity increases to mixed-severity, as well as the risk of creating conditions suitable for invasive species. The advantage to burning at these higher elevations (4,800 to 7,400 feet) is that there are fewer weeds, due to fewer roads and trails, in these areas.

Other burning activities that would occur in all action alternatives in the timber harvest units include excavator or hand piling and pile burning, as well as broadcast burning. Past observations have seen burn piles present a high risk for invasive species infestations with little to no revegetation by surrounding native vegetation. The high intensity burning of the confined area essentially sterilizes the soil and greatly inhibits native revegetation (Hebel, Smith, & Cromack, 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 is no natural competition to prevent establishment and persistence of invasive species. Broadcast burning has similar effects to that of pile burning. After the unit is harvested and slash is left scattered on the landscape, the fuel loading may provide varied burn intensities, some of which has the potential to expose mineral soil. The effects of burning on native vegetation include the removal of above-ground vegetation, burning up duff and shallow roots, and extreme heating of the soil surrounding stems and roots (James K Brown & Smith, 2000). These areas are priority for post-treatment monitoring and possible herbicide treatment for invasive species. Hand piling is preferred due to the little to no soil disturbance for moving the slash into piles. Excavator piling uses heavy equipment and creates more soil disturbance in the unit other than the piles themselves. Broadcast burns occur post-harvest, after equipment has disturbed the soil during harvest activities. The native vegetation in those units would essentially be impacted more than once.

Alternative 4 proposes less pile burning and broadcast burning proposed than alternative 2 and 3 (Table 16) due to no temporary roads and fewer units, therefore it would have less impact to native vegetation, suitable sensitive species habitat and less risk for invasive plant infestation. All action alternatives would have the same impact to native vegetation and habitats with ecosystem burning.

Roads: There are about 158 miles of NFS roads in the project area, in combination of open and closed. Alternatives 2 and 3 propose temporary road construction; alternative 4 proposes no temporary roads (Table 16). Alternative 2 would have the most effect to native vegetation and suitable habitat by constructing temporary roads, either on existing template or new construction; followed by alternative 3. Using an existing template is preferable to new construction since soil compaction and vegetation removal has already occurred in those corridors.

New temporary road construction effects to suitable habitat would be the removal of vegetation and soil compaction. Construction removes vegetation, often putting it to the side of the corridor where it is left to decompose. Use of equipment would compact the soil and create a drivable surface. This construction removes the area from the productive landbase for the life of the road, preventing native vegetation from growing back. Generally, temporary roads are on the landscape for the life of the project and then rehabilitated once they are no longer needed. If a road is rehabilitated via ripping and putting back the native surface and/or recontouring, eventually native vegetation will grow back, if it is not outcompeted by weeds, but plant growth would be hindered due to soil compaction and lack of nutrition, and weeds would have a competitive advantage in the harsher growing environment (Kolka & Smidt, 2004).

Using existing templates that were roads in the past but no longer on the NFS road system or accessible still present challenges for the recovery of native vegetation and suitable habitat after their use in the project area. Notably, these templates are generally weedy due to compaction and lack of canopy cover. Disturbing these templates when building temporary roads can move weed seed around, moving seed into the forest along skid trails and altering suitable habitat. These templates will be seeded with a native seed mix in an effort to reduce the impact of weeds to native vegetation. However, building temporary roads over compacted ground instead of over new ground reduces the potential amount of ground disturbance on the landscape, reduces soil compaction (thereby reducing weeds competitive edge over natives) and prevents further removal of native vegetation.

Other effects to suitable habitat include edge effects from road construction and changes to hydrology of wetlands that support suitable habitat. Edge effects are described as an increase in light, temperature, and wind, as well as a decrease in humidity, and, in the case of roads, an increase in dusting (Trombulak & Frissell, 2000). The extent of edge effects is difficult to determine, since it depends on the size of the adjacent opening/road corridor and the affected forest type but it can extend from 15 feet to 50 feet (Watkins, Chen, Pickens, & Brososke, 2003). The effect to native vegetation would be a change in habitat that could impact the diversity of the stand edge.

Roads can also alter hydrologic regimes by increasing or decreasing the water levels of the affected wetlands, as well as increasing silt to downstream wetlands (Chadde et al., 1998). These changes can indirectly impact native vegetation and sensitive plant suitable habitat. Roads are well known as corridors for invasive species, which can also indirectly impact wetlands and other natural areas (Trombulak & Frissell, 2000; Tyser & Worley, 1992; Von der Lippe & Kowarik, 2007). Temporary roads pose the risk of siltation into wetlands and temporarily altering water chemistry, which may affect native vegetation. Once the temporary roads are rehabilitated and the

landscape and vegetation has had time to recover, any effects to the downstream wetlands would cease. However, it has been observed on the landscape that if not rehabilitated properly, temporary roads have a lasting effect on the land. They 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 for sensitive plants decreases. Recontouring these roads and seeding them with an approved seed mix would inhibit weed spread.

All temporary roads constructed for this project will be rehabilitated by any site-appropriate combination of the following:

- Removing any installed culverts or temporary bridges.
- Recontouring the entire template to natural ground contour.
- Where recontouring is unnecessary, rip to a depth equal sufficient to ameliorate the presence of detrimental soil compaction (typically between 6 and 12 inches).
- Seeding with the native plant mix as specified by the Forest Botanist.
- Placing woody material on the template.
- Planting native shrubs and trees to augment natural vegetation.

Several historic roads which would be used as temporary roads to access units are proposed to be added to the NFS road system in intermittent stored service. These existing templates would be re-constructed for project activities and then put into storage until the next entry into the stands. Since no new excavation for the road prism would be necessary, there would not be additional soil disturbance to the surrounding vegetation and suitable habitat from these historic to intermittent stored service roads. The existing condition likely includes weed infestations, which would be treated prior to use and following project implementation according to the design criteria. Once they have been placed into intermittent stored service they would become inaccessible after implementation to weed treatment, putting the native vegetation and suitable habitat at risk of changing conditions.

Alternative 4 would have the least amount of impact on regional forester's sensitive species habitat due to no temporary road construction. Alternative 2 would have the most amount of impact on regional forester's sensitive species suitable habitat due to 6.7 miles of temporary road.

Non-native invasive species control: Sensitive and rare plants adjacent to areas of chemical invasive species control may be at risk of exposure to herbicide from project-related weed treatment. However, on the Flathead National Forest, TES plant surveys are conducted for each site before any chemical control treatments are implemented, as required by the Flathead National Forest Noxious and Invasive Weed Control Decision Notice (USDA Forest Service, 2001b, pp. DN-6 - DN-7). With the exception of some TES plants that occur in "disturbed" or early successional habitats (i.e. Howell's gumweed, pale corydalis, Austin's knotweed, and western moonwort), most invasive species generally do not persist in intact TES habitat due to differing habitat requirements. There are many infestations in the project area; chemical and biological methods are currently used to treat infestations in the project area.

Aquatic improvements: All three action alternatives propose re-routing 1.4 miles of NFS Road 546 (Emery Creek Road) out of the floodplain away from Emery Creek to benefit native cutthroat fish. Native vegetation and suitable habitat would be affected by road construction activities. Vegetation would be removed permanently from the landscape and weeds would have a corridor into a previously un-roaded area. The existing road template, currently infested with several

species of weeds, would be ripped, seeded, and rehabilitated. Once the template has grown over with shrubs and trees, the non-native species will likely recede in time, to be replaced by adjacent native vegetation. Eventually, these areas, which are in the riparian zone, will likely provide suitable habitat once again for rare plant species.

All three action alternatives propose to install six aquatic organism passage structures on the same roads. The effects would be similar to replacing culverts, although the footprint of the activity would be larger due to the larger structure that would be installed.

Alternative 2 proposes to replace up to twelve culverts on both open and closed roads. Culvert replacement would affect vegetation adjacent to the activity, but would not have long term effects different from the current effects of disturbance, weeds, and edge effects such as light availability and temperature changes. Alternative 3 proposes the same activity but with restrictions to implementation within the grizzly bear security core, the number of culverts proposed for replacement is fewer (Table 16). Alternative 4 proposes to replace the same three culverts as alternative 3, as well as remove the ten culverts along NFS Road 1614 and not replace them. This road would remain on the system but impassable to motor vehicles. That particular section of road has not yet been surveyed, so it is unknown if rare plants or weed infestations occur; however, it is likely there are weed infestations similar to the ones found on NFS Road 546, which leads to NFS Road 1614. Native vegetation would not likely come back along this road due to competition with weeds and to soil compaction restricting root growth.

In regards to native vegetation and potential weed spread, the alternative with the least amount of ground disturbance carries the least amount of threats to native vegetation and suitable habitat. Alternative 3 has the least amount of ground disturbance proposed for aquatic improvements and would have the least impact to native vegetation.

Nonmotorized trails: Alternatives 2 and 4 propose adding historic trails to the trail system to be able to manage and maintain them. Approximately 12 miles of trail would be added back to the system. To make up for adding trails back to the system near grizzly bear security core, the end of NFS Road 560A would be bermed to make up for the effects to grizzly bear core by the use of the trail system. These trails are historic yet have been kept open by users. Native vegetation has likely not grown over the trails, and there is the possibility of weeds on the trails spreading into the adjacent understory. Trails can affect sensitive plants by removing suitable habitat, especially in areas along streams, lakes, and associated wetlands, as well as trampling of native vegetation surrounding these sites. 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.

Alternative 3 proposes to rehabilitate the historic trail beds in the project area and not add to the system. This would include blocking access to the trails and possibly revegetate with native species. If allowed, native vegetation would eventually grow back over the tread; however, if there are weeds along these trails, they would impact natural revegetation and possibly impact the adjacent understory and suitable habitat without access to treat weeds.

If these trails are currently user maintained, adding them to the system would allow them to be prioritized along with other trails and recreation sites for weed treatment, which would in turn benefit native vegetation and suitable habitat.

Recreation site improvement: All action alternatives propose parking and traffic flow improvements at the North Lion Lake Recreation Site to accommodate increasing use and improve the site. The district is also proposing to install an accessible fishing pier on the South Lion Lake Recreation Site to provide increased recreational opportunities for the public at this site. The Lion Lake fen is located north of Lion Lake, adjacent to the current parking areas and proposed activities. Some surveys have been conducted in the past in the general area, but none specific to the fen. The Montana Natural Heritage Program's database shows that pod grass (*Scheuchzeria palustris*) occupies the site. Surveys will be completed during 2017 to monitor this population and to determine if other regional forester's sensitive species plants are present in the fen and surrounding areas. Impacts from modifications to the parking area are unknown, as the fen is already bordered by roads on three sides. If modifications are confined to the south side of NFS Road 5311, then there would not be any additional effects to the fen. Increasing capacity at the recreation site may increase foot traffic into the fen, especially during dry years, trampling plants and introducing weeds.

Alternatives 2, 3, and 4 – Cumulative effects

Past, present, and foreseeable actions within the project area include timber harvesting, fuels treatment, prescribed fire and burning activities, road construction, maintenance and reclamation, gravel pit activities, recreation, invasive species control, wildland fire, and fire suppression, forest product gathering, tree planting, Coram Experimental Forest and Coram research natural area, Hungry Horse Dam, administrative sites, and special use permits. These actions may have historically affected TES plants and may continue to have effects.

Timber harvesting and sapling thinning: 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 far more fragmented in forest structure and size class across the landscape than historically.

Additionally, harvesting activities disturb soil which increases the amount of exposed mineral soil. Soil disturbance carries a higher risk of invasive species establishment, and if equipment is contaminated, also has a higher risk of introducing 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 vegetation and sensitive species habitats.

The objective of sapling thinning is to thin dense stands, after an event (such as fire or clearcutting) has created an even-aged monoculture, to create a healthier stand of trees. The habitat created from these actions do not necessarily provide for suitable habitat. Many of these stands prior to thinning are very dense, allow very little light to the forest floor and do not support a diverse understory. They do not provide suitable habitat for most of listed TES plants either before or after sapling thinning.

There have been about 12,800 acres of past timber harvest in the project area. Many of these acres overlap and have been harvested many times over the same area. There have been approximately 5,200 acres of past precommercial (sapling) thinning in the project area. Ongoing projects within the Hungry Lion project area that will likely change suitable habitat include

Firefighter Timber Sale and Belton Fuels Stewardship. There are currently no other foreseeable timber projects within the project area.

Tree planting: Tree planting has occurred in the project area and will continue to occur. There is some soil disturbance associated with implementation, as well as localized vegetation removal. Eventually, the trees provide canopy and change habitat toward suitable for species that grow in the mid-elevation moist conifer habitat guild.

Road construction, maintenance and best management practices: Past, present, and future maintenance of roads can have both adverse and beneficial cumulative effects on regional forester's sensitive species 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 in the openings. Maintenance may increase traffic along these roads and thus increase the risk of the introduction of invasive species which could affect regional forester's sensitive species plant populations or habitat. Maintenance such as blading activities may also disturb plant populations adjacent to roads.

It is possible that past (and future) road construction may have affected ground water and sediment flow in some wetlands (Trombulak & Frissell, 2000). Increased siltation may result in shifts in the wetland vegetation composition, supporting emergent vegetation in place of submergent vegetation types (USDI Fish and Wildlife Service, 1996). Past road closures have positively affected suitable habitat and native vegetation by reducing the above effects and decreasing the potential for invasive species invasion. The Lion Lake fen, north of Lion Lake, which harbors the rare plant species pod grass, is bounded on three sides by roads. Hungry Horse Lake, which is surrounded by fen and supports English sundew, also has roads leading to the fen and crossing the outlet to the reservoir. There are several other wetlands near Hungry Horse Lake which have adjacent roads and forest management.

There 158 miles of NFS roads that are open year-round, seasonally, or closed year-round. A little over half of those roads (84 miles) are closed to the public and are not maintained on a regular basis. This figure does not reflect the amount of temporary roads or decommissioned roads that have been on the landscape in the past. Many of those corridors still exist, whether they are grown over with young saplings or native vegetation or are infested with weeds. There are an additional 31 miles of non-NFS roads, generally in the communities of Hungry Horse and Martin City.

Fire: In general, NFS lands contain high fuel loads in the understory due to fire suppression over the last century. Fire suppression has created a dense understory condition in many un-treated stands where, historically, low intensity understory fires occurred regularly. The fires that have been eliminated from the understory played a role in reducing fuels as well as encroaching vegetation. Fire suppression, resulting in closed-canopy forests, has reduced light levels and affected understory vegetation. Additionally, fire suppression activities, such as dozer lines and hand-dug fire lines, increase exposed mineral soil which can be vulnerable to invasive species establishment, which also affects the integrity of TES 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 now compete with invasive species for the remaining nutrients. The last large fire was in 1988, in the higher elevations of the project area, but there have been the occasional lightning strikes and subsequent suppression. Human activities have also caused some small fires in the project area. Vegetation has likely recovered from the 1988 fire.

Fuel reduction activities reduce the risk of catastrophic wildland fires and the need for fire suppression activities. Since vegetation removal and burning (broadcast and pile) are part of fuels reduction activities, there is a risk of disturbing undocumented TES plant populations. However, an intense burn would also disturb existing TES populations. Prescribed burning has similar effects to native vegetation and regional forester's sensitive species plants as do wildland fires, although they are generally less severe on the landscape than wildland fires.

Recreation: Campgrounds, hiking, biking, horse trails, motorized trails, lake and river access points, and other areas frequented by recreationists all require construction and maintenance. These activities cumulatively affect sensitive plants by removing suitable habitat, especially in areas along streams, lakes, and associated wetlands. Dispersed and developed camping increases the risk of introducing invasive species to TES plant habitat, as well as trampling of native vegetation surrounding these sites.

Trail construction and maintenance near wetlands and streams may affect wetland and riparian species by increasing siltation into nearby water or increasing the risk of introducing invasive species by recreationists. 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.

Other recreation activities such as off-trail hiking, hunting, trapping, outfitters and guides, berry picking, and horse riding can also impact sensitive plant habitat. Native vegetation and regional forester's sensitive species plants may experience cumulative effects of trampling and collecting from dispersed recreation.

Forest products: Public use of forest products (firewood, boughs, berries, etc.) may contribute to the cumulative effects to sensitive species populations and habitat. While obtaining forest products, trampling and collecting of regional forester's sensitive species plants may occur. Weed introduction can also occur via boots and equipment. Popular collection sites would have the most impact with possible habitat degradation. The project area is popular for firewood cutting, huckleberry picking, and other forest products as it is close to private land. Collection of forest products will continue to occur in the project area.

Invasive species control: Past vegetation management, wildland fire suppression, recreation, road-related activities, and administrative use have all contributed to the spread of invasive species in the project area. The proposed activities also carry the risk of introduction and further spread of invasives. The Flathead National Forest has an integrated weed management program that identifies and controls infestations across the Forest. Herbicide is the most commonly used treatment method to control invasive species, which can affect native plant species. The forest also uses biological control primarily on tansy ragwort, spotted knapweed, and Canada thistle. These organisms have spread on their own, as well as with human help, into the project area. Since areas to be treated with herbicide are surveyed prior to spraying, there would not be an effect to documented populations of sensitive plants. Currently, the forest sprays several roads and areas in the project area over the past four years. This project would also treat these roads before and after harvest.

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; however, due to the number of documented infestations, and frequent and recent

treatments, there would be a high risk of spread. Weed spread, if left unchecked, would negatively affect regional forester's sensitive species plant habitat.

Coram Experimental Forest and Coram Research Natural Area: The project area contains both experimental forest and a research natural area (RNA). Some activities, in cooperation with the Rocky Mountain Research Station (RMRS), are proposed in the experimental forest. Activities and studies have been conducted in this experimental forest since the 1930s. These activities are similar to the forest management implemented outside of the experimental forest and have had the same effects to regional forester's sensitive species and suitable habitat. The adjacent research natural area was formally established in 1988, although it was selected and informally managed as a research natural area since 1937. It was established "(1) to provide an area of undisturbed old-growth forest for comparison with manipulated tracts on the experimental forest; (2) to provide undisturbed old-growth forests of the western larch...and Douglas-fir...types...for continued study of ecological processes; and (3) to preserve a sample of "virgin" forests of western larch and Douglas-fir types for educational purposes," (USDA Forest Service, 1988). This designation and establishment, essentially since 1937, has provided an unmanaged area that preserves these habitat types, which also preserves them for regional forester's sensitive species plants. The research natural area baseline can change, either due to wildland fire or other natural processes such as wind throw, insect and disease and more, at which point the designation of research natural area for the purpose of providing undisturbed western larch and Douglas fir habitat types can be reassessed.

Inventoried roadless area: The project area contains inventoried roadless area, adjacent to wilderness. Other than prescribed burning and occasional recreational activities, this relatively unmanaged and non-weedy area provides a refuge for regional forester's sensitive species plants and suitable habitat.

Other actions in the project area: Hungry Horse Dam construction and maintenance has removed suitable habitat permanently from the landscape, with the resulting reservoir changing the local environment surrounding the reservoir, similar to lake effect. Increased humidity and precipitation could have incremental effects to local vegetation in the long term.

There is a Forest Service gravel pit off of NFS Road 11007 that has been used and will continue to be used in the project area. It is currently less than 100 feet from a nearby wetland. It contains several species of weeds. Gravel pits are a common seed source for invasive species to spread along roads and in recreation areas; wherever the gravel is used. Use of the gravel pit removes all vegetation in the area as well as the soil layers, making passive and active revegetation extremely difficult. There is no documented treatment in the Natural Resource Management database for this pit. If it is used for this project, it would be treated prior to use to reduce seed set of existing infestations.

Several special use permits have been issued within the project area. The non-ground disturbing permits do not have cumulative impacts to regional forester's sensitive species plants. Ground-disturbing special use permits such as utility corridors, private land access by road or driveway, railroad activities, recreation events, and Snotel sites, to name a few, alter suitable habitat similar to effects from road and trail construction, as well as recreation impacts. These permits tend to be long-term, removing or altering suitable habitat indefinitely.

The Hungry Horse/Glacier View and Spotted Bear Ranger Districts office is located in the project area and will continue to run operations for the districts into the future. Like other properties such as residences, city and county sites, and other developed areas, this administrative site removes

native vegetation and suitable habitat indefinitely. It is also a hub for weed seeds. When vehicles that have been on the forest, or traveled off-forest, park at the office, and then go out onto the forest, they become vectors for weed seed, possibly impacting native vegetation and suitable habitat along the way. The administrative area is sprayed for weeds annually to help mitigate weed spread.

Summary of Effects

The proposed Hungry Lion Project **may affect** whitebark pine individuals and habitat but would not lead to federal listing as Threatened or Endangered (currently listed as a Candidate species) in all action alternatives due to the proposed prescribed burning. Burning may impact individuals but would benefit habitat. Individuals or groups exhibiting rust-resistant properties would be selected for protective measures in an effort to keep them living on the landscape.

The proposed Hungry Lion Project **will affect** western moonwort (*Botrychium hesperium*) in all action alternatives on NFS Road 1615, but would not lead to federal listing or impact species viability. Although the population would not be avoided, the site is large enough that remaining individuals on the periphery of the proposed road use would likely re-establish the population post-implementation. Vehicles and equipment would remain within the running surface. Road blading would be prohibited in the population. Soil disturbance would both provide habitat for the western moonwort as well as spread the existing weed infestations in the road corridor. Since western moonwort is currently thriving alongside the weeds (pre-treatment), it is expected that western moonwort would continue to co-exist with the existing infestations. Weed control measures will be altered in the rare plant site to accommodate western moonwort. Post-implementation field visits will occur at this site to determine the condition of the population.

The proposed Hungry Lion Project **would not affect** the documented populations of English sundew or pod grass due to project design features protecting wetlands from ground-disturbing activities. The project **would not affect** the population of ascending moonwort due to no project activities nearby.

There would be direct, indirect and cumulative effects to suitable habitat; however some guilds such as wetlands and riparian areas would be protected from project activities. Upland and lowland suitable habitat would presumably recover in 10 to 50 years after implementation.

Determination: This project would impact individuals but would not result in a trend towards federal listing or loss of viability.

Regulatory Framework and Consistency

The Hungry Lion Project would meet the direction outlined by the Flathead National Forest in the forest plan and amendments, as well as direction found in Forest Service Manual 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 J-1) analyzes the potential effects of the alternatives.

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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. In the United States, it is estimated that invasive species (both plant and animal) create more than \$138 billion in losses each year nationally (USDA Animal and Plant Health Inspection Service, 2001). Non-native invasive plant species (also called noxious weeds), invasive plants, or invasive species, have disrupted natural processes on nearly 100 million acres in the United States and are spreading at an estimated rate of 14 percent per year (USDA Animal and Plant Health Inspection Service, 2001). On National Forest System lands, an estimated six to seven million acres are currently infested and increasing 8 to 12 percent per year (USDA Forest Service, 1995a, p. 1). 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 usually have no natural control in the place to which they are introduced, allowing them to spread aggressively and out-compete native plants and reduce overall native community biodiversity.

Forest Service Policy Executive Order 13112 (USDA, 2005; USDA Forest Service) and Forest Service Manual 2900 (USDA Forest Service, Forest Service Manual) identifies prevention of the introduction and establishment of non-native plant species as an agency objective. This policy directs the Forest Service to:

1. Determine the factors that favor establishment and spread of invasive plants;
2. Analyze invasive species risks in resource management projects; and
3. Design management practices that reduce these risks (USDA Forest Service, 1995a, 2001d, 2011b).

Summary of Findings

The Hungry Lion project area contains 1,498 infested acres of weeds. Weed control is difficult with the amount of forest management and recreation contributing to the weed problem. The risk of invasive species spread, introduction, establishment, and persistence as a result of project actions, would be high in all action alternatives of the Hungry Lion Project, although alternative 4 has the least amount of risk than the other action alternatives due to fewer activities. The reason for a high risk is due to the amount of weeds inventoried, as well as the close proximity to urban areas. Alternative 2 would carry the highest risk of introduction, spread, establishment, and persistence than the other action alternatives due to more soil disturbance, as well as travel through infestations, proximity to known infestations and increasing available light in the road corridors. Project design features would provide for weed treatment pre- and post-harvest, in addition to equipment washing and revegetation of disturbed sites, to help reduce the amount of weed spread in the project area due to project-specific activities.

Analysis Area

The spatial boundary of the analysis area for invasive species is the boundary of the project area and those haul routes that lead into the project area. A baseline of existing infestations in the project area is provided. Analysis is based on the project's influence and impacts on the risk of introduction, spread, and establishment of invasive species within the project area. A 0.25 mile buffer on roads and treatment units is based on the average skid distance logging equipment can potentially move vegetation and soil, and is used to provide consistency.

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, can persist indefinitely after the canopy closes. The risk of invasive plant introduction and spread could 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 could 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.

Methodology

All soil disturbing activities provide some level of risk for invasive species spread and establishment. Any habitat could have a low risk of invasion, regardless of activities occurring in that area. Since this low risk is always present, this report only analyzes those areas that are at risk of spread, introduction, establishment, and/or persistence of invasive species through project-related activities.

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 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 conditions become 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, based on harvest activity and miles of road projects. Disturbed areas are more likely to be colonized by invasive species than undisturbed areas.

As stated above, the direct effects in this analysis are measured by the proximity of known infestations to activities, and the amount of travel through infestations. These measures are closely related since travel through infestations can both spread and introduce invasive species. 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) (K. Taylor, Mangold, & Rew, 2011; Von der Lippe & Kowarik, 2007). Wind-dispersed seeds can be moved by fast-moving vehicles without physical attachment. 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 direct effects of road use are qualitatively analyzed based on maintenance level (ML). The maintenance level of a road indicates the type of traffic it can accommodate (USDA Forest Service, 2005). For example, maintenance level 5 roads “provide a high degree of user comfort and convenience” and are normally paved surfaces like highways. Maintenance level 4 roads “provide a moderate degree of user comfort and convenience at moderate travel speeds” and can generally accommodate two lanes of traffic. The road surface is generally aggregate but sometimes paved. Maintenance level 4 and 5 are better road surfaces that accommodate almost any vehicle. These roads would have the greatest amount of traffic and thus the higher risk for invasive plant introduction and spread. Maintenance level 3 roads are open, aggregate roads that can accommodate most passenger vehicles, although “user comfort and convenience are low priorities.” This maintenance level is the most common forest road type on the forest. Maintenance level 2 is “for use by high clearance vehicles. Passenger car traffic is not a consideration.” These roads have a low volume of traffic. The lowest level, maintenance level 1, is reserved for closed roads that can have any drivable surface but are not open unless needed for administrative work or emergencies. The majority of these roads are not accessible during times of the year when the weather makes them dangerous or impassible, such as deep snow or during spring break-up when the roads are extremely muddy. However, even with low traffic flow, the risk of picking up invasive plant seed is higher on maintenance level 1 and 2 roads, since most of these roads are overgrown with vegetation.

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 is the quantity of seed and the higher is the rate of establishment.

Indirect effects are measured by changes in habitat that make it more suitable for invasive species to establish and/or persist. They can be measured by the amount of soil disturbance and the availability of light after vegetation removal. Measures of indirect effects can be related to the proximity of infestations since the risk of establishment and persistence in an area is higher if there is a nearby seed source.

Soil disturbance does not necessarily 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 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, Dunwiddie, & Michaels, 2001). If an area is already infested, disturbing the soil can expose dormant seeds, allowing them to germinate. Activities associated with timber harvesting, road maintenance and reclamation, temporary road construction, trail and campground construction and maintenance, and fire suppression all disturb the soil.

The soil disturbance estimates in this analysis are based on detrimental soil disturbance data collected by the Forest Soil Scientist; however, all soil disturbance that expose fresh soil or the dormant seed bank is considered at risk for infestation. Although measurements of non-detrimental soil disturbance are not available, detrimental disturbance calculations provide a minimum estimate of disturbance for each alternative. Where there is detrimental disturbance, it is assumed that there is an associated and relative amount of non-detrimental disturbance. See Soils Section in this EA for more information. References to soil disturbance in this invasive plants analysis, generally refer to all soil disturbance.

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 invasive 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 thinning and regeneration harvest types. Clearcut and seed tree harvests allow more light onto the forest floor, increasing the risk of spread, establishment, and persistence. Only when the canopy closes would sun-loving invasive species be unable to thrive. If the light conditions are increased 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 suitable habitat. Once an infestation is established, it may persist for a long time, provided that vegetation conditions remain favorable. However, as vegetation conditions change, the infestation may die back. For example, tansy ragwort may invade a burned area and establish, but once the canopy recovers, the infestation would not persist. Forest edges created by the more intense harvest types would have a risk of establishment/persistence by edge species or species that can survive in both shady and sunny environments. Acres of harvest types and the proximity and/or presence of infestations will help to determine risk of introduction/spread and risk of establishment/persistence.

Risk Determination Criteria

The determination of risk of weed spread, introduction, establishment, and persistence is based on several criteria. There are no National, Regional or Forest guidelines that describe risk to a project area. The following tables define criteria for low, moderate, and high risk (Table 37 and Table 38).

Before defining risk criteria, it is imperative to understand what factors contribute to invasive plant infestations in a project area. As discussed above, there are four functions of weed movement where effects can be identified. For each function, there are a variety of factors that contribute to that function.

Determining the risk of weed introduction, spread, establishment and persistence requires information which come from the proposed project activities. Below are primary risk criteria for each level of determination. However, there may be more criteria not listed here that factor into a

determination that may be specific to a particular project. The final determination will be identified and justified at the end of the invasive plant species analysis.

Table 37. Factors contributing to weed movement in a project area

Introduction	Spread	Establishment	Persistence
Proximity to main roads	Amount and timing of activity	Substrate preparation	Silviculture prescription
Number of roads and amount of traffic	Proximity to infestations	Soil disturbance	Soil disturbance
Type/amount of machinery	Type/amount of machinery	Proximity of infestations	Reestablishment of native vegetation
Location and amount of recreation	Amount of activity in infested units	Removal of native vegetation Timing of activity Revegetation activity	Weed control efforts (including biocontrol)

Table 38. Definitions of risk criteria based on contributing factors

Low	Moderate	High
Little to no soil disturbance by machinery; hand methods No temp roads	Soil disturbance by machinery; skyline, tractor, skidding Few temp roads to be recontoured Detrimental disturbance <7%	Soil disturbance by logging activities, skidding long distances, temporary roads built/opened with little or no rehab; no recontouring
Planned revegetation (trees and shrubs)	Planned revegetation (trees and shrubs)	No revegetation or only seeding of roadsides
No or few main NFS roads near or in the project area	One main NFS road nearby or accessing project area	Many roads, both closed and open; multiple main roads accessing area
Little or no traffic (closed roads or admin use only)	Traffic common (roads are open)	Traffic regular and with speed; illegal motorized use is known in the area
Little or no recreation (no developed sites); little used trails or dispersed sites	Recreation such as nonmotorized trailheads, boat access, dispersed camping; some private lands nearby	Recreation such as popular trailheads (horse and/or motorized use), dispersed and developed campsites, boat access; large amounts of nearby private lands with easy access to FS lands; industrial timber lands intermixed in the project area
Very few existing infestations or none near activities	Infestations are common and within ¼ mile of proposed activities	Densely infested along trails, roads, in proposed areas, on privately owned or industrial timber lands
Winter/Spring activities	Timing of activities not modified	Timing of activities not modified or planned for late summer/fall

Invasive species management

The Flathead National Forest implemented 2001 Flathead National Forest Noxious and Invasive Weed Control (NIWC) Environmental Assessment (Project File Exhibit U-6), which evaluated the effects of treating invasive plants. The objective of the NIWC Decision Notice 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 Decision Notice outlines factors for prioritization (Project File Exhibit U-6, p. 6-7).

Methods to control the spread of invasive species include prevention, treatment, and containment. Methods used to prevent invasive species from introduction and spread into new areas include closing infested areas to travel, washing vehicles and equipment upon entering or leaving an area, and using weed-free seed and straw mulch for re-vegetation. Treatments such as manual, mechanical, biological, and chemical methods are generally limited to localized areas and Montana State listed invasive species (Montana Department of Agriculture, 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.

Project activities require the use of roads that are on the landscape but are not needed for the long term and will be rehabilitated following project activities. In the Hungry Lion Project, some of these temporary roads will be newly constructed for the project and some of these roads will be constructed on templates that remain on the ground from past activities. Temporary roads are not intended to be a part of the forest transportation system and not necessary for long-term resource management. Use of temporary roads is only for short term, non-recurrent purchaser use and not needed for recurrent management, all temporary roads will be fully rehabilitated following project activities.

Some historic road templates have been identified for use in the Hungry Lion Project and were determined to be needed for long term forest management needs. These roads will be reconstructed to be used for the project and will be places into intermittent store service following project activities to provide secure grizzly bear habitat. Please see chapter 2- design features and chapter 3-Threatened and Endangered Wildlife Species for a description of what activities will occur on these roads to meet the definition of “reclaimed” under amendment 19 of the forest plan. The historic road prisms in this project area are roads that were once part of a transportation system that were previously decommissioned or were roads constructed for timber management and were not fully rehabilitated after activities.

The seeding of temporary roads as a conservation measure to reduce invasive species infestations has occurred on the Flathead National Forest for the past 30 to 40 years. Desirable non-native mixes of grasses and forbs have primarily been used. Native grasses and forbs have been used only recently, with the adoption of Forest Service Manual 2070 – Vegetation Ecology, which directs the use of native plant materials on NFS lands. Observations of some of the temporary roads constructed in the last 30 to 40 years indicate some success in the prevention of infestation in the road corridors. Sun-loving species, such as knapweed, are not as abundant as the native and non-native grass and forb seed mixes on these old roads. However, shade-tolerant species, such as hawkweed, Canada thistle, and oxeye daisy are often abundant along these old temporary roads. There is no information on the circumstances of how these old roads were built or rehabilitated to make inferences on how invasive species became established in these old road beds. Observations of historic roads built over 50 years ago indicate that plant communities on some roads may recover with the encroachment of forest vegetation in the abandoned road template. Prevention measures were most likely not implemented during these older harvest operations. The Flathead National Forest now implements an integrated invasive species management process, which includes prevention methods, such as equipment cleaning and haul route weed spraying prior to operations in order to reduce seed set.

Existing Condition (Affected Environment)

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, timber production, and livestock grazing (Parks et al., 2005). Exotic seeds and plant material were transported with grain and feed, as well as 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 restricted access to 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 Flathead National Forest. Some roadless areas remain relatively invasive-free because of healthy undisturbed native plant communities where few vectors exist to spread invasives.

The Flathead National Forest has been less affected than many other public lands since most invasive species are best adapted to grasslands, shrub lands, and warmer/drier forest types than those that exist here. However, the Forest has many roads, landings, clearings, gravel pits, trails, campgrounds, and other areas with ground disturbance and highly susceptible to infestation.

Existing condition

Invasive species considered in this analysis are those listed as noxious by the State of Montana, as well as other non-native species determined to be highly invasive by the Forest (Montana Department of Agriculture, 2015). Currently there are about 28,200 infested acres on the Forest, comprised of 31 invasive species. The majority of these sites are in road corridors, gravel pits, and log landings. The main vector for spread are vehicles (road maintenance equipment, logging vehicles, and passenger cars and trucks), although the seeds of many species are also wind or animal dispersed. Twenty-one of these species occur in the project area (Table 39). The most abundant invasive species in the project area are St. John's wort, oxeye daisy and spotted knapweed. Refer to Project File Exhibit J-5 for species descriptions.

Table 39. Non-native invasive plants found within the Hungry Lion project area (infested acres are rounded to the nearest integer; less than 0.01 acres = trace)

Species	Common Name	Sites	Infested Acres
<i>Achillea nobilis</i>	noble yarrow	3	1.64
<i>Artemisia absinthium</i>	common wormwood	4	0.33
<i>Berteroa incana</i>	hoary alyssum	3	2.87
<i>Bromus tectorum</i>	cheat grass	1	4.30
<i>Centaurea biebersteinii</i>	spotted knapweed	48	447.89
<i>Cirsium arvense</i>	Canada thistle	27	33.49
<i>Cirsium vulgare</i>	bull thistle	8	1.90
<i>Cynoglossum officinale</i>	houndstongue	8	12.84
<i>Euphorbia esula</i>	leafy spurge	1	0.10
<i>Hieracium sp.</i>	hawkweed complex	19	72.62

Species	Common Name	Sites	Infested Acres
<i>Hypericum perforatum</i>	St. John' s wort	36	375.22
<i>Leucanthemum vulgare</i>	oxeye daisy	40	494.22
<i>Linaria vulgaris</i>	yellow toadflax	14	4.98
<i>Phalaris arundinacea</i>	reed canarygrass	1	0.89
<i>Polygonum cuspidatum</i>	Japanese knotweed	1	0.90
<i>Potentilla argentea</i>	silvery cinquefoil	2	1.14
<i>Potentilla recta</i>	sulphur cinquefoil	7	24.98
<i>Ranunculus acris</i>	tall buttercup	6	9.02
<i>Tanacetum vulgare</i>	common tansy	13	6.97
<i>Tragopogon dubius</i>	yellow salsify	2	1.27
--	Total	244	1,497.55

The Hungry Horse District have 19 percent of the infestations on the Forest. This district also contains the Great Bear Wilderness (part of the Bob Marshall Wilderness Complex), which does not contain the same amount of weeds as the managed parts of the Forest. The project area has five percent of the infestations on the Forest and 29 percent of the infestation on the Hungry Horse-Glacier View District. This high percentage on the district could be due to local factors such as proximity to town sites and traffic and recreation in the project area.

Almost all of the infestations in the project area are on roadsides or are associated with roads. There are a few infestations that are in openings or under canopy cover. Coram pastures have many weed species and are treated regularly. Many invasive species are sun-loving species. The main exceptions are the hawkweed complex and Canada thistle, which can thrive under shaded conditions as well as in sunny areas. Invasive species generally establish in disturbed areas where native plants are slow to re-establish. These areas are mostly associated with road corridors, landing sites for timber harvesting, gravel pits, skid roads, mechanical site preparation treatment on well drained or shallow soils, and utility and railroad corridors. See Project File Exhibit J-6 for infestation locations.

Desired Condition

The desired condition inferred from Executive Order 13112 (USDA, 2005), (USDA Forest Service, Forest Service Manual 2900), and the 2001 Flathead National Forest Noxious and Invasive Weed Control Environmental Assessment (NIWC EA) (Project File Exhibit U-5) (USDA Forest Service, 2001c) and Decision Notice (NIWC DN) (Project File Exhibit U-6) 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.

Environmental Consequences

The action alternatives propose various amounts of harvest prescriptions and temporary road construction (see chapter 2). Alternatives 2 and 3 contain the most harvesting and road construction. Alternative 4 has the least amount of harvesting and no temporary road construction and would have the least amount of ground disturbing activities.

Alternative 1 (no-action alternative) – Direct, indirect, and cumulative effects

There would be no activities and, therefore, no direct or indirect effects that would change the existing condition. 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 (vehicles, ATV/OHVs, road maintenance), or decrease due to increasing canopy cover, but not as a direct or indirect result of the no-action alternative.

The no-action alternative 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. Open roads and trails 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 the no-action alternative 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 lower than the action alternatives.

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. Ongoing actions such as annual road maintenance (mowing, grading, etc.) would still have the potential to affect invasive species. All infestations within the project area are eligible for treatment under a previous invasive species control decision (USDA Forest Service, 2001b).

There are many areas of disturbed soils (roads, trails) and open bare ground across the district, which can provide habitat for invasive species. Past ground-disturbing activities such as timber harvest and road construction and maintenance have contributed to the spread of invasive species in the area. Recreational and economic land uses (hunting, hiking, logging, firewood gathering, etc.) have also contributed to the spread of invasive species, since users and their vehicles can be vectors for seed spread. Wildlife has likely contributed to weed spread in the past by transporting seeds across the landscape. All these activities will continue into the future to some degree.

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 spread following a wildland fire are adjacent to roads, recreation sites such as trails, and suppression activities.

Alternatives 2, 3 and 4 – Direct & indirect effects

Chapter 2 describes the actions proposed for each alternative and the amount of acres/miles for each action. Each action alternative contains various amounts of similar actions such as timber harvesting, road construction, fuels treatments, and culvert activities. Below is a description of the effects of those action alternatives in regard to invasive species.

Proximity of known infestations

Approximately 104 units proposed for vegetation management in alternative 2 contain known infestations or are within 0.25 miles of an infestation. There is likely more than one occurrence of

a species and more than one species in a unit. Most of these infestations occur in old road beds or active road corridors at the edge of the units, but many infestations occur within unit boundaries away from roads, either in openings or under canopy (Project File Exhibit J-6). The infested units have a high risk of spread when heavy equipment moves through them, disturbing the soil and removing vegetative cover. Units that are not currently infested but have infestations within 0.25 mile of their unit boundary puts these units at a high risk of introduction, most likely by equipment or machinery transporting seed from another unit or nearby infestations along the road. Alternative 2 proposes the most amount of harvesting activities; Alternative 4 proposes the least amount of harvesting activities and carries the least amount of risk of introduction and spread.

The proposed ecosystem burns are not currently documented as containing weeds. Project-specific surveys will be conducted during 2017 and weeds will be inventoried. There is one trail leading up to the proposed burn units which the Natural Resource Management (NRM) database currently does not show weeds on the trail. The risk of spread from nearby infestations is low the ecosystem burns.

Ninety four percent of approximately 190 miles of existing road corridors (NFS road and other jurisdiction) in the analysis area either contain or are within a 0.25 mile of an infestation (Figure 8). There are likely more road prisms on the ground than in the GIS layer, and there are likely more infestations along roads that have not yet been inventoried. There are historic road templates currently on the landscape that are proposed for addition onto the National Forest road system in alternative 2 and 3. Past observations from historic roads have recorded infestations on these old templates. Adding these roads to the system in intermittent stored service, would allow for treatment of infestations during project activities and following project activities, but because of the reclamation that will occur on these roads, they will not be accessible for ongoing treatment of invasives. The surrounding landscape would continue to be at risk of weed spread. Most of the proposed temporary road templates would be constructed on old existing templates. At the time of this analysis, it is unknown if these existing road templates are infested. If they are infested, there is a high risk of moving seed from the infested main roads down the proposed temporary roads and introducing invasive species to natural areas. The main vector for introduction in the action alternatives would be vehicle use and the movement of equipment from site to site.

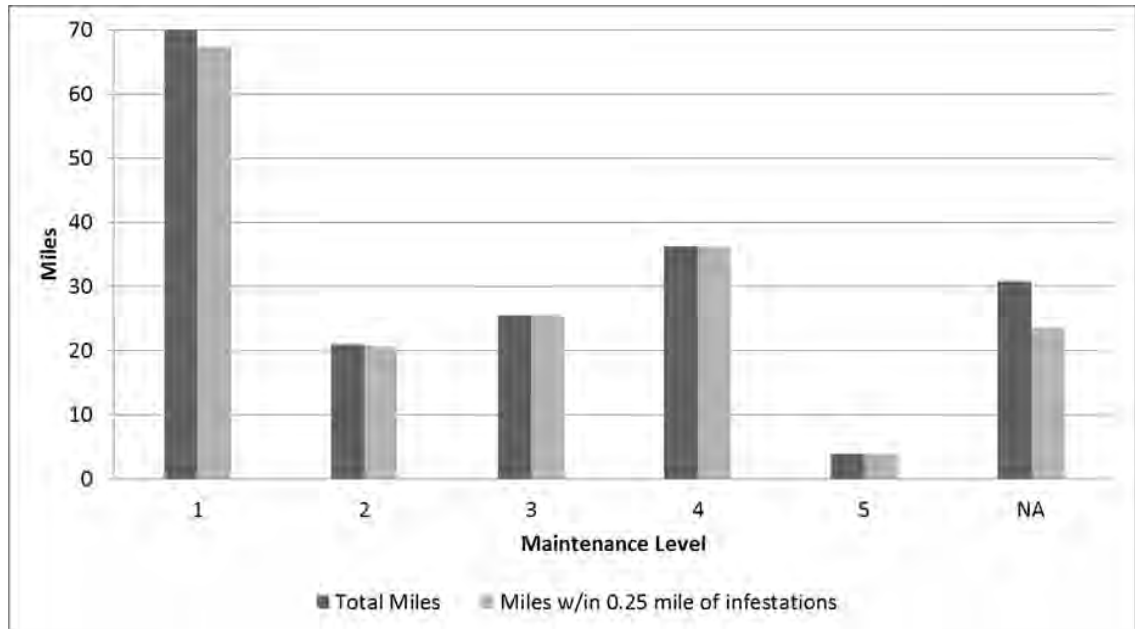


Figure 8. Total road mileage vs. infested road mileage in the Hungry Lion project area. NA=Non-NFS ownership.

The sections of road left behind from the proposed road reroutes on upper Emery Creek in all action alternatives would be rehabilitated using site appropriate measure (see design features, chapter 2). Recontouring and revegetation would eventually provide suitable habitat conditions conducive to natural revegetation. This would provide weed prevention as well as competition against weeds in the long term, reducing the risk of spread from the template into the surrounding landscape.

Although these actions would remove motorized traffic from the road corridors, they also prevent efficient weed treatment. Those infestations left behind the berms and between reclamation activities would continue to spread through natural means, unchecked by control methods. Seeding these roads would help reduce weed infestations by using up the available resources (e.g. light, water, nutrients, space), and preventing weed seed from landing and germinating.

The Timber Sale Contract specifies that all off-road equipment would be cleaned before entering NFS lands in order to prevent new invasive species from entering the forest. Use of dedicated skid trails would minimize the risk of spread across units.

The action alternatives propose to add historic trails back onto the NFS trail system. Similar to roads, trails provide linear corridors for human (and animal) vectors to introduce weed seed. These corridors provide opportunities for weeds to move into the surrounding landscape and vegetation, whereas if there were no corridor, that area would stay weed-free.

Amount of travel through infestations

Travel through infestations is difficult to quantify, even without considering non-project activity like passenger vehicle travel, bicycles, horses, OHV use, and wildlife vectors. Seeds can be transported in soil clinging to equipment and can later drop into an un-infested, or “clean area,” spreading or introducing an invasive species. The maintenance level of a road can indicate the

type of travel a certain road can accommodate. The higher clearance of a vehicle that is necessary to pass over a road may indicate less traffic over that road surface. Maintenance level 1 does not have traffic, as is the case with some maintenance level 2 roads due to closure devices or to impassability. Maintenance level 3 through 5 would presumably have more traffic since they are open and easier to travel. To reduce spread and introduction, if feasible, contractors should operate in clean units prior to infested units. In many cases, invasive species such as knapweed can encompass all the travel routes in the area, which then invade roads that are required for project activities. In these cases, the infestation is so severe that there is no practical way to treat it effectively prior to implementation or avoid it. The majority of the roads in the project area are maintenance level 1 (see Travel Analysis). Although they are not currently traveled, many of them are infested from past activities. Opening some of these roads to project activities would increase the amount of travel through infestations, spreading weed seed along the travel route.

Soil disturbance

Soil disturbance indirectly affects establishment of invasive species by providing suitable habitat. Invasive plant seed spread by equipment from unit to unit ideally could be limited by cleaning machinery between unit operations. Drifting seed establishes easier on disturbed soil than on intact soil. Harvesting, equipment, and temporary road activities would detrimentally disturb up to 237 acres in alternative 2, 162 acres in alternative 3, and 109 acres in alternative 4 (see the Soil Section in this EA for more information). These estimates measure only detrimental disturbance. In regard to invasive species, all soil disturbance creates a suitable substrate for seed germination by clearing space of vegetation and forest debris and providing unimpeded soil substrate. Since it is infeasible to measure all soil disturbance for each unit and associated activities, it is assumed that the proposed activities have an associated amount of general soil disturbance along with the detrimental soil disturbance measures, which allows for the comparison of relative disturbance between alternatives. The use of dedicated skid trails minimize the risk of introduction and spread as well as reduce the amount of soil disturbance across the treatment area.

Non-ecosystem fuels activities that would occur in all action alternatives in the timber harvest units include excavator or hand piling, and pile burning, as well as broadcast burning. Past observations have seen burn piles present a high risk for invasive species infestations with little to no revegetation by surrounding native vegetation. 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 is no natural competition to prevent establishment and persistence of invasive species. Broadcast burning has similar effects to that of pile burning. After the unit is harvested and slash is left on the landscape (instead of piled), the fuel loading may provide varied burn intensities, some of which has the potential to expose mineral soil. The effects of burning on native vegetation include the removal of above-ground vegetation, burning up duff and shallow roots, and extreme heating of the soil surrounding stems and roots (James K Brown & Smith, 2000). These areas are priority for post-treatment monitoring and possible herbicide treatment for invasive species. Hand piling is preferred due to the little to no soil disturbance for moving the slash into piles. Excavator piling uses heavy equipment and creates more soil disturbance in the unit in addition to the slash piles.

Alternative 4 would have less soil disturbance as a result of project activities and, therefore, would have a lower risk of establishment for invasive species than the other action alternatives.

Alternatives 2 and 3 include road maintenance and BMPs, reconstructing existing corridors, and temporary road rehabilitation. These activities would create ground disturbance for potential

weed establishment, as well as disturb existing weed infestations along the existing corridors. Regardless of proposed rehabilitation activities, these road activities would disturb soil and existing infestations, which would change the landscape in those areas for the long term, except in the case of full recontouring or subsoiling practices. Seeding, where necessary, would minimize the risk of establishment of invasive species (see chapter 2 – design features). Native or desired non-native species would compete with invasive species on disturbed soils of the reclaimed temporary roads. Soil compaction and disturbance of native vegetation would still occur in the initial construction, despite reclamation. Over the long-term, the temporary roads would most likely have a mix of the seeded re-vegetation species, new colonizers from the surrounding vegetation, and invasive species.

Several culverts are proposed to be replaced in the project area to allow fish passage and/or upsized to accommodate rare flood events (see chapter 2). Activities associated with removal or replacement of these culverts would disturb the existing infestations and soil, providing continued suitable habitat. Alternative 4 proposes to remove up to 12 culverts on a bermed road, requiring more disturbance in the future before chemical weed treatment could occur in the future.

Light availability

The short-term effect of logging would be that more light is let into the understory allowing the introduction (via equipment, wind, animals, etc.) and establishment (available suitable habitat) of sun-loving invasive species. Eventually, as the overstory in an unit recovers following thinning harvests, invasive species requiring more open conditions may not survive, and the increased risk of introduction and establishment would be a short-term impact. However, the longer the overstory remains open, as it would after regeneration harvests, the longer the habitat remains suitable for sun-loving species, and the longer the risk of establishment and persistence exists.

The amount of light reaching the forest floor can be controlled by the amount of canopy cover overhead. Regeneration harvests such as clearcut, seedtree and shelterwood open up the canopy and leave less than 30 percent canopy (Project File Exhibit J-4). Figure 9 shows how many acres each alternative would increase available light to the forest floor by harvest type. Regeneration harvests could increase the risk of spread of invasive plants and allow introduced sun-loving and edge species to persist until the canopy closes. Units with nearby infestations would have a higher risk of spread and establishment.

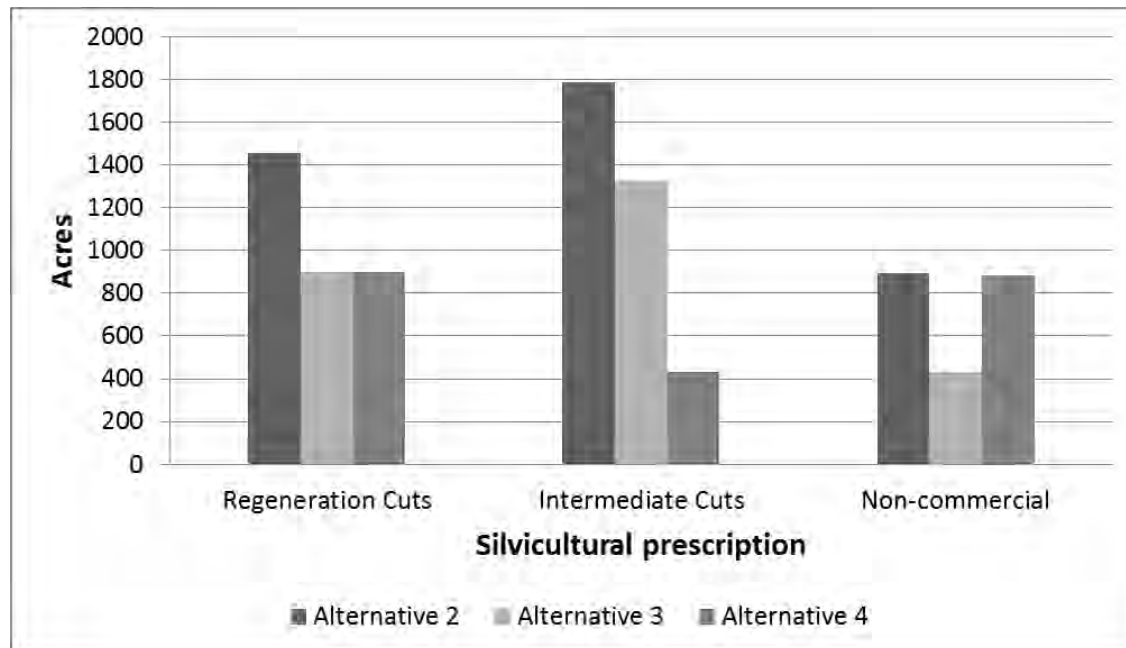


Figure 9. Increase in light availability by alternative

While the closure of overstory could limit the duration of the risk of establishment and persistence for some sun-loving species, it could elevate and prolong that risk for shade and edge-tolerant species, such as hawkweed and Canada thistle, since these species can quickly colonize an area before the native vegetation has a chance to recover after activities cease. Currently, 85 percent of the units proposed within the project area are infested with at least one of these edge species or within a quarter mile of these species (Project File Exhibit J-6).

Intermediate treatments like commercial thinning leave 70 percent or less of the canopy, with an average of 40 percent canopy cover retained (Project File Exhibit J-4). Commercial thinning does not have as high of a risk of sun-loving species spreading through the units as regeneration harvests; however, there is still a high risk of introducing and spreading sun, shade, and edge-tolerant species due to the amount of use the project area gets from management activities and recreation activities. Alternatives 2 and 3 would have the highest increase in light availability; alternative 4 would have the lowest increase of light availability.

Sapling thinning, conducted by hand, can leave 40 percent or less canopy cover immediately after implementation, depending on the site and the thinning needs. Other stands that are patchy with dense groups of trees and openings have been observed in the past to contain weeds. Releasing trees in those units allows for increased canopy cover over the long term, providing shade and reducing the amount of light available to weeds. Since there is generally little soil disturbance associated with this activity, sapling thinning carries a low risk of introducing and spreading invasives into the understory. Depending on the specific treatment, there is a moderate risk of persistence related to the amount of light let into the understory. Alternative 2 and 4 propose the same amount of sapling thinning which would allow more light into the understory than alternative 3.

Other activities, like tree planting, may also contribute to the risk of introduction and spread. Associated vehicles and personnel can be vectors for introduction and spread. However, planting

activities would be short-term with minimal impact to the soil. In addition, planting conifers would assist in regeneration of native vegetation and reduce the risk of establishment and persistence of sun-loving invasive species when the canopy cover becomes established. Tree planting varies by action alternative, as discussed in chapter 2. The remainder of the treatment units would be either site prepped or left alone for natural regeneration. Alternative 2 and 3 would plant the most conifers, since those alternatives propose the most timber removal.

Alternatives 2, 3 and 4 – Cumulative effects

Past, present, and reasonably foreseeable actions within the project area that have affected or would affect invasive species include timber harvesting, wildland fires and fire suppression, road construction, road maintenance and closures, recreation, forest products gathering, invasive species control and other activities (Project File Exhibit J-3). The earliest activities considered in this analysis occurred in the 1940s (excluding wildland fires) and, until relatively 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, such as road construction and timber harvest accompanied by a source of invasive plant seeds, had and 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 on the forest in the NRM database is 2003, and the earliest chemical treatment record is from 1991, but there have been invasive species on the Flathead National Forest for much longer. Previous activities (timber harvest, road construction and maintenance, recreation, etc.) 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 of known infestations

The project area contains approximately five percent of infestations across the Forest and 29 percent of the Hungry Horse District's documented infestations. In relation to the rest of the district, the Hungry Lion project area contains a sizable amount of weed infestations (Table 40). This is likely due to the amount of private lands near the project area. This is in contrast with the inventoried roadless area (adjacent to the Great Bear Wilderness) in the project area, with no documented infestations. There is a lot of recreation and forest product collection activities near private lands that can introduce and spread seed onto the neighboring NFS lands.

Ground conditions due to past activities such as timber harvest and hazard tree/blowdown removal in recreation sites can be affected by nearby infestations due to the opening of the canopy and associated ground disturbance which prepares the substrate for any weed seeds that land in those areas.

The use of the gravel pit on NFS Road 11007A in the project area is a source of weed seed that is spread along the corridors where gravel is spread. It has been treated in 2015 and 2016 and will continue to be treated in the future, to continue to reduce this source of weed seed.

Public use of forest products (firewood, boughs, berries, etc.) may contribute to the cumulative effects on invasive species. While obtaining forest products, forest users may introduce and/or spread weed seed in their collection areas, either from local infestations or from users' previous outdoor excursions. Popular collection sites would have the most impact with repeated entries. Firewood cutting, bough and cone collections, Christmas tree harvesting, and huckleberry

collection are all popular activities in the project area. Collection of forest products occurs often and will continue to occur in the project area.

The Coram pastures occur within the project area and harbor a variety of invasive species that are concentrated in a small area. These infestations have been treated multiple times; however due to the nature of active pastures, new weed seed is continually introduced. Stock using these pastures may introduce weed seed to other parts of the forest. Future treatment and use of weed-free straw and hay will continue to control the weeds in the pastures.

Coram RNA is bounded on the west by NFS Road 38, which has infestations along nearly the entire length. There are a couple infestations of Canada thistle in the RNA, likely from windblown seed or animal/human vector. The proximity of human activities (driving, walking, hunting, etc.) increases the likelihood of more weed species being introduced into the RNA. The advantage of the RNA designation to weed management is that there will not be any foreseeable management activities, reducing the risk of establishment and persistence of weeds. There is the possibility of wind events and subsequent blowdown of trees, which opens up gaps in the canopy, as the risk is present across the entire forest.

The inventoried roadless area is similar to Coram RNA in that there are fewer management activities. Burning is still a foreseeable action (and current action with this project), yet the lack of travel corridors into the inventoried roadless area and the lack of infestations nearby reduces the risk of introducing weeds into the inventoried roadless area.

Table 40. Non-native invasive species found forestwide, on the Hungry Horse District, and in the Hungry Lion project area. T=Trace not included in sums

Scientific Name	Common Name	Forest Acres	District Acres	Project Acres
Priority 1A – Not Present in Montana				
<i>Centaurea solstitialis</i>	yellow starthistle	0	0	0
<i>Isatis tinctoria</i>	dyer's woad	1	0	0
Priority 1B – Limited Presence in Montana				
<i>Chondrilla juncea</i>	rush skeletonweed	0	0	0
<i>Cytisus scoparius</i>	Scotch broom	0	0	0
<i>Lythrum salicaria</i> , <i>L. virgatum</i>	purple and wandlike loosestrife	0	0	0
<i>Polygonum cuspidatum</i> , <i>P. sachalinense</i> , <i>P. polystachyum</i>	Japanese knotweed complex	1	1	1
Priority 2A – Common in Isolated Areas in Montana				
<i>Berteroa incana</i>	hoary alyssum	4	3	3
<i>Echium vulgare</i>	blueweed	0	0	0
<i>Hieracium aurantiacum</i>	orange hawkweed	2,977	720	22
<i>Hieracium caespitosum</i> , <i>H. floribundum</i> , <i>H. piloselloides</i> , <i>H. pratense</i>	yellow hawkweed complex	1937	345	50
<i>Iris pseudacorus</i>	yellowflag iris	T	0	0
<i>Lepidium latifolium</i>	perennial pepperweed	0	0	0
<i>Ranunculus acris</i>	tall buttercup	35	10	9
<i>Senecio jacobaea</i>	tansy ragwort	521	T	0

Scientific Name	Common Name	Forest Acres	District Acres	Project Acres
Priority 2B – Abundant and Widespread in Montana				
<i>Butomus umbellatus</i>	flowering rush	0	0	0
<i>Cardaria draba</i>	whitetop	0	0	0
<i>Centaurea repens</i>	Russian knapweed	0	0	0
<i>Centaurea diffusa</i>	diffuse knapweed	0	0	0
<i>Centaurea stoebe</i>	spotted knapweed	7,615	1,236	448
<i>Cirsium arvense</i>	Canadian thistle	3,752	521	33
<i>Convolvulus arvensis</i>	field bindweed	5	0	0
<i>Cynoglossum officinale</i>	hound's-tongue	333	14	13
<i>Euphorbia esula</i>	leafy spurge	2	1	1
<i>Hypericum perforatum</i>	St. John's-wort	2,539	1,013	375
<i>Leucanthemum vulgare</i>	ox-eye daisy	4,691	1,128	494
<i>Linaria dalmatica</i>	Dalmatian toadflax	10	5	0
<i>Linaria vulgaris</i>	yellow toadflax	158	22	5
<i>Myriophyllum spicatum</i>	Eurasian water milfoil	0	0	0
<i>Potamogeton crispus</i>	curlyleaf pondweed	0	0	0
<i>Potentilla recta</i>	sulphur cinquefoil	687	34	25
<i>Tanacetum vulgare</i>	common tansy	330	11	7
<i>Tamarix spp.</i>	salt cedar or tamarisk	0	0	0
Regulated Plants – Not Listed as Noxious in Montana				
<i>Bromus tectorum</i>	cheatgrass	31	15	4
<i>Hydrilla verticillata</i>	hydrilla	0	0	0
<i>Eleagnus angustifolia</i>	Russian olive	0	0	0
Additional Invasive Species of Concern for the Flathead National Forest				
<i>Achillea nobilis</i>	noble yarrow	16	2	2
<i>Arctium minus</i>	common burdock	1	0	0
<i>Artemisia absinthium</i>	common wormwood	274	13	1
<i>Campanula rapunculoides</i>	creeping bellflower	1	0	0
<i>Carduus nutans</i>	musk thistle	T	0	0
<i>Cirsium vulgare</i>	bull thistle	988	121	2
<i>Euphorbia species</i>	spurge (all)	0	0	0
<i>Phalaris arundinacea</i>	reed canarygrass	868	3	1
<i>Potentilla argentea</i>	silvery cinquefoil	86	4	1
<i>Tragopogon dubuis</i>	yellow salsify	345	1	1
<i>Veronica officinalis</i>	common gypsyweed	1	1	0
Total		28,209	5,224	1,498

Amount of travel through infestations

The continued use of roads in the project area increases the risk of introduction and spread of invasive species over time. Although vehicles traveling unpaved roads seem to have a higher risk of transporting seed from one site to another than those traveling paved roads, it is difficult to

quantify how often the roads are traveled, the amount of seed that could be collected, and the distance that seed is transported. Unpaved roads (ML 1-3) tend to have vegetation growing along the sides or down the middle that hang directly over the road bed which can be brushed or trampled by vehicles. Paved roads (ML 4-5) have shoulders that are graveled and do not support much, if any, vegetation. Road maintenance levels can provide an indication of use. For the most part, passenger vehicles do not drive off of the pavement or well-maintained gravel roads, and therefore do not travel through infestations. However, these vehicles create wind at high speeds, which is a vector for seed spread. In addition to public education about prevention, the Forest has an active invasive species management program that chemically treats high traffic areas.

Less than half of the roads in the project are open for use. The drivable roads in the project area are ML 2, 3, 4 and 5. Maintenance Level 2 and 3 indicate the traffic flow is low, yet the risk of picking up seed and spreading it is high if there are infestations along the road corridor. Almost all of the roads have an infestation on at least a part of the road corridor, if not entirely along the road corridor, or are within 0.25 miles of an infestation (Figure 8).

Soil disturbance

Much of the NFS lands in the project area have been disturbed by other means such as fire, timber management, and road construction; which means that much of the project area contains suitable conditions for infestations. The existing roads continue to be maintained, which causes soil disturbance along the road bed and the roadsides. It is assumed that vegetation management and other soil disturbing activities would likely continue into the future in the project area.

Past timber management likely introduced weeds into the project area, including the Coram Experimental Forest. Past project surveys have inventoried several infestations that are not associated with roads and are likely associated with past soil disturbing activities such as timber harvesting. These infestations are difficult to treat due to the limited access by truck sprayer and the expense of backpack/hand spraying.

The removal and replacement of culverts in the past have re-disturbed those sites along roads, which churns up soil and the weed seed bed. These sites can be difficult to manage since they straddle water features, and truck spray booms are lifted over water sites as to not contaminate the water. Depending on the density of the infestation, biocontrol may be used.

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, Kapler Smith, Sutherland, & Brooks, 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. Due to the nature of fire suppression, there is also the risk of introducing species from off-forest and from out of state. This is why post-fire weed monitoring is important, so infestations can be caught while they can be controlled and eradicated. 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. Fire suppression would be likely to continue to occur in the project area, and there is no way to predict where or when these events would occur.

Light availability

Past harvesting in the project area increased the amount of acres with more light availability by 38 percent (Table 41) from past project activities. 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 will be shaded out. The project would increase light availability from seven to twelve percent depending on the alternative. Other past activities, such as blowdown from wind events and hazard tree removal in recreation sites, create gaps in the canopy that also increase light availability to the forest floor. Weeds are often found in openings where there is a gap in the canopy.

The last wildland fires occurred in 1988 and totaled 210 acres; there have also been small (less than an acre) fires due to human activities (see Fire/Fuels Section for discussion of fires in the project area). Wildland fires are possible during any future summer season. Generally, high-severity wildland fires completely burn up native vegetation, including the overstory, and create suitable conditions for invasive species to establish. Native vegetation has likely recovered since the last fire in the project area. It is possible that invasive species increased during that time but without historical records, it is difficult to make that assessment. The areas burned were higher in elevation and likely did not require much fire suppression activities such as dozer lines, etc., so the introduction of weed species was likely minimized. Prescribed burns have occurred in the project area between 1991 and present. Considering the frequency of vegetation management and fire in this project area, the forest canopy may not reach closure across all the impacted areas. Increasing light availability in the project area carries a high risk of establishment and persistence of invasive species, since the majority of the project area has been opened up before, invasive species are already present in the project area, there is much traffic and recreation from the local town site, and there is private land and land development adjacent to NFS lands.

Planting, on the other hand, promotes canopy cover by starting the revegetation process quicker than if the site was left to naturally revegetate. Providing shade in a short period of time reduces the risk of weed persistence. There has been approximately 2,570 acres of planting in the project area in the past, and it will likely continue into the future.

Table 41. Cumulative effects summary of light availability in the project area¹

	Alternative 2		Alternative 3		Alternative 4	
	Acres	Percent	Acres	Percent	Acres	Percent
Light Availability (Increase in Acres)						
Past ²	12,797	38	12,797	38	12,797	38
Present	4,138	12	2,660	8	2,220	7
Reasonably Foreseeable	0	0	--	--	0	0

¹Percentages (percent) are of the total amount of NFS land (33,966 acres) in the project area.

²Some of these acres could be located on the same site with multiple harvest entries in different time frames; providing totals would not be an accurate reflection of the existing condition.

Invasive species control

The Flathead National Forest has an integrated weed management program that identifies and controls weeds 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 species, which also affects native plant species. The forest also uses biological control primarily on tansy ragwort, spotted knapweed, and Canada thistle. The knapweed biological control organisms have likely spread into the project area, either on their own or with human help. The Forest has treated several roads in the project area over several years, most recently between 2012 and 2016 (Project File Exhibit J-7).

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. However, due to the amount of infestations along nearly all of the travel routes in the project area, there would still be a high risk of spread. Future spraying of haul routes and other roads in the project area would temporarily decrease invasive species spread on a short-term basis; however to benefit from these treatments, more long-term integrated management is necessary, which is outside the scope of this project.

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. Campgrounds, hiking, biking and horse trails, motorized trails, lake and river access points, and other areas frequented by recreationists all require construction and maintenance. Humans and associated activities are vectors contributing to the introduction and spread of invasive species within the project area. In the project area, there is sightseeing, hiking, camping, boating, hunting, biking, fishing, off-highway vehicle (OHV) use, snowmobile routes and dispersed recreation. There is an OHV track behind the Hungry Horse Ranger District office that is well used by the public. It does not impact project activities, yet it is likely a source of weed seed from which OHVs may spread onto the rest of the forest.

There are four developed recreation sites within the project area, adjacent to the Hungry Horse Reservoir and to Lion Lake. Trail construction and maintenance increase the risk of introducing invasive species by recreationists to natural areas. 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. There are 10 miles of system trails currently within the project area. The action alternatives would add user maintained trails to the system, increasing the amount of trails to 22 miles. Snowmobile routes follow system roads and one historic route. Snowmobile use in itself does not affect weed spread, except for the times of the season when the snow level is below seed heads. In this case, snowmobile treads can pick up plant parts and spread them to other areas. Maintenance of these routes occurs during the growing season, which includes road maintenance activities, brushing, etc. These activities can also spread weed seed along the snowmobile routes.

Other activities

Special use permits include a variety of activities on NFS lands. The ground disturbing activities, such as utility corridors, road and driveway permits, etc., disturb soil which prepares substrate for weed seed colonization, as well as provide increased light availability along those corridors, which also provides for suitable conditions. Once weeds infest these areas, those infestations can move around the landscape into other disturbed areas and along adjacent linear features.

The Hungry Horse-Glacier View and Spotted Bear Ranger Station, as well as the surrounding land development, provides for a consistent source of weed seed moving into and out of the area. For NFS lands, such as the Forest Service office, weed treatment occurs regularly to mitigate infestations which likely come from both FS vehicles and private vehicles.

Statement of Findings

As documented in the NRM database (USDA Forest Service, NRM), this project area is infested with many acres of weeds. Eradication is infeasible as with many large-scale landscapes, and control is difficult with the amount of forest management and recreation contributing to the weed problem. 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 high in all action alternatives of the Hungry Lion Project, although alternative 4 has the least amount of risk than the other action alternatives due to fewer activities. Alternative 2 would carry the highest risk of introduction, spread, establishment, and persistence than the other action alternatives due to more soil disturbance, as well as travel through infestations, proximity to known infestations and increasing available light in the road corridors. The risk is high due to the number of infestations along the roads and in forested areas in the project area, the increase of light and soil disturbance from treatments, frequent and local public access to the project area, and high recreational use. Other than implementing a project-specific intensive invasive species treatment plan that would have high costs and take years for implementation, there will be an invasive species problem in the project area indefinitely. This project, with its risks of weed spread, would provide for treatment pre- and post-harvest, in addition to equipment washing and revegetation of disturbed sites.

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 are set forth in amendment 2000-95-5 of Forest Service Manual 2080, Noxious Weeds Management and have been incorporated into the forest plan. Forest Service Manual 2900 Invasive Species Management was issued in 2011 and supersedes Forest Service Manual 2080; however it has not been incorporated into the forest plan. The Flathead National Forest will comply with both the forest plan and Forest Service Manual 2900. Treatment and monitoring of known infestations in the project area would be implemented under the authority and guidance of the NIWC DN (USDA Forest Service, 2001b). 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 U-6). Design features and management requirements for actions proposed under this project follow the Forest Service Manual amendment for invasive species management.

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Soils

Introduction

The following section documents the soil resource effects of the proposed Hungry Lion Resource Management Project (Hungry Lion Project). 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 soil characteristics, organic matter, and soil biological activity.

Physical soil 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. These physical changes to the soil affect productivity and are measured as detrimental soil disturbance (DSD).

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 (D. Page-Dumroese, Harvey, Jurgensen, & Graham, 1991). Humus is decomposed organic matter. Duff and litter are partially decomposed leaves, needles, and twigs less than 3 inches in diameter on the soil surface. 85 to 90 percent of the total nutrients in most coniferous trees are contained in branches, twigs, and foliage (Garrison & Moore, 1998). Coarse woody debris consists of woody stems greater than 3 inches in diameter (A.E. 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, 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, for example, below a road culvert or a rutted skid trail. All mass failures triggered by human causes are classified as detrimental soil disturbance. 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 northern region 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.

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 and temporary roads for the Hungry Lion Project. 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 U.S. Forest Service Northern Region Supplement 2500-99-1 (Project File Exhibit L-1) provide direction for maintaining soil quality. Establishment of existing condition for proposed treatment units followed the approach outlined in the northern region Soil NEPA technical guide (Project File Exhibit L-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 (Deborah S. 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 Hungry Lion project 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 Soil Disturbance Monitoring Protocol surveys were conducted using an 80 percent confidence interval. The margin of error around each estimate is plus or minus 5 percent. Sample size is determined automatically on the electronic Soil Disturbance Monitoring Protocol field form. Soil Disturbance Monitoring Protocol field data collection spreadsheets and activity area documentation forms are located in Project File Exhibit L-3. Information gathered during field investigations is also 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 L-4, L-5).

A study of soil moisture trends on the Flathead National Forest (Project File Exhibit L-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 features proposed to reduce anticipated disturbance from the Hungry Lion Project. In addition, monitoring reports for activities on soils similar to those in the Hungry Lion project area (Project File Exhibits L-7 through L-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 L-17).

The soils in the project area are described in the updated landtype report and soil survey for the Flathead National Forest (A. H. Martinson & Basko, 1983; Albin H. Martinson & Basko, 1998). Landtypes provide the basis for soil analysis. All 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 National Forest Management Act (NFMA) Sections 4-7, and therefore, predictions of potential impacts on soil productivity are required. 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)

In order to determine the existing condition of soils within the proposed activity areas, 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 sensitive soils that are wet, steep, or had evidence of past harvest that caused compaction, displacement, rutting, puddling, or soil erosion were identified.

Most soils on the Flathead National Forest, 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 Flathead National Forest 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 42 summarizes existing detrimental disturbance for proposed mechanical treatment units.

Table 42. Existing detrimental soil disturbance

Unit	Acres	Silviculture Prescription	Percent DSD
1	10.6	commercial thin	1
2	25.9	commercial thin	1
5	148.3	commercial thin	1
11	495.3	commercial thin	1
13	53.2	commercial thin	7
14	63.2	commercial thin	7
19	83.2	commercial thin	6
26	8.6	commercial thin	6
29	26.4	commercial thin	3
30	127.2	seedtree	6
32	83.5	seedtree	1
33	50.9	commercial thin	3
35B	20.5	seedtree	7
39	36.7	commercial thin	7
40	29.4	seedtree	3
45	16.0	commercial thin	3
50	10.3	seedtree	6
51	19.3	seedtree	3
57	51.0	seedtree	3
58	28.3	commercial thin	3
59	99.4	seedtree	7
60	21.8	commercial thin	8
62	18.0	commercial thin	10
62A	5.7	commercial thin	6
66	19.3	commercial thin	3
68	70.6	seedtree	7
71	15.8	seedtree	3
73	41.6	seedtree	3
76	30.4	commercial thin	7
78	119.1	commercial thin	7
82	68.7	commercial thin	8
85	43.7	seedtree	6
90	23.2	shaded fuel break	5
91B	24.7	shaded fuel break	9
92	11.7	shaded fuel break	5
93	7.5	commercial thin	8
101	26.7	understory removal	13

Unit	Acres	Silviculture Prescription	Percent DSD
102	101.3	understory removal	10
103	54.6	understory removal	1
104	72.9	understory removal	10
401	32.1	seed tree	6
403	27.8	commercial thin	3
404	35.6	seedtree	8
405	25.6	group selection	3
406	28.0	group selection	3

Soil productivity trends

Soil quality in the Hungry Lion project area is stable to trending upward. Past activities were minimal. 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 (J. K. Brown, Reinhardt, & Kramer, 2003; R. T. 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 43 lists landtype map units for proposed units (Albin H. Martinson & Basko, 1998). 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 43. Alternative 2. Landtypes of treatment units

Landtype	Relative Productivity	Surface Erosion Hazard	Mass Failure Hazard	Acres
27-7	moderate	moderate	low	894
26C-8	high	moderate	low	576
73	moderate	moderate	moderate	533
76	low	moderate	moderate	477
26J-7	high	moderate	low	317
57-9	moderate	moderate	low	296
26C-7	high	moderate	low	294
26L-7	high	moderate	low	260
26J-8	high	moderate	low	236
27-8	moderate	moderate	low	218
72	not rated	moderate	moderate	159
26J-9	high	moderate	low	128
14-2	high	moderate	low	112
26L-8	high	moderate	moderate	81

Landtype	Relative Productivity	Surface Erosion Hazard	Mass Failure Hazard	Acres
77	low	moderate	moderate	78
57-8	moderate	moderate	low	73
31	high	not rated	high	64
14-3	moderate	moderate	low	57
26A-8	high	moderate	low	22
24-8	moderate	moderate	low	21
74	moderate	not rated	not rated	17
28-7	moderate	moderate	low	17
26C-9	high	moderate	low	3
10-3	moderate	not rated	low	2

Productivity

Productivity of the landtypes in the Hungry Lion project 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 Hungry Lion project 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.

Sensitive soils

Sensitive soils contain an excess of soil moisture either yearlong or on a seasonal basis. Disturbance on sensitive soils can lead to loss of soil productivity. Areas of sensitive soils typically require design features for protection. Units 1 and 91B have design features that requires winter logging to minimize detrimental soil disturbance to sensitive soils.

Mass failure hazard

The dominant mass failure hazard rating for the Hungry Lion project area is low. Landtype 31 is rated as high for mass failure risk. The units intersecting with this landtype exhibited no signs of increased mass failure risk during field reconnaissance. Three of the four proposed units have had past harvest activity and showed no signs of post-harvest slope failures or instabilities.

Environmental Consequences

The analysis of effects for soils assumes that all design features 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 features 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 L-2). Cumulative effects are discussed in terms of the activity areas. The Forest Service Manual 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 soil disturbance is 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 (ie. harvest unit or burn unit) 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 Flathead National Forest suggests that some soil disturbances create bulk density below the levels that inhibit root growth (Project File Exhibit L-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 alternative)–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 soil disturbance. In addition, implementation of design features 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; D. S. Page-Dumroese, 1993; Williamson & Nielsen, 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 L-18). Designated skid trails with 100 foot spacing impact 11 percent of the harvest area (Garland, 1983). Post-harvest monitoring on the Flathead National Forest consistently shows less than 15 percent detrimental soil disturbance from ground based operations that use designated skid trails (Project File Exhibits L-7 through L-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 & Nielsen, 2000). Soil moisture monitoring on the Flathead National Forest showed that soils are drier than field capacity during the summer dry period which begins in July and often lasts well into October (Project File Exhibit L-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 L-10 through L-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 two to eight percent of the soil in a unit (J. D. McIver & Starr, 2000). Monitoring results on the Flathead National Forest show skyline yarding had levels of detrimental disturbance far below 15 percent of an activity area.

Fuel treatment - 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 Flathead National Forest 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 L-5). In addition, when they are used on slopes less than 45 percent, displacement of the topsoil is rare.

Fuel treatment - mastication

Use of ground-based mastication 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). Rutting and puddling are most often associated with ground-based mechanical equipment operation on wet soils (Williamson & Nielsen, 2000). Flathead National Forest soils are typically drier than field capacity between July and mid- to late-October (Project File Exhibit L-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 though 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 Flathead National Forest met the Regional soil quality objective with the cumulative effect of original regeneration harvest and mastication (Project File Exhibit L-19). Impacts in these two units were well below the regional objective for detrimental soil disturbance.

Sapling thin – 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 saplings or the hand piling of cut saplings. 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 (A.E. 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 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 and special cuts

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 (Certini, 2005). 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.

Mastication

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.

Sapling thin

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.

Soil microorganisms

Post-fire recovery of soil microorganisms occurs rapidly, frequently resulting in population levels greater than before the fire (Jurgenson, Larson, & Harvey, 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 (Borchers & Perry, 1990).

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 (Deborah S 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

Where there is a risk of soil erosion, it would be minimized by implementing the following management practices:

- Reducing the area where equipment operates
- Locating landings on relatively flat ground that can be properly drained
- Locating skid trails on slopes less than 35 percent that have soils with a low or moderate erosion hazard
- Using erosion control features such as water bars, seeding, replanting, and placing slash on disturbed soils

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

Timber harvest

Management activities that leave organic matter on the soil surface minimize soil erosion. Watershed Erosion Prediction Project (WEPP) model results estimate the potential soil erosion rate from mechanical treatment units at a maximum of 0.10 tons/acre (Table 44) (Project File Exhibit L-20). 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.

Table 44. Potential soil erosion – mechanical treatments

Alternative	Potential Erosion Rate (tons/acre)	Mechanical Treatment Acres	Potential Total Erosion (tons)
1	0.0	0	0
2	0.10	3,529	345
3	0.08	2,392	187
4	0.08	1,627	131

Sapling thin

Maintenance of infiltration rates and effective ground cover of soils is necessary to prevent erosion. The lack of biomass removal would maintain effective ground cover and the lack of increase in soil bulk density would result in no reduction in infiltration rates over the existing soil. No soil erosion is anticipated from this treatment.

Prescribed burning

With return period analysis based on a 30 year climate average there is an 11 percent probability there will be erosion following implementation of prescribed burns. Model results put the amount of erosion in this scenario at 0.01 tons per acre. There is a three percent probability that the burned area erosion rate could be as high as 0.11 tons per acre in that same year (Project File Exhibit L-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 activities is unlikely.

Temporary road construction

All temporary roads constructed for this project will be reclaimed by any site-appropriate combination of the following:

- Removing any installed culverts or temporary bridges
- Recontouring the entire template to natural ground contour
- Where recontouring is unnecessary, rip to a depth equal sufficient to ameliorate the presence of detrimental soil compaction (usually between 6 and 12 inches)
- Seeding with the native plant mix as specified by the Forest Botanist
- Placing woody material on the template
- Planting native shrubs and trees to augment natural vegetation

Recontouring 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. Recontouring would provide a suitable seed bed for native forest vegetation while increasing soil hydraulic conductivity, organic matter, total carbon, and total nitrogen (Lloyd, Lohse, & Ferre, 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 1.5 tons per acre per year over the three year sale contract period (Table 45). These figures represent total erosion from all segments for the anticipated duration of use (Project File Exhibit L-20).

Table 45. Potential soil erosion – temporary roads

Alternative	Potential Erosion Rate (tons/acre)	Disturbance Acres	Potential Total Erosion (tons)
1	0	0	0
2	1.5	13	58
3	0.9	5	15
4	0	0	0

System road construction

Although impacts on soils from system road designation and construction fall outside of the analysis areas, they are discussed and reviewed for potential soil stability concerns. New system roads are considered dedicated lands removed from the productive land base and thus are not included in soil quality objectives. Permanent road construction would consist of a maximum of 7.6 miles of new Forest Service system road constructed over recently decommissioned National Forest System (NFS) roads. Construction 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.

Aquatic improvements on system roads

Culvert replacements and/or removals 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.

Historic trail added back to system

Although impacts on soils from system trail designation fall outside of the analysis areas, they are discussed and reviewed for potential soil stability concerns. New system trails are considered dedicated lands removed from the productive land base and thus are not included in soil quality objectives. System trail designation on historic trails would consist of a 12.2 miles of Forest Service system trail over historic National Forest system trails. Designation would result in no loss of soil productivity from the corresponding area as the original trail templates have received consistent levels of use since abandonment.

Road reroutes on Emery Creek

Although impacts on soils from system road construction fall outside of the analysis areas, they are discussed and reviewed for potential soil stability concerns. New system roads are discussed to provide extent of impacts but are considered dedicated lands. Permanent road construction would consist of a maximum of 1.3 miles of Forest Service system road reroutes. Reroute construction would result in a loss of soil productivity from the corresponding area through displacement, compaction, and erosion in the proposed locations.

Erosion is expected from permanent road construction where native surfaces are exposed to rainfall impact and overland flow. Approximately 80 percent of total accumulated road erosion occurs within the first year after construction (Sheng, 1990). Road erosion and sediment yield

typically decline after construction (J. A. Jones, Swanson, Wemple, & Snyder, 2000; Switalski, Bissonette, DeLuca, Luce, & Madej, 2004).

Reroute would result in rehabilitation of 1.4 miles of existing road. Rehabilitation would consist of full recontouring. On this segment, signs of hydrologic recovery are expected within 10 to 30 years, while soil biological function would steadily return with accelerated recovery after a forest floor forms in 30 to 70 years.

Recontouring 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. Recontouring would provide a suitable seed bed for native forest vegetation while increasing soil hydraulic conductivity, organic matter, total carbon, and total nitrogen (Lloyd et al., 2013). These conditions would likely accelerate the recovery of the soil productivity.

Accessible fishing pier on Lion Lake

Although impacts on soils in designated recreation areas fall outside of the analysis areas, they are discussed and reviewed for potential issues. Pier construction would result in some short-term erosion and minor displacement during the construction phase. Since the site is already converted, there would be no additional impacts to soil productivity.

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 northern region soil quality objectives.

The estimated cumulative effects for each activity area from implementation of the action alternatives are displayed in Table 46. These predicted cumulative detrimental soil disturbance values are based on implementation of all required design features for soils in chapter 2.

Table 46. Cumulative effects summary

Unit	Existing Condition DSD	Treatment DSD	Alt 2 Temporary Road DSD	Alt 2 Cumulative DSD	Alt 3 Temporary Road DSD	Alt 3 Cumulative DSD	Alt 4 Cumulative DSD
1	1%	2%	0%	3%	0%	--	3%
2	1%	2%	0%	3%	0%	--	--
3	0%	10%	1%	11%	1%	11%	--
4	0%	6%	1%	7%	--	--	--
5	1%	6%	2%	9%	1%	8%	--
6	0%	6%	0%	6%	0%	6%	6%
7	0%	4%	8%	12%	--	--	--
8	0%	8%	4%	12%	4%	12%	--
9	0%	6%	1%	7%	--	--	--
11	1%	6%	0%	7%	0%	7%	--
12	0%	10%	0%	10%	0%	10%	10%

Unit	Existing Condition DSD	Treatment DSD	Alt 2 Temporary Road DSD	Alt 2 Cumulative DSD	Alt 3 Temporary Road DSD	Alt 3 Cumulative DSD	Alt 4 Cumulative DSD
13	7%	6%	0%	13%	0%	13%	13%
14	7%	6%	1%	14%	--	--	--
16	0%	8%	2%	10%	--	--	--
16A	0%	8%	2%	10%	--	--	--
17	0%	8%	0%	8%	0%	8%	8%
18	recreation area (special cut)						
19	6%	6%	1%	13%	1%	13%	12%
20	0%	6%	0%	6%	0%	6%	6%
22	0%	10%	0%	10%	--	--	--
22A	0%	8%	1%	9%	--	--	--
23	recreation area (special cut)						
25	recreation area (special cut)						
26	6%	6%	0%	12%	0%	12%	12%
27	0%	6%	1%	7%	1%	7%	7%
29	3%	6%	1%	10%	1%	10%	-
30	6%	8%	0%	14%	0%	14%	14%
31	0%	10%	0%	10%	--	--	10%
32	1%	10%	0%	11%	0%	11%	11%
33	3%	6%	2%	11%	--	--	--
34	0%	8%	5%	13%	--	--	--
34A	0%	8%	5%	13%	--	--	--
35	0%	10%	0%	10%	0%	10%	--
35A	0%	2%	0%	2%	0%	2%	--
35B	7%	6%	0%	13%	0%	13%	13%
37	0%	8%	0%	8%	0%	8%	8%
37A	0%	10%	0%	10%	0%	10%	10%
38	0%	8%	0%	8%	0%	8%	--
39	7%	6%	0%	13%	0%	13%	--
40	3%	10%	0%	13%	0%	13%	13%
41	0%	8%	1%	9%	1%	9%	--
41A	0%	8%	1%	9%	1%	9%	--
43A	0%	8%	0%	8%	0%	8%	8%
45	3%	6%	0%	9%	0%	9%	9%
46	0%	10%	0%	10%	0%	10%	10%
50	6%	8%	0%	14%	--	--	--
50A	0%	10%	0%	10%	--	--	--
51	3%	10%	0%	13%	0%	13%	13%
52	0%	10%	0%	10%	0%	10%	10%
54	0%	8%	0%	8%	0%	8%	8%
55	0%	8%	0%	8%	--	--	8%

Unit	Existing Condition DSD	Treatment DSD	Alt 2 Temporary Road DSD	Alt 2 Cumulative DSD	Alt 3 Temporary Road DSD	Alt 3 Cumulative DSD	Alt 4 Cumulative DSD
56	0%	8%	0%	8%	--	--	--
56A	0%	8%	0%	8%	--	--	--
57	3%	8%	0%	11%	--	--	11%
58	3%	6%	1%	10%	1%	10%	--
59	7%	6%	0%	13%	0%	13%	13%
60	8%	6%	0%	14%	0%	14%	14%
61	0%	6%	0%	6%	0%	6%	--
62	10%	2%	0%	12%	--	--	--
62A	6%	6%	0%	12%	--	--	--
63	0%	10%	0%	10%	0%	10%	--
66	3%	6%	0%	9%	0%	9%	--
68	7%	6%	0%	13%	--	--	13%
71	3%	8%	0%	11%	0%	11%	11%
71A	0%	10%	0%	10%	0%	10%	10%
73	3%	10%	0%	13%	0%	13%	--
75	0%	8%	0%	8%	0%	8%	8%
76	7%	6%	0%	13%	0%	13%	--
77	0%	6%	1%	7%	1%	7%	--
78	7%	6%	1%	14%	1%	14%	--
80	recreation area (special cut)						
81	recreation area (special cut)						
82	8%	2%	0%	10%	--	--	--
83	0%	2%	1%	3%	--	--	--
84	0%	6%	0%	6%	--	--	--
85	6%	6%	0%	12%	--	--	12%
86	0%	8%	0%	8%	0%	8%	8%
87	0%	8%	1%	9%	--	--	--
87A	0%	10%	0%	10%	--	--	10%
88	0%	8%	1%	9%	--	--	--
88A	0%	10%	0%	10%	--	--	10%
89A	0%	8%	0%	8%	--	--	8%
89B	0%	8%	0%	8%	--	--	8%
90	5%	8%	0%	13%	--	--	13%
91A	0%	8%	0%	8%	--	--	8%
91B	9%	4%	0%	13%	--	--	13%
92	5%	8%	0%	13%	--	--	13%
93	8%	2%	0%	10%	0%	10%	10%
100	0%	2%	0%	2%	0%	2%	2%
101	hand treatment						
102	10%	2%	0%	12%	0%	12%	12%

Unit	Existing Condition DSD	Treatment DSD	Alt 2 Temporary Road DSD	Alt 2 Cumulative DSD	Alt 3 Temporary Road DSD	Alt 3 Cumulative DSD	Alt 4 Cumulative DSD
103	1%	2%	0%	3%	0%	3%	3%
104	10%	2%	0%	12%	0%	12%	12%
200	hand treatment						
201	hand treatment						
202	hand treatment						
203	hand treatment						
204	hand treatment						
205	hand treatment						
206	hand treatment						
211	hand treatment						
212	hand treatment						
213	hand treatment						
214	hand treatment						
215	hand treatment						
216	hand treatment						
217	hand treatment						
218	hand treatment						
220	hand treatment						
221	hand treatment						
224	hand treatment						
225	hand treatment						
226	hand treatment						
227	hand treatment						
228	hand treatment						
229	hand treatment						
301	0%	3%	0%	3%	0%	3%	3%
302	0%	3%	0%	3%	0%	3%	3%
303	0%	3%	0%	3%	0%	3%	3%
304	0%	3%	0%	3%	0%	3%	3%
305	0%	3%	0%	3%	0%	3%	3%
306	0%	3%	0%	3%	0%	3%	3%
401	6%	8%	0%	14%	0%	14%	14%
402	0%	8%	0%	8%	0%	8%	8%
403	3%	8%	0%	11%	0%	11%	11%
404	8%	6%	0%	14%	0%	14%	14%
405	3%	8%	0%	11%	0%	11%	11%
406	3%	8%	0%	11%	0%	11%	11%
501	Hand Treatment						

Table 47 displays the total acres of predicted detrimental soil disturbance and soil erosion from the proposed activities by alternative. The action alternatives are designed to minimize detrimental soil disturbance by implementing the design features described in chapter 2.

Table 47. Detrimental soil disturbance and erosion by alternative

Description	Alternative 2	Alternative 3	Alternative 4
Detrimental disturbance from proposed activities (acres)	237	162	109
Cumulative detrimental disturbance (acres)	348	237	181
Predicted soil erosion (tons)	410	209	138

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.

Duration of effects

Displacement and erosion, the loss of topsoil, is a long-term and perhaps a permanent loss of soil productivity. However, management practices outlined in the design features would reduce the occurrence of displacement and erosion to within the northern region soil quality objectives.

Compaction may last from 10 to 70 years (Gonsior, 1983). Monitoring of 40 year old activities within this project area averaged between three and six percent detrimental soil disturbance, indicating significant recovery of compacted soils has occurred.

Reductions in organic matter content reverse quickly as vegetation is established. Organic debris accumulates on the surface and roots grow, die, and are decomposed in the soil. These organic materials release nutrients and improve the quality of the soil by improving its structure and reducing compaction and other disturbances. Loss of organic matter is a short term change lasting about 10 years once vegetation returns to the soil.

Light and moderate severity burned areas have minor effects well within the natural range of variability for wildfire. Areas burned under conditions that produce light or moderate burn severity would vegetate quickly due to viable seeds or roots that could produce more plants and the complement of microorganisms and nutrients remaining on site (Ryan & Noste, 1985).

Changes in soil microorganisms are not permanent. Recovery would occur as soon as organic matter is present in the soil, which could be immediately after the proposed management is carried out.

Soil erosion will be controlled through the use of erosion control measures. In addition, bare soils would naturally recover or be revegetated with native seed. Any erosion that occurs would be short-lived, most likely occurring during the time between the soil disturbance and the implementation of erosion control measures.

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 46. All proposed activities associated with the action alternatives would meet the soil quality objectives with the implementation of the design features for soils described in chapter 2.

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(USDA Forest Service)). The Forest Service 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 National Forest Management Act 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). northern region soil quality objectives identified in Forest Service Manual R-1 Supplement 2500-99-01 (Project File Exhibit I-1) were set forth to meet the direction of National Forest Management Act to manage Forest Service lands without permanent impairment of land productivity and to maintain or improve soil quality.

Regional guidance is available from the northern region Forest Service Manual for Soil Management 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.”

Aquatics

Introduction

This section describes existing conditions of aquatic resources and the potential effects of alternatives. The analysis contains the following components:

- Hydrologic Processes¹
- Hillslope Erosion and Sediment Delivery²
- Aquatic Habitat/Stream Morphology³ and Water Quality⁴
- Aquatic Species

Summary of Findings

All subwatersheds in the project area with the exception of the Hungry Horse Reservoir-Aurora Creek subwatershed were determined in a nation-wide reviewed called “Watershed Condition Framework” to be in Class 1, Functioning Condition (USDA Forest Service, 2011a). The Hungry Horse Reservoir-Aurora Creek subwatershed was identified as a Class 2 watershed (Functioning at Risk) due to poor water quantity and aquatic habitat conditions in the South Fork Flathead River (USDA Forest Service, 2011a) as a result of the effects of the Hungry Horse Dam. These subwatersheds will remain in these same watershed conditions following the implementation of all alternatives.

Changes in equivalent clearcut area values would not result in measurable increases in water yield when compared to the estimated low end range of natural variability. The combination of successful application of effective BMPs, with the limited size and spatial distribution of associated increases is unlikely to measurably change hydrologic processes beyond the hillslope scale. Relocation of NFS Road 546 in alternatives 2, 3, and 4, would reduce road/stream hydrologic connectivity in the Emery Creek subwatershed. Neither the addition of an existing trail to the forest trail system or the rehabilitation of this route, would alter hydrologic processes from the existing condition. Construction of an accessible fishing pier on Lion Lake is not anticipated to produce measurable changes in hydrologic processes affecting the lake.

The sediment delivery associated with proposed activities in alternative 2, 3, and 4, is such that it would be difficult to measure or differentiate from natural variation in sediment. Measurable effects at the reach scale may result following culvert replacements but are anticipated to return to background levels within three years of disturbance. The short term increases in sediment delivery is a tradeoff for reducing long term risk associated with potential failure, which is greater in alternative 3, which does not replace or remove at risk culverts in grizzly bear security core on NFS Road 1614, and therefore does not require a forest plan amendment for this work. The proposed road relocation in Emery Creek is estimated to reduce annual sediment delivery to Emery Creek from NFS Road 546 across all alternatives.

¹Includes precipitation, runoff, streamflow, and evapotranspiration.

²Includes average annual hillslope erosion and sediment delivery.

³Includes a general description of stream habitat types and channel morphology.

⁴Includes in-stream sediment and nutrient levels.

Temporary roads and roads proposed to be added to the system do not appreciably change stream crossing density, road density, or road/stream hydrologic connectivity relative to the existing condition across all action alternatives. Therefore, a measurable change in annual water yield or peak flows is not anticipated to result from construction or re-use of these roads. Thus, measurable effects to aquatic habitats or channel morphology related to changes in annual water yield or peak flows are also not anticipated.

Effects to aquatic species are intricately tied to changes in aquatic habitat and water quality. Through actions proposed under alternatives 2, 3, and 4, the principal mechanism driving change in aquatic habitat and water quality is replacement of stream aligned culverts which are anticipated to produce short term (less than three year) negative impacts to aquatic habitat and water quality through increased sediment delivery and reduced water quality. However, these short term impacts are not anticipated to result in a loss of viability for native fish. In the long-term, the improved fish passage and improvements made to the road network to minimize their impact will help bolster fish populations. The proposed fishing pier on Lion Lake would likely increase harvest rates of non-native fish species but would not alter fish populations.

Analysis Area

Spatial bounds for direct, indirect, and cumulative effects

The spatial bounds of analysis areas are variable, depending on which component of aquatic resources is analyzed. Erosion and sediment delivery are generally addressed at the subwatershed scale but tier to hillslope scale analysis. Potential effects related to water yield, channel morphology, and water quality are addressed at the subwatershed scale (HUC12), but tier to upland hydrologic and hillslope-scale analyses. Similarly, analysis of effects to aquatic species generally focus on hillslope, stream reach, subwatershed (HUC12) and the population or subbasin scale (HUC8). Each component of the analysis describes the scale at which the direct and indirect effects are being predicted. Map 3-4 displays subwatersheds and subbasins used for the analysis relative to the proposed project area giving spatial reference to the distribution of these potential action on the landscape.

Temporal bounds for direct, indirect, and cumulative effects

Temporal bounds for aquatic resources range between short-term (project initiation out approximately five years post completion) and long term (greater than five years post completion), depending on the type and scale of effects. For example, road treatments such as BMP improvements can reduce sediment delivery within one year, and these effects can persist for several years. By contrast, forest treatments such as timber harvest can change hydrologic processes and disturbance regimes for several decades. Each component of the analysis describes the temporal nature of predicted effects.

Sediment delivery estimates associated with proposed vegetation management actions are based on a 50 year climate simulation using the Disturbed WEPP (Water Erosion Prediction Program) interface (WEPP) model. Similarly, estimates associated with road sediment delivery utilize the WEPP: Road-batch interface. 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 three to five year period). Erosion and sediment delivery estimates for roads are also based on a 50 year climate simulation. Therefore, estimated sediment volumes from treatment units and proposed roads represent the average of what could potentially occur over a 50 year period. Hillslope erosion and sediment delivery estimates reflecting relative changes

between treated and untreated conditions are presented in probabilistic terms utilizing 93 years of possible climate data using the Disturbed WEPP-batch interface.

Methodology

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, soil inventories, watershed boundaries, transportation systems, Montana Natural Heritage Program, National Wetland Inventory dataset, 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 includes U.S. Geological Survey stream flows, fish passage assessments, Montana Department of Environmental Quality (MDEQ) reports, relevant past NEPA documents, Natural Resources Conservation Service (NRCS) snow surveys, soil condition surveys, aquatic habitat surveys, USFS Watershed Condition Frame-work assessments, Water Erosion Prediction Program (WEPP) surveys and culvert risk assessments. The Flathead National Forest and Montana Department of Fish, Wildlife and Parks have conducted site-specific fish habitat condition, fish population and genetic status inventories relative to the project area within principal streams for more than twenty years. Data utilized in this analysis is available at Flathead National Forest fisheries files and/or Montana Department of Fish, Wildlife and Parks.

Potential erosion and sediment delivery is generated using the Water Erosion Prediction Program (WEPP) which is a predictive model. The WEPP model and its associated interface programs use simulated climate variables (temperature, precipitation), hillslope characteristics, soil texture, and vegetative cover to predict soil moisture, infiltration, surface runoff, erosion, and sediment delivery. Specific outputs include detailed precipitation, surface runoff, upland erosion, and sediment delivery. It is important to note that erosion rates are highly variable, and most models can predict only a single value. Furthermore, predicted erosion values may only be within 50 percent of the true value.

The WEPP model was developed by an interagency group of scientists with the Agricultural Research Service, Natural Resources Conservation Service, Forest Service, Bureau of Land Management, and the Geological Survey. Work began on the WEPP model in 1985 with the goal of replacing the Universal Soil Loss Equation. The model essentially describes the physical processes that lead to erosion and transport of soil material. These processes include infiltration and surface runoff; soil detachment, transport, and deposition; and plant growth, senescence, and residue decomposition. For each simulation day, the model calculates the soil water content in multiple layers, plant growth, and residue decomposition. The effects soil consolidations are also modeled.

To offer the erosion and sedimentation prediction capabilities of the WEPP model to a greater number of users, a set of simplified user interfaces were developed in the early 1990s. These inter-faces run with a web browser from USFS Web sites. All of the WEPP interface programs rely on detailed climate data, which is provided through a climate generator (Rock: Clime) that includes data from over 2,600 climate stations in all 50 states. The CLIGEN database is supplemented with the Parameter-elevation Regressions on Independent Slopes Model that gives users the ability to create custom climate data sets based on nearby weather stations.

The general approach in this analysis is to estimate potential sediment delivery to streams that may result from management alternatives. It is important to recognize that the WEPP model runs

a simulation of climate for a given time period, and this simulation includes storm and snowmelt events of various magnitudes and frequency. Therefore, each simulation has events with a recurrence intervals that are less than or equal to the simulation period (i.e. a 50 year simulation will likely have 10, and even 50 year storm events). Sediment delivery from roads generated through the existing spatial dataset (NetMAP-WEPProad dataset) were validated against WEPP model outputs generated from field data collected at stream crossings in the primary affected subwatersheds. All WEPP model runs and validation of the NetMAP dataset are located in Project File Exhibits M-1, M-2, M-5, M-6, and M-7.

All of the information described above is used together to define the condition of aquatic resources and to help predict how proposed activities may affect them. Throughout the analysis, peer-reviewed scientific literature is used to support the assessment of existing conditions and to support predictions of project effects. Monitoring data and scientific literature is drawn from subject areas including fisheries science, forest hydrology, fluvial geomorphology, soil science, climate change science and aquatic ecology.

Existing Condition (Affected Environment)

The project area is primarily situated within the Emery Creek, Hungry Horse Creek, Hungry Horse Reservoir, Spring Meadow Creek, and the Abbot Creek subwatersheds (HUC12s). Proposed activities would occur to a lesser extent within the Hungry Horse Reservoir-Aurora Creek subwatershed. All subwatersheds are located within the larger South Fork Flathead River or Flathead Lake subbasins (HUC8) as illustrated in Map 3-4. All proposed activities are located on the north side of Hungry Horse Reservoir and South Fork Flathead River although several analysis subwatershed boundaries extend to the south of these features (Map 3-4). Principal streams and waterbodies within the project area include: Hungry Horse Creek, Emery Creek, Abbot Creek, South Fork Abbot Creek, Margaret Creek, Tiger Creek, Lost Mare Creek and Hungry Horse Reservoir. Margaret, Tiger and Lost Mare Creeks are all tributaries to Hungry Horse Creek.

Geologic parent material within the analysis area subwatersheds are typical of the Flathead National Forest. The highest elevation ridgetops are capped by the Helena Formation (limestone) while the Empire and Spokane Formations (argillites) make up the mid-slopes. Occasionally outcroppings of Sheppard, Snowslip and Mount Shields Formations protrude from deep glacial deposits (tills, outwash, moraines, etc.) which form lower slopes and valley bottoms. These formations are generally nutrient-limited leading to low stream nutrient concentrations during base flow periods which is characteristic of the North, Middle, and South Forks of the Flathead River system. Soils derived from parent geology are influenced by volcanic ash. Most hillslopes in the project area are concave and have low sediment delivery potential, especially where valley bottoms are relatively wide. Streams are typically high gradient (greater than three percent) and dominated by cobbles and gravel substrate.

In 2011, subwatersheds within the project area were assessed by an interdisciplinary team (ID team) in support of the Watershed Condition Framework. This assessment included a wide variety of physical and biological attributes of soils, water, fisheries, and vegetation. Some components of the assessment were based on quantitative data, while others were generated from professional judgement. All subwatersheds in the project area with the exception of the Hungry Horse Reservoir-Aurora Creek subwatershed were determined to be in Class 1, Functioning Condition (USDA Forest Service, 2011a). The Hungry Horse Reservoir-Aurora Creek subwatershed was identified as a Class 2 watershed (Functioning at Risk) due to poor water quantity and aquatic

habitat conditions in the South Fork Flathead River (USDA Forest Service, 2011a). This determination is strictly associated with flow regulation on the South Fork Flathead River below Hungry Horse Dam and do not reflect habitat conditions elsewhere in the subwatershed.

Hungry Horse Reservoir was created following the completion of Hungry Horse Dam on the South Fork Flathead River in 1953; effectively isolating many aquatic species from upstream migration as well as functionally serving as a sediment/nutrient sink buffering water quality effects and regulating stream flows to lower portions of the Flathead River system and ultimately Flathead Lake.

The existing conditions described below are reflective of the past and ongoing activities that are relevant to aquatic resources. These activities are summarized in the Cumulative Effects Worksheet (Project File Exhibit M-22). The most pertinent past and ongoing activities include wildfire, vegetation management, and road management, and are described in detail below.

Hydrologic processes

Average annual precipitation ranges between 30 and 100 inches. Most of this precipitation comes as snow during the winter months. Roughly two-thirds of annual precipitation is lost through evapotranspiration and the rest leaves the project area as streamflow. Annual peak discharges generally occur in April, May, or June. These flows are driven by snowmelt (by itself), mid-winter rain-on-snow, rain-during-snowmelt, or summer thunderstorms. Slow release of groundwater provides stream base-flow beginning in mid-July and continues until the fall rains, which typically begin in mid-October. Many of the higher elevation and steeper streams that occur in the project area are flashy in nature typically responding quickly to snowmelt, spring and early summer rainfall. This characteristic of flashy streamflow is thought to be due to the larger area of Mississippian, Devonian, and Cambrian age limestone and dolomite bedrock that occurs in these areas. These bedrocks trend to develop soils that are shallow with a high percentage of rock fragments and/or landscapes with a high percentage of rock outcrop. This results in soils/landscapes that have a low water holding capacity that does not provide season long groundwater flow in the stream channels. Likewise, much of the affected subwatersheds share a south/southwest aspect. Aspect can influence the amount of direct solar radiation and therefore rates of snow ablation, evapotranspiration and water cycling in general (Broxton, Troch, & Lyon, 2009). As a result, the time between water entering the catchment as precipitation and leaving as stream flow (transit times) can be variable depending on aspect. Furthermore, the region is deeply mantled by reworked glacial till and outwash, which can mask the interactions between groundwater and surface water (MDEQ, 2004).

Higher temperature during the past few decades has decreased snow cover depth, duration, and extent, a trend that will probably continue with further warming (Vose, Peterson, & Patel-Weynand, 2012). Increased average annual temperatures in western Montana have risen 1.33°C from 1900 to 2006 which is 1.8 times greater than the 0.74 °C rise in Global temperatures over the same time period (Pederson, Graumlich, Fagre, Kipfer, & Muhlfeld, 2010). Overall warming in the mountainous areas of western Montana correlate with observed advances in center-of-mass timing in stream flow (Stewart, Cayan, & Dettinger, 2005), and a 30 percent reduction in April 1 snow water equivalent across the Pacific Northwest since 1950 (P. W. Mote, Hamlet, Clark, & Lettenmaier, 2005). Snow water equivalent is the amount of water contained in snow, and is usually expressed in inches. The snow water equivalent on April 1 of each year is a common metric used in water supply forecasting and spring runoff. Snow water equivalent has been measured at the Natural Resources Conservation Service-Emery Creek Snotel site (#469) since 1977. The April 1 snow water equivalent data suggests a slight downward trend (see Project File

Exhibit M-8). These findings are consistent with those from Kendall (2011) who analyzed long term trends in April snow water equivalent at 33 sites in the Upper Flathead Basin. Under current climate change scenarios, further reduction in April 1 snow water equivalent, advancement of melt out and reduced annual water yield would be expected.

Forest management, principally timber harvest and road building has been ongoing in the affected subwatersheds since around the time the town of Coram was established in 1905 (McKay, 1994) and have continued through present times. Records of timber harvest on public lands in this area prior to 1940 were not well documented and therefore not available for this analysis. Forest practices on public and private lands prior to the early 1990s tended to be intensive with large scale clearcutting and lacked watershed protection measures which today are required by law. These activities have changed forested conditions (and ultimately hydrologic processes) throughout the project area and formulated the existing condition. However, the ability of time to promote hydrologic recovery from these past disturbances is reflected in the current watershed condition framework rating indicating fully functioning and stable physical habitat conditions and good water quality (Project File Exhibit M-26).

A water yield analysis for affected subwatersheds was completed following procedures outlined in Kendall (2015a) adapted from Montana Department of Natural Resources and Conservation. Table 48 displays equivalent clearcut area (ECA) model results (acres of ECA) for the existing condition. Equivalent clearcut area model results generally provide insight into potential changes in average annual water yield that result from loss of forest canopy and associated reductions in evapotranspiration and interception. A full assessment of water yield and peak flows relative to the analysis subwatersheds is presented in Project File Exhibit M-3.

Table 48. Existing ECA summary for analysis area subwatersheds

Subwatershed (HUC12)	¹ Percent ECA		Max. Year	Max. Contributing Factor	² Low end range of Natural Range of Variability	³ Potential Low/Moderate Peak Flow Response under Current Condition
	Existing (2017)	Historic Max. Value/Year				
Abbot Creek	16.2	60.8	1929	wildfire	5-24%	below limit of detection (+/- 10%)
Emery Creek	3.2	8.9	1980	timber harvest	5-24%	below limit of detection (+/- 10%)
Hungry Horse Creek	2.6	21.7	1926	wildfire	5-24%	below limit of detection (+/- 10%)
Hungry Horse Reservoir - Aurora Creek	6.7	14.1	2003	wildfire	5-24%	below limit of detection (+/- 10%)
⁴ Hungry Horse Reservoir - Spring Meadows Creek	23.3	46.8	2003	wildfire	5-24%	below limit of detection (+/- 10%)

¹ECA values based on guidance from Kendall (2015a) and assumptions outlined in Project File Exhibit M-9.

²Values computed from Losensky (1994).

³Values computed from Grant and others (2008) for mean reported change in peak flows for all data.

⁴ECA values do not include area inundated by Hungry Horse Reservoir from 1950 through present.

Based on equivalent clearcut area model results presented in Table 48 and detailed in Project File Exhibit M-3, measurable increases in low to moderately sized peak flows (less than six year peak flow events) as described by Grant and others (2008) as well as annual water yield in analysis area subwatersheds appear to be functioning within the natural range of variability relative to equivalent clearcut area estimates produced by Losensky (1994).

Additionally, road networks can change a variety of hydrologic processes at hillslope and small watershed area scales. Forest roads, whether paved or unpaved, typically have very low infiltration rates and, therefore, convert nearly all of the rainfall or snowmelt into overland flow. When they are cut into the hillslopes, they also can intercept the slower moving subsurface flow (Edwards, Wood, & Quinlivan, 2016; Troendle, MacDonald, Luce, & Larsen, 2009). Research by Kahklen and Moll (1999) found groundwater levels adjacent to road prisms were affected for a distance of up to 10 meters. Groundwater levels immediately below the road were typically lower than above the road, but recovered relatively quickly (Kahklen & Moll, 1999). Furthermore, a decrease in channel roughness with an extension of stream channel networks by hydrologically connected roads affects flow routing and can speed stormflow, potentially advancing and/or increasing the peak flow without a change in volume (Kuras, Alila, & Weiler, 2012). Table 49 quantifies miles of hydrologically connected road segments as a percentage increase in stream length within each of the analysis subwatersheds. For the purpose of the analysis, hydrologically connected road segments include National Forest System (NFS) roads, private roads (including County and State), and historical road segments within 50 feet of NHD flowlines (the same minimum streamside management zone buffer assigned by the State streamside management zone law (MDNRC, 2006)). Likewise, Table 49 also displays all road segments within 10 meters of lentic riparian land types (the maximum distance for groundwater response measured by Kahklen and Moll (1999)) to document potential areas road/groundwater interactions could affect the aquatic resource. Historic roads were included in this analysis because effects on hydrologic processes can persist depending on the level of decommissioning work that was performed. This is particularly true on steep hillslopes where historic prisms remain.

Table 49. Road/stream connectivity and road/wetland interaction

HUC12 Name	¹ Total Road Length (mi)	¹ Total Road Density (mi/mi ²)	USDA (1996) Road Density Classification (mi/mi ²)	² Miles Hydrologically Connected Road Length (percent connected)	² Stream Length Increase (percent increase)	³ All Road Length (mi) within 10 Meters of Wetland Habitat
Abbot Creek	189.34	3.04	High (1.7-4.7)	4.99 (2.6)	3.64	5.45
Emery Creek	30.98	1.18	Moderate (0.7-1.7)	1.07 (3.5)	2.32	1.35
Hungry Horse Creek	9.68	0.44	Low (0.1-0.7)	0.41 (4.2)	0.94	0.59
Hungry Horse Reservoir – Aurora Creek	22	1.36	Low (0.1-0.7)	0.54 (2.5)	1.31	0.54
Hungry Horse Reservoir - Spring Meadows Creek	60.52	2.35	High (1.7-4.7)	1.7 (2.8)	2.21	0.89

¹All roads including non-Forest System Roads and hydrologically connected historical road lengths.

²All road lengths within 50 ft. of mapped NHD streams. Excludes road lengths associated with historic road/stream crossings (stream aligned culverts removed).

³Does not include landtype habitats captured by surface water connectivity buffer of 50 ft.: FL2A, FL2D, MS3A, SL2A, SL3A, WS5A, Lake, and NL2A.

Moderate to low overall road density combined with a small percentage of stream length increase resulting from hydrologically connected road segments (Table 49) suggest that any level of water yield or peak flow increase associated with the existing road network would be difficult to detect (if present) even at the reach scale in all but the Abbot Creek subwatershed. These assumptions are consistent with Cissel and others (2013) who performed intensive field surveys and modeling in the Clearwater and Swan River valleys of western Montana concluding four percent road/stream hydrologic connectivity (10 miles out of 253 miles) which was considered to be a relatively low value. Likewise, effects to lentic riparian land types due to groundwater interception by existing road prisms are also anticipated to be difficult to detect if present at the hillslope scale given the length and position of road segments on the landscape relative to lentic riparian land types (Project File Exhibit M-23).

In contrast, the Abbot Creek subwatershed maintains a Class 1: Functioning Condition rating with a road density rating of “High”. However, further evaluation of physical subwatershed characteristics appear to counter act potential water yield and peak flow effects. The landscape position of the road system is situated in low relief areas over coarse glacial deposits which functions to dissipate overland flow energy and promote rapid infiltration. Additionally, stream connected road segments comprise less than three percent of the overall road length which is below “low” values identified by Cissel and others (2013). Combined, these factors are anticipated to reduce potential increases in annual water yield or peak flows at the subwatershed scale.

Hillslope erosion and sediment delivery

Climate, geology and geomorphic processes combined to create various landforms. Landforms, soils and the associated vegetation are the dominant physical features that affect watershed functions and processes (MDEQ, 2004). The same physical features influence the erosion processes that occur across the landscape. Landforms in the project area are the result of extensive glacial activity. Dominant landforms include steep alpine glacial land, breaklands, gently to moderately sloped glacial land and mountain slopes and ridges. Soils are typically thin on ridge tops and mantled by glacial till on lower slopes. Drainage patterns are generally dendritic. Surface soils are heavily influenced by volcanic ash.

Undisturbed forest hillslopes have minimal surface erosion (W. J. Elliot, 2013). In contrast, disturbed areas can sometimes generate sediment much greater than those of undisturbed forest hillslopes (W. J. Elliot, 2013; Ice & Stednick, 2004). Wildfire is the natural disturbance that generates the greatest amount of erosion and sediment delivery (W. J. Elliot, 2013), while forest roads are generally recognized as the greatest anthropogenic generator of sediment (Castro & Reckendorf, 1995; W. J. Elliot, 2013; Sugden & Woods, 2007) and improperly designed roads can directly affect aquatic ecosystems (MDEQ, 2004). Because forest roads are primary contributors of sediment, they represent the greatest concern in terms of non-point source pollution, water quality, and aquatic habitat (Bauer & Ralph, 2001). Therefore, hillslope erosion and sediment delivery are of primary concern following any disturbance whether it be natural or anthropogenic. Natural sources of sediment exist at all spatial scales identified for analysis (active slumping in the Alpha Creek drainage, outside the project area but within the Hungry Horse-Aurora Creek sub-watershed (Map 3-4) following wildfire is a prime example) while anthropogenic sources are primarily limited spatially to areas outside of designated wilderness. It is important to clarify that soil erosion occurring on a hillslope must be transported to a stream channel in order to become

sediment yield (sediment delivery). It is also critical to note that mountain sediment yields are naturally episodic and long term sediment delivery is dominated by large natural events with low recurrence intervals (Kirchner et al., 2001). On the contrary, short term erosion rates (incremental erosion) prevail on the landscape most of the time, although they only account for a small fraction of total sediment yield (Kirchner et al., 2001). Disturbed WEPP-batch model outputs for the existing condition indicate there is a zero to four percent probability of sediment delivery in any given year from undisturbed hillslope polygons within identified treatment areas (Project File Exhibit M-7). These data suggest a minimum 25 year event is necessary to cause sediment delivery under current conditions.

When assessing the degree of road development in any given watershed, it is important to consider the location of roads in relation to sensitive soils, slope steepness, proximity to stream channels, and how many stream-road crossings may be present. Crossing density has shown a correlation with the amount of fine sediment in streams (Schnackenberg & MacDonald, 1998). Intuitively, this makes sense because stream crossings are places where roads and streams are closest together. Crossing density for the subwatersheds that overlap with the project area are shown in Table 50. Generally, roads away from stream crossings divert water onto forested areas that filter sediment. Montana best management practices require that road drainage be routed through filter strips to trap sediment and prevent delivery to streams. Results from the 2016 Montana BMP Monitoring Report (MDNRC, 2016b) show that across all ownerships, best management practices were effective in protecting soil and water resources 98.9 percent of the time, which means that eroded material does not reach draws, channels, or floodplains.

Table 50. Road crossing density by subwatershed

HUC12 Name	Watershed Area (mi ²)	# NHD Stream Crossings	¹ Crossing Density (crossings/mi ²)
Abbot Creek	62	98	0.6
Emery Creek	26	32	0.8
Hungry Horse Creek	22	11	2.0
Hungry Horse Reservoir - Aurora Creek	16	9	1.8
Hungry Horse Reservoir - Spring Meadows Creek	26	41	0.6

¹Accounts for NHD stream crossings on Forest System Roads and other roads as identified in the Forest Service INFRA database.

Predicted maximum average annual erosion rates and sediment delivery to streams from Forest System Roads were estimated using the WEPP road surface erosion model within NetMap GIS tool box. 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. Background sediment yield in each of the affected subwatersheds based on estimates of short term annual average sediment delivery for undisturbed forest conditions as presented in Elliot (2013) is displayed in Table 51. Table 51 also includes estimated sediment delivery associated with existing National Forest System roads within each subwatershed and the proportion of road sediment delivery relative to estimated maximum potential background values. A completed list of estimated road sediment delivery is presented in Project File Exhibit M-1.

Table 51. Estimated sediment delivery within analysis area subwatersheds

Subwatershed (HUC12)	¹Estimated Maximum Potential Background Sediment Delivery for entire Subwatershed (tons/yr)	²Estimated Road Sediment Delivery (tons/yr)	³Estimated Percent Sediment Delivery from Roads (tons/yr)
Abbot Creek	1,425	18	1.2
Emery Creek	498	31	6.2
Hungry Horse Creek	601	2	0.3
Hungry Horse Reservoir - Aurora Creek	370	5	1.3
Hungry Horse Reservoir - Spring Meadows Creek	589	25	4.3

¹Total Sediment Delivery estimated based on short term average annual rate for undisturbed forests as presented in Elliot (2013).

²Estimated sediment delivery utilizes NetMap WEPP outputs for entire road length. NetMap outputs were verified for accuracy using field WEPP data collected at stream crossings in the following subwatersheds: Emery Creek, Hungry Horse Creek, and Abbot Creek. Results indicate NetMap outputs and field WEPP outputs are within the standard range of predicted error of each other (plus or minus 50 percent). Project File Exhibits M-1 and M-2 display results from NetMap and field WEPP road outputs.

³Estimates relative to estimated maximum potential background sediment delivery for entire subwatershed.

Both hillslope erosion and sediment delivery are important to forest managers. Detachment and displacement of sediment can adversely affect forest soil productivity (William J Elliot, Page-Dumroese, & Robichaud, 1998), and delivered sediment adversely impacts aquatic habitat (W. J. Elliot, 2013) and reduces the water quality potentially impairing beneficial uses. The effects of hillslope erosion and sediment delivery to water quality, channel morphology and aquatic habitat are discussed in further detail in those sections of this document. A comprehensive discussion of soil productivity can be found in the Soils specialist report.

Aquatic habitat/stream morphology and water quality

Aquatic Habitat/Stream Morphology

The project area contains a variety of stream channel types ranging from steep bedrock controlled headwater channels to low gradient, meandering stream channels in valley bottoms. Stream channel and flood-plain dimensions are a function of different sediment transport and deposition patterns. In headwater reaches, the capacity to transport sediment exceeds sediment supply, so erosion is more common than deposition. In stream reaches that flatten and begin to meander, the capacity to transport sediments typically balances the amount of available sediments. Small changes in either sediment availability and/or stream power can cause streams to adjust and sometimes degrade aquatic habitat and water quality (MDEQ, 2004). Extreme flood events can significantly alter the morphological characteristics of stream channels and can also affect the condition of the stream's floodplains and riparian corridors. In some cases, the resulting changes are evident many years after the events (MDEQ, 2004).

Analysis of instream sediment levels is critical to describe existing stream habitat conditions and is especially important in managed watersheds. Roads have been identified as the largest contributing anthropogenic source of sediment in managed watersheds and the interaction between roads and streams ultimately effects stream morphology, aquatic habitat and water quality (Edwards et al., 2016). Therefore, an inventory of NFS roads was performed in 2015 and 2016 focusing specifically on the interaction between roads and streams within the project area.

Results indicate the need for replacement of up to 18 stream culverts. Six of the 18 sites are situated within fish bearing reaches of perennial streams. The remaining 12 sites are located in non-fish bearing reaches of either intermittent or perennial streams which are tributary to downstream habitats. Ten of these culverts are located on Road 1614, which is a bermed road located within grizzly bear security core habitat, culvert replacement on this road will require a forest plan amendment to allow for 30 days of work to occur in the non-denning season in grizzly bear core (chapter 3 – Threatened and Endangered Wildlife Species).

Table 52 summarizes recommended work based on attributes from field data and by road number and stream name in order of priority based on the amount of habitat restricted, fish species present and site conditions. Potential effects include isolation or restricted use of habitats for aquatic species, alteration of stream capacity and energy balance as well as limitation to the natural hydrologic regime of streams which over time could reduce habitat conditions and degrade water quality. These potential effects may not be reflected in current watershed condition framework assessment summaries because effects may have yet to occur, or may be difficult to quantify beyond the reach scale. The current classification for aquatic habitat conditions in all project area streams is “Good” as defined through the watershed condition framework assessment (Project File Exhibit M-26).

Table 52. Stream culvert work identified through field observations in 2015 and 2016

Road No.	Stream	AOP Recommended (Y/N)	Fish Barrier Status	¹Primary Fish Species Affected	Miles of Habitat Restriction
38	Hungry Horse Creek	Y	full	westslope cutthroat trout	1
546	Unnamed tributary to Emery Creek	Y	partial	westslope cutthroat trout	0.15
546	Oliver Creek	Y	partial	westslope cutthroat trout	0.5
590A	Abbot Creek	Y	partial	brook trout	0.75
590G	South Fork Abbot Creek	Y	full	brook trout	0.2
10805	Abbot Creek	Y	none	brook trout	n/a
1614	Remington Creek	N	no fish habitat	westslope cutthroat trout	n/a
1614	Strife Creek	N	no fish habitat	westslope cutthroat trout	n/a
1614	Royal Creek	N	no fish habitat	westslope cutthroat trout	n/a
1614	Oliver Creek	N	no fish habitat	westslope cutthroat trout	n/a
1614	Unnamed tributary to Emery Creek	N	no fish habitat	westslope cutthroat trout	n/a
1614	Unnamed tributary to Emery Creek	N	no fish habitat	westslope cutthroat trout	n/a
1614	Unnamed tributary to Emery Creek	N	no fish habitat	westslope cutthroat trout	n/a
1614	Unnamed tributary to Emery Creek	N	no fish habitat	westslope cutthroat trout	n/a

Road No.	Stream	AOP Recommended (Y/N)	Fish Barrier Status	¹ Primary Fish Species Affected	Miles of Habitat Restriction
1614	Unnamed tributary to Emery Creek	N	no fish habitat	westslope cutthroat trout	n/a
1614	Unnamed tributary to Emery Creek	N	no fish habitat	westslope cutthroat trout	n/a
590B	Unnamed tributary to Abbot Creek	N	none	brook trout	n/a
10129	Unnamed tributary to South Fork Abbot Creek	N	none	brook trout	n/a

¹Primary fish species listed does not preclude the presence of other species. Primary fish species include downstream species likely affected by the existing structure.

Fine sediment levels in streams are regularly monitored on the Flathead National Forest through two different programs. The first program is McNeil core sampling in key westslope cutthroat trout spawning areas by Montana Department of Fish, Wildlife and Parks. This program began in the early 1980s and now includes 26 sites on the forest, four of which are in project area streams. Results of the McNeil core samples within the project area are included in Project File Exhibit M-10 relative to cutthroat survivability threshold values (35 percent) for fine sediment as presented in (MDEQ, 2004). Sample results (percent fines less than 6.35 mm) appear to fluctuate between 20 and 40 percent. However, it is important to understand that the distribution of sediment in streams is dynamic, generally related to the local gradient, and also strongly influenced by seasonal flow regimes. Fines tend to build up during periods of drought and flush out during higher stream flows. Reach-scale stream gradients can change over time as channels adjust to changes in sediment and/or woody material. Based on the data, it is difficult to determine if any long term trends have occurred (Project File Exhibit M-11).

The second program is the Pacific Fish Strategy (PACFISH)/ Inland Native Fish Strategy (INFISH) Biological Opinion (PIBO) monitoring program. The PIBO data set began in 2001, is the most robust data available on the forest, includes 70 sites in both reference and managed watersheds. Several habitat parameters are measured in the PIBO program that directly relate to in-stream sediment, including particle size distribution, percent fines in pool tails, residual pool depth, percent pools, and bank stability. This program allows the evaluation of trends and comparison of reference and managed conditions. Recent assessments of stream channel conditions on the Flathead National Forest indicate that streams in managed and reference watersheds are similar in terms of dimensions, bank stability, the amount of woody material, and the health of riparian vegetation (Kendall 2010; Kendall 2012). However, streams in managed watersheds sometimes have slightly higher levels of fine sediment (C. Kendall, 2010, 2012; Kershner, Roper, Bouwes, Henderson, & Archer, 2004). A single PIBO monitoring site (South Fork Abbot Creek, a managed watershed), exists within the project area while Dudley Creek (another managed watershed) is positioned just outside the project boundary. Evaluation of habitat parameters (Shear Stress Index vs. Median Particle Size and Stream Power Index 2 (sA0.4) vs. Median Particle Size) from these sites reflect similar conclusions to those presented by Kendall (C. Kendall, 2010, 2012) suggesting streams in managed watersheds may have greater sediment supply compared to reference sites (Project File Exhibit M-12). Kendall (2012) further theorizes these results may indicate chronic sediment delivery from the forest road system (Table 50), or recent wildfire (Table 48). While the data from the South Fork Abbot Creek and Dudley

Creek PIBO sites are suggestive, they should be interpreted with caution due to the very small sample size and extreme variability of stream systems.

Furthermore, results from fish habitat inventories conducted on Emery Creek and Hungry Horse Creek in 1996 and 1997 indicated that Hungry Horse Creek and upper Emery Creek provided quality fish habitat. However, these survey results also indicated lower Emery Creek had few pools, sparse woody debris and unstable banks, resulting in a simplified channel and presumably lower fish density. The cause of the channel simplification was due to approximately 1.5 miles of channel restriction associated with NFS Road 11140. The road was relocated outside of the riparian habitat conservation areas and considerable in-channel restoration took place in 1998 by means of adding logs, rootwads and boulders. A select portion of the lower (restored) stream reach and upper (control) reach was re-inventoried in 2015. Both reaches had substantially more frequent but smaller sized pools, substantially more wood, larger sized wood, increased stream bank stability and undercut banks and slightly coarser stream substrate. This indicates an improving trend in fish habitat conditions in Emery Creek. A full report of this stream habitat inventory is presented in Project File Exhibit M-13.

Water Quality

Sediment and nutrients (primarily total nitrogen and total phosphorus) are the principal water quality parameters of concern when analyzing the effects of both natural and anthropogenic disturbances in forested watersheds. Natural ranges of these water quality parameters are essential to maintaining natural ecologic function but can also impair these same functions when values fall outside the natural range of variation. For example, too much sediment in streams can impair water quality and also degrade macroinvertebrate and fish habitat by filling interstitial spaces and pools, and decrease inter-gravel dissolved oxygen concentrations; both of which inhibits fish reproduction (Newcombe & MacDonald, 1991). Likewise, increased nutrient loading to surface waters can increase autotrophic production which can both benefit as well as negatively impact the biotic resource (principally fish and macroinvertebrate communities) depending on other watershed and climatic variables. The natural amount of nutrients or sediment in a water body varies spatially and temporally depending on the type of stream system, hydrogeologic setting, climate, and time since natural disturbance (e.g. wildfire).

No waterbodies within the project area or affected subwatersheds are identified for pollutant impairments on the State's 2016 303(d) list (MDEQ, 2016). The State has identified the South Fork of the Flathead River below Hungry Horse Dam to the confluence with the Middle Fork of the Flathead River (approximately 5.3 stream miles) as impaired due to flow regime alterations associated with operation of Hungry Horse Dam.

Water quality beneficial use classification (Montana Department of Environmental Quality Administrative Rules) within the analysis area subwatersheds are all identified as B-1. B-1 waters are to be maintained suitable for drinking, culinary, and food processing purposes, 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 (MDEQ, 2017a). Additionally, the State has assigned individual waterbodies unique water quality assessment categories. Waterbodies assigned to Water Quality Category 1 have been assessed for all beneficial uses and are determined to be fully supporting all those uses (Hungry Horse Creek, Hungry Horse Reservoir). Water Quality Category 3 waterbodies do not have use-supported determinations as insufficient data is available to assess the use-support of any applicable beneficial use (Emery Creek, Margaret Creek, Tiger Creek). Category 4C waterbodies have identified threats or impairments resulting from pollution categories such as dewatering or

habitat modification and, thus, a total maximum daily load is not required (South Fork of the Flathead River below Hungry Horse Reservoir).

Numeric and narrative surface water quality standards have been developed for many parameters to protect human health and aquatic life. Numeric standards are identified in Department Circular WQ-7 (MDEQ, 2017a) while narrative standards can be found in the General Prohibitions of the surface water quality standards (MDEQ, 2014a). Water quality data have been collected recently on streams within the analysis area subwatersheds (MDEQ, 2017b). These data are presented in Table 53 relative to numeric and narrative standards set forth by the State. Mean values of measured water quality parameters presented in Table 53 do not exceed numeric standards indicating water quality in these streams (and associated tributaries) is typically good. Estimates for average background total suspended solids (TSS) concentrations for watersheds in this geoclimatic region is 3.5 mg/l, with a range of 0.6 to 12.7 mg/l (USDA Forest Service, 2011a).

Stream water temperature is another key water quality parameter that impacts aquatic ecosystems and defines distribution of native bull trout and cutthroat trout (Segura, Caldwell, Sun, McNulty, & Zhang, 2014). While there is conflicting information in the peer-reviewed literature about the relative ranking of contributing factors to stream temperature increases, the importance of stream shading to reduce the amount of incoming solar radiation is well documented (Isaak et al., 2010; Johnson, 2004; Larson & Larson, 1996) and is the primary variable affected by most natural and anthropogenic disturbances. The literature suggests some level of water temperature increase may result in response to reduced stream shading (Isaak et al., 2010; Johnson, 2004; Larson & Larson, 1996) and climate change (Isaak et al., 2010; Segura et al., 2014). While insufficient temperature data (spatial and temporal) exist on area streams to clearly document trends in stream water temperatures, it is safe to assume some level of stream water temperature increase resulted from road construction and/or land clearing specifically in lower Emery Creek (NFS Road 11140, road construction adjacent to stream), Hungry Horse Creek (NFS Road 38), and Abbot Creek (land clearing associated with Coram pastures). Approximately 1.5 miles of the lower portion of original NFS Road 11140 was relocated away from Emery Creek in 1998 due to aquatic concerns. While this action has successfully reduced road related sediment contributions to lower Emery Creek, restoration of streamside shading (provided by mature conifers) is difficult to attain over such a short time frame. Similarly, existing NFS Road 38 parallels Hungry Horse Creek for approximately 3.9 miles encroaching on the stream periodically and eliminating shading vegetation in these areas, however, interruption of stream shading on Hungry Horse Creek is unlikely to be expansive enough to result in measurable downstream temperature increases. Likewise, both Emery Creek and Hungry Horse Creek have upland watersheds supporting healthy riparian communities (Project File Exhibit M-26) promoting cool and clean water. Furthermore, water temperature in these streams does not impair any beneficial uses as defined by the State.

Land Clearing associated with Coram pastures occurred in the early 1900s and has been maintained, effectively reducing stream shading for approximately 0.6 miles of Abbot Creek on National Forest Lands. Again, stream temperature data do not exist for this reach of Abbot Creek however, the degree of near stream canopy reduction suggest some level of stream water temperature increase may have resulted from these actions and continues today. However, any increase in stream temperature associated with the existing condition has not resulted in any beneficial use change as defined by the State. For all streams, effects to stream water temperature occurring from canopy reduction are variable across the landscape depending on aspect and groundwater influx which may offset temperature increases associated with canopy loss in those areas. Any effects of stream shading loss on water temperatures is likely to persist until canopy

cover from streamside vegetation is sufficient to restore pre-disturbance shading attributes at which time, restored stream shading may buffer affected streams from additional warming related to climate change (Isaak et al., 2010).

Table 53. Measured water quality parameters in project area streams relative to State standards

Subwatershed (HUC12)	Stream Name	Site ID	Period of Record	Water Quality Parameter							³ Narrative Standard
				¹ Total Nitrogen (µg/l)	² Numeric Standard (µg/l)	¹ Total Phosphorus (µg/l)	² Numeric Standard (µg/l)	¹ Dissolved Oxygen (mg/l)	¹ Numeric Standard (mg/l)	¹ Total Suspended Sediment (mg/l)	
Emery Creek	Emery Creek	C08EMRYC01	2007-2008	0.032	325	0.025	25	no data	5	41.33	No increases are allowed above naturally occurring concentrations of sediment or suspended sediment (except as permitted in 75-5-318, MCA). Settle able solids, oils, or floating solids, which will or are likely to create a nuisance or render the waters harmful, detrimental, or injurious to public health, recreation, safety, welfare, livestock, wild animals, birds, fish, or other wildlife.
Hungry Horse Creek	Hungry Horse Creek	C08HHRDC20	2004	0.73	325	0.005	25	4.56	5	0	
Hungry Horse Reservoir – Aurora Creek	South Fork Flathead River (below Hungry Horse Dam)	HUN101	2009-2015	128	325	13	25	9.96	5	1	

¹Average of measured values.²Numeric standards presented in DEQ Circular 12A (MDEQ, 2014b). Standards may be seasonally applicable.³Numeric standards presented in Circular 7 (MDEQ, 2017a), narrative standards presented an ARM 17.30.623 (f).⁴Value excludes outlier in the dataset (point measurement captured seasonal spike at 270 µg/l).

Aquatic Species

In order to characterize the needs of many diverse aquatic species, the Forest Service relies on the use of management indicator species to assess habitat. Meeting the habitat needs for native trout species will meet the needs for other aquatic species. The Flathead National Forest LRMP has identified westslope cutthroat trout (*Oncorhynchus clarki lewisi*) and bull trout (*Salvelinus confluentus*) as management indicator species since they are native to the forest and sensitive to habitat degradation.

There are three separate analysis areas for aquatic species, the Abbot Creek subwatershed, Lion Lake, and the South Fork Flathead River subbasin. The Abbot Creek subwatershed primarily contains non-native species and is divided into two distinct fish population reaches by a Montana Fish Wildlife and Parks (MFWP) constructed fish barrier at the U.S. Highway 2 crossing (about 0.4 miles upstream from confluence with Middle Fork Flathead River). Lower Abbot Creek primarily contains non-native rainbow trout (*Oncorhynchus mykiss*) and hybrid rainbow x cutthroat trout. Lower Abbot Creek also contains native sculpins (*Cottus spp.*), sparse numbers of cutthroat trout (unknown purity), sparse largescale suckers (*Catostomus macrocheilus*) and occasional bull trout (*Salvelinus confluentus*). Bull trout do not spawn in Abbot Creek and it is not designated critical habitat. Fish biologists presume that bull trout are intermittently straying into Lower Abbot Creek (below the barrier) to forage. No activities are proposed in Lower Abbot Creek in any alternative. A map showing the distribution of fish in Abbot Creek and location of migration barriers are presented in Project File Exhibit M-14. Abbot Creek flows into Middle Fork Flathead River, which is designated as bull trout critical habitat.

Upstream of U.S. Highway 2, Abbot Creek and South Fork Abbot Creek contain non-native brook trout (*Salvelinus fontinalis*). Recent population samples captured no other species. Although the original source of this invasive species is unknown, brook trout are now firmly established and the native cutthroat trout is functionally extirpated from Abbot Creek. Brook trout have access to almost the entire watershed but approximately 0.2 miles of the headwaters of South Fork Abbot Creek is blocked by a poorly designed road culvert. Because brook trout are numerous in Abbot Creek, the barrier does not appear to have negatively impacted their viability.

Lion Lake is a 39 acre lake located on Whelp Creek controlled by a dam at the outlet. The lake level was artificially raised a few feet during Hungry Horse Dam construction and has remained there since. Because the inlet stream is fishless and the outlet is blocked by a dam, the lake is separate from the other aquatic analysis areas. The lake has abundant pumpkinseed sunfish (*Lepomis gibbosus*), rainbow trout, yellow perch (*Perca flavens*), largemouth bass (*Micropterus salmoides*), and northern pike (*Esox lucius*) and also scarce numbers of lake whitefish (*Coregonus clupeaformis*), black crappie (*Pomoxis nigromaculatus*) and white sucker (*Catostomus commersoni*) (Project File Exhibit M-25). None of these species are native and all were introduced by authorized or unauthorized stocking. All but rainbow trout are wild and self-sustaining populations. Montana Fish Wildlife and Park stocks between 100 and 3,000 rainbow trout in Lion Lake annually. Lion Lake has no bull trout or bull trout critical habitat.

The South Fork Flathead River subbasin, supports an intact assemblage of native species. South Fork Flathead River subbasin is isolated from the rest of the Flathead Lake basin due to the Hungry Horse Dam. This dam, completed in 1953, blocks all upstream and (presumably) downstream movements. After the Reservoir filled, fish adapted to their new environment and now use the reservoir rather than Flathead Lake for that part of their life history. Previously deep drawdowns of the reservoir (up to 85 feet below full pool) negatively impacted the food web and fish production. This practice ceased in 2004 and now the reservoir is only drawn down a

maximum of 20 feet below full pool. This has greatly stabilized primary productivity of the reservoir, which in turn has benefitted fish populations.

Westslope cutthroat trout are present in the South Fork Flathead River subbasin as adfluvial, fluvial and resident life forms. All life forms spawn in tributary streams in the springtime when water temperature is about 10 degrees Celsius and flows are high. Westslope cutthroat trout spawn when they are about four or five years old, and only a few survive to spawn again (McIntyre & Rieman, 1995). Fry emerge in late June to mid-July and spend one to four years in their natal streams. Resident cutthroat trout spend their entire lives in tributary streams, while migratory forms may travel a hundred kilometers as they move between Hungry Horse Reservoir and spawning habitat. The subbasin is considered a stronghold for westslope cutthroat trout (Shepard, May, & Urie, 2005) and classified as a high-integrity subbasin in the Interior Columbia Basin Ecosystem Management Project (Quigley, Haynes, & Graham, 1996). In order to conserve this valuable population, MFWP has eradicated non-native fish populations in scattered lakes throughout the subbasin. At the time of this writing, Sunburst Lake and Handkerchief Lake are the last known lakes containing non-native species.

In the project area, westslope cutthroat trout are found in Hungry Horse Reservoir as well as Emery Creek, Hungry Horse Creek and suitable habitats of their respective perennial tributaries (e.g. Remington, Oliver, Tiger, Margaret, and Lost Mare Creeks). These streams contain spawning and rearing habitats for the larger meta-population of Hungry Horse Reservoir westslope cutthroat trout. Both the populations in the streams and the larger meta-population in the reservoir are at a low risk of extinction since the population size is robust and the migratory form is present (Rieman & McIntyre, 1993). Genetic testing of streams in the South Fork Flathead River drainage (above Hungry Horse Reservoir) indicate these populations of westslope cutthroat trout are genetically pure (greater than 99 percent). Genetic sampling results for streams within the project area are presented in Project File Exhibit M-15.

Historically, impacts to cutthroat trout in the project area have been isolated to habitat degradation in the lower 1.5 miles Emery Creek related to road encroachment and three fish barriers (two on Emery Creek and one on Hungry Horse Creek). Road encroachment resulted in a loss of woody debris, reduced habitat complexity, unstable banks, excessive sedimentation and loss of shade in this portion of Emery Creek and may have reduced the growth and survival rate of cutthroat trout. As detailed under the existing condition for “Aquatic Habitat”, encroaching portions of NFS Road 11140 in lower Emery Creek have been relocated away from the stream channel and aquatic habitats appears to be trending towards improvement. The impact of this to cutthroat trout has not been monitored but it is assumed that cutthroat trout are responding with improved growth and survival. These assumptions are further supported through Montana Fish Wildlife and Parks redd count data which indicate westslope cutthroat trout population is robust and stable (Project File Exhibit M-16). Two portions of NFS Road 546 totaling approximately 0.45 miles are still encroaching on the stream in upper Emery Creek and continue to effect adjacent water quality and aquatic habitats.

There are three known barriers that block cutthroat trout upstream movements. The culvert on NFS Road 38 at Hungry Horse Creek is not properly sized and has gradually resulted in a waterfall at the outlet that blocks all upstream fish passage restricting access to approximately one mile of potential habitat. It is not known if any cutthroat trout persist above the barrier. Two culverts on NFS Road 546, one on Oliver Creek and one on an unnamed tributary to Emery Creek appear to block upstream movement of juvenile cutthroat trout, however fish biologists believe adult fish can navigate upstream. This “partial fish barrier” is likely reducing survival of some

juvenile cutthroat trout but the impact to the overall Emery Creek population is likely low given the amount of existing habitat available to westslope cutthroat trout elsewhere in the Emery Creek subwatershed.

Bull trout are classified as Threatened Species and protected under the Endangered Species Act (ESA) of 1973, as amended. They exist in the South Fork Flathead River subbasin with an adfluvial migratory life form. Adult bull trout spawn in various tributary streams in the fall creating “redds” (spawning nests). Fry emerge from redds in late winter. Juvenile fish rear in rivers until age two or three and then move downstream to Hungry Horse Reservoir to mature. Bull trout become sexually mature around age five to seven and return to their natal stream to spawn and may do so repeatedly over their lifetimes (Fraley & Shepard, 1989; Goetz, 1989). The South Fork Flathead subbasin is considered a “stronghold” for bull trout, with stable populations based on redd count data (Project File Exhibit M-30).

In order to describe habitat utilization of this mobile species, the U.S. Fish and Wildlife Service (2015) distinguishes “Spawning and Rearing” (SR) habitat from “Foraging, Migratory and Overwinter” (FMO) habitat. Spawning and rearing habitat are discrete stream reaches that are strongly linked to groundwater upwellings or downwellings typically found in bounded alluvial floodplains (Colden V. Baxter, Frissell, & Hauer, 1999; Colden V. Baxter & Hauer, 2000; Bean, 2012). There are 10 streams in South Fork Flathead subbasin with SR habitat, all of which are upstream from the project area. Habitat downstream of those SR habitats, including Hungry Horse Reservoir, is FMO habitat. There are no SR streams within the Hungry Lion project area. While the reservoir is designated as critical habitat, none of the project area streams are designated as bull trout critical habitat and Montana Fish Wildlife and Parks classifies bull trout abundance in project streams as either rare, incidental or unknown (Project File Exhibit M-25). The analysis assumes bull trout do occasionally enter the lower portions of Emery Creek or Hungry Horse Creek to forage and thus considers these streams FMO habitat.

In order to prioritize 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. Each watershed is scored as “functioning appropriately” or “functioning at risk” or “functioning at unacceptable risk” based on bull trout needs, regardless of whether bull trout actually utilize the watershed or if the condition is due to human impacts or natural state. This effort is focused on spawning and rearing habitats and has little meaning on incidental foraging streams such as in the project area. Three of the five watersheds in the project area were identified to be “functioning at unacceptable risk”, these include: Abbot Creek, Aurora Creek, and Emery Creek. Further information on the status of bull trout baselines in the project area are found in the biological assessment Project File Exhibit M-28.

Other native aquatic species present in the South Fork Flathead River subbasin include mountain whitefish, peamouth (*Mylocheilus caurinus*), tailed frogs (*Ascaphus montanus*) northern pikeminnow, (*Ptychocheilus oregonensis*), largescale sucker, and sculpin species (*Cottus sp.*). Whitefish, peamouth, pikeminnow and suckers are found in larger streams and rivers such as lower Hungry Horse Creek. They are regarded as “habitat generalists” and do not appear to be sensitive to changes in sediment or habitat complexity (W. B. Scott & Crossman, 1973). Sculpins may be sensitive to stream substrate changes. Sculpins are not considered migratory and tend to reside in small areas their entire lives.

Environmental Consequences

The extent to which timber harvest activities, transportation management, mechanical fuels treatments and prescribed fire affect hydrological processes, erosion and sediment delivery, aquatic habitat and water quality, and aquatic species largely depends on site characteristics (topography, soil, aspect, and precipitation patterns), burn severity, proximity to streams, harvest methods, and the extent of additional travel infrastructure (roads) needed. Primary aquatic concerns are alteration of hydrologic processes, erosion, and sediment/nutrient delivery potential to area streams. These variables ultimately affect water quality and can have negative effects on aquatic habitat, channel morphology, and aquatic species. Therefore, analysis of alternatives focuses on these elements making qualitative and quantitative comparisons to the existing condition/no-action alternative. Additionally, some elements of the action alternatives are not expected to have any measurable effects.

Direct impacts to stream channels from contemporary forest management activities are rare due to streamside management zones, riparian habitat conservation areas, best management practices, and executive orders for floodplains and wetlands. Culvert removals, aquatic organism passage (AOP) projects, road reclamation and storage are common exceptions, although these activities are generally designed to improve aquatic resources in the long term (Craig N. Kendall, 2015b). The action alternative is designed to minimize soil disturbance through utilization of alternative harvest methods in appropriate locations (skyline) and existing road systems. Design features of the action alternatives were also developed to distribute potential effects of prescribed fire and culvert replacements both spatially and temporally across the landscape.

Uncertainties Associated with Effects Analysis

Hydrologic processes are complex, but more importantly probabilistic, meaning that they are highly variable and displayed according to the likelihood of occurrence. This presents a challenge when predicting effects in a NEPA framework. The potential effects of management activities must be considered in terms of risk. The term potential is used throughout the analysis when referring to hillslope erosion and sediment delivery because the nature of the effects is probabilistic. For example, a temporary road could be a substantial source of sediment if a 25 year thunderstorm event occurred during project implementation. However, a high intensity thunderstorm may not occur between the time the road would be constructed and fully rehabilitated.

Separate interfaces of the WEPP model are used to analyze potential erosion and sediment delivery from proposed harvest units and temporary roads. Predicted erosion values may only be within 50 percent of the true value. Erosion rates are highly variable, and most models can predict only a single value. Research has shown that observed values vary widely for identical plots or the same plot from year to year (W. J. Elliot, 2013; Tysdal, Elliot, Luce, & Black, 1999). In addition, observed erosion rates can be very different from those predicted by WEPP interfaces (Larsen & MacDonald, 2007).

Alternative 1 (no-action alternative) – Direct, indirect, and cumulative effects

Hydrologic processes

Under the no-action alternative, the existing condition as described in the Affected Environment would persist. Hydrologic processes would be unaltered through implementation of prescribed

fire, fuels reduction or timber harvest on NFS lands. Existing stream aligned culverts identified as being “at risk” due to design capacity or alignment issues (Project File Exhibit M-21) would continue to alter hydrologic processes relative to natural conditions although these effects may not be measurable beyond the hillslope scale. Similarly, existing portions of NFS Road 546 identified as having stream capture potential would continue to alter near stream hydrologic processes at the hillslope and reach scale. However, natural disturbances (wildfire) and climatic variability would be the primary mechanisms continuing to drive changes in hydrologic processes over time.

Hillslope erosion and sediment delivery

Under the no-action alternative, the existing condition as described in the *Affected Environment* would persist. On NFS lands, any current soil erosion or sediment delivery outside of existing roads would decrease as vegetation returns to soils that lack plant cover. However, existing stream aligned culverts identified as being “at risk” due to design capacity or alignment issues would remain on the landscape. These legacy disturbances would maintain current risk of failure and associated sediment delivery as depicted below in Table 60. Furthermore, potential sediment delivery presented in Table 60 associated with hypothetical culvert failures represent the cumulative effect associated with failure of all culverts in the same year. While the likelihood of this scenario is small, cumulative values are presented for the purpose of comparison relative to potential sediment delivery generated through implementation of the action alternatives. It is important to disclose that replacement of culverts identified in action alternatives do not entirely preclude potential failure risk. Rather, failure risk is reduced through improved flow capacity and proper alignment and more culvert replacements generally represent larger reductions in sediment delivery potential relative to failure scenarios.

Similarly, portions of NFS Road 546 which are vulnerable to stream capture would continue to contribute sediment to Emery Creek and maintain the current level of risk associated with stream capture. Wildfires could also cause short-term increases in soil erosion and sediment delivery. Overall, soil erosion and sediment delivery rates would fluctuate with natural changes in vegetation and in response to climatic variability.

Aquatic habitat/channel morphology and water quality

Under the no-action alternative, the existing condition as described in the affected environment would persist. No additional disturbance would result from the no-action alternative and therefore no direct additional sediment delivery would occur. However, indirectly under the no-action alternative, sediment delivery and subsequent habitat and water quality degradation associated with “at risk” stream aligned culverts and road segments having stream capture potential would not be mitigated. As a result, the current risk to aquatic habitat and water quality would remain. Potential sediment delivery associated with culvert failure is quantified in Table 60. Any additional changes to aquatic habitat/channel morphology and water quality would be a product of natural processes, climate change variability, ongoing development and use of the National Forest (not related to the Hungry Lion Project), or private land uses.

Aquatic species

Under the no-action alternative, the existing condition of aquatic species would persist. No change would happen to Lion Lake’s fishery. However, indirect effects to aquatic habitat and water quality explained above would have potential to affect aquatic species in the other analysis areas. Existing barriers to aquatic organism passage would remain on the landscape and continue to restrict movement in Emery Creek tributaries, Hungry Horse Creek, Abbot Creek and South

Fork Abbot Creek. Additional sediment delivery risk associated with culvert failure or road capture could jeopardize the health and survivability of juvenile fish for two years or longer depending on the magnitude of habitat effects (Furthermore, potential sediment delivery presented in Table 60 associated with hypothetical culvert failures represent the cumulative effect associated with failure of all culverts in the same year. While the likelihood of this scenario is small, cumulative values are presented for the purpose of comparison relative to potential sediment delivery generated through implementation of the action alternatives. It is important to disclose that replacement of culverts identified in action alternatives do not entirely preclude potential failure risk. Rather, failure risk is reduced through improved flow capacity and proper alignment and more culvert replacements generally represent larger reductions in sediment delivery potential relative to failure scenarios).

Potential effects would be most pronounced at the reach scale in Emery Creek but are unlikely to be measurable at the population scale (South Fork Flathead River). Aside from potential effects associated with increased sediment delivery risk, changes to aquatic species would most likely be a product of natural processes, ongoing development and use of the National Forest, or private land uses. Bull trout and westslope cutthroat trout populations would remain viable and healthy.

Alternative 2 – Direct & indirect effects

Hydrologic processes

Surface disturbing activities can change hydrologic processes by altering soils through compaction (reduced infiltration), removing ground cover (Karr et al., 2004), modification of natural flow paths via hydrologic connectivity through roads and skid trails, as well as by altering interception, evapotranspiration, snow accumulation and ablation rates. These factors ultimately can affect water yield as well as the magnitude and timing of peak flows. Changes in water quantity, particularly changes in the magnitude and frequency of peak flows, may contribute to increased erosion and scour of the streambed and banks which can compromise habitat conditions for aquatic organisms. For this issue the assumed direct linkage between vegetation disturbance (equivalent clearcut area) and hydrologic response (i.e., peak flows and water yield) (Bosch & Hewlett, 1982; Stednick, 1996) is used to determine the effects of the proposed activities on the hydrologic environment relative to estimated pre-management range of variability and within the context of natural processes such as wildfire.

Literature review conducted by Troendle and others (2009) conclude that light to moderate prescribed fire has little effect on hydrologic processes. This is largely because only a small percentage of the vegetation is affected and net changes in infiltration characteristics are minimal (Troendle et al., 2009). Therefore, the effects of prescribed fire on hydrologic processes are not carried forward for analysis. Similarly, based on existing research relative to vegetation recovery and water yield (Callahan, 1996; Grant et al., 2008), combined with the scale and nature of proposed fuels reduction (understory removal), effects analysis for these actions relative to water yield are also not carried forward for analysis.

Harvest activities

Vegetation removal can affect hydrologic processes through reductions in interception, evapotranspiration, snow accumulation and ablation rates. Most of the literature agrees that timber harvest can increase the amount of runoff (or water yield) from the harvested area (Keppeler & Ziemer, 1990; Moore & Wondzell, 2005; Stednick, 1996). Findings from Mica Creek Experimental Forest in northern Idaho indicate that water yield varies by type of treatment

(thinning versus clearcut), season and climate as suggested by Callahan (1996). Hubbart and others (2007) concluded that cumulative effects of timber harvest practices decreased with increasing distance from harvest treatments areas. These findings support conclusions based from comprehensive literature reviews conducted by MacDonald and Stednick (2003), Stednick (1996), and Bosch and Hewlett (1982) suggesting an equivalent clearcut area of at least 15 to 25 percent is needed to produce a measureable water yield increase during wet years, depending on several environmental variables. Table 54 displays estimated equivalent clearcut area values associated with actions outlined under alternative 2 including estimated values associated with other land uses in each of the affected analysis areas.

Table 54. Estimated ECA associated with alternative 2

HUC12	% ECA			
	Existing	Alternative 2	Historic Maximum	Losensky Estimated Low-end Range of Natural Variability
Abbot Creek	16.2	23.4	60.8	5-24
Emery Creek	3.2	19.2	8.9	5-24
Hungry Horse Creek	2.6	9.7	21.7	5-24
Hungry Horse Reservoir-Aurora Creek	6.7	8	14.1	5-24
Hungry Horse Reservoir-Spring Meadows Creek	23.3	27.3	46.8	5-24

Under alternative 2, proposed timber harvest and fuels reduction would reduce canopy cover increasing equivalent clearcut area values in all affected subwatersheds (Table 54). However, change in equivalent clearcut area values would not result in measurable increases in water yield when compared to the estimated low end range of natural variability as displayed in Table 54 and explained in detail in Project File Exhibit M-3. It is important to disclose that equivalent clearcut area change in the Emery Creek subwatershed exceeds 15 percent relative to the existing condition (16 percent increase, assuming all harvest is completed the same year). Thus, associated changes in water yield may occur following proposed disturbance during wet years. However, because these changes are relative to the existing condition and fall within estimates for low-end range of natural variability (Table 54), associated water yield increases are also anticipated to be within this natural range. Consequently, equivalent clearcut area changes and associated direct or indirect hydrologic responses would emulate historic variability. Predicted equivalent clearcut area values would return to existing conditions within approximately 11 years for the Abbot Creek subwatershed, 35 years for the Emery Creek subwatershed, 24 years for Hungry Horse Creek subwatershed, two years for the Hungry Horse Reservoir-Aurora Creek subwatershed, and four years for the Hungry Horse Reservoir-Spring Meadows Creek subwatershed.

Furthermore, because estimated equivalent clearcut area values under alternative 2 are within or near the low end range of natural variability (Table 54) and well below historic maximums (except for Emery Creek subwatershed as detailed in Project File Exhibit M-3), these data suggest existing channel and aquatic habitat conditions are capable of handling increases in peak flows without lingering effects, and/or; recurrence of large natural watershed disturbances and associated increases in peak flow events may be a principal mechanism for development and maintenance of watershed processes observed under the existing condition. Because the change in equivalent clearcut area values relative to the low end range of natural variability for each subwatershed are less than the minimum threshold required for detecting changes in peak flows,

measurable increases in small to moderately sized peak flow events (relative to the low end range of natural variability) are not anticipated under alternative 2.

Temporary and intermittent stored service roads

Alternative 2 proposes construction of up to 6.7 miles of temporary road and reconstruction of approximately 7.6 miles of existing road templates which would be added back to the system and stored once project operations were complete. Compaction of soils from construction of new roads results in less infiltration and greater overland flow. When this increased flow is intercepted by road networks that cross subsurface flowpaths and change flow routing, both the peak magnitude and time of peak concentration may change in a watershed (Grant et al., 2008). This effect should roughly scale with percentage of area compacted or length of road network that is directly connected to streams or both but is highly dependent on the location of roads in the landscape (Grant et al., 2008). The effect of roads on the size of peak flows can be minimized through implementation of best management practices that reduce road/stream connectivity, road density and limit proximity of roads relative to stream channels (Troendle et al., 2009). Alternative 2 would require all road systems (including temporary roads) to be in compliance with both State and Federal BMP standards which include site-specific practices to minimize hydrologic connectivity with streams and wetland habitats. No new roads are located within 10 meters of mapped lentic riparian habitats and therefor would not influence groundwater in these areas (Project File Exhibit M-23). The data indicates that road density attributes would not appreciably change relative to the existing condition through implementation of alternative 2 (Table 55).

Table 55. Road related attributes affecting hydrologic processes

HUC12 Name	¹ Total Road Density (mi/mi ²)			² Hydrologically Connected Road Length (mi)		
	Existing Condition	Alternative 2	³ Increase (mi/mi ²)	Existing Condition	Alternative 2	³ Increase (mi)
Abbot Creek	3.0	3.1	0.08	4.99	5.25	0.26
Emery Creek	1.2	1.4	0.27	1.07	0.68	-0.39
Hungry Horse Creek	0.4	0.5	0.08	0.41	0.45	0.04
Hungry Horse Reservoir-Aurora Creek	1.4	1.4	0.00	0.54	0.54	0.00
Hungry Horse Reservoir-Spring Meadows Creek	2.3	2.4	0.02	1.7	1.72	0.02

¹All roads including non-Forest System Roads and hydrologically connected historical road lengths.

²All road lengths within 50 feet of mapped NHD streams. Excludes road lengths associated with historic road/stream crossings (stream aligned culverts removed).

³Increase relative to the Existing Condition.

Effects of temporary road construction and use on hydrologic processes would persist from the date of construction until the vegetative component reaches hydrologic recovery following reclamation (approximately 5 to 65 years based on local climate and vegetation recovery curves presented in Callahan (1996)). In general, less disturbance associated with road construction is better as hydrologic processes are altered over a smaller area. During implementation, alternative 2 would result in a temporary increase of approximately 0.38 miles of road/stream hydrologic connectivity (Table 55). This increase would be associated with construction of new temporary roads (0.3 mile increase) and reconditioning of existing templates (0.08 mile increase) which

would be added back to the Forest Road System in a stored condition. However, following rehabilitation hydrologic processes would be restored to conditions similar to those of the adjacent landscape for all temporary roads. Furthermore, relocation of portions of the upper Emery Creek Road (NFS Road 546) would reduce road/stream hydrologic connectivity by an additional 0.45 miles in the Emery Creek subwatershed resulting in a net decrease of 0.39 miles in road/stream hydrologic connectivity. Rehabilitation of temporary roads utilizing existing road templates (1.5 miles total and 0.02 miles hydrologically connected) would benefit hydrologic function in these areas relative to the existing condition. However, effects from restoration are not anticipated to be measurable beyond the hillslope scale.

It is important to note that roads proposed for storage (intermittent stored service roads) would be stored in a condition similar to what is currently on the landscape. While these efforts are beneficial to water quality in the form of reduced road surface erosion and road/stream interaction, they do not restore soil infiltration capacity or soil productivity to the same degree as road surfaces which are ripped or fully recontoured (Luce & Black, 1999). Thus, road prisms remaining on the landscape continue to influence hydrologic processes to some degree at the hillslope scale, although this does not represent a change from the existing condition.

Road relocation

Relocation of two portions of the upper Emery Creek Road (NFS Road 546) totaling approximately 1.4 miles is an action common to all action alternatives. Both road segments are encroaching on Emery Creek and may be affecting hydrologic processes adjacent to the stream. Relocation would reduce road stream hydrologic connectivity by approximately 0.45 miles in the Emery Creek subwatershed relative to the existing condition. Abandon portions of the road would be fully recontoured to promote hydrologic recovery which is expected within 5 to 65 years. Effects of this action are included above in Table 55, this action would not alter existing road density.

Historic trail added back to system

Alternative 2 would designate 12.2 miles of Forest Service system trail over historic National Forest system trails. Designation would result in no change in hydrologic processes relative to the existing condition. The original trail templates have received consistent levels of use since officially being removed from the trail system.

Accessible fishing pier on Lion Lake

All action alternatives propose construction of an accessible fishing pier on Lion Lake and accessibility improvements to the Lion Lake trail. Construction of the permanent facility would alter hydrologic processes in the construction area through addition of fill material, compaction of soils, and removal of vegetation in the lake shore environment. These actions may have localized effects to hydrologic processes affecting lake water infiltration and recharge. However, effects are unlikely to produce any measurable changes in lake water levels or lake water residence times.

Summary

Changes in equivalent clearcut area values would not result in measurable increases in water yield when compared to the estimated low end range of natural variability as displayed in Table 54 and explained in detail in the Project File Exhibit M-3. Relative to the existing condition, temporary roads and proposed intermittent stored service roads would temporarily increase road/stream hydrologic connectivity by 0.38 miles during implementation which would be reduced to 0.08 miles once rehabilitation of temporary roads is complete. The combination of successful

application of effective BMPs, with the limited size and spatial distribution of associated increases (Table 55), is unlikely to measurably change hydrologic processes beyond the hillslope scale. Relocation of NFS Road 546 would reduce road/stream hydrologic connectivity in the Emery Creek subwatershed by an additional 0.45 miles across all alternatives. Hydrologic processes would recover on rehabilitated portions of the reroute over time (5 to 65 years) and be most evident at the hillslope scale as reestablishment of near stream vegetation and decompaction of the existing road template. The addition of an existing trail to the forest trail system would not alter hydrologic processes from the existing condition and construction of an accessible fishing pier on Lion Lake is not anticipated to produce measurable changes in hydrologic processes affecting the lake.

Hillslope erosion and sediment delivery

It is generally acknowledged that wildfire is the dominant disturbance mechanism driving soil erosion and sediment delivery in forested ecosystems (W. J. Elliot, 2013; Wondzell, 2001). It is also understood that management actions utilizing silvicultural treatments to modify stand composition, structure, and stocking (including mechanical fuel treatment, and prescribed fire) may help reduce the long-term risk of large stand replacing fires (Wondzell, 2001). However, such actions may also create additional surface disturbance through the use of roads (existing, re-opening or construction of new roads) and heavy equipment increasing erosion and sediment delivery potential until such disturbances are effectively rehabilitated.

Hillslope erosion and sediment delivery following ground disturbance is a function of several interacting factors, but for a given location and rainfall intensity the key concerns are the amount of soil compaction and loss of surface cover (Wagenbrenner, MacDonald, Coats, Robichaud, & Brown, 2015). Ground disturbance associated with alternative 2 include harvest activities (e.g. skid trails and landings), prescribed fire, road construction and use, road BMPs (drainage), replacement of stream aligned culverts, and construction of an accessible fishing pier on Lion Lake. Estimated sediment delivery resulting from proposed activities are summarized for each of the affected subwatersheds in Table 56. Effects on hillslope erosion and sediment delivery are discussed in further detail by proposed disturbance mechanism below. Natural stream processes would eventually transport any delivered sediment downstream to the Flathead River system (Abbot Creek subwatershed) or Hungry Horse Reservoir (Emery Creek subwatershed, Hungry Horse Creek subwatershed, Hungry Horse Reservoir-Spring Meadows Creek subwatershed).

The Hungry Horse Reservoir-Aurora Creek subwatershed was not included in the sediment delivery results because harvest activities were not anticipated to produce any sediment delivery. There will be no culvert replacements or removals, prescribed fire, temporary roads, or ISS road changes occurring in this subwatershed, and the adoption of the trail system is not anticipated to change sediment delivery. The sediment delivery to Lion Lake from the proposed fishing pier would be difficult to measure given effectiveness of BMPs. This is true across all alternatives and will not be included in any of the tables displaying estimated sediment delivery.

All proposed activities would be in compliance with both State and Federal BMP standards which include site-specific practices to minimize hydrologic connectivity with streams and wetland habitats. Results from the 2016 Montana BMP Monitoring Report (MDNRC, 2016a) show that across all ownerships, BMPs were effective in protecting soil and water resources 98.9 percent of the time, which means that eroded material does not reach draws, channels, or floodplains. Similarly, all site appropriate Inland Native Fish Strategy (INFISH) riparian habitat conservation areas buffers would apply to streams and wetlands further protecting these sensitive areas hydrologically from proposed treatments (USDA, 1995). Site appropriate INFISH riparian habitat

conservation areas are generally greater than state required buffers providing additional protection to streams and wetlands.

Table 56. Potential sediment delivery associated with implementation of alternative 2

Action	Abbot Creek			Emery Creek			Hungry Horse Creek			Hungry Horse Reservoir-Spring Meadows Creek		
	² Annual Sediment Delivery Potential (tons)											
	⁴ 2018	⁴ 2019	2020	⁴ 2018	⁴ 2019	2020	⁴ 2018	⁴ 2019	2020	⁴ 2018	⁴ 2019	2020
¹ Road Construction/Use	1.42 (0.1%)	0.42 (0.03%)	0	3.44 (0.69%)	1.26 (0.25%)	0	0.98 (0.16%)	0.66 (0.11%)	0	0.04 (0%)	0.01 (0%)	0
⁵ Road Relocation	n/a	n/a	n/a	0	-0.62	-0.75	n/a	n/a	n/a	n/a	n/a	n/a
Harvest/Fuels Reduction	0.01 (0%)	0	0	0.02 (0%)	0	0	0	0	0	0	0	0
Culvert Replacement/BMPs	5.8 (0.41%)	1.7 (0.69%)	0	2.7 (0.54%)	25.52 (5.12%)	7.1 (1.4%)	1.8 (0.30%)	0.5 (0.08%)	0	0	0	0
Prescribed Fire	n/a	n/a	n/a	1.49 (0.3%)	1.22 (0.25%)	0	n/a	n/a	n/a	n/a	n/a	n/a
Total	6.43	2.12	0	7.65	27.38	6.35	2.78	1.02	0	0.04	0.01	0
³ Total Sediment Delivery as a percentage of HUC12 maximum delivery	0.51%	0.15%	0%	1.54%	5.50%	1.28%	0.46%	0.12%	0%	0%	0%	0%

¹Culvert installation and removal associated with temporary and intermittent stored service roads included in sediment delivery estimate.

²Assumes maximum sediment delivery potential from analysis in the following paragraphs.

³Assumes average annual sediment delivery rate as displayed in Elliot (2013).

⁴Rate of recovery estimate based on methods outlined in Shapiro (2010).

⁵Values represent sediment delivery reduction and assume delivery from relocated road segments is zero.

()Values in parenthesis represent percentage of total maximum average annual sediment delivery for undisturbed forests as displayed in Elliot (2013).

Harvest activities/fuels treatments

Erosion modeling for proposed harvest and fuels treatment areas was completed using the Water Erosion Prediction Program (WEPP), Disturbed WEPP-batch interface to estimate sediment delivery relative to fully forested conditions (existing conditions) as well as short term average annual estimates for undisturbed forests presented in Elliot (2013). Erosion modeling conducted as part of this analysis is based on a 50 year climate average and utilized riparian habitat conservation areas buffers as directed through INFISH guidance (USDA, 1995). Model outputs indicate there is a 0 to 24 percent probability sediment delivery would occur in the first year following treatment which is 20 percent higher than the existing condition represented by the fully forested Disturbed WEPP-batch output scenario (Project File Exhibit M-7). However, under alternative 2, model outputs indicate a five year event would result in sediment delivery from only two out of a possible 804 modeled hillslopes. Table 57 displays Disturbed WEPP-batch model outputs for hillslopes identified as having sediment delivery potential (20 percent probability) relative to the existing condition and estimates for average annual sediment delivery as presented by Elliot (2013). Project File Exhibit M-24 gives spatial reference to these hillslopes relative to streams and subwatershed boundaries. The occurrence probability of 20 percent (five year event) is utilized in this analysis as a storm event of this magnitude is likely to occur over the course of implementation (approximately five years). Project File Exhibit M-7 displays model output sediment delivery for larger storm events having less than 20 percent probability of occurrence.

The Disturbed WEPP-batch interface utilizes Water Erosion Prediction Project (WEPP) technology as the runoff and erosion calculation engine. WEPP simulates both interrill and rill erosion processes and incorporates position to predict runoff and erosion at the hillslope scale (Flanagan & Livingston, 1995). It is important to understand that Disturbed WEPP-batch results come with predicted error of plus or minus 50 percent and should only be used as an indicator of erosion potential relative to other Disturbed WEPP scenarios. For a more complete description of Disturbed WEPP visit <https://forest.moscowfs.wsu.edu/fswepp/docs/distweppdoc.html>. Project File Exhibit M-17 outlines methods and assumptions used to generate representative hillslope profiles using the WEPP hillslope delineation ArcTool.

Table 57. Disturbed WEPP model outputs for sediment delivery (20 percent probability)

HUC12 Name	Harvest Unit No.	Hillslope No.	Hillslope Acres	Sediment Delivery (tons)		
				5 Year Event ²		¹ Average Annual Delivery
				Alternative 2	Existing Condition	
				(20% occurrence probability)		
Abbot Creek	87	121	12.55	0.01	0	0-0.45
Emery Creek	55	296	16.89	0.02	0	0-0.6

¹Based on short term average annual estimates for undisturbed Forests presented in Elliot (2013).

²Estimates from Disturbed WEPP-batch model outputs presented in Project File Exhibit M-7.

Maximum predicted sediment delivery for the occurrence probability presented in Table 57 is within average annual delivery rates for undisturbed forest conditions as presented in Elliot (2013). Therefore, when combined with effectiveness of design features and BMPs, quantification of harvest related sediment delivery would be increasingly difficult to detect (if present) or discern from other natural or anthropogenic sources even at the hillslope scale. Furthermore, due to predicted effectiveness of BMPs and design features, potential sediment delivery is not anticipated to extend past the initial year of harvest.

Prescribed Fire

Alternative 2 proposes the use of prescribed fire in six units encompassing approximately 759 acres within the Emery Creek subwatershed (common to all action alternatives). This acreage does not exclude the riparian habitat conservation area buffers which will be avoided during ignition but may allow fire to burn into them. Erosion modeling for proposed prescribed fire treatment areas was completed using the same methods as outlined for harvest and fuels treatment units. Through design features, only half of proposed units would be treated in a given year and all units have expanded riparian habitat conservation areas (150 feet), expanded riparian habitat conservation areas are accounted for in all WEPP model output scenarios. Model outputs indicate there is a 0 to 24 percent probability sediment delivery would occur in the first year following treatment which is 22 percent higher than the existing condition (Project File Exhibit M-7). Under alternative 2, model outputs indicate a five year event would result in sediment delivery from 19 of 36 modeled hillslopes. Project File Exhibit M-7 displays model outputs for hillslopes identified as having sediment delivery potential (20 percent probability) relative to the existing condition and estimates for the range of average annual sediment delivery as presented by Elliot (2013). Project File Exhibit M-24 gives spatial reference to these hillslopes relative to streams, subwatershed boundaries, and other hillslopes delivering sediment in response to harvest activities or prescribed fire. It is important to note that there is also a 76 percent probability no sediment delivery would occur as a result of prescribed fire implementation. Project File Exhibit M-7 displays model output sediment delivery for larger storm events having less than 20 percent probability of occurrence.

Maximum predicted sediment delivery for all hillslopes are within the estimated range for average annual delivery in undisturbed forest conditions as presented in Elliot (2013). Potential sediment delivery may be detectable following a five year event in the unnamed tributary to Emery Creek adjacent Unit 302 (hillslope 15) and in Remington Creek adjacent Unit 305 (hillslope 41) (Project File Exhibit M-24) although the level of sediment delivery would be difficult to differentiate from natural sources at the reach scale. Measurable effects resulting from model predicted sediment delivery for all other hillslopes are not anticipated to be discernable from other sources at or beyond the hillslope scale. In all cases, post-fire vegetation response is anticipated to be rapid as soil productivity would be preserved as a result of lower soil burn severities and increased nutrient availability as described in the Soils specialist report. Therefore, sediment delivery is not expected to persist past the first year following burning.

Temporary and intermittent stored service roads

Alternative 2 proposes adding existing road templates to the Forest road system (in a stored condition), construction of new temporary roads and utilizing existing road templates as new temporary roads. All temporary roads will be fully rehabilitated following project activities as described in the design features. The effects of roads on erosion and sediment delivery are outlined in detail in the Affected Environment but would be most pronounced during construction/reconstruction and use. Key attributes identified in the affected environment that influence potential road erosion and sediment delivery include: road density (mi/mi²), road/stream hydrologic connectivity. These attributes are displayed above in Table 55 relative to the existing condition/no-action.

Existing roads utilized for haul would continue to contribute sediment as outlined in the affected environment (Table 51 and Table 52) although BMP effectiveness is anticipated to reduce actual sediment delivery. Similarly, reconditioning of existing roads proposed for storage (intermittent stored service roads), construction and use of temporary roads, including associated stream

crossings (Digital Elevation Modeling (DEM) generated stream centerlines) would result in added sediment delivery potential as depicted in Table 58 and described by individual road segment in Project File Exhibits M-5 and M-6. Delivery potential could be reduced further by avoiding stream crossings in select road segments as depicted in Project File Exhibits M-5 and M-6. Regardless, estimated increases would persist until rehabilitation occurs at which time the volume of potential sediment delivery would be reduced. Supporting this notion of recovery over time, sediment yields from Belt Metasediments (similar to those in the project area) following road building have been measured to be approximately seven times those of undisturbed conditions in year one, but decreasing to levels twice those of undisturbed conditions within two years (Shapiro, 2010). Based on this research, Shapiro (2010) concludes it is reasonable to assume sediment yields within three years of disturbance would be close to undisturbed levels. Effects analysis of sediment delivery associated with temporary road and stream crossing reclamation utilize findings from Shapiro (2010) to address the temporal scale of associated temporary road related impacts. Both temporary and intermittent stored service roads are subject to meeting BMP standards (potential sediment delivery from BMP implementation are incorporated in the WEPP model outputs because these increases (or potential reductions) would fall within standard predicted error for model outputs (plus or minus 50 percent)).

Table 58. Estimated maximum sediment delivery (yield) associated with ISS and temporary roads

Subwatershed (HUC12)	Year	¹ Sediment Yield (tons)				
		Alternative 1 (No-action)	Alternative 2			
			² ISS roads	# ISS stream crossings (Rd No.)	² Temporary Roads	# Temp stream crossings (Rd No.)
Abbot Creek	2018	no assumed sediment delivery from decommissioned roads	none proposed	0	1.42	1(temp E), 1(temp H)
	2019	no assumed sediment delivery from decommissioned roads	none proposed	0	0.41	1(temp E), 1(temp H)
	2020	no assumed sediment delivery from decommissioned roads	none proposed	0	return to background	1(temp E), 1(temp H)
Emery Creek	2018	no assumed sediment delivery from decommissioned roads	3.43	2 (1622), 1 (1629)	0.01	0
	2019	no assumed sediment delivery from decommissioned roads	1.26	2 (1622), 1 (1629)	0	0
	2020	no assumed sediment delivery from decommissioned roads	0.92	2 (1622), 1 (1629)	return to background	0
Hungry Horse Creek	2018	no assumed sediment delivery from decommissioned roads	0.53	1 (1619)	0.45	1(temp R)
	2019	no assumed sediment delivery from decommissioned roads	0.18	1 (1619)	0.13	1(temp R)

Subwatershed (HUC12)	Year	¹ Sediment Yield (tons)				
		Alternative 1 (No-action)	Alternative 2			
			² ISS roads	# ISS stream crossings (Rd No.)	² Temporary Roads	# Temp stream crossings (Rd No.)
	2020	no assumed sediment delivery from decommissioned roads	0.18	1 (1619)	return to background	1(temp R)
Hungry Horse Reservoir-Spring Meadows Creek	2018	no assumed sediment delivery from decommissioned roads	none proposed	0	0.04	0
	2019	no assumed sediment delivery from decommissioned roads	none proposed	0	0.01	0
	2020	no assumed sediment delivery from decommissioned roads	none proposed	0	return to background	0

¹Estimates and assumptions detailed in Project File Exhibit M-5.

²Rate of recovery estimate based on methods outlined in Shapiro (2010). Recover begins following reclamation of temporary roads, timing of reclamation may vary both spatially and temporally. Values includes culvert installation and removal through processes described in Project File Exhibit M-19.

Based on model results presented in Table 58 and Table 56 sediment delivery associated with intermittent stored service and temporary roads would result in up to 0.1 percent increase in total sediment delivery to the Abbot Creek subwatershed, 0.69 percent increase in the Emery Creek subwatershed, 0.16 percent increase in the Hungry Horse Creek subwatershed, and zero predicted increase in both Hungry Horse Reservoir-Aurora Creek and Hungry Horse Reservoir-Spring Meadows Creek subwatersheds (relative to existing conditions). Detecting this level of change beyond the hillslope scale would be extremely difficult to distinguish from other natural and anthropogenic sources of sediment. Effects of increased sediment delivery at the reach scale are discussed in more detail in the Aquatic Habitat/Channel Morphology and Water Quality sections of this EA.

Road relocation

Relocation of two portions of the upper Emery Creek Road (NFS Road 546) totaling approximately 1.4 miles is an action common to all action alternatives. Both road segments are currently delivering sediment to Emery Creek. Relocation would reduce road stream hydrologic connectivity as detailed above under “hydrologic processes” effectively increasing the stream buffer width to Emery Creek and eliminating sediment delivery from relocated portions of these road segments. Table 59 outlines reductions in estimated sediment delivery over time through relocation. Abandon portions of the road would be fully recontoured and stabilized to promote hydrologic recovery, reduce erosion, and minimize sediment delivery to Emery Creek.

Table 59. Maximum estimated sediment delivery from proposed road reroute and associated reclamation

Location	Year	¹ Sediment Delivery (tons)		
		No-action	Action Alternatives	Estimated Annual Reduction in Sediment Delivery (tons)
Emery Creek-1	2018	0.75	0.75	0.00

Location	Year	¹ Sediment Delivery (tons)		
		No-action	Action Alternatives	Estimated Annual Reduction in Sediment Delivery (tons)
Emery Creek-2	2019	0.75	0.22	0.54
	2020	0.75	0.11	0.65
	2018	0.12	0.12	0.00
	2019	0.12	0.03	0.08
	2020	0.12	0.02	0.10

¹Delivery values derived from NetMap-WEPProad output and utilize recovery as presented by Shapiro (2010).

Based on model results, proposed road relocation would reduce sediment delivery to Emery Creek starting the second year after relocation/reclamation. Estimated savings could reach 0.62 tons in year two and 0.75 tons per year thereafter (Table 59). Effects would be most pronounced at the reach scale although they may be difficult to distinguish from natural variability in sediment delivery. The effects of sediment delivery at the reach scale are discussed in more detail in the Aquatic Habitat/Channel Morphology and Water Quality sections of this report.

Culvert replacement/aquatic organism passage improvements

Alternative 2 identifies replacement of up to 18 stream aligned culverts, six of which are barriers to aquatic organism passage. Short-term erosional responses from stream crossing excavations can occur in the form of surface erosion, rilling, and gully, channel scour, and minor slumping within excavations (Klein, 2003). Surface erosion however represents only a small proportion of total erosion at excavated stream crossings (Klein, 2003) and these contributions can be reduced to immeasurable levels with effective implementation of site appropriate BMPs. Madej (2001) explains that erosion following treatment is highly variable, and many site-specific conditions (such as the presence of bedrock, springs or poorly drained soils or incomplete excavations) can influence post-treatment erosion as well.

Based on field measurements of multiple stream excavation sites in northern California, Klein (2003) calculated average sediment yields the first year following excavation at 0.29 cubic yards/yard of excavated stream channel length. Similarly, assumptions outlined in Project File Exhibit M-19 draw estimates of sediment delivery from measured values of culvert installations and erosion monitoring on the Flathead National Forest. Both processes were used to produce an estimated range of potential sediment yield associated with replacement of culverts in the project area. Dry soil bulk density for soils in this area range between 0.65 and 0.95 grams/cm³ (Albin H. Martinson & Basko, 1998) and the maximum value was used to compute mass of sediment contributions. Results are displayed below in Table 60.

It is important to note that typically, most erosional responses occur within the first several years following culvert removal and greatly diminish with vegetation re-growth and as channels find stable grades armoring themselves with rock and woody debris (Madej, 2001). This analysis utilizes recommendations from Shapiro (2010) to address the temporal scale of sediment delivery. With this understanding of temporal variability, it is critical to point out that timing of the culvert removal may shift the temporal distribution of sediment delivery. However, the total volume of sediment delivery associated with culvert removals for the project in its entirety would remain unchanged.

Furthermore, potential sediment delivery presented in Table 60 associated with hypothetical culvert failures represent the cumulative effect associated with failure of all culverts in the same

year. While the likelihood of this scenario is small, cumulative values are presented for the purpose of comparison relative to potential sediment delivery generated through implementation of the action alternatives. It is important to disclose that replacement of culverts identified in action alternatives do not entirely preclude potential failure risk. Rather, failure risk is reduced through improved flow capacity and proper alignment and more culvert replacements generally represent larger reductions in sediment delivery potential relative to failure scenarios.

Table 60. Maximum estimated sediment delivery (yield) from hypothetical culvert failure and culvert replacement

Subwatershed (HUC12)	Year	Associated Road No./Stream	Alternative 1 (No-action) (³ culvert failures)		Alternative 2
			² Sediment Yield (tons)		
			Klein (2003)	FNF (Project File Exhibit M-19)	
Abbot Creek	2018	NFS Road 590A, 590B, 590G, 10129, and 10803/Abbot Creek, South Fork Abbot Creek and tributaries	26.6	34.8	5.8
	2019	NFS Road 590A, 590B, 590G, 10129, and 10803/Abbot Creek, South Fork Abbot Creek and tributaries	26.6	34.8	1.7 ¹
	2020	NFS Road 590A, 590B, 590G, 10129, and 10803/Abbot Creek, South Fork Abbot Creek and tributaries	26.6	34.8	¹ return to background
Emery Creek	2018	NFS Road 546 and 1614/Emery Creek tributaries	126	224.3	2.7
	2019	NFS Road 546 and 1614/Emery Creek tributaries	126	224.3	25.52 ¹
	2020	NFS Road 546 and 1614/Emery Creek tributaries	126	224.3	7.1 ¹ (returning to background in 2021)
Hungry Horse Creek	2018	NFS Road 38/Hungry Horse Creek	8.3	7.3	1.8
	2019	NFS Road 38/Hungry Horse Creek	8.3	7.3	0.5 ¹
	2020	NFS Road 38/Hungry Horse Creek	8.3	7.3	¹ return to background

¹Rate of recovery estimate based on methods outlined in Shapiro (2010).

²Estimates represent potential sediment delivery through processes described in Klein (2003) and Project File Exhibit M-19.

³Estimate follows guidance displayed in Project File Exhibit M-19 and displays total sediment delivery associated with complete failure of all culverts identified for replacement.

Historic trail added back to system

Alternative 2 would designate 12.2 miles of Forest Service system trail over historic National Forest system trails. Designation would result in no change in hillslope erosion or sediment delivery relative to the existing condition which is not anticipated to be measurable at the reach scale. The original trail templates have received consistent levels of use since officially being removed from the trail system. With designation, existing trails would be maintained to be sustainable, and continue to minimize hillslope erosion and sediment delivery.

Accessible fishing pier on Lion Lake

All action alternatives propose construction of the accessible fishing pier on Lion Lake. Construction and use of the permanent facility would generate sediment which could be delivered to the lake. The volume of sediment delivered would be proportionate to the size of disturbance and proximity to or within the lakeshore environment. Effectiveness of BMPs during construction are anticipated to minimize sediment delivery to Lion Lake outside the construction footprint. Following guidance from Shapiro (2010), construction related sediment delivery is anticipated to be temporary, being reduced to background levels within three years of completion. Potential sediment delivery from use of the new recreation facility would be difficult to quantify but likely be dependent on the level of use. These actions may have short-term localized effects to lake water quality as explained in the effects analysis for water quality.

Summary

Table 56 displays the spatial and temporal distribution of sediment delivery associated with proposed activities under alternative 2. As illustrated in Table 56, sediment delivery (for all actions) as a percentage of estimated total maximum delivery potential for the affected subwatershed does not exceed 0.51 percent in all subwatersheds except Emery Creek (up to 5.5 percent). Detecting this level of change at the subwatershed scale would be difficult to measure or differentiate from natural variation in sediment supplies given the spatial and temporal distribution of effects and proven effectiveness of BMPs. Measurable effects at the reach scale (or within approximately 810 meters of delivery point) may result following culvert removals but are anticipated to return to background levels within three years of disturbance. Short term (less than three years) increases in sediment delivery is a tradeoff for reducing long term risk associated with potential road failure. Estimates of sediment delivery under hypothetical culvert failure scenarios is greater than delivery predicted through culvert replacement (Furthermore, potential sediment delivery presented in Table 60 associated with hypothetical culvert failures represent the cumulative effect associated with failure of all culverts in the same year. While the likelihood of this scenario is small, cumulative values are presented for the purpose of comparison relative to potential sediment delivery generated through implementation of the action alternatives. It is important to disclose that replacement of culverts identified in action alternatives do not entirely preclude potential failure risk. Rather, failure risk is reduced through improved flow capacity and proper alignment and more culvert replacements generally represent larger reductions in sediment delivery potential relative to failure scenarios) and could produce a long term (greater than three years) reduction in potential sediment delivery. The proposed road relocation in Emery Creek is estimated to reduce annual sediment delivery to Emery Creek from NFS Road 546 by as much as 0.62 tons the second year after reclamation, and 0.75 tons per year thereafter (Table 59).

Aquatic habitat/channel morphology and water quality

The health and quality of aquatic habitat/channel morphology and water are intricately tied to hydrologic processes, hillslope erosion and sediment delivery. Principal mechanisms for sediment and nutrient delivery to/from streams are increased runoff and soil erosion as well as sub-surface transport (nutrient leaching to groundwater). Increases in the duration of higher stream flows (and associated sediment delivery) have potential to modify aquatic habitats and alter channel morphology although hydrologic systems accommodate some level of change without irreversible damage. 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 and channel morphology. Similarly, increased sediment delivery is used as a surrogate for TSS and nutrient (specifically phosphorus) concentrations in this analysis. Sediment delivery potential for

alternative 2 was quantified in Table 56 from the effects analysis for “*Hillslope Erosion and Sediment Delivery*”. It is important to note that effects to aquatic habitats and water quality resulting from sediment delivery can be spatially and temporally broader because delivered sediment is transported downstream over time. The size and duration of effects would be variable depending on local conditions, natural processes and the magnitude of sediment delivery. The effects of the proposed activities are discussed separately below for both Aquatic Habitat/Channel Morphology and Water Quality.

As detailed in the Existing Condition/Affected Environment, the importance of stream shading to reduce the amount of incoming solar radiation moderating stream water temperature is well documented (Isaak et al., 2010; Johnson, 2004; Larson & Larson, 1996) and is the primary variable affected by most natural and anthropogenic disturbances. However, under all action alternatives, no harvest would occur in riparian habitat conservation areas, therefore no reduction in stream shading or changes to stream water temperature would result through implementation of alternative 2. Thus, the effects of all action alternatives on stream water temperature is dismissed from further analysis.

Aquatic habitat/channel morphology

Timber harvest/fuels reduction

As displayed above in Table 57, there is a 20 percent probability proposed timber harvest/fuels reduction activities could result in additional sediment delivery in the Abbot Creek and Emery Creek subwatersheds. However, these potential increases would result in less than 0.01 percent of total maximum sediment delivery potential based on average annual estimates for undisturbed forests presented in Elliot (2013) and are temporally limited to the first year following treatment. Therefore, changes (if any) to key indicators of aquatic habitat or channel morphologic conditions related to increased sediment delivery from proposed treatment units would respond in a similar manner. Any potential changes would occur at the hillslope scale immediately adjacent the point of delivery and likely be indistinguishable from potential effects associated with other natural variables beyond the hillslope scale. Other subwatersheds within the project area would be unaffected by sediment delivery through implementation of timber harvest (Table 57) and fuels reduction and therefore have no effect on aquatic habitat or channel morphology.

Furthermore, riparian habitat conservation areas by design are excluded from treatment units and all site appropriate INFISH riparian habitat conservation area buffers would be implemented. Therefore, proposed harvest activities would not disrupt natural recruitment of large woody debris or directly manipulate aquatic habitats or channel morphology. Therefore, no direct or indirect effects to aquatic habitats or stream channel morphology are anticipated.

Prescribed fire

The application of prescribed fire is spatially limited to the Emery Creek subwatershed (Project File Exhibit M-24). Prescribed fire has potential to deliver sediment to area streams (Table 56 and Project File Exhibit M-32). Increased sediment delivery may temporarily alter physical channel habitat conditions by increasing width to depth ratios, reducing median particle size, and filling pools. However, the analysis summarizes that the level of sediment delivery increase from prescribed fire units would be difficult to distinguish from natural sources even at the reach scale. Therefore, effects to aquatic habitats and stream channel morphology would also likely be indistinguishable from those associated with natural processes at the reach scale. Project File Exhibit M-24 gives spatial reference to affected stream reaches while Project File Exhibit M-32 quantifies sediment delivery to these reaches. Furthermore, any potential measurable effects

would be variable depending on climate and stream flow conditions following disturbance, limited spatially to the stream reach immediately below the treatment units and temporally limited by the duration and magnitude of sediment delivery displayed in Project File Exhibit M-32. Measurable alteration of existing channel conditions in Emery Creek or its principal tributaries is not expected.

Temporary and intermittent stored service roads

As displayed in Table 56, potential sediment delivery associated with new road construction/reconstruction and use would be elevated in all subwatersheds except Hungry Horse Reservoir-Aurora Creek, where there are no temporary roads or ISS roads proposed. Sediment delivery is isolated to stream crossings and stream reaches immediately below these crossings. However, all of the affected stream crossings are first order, seasonal or ephemeral streams which do not contain aquatic habitat. Because effects are isolated to reaches in these streams, and impacts from sedimentation are often reduced due to attenuation with increasing distance from source area, no measurable effect to downstream aquatic habitats would be expected.

Furthermore, temporary roads and roads proposed to be added to the system do not appreciably change stream crossing density, road density, or road/stream hydrologic connectivity relative to the existing condition as displayed in Table 55. Therefore, a measurable change in annual water yield or peak flows is not anticipated to result from construction or re-use of these roads. Thus, measurable effects to aquatic habitats or channel morphology related to changes in annual water yield or peak flows are also not anticipated.

Road relocation

Relocation of two portions of the upper Emery Creek Road (NFS Road 546) totaling approximately 1.4 miles is an action common to all action alternatives. Both road segments are currently delivering sediment to Emery Creek and approximately 0.45 miles of road encroachment has limited channel migration and eliminated near stream riparian vegetation reducing stream shade and large woody debris recruitment from these areas. Likewise, encroaching portions of these road segments represent elevated risk for stream capture under high flow conditions, following instream debris accumulation, or natural processes dictating lateral stream channel migration. Relocation would reduce road stream hydrologic connectivity effectively increasing the stream buffer width to Emery Creek and eliminating sediment delivery from relocated portions of these road segments. Road relocation would also eliminate risk of potential stream capture preventing downstream degradation to aquatic habitats and water quality. Table 59 outlines reductions in estimated sediment delivery over time through relocation. Abandon portions of the road would be fully recontoured and stabilized to promote hydrologic recovery. Thus, riparian vegetation would be established over time as would large woody debris recruitment and natural migration of the adjacent stream channel. Initially (one to five years post rehabilitation), effects would be most pronounced at the reach scale through establishment of riparian vegetation. Over time (5 to 65 years), increased stream shading, natural stream morphologic development and recruitment of large woody debris are expected to enhance aquatic habitats in affected stream reaches (approximately 0.45 miles), although effects may be difficult to distinguish from natural variability outside of the treatment areas.

Culvert replacement/aquatic organism passage improvements

Alternative 2 proposes replacing up to 18 stream aligned culverts of which six are situated on perennial fish bearing streams and will be replaced with aquatic organism passage structures (AOPs). Disturbance and sediment delivery associated with similar actions has been documented

to potentially modify aquatic habitats, channel morphology and water quality (Foltz, Yanosek, & Brown, 2008; Klein, 2003; Madej, 2001; NFWF, 2004; Shapiro, 2010). Effects to aquatic habitat/channel morphology are twofold. First, stream channel and banks within the area of disturbance would be permanently modified. The physical process of removing and replacing the culvert and re-grading the stream channel in its place would accomplish this. Standard design practices for culvert replacement (Project File Exhibit M-20) would maintain channel gradient and meet design features to withstand the 100 year discharge and accommodate aquatic organism passage (AOP) at necessary locations. Second, sediment delivery resulting from culvert replacement may temporarily alter channel habitat conditions by increasing percent pool tail fines, reducing median particle size, and decreasing residual pool depths. 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 crossings (approximately 810 meters on average as measured by Foltz and others (2008)) and temporally by the duration and magnitude of sediment delivery displayed in Table 60 above.

Furthermore, replacement of “at risk” stream aligned culverts (Project File Exhibit M-21) would reduce future risk of road failure (e.g. culverts would be upsized, re-aligned, or maintained). Estimated sediment delivery associated with road failure is presented in Table 60 and is greater than estimates for replacement. Therefore, identified culvert work would reduce the level of risk and decrease the magnitude of potential downstream effects associated with road failure to aquatic habitats and water quality relative to the existing condition.

Water quality

Sediment and nutrients (primarily nitrogen and phosphorus) are the principal water quality parameters of concern when analyzing the effects of both natural and anthropogenic disturbances in forested watersheds. Natural ranges of these water quality parameters are essential to maintaining natural ecologic function but can also impair these same functions when values fall outside the natural range of variation. In this analysis, water yield and sediment delivery as they related to proposed activities are generally used as surrogates for water quality response.

Timber harvest/fuels reduction

Effects analysis for both “Hydrologic Processes” and “Hillslope Erosion and Sediment Delivery” showed no measurable water yield increases and indicate sediment delivery would be isolated to two hillslopes, one in the Abbot Creek subwatershed and the other in the Emery Creek subwatershed (Project File Exhibit M-24 and Table 58). Estimated sediment delivery from these two hillslopes is presented in Table 56 and Table 58 in probabilistic terms (20 percent probability) and could reach 0.02 tons (20 pounds) in the Emery Creek subwatershed and 0.01 tons (10 pounds) in the Abbot Creek subwatershed the year after treatment. These values represent less than 0.01 percent of the total maximum sediment delivery potential for each subwatersheds and would be difficult to distinguish from other sediment sources at or beyond the hillslope scale. No water yield increase or sediment delivery was anticipated in other affected subwatersheds relative to natural variability (Project File Exhibit M-3). Therefore, no measurable increases in TSS concentrations or total phosphorus concentrations associated with timber harvest or fuels reduction would be expected from increased sediment delivery or increased stream flow at the reach scale or beyond.

Slash material generated through harvest activities can alter organic matter dynamics (Bilby & Bisson, 1992) including the rate of mineralization (Gravelle, Ice, Link, & Cook, 2009). In general, more intense and widespread harvest impacts create greater potential for change in

nutrient cycling and stream chemistry (Gravelle et al., 2009). Natural processes following harvest such surface runoff and nutrient leaching represent additional mechanisms for nutrient transport to surface waters. Gravelle and others (2009) measured statistically significant increases in stream nitrogen concentrations below clearcut harvest units in the Mica Creek Experimental Watershed in northern Idaho (mean monthly increases of 290 µg/l). Peak nutrient concentrations typically corresponded to spring runoff periods and appear to correlate with post-harvest broadcast burning which may reduce plant uptake of nutrients and further accelerate mineralization rates (Gravelle et al., 2009). Similar responses were not observed for phosphorus or downstream of partial cut harvest activity (Gravelle et al., 2009). Gravelle and others (2009) also concluded water quality effects are most pronounced at the reach scale and that dilution and attenuation (possibly due to instream processing and/or uptake of nutrients) occurs with increasing distance from input sources which can mute effects at the larger subwatershed scale. It is important to note that while statistically significant increases in stream nitrogen concentrations were observed by Gravelle and others (2009), harvest methods for the study applied stream protections zones per Idaho's Forest Practices Act which created a maximum buffer of 75 feet from the ordinary high water mark for Class I streams (fish bearing); and only 30 feet from the ordinary high water mark for Class II streams (non-fish bearing). Design features for all action alternatives follow both INFISH guidance and Montana streamside management zone laws for applying stream buffers which are much greater than those used by Gravelle and others (2009).

Effects of proposed regeneration harvest on stream nutrient loading similar to those observed by Gravelle and others (2009) could be expected to occur in the project area. However, larger buffers to surface waters through application of INFISH guidance and the Montana streamside management zone law would facilitate greater nutrient uptake (soils and vegetation) further reducing overall nutrient contributions to area surface waters relative to measured values by Gravelle and others (2009). As a result, measurable effects (if any) would be isolated to the point of delivery at the hillslope scale below regeneration harvest units in Emery Creek, Hungry Horse Creek, Tiger Creek (Hungry Horse tributary), Hungry Horse Reservoir and first order tributaries of Abbot Creek. If these effects were to occur, they may be difficult to distinguish from other natural nutrient sources but could persist for up to three years post-harvest following observations by Gravelle and others (2009). Nutrient concentrations would be expected to peak seasonally in response to spring runoff. However, exceedance of seasonal numeric nutrient standards (Table 53) are not anticipated even at the reach scale. No changes to beneficial use classes or water quality categories would occur as a result of the proposed treatments.

Prescribed fire

Increased water yield is not anticipated to occur as a result of prescribed fire because light to moderate prescribed fire has little effect on hydrologic processes (Troendle et al., 2009). As detailed in the effects analysis for "*Hillslope Erosion and Sediment Delivery*" and Project File Exhibit M-24 there is a 20 percent probability of sediment delivery from 19 of 36 hillslopes representing proposed prescribed fire polygons (prescribed fire units are limited to the Emery Creek subwatershed). Total estimated sediment delivery associated with prescribed fire is 2.71 tons which represents only 0.54 percent of maximum potential sediment delivery for the entire Emery Creek subwatershed (Table 56). Furthermore, given the spatial and temporal distribution of prescribed fire units within the subwatershed (Table 56 and Project File Exhibit M-24) effects to water quality in the form of sediment delivery beyond the reach scale would be increasingly difficult to distinguish from other sediment sources. Therefore, no measurable increases in TSS concentrations or total phosphorus concentrations associated with sediment delivery generated from prescribed fire would be expected at the reach scale or beyond.

Furthermore, several studies focusing on effects of prescribed fire on stream water quality (Elliott & Vose, 2006), have found little to no detectable changes in stream water chemistry after prescribed burning. Research conducted by Vose used a nutrient cycling model to simulate stream nitrogen response under three fire scenarios: moderate-severity prescribed fire, high-severity prescribed fire, and high-severity wildfire. Only under the wildfire scenario was there a significant increase in stream nitrogen concentrations (Elliott & Vose, 2006). A similar water quality response is anticipated with prescribed fire in the analysis area principally as a result of reduced soil burn severity, burn mosaic, treatment scale, spatial and temporal distribution of proposed treatment units. Exceedance of seasonal numeric nutrient standards (Table 53) are not anticipated at the reach scale in response to prescribed fire.

Temporary and intermittent stored service roads

Road sediment delivery and associated nutrients are the primary water quality concerns associated with construction and use of roads proposed under alternative 2. As displayed in Table 56 and Table 58, maximum potential sediment delivery associated with new road construction/reconditioning and use would be elevated in all project area subwatersheds except Hungry Horse Reservoir-Aurora Creek, where there are no temporary roads or ISS roads proposed. However, these increases represent 0.69 percent or less of total maximum sediment delivery potential based on average annual estimates for undisturbed forests presented in Elliot (2013). Water quality effects from increased sedimentation and nutrient loading would be isolated to stream reaches immediately below the point of delivery (Table 58) and are projected to return to background conditions within three years of rehabilitation of temporary roads and reclamation of ISS roads based on guidance Shapiro (2010). Furthermore, Gravelle and others (2009) concluded no statistically significant increases in stream nutrient concentrations resulted from road construction/use in the Mica Creek Experimental Watershed in northern Idaho. A similar response to temporary road construction and use on stream nutrient concentrations would be expected following implementation of alternative 2. Measurable water quality changes (if any) specifically related to sediment delivery from proposed roads would be spatially isolated to hydrologically connected stream reaches. Effects would also be variable depending on climate and stream flow conditions which would make them even more difficult to separate from natural sources. Exceedance of seasonal numeric nutrient standards (Table 53) as a result of temporary road construction/use are not anticipated even at the reach scale.

Road relocation

Relocation of two portions of the upper Emery Creek Road (NFS Road 546) totaling approximately 1.4 miles is an action common to all action alternatives. Both road segments currently deliver sediment to Emery Creek reducing stream water quality at the point of delivery (hillslope scale). As outlined in the effects analysis for Aquatic Habitat, approximately 0.45 miles of the proposed reroutes are closely positioned near Emery Creek and present a risk of stream capture and water quality deterioration resulting from road surface sediment delivery. Relocation would reduce road stream hydrologic connectivity eliminating capture potential and sediment delivery from these road segments. Abandon portions of the road would be fully recontoured and stabilized to promote hydrologic recovery, reduce erosion, and minimize sediment delivery to Emery Creek. Water quality effects are unlikely to be measurable beyond the reach scale due to the volume of existing road sediment delivery (Table 58) but would benefit stream water quality. Eliminating potential stream capture risk preserves existing downstream water quality by removing a potential significant source of sediment.

Culvert replacement/aquatic organism passage improvements

Culvert replacement would affect water quality as suspended sediment and nutrients associated with potential sediment delivery increases (Table 56 and Table 60) would be elevated during construction. Measured water quality response during culvert removals in northwest Montana by Shapiro (2010) documents maximum TSS values of 4,500 mg/l although rapid subsidence in TSS levels was also documented during periods when construction was inactive showing high levels (such as 2,000 mg/l or higher) dropping within minutes, to 200 or 400 mg/l. A similar water quality response is anticipated for all proposed culvert replacements (including AOPs) during construction. These effects would primarily be limited spatially to the stream reach immediately below proposed work and temporally to the three year period following project completion as detailed in the effects analysis for Hillslope Erosion and Sediment Delivery (Furthermore, potential sediment delivery presented in Table 60 associated with hypothetical culvert failures represent the cumulative effect associated with failure of all culverts in the same year. While the likelihood of this scenario is small, cumulative values are presented for the purpose of comparison relative to potential sediment delivery generated through implementation of the action alternatives. It is important to disclose that replacement of culverts identified in action alternatives do not entirely preclude potential failure risk. Rather, failure risk is reduced through improved flow capacity and proper alignment and more culvert replacements generally represent larger reductions in sediment delivery potential relative to failure scenarios.). Temporary exceedance of numeric and narrative water quality standards would result from proposed work (particularly TSS). However, these effects would be spatially isolated (Foltz et al., 2008) and temporally limited. All work would be compliant with applicable State and Federal regulatory requirements.

Additionally, culvert replacement would reduce the long term risk (greater than three years) of road failure and associated sediment delivery impacts from “at risk” culverts (Project File Exhibit M-21). Thus, a similar reduction in long term risk to water quality would result from this action. While the level of risk associated with road failure is a qualitative measure, it may be of increasing importance under current climate change projections which suggest warmer winter temperatures (Isaak et al., 2010) increasing the likelihood of rain on snow events (and associated flooding).

Historic trail added back to system

Alternative 2 would designate 12.2 miles of Forest Service system trail over historic National Forest system trails. Designation would result in no change in hillslope erosion or sediment delivery relative to the existing condition. Therefore, relative to the existing condition, associated water quality effects from adding the historic trail back to the system would also not be expected. With designation, existing trails would be maintained in sustainable fashion, and continue to minimize hillslope erosion and sediment delivery.

Accessible fishing pier on Lion Lake

All action alternatives propose construction of the accessible fishing pier on Lion Lake. Construction and use of the permanent facility would generate sediment which could be delivered to the lake. Associated water quality effects would be limited to the local area of disturbance and primarily be in the form of increase suspended sediment and reduced water clarity during the construction period and seasonally during runoff periods for up to three years depending on the level of vegetative recovery.

Potential water quality effects associated with sediment delivery from use of the new recreation facility would be difficult to quantify but likely be dependent on the level of use. Neither construction nor use of the proposed facility is anticipated to jeopardize existing beneficial uses or water quality classifications.

Summary

Sediment delivery resulting from culvert replacement (see effects analysis for *Hillslope Erosion and Sediment Delivery*) may temporarily alter channel habitat conditions and water quality by increasing percent pool tail fines, reducing median particle size, decreasing residual pool depths, and increasing TSS (Shapiro, 2010). Measurable effects would be variable depending on effectiveness of BMPs, climate/stream flow conditions following disturbance, spatially limited to stream reaches immediately below construction areas (approximately 810 meters on average as measured by Foltz and others (2008)), and temporally limited by the duration and magnitude of sediment delivery similar to values displayed in Table 60. Furthermore, identified culvert work would reduce the level of risk and decrease the magnitude of potential downstream effects associated with road failure to aquatic habitats and water quality relative to the existing conditions (Table 60). Relocation of two segments of NFS Road 546 would reduce habitat and water quality effects associated with the existing position of these road segments. Effects are anticipated to benefit water quality and aquatic habitat but may not be measurable at the reach scale or beyond.

Proposed regeneration harvest may affect water quality by increasing stream nutrient concentrations (particularly Nitrogen). These effects would be concentrated spatially to Emery Creek, Hungry Horse Creek, Tiger Creek (Hungry Horse tributary) and first order tributaries of Abbot Creek. Effects may persist at elevated levels for up to three years post-harvest following observations by Gravelle and others (2009). Nutrient concentrations would be expected to peak seasonally in response to spring runoff although exceedance of seasonal numeric nutrient standards (Table 53) are not anticipated even at the reach scale. No changes to beneficial use classes or water quality categories would occur as a result of the proposed treatments.

Temporary roads and roads proposed to be added to the system do not appreciably change stream crossing density, road density, or road/stream hydrologic connectivity relative to the existing condition as displayed in Table 52. Therefore, a measurable change in annual water yield or peak flows is not anticipated to result from construction or re-use of these roads. Thus, measurable effects to aquatic habitats or channel morphology related to changes in annual water yield or peak flows are also not anticipated.

Aquatic species

Effects to aquatic species draws inference from effects analysis associated with *Hydrologic Processes, Hillslope Erosion and Sediment Delivery*, as well as *Aquatic Habitat/Channel Morphology and Water Quality*. Effects from these indicators are assumed to impact aquatic species when they overlap spatially. The following discussion focuses on direct and indirect effects to species found in the immediate project area, whereas the cumulative effects analysis considers any downstream impacts to bull trout or cutthroat trout.

Timber harvest/fuels reduction

Effects to aquatic species resulting from timber harvest and fuels reduction is generally tied to changes in quantity or quality of water; or through direct manipulation of near stream habitats. Analysis of “Hydrologic Processes” indicate changes in annual water yield and peak flows to be

within the natural range of variability for all affected subwatersheds (Project File Exhibit M-3). Similarly, design features of alternative 2 dictate that harvest and fuels reduction activities avoid near stream habitats through application of site appropriate INFISH riparian habitat conservation areas buffer widths. These efforts would preclude direct manipulation to near stream habitats that could impact aquatic species. Finally, estimates for sediment delivery associated with timber harvest and fuels reduction would be small (20 percent probability for sediment delivery of up to 20 pounds in Emery Creek and up to 10 pounds in Abbot Creek) and unlikely be detectable at the reach scale. Thus, proposed harvest and fuels reduction activities are not anticipated to have any measurable effect to aquatic habitats or the aquatic species that utilize them at the reach scale or beyond.

Prescribed fire

Effects to aquatic species resulting from application of prescribed fire would be related to changes in the quantity and/or quality of water in affected stream habitats. However, as detailed in the effects analysis for “Hydrologic Processes”, increased water yield is not anticipated to occur as a result of prescribed fire because light to moderate prescribed fire has little effect on hydrologic processes (Troendle et al., 2009). Furthermore, as detailed in the effects analysis for “*Hillslope Erosion and Sediment Delivery*” and Table 57 there is a 76 percent probability that no sediment delivery would occur from treated hillslopes. Similarly, if sediment were to be delivered from the prescribed fire area measurable effects are anticipated to be isolated to the stream reach immediately below burned hillslopes (none of which are fish bearing; Project File Exhibit M-24) and temporally limited to the year following treatment. Furthermore, the literature suggests little to no detectable changes in stream water chemistry after prescribed burning would occur (Elliott & Vose, 2006). Because similar water quality responses are anticipated with prescribed fire in the analysis area, effects to aquatic species are also not expected to be measurable.

Temporary and intermittent stored service roads

As detailed in the effects analysis for “Aquatic Habitat”, temporary roads and roads proposed for storage (intermittent stored service roads) generally avoid aquatic habitats and are not anticipated to produce any measurable changes to existing habitat conditions, sediment delivery rates, or water yield beyond the hillslope scale. Therefore, measurable effects to aquatic species are also not anticipated at the reach scale or beyond.

Road relocation

Relocation of two portions of the upper Emery Creek Road (NFS Road 546) totaling approximately 1.4 miles is an action common to all action alternatives. As detailed in the previous effects analysis for “*Hillslope Erosion and Sediment Delivery*” proposed road relocation would reduce sediment delivery to Emery Creek starting the second year after relocation/reclamation (Table 59). Reduced road sediment delivery would improve water quality adjacent to the road segments and be beneficial to westslope cutthroat trout. Similarly, reclamation of these road segments would contribute towards restoration of aquatic habitat and channel morphology (approximately 0.45 miles) which would also be beneficial to cutthroat trout. These effects are expected to be isolated to the stream reach immediately adjacent to road reclamation and while they would benefit aquatic species, the effects would not be measurable to the overall westslope cutthroat trout in the South Fork Flathead River subbasin.

Culvert replacement/aquatic organism passage improvements

Culvert replacements and AOP improvements are all anticipated to provide long-term benefit (greater than three years) to aquatic species as well as hydrologic processes, water quality and

aquatic habitat (see effects analysis for those indicators). However, short-term effects (less than three years) in the form of increased sediment delivery (reduced water quality) and downstream aquatic habitat alteration are expected tradeoffs. Design features for action alternatives aim to minimize effects to aquatic species through seasonal timing restrictions and temporal distribution of implementation (see chapter 2).

Five culvert replacements (including three AOP structures) are proposed in the Abbot Creek subwatershed, while 13 culvert replacements (including three AOP structures) are proposed in the South Fork Flathead River subbasin. Based on the above effects analysis for key indicators, measurable negative effects from proposed culvert replacements and AOPs are primarily concentrated to the reach scale, most pronounced immediately below construction activities, and temporally limited to the three year period after construction (Table 56). Therefore, short term (less than three years) negative effects to aquatic species would be expected to occur over a similar spatial and temporal scale. Where culverts positioned upstream of fluvial habitats are proposed for removal, effects may extend beyond the reach scale or longer than three years as project related sediment continues to be transported downstream through natural processes. However, the magnitude of downstream change may be difficult to distinguish from natural sediment sources with increasing basin area, would be variable, dependent on climate and other natural hydrologic processes. Qualitatively, these effects may cause dispersion of aquatic species as well as temporarily reduce habitat quality and juvenile fish survivability although these effects would largely be confined to the reach scale or up to approximately 810 meters below culvert replacements (Foltz et al., 2008). Westslope cutthroat trout (South Fork Flathead River subbasin) and brook trout (Abbot Creek subwatershed) would be affected where present but temporary small declines in their numbers would not result in a loss of viability or local extirpation for either population.

In the long term (greater than three years) sediment delivery associated with proposed culvert removals and AOPs would be reduced to near background levels, risk of culvert failure and associated sediment delivery would be reduced (Table 60), and suitable fish habitat above existing barriers would be reconnected (Table 61 and Project File Exhibit M-18). Access to additional stream habitats and reduced sediment delivery potential would improve the health and resiliency of aquatic species in the face of potential future disturbances (e.g. wildfire) or environmental change. The addition of one mile of available habitat in Hungry Horse Creek could produce measurable improvements to westslope cutthroat trout populations while all other AOPs would benefit fish but effects are not likely to be measurable at the population scale.

Table 61. Aquatic habitat connectivity restoration through proposed AOP projects

Road No.	Stream	AOP (Y/N)	Current Status	¹ Primary Fish Species Affected	Miles of Habitat Restriction
38	Hungry Horse Creek	Y	Full barrier	westslope cutthroat trout	1
546	unnamed tributary to Emery Creek	Y	Partial barrier	westslope cutthroat trout	0.15
546	Oliver Creek	Y	Partial barrier	westslope cutthroat trout	0.5
590A	Abbot Creek	Y	Partial barrier	brook trout	0.75
590G	South Fork Abbot Creek	Y	Full barrier	brook trout	0.2
10805	Abbot Creek	Y	Not a barrier	brook trout	n/a

¹Primary fish species listed does not preclude the presence of other species. Primary fish species includes downstream species likely affected by the existing structure.

Historic trail added back to system

Designation of 12.2 miles of Forest Service system trail over historic National Forest system trails would result in no change in hillslope erosion, sediment delivery, aquatic habitat or water quality relative to the existing condition. Therefore, effects to aquatic species are also not anticipated.

Accessible fishing pier on Lion Lake

All action alternatives propose construction of an accessible fishing pier on Lion Lake. Construction and use of the permanent facility would generate sediment which could be delivered to the lake although effects to aquatic habitat and water quality are generally isolated to the area of disturbance. These actions may temporarily trigger dispersion of fish from the construction site. Similarly, improved access may increase fishing pressure and thus fish harvest at the site. Species most likely to be impacted by the pier are rainbow trout, sunfish and perch because they are near the shore and numerous. Increased harvest would reduce the number of catchable rainbow trout but it is not a permanent impact since Montana Fish Wildlife & Parks regularly stock this species. Increased harvest would also reduce the number of catchable sized sunfish and perch. This is not anticipated to be substantial enough to reduce reproductive success since both species are capable of compensating with earlier age of maturity (spawn at smaller sizes). Thus the numbers of catchable sized fish would decline over every summer (when the pier is usable) and then be replenished the following spring. The overall population viability would not be affected.

Summary

Effects to aquatic species are intricately tied to changes in aquatic habitat and water quality. Through actions proposed under alternative 2, the principal mechanism driving change in aquatic habitat and water quality is replacement of stream aligned culverts which are anticipated to produce short term (less than three year) negative impacts to aquatic habitat and water quality through increased sediment delivery (Table 56) and reduced water quality. However, these short term impacts are not anticipated to result in a loss of viability for any species and are an expected tradeoff for long term (greater than three years) benefit to aquatic habitat and water quality as potential road failure risk is reduced and habitat connectivity is restored. The long term benefits of reduced road failure risk and improved habitat connectivity would be improved health and resiliency of aquatic species in the face of potential future disturbances (e.g. wildfire) or environmental change. Table 60 quantifies the volume of sediment delivery at risk under hypothetical culvert failure scenarios and Table 61 displays miles of stream habitat reconnected through proposed AOP projects.

Alternative 2 – Cumulative effects**Hydrologic processes**

Proposed timber harvest and fuels reduction would reduce canopy cover increasing equivalent clearcut area values in all affected subwatersheds (Table 54). However, change in equivalent clearcut area values would not result in measurable increases in water yield when compared to the estimated low end range of natural variability as displayed in Table 54 and explained in detail in Project File Exhibit M-3. It is important to disclose that equivalent clearcut area change in the Emery Creek subwatershed exceeds 15 percent relative to the existing condition (16 percent increase, assuming all harvest is completed the same year). Thus, associated changes in water yield may occur following proposed disturbance during wet years. However, because these changes are relative to the existing condition and fall within estimates for low-end range of

natural variability (Table 54), associated water yield increases are also anticipated to be within this natural range. Consequently, equivalent clearcut area changes and associated direct or indirect hydrologic responses would emulate historic variability. Predicted equivalent clearcut area values would return to existing conditions within approximately 11 years for the Abbot Creek subwatershed, 35 years for the Emery Creek subwatershed, 24 years for Hungry Horse Creek subwatershed, two years for the Hungry Horse Reservoir-Aurora Creek subwatershed, and four years for the Hungry Horse Reservoir-Spring Meadows Creek subwatershed.

Furthermore, implementation of alternative 2 would not appreciably change road density or road/stream hydrologic connectivity when compared to the existing condition. The combination of successful application of effective BMPs, with the limited size and spatial distribution of associated changes (Table 55), is unlikely to measurably change hydrologic processes beyond the hillslope scale. Therefore effects to hydrologic processes are not anticipated to be measurable or collectively add to effects at the subwatershed scale.

Hillslope erosion and sediment delivery

As detailed in the effects analysis for the alternative 2, proposed road construction/reconstruction and use, prescribed fire, vegetation management, fuels reduction, and culvert replacements all have potential to cause hillslope erosion and deliver sediment to area surface waters. Similarly, past, ongoing and reasonably foreseeable management actions such as timber harvest, maintenance/use of existing road networks, road reclamation, culvert replacement and/or removal, firewood gathering, recreational facilities (e.g. boat launches and camp grounds), and grazing practices could or have also potentially contributed sediment to area surface waters. However, sediment delivery from these sources are temporally and spatially limited, in some cases may not be measurable, and in most cases do not overlap in time or space with measurable effects detailed under alternative 2 (Table 62, Project File Exhibit M-22). The principal sources of sediment that could measurably contribute to cumulative sediment delivery at the subwatershed scale include maintenance and use of existing travel infrastructure and replacement of one stream aligned culvert on NFS Road 546 (crossing an unnamed perennial tributary to Emery Creek). Culvert replacement on NFS Road 546 occurred in the fall of 2016 and is estimated to have elevated sediment delivery by up to 0.05 percent in the Emery Creek subwatershed in 2018 and when combined with estimated increases from the existing road network and alternative 2 the cumulative anthropogenic sediment delivery to the subwatershed could reach 11.9 percent. This is an increase of 5.7 percent relative to the existing condition (Table 62). This level of increase would not be distinguishable from natural variations in sediment delivery at the subwatershed scale. Table 62 displays results for all analysis areas as well as the temporal distribution of sediment delivery from actions identified as having quantifiable contributions of sediment to analysis area subwatersheds. Effects past the subwatershed scale are not anticipated to be measurable or distinguishable from other sources given the spatial distribution of sediment sources and attenuation of effects with increasing distance from the source area. The volume of predicted sediment delivery to Hungry Horse Reservoir from alternative 2 (maximum 0.04 tons or 40 pounds) would not be measurable past the hillslope scale.

Table 62. Cumulative sediment delivery within affected subwatersheds

Action	Abbot Creek			Emery Creek			Hungry Horse Creek			Hungry Horse Reservoir-Spring Meadows Creek		
	³ Annual Sediment Delivery Potential (tons)											
	⁴ 2018	⁴ 2019	2020	⁴ 2018	⁴ 2019	2020	⁴ 2018	⁴ 2019	2020	⁴ 2018	⁴ 2019	2020
1Road Construction/Use	1.42 (0.1%)	0.42 (0.03%)	0	3.44 (0.69%)	1.26 (0.25%)	0.92 (0.18%)	0.98 (0.16%)	0.31 (0.05%)	0.18 (0.03%)	0.04 (0%)	0.01 (0%)	0
5Road Relocation	n/a	n/a	n/a	0	-0.62 (-0.12%)	-0.75 (-0.15%)	n/a	n/a	n/a	n/a	n/a	n/a
Harvest/Fuels Reduction	0.01 (0%)	0	0	0.02 (0%)	0	0	0	0	0	0	0	0
Culvert Replacement/BMPs	5.8 (0.41%)	1.7 (0.69%)	0	2.7 (0.54%)	25.6 (5.14%)	7.0 (1.4%)	1.8 (0.30%)	0.5 (0.08%)	0	0	0	0
Prescribed Fire	n/a	n/a	n/a	1.49 (0.3%)	1.22 (0.25%)	0	n/a	n/a	n/a	n/a	n/a	n/a
2016 NFS Road 546 culvert replacement	0	0	0	0.257 (0.05%)	0	0	0	0	0	0	0	0
Existing Roads & Road Maintenance	18 (1.2%)	18 (1.2%)	18 (1.2%)	31 (6.2%)	31 (6.2%)	31 (6.2%)	2 (0.3%)	2 (0.3%)	2 (0.3%)	25 (4.3%)	25 (4.3%)	25 (4.3%)
Total Cumulative Sediment Delivery	25.23	20.12	18	38.9	59.46	38.17	4.78	2.81	2.18	25.04	25.01	0
Total Increase Relative to Existing Conditions	7.23	2.12	0	7.91	28.46	7.17	2.78	0.81	0.18	0.04	0.01	0
² Total Cumulative Sediment Delivery as a percentage of HUC12 maximum delivery	1.77%	1.41%	1.20%	7.81%	11.94%	7.66%	0.76%	0.43%	0.33%	4.30%	4.30%	4.30%

¹Culvert installation and removal associated with temporary and intermittent stored service roads included in sediment delivery estimate.

²Assumes average annual sediment delivery rate as displayed in Elliot (2013).

³Assumes maximum sediment delivery potential from analysis in the following paragraphs.

⁴Rate of recovery estimate based on methods outlined in Shapiro (2010).

⁵Values represent sediment delivery reduction and assume delivery from relocated road segments is zero.

() Values in parenthesis represent percentage of total maximum average annual sediment delivery for undisturbed forests as displayed in Elliot (2013).

Additionally, past and proposed culvert replacements and road relocation projects would or have reduced long term (greater than three years) sediment delivery potential to affected subwatersheds via reduced road stream interaction and minimizing culvert failure risk through upsizing or re-aligning “at risk” culverts. Estimated sediment delivery reductions associated with proposed road reroutes on NFS Road 546 are quantified in Table 62 while benefits from past actions are measured qualitatively simply through reduced risk.

Aquatic habitat/channel morphology and water quality

Cumulative effects of alternative 2 are not anticipated to permanently degraded aquatic habitats or alter existing water quality use designations although alternative 2 would have cumulative effects to aquatic habitats and water quality. The sources of potential impact to aquatic habitat/channel morphology and water quality are the same as detailed above for Hillslope Erosion and Sediment Delivery. Increases in sediment delivery rates are therefore utilized as a surrogate for analyzing potential effects on aquatic habitats and channel morphology relative to key indicators described in the Affected Environment (percent fines). Similarly, increases in sediment delivery will also be used as a surrogate for mobilization of stored stream sediments and increased TSS concentrations in this analysis. Likewise, because nutrient transport to streams is strongly tied to sediment delivery (specifically phosphorus), sediment delivery rates again will be used as a surrogate for nutrient delivery. Cumulative sediment delivery is summarized in Table 62. In general, less sediment delivery corresponds to less impact. The effects are analyzed at the subwatershed scale unless noted otherwise.

Proposed culvert replacements and AOPs would contribute short term (less than three years) reductions in aquatic habitat and water quality at the reach scale immediately below proposed work as detailed in the effects analysis for alternative 2. Replacement of a stream aligned culvert on NFS Road 546 in 2016 would contribute similar habitat and water quality impacts in 2018 collectively contributing towards temporary reductions in stream habitat and water quality conditions (increased fines, reduced pool depths, elevated TSS) below the construction site which directly affected an unnamed perennial tributary to Emery Creek (Table 62). Collectively at the subwatershed scale, culvert replacement efforts within the Emery Creek subwatershed would temporarily reduce habitat conditions and water quality below 13 culvert replacement sites, eight of which are situated on perennial streams. However, temporary reductions in stream habitat and water quality conditions is the expected tradeoff for reducing long term (greater than three years) risk of culvert failure and associated habitat and water quality deterioration. Furthermore, replacement of existing culverts on fish bearing streams with AOP structures increases habitat connectivity for westslope cutthroat trout. Combined with the AOP constructed in 2016 (estimated 0.16 miles habitat connectivity increase), proposed AOPs outlined under alternative 2 would increase habitat connectivity by 0.8 miles in the Emery Creek subwatershed (Table 61).

Additionally, as detailed in Project File Exhibit M-13, past road decommissioning (including culvert removal), and road relocation appear to be contributing towards habitat recovery in previously degraded reaches of Emery Creek (specifically the lower 1.6 miles). Similarly, anticipated long term (greater than three years) benefits from proposed road reroutes would include habitat recovery on approximately 0.45 miles of upper Emery Creek (Table 62). Collectively this would result in 2.05 miles of long term habitat improvement associated with road relocations. Qualitatively, the effects of past road decommissioning combined with road reroutes would continue to benefit aquatic habitat and water quality as natural hydrologic processes are restored with time.

Aquatic species

The most substantial impact to aquatic species from land management has been the construction and maintenance of Hungry Horse Dam which has benefitted bull trout and westslope cutthroat trout by preventing non-native species from reaching portions of the South Fork Flathead River subbasin upstream of the dam. Conversely, introduction of non-native species (brook trout and rainbow trout) in the Abbot Creek subwatershed has largely contributed to the extirpation of westslope cutthroat trout. Similarly, creation of a fish barrier on Abbot Creek at the U.S. Highway 2 crossing has effectively blocked upstream movement of both westslope cutthroat trout and bull trout. Historically, Lion Lake was probably fishless therefore unlikely supported westslope cutthroat trout or bull trout, all current species are introduced.

Because the health and viability of aquatic species is intricately tied to habitat and water quality, special consideration is given anthropogenic sources of sediment and disturbances that may measurably alter aquatic habitat and/or degrade water quality. In this analysis sediment delivery is generally used as a surrogate for habitat alteration and water quality effects. The analysis compares estimated effects to aquatic species in each of the analysis areas (subbasin, subwatershed, lake and scale) and therefore presents these effects relative to the natural range of variability at these scales providing context into the magnitude of effects. Table 63 and Table 64 outline estimated cumulative annual sediment delivery from natural and measurable anthropogenic sources at the subbasin and subwatershed scales. Measurable sources of sediment at the Lion Lake scale were not identified in Project File Exhibit M-22 or through analysis of effects. Other anthropogenic sources include firewood gathering, grazing and recreational use in or near surface waters (e.g. fishing, boating, and camping). These effects are qualitatively included in the analysis as “minor” sources but not included in Table 63 or Table 64.

Table 63. South Fork Flathead River subbasin cumulative sediment delivery

Sediment Source	2018	2019	2020
	¹ Maximum Potential Sediment Delivery (tons/year)		
⁵ Existing Forest System Roads (including maintenance and BMP work)	356	356	356
Hungry Lion - Alternative 2	11	29	7
² Betty Baptiste Project (includes Hoke and South Fork Logan Creek CMP replacements)	27	0	0
³ Spotted Bear River Project	0	2	0
³ Soldier Addition II	2	0	0
³ Trail Creek Salvage	4	0	0
Other CMP replacements (McInernie and Kneiff Creeks)	16	5	0
Anthropogenic Cumulative Maximum Sediment Delivery Potential	416	36	7
Natural & Anthropogenic Cumulative Maximum Sediment Delivery Potential	1,434	1,041	903
³ 2015 Wildfire	1,018	1,005	896
⁴ Estimated Maximum Potential Background Sediment Delivery	38,252	38,252	38,252

¹Rate of recovery based on estimates in Shapiro (2010).

²Based on information from the Betty Baptiste Proposed Action.

³Data from Trail Creek Salvage EA (USDA Forest Service, 2016).

⁴Estimate reflects maximum average annual sediment delivery for undisturbed forests as described in Elliot (2013).

⁵Estimate from NetMAP: road WEPP GIS dataset.

Table 64. Abbot Creek subwatershed cumulative sediment delivery

Sediment Source	2018	2019	2020
	¹ Maximum Potential Sediment Delivery (tons/year)		
³ Existing Forest System Roads (including maintenance and BMP work)	18	18	18
Hungry Lion - Alternative 2	7	2	0
Anthropogenic Cumulative Maximum Sediment Delivery Potential	25	20	18
² Estimated Maximum Potential Background Sediment Delivery	1,424	1,424	1,424

¹Rate of recovery based on estimates in Shapiro (2010).

²Estimate reflects maximum average annual sediment delivery for undisturbed forests as described in Elliot (2013).

³Estimate from NetMAP: road WEPP GIS dataset.

Bull trout: In consideration of other past, present and reasonably foreseeable actions described above, alternative 2 does add a very minor amount of sediment delivery to bull trout FMO habitat, as well as improve habitat connectivity in FMO habitat. However, these effects are unlikely to affect bull trout or any downstream critical habitat.

As reviewed on tables above, the net impact of land management is just 1.1 percent of the average annual estimated sediment delivery potential for the South Fork Flathead River and 1.7 percent of delivery potential for lower Abbot Creek. This level of increase would be indistinguishable from natural sources at the subbasin scale and would not increase sediment delivery values above those estimated by Elliot (2013) for undisturbed forests. Additionally, sediment delivery from sources displayed in Table 63 are temporally limited and in the case of culvert replacement, short term (less than three years) increases in sediment delivery are the expected tradeoff for reducing long term (less than three years) sediment delivery risk. Thus bull trout FMO habitat would continue to function within natural range of variability. Bull trout will be able to utilize the habitat for foraging just like with the no-action alternative.

Furthermore, the construction of AOPs in the South Fork Flathead River subbasin would increase availability of potential bull trout FMO habitat in Emery Creek, Hungry Horse Creek, South Fork Logan Creek, Ryle Creek, Big Bill Creek, Hoke Creek and McInernie Creeks (although bull trout rarely utilize these streams). Access to additional stream habitats and reduced long term (greater than three years) sediment delivery potential would improve the health and resiliency of aquatic species (including bull trout) in the face of potential future disturbances (e.g. wildfire) or environmental change. Bull trout populations at the subbasin scale would remain viable and “stable” with implementation of alternative 2.

Westslope cutthroat trout: Collectively, sediment delivery as presented in Table 63 could degrade aquatic habitat and water quality ultimately reducing cutthroat trout spawning success in affected reaches for up to two years in portions of the South Fork Flathead River subbasin. However, as displayed in Table 62, cumulative anthropogenic sediment delivery represents only 1.1 percent of maximum potential sediment delivery for undisturbed forests as described by Elliot (2013). Furthermore, the 2015 wildfires represent nearly 70 percent of total estimated sediment delivery for the subbasin and these contributions are considered to be well within the natural range of variation (USDA Forest Service, 2016). Therefore, the data suggest existing aquatic habitat conditions and associated effects to aquatic species are capable of handling temporary increases in sediment delivery rates without lingering effects, and/or; recurrence of large natural watershed disturbances and associated increases in sediment delivery may be a principal

mechanism for development and maintenance of aquatic habitats as well as the health and viability of westslope cutthroat trout observed under the existing condition.

Furthermore, it is important to disclose that temporary negative effects to aquatic species through increased sediment delivery and habitat degradation are short term (less than three years) tradeoffs for perceived long term (greater than three years) benefits. As outlined under cumulative effects to bull trout, effects from culvert replacement or removal reduce or eliminate long term risk of culvert failure ultimately benefiting downstream aquatic habitats and aquatic species through reduced sediment delivery potential. Likewise, construction of AOPs increases habitat connectivity facilitating access to additional stream habitats. Both efforts would collectively contribute towards improving the health and resiliency of aquatic species (including westslope cutthroat trout) in the face of potential future disturbances (e.g. wildfire) or environmental change. Relative to the existing condition, cumulative effects to westslope cutthroat trout populations would promote increased long term (greater than three years) population viability in the South Fork Flathead River subbasin. Table 52 details effects of proposed AOPs on habitat connectivity by primary fish species for all affected analysis areas.

Alternative 3 – Direct & indirect effects

Key indicators used to quantify potential effects in the alternative 2 analysis are carried forward in the analysis of alternative 3. Results are presented relative to the existing condition/no-action alternative and summarized in table format when possible. Actions common to alternative 2 include prescribed fire, NFS Road 546 road relocations, and construction of an accessible fishing pier at Lion Lake. Detailed effects analysis for these actions are included in the analysis for alternative 2 and incorporated here by reference. Results from the alternative 2 effects analysis for indicators such as sediment delivery and road related attributes (road density and hydrologic connectivity) are also included in alternative 3 analysis through inclusion in summary tables.

Hydrologic processes

Harvest activities

Under alternative 3, proposed timber harvest and fuels reduction would reduce canopy cover increasing equivalent clearcut area values in all affected subwatersheds (Table 65). However, change in equivalent clearcut area values would not result in measurable increases in water yield when compared to the estimated low end range of natural variability as displayed in Table 65 and explained in detail in Project File Exhibit M-3. Predicted equivalent clearcut area values would return to existing conditions within approximately three years for the Abbot Creek subwatershed, 15 years for Emery Creek subwatershed, seven years for Hungry Horse Creek subwatershed, and one year for both Hungry Horse Reservoir-Aurora Creek and Hungry Horse Reservoir-Spring Meadows Creek subwatersheds. A comprehensive water yield analysis is presented in Project File Exhibit M-3.

Table 65. Estimated ECA values associated with land use proposals under alternative 3

HUC12 Name	% ECA			
	Existing	Alternative 3	Historic Maximum	Losensky Estimated Low-end Range of Natural Variability
Abbot Creek	16.2	17.7	60.8	5-24
Emery Creek	3.2	7.1	8.9	5-24

HUC12 Name	% ECA			
	Existing	Alternative 3	Historic Maximum	Losensky Estimated Low-end Range of Natural Variability
Hungry Horse Creek	2.6	3.9	21.7	5-24
Hungry Horse Reservoir-Aurora Creek	6.7	7	14.1	5-24
Hungry Horse Reservoir-Spring Meadows Creek	23.3	23.6	46.8	5-24

Because estimated equivalent clearcut area values under alternative 3 are within or near the low end range of natural variability (Table 65) and well below historic maximums, these data suggest existing channel and aquatic habitat conditions are capable of handling increases in peak flows without lingering effects, and/or; recurrence of large natural watershed disturbances and associated increases in peak flow events may be a principal mechanism for development and maintenance of watershed processes observed under the existing condition. Because the change in equivalent clearcut area values relative to the low end range of natural variability for each subwatershed are less than the minimum threshold required for detecting changes in peak flows, measurable increases in small to moderately sized peak flow events (relative to the low end range of natural variability) are not anticipated under alternative 3.

Temporary and intermittent stored service roads

Alternative 3 proposes construction of up to 2.8 miles of temporary road and reconstruction of approximately 4.2 miles of existing road templates which would be added back to the system and stored once project operations were complete. No new roads are located within 10 meters of mapped lotic riparian habitats and therefor would not influence groundwater in these areas. The data indicate, road density attributes are not appreciably changed relative to the existing condition through implementation of alternative 3 (Table 66).

Table 66. Road related attributes affecting hydrologic processes

HUC12 Name	¹ Total Road Density (mi/mi ²)			² Hydrologically Connected Road Length (mi)		
	Existing Condition	Alternative 3	³ Increase (mi/mi ²)	Existing Condition	Alternative 3	³ Increase (mi)
Abbot Creek	3.04	3.08	0.04	4.99	5.04	0.05
Emery Creek	1.18	1.31	0.13	1.07	0.62	-0.45
Hungry Horse Creek	0.44	0.51	0.07	0.41	0.43	0.02
Hungry Horse Reservoir-Aurora Creek	1.36	1.36	0.00	0.54	0.54	0.00
Hungry Horse Reservoir-Spring Meadows Creek	2.35	2.35	0.01	1.7	1.70	0.00

¹All roads including non-Forest System Roads and hydrologically connected historical road lengths.

²All road lengths within 50 feet of mapped NHD streams. Excludes road lengths associated with historic road/stream crossings (stream aligned culverts removed).

³Increase relative to the Existing Condition.

Alternative 3 would result in a temporary increase of approximately 0.07 miles of road/stream hydrologic connectivity associated with new temporary road construction (Table 66). This temporary increase would be erased following rehabilitation of temporary roads as hydrologic processes would be restored to conditions similar to those of the adjacent landscape. Furthermore, relocation of portions of the upper Emery Creek Road (NFS Road 546) would reduce road/stream hydrologic connectivity by an additional 0.45 miles in the Emery Creek subwatershed resulting in a net decrease of 0.38 miles in road/stream hydrologic connectivity through implementation of alternative 3.

Historic trail rehabilitation

Alternative 3 would rehabilitate 12.2 miles of historic National Forest system trails restoring hydrologic processes at the hillslope scale. No measurable effect to water yield or peak flows are currently attributable to the trail system and no measurable change would be anticipated following rehabilitation. Due to the trails position on the landscape and lack of interaction with stream channels, the effects of trail rehabilitation would be unmeasurable.

Summary

Changes in equivalent clearcut area values would not result in measurable increases in water yield when compared to the estimated low end range of natural variability as displayed in Table 65 and explained in detail in Project File Exhibit M-3. Relative to the existing condition, temporary roads and proposed intermittent stored service roads would increase road/stream hydrologic connectivity by 0.07 miles during implementation but reduce overall connectivity by 0.38 miles once reclamation of temporary roads and the NFS Road 546 reroute is complete (Table 66). The combination of successful application of effective BMPs, with the limited size and spatial distribution of associated increases (Table 66), is unlikely to measurably change hydrologic processes beyond the hillslope scale. Relocation of NFS 546 would reduce road/stream hydrologic connectivity in the Emery Creek subwatershed by an additional 0.45 miles across all alternatives. Hydrologic processes would recover on reclaimed portions of the reroute over time (5 to 65 years) and be most evident at the hillslope scale as reestablishment of near stream vegetation and decompaction of the existing road template. Restoration of 12.2 miles of existing trail is not anticipated to result in any measurable effects given the scale of trail restoration efforts and position on the landscape relative to stream channels.

Hillslope erosion and sediment delivery

Ground disturbance associated with alternative 3 include harvest activities (e.g. skid trails and landings), prescribed fire, road construction and use, road BMPs (drainage) and replacement of a stream aligned culverts (outside of mapped grizzly bear core habitat). Estimated sediment delivery resulting from proposed activities are summarized for each of the affected subwatersheds in Table 67. Effects on hillslope erosion and sediment delivery are discussed in further detail by proposed disturbance mechanism below.

Harvest activities/fuels treatments

Disturbed WEPP-batch Model outputs indicate there is less than a 20 percent probability of sediment delivery in the first year following treatment which is up to 16 percent higher than the existing condition represented by the fully forested Disturbed WEPP-batch output scenario (Project File Exhibit M-7). However, under alternative 3, model outputs indicate a five year event would not result in sediment delivery from any modeled hillslopes within treatment polygons. Project File Exhibit M-7 displays model output sediment delivery for larger storm events having less than 20 percent probability of occurrence.

Table 67. Potential sediment delivery associated with implementation of alternative 3

Action	Abbot Creek			Emery Creek			Hungry Horse Creek			Hungry Horse Reservoir-Spring Meadows Creek		
	² Annual Sediment Delivery Potential (tons)											
	⁴ 2018	⁴ 2019	2020	⁴ 2018	⁴ 2019	2020	⁴ 2018	⁴ 2019	2020	⁴ 2018	⁴ 2019	2020
¹ Road Construction/Use	0.82 (0.06%)	0.25 (0.02%)	0	2.34 (0.47%)	0.86 (0.17%)	0.63 (0.13)	0.49 (0.08%)	0.18 (0.03%)	0.05 (0%)	0.04 (0%)	0.01 (0%)	0
⁵ Road Relocation	n/a	n/a	n/a	0	-0.62 (-0.12%)	-0.75 (-0.15)	n/a	n/a	n/a	n/a	n/a	n/a
Harvest/Fuels Reduction	0	0	0	0	0	0	0	0	0	0	0	0
Culvert Replacement/BMPs	5.8 (0.41%)	1.7 (0.12%)	0	2.7 (0.54%)	2.57 (0.52%)	0.51 (0.1%)	1.8 (0.30%)	0.5 (0.08%)	0	0	0	0
Prescribed Fire	n/a	n/a	n/a	1.49 (0.3%)	1.22 (0.25%)	0	n/a	n/a	n/a	n/a	n/a	n/a
Total	6.62	1.95	0	6.53	4.03	0.39	2.29	0.68	0.05	0.04	0.01	0
³ Total Sediment Delivery as a percentage of HUC12 Maximum Delivery	0.46%	0.15%	0%	1.31%	0.81%	0.08%	0.38%	0.12%	0%	0%	0%	0%

¹Culvert installation and removal associated with temporary and intermittent stored service roads included in sediment delivery estimate.

²Assumes maximum sediment delivery potential from analysis in the following paragraphs.

³Assumes average annual sediment delivery rate as displayed in Elliot (2013).

⁴Rate of recovery estimate based on methods outlined in Shapiro (2010).

⁵Values represent sediment delivery reduction and assume delivery from relocated road segments is zero.

()Values in parenthesis represent percentage of total maximum average annual sediment delivery for undisturbed forests as displayed in Elliot (2013).

Temporary and intermittent stored service roads

Alternative 3 proposes adding existing road templates to the Forest road system (in a stored condition), construction of new temporary roads which would be fully rehabilitated following project activities and utilizing existing road templates which would then be reclaimed and placed into intermittent stored service. Key attributes identified in the affected environment that influence potential road erosion and sediment delivery include: road density (mi/mi²) and road/stream hydrologic connectivity. These attributes are displayed above in Table 66 relative to the existing condition/no-action.

Reconditioning of existing roads proposed for storage (intermittent stored service roads), construction and use of temporary roads (including associated stream crossings) would result in added sediment delivery potential as depicted in Table 68. These estimated increases would persist until rehabilitation occurs at which time the volume of potential sediment delivery would be reduced.

Table 68. Estimated maximum sediment delivery (yield) from ISS and temporary roads

Subwatershed (HUC12)	Year	¹ Sediment Yield (tons)				
		Alternative 1 (no-action)	Alternative 3			
			ISS roads	# ISS stream crossings (Rd No.)	² Temporary Roads	# Temp stream crossings (Rd No)
Abbot Creek	2018	no assumed sediment delivery from decommissioned roads	none proposed	0	0.82	1(temp E), 1(temp H)
	2019	no assumed sediment delivery from decommissioned roads	none proposed	0	0.24	1(temp E), 1(temp H)
	2020	no assumed sediment delivery from decommissioned roads	none proposed	0	return to background	1(temp E), 1(temp H)
Emery Creek	2018	no assumed sediment delivery from decommissioned roads	2.34	2(1622), 1(1629)	none proposed	0
	2019	no assumed sediment delivery from decommissioned roads	0.86	2(1622), 1(1629)	none proposed	0
	2020	no assumed sediment delivery from decommissioned roads	0.63	2(1622), 1(1629)	none proposed	0
Hungry Horse Creek	2018	no assumed sediment delivery from decommissioned roads	0.09	0	0.40	1(temp R)
	2019	no assumed sediment delivery from decommissioned roads	0.05	0	0.13	1(temp R)
	2020	no assumed sediment delivery from decommissioned roads	0.05	0	return to background	1(temp R)

Subwatershed (HUC12)	Year	¹ Sediment Yield (tons)				
		Alternative 1 (no-action)	Alternative 3			
			ISS roads	# ISS stream crossings (Rd No.)	² Temporary Roads	# Temp stream crossings (Rd No)
Hungry Horse Reservoir-Spring Meadows Creek	2018	no assumed sediment delivery from decommissioned roads	0.05	0	none proposed	0
	2019	no assumed sediment delivery from decommissioned roads	none proposed	0	none proposed	0
	2020	no assumed sediment delivery from decommissioned roads	none proposed	0	none proposed	0

¹Estimates and assumptions detailed in Project File Exhibit M-5.

²Rate of recovery estimate based on methods outlined in Shapiro (2010). Recover begins following rehabilitation of temporary roads, timing of rehabilitation may vary both spatially and temporally. Values includes culvert installation and removal through processes described in Project File Exhibit M-19.

Based on model results presented in Table 67 and Table 68 sediment delivery associated with intermittent stored service and temporary roads would result in up to 0.06 percent increase in total sediment delivery to the Abbot Creek subwatershed, 0.47 percent increase in the Emery Creek subwatershed, 0.08 percent increase in the Hungry Horse Creek subwatershed, and zero predicted increase in both Hungry Horse Reservoir-Aurora Creek and Hungry Horse Reservoir-Spring Meadows Creek subwatersheds (relative to existing conditions). Detecting this level of change beyond the hillslope scale would be extremely difficult to distinguish from other natural and anthropogenic sources of sediment. Effects of increased sediment delivery at the reach scale are discussed in more detail in the Aquatic Habitat/Channel Morphology and Water Quality sections for alternative 3.

Historic trail rehabilitation

Alternative 3 would rehabilitate 12.2 miles of historic National Forest system trails restoring hydrologic processes at the hillslope scale. Rehabilitation of trails would theoretically reduce potential hillslope erosion and sediment delivery. However, due to the trails position on the landscape and lack of interaction with stream channels, the effects of trail rehabilitation would be unmeasurable.

Culvert replacement/aquatic organism passage improvements

Alternative 3 identifies replacement of up to nine stream aligned culverts, six of which are AOPs. The same methods and assumption for estimating sediment delivery outlined under alternative 2 apply to analysis of effects for alternative 3. Results for potential sediment delivery under alternative 3 are displayed below in Table 69. Furthermore, replacement of existing stream aligned culverts within grizzly bear core habitat on NFS Road 1614 would not occur and no forest plan amendment would be needed. As detailed in the affected environment and Project File Exhibit M-21, several existing stream aligned culverts on NFS Road 1614 are vulnerable to failure due to capacity or alignment issues. Without improved drainage capacity or corrected alignment, the current risk of failure remains in these locations (Table 69).

Table 69. Estimated maximum sediment delivery (yield) from hypothetical culvert failure and culvert replacement.

Subwatershed (HUC12)	Year	Associated Road No./Stream	Alternative 1 (no-action) (³ culvert failures)	Alternative 3 (culvert replacements)	Alternative 3: Remaining Risk (associated with existing culverts on NFS Road 1614)		
						² Sediment Yield (tons)	
			Klein	FNF		Klein	FNF
Abbot Creek	2018	NFS Road 590A, 590B, 590G, 10129, and 10803/Abbot Creek, South Fork Abbot Creek and tributaries	26.6	34.8	5.8	n/a	n/a
	2019		26.6	34.8	1.7 ¹	n/a	n/a
	2020		26.6	34.8	¹ return to background	n/a	n/a
Emery Creek	2018	NFS Road 546 and 1614/Emery Creek tributaries	126	224.3	2.7	99	198
	2019		126	224.3	2.57 ¹	99	198
	2020		126	224.3	0.51 ¹ , returning to background in 2021	99	198
Hungry Horse Creek	2018	NFS Road 38/Hungry Horse Creek	8.3	7.3	1.8	n/a	n/a
	2019		8.3	7.3	0.5 ¹	n/a	n/a
	2020		8.3	7.3	¹ return to background	n/a	n/a

¹Rate of recovery estimate based on methods outlined in Shapiro (2010).

²Estimates represent potential sediment delivery through processes described in Klein (2003) and Project File Exhibit M-19.

³Estimate follows guidance displayed in Project File Exhibit M-19 and displays total sediment delivery associated with complete failure of all culverts identified for replacement.

Summary

Table 67 displays the spatial and temporal distribution of sediment delivery associated with proposed activities under alternative 3. As illustrated in Table 67, sediment delivery (for all actions) as a percentage of estimated total maximum delivery potential for the affected subwatershed does not exceed 0.46 percent in all subwatersheds except Emery Creek (up to 1.31 percent). Detecting this level of change at the subwatershed scale would be difficult to measure or differentiate from natural variation in sediment supplies given the spatial and temporal distribution of effects and proven effectiveness of BMPs. Measurable effects at the reach scale (or within approximately 810 meters of delivery point) may result following culvert removals but are anticipated to return to background levels within three years of disturbance. Short term (less than three years) increases in sediment delivery is a tradeoff for reducing long term risk associated with potential road failure. Estimates of sediment delivery under hypothetical culvert failure scenarios is greater than delivery predicted through culvert replacement (Table 69) and could produce a long term (greater than three years) reduction in potential sediment delivery from these locations. Because not all stream aligned culverts would be removed from NFS Road 1614, remaining culverts would retain the existing level of risk associated with failure (Table 69). The proposed road relocation in Emery Creek is estimated to reduce annual sediment delivery to

Emery Creek from NFS Road 546 by as much as 0.62 tons the second year after reclamation, and 0.75 tons per year thereafter (Table 59).

Aquatic habitat/channel morphology and water quality

Aquatic habitat/channel morphology

Timber Harvest/Fuels Reduction

As displayed above in Table 67, proposed timber harvest and fuels reduction activities are not anticipated to result in additional sediment delivery to area streams. Therefore, changes (if any) to key indicators of aquatic habitat or channel morphologic conditions related to increased sediment delivery from proposed treatments would not occur.

Furthermore, riparian habitat conservation areas by design are excluded from treatment units and all site appropriate INFISH riparian habitat conservation area buffers would be implemented. Therefore, proposed harvest activities would not disrupt natural recruitment of large woody debris or directly manipulate aquatic habitats or channel morphology. Therefore, no direct or indirect effects to aquatic habitats or stream channel morphology are anticipated.

Temporary and intermittent stored service roads

As displayed in Table 68, potential sediment delivery associated with new road construction/reconstruction and use would be elevated in all subwatersheds except Hungry Horse Reservoir-Aurora Creek. Sediment delivery is isolated to stream crossings and stream reaches immediately below these crossings. However, all of the affected stream crossings are first order, seasonal or ephemeral streams which do not contain aquatic habitat. Because effects are isolated to reaches in these streams, no measurable effect to downstream aquatic habitats would be expected.

Furthermore, temporary roads and roads proposed to be added to the system do not appreciably change stream crossing density, road density, or road/stream hydrologic connectivity relative to the existing condition during use (Table 66). Therefore, a measurable change in annual water yield or peak flows are not anticipated to result from construction or re-use of these roads. Thus, measurable effects to aquatic habitats or channel morphology are also not anticipated.

Historic trail rehabilitation

Alternative 3 would rehabilitate 12.2 miles of historic National Forest system trails restoring hydrologic processes at the hillslope scale. No measurable effect to water yield or peak flows are currently attributable to the trail system and no measurable change would be anticipated following rehabilitation. With no measurable changes to water yield or sediment delivery, changes to aquatic habitats would not occur.

Culvert replacement/aquatic organism passage improvements

Alternative 3 proposes replacing up to nine stream aligned culverts of which six are situated on perennial fish bearing streams (AOPs). As detailed in the effects analysis for alternative 2, disturbance and sediment delivery associated with similar actions has been documented to potentially modify aquatic habitats, channel morphology and water quality by increasing width to depth ratios, reducing median particle size, and filling pools (Foltz et al., 2008; Klein, 2003; Madej, 2001; NFWF, 2004; Shapiro, 2010). 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 crossings (approximately 810 meters on average as measured by Foltz and others (2008)) and temporally by the duration and magnitude of sediment delivery displayed in Table 69 above.

Furthermore, replacement of “at risk” stream aligned culverts would reduce future risk of road failure and associated habitat degradation below these sites. Estimated sediment delivery associated with road failure is presented in Table 69 and is greater than estimates for replacement. Therefore, identified culvert work would reduce the overall level of risk and decrease the magnitude of potential downstream effects associated with road failure to aquatic habitats and water quality relative to the existing condition. It is important to note that the existing level of risk from nine remaining stream aligned culverts on NFS Road 1614 within grizzly bear core habitat (Emery Creek subwatershed) would be unchanged relative to the existing condition (Table 69).

Water Quality

Timber harvest/fuels reduction

Effects analysis for both “*Hydrologic Processes*” and “*Hillslope Erosion and Sediment Delivery*” showed no measurable water yield increase and no sediment delivery resulting from implementation of proposed timber harvest and fuels reduction projects under alternative 3 (Table 65). Therefore, no measurable increases in TSS concentrations or total phosphorus concentrations associated with timber harvest or fuels reduction would be expected at the hillslope scale or beyond.

Increased stream nitrogen loading may occur at the hillslope scale below regeneration harvest units because, slash material generated through harvest activities can alter organic matter dynamics (Bilby & Bisson, 1992) including the rate of mineralization (Gravelle et al., 2009), and natural processes following harvest such surface runoff and nutrient leaching represent additional mechanisms for nutrient transport to surface waters. Through these mechanisms, increases in stream nitrogen concentrations could occur in surface waters adjacent to regeneration harvest areas in Emery Creek, Hungry Horse Creek, South Fork Abbot Creek and Hungry Horse Reservoir. However, larger buffers to surface waters through application of INFISH guidance and the Montana streamside management zone law would facilitate greater nutrient uptake (soils and vegetation) further reducing overall nutrient contributions relative to measured values by Gravelle and others (2009). If these effects were to occur, they may be difficult to distinguish from other natural nutrient sources but could persist for up to three years post-harvest following observations by Gravelle and others (2009). Nutrient concentrations would also be expected to peak seasonally in response to spring runoff. However, exceedance of seasonal numeric nutrient standards (Table 53) are not anticipated even at the reach scale. No changes to beneficial use classes or water quality categories would occur as a result of the proposed treatments.

Temporary and intermittent stored service roads

Alternative 3 proposes adding 4.17 miles of existing road templates back to the forest system in a stored condition and construction of 2.81 miles of new temporary road. Road sediment delivery and associated nutrients are the primary water quality concerns associated with construction and use of roads proposed under alternative 3. As displayed in Table 65 and Table 68, maximum potential sediment delivery associated with new road construction/reconditioning and use would be elevated in all project area subwatersheds except Hungry Horse Reservoir-Aurora Creek. However, these increases represent 0.47 percent or less of total maximum sediment delivery potential based on average annual estimates for undisturbed forests presented in Elliot (2013). Water quality effects from increased sedimentation and nutrient loading would be isolated to

stream reaches immediately below the point of delivery (Table 68) and are projected to return to background conditions within three years of reclamation based on guidance in Shapiro (2010). Furthermore, Gravelle and others (2009) concluded no statistically significant increases in stream nutrient concentrations resulted from road construction/use in the Mica Creek Experimental Watershed in northern Idaho. A similar response to temporary road construction and use on stream nutrient concentrations would be expected following implementation of alternative 2. Measurable water quality changes (if any) specifically related to sediment delivery from proposed roads would be spatially isolated to hydrologically connected stream reaches. Effects would also be variable depending on climate and stream flow conditions which would make them even more difficult to separate from natural sources. Exceedance of seasonal numeric nutrient standards (Table 53) as a result of temporary road construction/use are not anticipated even at the reach scale.

Historic trail rehabilitation

Alternative 3 would rehabilitate 12.2 miles of historic National Forest system trails restoring hydrologic processes at the hillslope scale. No measurable effect to water yield, peak flows, or sediment delivery are currently attributable to the trail system and no measurable change would be anticipated following rehabilitation. Due to the trails position on the landscape and lack of interaction with stream channels, rehabilitation efforts are not anticipated to have any measurable effect on water quality.

Culvert replacement/aquatic organism passage improvements

Alternative 3 proposes replacing up to nine stream aligned culverts of which six are situated on perennial fish bearing streams (AOPs). As detailed in the effects analysis for alternative 2 culvert replacement would affect water quality as suspended sediment and nutrients associated with potential sediment delivery increases would be elevated during construction. Measured water quality response during culvert removals in northwest Montana by Shapiro (2010) documents maximum TSS values of 4,500 mg/l although rapid subsidence in TSS levels was also documented during periods when construction was inactive showing high levels (such as 2,000 mg/l or higher) dropping within minutes, to 200 or 400 mg/l. A similar water quality response is anticipated for all proposed culvert replacements (including AOPs) during construction. These effects would primarily be limited spatially to the stream reach immediately below proposed work and temporally to the three year period following project completion as detailed in the effects analysis for *Hillslope Erosion and Sediment Delivery* (Table 69). Temporary exceedance of numeric and narrative water quality standards would result from proposed work (particularly TSS). However, these effects would be spatially isolated (Foltz et al., 2008) and temporally limited. All work would be compliant with applicable State and Federal regulatory requirements.

Furthermore, replacement of “at risk” stream aligned culverts would reduce long term risk of road failure and associated water quality degradation below these sites. Estimated sediment delivery associated with road failure is presented in Table 69 and is greater than estimates for replacement. Therefore, identified culvert work would reduce the overall level of risk and decrease the magnitude of potential downstream effects relative to the existing condition. It is important to note that the existing level of failure risk from nine stream aligned culverts on NFS Road 1614 within grizzly bear core habitat (Emery Creek subwatershed) would be unchanged from the existing condition (Table 69).

Summary

The principal mechanism driving alteration of aquatic habitats and water quality under alternative 3 is replacement of up to nine stream aligned culverts within the project area. Sediment delivery resulting from culvert replacement may temporarily alter channel habitat conditions and reduce water quality. Measurable effects would be variable depending on effectiveness of BMPs, climate/stream flow conditions following disturbance, spatially limited to stream reaches immediately below construction areas (approximately 810 meters on average as measured by Foltz and others (2008)), and temporally limited by the duration and magnitude of sediment delivery similar to values displayed in Table 69. Identified culvert work would reduce the level of risk and decrease the magnitude of potential downstream effects associated with road failure to aquatic habitats and water quality relative to the existing conditions (Table 69), however, nine “at risk” stream aligned culverts identified in the affected environment on NFS Road 1614 within grizzly bear core habitat would remain as would the current level of risk of habitat and water quality degradation associated with failure.

Relocation of two segments of NFS Road 546 would reduce habitat and water quality effects associated with the existing position of and sediment delivery from these road segments. Effects are anticipated to benefit water quality and aquatic habitat but may not be measurable at the reach scale. Proposed regeneration harvest may affect water quality by increasing stream nutrient concentrations (particularly Nitrogen). However, exceedance of seasonal numeric nutrient standards (Table 53) are not anticipated even at the reach scale. Application of prescribed fire and reclamation of 12.2 miles of existing trail are not anticipated to produce detectable changes in aquatic habitats or stream water chemistry at the reach scale. Construction of an accessible fishing pier at Lion Lake is anticipated to temporarily reduce water quality during construction at the site. No changes to beneficial use classes or water quality categories would occur as a result of the proposed treatments.

Aquatic species

Effects to aquatic species draws inference from effects analysis associated with *Hydrologic Processes, Hillslope Erosion and Sediment Delivery*, as well as *Aquatic Habitat/Channel Morphology and Water Quality*. Effects from these indicators are assumed to impact aquatic species when they overlap spatially. The following discussion describes potential impacts from each activity generally to all fish species present in the analysis area and specifically to westslope cutthroat trout.

Timber harvest/fuels reduction

Effects to aquatic species resulting from timber harvest and fuels reduction is generally tied to changes in quantity or quality of water; or through direct manipulation of near stream habitats. Analysis of “Hydrologic Processes” indicate changes in annual water yield and peak flows to be within the natural range of variability for all affected subwatersheds (Project File Exhibit M-3). Similarly, design features for all activities dictate that harvest and fuels reduction activities avoid near stream habitats through application of site appropriate INFISH riparian habitat conservation areas buffer widths (USDA, 1995). These efforts would preclude direct manipulation to near stream habitats that could impact aquatic species. Finally, estimates for sediment delivery associated with timber harvest and fuels reduction are not anticipated. Thus, proposed harvest and fuels reduction activities are not anticipated to have any measurable effect to aquatic habitats or the aquatic species that utilize them at the reach scale or beyond.

Temporary and intermittent stored service roads

As detailed in the effects analysis for “Aquatic Habitat”, temporary roads and roads proposed for storage (intermittent stored service roads) generally avoid aquatic habitats and are not anticipated to produce any measurable changes to existing habitat conditions, sediment delivery rates, or water yield beyond the hillslope scale. Therefore, measurable effects to aquatic species are also not anticipated at the reach scale or larger.

Culvert replacement/aquatic organism passage improvements

Replacement of up to nine stream aligned culverts including six AOPs are anticipated to provide long-term benefit (greater than three years) to aquatic species as well as hydrologic processes, water quality and aquatic habitat. However, short-term effects (less than three years) in the form of increased sediment delivery (reduced water quality) and downstream aquatic habitat alteration are expected tradeoffs (Table 69). Design features of alternatives aim to minimize effects to aquatic species through seasonal timing restrictions and temporal distribution of implementation.

Based on the above effects analysis for key indicators, measurable negative effects from proposed culvert replacements and AOPs are primarily concentrated to the reach scale, most pronounced immediately below construction activities, and temporally limited to the three year period after construction (Table 69). Therefore, short term (less than three years) negative effects to aquatic species would be expected to occur over a similar spatial and temporal scale. However, it is important to note that while sediment delivery may return to background levels within three years of construction, effects aquatic habitats may extend beyond the reach scale or longer than three years as project related sediment continues to be transported downstream through natural processes. However, the magnitude of downstream change may be difficult to distinguish from natural sediment sources with increasing basin area, would be variable, dependent on climate and other natural hydrologic processes.

Qualitatively, these effects may cause dispersion of aquatic species and temporarily reduce habitat quality and juvenile fish survivability although these effects would largely be confined to the reach scale or up to approximately 810 meters below culvert replacements (Foltz et al., 2008). Westslope cutthroat trout in Emery and Hungry Horse Creek could be affected at the localized scale near the culverts but it would not result in a loss of viability.

In the long term (greater than three years) sediment delivery associated with proposed culvert replacement and AOPs would be reduced to near background levels, risk of culvert failure and associated sediment delivery would be reduced (Table 69), and suitable fish habitat above existing barriers would be reconnected (Table 61, Project File Exhibit M-14). Access to additional stream habitats and reduced sediment delivery potential would improve the health and resiliency of aquatic species in the face of potential future disturbances (e.g. wildfire) or environmental change.

Summary

Effects to aquatic species are intricately tied to changes in aquatic habitat and water quality. Through actions proposed under alternative 3, the principal mechanism driving change in aquatic habitat and water quality is replacement of stream aligned culverts which are anticipated to produce short term (less than three year) negative impacts to aquatic habitat and water quality through increased sediment delivery (Table 67) and reduced water quality. However, these short term impacts are not anticipated to result in a loss of viability and are an expected tradeoff for long term (greater than three years) benefit to aquatic habitat and water quality as potential road failure risk is reduced and habitat connectivity is restored. The long term benefits of reduced road

failure risk and improved habitat connectivity would be improved health and resiliency of aquatic species in the face of potential future disturbances (e.g. wildfire) or environmental change.

Alternative 3 – Cumulative effects

Key indicators used to quantify potential cumulative effects in the alternative 2 cumulative effects analysis are carried forward in the cumulative effects analysis of alternative 3. Results are presented relative to the existing condition/no-action alternative and summarized in table format when possible.

Hydrologic processes

Changes in equivalent clearcut area values would not result in measurable increases in water yield when compared to the estimated low end range of natural variability as displayed in Table 65 and explained in detail in Project File Exhibit M-3. Predicted equivalent clearcut area values would return to existing conditions within approximately three years for the Abbot Creek subwatershed, 15 years for Emery Creek subwatershed, seven years for Hungry Horse Creek subwatershed, and one year for both Hungry Horse Reservoir-Aurora Creek and Hungry Horse Reservoir-Spring Meadows Creek subwatersheds.

Furthermore, implementation of alternative 3 would not appreciably change road density or road/stream hydrologic connectivity when compared to the existing condition. The combination of successful application of effective BMPs, with the limited size and spatial distribution of associated changes, is unlikely to measurably change hydrologic processes beyond the hillslope scale. Therefore effects to hydrologic processes are not anticipated to be measurable or collectively add to effects at the subwatershed scale.

Hillslope erosion and sediment delivery

The principal anthropogenic sources of sediment that overlap effects from alternative 3 and could measurably contribute to cumulative sediment delivery at the subwatershed scale include maintenance and use of existing travel infrastructure and replacement of one stream aligned culvert on NFS Road 546 (crossing an unnamed perennial tributary to Emery Creek). Culvert replacement on NFS Road 546 in the fall of 2016 is estimated to have elevated sediment delivery by up to 0.05 percent in the Emery Creek subwatershed in 2018 and when combined with estimated increases from the existing road network and alternative 3 the cumulative anthropogenic sediment delivery to the subwatershed could reach 7.59 percent. This is an increase of 1.39 percent relative to the existing condition (Table 70). This level of increase would not be distinguishable from natural variations in sediment delivery at the subwatershed scale. Table 70 displays results for all analysis areas as well as the temporal distribution of sediment delivery from actions identified as having quantifiable contributions of sediment to analysis area subwatersheds. Effects past the subwatershed scale are not anticipated to be measurable or distinguishable from other sources given the spatial distribution of sediment sources and attenuation of effects with increasing distance from the source area. The volume of predicted sediment delivery to Hungry Horse Reservoir from alternative 3 (maximum 0.04 tons or 40 pounds) would not be measurable past the hillslope scale.

Table 70. Cumulative sediment delivery within affected subwatersheds

Action	Abbot Creek			Emery Creek			Hungry Horse Creek			Hungry Horse Reservoir-Spring Meadows Creek		
	² Annual Sediment Delivery Potential (tons)											
	⁴ 2018	⁴ 2019	2020	⁴ 2018	⁴ 2019	2020	⁴ 2018	⁴ 2019	2020	⁴ 2018	⁴ 2019	2020
¹ Road Construction/Use	0.82 (0.06%)	0.25 (0.02%)	0	2.34 (0.46%)	0.86 (0.17%)	0.63 (0.13%)	0.49 (0.16%)	0.18 (0.05%)	0.05 (0.03%)	0.04 (0%)	0.01 (0%)	0
⁵ Road Relocation	n/a	n/a	n/a	0	-0.62 (-0.12%)	-0.75 (-0.15%)	n/a	n/a	n/a	n/a	n/a	n/a
Harvest/Fuels Reduction	0	0	0	0	0	0	0	0	0	0	0	0
Culvert Replacement/BMPs	5.8 (0.41%)	1.7 (0.69%)	0	2.7 (0.54%)	2.57 (0.52%)	0.51 (0.1%)	1.8 (0.30%)	0.5 (0.08%)	0	0	0	0
Prescribed Fire	n/a	n/a	n/a	1.49 (0.3%)	1.22 (0.25%)	0	n/a	n/a	n/a	n/a	n/a	n/a
2016 NFS Road 546 culvert replacement	0	0	0	0.257 (0.05%)	0	0	0	0	0	0	0	0
Existing Roads & Road Maintenance	18 (1.2%)	18 (1.2%)	18 (1.2%)	31 (6.2%)	31 (6.2%)	31 (6.2%)	2 (0.3%)	2 (0.3%)	2 (0.3%)	25 (3.11%)	25 (3.11%)	25 (3.11%)
Total Cumulative Sediment Delivery	24.62	19.95	18	37.79	35.03	31.39	4.29	2.68	2.05	25.04	25.01	25
Total Increase Relative to Existing Conditions	6.62	1.95	0	6.79	4.03	0.39	2.29	0.68	0.05	0.04	0.01	0
³ Total Cumulative Sediment Delivery as a percentage of HUC12 maximum delivery	1.73%	1.40%	1.20%	7.59%	7.03%	6.30%	0.76%	0.43%	0.33%	3.15%	3.12%	3.11%

¹Culvert installation and removal associated with temporary and intermittent stored service roads included in sediment delivery estimate.

²Assumes maximum sediment delivery potential from analysis in the following paragraphs.

³Assumes average annual sediment delivery rate as displayed in Elliot (2013).

⁴Rate of recovery estimate based on methods outlined in Shapiro (2010).

⁵Values represent sediment delivery reduction and assume delivery from relocated road segments is zero.

()Values in parenthesis represent percentage of total maximum average annual sediment delivery for undisturbed forests as displayed in Elliot (2013).

Additionally, past and proposed culvert replacements and road relocation projects would or have reduced long term (greater than three years) sediment delivery potential to affected subwatersheds via reduced road stream interaction and minimizing culvert failure risk through upsizing or re-aligning “at risk” culverts. Estimated sediment delivery reductions associated with proposed road reroutes on NFS Road 546 are quantified in Table 70 while benefits from past actions are measured qualitatively simply through reduced risk. It is important to note that under alternative 3, “at risk” stream aligned culverts on NFS Road 546 and within grizzly bear core habitat would remain as would associated risk of failure. This associated risk is represented in Table 69 by an additional 99 to 198 tons of sediment delivery potential to downstream habitats if failure were to occur (see Table 69).

Aquatic habitat/channel morphology and water quality

Cumulative effects of alternative 3 are not anticipated to permanently degraded aquatic habitats or alter existing water quality use designations although alternative 3 would have cumulative effects to aquatic habitats and water quality. Cumulative sediment delivery is summarized in Table 70. In general, less sediment delivery corresponds to less impact. The effects are analyzed at the subwatershed scale unless noted otherwise.

Proposed culvert replacements and AOPs would contribute short term (less than three years) reductions in aquatic habitat and water quality at the reach scale immediately below proposed work as detailed in the effects analysis for alternative 3. Replacement of a stream aligned culvert on NFS Road 546 in 2016 would contribute similar habitat and water quality impacts in 2018 that would collectively contribute towards temporary reductions in stream habitat and water quality conditions (increased fines, reduced pool depths, elevated TSS) below the construction site which directly affected an unnamed perennial tributary to Emery Creek (Table 70). Collectively at the subwatershed scale, culvert replacement efforts would temporarily reduce habitat conditions and water quality below five culvert replacement sites. Three are situated on perennial streams and one on a seasonal stream in the Emery Creek subwatershed while one replacement would occur on perennial Hungry Horse Creek in the Hungry Horse Creek subwatershed. However, temporary reductions in stream habitat and water quality conditions are expected tradeoffs for reducing long term (greater than three years) risk of culvert failure and associated habitat and water quality deterioration.

Furthermore, replacement of existing culverts on fish bearing streams with AOP structures increases habitat connectivity for westslope cutthroat trout. Combined with the AOP constructed in 2016 (estimated 0.16 miles habitat connectivity increase), proposed AOPs outlined under alternative 3 would increase habitat connectivity by 0.8 miles in the Emery Creek subwatershed (Table 61). Likewise, as detailed in Project File Exhibit M-13, past road decommissioning (including culvert removal), and road relocation appear to be contributing towards habitat recovery in previously degraded reaches of Emery Creek (specifically the lower 1.6 miles). Similarly, long term (greater than three years) benefits from proposed road reroutes under alternative 3 would include habitat recovery on approximately 0.45 miles of upper Emery Creek. Collectively this would result in 2.05 miles of long term habitat improvement associated with road relocations. Qualitatively, the effects of past road decommissioning combined with road reroutes would continue to benefit aquatic habitat and water quality as natural hydrologic processes are restored with time.

Aquatic species

Cumulative effects to aquatic species in the Abbot Creek subwatershed and Lion Lake analysis area under alternative 3 are the same as those described for cumulative effects under alternative 2.

In regards to the South Fork Flathead River subbasin, the most substantial impact to aquatic species from land management has been the construction and maintenance of Hungry Horse Dam which has benefitted bull trout and westslope cutthroat trout by preventing non-native species from reaching this analysis area.

Table 71 outlines estimated annual sediment delivery from natural and measurable anthropogenic sources at the subbasin scale. Other anthropogenic sources include firewood gathering, grazing, and recreational use in or near surface waters (e.g. fishing, boating, and camping). These effects are qualitatively included in the analysis as “minor” sources but not included in Table 71. It is important to note that alternative 3 would not replace several stream aligned culverts in the Emery Creek subwatershed which were identified as undersized or improperly aligned (Project File Exhibit M-21). Therefore, a level of risk remains by leaving the existing structures. This risk is represented in Table 69 by an additional 99 to 198 tons of sediment delivery potential to downstream habitats and ultimately aquatic species if failure were to occur (Table 69).

Table 71. Cumulative sediment delivery in the South Fork Flathead River subbasin

Sediment Source	2018	2019	2020
	¹ Maximum Potential Sediment Delivery (tons/year)		
⁵ Existing Forest System Roads (including maintenance and BMP work)	356	356	356
Hungry Lion - Alternative 3	9	5	0.4
² Betty Baptiste Project (includes Hoke and South Fork Logan Creek CMP replacements)	27	0	0
³ Spotted Bear River Project	0	2	0
³ Soldier Addition II	2	0	0
³ Trail Creek Salvage	4	0	0
Other CMP replacements (McInernie and Kneiff Creeks)	16	5	0
Anthropogenic Cumulative Maximum Sediment Delivery Potential	414	11	0.4
Natural & Anthropogenic Cumulative Maximum Sediment Delivery Potential	1,432	1,016	896
³ 2015 Wildfire	1,018	1,005	896
⁴ Estimated Maximum Potential Background Sediment Delivery	38,252	38,252	38,252

¹Rate of recovery based on estimates in Shapiro (2010).

²Based on information from the Betty Baptiste Proposed Action.

³Data from Trail Creek Salvage EA (USDA Forest Service, 2016).

⁴Estimate reflects maximum average annual sediment delivery for undisturbed forests as described in Elliot (2013).

⁵Estimate from NetMAP: road WEPP GIS dataset.

Bull trout

Similar to alternative 2, alternative 3 does add to a cumulative effect to bull trout FMO habitat by sediment delivery and improved habitat connectivity. However, these effects are unlikely to affect bull trout at the population scale (South Fork Flathead River subbasin) or bull trout critical habitat.

As presented in Table 71, the net impact of land management within the South Fork Flathead River subbasin are just 1.1 percent of the average annual estimated sediment delivery potential for the South Fork Flathead River. This level of increase would be indistinguishable from natural sources at the subbasin scale. Additionally, sediment delivery from sources displayed in Table 71 are temporally limited to less than three years. Thus, bull trout FMO habitat in the South Fork Flathead River subbasin would continue to function within natural range of variability. Bull trout would be fully capable of utilizing the habitat for foraging.

Furthermore, the cumulative construction of AOPs in the South Fork Flathead River subbasin would increase availability of potential bull trout FMO habitat in Emery Creek, Hungry Horse Creek, South Fork Logan Creek, Ryle Creek, Big Bill Creek, Hoke Creek and McInernie Creeks (although bull trout rarely utilize these streams). Access to additional stream habitats and reduced long term (greater than three years) sediment delivery potential would improve the health and resiliency of aquatic species (including bull trout) in the face of potential future disturbances (e.g. wildfire) or environmental change. Bull trout populations at the subbasin scale would remain viable with implementation of alternative 3.

Westslope cutthroat trout

Collectively, sediment delivery as presented in Table 71 could degrade aquatic habitat and water quality ultimately reducing westslope cutthroat trout spawning success in affected reaches for up to two years in portions of the South Fork Flathead River subbasin. However, as displayed in Table 70, cumulative anthropogenic sediment delivery represents only 1.1 percent of maximum potential sediment delivery for undisturbed forests as described by Elliot (2013). Furthermore, the 2015 wildfires represent nearly 70 percent of total estimated sediment delivery for the subbasin and these contributions are considered to be well within the natural range of variation (USDA Forest Service, 2016). Therefore, the data suggest existing aquatic habitat conditions and associated effects to aquatic species are capable of handling temporary increases in sediment delivery rates without lingering effects, and/or; recurrence of large natural watershed disturbances and associated increases in sediment delivery may be a principal mechanism for development and maintenance of aquatic habitats as well as the health and viability of westslope cutthroat trout observed under the existing condition.

Furthermore, it is important to disclose that temporary negative effects to aquatic species through increased sediment delivery and habitat degradation as a result of culvert replacements are short term (less than three years) tradeoffs for perceived long term (greater than three years) benefits. As outlined under cumulative effects to bull trout, effects from culvert replacement or removal, reduce or eliminate long term risk of culvert failure ultimately benefiting downstream aquatic habitats and aquatic species through reduced sediment delivery potential. Likewise, construction of AOPs increases habitat connectivity facilitating access to additional stream habitats. Both efforts would collectively contribute towards improving the health and resiliency of aquatic species (including westslope cutthroat trout) in the face of potential future disturbances (e.g. wildfire) or environmental change. Relative to the existing condition, cumulative effects to westslope cutthroat trout populations would promote increased long term (greater than three years) population viability in the South Fork Flathead River subbasin. Cumulative effects to cutthroat trout in the Abbot Creek subwatershed are not anticipated as the species are no longer found in affected stream reaches.

Alternative 4 – Direct & indirect effects

Key indicators used to quantify potential effects in the alternative 2 analysis are carried forward in the analysis of alternative 4. Results are presented relative to the existing condition/no-action alternative and summarized in table format when possible. Actions common to alternative 2 include prescribed fire, NFS Road 546 road relocations, adding 12.2 miles of existing trail back to the system, and construction of an accessible fishing pier at Lion Lake. Detailed effects analysis for these actions are included in the analysis for alternative 2 and incorporated here by reference. Results from the alternative 2 effects analysis for indicators such as sediment delivery are also included in alternative 4 analysis through inclusion in summary tables. Alternative 4 does not utilize temporary roads or propose adding existing road templates back to the forest road system therefore indicators related to those variables are not considered in the analysis. Alternative 4 also proposes to remove the culverts on Road 1614 rather than replace them, which will require a forest plan amendment to do 30 days of work in grizzly bear core habitat.

Hydrologic processes

Harvest activities

Alternative 4 proposed timber harvest and fuels reduction would reduce canopy cover increasing equivalent clearcut area values in all affected subwatersheds as outlined below in Table 72. However, change in equivalent clearcut area values would not be significant enough (greater than 15 percent change) to produce measurable increases in water yield relative to the existing condition or estimated low end range of natural variability as detailed in the water yield report (Project File Exhibit M-3). Predicted equivalent clearcut area values would return to existing conditions within approximately two years for the Abbot Creek subwatershed, 14 years for Emery Creek subwatershed, four years for Hungry Horse Creek subwatershed, one year for Hungry Horse Reservoir-Aurora Creek subwatershed, and one year for Hungry Horse Reservoir-Spring Meadows Creek subwatershed.

Table 72. Estimated ECA values relative to existing conditions and historic variability

HUC12 Name	% ECA			
	Existing	Alternative 4	Historic Maximum	Losensky Estimated Low-end Range of Natural Variability
Abbot Creek	16.2	17	60.8	5-24
Emery Creek	3.2	6.8	8.9	5-24
Hungry Horse Creek	2.6	3.2	21.7	5-24
Hungry Horse Reservoir-Aurora Creek	6.7	7	14.1	5-24
Hungry Horse Reservoir-Spring Meadows Creek	23.3	23.9	46.8	5-24

Because estimated equivalent clearcut area values under alternative 4 are within the low end range of natural variability (Table 72) and well below historic maximums, these data suggest existing channel and aquatic habitat conditions are capable of handling increases in peak flows without lingering effects, and/or; recurrence of large natural watershed disturbances and associated increases in peak flow events may be a principal mechanism for development and maintenance of watershed processes observed under the existing condition. Because the change in equivalent clearcut area values relative to the low end range of natural variability for each

subwatershed are less than the minimum threshold required for detecting changes in peak flows, measurable increases in small to moderately sized peak flow events (relative to the low end range of natural variability) are not anticipated under alternative 4.

Summary

Under alternative 4, changes in equivalent clearcut area values would not result in measurable increases in water yield or peak flows when compared to the estimated low end range of natural variability as displayed in Table 72 and explained in detail in Project File Exhibit M-3. Relocation of NFS Road 546 would reduce road/stream hydrologic connectivity in the Emery Creek subwatershed by an additional 0.45 miles (common to all action alternatives). Hydrologic processes would recover on reclaimed portions of the reroute over time (5 to 65 years) and be most evident at the hillslope scale as reestablishment of near stream vegetation and decompaction of the existing road template. The addition of an existing trail to the forest trail system would not alter hydrologic processes from the existing condition and construction of an accessible fishing pier on Lion Lake is not anticipated to produce measurable changes in hydrologic processes affecting the lake.

Hillslope erosion and sediment delivery

Ground disturbance associated with alternative 4 include harvest activities (e.g. skid trails and landings), prescribed fire, road BMPs (drainage) as well as replacement and removal of a stream aligned culverts. Estimated sediment delivery resulting from proposed activities are summarized for each of the affected subwatersheds in Table 73. Effects on hillslope erosion and sediment delivery are discussed in further detail by proposed disturbance mechanism below.

Table 73. Potential sediment delivery associated with implementation of alternative 4

Action	Abbot Creek			Emery Creek			Hungry Horse Creek			Hungry Horse Reservoir-Spring Meadows Creek		
	³ Annual Sediment Delivery Potential (tons)											
	⁵ 2018	⁵ 2019	2020	⁵ 2018	⁵ 2019	2020	⁵ 2018	⁵ 2019	2020	⁵ 2018	⁵ 2019	2020
¹ Road Construction/Use	0	0	0	0	0	0	0	0	0	0	0	0
⁶ Road Relocation	n/a	n/a	n/a	0	-0.62 (-0.12%)	-0.75 (-0.15)	n/a	n/a	n/a	n/a	n/a	n/a
Harvest/Fuels Reduction	0	0	0	0	0	0	0	0	0	0	0	0
² Culvert Removal/Replacement/ BMPs	5.8 (0.41%)	1.7 (0.12%)	0	2.7 (0.54%)	36.5 (7.33%)	10.2 (2.05%)	1.8 (0.30%)	0.5 (0.08%)	0	0	0	0
Prescribed Fire	n/a	n/a	n/a	1.49 (0.3%)	1.22 (0.25%)	0	n/a	n/a	n/a	n/a	n/a	n/a
Total	6.2	1.82	0	4.19	37.1	9.45	2.29	0.68	0.05	0.04	0.01	0
⁴ Total Sediment Delivery as a percentage of HUC12 maximum delivery	0.44%	0.13%	0%	0.84%	7.45%	1.90%	0.38%	0.12%	0%	0%	0%	0%

¹Culvert installation and removal associated with temporary and intermittent stored service roads included in sediment delivery estimate.

²Culvert replacement values from exhibit A-19 while estimates for culvert removal utilize values from Klein (2003).

³Assumes maximum sediment delivery potential from analysis in the following paragraphs.

⁴Assumes average annual sediment delivery rate as displayed in Elliot (2013).

⁵Rate of recovery estimate based on methods outlined in Shapiro (2010).

⁶Values represent sediment delivery reduction and assume delivery from relocated road segments is zero.

() Values in parenthesis represent percentage of total maximum average annual sediment delivery for undisturbed forests as displayed in Elliot (2013).

Harvest activities/fuels treatments

Disturbed WEPP-batch Model outputs indicate there is less than a six percent probability of sediment delivery in the first year following treatment which is up to six percent higher than the existing condition represented by the fully forested Disturbed WEPP output scenario (Project File Exhibit M-7). Under alternative 4, model outputs indicate a five year event would not result in sediment delivery from any modeled hillslopes (Table 73). Project File Exhibit M-7 displays model output sediment delivery for larger storm events having less than 20 percent probability of occurrence.

Culvert replacement/aquatic organism passage improvements

Alternative 4 identifies replacement of up to eight stream aligned culverts some of which are barriers to aquatic organism passage as well as removal of up to 10 existing stream aligned culverts on NFS Road 1614. As detailed in Project File Exhibit M-21, several existing stream aligned culverts on NFS Road 1614 are vulnerable to failure due to capacity or alignment issues. Removing these structures effectively eliminates the current risk of failure although removal of stream aligned culverts initially generate more sediment delivery to stream systems than do culvert replacements (Table 74). The same methods and assumption for estimating sediment delivery outlined under alternative 2 apply to analysis of effects for alternative 4.

Table 74. Estimated maximum sediment delivery (yield) associated with hypothetical culvert failure, replacement, and removal

Subwatershed (HUC12)	Year	Associated Road No./Stream	Alternative 1 (no-action) (³ culvert failures)		Alternative 4 (culvert replacements)	Alternative 4 (culvert removals)		
			² Sediment Yield (tons)					
			Klein	FNF			Klein	FNF
Abbot Creek	2018	NFS Road 590A, 590B, 590G, 10129, and 10803/Abbot Creek, South Fork Abbot Creek and tributaries	26.6	34.8	5.8	no culverts proposed for removal	no culverts proposed for removal	
	2019		26.6	34.8	1.7 ¹	no culverts proposed for removal	no culverts proposed for removal	
	2020		26.6	34.8	¹ return to background	no culverts proposed for removal	no culverts proposed for removal	
Emery Creek	2018	NFS Road 546 and 1614/Emery Creek tributaries	126	224.3	2.7	0	0	
	2019		126	224.3	0.8 ¹	35.7	54.2	
	2020		126	224.3	¹ return to background	10.2 ¹ , returning to background in 2021	15.5 ¹ , returning to background in 2021	

Subwatershed (HUC12)	Year	Associated Road No./Stream	Alternative 1 (no-action) (³ culvert failures)		Alternative 4 (culvert replacements)	Alternative 4 (culvert removals)		
			² Sediment Yield (tons)					
			Klein	FNF			Klein	FNF
Hungry Horse Creek	2018	NFS Road 38/Hungry Horse Creek	8.3	7.3	1.8	no culverts proposed for removal	no culverts proposed for removal	
	2019		8.3	7.3	0.5 ¹	no culverts proposed for removal	no culverts proposed for removal	
	2020		8.3	7.3	¹ return to background	no culverts proposed for removal	no culverts proposed for removal	

¹Rate of recovery estimate based on methods outlined in Shapiro (2010).

²Estimates represent potential sediment delivery through processes described in Klein (2003) and Project File Exhibit M-19.

³Estimate follows guidance displayed in Project File Exhibit M-19 and displays total sediment delivery associated with complete failure of all culverts identified for replacement or removal.

Summary

The principal mechanism generating sediment through actions proposed under alternative 4 is removal up to 10 culverts and replacement of up to eight stream aligned culverts. As illustrated in Table 73, sediment delivery (for all actions) as a percentage of estimated total maximum delivery potential for the affected subwatershed does not exceed 0.44 percent in all subwatersheds except Emery Creek (up to 7.45 percent). Detecting this level of change at the subwatershed scale would be difficult to measure or differentiate from natural variation in sediment supplies given the spatial and temporal distribution of effects and proven effectiveness of BMPs. However, measurable effects at the reach scale (or within approximately 810 meters of delivery point) may result following culvert removals but are anticipated to return to background levels within three years of disturbance. Short term (less than three years) increases in sediment delivery is a tradeoff for reducing long term risk associated with potential road failure. Estimates of sediment delivery under hypothetical culvert failure scenarios is greater than delivery predicted through culvert replacement or removal (Table 74) and would produce a long term (greater than three years) reduction in potential sediment delivery relative to the existing condition.

Aquatic habitat/channel morphology and water quality

Aquatic habitat/channel morphology

Timber harvest/fuels reduction

As displayed above in Table 73, proposed timber harvest and fuels reduction activities are not anticipated to result in additional sediment delivery to area streams. Therefore, changes to key indicators of aquatic habitat or channel morphologic conditions as described in the Affected Environment related to increased sediment delivery from proposed treatments would not occur.

Furthermore, riparian habitat conservation areas by design are excluded from treatment units and all site appropriate INFISH riparian habitat conservation area buffers would be implemented. Therefore, proposed harvest activities would not disrupt natural recruitment of large woody

debris or directly manipulate aquatic habitats or channel morphology. Therefore, no direct or indirect effects to aquatic habitats or stream channel morphology are anticipated.

Culvert replacement/aquatic organism passage improvements

Alternative 4 proposes replacing up to eight stream aligned culverts of which six are situated on perennial fish bearing streams (AOPs) as well as removal of up to 10 stream aligned culverts on NFS Road 1614. As detailed in the effects analysis for alternative 2, disturbance and sediment delivery associated with similar actions has been documented to potentially modify aquatic habitats, channel morphology and water quality by increasing width to depth ratios, reducing median particle size, and filling pools (Foltz et al., 2008; Klein, 2003; Madej, 2001; NFWF, 2004; Shapiro, 2010). 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 crossings (approximately 810 meters on average as measured by Foltz and others (2008)) and temporally by the duration and magnitude of sediment delivery displayed in Table 74 above (see effects analysis for Hillslope Erosion and Sediment Delivery).

Furthermore, replacement of “at risk” stream aligned culverts (Project File Exhibit M-21) would reduce future risk of road failure and associated habitat degradation below these sites. Estimated sediment delivery associated with road failure is presented in Table 74 and is greater than estimates for replacement. Therefore, identified culvert work would reduce the overall level of risk and decrease the magnitude of potential downstream effects associated with road failure to aquatic habitats and water quality relative to the existing condition.

Water quality

Timber harvest/fuels reduction

Effects analysis for both “*Hydrologic Processes*” and “*Hillslope Erosion and Sediment Delivery*” showed no measurable water yield increase and no sediment delivery resulting from implementation of proposed timber harvest and fuels reduction projects under alternative 4 (Table 72 and Table 73). Therefore, no measurable increases in TSS concentrations or total phosphorus concentrations associated with timber harvest or fuels reduction would be expected at the hillslope scale or beyond through implementation of actions proposed under alternative 4.

Increased stream nitrogen loading may occur at the hillslope scale below regeneration harvest units because, slash material generated through harvest activities can alter organic matter dynamics (Bilby & Bisson, 1992) including the rate of mineralization (Gravelle et al., 2009), and natural processes following harvest such surface runoff and nutrient leaching represent additional mechanisms for nutrient transport to surface waters. Through these mechanisms, increases in stream nitrogen concentrations could occur in surface waters adjacent to regeneration harvest areas in Emery Creek, Hungry Horse Creek, South Fork Abbot Creek and Hungry Horse Reservoir. However, larger buffers to surface waters through application of INFISH guidance and the Montana streamside management zone law would facilitate greater nutrient uptake (soils and vegetation) further reducing overall nutrient contributions relative to measured values by Gravelle and others (2009). If these effects were to occur, they may be difficult to distinguish from other natural nutrient sources but could persist for up to three years post-harvest following observations by Gravelle and others (2009). Nutrient concentrations would also be expected to peak seasonally in response to spring runoff. However, exceedance of seasonal numeric nutrient standards (Table 53) are not anticipated even at the reach scale. No changes to beneficial use classes or water quality categories would occur as a result of the proposed treatments.

Culvert replacement/aquatic organism passage improvements

Alternative 4 proposes replacing up to eight stream aligned culverts of which six are situated on perennial fish bearing streams (AOPs) and removing up to 10 stream aligned culverts from NFS Road 1614. Culvert replacement would affect water quality as suspended sediment and nutrients associated with potential sediment delivery increases would be elevated during construction (Table 73 and Table 74). A similar water quality response is anticipated for all proposed culvert replacements (including AOPs) during construction. These effects would primarily be limited spatially to the stream reach immediately below proposed work and temporally to the three year period following project completion as detailed in the effects analysis for *Hillslope Erosion and Sediment Delivery* and presented in Table 74. Temporary exceedance of numeric and narrative water quality standards would result from proposed work (particularly TSS). However, these effects would be spatially isolated (Foltz et al., 2008) and temporally limited (Table 74). All work would be compliant with applicable State and Federal regulatory requirements.

Furthermore, replacement of “at risk” stream aligned culverts (Project File Exhibit M-21) would reduce long term (greater than three years) risk of road failure and associated water quality degradation below these sites. Estimated sediment delivery associated with road failure is presented in Table 74 and is greater than estimates for culvert removal or replacement. Therefore, identified culvert work would reduce the overall level of risk and decrease the magnitude of potential downstream effects associated with road failure to water quality relative to the existing condition.

Summary

The principal mechanism driving alteration of aquatic habitats and water quality under alternative 4 is replacement of up to eight stream aligned culverts and removal of up to 10 stream aligned culverts within the project area. Sediment delivery resulting from culvert replacement may temporarily alter channel habitat conditions and water quality by increasing percent pool tail fines, reducing median particle size, decreasing residual pool depths, and increasing TSS (Shapiro, 2010). Measurable effects would be variable depending on effectiveness of BMPs, climate/stream flow conditions following disturbance, spatially limited to stream reaches immediately below construction areas (approximately 810 meters on average as measured by Foltz and others (2008)), and temporally limited by the duration and magnitude of sediment delivery similar to values displayed in Table 74. Identified culvert work would reduce the level of risk and decrease the magnitude of potential downstream effects associated with road failure to aquatic habitats and water quality relative to the existing conditions (Table 74).

Aquatic species

Timber harvest/fuels reduction

Effects to aquatic species resulting from timber harvest and fuels reduction is generally tied to changes in quantity or quality of water; or through direct manipulation of near stream habitats. Analysis of “Hydrologic Processes” indicate changes in annual water yield and peak flows to be within the natural range of variability for all affected subwatersheds (Project File Exhibit M-3). Similarly, design features of the alternatives dictate harvest and fuels reduction activities avoid near stream habitats through application of site appropriate INFISH riparian habitat conservation areas buffer widths. These efforts would preclude direct manipulation to near stream habitats that could impact aquatic species. Finally, estimates for sediment delivery associated with timber harvest and fuels reduction are not anticipated. Thus, proposed harvest and fuels reduction

activities are not anticipated to have any measurable effect to aquatic habitats or aquatic species at the reach scale or beyond.

Culvert replacement/aquatic organism passage improvements

Replacement of up to eight stream aligned culverts including six AOPs and removal of 10 stream aligned culverts on NFS Road 1614 are anticipated to provide long-term benefit (greater than three years) to aquatic species as well as hydrologic processes, water quality and aquatic habitat (see effects analysis for those indicators). However, short-term effects (less than three years) in the form of increased sediment delivery (reduced water quality) and downstream aquatic habitat alteration are expected tradeoffs (Table 74). Design features for all action alternatives aim to minimize effects to aquatic species through seasonal timing restrictions and temporal distribution of implementation.

Based on the above effects analysis for key indicators, measurable negative effects from proposed culvert replacements and AOPs are primarily concentrated to the reach scale, most pronounced immediately below construction activities, and temporally limited to the three year period after construction (Table 74). Therefore, short term (less than three years) negative effects to aquatic species would be expected to occur over a similar spatial and temporal scale. However, it is important to note that while sediment delivery may return to background levels within three years of construction, effects aquatic habitats may extend beyond the reach scale or longer than three years as project related sediment continues to be transported downstream through natural processes. However, the magnitude of downstream change may be difficult to distinguish from natural sediment sources with increasing basin area, would be variable, dependent on climate and other natural hydrologic processes.

Qualitatively, these effects may cause dispersion of aquatic species and temporarily reduce habitat quality and juvenile fish survivability although these effects would largely be confined to the reach scale or up to approximately 810 meters below culvert replacements (Foltz et al., 2008). Westslope cutthroat trout would be affected where present (South Fork Flathead River subbasin) but temporary small declines in the numbers would not result in a loss of viability or local extirpation for either population.

In the long term (greater than three years) sediment delivery associated with proposed culvert removals and AOPs would be reduced to near background levels, risk of culvert failure and associated sediment delivery would be reduced (Table 74), and suitable fish habitat above existing barriers would be reconnected (Table 61). Access to additional stream habitats and reduced sediment delivery potential would improve the health and resiliency of aquatic species in the face of potential future disturbances (e.g. wildfire) or environmental change.

Summary

Effects to aquatic species are intricately tied to changes in aquatic habitat and water quality. Through actions proposed under alternative 4, the principal mechanism driving change in aquatic habitat and water quality is replacement of stream aligned culverts which are anticipated to produce short term (less than three year) negative impacts to aquatic habitat and water quality through increased sediment delivery (Table 73) and reduced water quality. However, these short term impacts are not anticipated to result in a loss of viability or local extirpation for westslope cutthroat trout or bull trout populations and are an expected tradeoff for long term (greater than three years) benefit to aquatic habitat and water quality as potential road failure risk is reduced and habitat connectivity is restored. The long term benefits of reduced road failure risk and

improved habitat connectivity would be improved health and resiliency of aquatic species in the face of potential future disturbances (e.g. wildfire) or environmental change.

Alternative 4 – Cumulative effects

Key indicators used to quantify potential cumulative effects in the alternative 2 analysis are carried forward in the cumulative effects analysis of alternative 4. Results are presented relative to the existing condition/no-action alternative and summarized in table format when possible.

Hydrologic processes

Alternative 4 proposed timber harvest and fuels reduction would reduce canopy cover increasing equivalent clearcut area values in all affected subwatersheds as outlined below in Table 75. However, change in equivalent clearcut area values would not be significant enough (greater than 15 percent change) to produce measurable increases in water yield relative to the existing condition or estimated low end range of natural variability as detailed in the water yield report (Project File Exhibit M-3). Predicted equivalent clearcut area values would return to existing conditions within approximately two years for the Abbot Creek subwatershed, 14 years for Emery Creek subwatershed, four years for Hungry Horse Creek subwatershed, one year for Hungry Horse Reservoir-Aurora Creek subwatershed, and one year for Hungry Horse Reservoir-Spring Meadows Creek subwatershed.

Furthermore, implementation of alternative 4 would not change road density or road/stream hydrologic connectivity when compared to the existing condition. No new temporary roads are proposed and no existing road templates would be utilized or added back to the forest road system. The combination of successful application of effective BMPs, with the limited size and spatial distribution of associated changes, is unlikely to measurably change hydrologic processes beyond the hillslope scale. Therefore effects to hydrologic processes are not anticipated to be measurable or collectively add to effects at the subwatershed scale.

Hillslope erosion and sediment delivery

The principal sources of sediment that could measurably contribute to cumulative sediment delivery at the subwatershed scale include maintenance and use of existing travel infrastructure and replacement of one stream aligned culvert on NFS Road 546 (crossing an unnamed perennial tributary to Emery Creek). Culvert replacement on NFS Road 546 in the fall of 2016 is estimated to have elevated sediment delivery by up to 0.05 percent in the Emery Creek subwatershed in 2018 and when combined with estimated increases from the existing road network and alternative 4 the cumulative anthropogenic sediment delivery to the subwatershed could reach 13.65 percent. This is an increase of 7.45 percent relative to the existing condition (Table 75). This level of increase would not be distinguishable from natural variations in sediment delivery at the subwatershed scale. Table 75 displays results for all analysis areas as well as the temporal distribution of sediment delivery from actions identified as having quantifiable contributions of sediment to analysis area subwatersheds. Effects past the subwatershed scale are not anticipated to be measurable or distinguishable from other sources given the spatial distribution of sediment sources and attenuation of effects with increasing distance from the source area.

Table 75. Cumulative sediment delivery within affected subwatersheds

Action	Abbot Creek			Emery Creek			Hungry Horse Creek			Hungry Horse Reservoir-Spring Meadows Creek		
	² Annual Sediment Delivery Potential (tons)											
	⁴ 2018	⁴ 2019	2020	⁴ 2018	⁴ 2019	2020	⁴ 2018	⁴ 2019	2020	⁴ 2018	⁴ 2019	2020
¹ Road Construction/Use	0	0	0	0	0	0	0	0	0	0	0	0
⁵ Road Relocation	n/a	n/a	n/a	0	-0.62 (-0.12%)	-0.75 (-0.15%)	n/a	n/a	n/a	n/a	n/a	n/a
Harvest/Fuels Reduction	0	0	0	0	0	0	0	0	0	0	0	0
Culvert Replacement/ Removal/BMPs	5.8 (0.41%)	1.7 (0.12%)	0	2.7 (0.54%)	36.5 (7.33%)	10.2 (2.05%)	1.8 (0.30%)	0.5 (0.08%)	0	0	0	0
Prescribed Fire	n/a	n/a	n/a	1.49 (0.3%)	1.22 (0.25%)	0	n/a	n/a	n/a	n/a	n/a	n/a
2016 NFS Road 546 Culvert Replacement	0	0	0	0.257 (0.05%)	0	0	0	0	0	0	0	0
Existing Roads & Road Maintenance	18 (1.2%)	18 (1.2%)	18 (1.2%)	31 (6.2%)	31 (6.2%)	31 (6.2%)	2 (0.3%)	2 (0.3%)	2 (0.3%)	25 (3.11%)	25 (3.11%)	25 (3.11%)
Total Cumulative Sediment Delivery	24.62	19.7	18	35.45	67.97	40.45	3.8	2.5	2	25.04	25.01	25
Total Increase Relative to Existing Conditions	5.8	1.7	0	4.45	10.38	9.45	1.8	0.5	0	0.04	0.01	0
³ Total Cumulative Sediment Delivery as a percentage of HUC12 maximum delivery	1.67%	1.40%	1.20%	7.12%	13.65%	8.12%	0.63%	0.42%	0.33%	3.11%	3.11%	3.11%

¹Culvert installation and removal associated with temporary and intermittent stored service roads included in sediment delivery estimate.

²Assumes maximum sediment delivery potential from analysis in the following paragraphs.

³Assumes average annual sediment delivery rate as displayed in Elliot (2013).

⁴Rate of recovery estimate based on methods outlined in Shapiro (2010).

⁵Values represent sediment delivery reduction and assume delivery from relocated road segments is zero.

(%)Values in parenthesis represent percentage of total maximum average annual sediment delivery for undisturbed forests as displayed in Elliot (2013).

Additionally, past and proposed culvert replacements and road relocation projects would or have reduced long term (greater than three years) sediment delivery potential to affected subwatersheds via reduced road stream interaction and minimizing culvert failure risk through upsizing or re-aligning “at risk” culverts. Estimated sediment delivery reductions associated with proposed road reroutes on NFS Road 546 are quantified in Table 75 while benefits from past actions are measured qualitatively simply through reduced risk. Because alternative 4 would remove stream aligned culverts on NFS Road 546 within grizzly bear core habitat, potential sediment delivery from hypothetical culvert failure is effectively eliminated. However, minor amounts of sediment would likely be generated through snowmobile grooming and brushing as it would be necessary for equipment to navigate all stream crossings to perform these operations. Brushing operations would likely occur every three to five years and associated sediment delivery would be difficult to detect even at the reach scale. Grooming operations typically would not generate sediment outside of low snowpack years and during shoulder season operations when snow conditions are soft and navigation of stream crossings can be difficult. The magnitude of sediment delivery during these periods is anticipated to be minor but variable and would likely be reflective of the degree of disturbance and weather conditions at the time of grooming. Furthermore, continued use of reclaimed stream crossings would limit stream bank recovery which may also influence erosion and sediment delivery potential from the excavated area as well as adjoining road surface.

Aquatic habitat/channel morphology and water quality

Cumulative effects of alternative 4 are not anticipated to permanently degrade aquatic habitats or alter existing water quality use designations, although alternative 4 would have cumulative effects to aquatic habitats and water quality. Cumulative sediment delivery is summarized in Table 75. In general, less sediment delivery corresponds to less impact. The effects are analyzed at the subwatershed scale unless noted otherwise.

Proposed culvert replacements, culvert removals and AOPs would contribute short term (less than three years) reductions in aquatic habitat and water quality at the reach scale immediately below proposed work as detailed in the effects analysis for alternative 3. Replacement of a stream aligned culvert on NFS Road 546 in 2016 would contribute similar habitat and water quality impacts in 2018 that would collectively contribute towards temporary reductions in stream habitat and water quality conditions (increased fines, reduced pool depths, elevated TSS) below the construction site which directly affect an unnamed perennial tributary to Emery Creek (Table 75). Collectively at the subwatershed scale, culvert replacement or removal efforts within the Emery Creek subwatershed would temporarily reduce habitat conditions and water quality below 13 sites, eight of which are situated on perennial streams. However, temporary reductions in stream habitat and water quality conditions is the expected tradeoff for reducing long term (greater than three years) risk of culvert failure and associated habitat and water quality deterioration as depicted in Table 74 through estimates for sediment delivery following potential culvert failure. Furthermore, replacement of existing culverts on fish bearing streams with AOP structures (the 2016 replacement was an AOP structure) increases habitat connectivity for westslope cutthroat trout. Combined with the AOP constructed in 2016 (estimated 0.16 miles habitat connectivity increase), proposed AOPs outlined under alternative 4 would increase habitat connectivity by 0.8 miles in the Emery Creek subwatershed (Table 61).

Additionally, as detailed in Project File Exhibit M-13, past road decommissioning (including culvert removal), and road relocation appear to be contributing towards habitat recovery in previously degraded reaches of Emery Creek (specifically the lower 1.6 miles). Similarly, anticipated long term (greater than three years) benefits from proposed road reroutes would include habitat recovery on approximately 0.45 miles of upper Emery Creek (Table 75).

Collectively this would result in 2.05 miles of long term habitat improvement associated with road relocations. Qualitatively, the effects of past road decommissioning combined with road reroutes would continue to benefit aquatic habitat and water quality as natural hydrologic processes are restored with time.

Aquatic species

Effects to aquatic species in the Abbot Creek subwatershed under alternative 4 are similar to those described under alternative 2 although cumulative sediment delivery would be reduced by 0.82 tons in 2018 and 0.25 tons in 2019. At the subwatershed scale, these reductions correspond to only 0.06 percent in 2018 and 0.02 percent in 2019 which would not result in a measurable effect to aquatic species relative to conditions outlined under the alternative 2 analysis.

Cumulative effects to aquatic species in the Lion Lake analysis area under alternative 4 are the same as those described for cumulative effects under alternative 2.

For the South Fork Flathead subbasin, the most substantial impact to aquatic species from land management has been the construction and maintenance of Hungry Horse Dam which has benefitted bull trout and westslope cutthroat trout by preventing non-native species from reaching this analysis area.

Table 76 outlines estimated annual sediment delivery from natural and measurable anthropogenic sources at the subbasin scale. Other anthropogenic sources include firewood gathering, grazing and recreational use in or near surface waters (e.g. fishing, boating, and camping). These effects are qualitatively included in the analysis as “minor” sources but not included in Table 76.

Table 76. Estimated maximum cumulative sediment delivery potential in the South Fork Flathead River subbasin

Sediment Source	2018	2019	2020
	¹ Maximum Potential Sediment Delivery (tons/year)		
⁵ Existing Forest System Roads (including maintenance and BMP work)	356	356	356
Hungry Lion - Alternative 4	6.3	10.9	9.5
² Betty Baptiste Project (includes Hoke and South Fork Logan Creek CMP replacements)	27.0	0.0	0.0
³ Spotted Bear River Project	0.0	2.0	0.0
³ Soldier Addition II	2.0	0.0	0.0
³ Trail Creek Salvage	4.0	0.0	0.0
Other CMP replacements (McInernie and Kneiff Creeks)	16.0	4.6	0.0
Anthropogenic Cumulative Maximum Sediment Delivery Potential	411.2	17.5	9.5
Natural & Anthropogenic Cumulative Maximum Sediment Delivery Potential	1,429.2	1,022.5	905.5
³ 2015 Wildfire	1,018	1,005	896
⁴ Estimated Maximum Potential Background Sediment Delivery	38,252	38,252	38,252

¹Rate of recovery based on estimates in Shapiro (2010).

²Based on information from the Betty Baptiste Proposed Action

³Data from Trail Creek Salvage EA (USDA Forest Service, 2016).

⁴Estimate reflects maximum average annual sediment delivery for undisturbed forests as described in Elliot (2013).

⁵Estimate from NetMAP: road WEPP GIS dataset.

Bull trout

Similar to alternative 2, alternative 4 does add to a cumulative effect to bull trout FMO habitat by sediment delivery and improved habitat connectivity. However, these effects are unlikely to affect bull trout at the population scale (South Fork Flathead River subbasin) or their critical habitat.

As presented in Table 76, the net impact of land management within the South Fork Flathead River subbasin are just 1.1 percent of the average annual estimated sediment delivery potential for the South Fork Flathead River. This level of increase would be indistinguishable from natural sources at the subbasin scale. Additionally, sediment delivery are temporally limited to less than three years. Thus, bull trout FMO habitat in the South Fork Flathead River subbasin would continue to function within natural range of variability. Bull trout would be fully capable of utilizing the habitat for foraging.

Furthermore, the construction of AOPs in the South Fork Flathead River subbasin would increase availability of potential bull trout FMO habitat in Emery Creek, Hungry Horse Creek, South Fork Logan Creek, Ryle Creek, Big Bill Creek, Hoke Creek and McInernie Creeks (although bull trout rarely utilize these streams). Access to additional stream habitats and reduced long term (greater than three years) sediment delivery potential would improve the health and resiliency of aquatic species (including bull trout) in the face of potential future disturbances (e.g. wildfire) or environmental change. Bull trout populations at the subbasin scale would remain viable with implementation of alternative 4.

Westslope cutthroat trout

Collectively, sediment delivery as presented in Table 76 could degrade aquatic habitat and water quality ultimately reducing cutthroat trout spawning success in affected reaches for up to two years in portions of the South Fork Flathead River subbasin. However, as displayed in Table 75, cumulative anthropogenic sediment delivery represents only 1.1 percent of maximum potential sediment delivery for undisturbed forests as described by Elliot (2013). Furthermore, the 2015 wildfires represent nearly 70 percent of total estimated sediment delivery for the subbasin and these contributions are considered to be well within the natural range of variation (USDA Forest Service, 2016). Therefore, the data suggest existing aquatic habitat conditions and associated effects to aquatic species are capable of handling temporary increases in sediment delivery rates without lingering effects, and/or; recurrence of large natural watershed disturbances and associated increases in sediment delivery may be a principal mechanism for development and maintenance of aquatic habitats as well as the health and viability of westslope cutthroat trout observed under the existing condition.

Furthermore, it is important to disclose that temporary negative effects to aquatic species through increased sediment delivery and habitat degradation are short term (less than three years) tradeoffs for perceived long term (greater than three years) benefits. As outlined under cumulative effects to bull trout, effects from culvert replacement or removal reduce or eliminate long term risk of culvert failure ultimately benefiting downstream aquatic habitats and aquatic species through reduced sediment delivery potential. Likewise, construction of AOPs increases habitat connectivity facilitating access to additional stream habitats. Both efforts would collectively contribute towards improving the health and resiliency of aquatic species (including westslope cutthroat trout) in the face of potential future disturbances (e.g. wildfire) or environmental change. Relative to the existing condition, cumulative effects to westslope cutthroat trout populations would promote increased long term (greater than three years) population viability in the South Fork Flathead River subbasin. Cumulative effects to cutthroat trout in the Abbot Creek subwatershed are not anticipated as the species are no longer found in affected stream reaches.

Regulatory Framework and Consistency

Management and protection of water resources on National Forest System (NFS) lands is regulated by the Federal Water Pollution Control Act (Clean Water Act), the Endangered Species 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 best management practices (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 Hungry Lion Project would utilize all applicable BMPs during project design and implementation as described in best management practices for Forestry in Montana (MDNRC, 2015). Also the Forest Service - Soil and Water Conservation Practices (Forest Service Handbook 2509.22 (USDA Forest Service)) are combined with Montana State BMPs 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. The forest plan emphasizes the application of BMPs "to protect or improve the quality

of the water source" (USDA Forest Service, 1986 p. II-49). All management alternatives would meet the requirements of the Clean Water Act.

Endangered Species Act

There are two aquatic species that occur on the Flathead National Forest that are protected with the Endangered Species Act, namely the Meltwater Lednian Stonefly (*Lednia tumana*) and bull trout. The Meltwater Lednian Stonefly is listed as "proposed" species but it is not present in the project area. A Biological Assessment for this species is located in Project File Exhibit M-29.

Bull trout are listed as a "threatened" species under the Endangered Species Act and are present in the project area. Bull trout critical habitat has been designated in Hungry Horse Reservoir and the Middle Fork Flathead River but not in tributary streams of the project area. Critical habitat is evaluated by nine Primary Constituent Elements (PCEs). Table 77 itemizes each PCE and the project impacts. A Biological Assessment for the impacts of the project to bull trout and bull trout critical habitat is in Project File Exhibit M-28.

Table 77. Review of bull trout critical habitat PCE

PCE Number	Description	Hungry Lion Project impact (Alternative 2)
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 15 °C 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.	While the project does improve channel complexity in Emery Creek, that stream is not critical habitat. 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.	A very small amount of fine sediment is anticipated to reach Hungry Horse Reservoir and Middle Fork Flathead River. 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	While the project does restore subsurface water connectivity in Emery Creek, that stream is not

PCE Number	Description	Hungry Lion Project impact (Alternative 2)
	contribute to water quality and quantity.	critical habitat. 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.	While the project does restore habitat connectivity (eliminates physical barriers) in Abbot Creek, Emery Creek and Hungry Horse Creek, these streams are not critical habitat. 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. The two species are westslope cutthroat trout and western pearlshell mussel (*Margaritifera falcata*). The pearlshell mussel is not found in the analysis area and therefore all action alternatives of the project have “no impact” to the pearlshell mussel. For cutthroat trout, all action alternatives of the project “may impact individuals or their habitat but will not result in a loss of species viability or create a significant trend towards federal listing”. This is due to consideration of the temporary impacts generated during culvert replacement and road relocation, even though ultimately these actions are beneficial. The biological evaluation is available in the Project File Exhibit M-31.

Montana streamside management zone law

The purpose of the Montana streamside management zone law is to protect the quality and quantity of forest waters and to conserve the integrity of Montana streamside zones. The law prohibits clearcutting, 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 must approve any exceptions to these prohibited practices. Streamside management zones are typically nested within riparian habitat conservation areas that are defined in the forest plan. All management alternatives comply with State streamside management zone laws.

Wetlands and floodplains

Wetlands and floodplains are protected under Executive Orders 11990 and 11988, respectively. All wetlands and riparian zones would have riparian habitat conservation areas and streamside management zones around them to meet forest plan direction and Montana streamside management zone law. Therefore all alternatives would meet the requirements of these Executive Orders.

Forest plan direction

The Flathead National Forest Land and Resource Management Plan 1986 (USDA Forest Service, 1986) 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 were established beside streams, lakes and wetlands. Various riparian goals are identified and activities within riparian habitat conservation areas must not regard either goals or Riparian Management Objectives. No activity is proposed in riparian habitat conservation areas except for NFS Road 546 road relocations and culvert replacement or removals. These activities fully maintain all INFISH goals and standards. Project File Exhibit M-27 further details how these two actions comply with INFISH.

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 under any alternative. 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]. This 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. Sediment sources were evaluated prior to the Paint Emery and Fire Fighter Projects and all known sources were rehabilitated. The amendment also seeks (4) “opportunities for recovery of westslope cutthroat trout populations in streams having non-native trout” but this is not required for every project and was not part of the purpose and need.

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. The 124 is a joint permit that ensures compliance with applicable State and Federal laws that relate to protection of streams, wetlands, floodplains, and other water-related features.

Where work is needed within a streambed, stream banks, floodplain, or wetland the Forest Service will submit a Joint Application (310 form 270) to all appropriate local, State and Federal

agencies to acquire necessary permits. Exemptions from Clean Water Act permitting exist for “normal farming, silviculture, or ranching activities” as defined in Section 404(f)(1)(A) of the Clean Water Act. These exemptions do not preclude the Forest Service from obtaining required non-Federal permits such as Stream Protection Act 124 permits from Montana Fish Wildlife and Parks, Floodplain Permits from City or County Floodplain Administrators or Navigable Rivers Land Use License/Easements from the Department of Natural Resources and Conservation. 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.

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Threatened and Endangered Wildlife Species

Introduction

There are two threatened and endangered wildlife species (TES) and one proposed wildlife species that may be found in the Hungry Lion project area, as well as throughout the South Fork of the Flathead (Table 78).

Life history information on these species can be found in the Flathead National Forest Evaluation and Compliance with National Forest Management Act (NFMA) Requirements to Provide for Diversity of Animal Communities (USDA Forest Service, 2017b). The gray wolf was delisted in 2012; effects analysis for the gray wolf can be found in the Sensitive Wildlife Species section of this EA. The North American wolverine is currently proposed for listing.

Table 78. Threatened, endangered, and proposed species and critical habitat known or suspected to occur within the influenced area of project activities

Species	Status	Occurrence
Canada Lynx (<i>Lynx canadensis</i>)	Threatened; Critical Habitat	Resident
Grizzly Bear (<i>Ursus arctos</i>)	Threatened	Resident
Wolverine (<i>Gulo gulo</i>)	Proposed	Resident

Canada Lynx

Summary of Findings

Of the action alternatives, alternative 3 would have the least amount of impact to lynx, lynx foraging habitat, lynx denning and would result in the smallest amount of early stand initiation habitat created. Alternative 2 would affect almost twice the amount of lynx foraging habitat. All 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. Proposed recreational improvements and proposed system trails would not contribute adverse effects to lynx.

Table 79. Comparison of effects to lynx foraging habitat across all project Lynx Analysis Units by alternative

Alternative	Acres Multistory Forage Treated	Acres Stand Initiation Forage Treated	Acres Denning Habitat Treated	% Increase in Early Stand Initiation Habitat From Existing Condition
1	0	0	0	0%
2	351	407	458	17%
3	261	84	309	10%
4	113	407	166	13%

Analysis Area

In accordance with the Lynx Conservation Assessment and Strategy (ILBT, 2013; USDA Forest Service, USDI Fish and Wildlife Service, USDI Bureau of Land Management, & USDI National

Park Service, 2000), 109 Lynx Analysis Units (LAUs) were identified and mapped on Flathead National Forest lands. The proposed Hungry Lion Project is located within portions of the Coram Abbot, Lake Five, Emery Creek, and Hungry Horse Creek Lynx Analysis Units (Project File Exhibit H-6). These units approximate the size of an area used by an individual lynx and encompass both lynx habitat and areas classified as non-habitat. The Lake Five, Emery Creek, Coram Abbot and Hungry Horse Creek Lynx Analysis Units (approximately 61,203 acres combined) are the geographic area used to analyze direct, indirect, and cumulative effects for Canada lynx (USDA Forest Service, 2007).

Temporal Bounds

The length of time for the proposed activities associated with the Hungry Lion Project is approximately five years. This is based on the probable contract length for the proposed project, and the timeframes for related activities. The temporal scale of the effects analysis extends 100 years into the future, enough time for dense forest conditions and mature multistory stands to develop and trees to die and/or fall over and create denning habitat. Temporal bounds for specific activities are discussed below.

Methodology

Data used included aerial photography, National Agricultural Imagery Program (NAIP) images, stand exams, VMAP data, review of the best available science, and geographic information system (GIS) and dataset information for features, such as general forest attributes, slope, aspect, habitat type, forest type, elevation, and mapped lynx habitat based on the Flathead National Forest model. In addition, site-specific information on habitat characteristics was collected from on-site visits of proposed treatment areas. Effects to lynx winter foraging habitat and creation of early stand initiation habitat are used to evaluate the project alternatives.

Habitat

Winter foraging habitat for lynx includes dense sapling-size stands (e.g., stand initiation) that are tall enough to protrude above the snow in the winter months and are dense enough to support snowshoe hare (USDA Forest Service, 1999a) and multistory forest stands that include dense patches of trees in the understory or overstory trees with limbs that touch the ground. These dense stands that lynx select use for foraging during the winter months have deep snow depths and high amounts of snowshoe hare (Project File Exhibit H-6). During summer, lynx broaden their resource use to select younger forests with high horizontal cover, abundant total shrubs, abundant small-diameter trees, and dense saplings, especially spruce and fir saplings that don't protrude above the snow during the winter months (John R. Squires, Decesare, Kolbe, & Ruggiero, 2010).

Canada lynx modeled habitat is widespread across the U.S. Forest Service's Northern Region and the Flathead National Forest (USDA Forest Service, 2017b). Lynx have evolved with forest disturbance (USDA Forest Service et al., 2000). Stand-replacing fire has been a dominant influence historically in the northern Rocky Mountains. The dominant regime in lynx habitat in pre-settlement times was long-interval (40 to 200 years), high-severity, stand-replacing fire in continuous forests of lodgepole pine, spruce, and subalpine fir, often with smaller acreages subjected to non-lethal, low-severity fires in the intervals between stand-replacing fires (USDA Forest Service et al., 2000). Dense regenerating vegetation as stand initiation from disturbance or as an understory in stands provides horizontal cover for snowshoe hare. The amount and density of horizontal cover strongly influences snowshoe hare abundance (Mills et al., 2005). Depending

on the prescription type, vegetation management may mimic natural disturbance and can reduce stand density and encourage understory growth (Fuller & Harrison, 2010).

The highest quality winter lynx habitat is mature, multi-layer forests with Engelmann spruce and subalpine fir in the overstory and midstory (John R. Squires et al., 2010). Lynx multistory foraging habitat is further described in Project File Exhibit H-6. The importance of multistory forests is further supported by Nathan Daniel Berg (2010) and Nathan D. Berg, Gese, Squires, and Aubry (2012), which documented the highest hare densities in multistory forests in Wyoming. In northwest Montana, forests used during winter were composed of larger diameter trees with higher horizontal cover, more abundant snowshoe hares, and deeper snow John R. Squires et al. (2010). During the winter, lynx selected an elevation band between 1,260 to 2,355 meters (4,134 to 7,726 feet) (John R. Squires et al., 2010). John R. Squires et al. (2010) recommended that, “Given that lynx in Montana exhibit seasonal differences in resource selection, we encourage managers to maintain habitat mosaics. Because winter habitat may be most limiting for lynx, these mosaics should include abundant multistory, mature spruce–fir forests with high horizontal cover that are spatially well-distributed” (John R. Squires et al., 2010). This science is consistent with management direction in the Northern Rockies Lynx Management Direction. The Northern Rockies Lynx Management Direction incorporated management direction into land management plans for the conservation and recovery of Canada lynx (USDA Forest Service, 2007). The Northern Rockies Lynx Management Direction sets standards, objectives, and guidelines for lynx habitat including early stand initiation, stand initiation, and multistory forage (i.e., Veg S1 - Veg S6). The Northern Rockies Lynx Management Direction is discussed in more detail under the Regulatory Consistency section. The mosaic of forest openings and lynx forage throughout the project Lynx Analysis Units were considered in regard to habitat distribution and lynx travel when designing the proposed project.

Snowshoe hares are the primary prey of lynx, comprising 35 to 97 percent of the diet throughout the range of the lynx (Apps, 2000; Burdett, 2008; G. Mowat, Poole, & O'Donoghue, 2000; Shenk, 2009; J. R. Squires & Ruggiero, 2007). Lynx habitat selection largely reflects that of hares, both seasonally, as well as through the hare population cycle (McCann & Moen, 2011; Garth Mowat & Slough, 2003; J. R. Squires & Ruggiero, 2007). Red squirrels are an alternate prey species; however, in northwestern Montana red squirrels were only two percent of the biomass of the winter diet (J. R. Squires & Ruggiero, 2007).

Composition of a landscape between forest stands that support snowshoe hares and adjacent less suitable stands has been studied to examine influence on snowshoe hare densities, lynx foraging, and movement. Lewis, Hodges, Koehler, and Mills (2011) found stand density and moist stand habitats as the best predictors of high hare densities. Lewis et al. (2011) also detected a negative correlation for snowshoe hare density within 300 meters (984 feet) of open stand types. Forests grown and change over time. John R. Squires et al. (2013) points out that vegetative density can decrease as forests age as density decreases as a stand moves from stand initiation to stem exclusion structural stages.

Snowshoe hare and lynx are a disturbance dependent species and select stands and home ranges where a mosaic of stand conditions persists into the future. Fuller and Harrison (2010) examined lynx foraging strategies and found high forage selection for clearcuts with high stem density and tall regenerating trees. Lynx traversed through stands with low understory density less than randomly expected (Fuller & Harrison, 2010). John R. Squires et al. (2013) found that lynx selected high densities of vegetative cover when traversing landscapes.

Kosterman (2014) examined reproductive success of five simplified forest structure types within female home ranges. Kosterman (2014) found that 50 percent mature forest and approximately 10 to 15 percent young regenerating forest appeared to be the optimal combination of structure types. However, Kosterman's (2014) work did not include a detailed examination of forest density for stand initiation or multistory lynx foraging conditions (J. Squires, 2015) (Project File Exhibit H-6)). Instead, the analysis classified general forest types from satellite imagery and VMAP. Kosterman's coarse classifications cannot be directly compared to the project area analysis. Further, the habitat analysis included in this report represents a more detailed and accurate classification of lynx habitat as it includes representation of types of lynx foraging habitats, not just simplified forest structure classes and is consistent with the best available science (Project File Exhibit H-6).

At the population level, John R. Squires et al. (2013) suggests that degree of infrastructure (highway traffic volume and urbanization) most impacts landscape connectivity for lynx movement. Information from John R. Squires et al. (2013) suggests that while forest fragmentation between patches of lynx habitat can increase resistance to lynx movement, lack of genetic isolation within the population indicates good landscape connectivity through the northern region (M. K. Schwartz, Mills, McKelvey, Ruggiero, & Allendorf, 2002). John R. Squires et al. (2013) identified a large-scale potential corridor for lynx connectivity from Canada to the northern Rockies that extended from the Whitefish Range down the western front of the Swan Mountains to Seeley Lake. None of the proposed activities would occur within the most likely putative travel corridor generated by John R. Squires et al. (2013). The Hungry Lion Project considered John R. Squires et al. (2013) and structured treatments to maintain lynx foraging and travel habitats in a mosaic pattern across the project Lynx Analysis Units suitable for lynx travel. The Northern Rockies Lynx Management Direction speaks to making habitats permeable for lynx and maintaining travel and foraging habitats. Developed corridors, such as highways or urbanization that most impact connectivity for lynx, are not a part of the Hungry Lion Project.

Denning habitat includes older forest stands where larger amounts of down woody material would be expected to occur (USDA Forest Service, 1999a; USDA Forest Service et al., 2000). In a study in northwestern Montana (John R. Squires, Ruggiero, Kolbe, & DeCesare, 2006), it was found that lynx denned in pre-existing sheltered spaces created by downed logs (62 percent), root-wads from wind-thrown trees (19 percent), boulder fields (10 percent), slash piles (six percent), and live trees (four percent). John R. Squires, DeCesare, Kolbe, and Ruggiero (2008) found that female dens were primarily located in spruce-fir stands with abundant coarse woody debris and high horizontal cover; however, denning did occur in stands with coarse woody debris, but insufficient cover for snowshoe hares. In this study, 80 percent of dens were in mature forest stands and 13 percent in mid-seral regenerating stands; young regenerating stands and thinned stands were seldom used for denning. Lynx denning habitat did not appear to be limiting in northwestern Montana (John R. Squires et al., 2008).

Lands within the Lynx Analysis Units have been delineated into lynx habitat and non-lynx habitat. This delineation is based on both elevation and snow-depth, and on-site characteristics; non-habitat (includes dry forest habitat types, areas with less than 24 to 30 inches of snow, high elevation habitat types on specific sites, and other unusable areas such as permanent water, rock, and human development.).

Current science and studies, Ecology and Conservation of Lynx in the United States (USDA 1999), the Northern Rockies Lynx Management Direction, and local field validation were used to

determine lynx habitat across the Flathead National Forest. Distinct Lynx Analysis Units were established, and the Forest developed a mapping protocol to designate lynx and non-lynx habitat within the different Lynx Analysis Units. A combination of snow depth and forest habitat criteria was used as the basis to model lynx versus non-lynx habitat. The snow depth below, which lynx use is expected to decline on the Flathead National Forest, has been defined as less than 24 to 30 inches of snow. At this snow depth and below, there is usually increased use by mountain lions and coyotes (USDA Forest Service, 1999a). The subsequent increase in competition for prey and the increase in potential predation on lynx results in the decreased use of these areas by lynx.

The Hungry Lion Project Lynx Analysis Units includes many diverse forest types, including subalpine fir, Engelmann spruce, whitebark and western white pine, and a small component of cedar hemlock forest. Forage opportunities for lynx would have been dependent on vegetative patterns across the landscape at the time (e.g., snowshoe hare habitat). The following table (Table 80) summarizes the current situation for potential Canada lynx habitat in the project Lynx Analysis Units (Coram Abbot, Lake Five, Emery Creek and Hungry Horse Creek Lynx Analysis Units) based on the Flathead lynx habitat model and project area validation. The Lynx Analysis Units have been broken up into habitat and non-habitat. Baseline lynx habitat was modeled for Lynx Analysis Units using size class, canopy cover, and habitat type from the northern region Vegetation Mapping Project (VMAP). Stand information was updated based on field review to create the most accurate representation of existing stand conditions within the project area. For an in-depth description of the model query elements, the habitat classifications, and the modeling process steps of the Flathead lynx model, refer to the Project File Exhibit H-6.

Table 80. Existing condition of lynx habitat and successional stages in the Hungry Lion Project Lynx Analysis Units

LAU Name	LAU Total Acres	Total Lynx Habitat (Acres and % of LAU area)	Early Stand Initiation ¹ (Acres and % of Lynx Habitat)	Stand Initiation ² (Acres and % of Lynx Habitat)	Multistory ³ (Acres and % of Lynx Habitat)	Stem Exclusion ⁴ ; Multistory Non-Foraging (Acres and % of Lynx Habitat)
Coram Abbot	15,449	8,450 (55%)	96 (1 %)	1,201 (14%)	3,224 (38%)	3,929 (46%)
Emery Creek	13,951	11,860 (85%)	736 (6%)	1,643 (14%)	5,404 (46%)	4,077 (34%)
Hungry Horse Creek	14,891	11,174 (75%)	1,162 (10%)	531 (5%)	6,015 (54%)	3,466 (31%)
Lake Five	16,912	3,760 (22%)	480 (13%)	211 (5%)	1,746 (46%)	1,323 (35%)

¹Stand initiation structural stage where the trees have not grown tall enough to protrude above the snow in winter. May provide summer foraging habitat.

²Stand initiation structural stage with sufficient above the snow vegetative density that currently provides winter snowshoe hare habitat.

³Multistory structural stage with many age classes and vegetation layers with sufficient density that provide snowshoe hare habitat. This stage may contain denning habitat.

⁴Other – Stem exclusion structural stage – Closed canopy with understory limited; Multistory structural stage with many age classes and vegetation layers that do not provide snowshoe hare habitat. This stage may contain denning habitat

Population

Lynx are expected to occur over much of the Flathead National Forest, with over 1.7 million acres (73 percent of the forest) modeled as lynx habitat (USDA Forest Service, 2017b). Lynx

populations appear to occur at naturally low densities, probably because of limited habitat and limited availability of their primary prey, snowshoe hares. The United States Fish and Wildlife Service (USDI Fish and Wildlife Service, 2000) concluded when listing the species that a resident population of lynx is distributed throughout its historic range in Montana. Numerous historic and current lynx records exist in western Montana; winter snow-track surveys and ongoing telemetry studies indicate a number of lynx in Montana, as well. There are numerous reports of lynx sightings or their tracks across the Flathead National Forest, including those of lynx adults with kittens (USDA Forest Service, 2017b). Although lynx populations are difficult to monitor without the aid of large-scale telemetry or hair-snare programs, efforts such as carnivore snow-track surveys, lynx hair-snare sampling, and the compilation of incidental sightings continue across the forest. Squires trapped seven individual lynx in the South Fork subwatershed from 2002 to 2004. Estimates of the numbers of lynx are not specifically available at the Lynx Analysis Unit level, but year-round presence of lynx in the drainages of the South Fork is known.

Historically, lynx populations were affected by trapping, but lynx trapping in Montana closed in 2005. The direct, indirect, and cumulative effects of roads are not expected to influence lynx populations or habitat use at the local landscape level and so will not be considered further in the analysis. At the Flathead National Forest 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 Fish and Wildlife Service, 2009b).

Carnivore surveys using a combination of survey methods (2013 to 2016) on the Flathead National Forest have detected lynx across the Flathead National Forest and within the project Lynx Analysis Units (SWCC, 2015; USDA Forest Service, 2017b).

Environmental Consequences

Alternative 1 (no-action alternative) – Direct, indirect, and cumulative effects

Under the no-action alternative, there would be no vegetation treatments or associated activities proposed. There would be no direct effects to Canada lynx as a result of implementing this alternative; there would be no loss of forage habitat or hiding cover, no decrease in security, and no displacement from the management activities proposed in the project Lynx Analysis Units. Stands that only provide summer forage for lynx now, because they are too short to protrude above the snow in winter, would be expected to continue to grow, becoming good winter hare habitat (i.e. stand initiation hare habitat). Red squirrel habitat (alternate prey for lynx) would be maintained in old growth and other mature cone-bearing forest stands across the project Lynx Analysis Units.

Forest vegetation would continue to grow. Stand initiation stands would grow into stem exclusion habitat, while other stands may recruit a dense understory of spruce/fir creating multistory foraging habitat conditions. Indirectly, not implementing the proposed vegetative treatments could increase the risk of a wildfire burning more intensely in the project area in the future, which could result in changes in available forage, cover, and denning habitat for lynx across the project Lynx Analysis Units. Fires have historically produced both positive and negative effects for lynx; negative effects including potential large-scale loss of hiding cover and existing foraging habitat. On the positive side, forage habitat would be potentially increased in approximately 20 years once forests have imitated enough to provide stand initiation snowshoe hare habitat. Recruitment

of multistory foraging habitat from forest regenerated by fire would occur over a much longer time period depending the severity and intensity of the wildfire.

Motorized use would continue to occur on roads within the project area. There is no evidence that lynx avoid roads open to forest uses. Established human activities would continue, including road maintenance, firewood cutting, trapping, and development on private lands. Alternative 1 would not contribute negative cumulative effects to Canada lynx in the South Fork drainage.

Alternative 2 – Direct & indirect effects

Winter lynx forage

The Northern Rockies Lynx Management Direction provides standards and guidelines for management and conservation of lynx habitat. The Northern Rockies Lynx Management Direction (USDA Forest Service, 2007) allows for reduction of lynx foraging habitat within the wildland-urban interface and includes exception acres for treatment outside the wildland-urban interface for the purposes of whitebark pine or western white pine restoration.

The Hungry Lion Project used the Flathead County wildland-urban interface. The Northern Rockies Lynx Management Direction and wildland-urban interface are further discussed in the Regulatory Consistency section below. Table 81 displays the approximate acre changes in available foraging habitat by Lynx Analysis Units for alternative 2. Project File Exhibit H-6 displays how acres of treatment are counted based on prescription, if treatment occurred.

Table 81. Alternative 2 changes to successional stages of lynx habitat in the Hungry Lion Project Lynx Analysis Units

LAU Name	LAU Total Acres	Total Lynx Habitat Acres - % of LAU Area (% Change)	Early Stand Initiation ¹ Acres - % of Lynx Habitat (% Change)	Stand Initiation ² Acres - % of Lynx Habitat (% Change)	Multistory Acres ³ - % of Lynx Habitat (% Change)	Stem Exclusion ⁴ ; Multistory Non-Foraging Acres - % of Lynx Habitat (% Change)
Coram Abbot	15,449	8,450 (55%)	702-8% (+7%)	1,133-13% (-1%)	3,048-36% (-2%)	3,567-42% (-4%)
Emery Creek	13,951	11,860 (85%)	1,862-16% (+10%)	1,317-11% (-3%)	5,404-46% (0%)	3,277-29% (-5%)
Hungry Horse Creek	14,891	11,174 (75%)	1,186-10% (0%)	518-5% (0%)	6,015-54% (0%)	3,455-31% (0%)
Lake Five	16,912	3,760 (22%)	480-13% (0%)	211-5% (0%)	1,572-42% (-4%)	1,497-40% (+5%)

¹Stand initiation structural stage where the trees have not grown tall enough to protrude above the snow in winter. May provide summer foraging habitat.

²Stand initiation structural stage that currently provides winter lynx foraging conditions.

³Multistory structural stage with many age classes and vegetation layers with sufficient density to provide winter lynx foraging conditions. This stage may contain denning habitat.

⁴Other – Stem exclusion structural stage – Closed canopy with understory limited; Multistory structural stage with many age classes and vegetation layers that do not provide snowshoe hare habitat. This stage may contain denning habitat.

Effects to lynx foraging habitat were analyzed based on harvest and burn prescriptions. Treatment in lynx winter foraging habitat (Table 81: stand initiation; multistory) would not permanently

remove this habitat, but alter composition of vertical and horizontal cover thereby altering the structural stage of the stand. Changes in stand characteristics would be dependent on the prescribed treatment for each stand. Treatments in non-lynx habitat would remain non-lynx habitat (Project File Exhibit H-6).

The analysis was conservative regarding effects of proposed activities to lynx foraging habitat. For instance, group selection treatments were assumed to create Early Stand Initiation habitat (temporarily unsuitable) across the entirety of the unit even though the prescriptions would only regenerate small patches within a stand and thin the remainder of the unit area. Similarly, stand initiation foraging habitat proposed for precommercial thinning was considered to convert to early stand initiation, even though the remaining trees would still be tall enough to protrude above the snow. However, because these stands would no longer provide the density and horizontal cover to provide winter snowshoe hare habitat, this stand initiation seral class was considered to be temporarily unsuitable for early stand initiation.

Regeneration treatments including seed tree, shelterwood, post and pole, shadedfuel breaks, and group selection would remove stand overstory and recruit young saplings within the stand area. Existing lynx foraging acres that would receive regeneration treatments would retain some young and mature trees, but not function as lynx foraging habitat. For this reason, stands with proposed regeneration harvest were classified as “early stand initiation” habitat for post treatment acres. Intermediate treatments like specialized cuts, commercial thin and understory removal would reduce stand density within lynx foraging habitat, but would retain overstory cover. These treatment acres would be temporarily converted to “stem exclusion stands” habitat until sufficient horizontal cover returns to provide snowshoe hare habitat. Precommercial thinning would also reduce stand density. These treatment acres would either be added to “early stand initiation,” or “stem exclusion” acres depending on the stand and treatment type. Upland burning would occur in non-habitat areas for lynx comprised of south facing slopes with dry, mostly open with intermittent trees slopes. The estimated composition of lynx habitat (existing and treated) in the affected Lynx Analysis Units is shown in Table 82 for each respective Lynx Analysis Unit for alternative 2. Treatments would not result in permanent stand changes. A list of stands by unit, treatment type, and pre/post lynx habitat stage is located in Project File Exhibit H-6. Forest regeneration and succession would occur in treated stands over time.

Table 82. Alternative 2. Approximate acres of existing lynx habitat structural stage affected by treatments.

LAU Name	Non-Habitat	Stand Initiation ¹ Acres	Early Stand Initiation Hare Habitat ²	Multistory Hare Habitat ³ Acres	Other ⁴ (Stem Exclusion; Multistory Non-Feeding)
Coram Abbot	686	68	0	177	824
Emery Creek	825	326	0	0	1,009
Hungry Horse Creek	35	13	0	0	341
Lake Five	417	0	0	174	0
Total	1,963	407	0	351	2,174

¹Stand initiation structural stage with sufficient density that currently provides winter lynx foraging conditions.

²Stand initiation structural stage where the trees have not grown tall/ dense enough to protrude above the snow in winter

³Multistory structural stage with many age classes and vegetation layers of sufficient density to provide winter lynx foraging conditions. This stage may contain denning habitat.

⁴Other – Stem exclusion structural stage – Closed canopy with understory limited; Multistory structural stage with many age classes and vegetation layers that do not provide snowshoe hare habitat. This stage may contain denning habitat.

Proposed regeneration, intermediate, and precommercial treatments would decrease lynx forage within three of the four project Lynx Analysis Units. Treatments would convert lynx foraging and denning habitat into non-foraging forest stages. For alternative 2, the proposed activities would reduce stand initiation foraging habitat by one percent in the Coram Abbot Lynx Analysis Unit and three percent in the Emery Creek Lynx Analysis Unit. Stand initiation would be reduced by 13 acres in the Hungry Horse Creek Lynx Analysis Unit which is not enough to equal a percentage change. Multistory forage would be decreased by two percent in the Coram Abbot Lynx Analysis Unit and four percent in the Lake Five Lynx Analysis Unit. It should be noted that only 22 percent of the Lake Five Lynx Analysis Unit provides potential lynx habitat. The percent reduction in multistory in this Lynx Analysis Unit is larger in part to the relatively small acres of potential habitat available.

The reduction in lynx forage resulting from the implementation of proposed activities would not be permanent; natural regeneration and planted seedlings would grow back and provide snowshoe hare habitat. John R. Squires et al. (2010) found that in Montana, hares are not using regenerated stands until approximately 20 or more years after logging or fire. The time it takes for regenerated stands to grow into stand initiation lynx foraging habitat is dependent on aspect, elevation, and habitat type in addition to other factors such as fire severity, precipitation etc. Design features would retain some existing horizontal cover (10 percent of understory trees) within intermediate treatment stands. This criterion would improve return interval of horizontal cover in these units.

Lynx travel patterns between foraging habitat would change to avoid forest openings. Shaded Fuelbreaks proposed in alternative 2 create long linear, narrow open forest conditions along NFS Road 38 and may be avoided by lynx. Other areas along NFS Road 38 would still provide closed forest canopy (stem exclusion, multistory, stand initiation) on either side of the road suitable for lynx travel to reach foraging habitats on either side of NFS Road 38.

Alternative 2 would treat 350 acres of multistory lynx foraging habitat in the wildland-urban interface for fuels reduction. Alternative 2 also proposes sapling thinning for western white pine in 407 acres (units 200, 201, 202, 204, 213, 215, 218, 220, 221, 224, 225, 226, 227, 228, and 229) of stand initiation habitat outside of the wildland-urban interface for restoration of whitebark pine in accordance with the Northern Rockies Lynx Management Direction (USDA Forest Service, 2007). Outside of these acres, no other lynx foraging habitat would be removed outside of the wildland-urban interface through project activities. While the analysis above assumes the acres in these units would no longer function as lynx habitat, design features would retain 80 percent of the lynx foraging habitat in the stand (see Chapter 2-design features). While the above analysis accounts for a total loss of these acres from lynx foraging habitat, an approximate total of 81 acres (20 percent of 407) would actually be removed from lynx foraging habitat. For more information, see Regulatory Consistency section below.

Denning habitat

Lynx den sites are predominately found in mature boreal forest stands that have a large amount of cover and abundant, coarse, woody debris, such as downed trees and root wads (John R. Squires et al., 2008). Den sites have also been associated with moister forest stands containing denser understory cover (John R. Squires et al., 2006).

Based on the characteristics of lynx denning habitat described above, multistory forage and some stem exclusion stands (non-feeding) from Table 81 were estimated to be denning habitat. Denning habitat is not limited and widespread throughout the project area. For denning, this analysis considered stem exclusion late seral and old growth stands and multistory forage in the project

area ((John R. Squires et al., 2008); Project File Exhibit H-6). These stands have high levels of snags and coarse woody debris or mature forest with high horizontal cover based on field visits and common stand exams. Other denning habitat exists out of these stands; however, these qualifications likely represent the highest quality denning conditions. The proposed project activities would decrease estimated lynx denning habitat across 458 acres. This reduction would be approximately three percent of the denning conditions in the project Lynx Analysis Units (Table 83). Upland burning would have little effect on denning habitat over time as these treatments would occur in non-habitat for lynx.

Table 83. Alternative 2. Effects to high quality denning conditions in the project Lynx Analysis Units

LAU	Estimated High Quality Denning Habitat (Acres)	Estimated Reduction (Acres)
Coram Abbot	3,905	226
Emery Creek	5,812	43
Hungry Horse Creek	6,139	15
Lake Five	1,774	174

John R. Squires et al. (2008) believed that few lynx populations are limited by a lack of immediate den sites given their large home ranges and low den site fidelity. Due to the abundant cover and large amounts of down woody debris, some old growth forest types contain characteristics indicative of denning habitat. There would be no treatment to old growth forest stands under alternative 2. Design features in treatment areas would retain 10 tons of down woody debris per acre where available and snags would be retained in each treatment area for future recruitment of lynx denning structures. Given the design features, forest plan direction and information that denning habitat is widespread, the reduction of denning habitat is likely to have little impact on lynx in any of the project Lynx Analysis Units.

Early stand initiation/stem exclusion/non-habitat

Stem exclusion (listed in Table 82 as “other”) habitat includes open stands with intermittent canopy, relatively closed overstory canopy, and limited understory vegetation. These stands do not contain snowshoe hare habitat (lynx forage) due to lack of horizontal cover, but can serve as hiding cover for lynx to travel through. Proposed treatments would treat 2,174 acres of stem exclusion non-feeding habitat across the project Lynx Analysis Units. The project would not treat any early stand initiation habitats in the project Lynx Analysis Units.

Stem exclusion habitat structure is generally not progressing towards hare habitat. Although there would be a loss of hiding cover over the short term (10 years), there is also an opportunity through harvest prescriptions to move the stands towards conditions that provide future forage and/or denning habitat for Canada lynx. In commercial thinning units the remaining trees in the stand would have improved growing conditions and would increase in size. Over time shade-resistant trees would develop in the understory and these stands would progress towards multistory lynx foraging habitat. Cone bearing mature forest (red squirrel habitat) would remain well distributed after project activities. The proposed regeneration of stem exclusion stands within the project Lynx Analysis Units would remove most of the existing overstory structure. The stands would be expected to return to a lynx foraging seedling/sapling structure (stand initiation) within approximately 20 years.

Early stand initiation acres (Table 81 and Table 82) include young stands that either do not protrude sufficiently above the snow or do not have a sufficient density of horizontal cover to provide winter snowshoe hare habitat in the winter months. These stands are composed of a range of condition from openings from recent regeneration with little or no tree regeneration to areas of dense saplings recently regenerating, not yet tall enough to protrude above the snow or provide snowshoe hare habitat during the winter months. Recent regenerated forest with little or no re-growing saplings would likely be avoided by lynx. Lynx may forage and travel through stands on the more advanced end of the early stand initiation stage during the summer months, but would likely avoid these areas, buried by snow, during the winter months. Alternative 2 would increase the amount of early stand initiation habitat in the Coram Abbot Lynx Analysis Unit by seven percent and the Emery Creek Lynx Analysis Unit by 10 percent. Precommercial thin treatments of early stand initiation habitat would increase spacing between trees and may decrease the potential of these stands to regenerate into future dense stand initiation snowshoe hare habitat. However, precommercial thin treatments may release trees from competition and result in faster growing trees with full crowns and place the trees on a more expedient trajectory towards a mature canopied forest, which lynx are known to move through.

Alternative 2 proposed activities would also affect approximately 1,963 acres of non-habitat in the project Lynx Analysis Units. These acres would remain non-habitat after treatment (Project File Exhibit H-6). Lynx travel would still be possible across areas of non-habitat within the project Lynx Analysis Units.

Project activities would maintain a mosaic of stand conditions that provide for lynx travel throughout the project Lynx Analysis Units. Lynx foraging habitat would remain well distributed and connect by forest conditions that lynx are comfortable traveling through.

Habitat security

The best information suggests that forest roads do not affect lynx (USDI Fish and Wildlife Service, 2007a). USDA Forest Service et al. (2000) found that lynx do not avoid roads, except at high traffic volumes (Apps, 2000). Effects of highways with high speeds and high traffic volumes are not the same as the effects of forest roads. With regard to forest roads, such as those that occur in the Hungry Lion Lynx Analysis Units, an analysis on the Okanogan National Forest in Washington showed lynx neither preferred nor avoided forest roads, and the existing road density does not appear to affect lynx habitat selection (McKelvey, Aubry, & Ortega, 1999; USDI Fish and Wildlife Service, 2000). In Montana, forest roads with low vehicular or snowmobile traffic had little effect on lynx resource selection patterns (USDA Forest Service, 2013b). Squires concluded that lynx did not avoid the subset of roads that were open to wheeled vehicle travel during the denning season or at any other time (John R. Squires et al., 2010).

Given that lynx have been documented to be tolerant of motorized and human activity, the potential for displacement from project activities is low. Road construction, maintenance, re-routes, AOP installation, rehabilitation, recontouring, and reclamation may displace individual lynx in proximity to the activity occurring; however the displacement is not likely to limit the animal's movement or cause underuse of available habitats. Alternative 2 would not increase public motorized access from the existing condition.

Winter logging

Alternative 2 proposes some vegetation management activities that would occur during the winter months. Project activities could displace lynx. Lynx have shown tolerance to human activity (USDA Forest Service, 2013b; USDA Forest Service et al., 2000). Little to no effects of

displacement are expected considering lynx tolerance to motorized activity and distribution of available lynx foraging habitat in the project Lynx Analysis Units. Further, project activities would occur in only a portion of the winter lynx foraging habitat within the project Lynx Analysis Units leaving the remaining foraging habitat free from potential disturbance. Lynx forage across a broader variety of habitats in the summer months relative to the winter and potential displacement effects would have even less effect relative to winter activity (John R. Squires et al., 2010). There is little existing evidence that snow compaction from winter logging causes competition with other predators, exerting a population level threat to lynx (USDA Forest Service, 2007). Bunnell, Flinders, and Wolfe (2006) found that coyotes used packed snowmobile trails to enter areas of deeper snow, however deep, fluffy snows dictated coyotes to use only packed trails and as elevation increased, coyote presence decreased. Kolbe, Squires, Pletscher, and Ruggiero (2007) provides evidence for northwest Montana that the overall influence of snowmobile trails in the Seeley Lake area appeared to be minimal.

Recreational improvements

Improvements around Lion Lake would occur in non-habitat for Canada lynx and aren't expected to impact lynx travel, foraging, or denning conditions. The area contains existing high amounts of human activity and lynx using suitable habitats nearby likely avoid the lake and surroundings. The proposed historic trails to be added to the system are not expected to have adverse effects to lynx. Little information exists on the effects of nonmotorized human uses to lynx, but as lynx display little avoidance of motorized routes, likely human use on the proposed trail systems would not result in displacement avoidance by lynx of adjacent habitats.

Alternative 3 – Direct & indirect effects

Winter lynx forage

The effects to lynx habitat, assumptions and categorizations used for alternative 2 are also used here for alternative 3. Table 84 displays the approximate acre changes in available foraging habitat by Lynx Analysis Unit for alternative 2. Project File Exhibit H-6 displays how acres of treatment are counted based on prescription, if treatment occurred. Alternative 3 would treat 414 less lynx foraging habitat acres than proposed in alternative 2.

Table 84. Alternative 3. Changes to successional stages of lynx habitat in the Hungry Lion Project Lynx Analysis Units

LAU Name	LAU Total Acres	Total Lynx Habitat Acres – % of LAU area (% Change)	Early Stand Initiation ¹ Acres – % of Lynx Habitat (% Change)	Stand Initiation ² Acres – % of Lynx Habitat (% Change)	Multistory Acres ³ – % of Lynx Habitat (% Change)	Stem Exclusion ⁴ ; Multistory Non-Foraging Acres – % of Lynx Habitat (% Change)
Coram Abbot	15,449	8,450 (55%)	461-5% (+5%)	1,201-14% (0%)	3,111-37% (-1%)	3,677-43% (3%)
Emery Creek	13,951	11,860 (85%)	1,278-11% (+5%)	1,559-13% (-1%)	5,404-46% (0%)	3,619-31% (-3%)
Hungry Horse Creek	14,891	11,174-75%	1,162-10% (0%)	531-5% (0%)	6,015-54% (0%)	3,466-31% (0%)

LAU Name	LAU Total Acres	Total Lynx Habitat Acres – % of LAU area (% Change)	Early Stand Initiation ¹ Acres – % of Lynx Habitat (% Change)	Stand Initiation ² Acres – % of Lynx Habitat (% Change)	Multistory Acres ³ – % of Lynx Habitat (% Change)	Stem Exclusion ⁴ ; Multistory Non-Foraging Acres – % of Lynx Habitat (% Change)
Lake Five	16,912	3,760-22%	480-13% (0%)	211-5% (0%)	1,598-43% (-3%)	1,471-39% (+4%)

¹Stand initiation structural stage where the trees have not grown tall enough to protrude above the snow in winter. May provide summer foraging habitat.

²Stand initiation structural stage with sufficient above the snow vegetative density that currently provides winter snowshoe hare habitat.

³Multistory structural stage with many age classes and vegetation layers with sufficient density that provide snowshoe hare habitat. This stage may contain denning habitat.

⁴Other – Stem exclusion structural stage – Closed canopy with understory limited; Multistory structural stage with many age classes and vegetation layers that do not provide snowshoe hare habitat. This stage may contain denning habitat.

Proposed regeneration, intermediate, and precommercial treatments would decrease lynx forage within three of the four project Lynx Analysis Units. Treatments would convert lynx foraging and denning habitat into non-foraging forest stages. For alternative 3, the proposed activities would reduce stand initiation habitat by one percent in the Emery Creek Lynx Analysis Unit. Multistory forage would be decreased by one percent in the Coram Abbot Lynx Analysis Unit and three percent in the Lake Five Lynx Analysis Unit. It should be noted that only 22 percent of the Lake Five Lynx Analysis Unit provides potential lynx habitat. The percent reduction in multistory in this Lynx Analysis Unit is larger in part to the relatively small acres of potential habitat available.

Table 85. Alternative 3. Approximate acres of existing lynx habitat structural stage affected by treatments

LAU Name	Non-Habitat	Stand Initiation ¹ Acres	Early Stand Initiation Hare Habitat ²	Multistory Hare Habitat ³ Acres	Other ⁴ (Stem Exclusion; Multistory Non-Feeding)
Coram Abbot	577	0	0	113	589
Emery Creek	801	84	0	0	667
Hungry Horse Creek	24	0	0	0	200
Lake Five	212	0	0	148	0
Total	1,614	84	0	261	1,456

¹Stand initiation structural stage with sufficient density that currently provides winter lynx foraging conditions.

²Stand initiation structural stage where the trees have not grown tall/ dense enough to protrude above the snow in winter.

³Multistory structural stage with many age classes and vegetation layers of sufficient density to provide winter lynx foraging conditions. This stage may contain denning habitat.

⁴Other – Stem exclusion structural stage – Closed canopy with understory limited; Multistory structural stage with many age classes and vegetation layers that do not provide snowshoe hare habitat. This stage may contain denning habitat.

Alternative 3 would treat 261 acres of lynx foraging habitat inside the wildland-urban interface for fuels reduction. Alternative 3 would treat 84 acres of stand initiation habitat outside of the wildland-urban interface (unit 200) for western white pine restoration. This is 317 acres less than alternative 2. While the analysis above assumes the acres in these units would no longer function as lynx habitat, design features would retain 80 percent of the lynx foraging habitat in the stand (see design features). While the above analysis accounts for a total loss of these acres from lynx

foraging habitat, an approximate total of 17 acres (20 percent of 83) would actually be removed from lynx foraging habitat. For more information, see Regulatory Consistency section below.

Denning habitat

Lynx denning habitat was calculated the same way as discussed in alternative 2. These stands have high levels of snags and coarse woody debris or mature forest with high horizontal cover based on field visits and common stand exams. Other denning habitat exists out of these stands; however, these qualifications likely represent the highest quality denning conditions. The proposed project activities would decrease estimated lynx denning habitat across 309 acres. This reduction would be approximately two percent of the denning conditions in the project Lynx Analysis Units (Table 86). Upland burning would have little effect on denning habitat over time as these treatments would occur in non-habitat for lynx.

Table 86. Alternative 3. Effects to high quality denning conditions in the project Lynx Analysis Units

LAU	Estimated High Quality Denning Habitat (Acres)	Estimated Reduction (Acres)
Coram Abbot	3,905	140
Emery Creek	5,812	21
Hungry Horse Creek	6,139	0
Lake Five	1,774	148

Given the design features, forest plan direction and information that denning habitat is widespread, the reduction of denning habitat in alternative 3 is likely to have little impact on lynx in any of the project Lynx Analysis Units.

Early stand initiation/stem exclusion/non-habitat

As discussed in alternative 2, stem exclusion (listed in Table 83 as “other”) habitat includes open stands with intermittent canopy, relatively closed overstory canopy, and limited understory vegetation. Classification and timing of effects from different treatments is described under alternative 2. Proposed treatments would treat 1,456 acres of stem exclusion non-feeding habitat across the project Lynx Analysis Units. The project would not treat any early stand initiation habitats in the project Lynx Analysis Units.

Early stand initiation acres (Table 84 and Table 85) include young stands that either do not protrude sufficiently above the snow or do not have a sufficient density of horizontal cover to provide winter snowshoe hare habitat in the winter months. Alternative 3 would increase the amount of early stand initiation habitat in the Coram Abbot Lynx Analysis Unit by five percent and the Emery Creek Lynx Analysis Unit by five percent. This would result in seven percent less habitat that is temporarily unsuitable for lynx than proposed in alternative 2. Precommercial thin treatments of early stand initiation habitat would increase spacing between trees and may decrease the potential of these stands to regenerate into future dense stand initiation snowshoe hare habitat. However, precommercial thin treatments may release trees from competition and result in faster growing trees with full crowns and place the trees on a more expedient trajectory towards a mature canopied forest, which lynx are known to move through.

Alternative 3 proposed activities would also affect approximately 1,614 acres of non-habitat in the project Lynx Analysis Units. These acres would remain non-habitat after treatment (Project

File Exhibit H-6). Lynx travel would still be possible across areas of non-habitat within the project Lynx Analysis Units.

Project activities would maintain a mosaic of stand conditions that provide for lynx travel throughout the project Lynx Analysis Units. Lynx foraging habitat would remain well distributed and connect by forest conditions that lynx are comfortable traveling through.

Habitat security

The best information suggests that forest roads do not affect lynx (USDI Fish and Wildlife Service, 2007a). USDA Forest Service et al. (2000) found that lynx do not avoid roads, except at high traffic volumes (Apps, 2000). Effects of highways with high speeds and high traffic volumes are not the same as the effects of forest roads. With regard to forest roads, such as those that occur in the Hungry Lion Lynx Analysis Units, an analysis on the Okanogan National Forest in Washington showed lynx neither preferred nor avoided forest roads, and the existing road density does not appear to affect lynx habitat selection (McKelvey et al., 1999; USDI Fish and Wildlife Service, 2000). In Montana, forest roads with low vehicular or snowmobile traffic had little effect on lynx resource selection patterns (USDA Forest Service, 2013b). Squires concluded that lynx did not avoid the subset of roads that were open to wheeled vehicle travel during the denning season or at any other time (John R. Squires et al., 2010).

Given that lynx have been documented to be tolerant of motorized and human activity the potential for displacement from project activities is low. Road construction, maintenance, reroutes, AOP installation, rehabilitation, recontouring, and reclamation may displace individual lynx in proximity to the activity occurring; however the displacement is not likely to limit the animal's movement or cause underuse of available habitats. Alternative 3 would not increase public motorized access from the existing condition.

Winter logging

Alternative 3 proposes some vegetation management activities that would occur during the winter months. Project activities could displace lynx. Lynx have shown tolerance to human activity (USDA Forest Service, 2013b; USDA Forest Service et al., 2000). Little to no effects of displacement are expected considering lynx tolerance to motorized activity and distribution of available lynx foraging habitat in the project Lynx Analysis Units. Further, project activities would occur in only a portion of the winter lynx foraging habitat within the project Lynx Analysis Units leaving the remaining foraging habitat free from potential disturbance. Lynx forage across a broader variety of habitats in the summer months relative to the winter and potential displacement effects would have even less effect relative to winter activity (John R. Squires et al., 2010). There is little existing evidence that snow compaction from winter logging causes competition with other predators, exerting a population level threat to lynx (USDA Forest Service, 2007). Bunnell et al. (2006) found that coyotes used packed snowmobile trails to enter areas of deeper snow, however, deep, fluffy snows dictated coyotes to use only packed trails and as elevation increased, coyote presence decreased. Kolbe et al. (2007) provides evidence for northwest Montana that the overall influence of snowmobile trails in the Seeley Lake area appeared to be minimal.

Recreational improvements

Improvements around Lion Lake would occur in non-habitat for Canada lynx and aren't expected to impact lynx travel, foraging, or denning conditions. The area contains existing high amounts of human activity and lynx using suitable habitats nearby likely avoid the lake and surroundings. There would be no historic trails added to the system. Little information exists on the effects of

nonmotorized human uses to lynx, but as lynx display little avoidance of motorized routes. Rehabilitation of historic trails would result in less potential disturbance to lynx over the long term. Given, little known effect of nonmotorized trails to lynx, this potential is small.

Alternative 4 – Direct & indirect effects

Winter lynx forage

The effects to lynx habitat, assumptions, and categorizations used for alternative 2 are also used here for alternative 4. Table 84 displays the approximate acre changes in available foraging habitat by Lynx Analysis Unit for alternative 2. Project File Exhibit H-6 displays how acres of treatment are counted based on prescription, if treatment occurred. Alternative 4 would treat 235 acres less lynx foraging habitat acres than proposed in alternative 2 and 175 acres more than alternative 3.

Table 87. Alternative 4. Changes to successional stages of lynx habitat in the Hungry Lion Project Lynx Analysis Units

LAU Name	LAU Total Acres	Total Lynx Habitat Acres – % of LAU Area (% Change)	Early Stand Initiation ¹ Acres – % of Lynx Habitat (% Change)	Stand Initiation ² Acres – % of Lynx Habitat (% Change)	Multistory Acres ³ – % of Lynx Habitat (% Change)	Stem Exclusion ⁴ ; Multistory Non-Foraging Acres – % of Lynx Habitat (% Change)
Coram Abbot	15,449	8,450 (55%)	569-7% (+6%)	1,133-13% (-1%)	3,111-37% (-1%)	3,637-43% (-3%)
Emery Creek	13,951	11,860 (85%)	1,555-13% (+7%)	1,317-11% (-3%)	5,404-46% (0%)	3,584 (30%) (-4%)
Hungry Horse Creek	14,891	11,174 (75%)	1,186-10% (0%)	518-5% (0%)	6,015-54% (0%)	3,455-31% (0%)
Lake Five	16,912	3,760 (22%)	480-13% (0%)	211-5% (0%)	1,746-46% (0%)	1,323-35% (0%)

¹Stand initiation structural stage where the trees have not grown tall enough to protrude above the snow in winter. May provide summer foraging habitat.

²Stand initiation structural stage with sufficient above the snow vegetative density that currently provides winter snowshoe hare habitat.

³Multistory structural stage with many age classes and vegetation layers with sufficient density that provide snowshoe hare habitat. This stage may contain denning habitat.

⁴Other – Stem exclusion structural stage – Closed canopy with understory limited; Multistory structural stage with many age classes and vegetation layers that do not provide snowshoe hare habitat. This stage may contain denning habitat.

Proposed regeneration, intermediate, and precommercial treatments would decrease lynx forage within three of the four project Lynx Analysis Units. Treatments would convert lynx foraging and denning habitat into non-foraging forest stages. For alternative 4, the proposed activities would reduce stand initiation habitat by three percent in the Emery Creek Lynx Analysis Unit and one percent in the Coram Abbot Lynx Analysis Unit. Stand initiation would be reduced by 13 acres in the Hungry Horse Creek Lynx Analysis Unit, which is not enough to equal a percentage change. Multistory forage would be decreased by one percent in the Coram Abbot Lynx Analysis Unit. Unlike alternatives 2 and 3, lynx foraging habitat would not be affected in the Lake Five Lynx Analysis Unit.

Lynx travel patterns between foraging habitat would change to avoid forest openings. Shaded Fuelbreaks proposed in alternative 2 create long linear, narrow open forest conditions along NFS Road 38 and may be avoided by lynx. Other areas along NFS Road 38 would still provide closed forest canopy (stem exclusion, multistory, and stand initiation) on either side of the road suitable for lynx travel to reach foraging habitats on either side of NFS Road 38.

Table 88. Alternative 4. Approximate acres of existing lynx habitat structural stage affected by treatments

LAU Name	Non-Habitat	Stand Initiation ¹ Acres	Early Stand Initiation Hare Habitat ²	Multistory Hare Habitat ³ Acres	Other ⁴ (Stem Exclusion; Multistory Non-Feeding)
Coram Abbot	161	68	0	113	609
Emery Creek	781	326	0	0	603
Hungry Horse Creek	40	13	0	0	11
Lake Five	255	0	0	0	0
Total	1,237	407	0	113	1,223

¹Stand initiation structural stage with sufficient density that currently provides winter lynx foraging conditions.

²Stand initiation structural stage where the trees have not grown tall/ dense enough to protrude above the snow in winter.

³Multistory structural stage with many age classes and vegetation layers of sufficient density to provide winter lynx foraging conditions. This stage may contain denning habitat.

⁴Other – Stem exclusion structural stage – Closed canopy with understory limited; Multistory structural stage with many age classes and vegetation layers that do not provide snowshoe hare habitat. This stage may contain denning habitat.

Alternative 4 would treat 129 acres of lynx foraging habitat inside the wildland-urban interface for fuels reduction. Alternative 4 would treat 391 acres outside of the wildland-urban interface (unit 200, 201, 202, 024, 213, 215, 220, 221, 224, 225, 226, 227, 228, and 229) for western white pine restoration. While the analysis above assumes the acres in these units would no longer function as lynx habitat, design features would retain 80 percent of the lynx foraging habitat in the stand (see design features). While the above analysis accounts for a total loss of these acres from lynx foraging habitat, an approximate total of 78 acres (20 percent of 83) would actually be removed from lynx foraging habitat. For more information, see Regulatory Consistency section below.

Denning habitat

Lynx denning habitat was calculated the same way as discussed in alternative 2. These stands have high levels of snags and coarse woody debris or mature forest with high horizontal cover based on field visits and common stand exams. Other denning habitat exists out of these stands; however, these qualifications likely represent the highest quality denning conditions. The proposed project activities would decrease estimated lynx denning habitat across 166 acres. This reduction would be approximately one percent of the denning conditions in the project Lynx Analysis Units (Table 89). Upland burning would have little effect on denning habitat over time as these treatments would occur in non-habitat for lynx.

Table 89. Alternative 4. Effects to high quality denning conditions in the project Lynx Analysis Units

LAU	Estimated High Quality Denning Habitat (Acres)	Estimated Reduction (Acres)
Coram Abbot	3,905	140
Emery Creek	5,812	21

LAU	Estimated High Quality Denning Habitat (Acres)	Estimated Reduction (Acres)
Hungry Horse Creek	6,139	5
Lake Five	1,774	0

Given the design features, forest plan direction and information that denning habitat is widespread, reduction of denning habitat in alternative 4 is likely to have little impact on lynx in any of the project Lynx Analysis Units.

Early stand initiation/stem exclusion/non-habitat

As discussed in alternative 2, Stem exclusion (listed in Table 88 as “other”) habitat includes open stands with intermittent canopy, relatively closed overstory canopy, and limited understory vegetation. Classification and timing of effects from different treatments is described under alternative 2. Proposed treatments would treat 1,223 acres of stem exclusion non-feeding habitat across the project Lynx Analysis Units. The project would not treat any early stand initiation habitats in the project Lynx Analysis Units.

Early stand initiation acres (Table 87 and Table 88) include young stands that either do not protrude sufficiently above the snow or do not have a sufficient density of horizontal cover to provide winter snowshoe hare habitat in the winter months. Alternative 3 would increase the amount of early stand initiation habitat in the Coram Abbot Lynx Analysis Unit by six percent and the Emery Creek Lynx Analysis Unit by seven percent. This would result in four percent less habitat that is temporarily unsuitable for lynx than proposed in alternative 2 and three percent more than in alternative 3. Precommercial thin treatments of early stand initiation habitat would increase spacing between trees and may decrease the potential of these stands to regenerate into future dense stand initiation snowshoe hare habitat. However, precommercial thin treatments may release trees from competition and result in faster growing trees with full crowns and place the trees on a more expedient trajectory towards a mature canopied forest, which lynx are known to move through.

Alternative 4 proposed activities would also affect approximately 1,237 acres of non-habitat in the project Lynx Analysis Units. These acres would remain non-habitat after treatment (Project File Exhibit H-6). Lynx travel would still be possible across areas of non-habitat within the project Lynx Analysis Units.

Project activities would maintain a mosaic of stand conditions that provide for lynx travel throughout the project Lynx Analysis Units. Lynx foraging habitat would remain well distributed and connect by forest conditions that lynx are comfortable traveling through.

Habitat security

The best information suggests that forest roads do not affect lynx (USDI Fish and Wildlife Service, 2007a). USDA Forest Service et al. (2000) found that lynx do not avoid roads, except at high traffic volumes (Apps, 2000). Effects of highways with high speeds and high traffic volumes are not the same as the effects of forest roads. With regard to forest roads, such as those that occur in the Hungry Lion Lynx Analysis Units, an analysis on the Okanogan National Forest in Washington showed lynx neither preferred nor avoided forest roads, and the existing road density does not appear to affect lynx habitat selection (McKelvey et al., 1999; USDI Fish and Wildlife Service, 2000). In Montana, forest roads with low vehicular or snowmobile traffic had little effect on lynx resource selection patterns (USDA Forest Service, 2013b). Squires concluded that lynx

did not avoid the subset of roads that were open to wheeled vehicle travel during the denning season or at any other time (John R. Squires et al., 2010).

Given that lynx have been documented to be tolerant of motorized and human activity the potential for displacement from project activities is low. Road construction, maintenance, re-routes, AOP installation, rehabilitation, recontouring, and reclamation may displace individual lynx in proximity to the activity occurring; however, the displacement is not likely to limit the animal's movement or cause underuse of available habitats. Alternative 3 would not increase public motorized access from the existing condition.

Winter logging

Alternative 4 proposes some vegetation management activities that would occur during the winter months. Project activities could displace lynx. Lynx have shown tolerance to human activity (USDA Forest Service, 2013b; USDA Forest Service et al., 2000). Little to no effects of displacement are expected considering lynx tolerance to motorized activity and distribution of available lynx foraging habitat in the project Lynx Analysis Units. Further, project activities would occur in only a portion of the winter lynx foraging habitat within the project Lynx Analysis Units leaving the remaining foraging habitat free from potential disturbance. Lynx forage across a broader variety of habitats in the summer months relative to the winter and potential displacement effects would have even less effect relative to winter activity (John R. Squires et al., 2010). There is little existing evidence that snow compaction from winter logging causes competition with other predators, exerting a population level threat to lynx (USDA Forest Service, 2007). Bunnell et al. (2006) found that coyotes used packed snowmobile trails to enter areas of deeper snow, however, deep, fluffy snow dictated coyotes to use only packed trails and as elevation increased, coyote presence decreased. Kolbe et al. (2007) provides evidence for northwest Montana that the overall influence of snowmobile trails in the Seeley Lake area appeared to be minimal.

Recreational improvements

Improvements around Lion Lake would occur in non-habitat for Canada lynx and aren't expected to impact lynx travel, foraging, or denning conditions. The area contains existing high amounts of human activity and lynx using suitable habitats nearby likely avoid the lake and surroundings. The proposed historic trails to be added to the system are not expected to have adverse effects to lynx. Little information exists on the effects of nonmotorized human uses to lynx, but as lynx display little avoidance of motorized routes likely human use on the proposed trail systems would not result in displacement avoidance by lynx of adjacent habitats.

Alternative 2, 3, and 4 – Cumulative effects

Past timber management and road building on all ownership lands in the Hungry Lion Lynx Analysis Units have occurred; it is anticipated that timber management activities would continue into the future. Other on-going activities include hunting, trapping, firewood cutting, recreational activities, existing special use permits, road maintenance activities, noxious weed treatments, residential development, and land conversion on private lands. Timber management and road building, along with conversion of private lands in the area, have an effect on the availability of forage and denning habitat for Canada lynx. In addition, the combination of each of the activities described above could affect the ability of Canada lynx to move across the landscape securely. Landscapes in which hare habitat is more contiguous, or where good patches of hare habitat are surrounded by other patches of similar habitat quality, support more snowshoe hare (lynx forage) than landscapes that are more fragmented or include dry habitats that are poorer quality (USDA Forest Service et al., 2000).

There have been past harvest activities within the project Lynx Analysis Units including the Hungry Horse/West Glacier Fuels Reduction, Paint Emery, Firefighter, and Belton Fuels. These projects have altered the forest mosaic and juxtaposition of travel cover within the project Lynx Analysis Units. Regeneration harvest from these projects greater than 20 years old has likely recruited stand initiation winter foraging conditions in lynx habitat. The Firefighter Project is still active in the Hungry Horse Creek Lynx Analysis Units. The remaining harvest units would occur in stem exclusion habitat. No winter harvest would occur. Prescribed fire from the Belton Project would not affect lynx foraging habitat in the Lake Five Lynx Analysis Unit. Completed work from past projects was incorporated in the habitat baseline. Combined with the effects of these past project, the Hungry Lion alternatives would not regenerate more than 15 percent of lynx habitat in any project Lynx Analysis Unit in a 10 year period. A mosaic of conditions still exist and mature multistory foraging habitat is still well distributed in the project Lynx Analysis Units and connected by a network of forest cover to provide lynx traveling conditions.

John R. Squires et al. (2013) characterized major highways and permanent development as the major barrier to connectivity between to lynx populations. The Hungry Lion Project does not propose any improvement to the highway adjacent to the project area or urbanization on private land. Future highway improvement or development on private land on the western edge of the project Lynx Analysis Units (Coram Abbot and Lake Five). The U.S. Highway 2 corridor and the majority of private lands occur in non-lynx habitats; while the distribution of lynx potential habitat and lynx foraging conditions to the east of these developed areas.

Effects of past harvest on private land to lynx habitat were characterized using stand attributes in recent VMAP data, NAIP imagery, and field verification. These data sources were used to characterize the area within the four Lynx Analysis Units including NFS and private lands. This information was considered in the habitat baseline. Grazing from livestock is ongoing at Coram pasture in the Coram Abbot Lynx Analysis Unit. This use occurs in non-lynx habitat and does not have effects to lynx or lynx habitat.

Groomed snowmobile trails exist in the project area and approximately 32 percent of the Lynx Analysis Units are open to motorized over-the-snow travel from December 1 to March 31, conditions permitting. Winter harvest operations would restrict snowmobile use while harvest operations and hauling were occurring during the winter months. No additional grooming is proposed in the Hungry Lion Project. Winter harvest is not expected to combine with existing motorized winter travel to have negative effects. As stated above, there is little existing evidence that snow compaction from winter logging causes competition with other predators, exerting a population level threat to lynx (USDA Forest Service, 2007).

Adult mortality for Canada lynx (John R. Squires et al., 2010); includes starvation in winter and early spring, predation by lions during non-snow periods, and human conflict (e.g., accidental trapping or malicious shooting). Given the small relative reduction to foraging habitat and that the Hungry Lion Project would not increase public motorized access in the project Lynx Analysis Units, the project is not expected to increase the probability of lynx mortality. Trapping for Canada lynx is currently not permitted. Trapping season is December 1 to February 15 for the project Lynx Analysis Units. Trappers can currently travel under their own power over snowed in closed roads, snowed-in trails and on snow cross-country through forest stands in the winter time to deploy traps. The proposed trails would not be groomed and would facilitate little additional access during the winter months for trappers based on the trapping season, the terrain, and the snow pack in the project area. Due to this rationale, the proposal to return historic trails to the

system in alternatives 2 and 4 would not provide more opportunity for nonmotorized trapper access than already exists within the project Lynx Analysis Units.

A mosaic of forest stand conditions and successional stages would continue to exist under each of the project action alternatives, capable of supporting a viable population of lynx on the Flathead National Forest and within the South Fork of the Flathead River.

Determination

The Canada Lynx is listed as a “Threatened” species under the Endangered Species Act (ESA). A biological assessment was prepared and submitted to the U.S. Fish and Wildlife Service.

Regulatory Framework and Consistency

The Canada lynx was classified as Threatened in Montana on March 24, 2000, and is currently protected under the Endangered Species Act. Threatened status affords a species and its habitat special protection from adverse effects resulting from federally authorized or funded projects.

The LCAS was developed in 2000 to guide lynx conservation and management and was revised in 2013. The LCAS established mapping of Lynx Analysis Units and analysis for effects to lynx at the Lynx Analysis Unit scale. The Northern Rockies Lynx Management Direction directs the continued use of Lynx Analysis Units for effects analysis.

In March 2007, the Record of Decision for the Northern Rockies Lynx Management Direction incorporated goals, objectives, standards, and guidelines into existing plans of all National Forests in the Northern Rockies Lynx Planning Area, including the Flathead National Forest. The Northern Rockies Lynx Management Direction allows a limited range of fuel or timber management projects that can be conducted within the wildland-urban interface and limited precommercial thinning for other resource benefits, under exceptions or exemptions from amendment standards VEG S1, S2, S5, and S6. Within the Northern Rockies Lynx Management Direction, the wildland-urban interface definition is the “area adjacent to an at-risk community that is identified in the community wildfire protection plan” (HFRA § 101). The Flathead County fire plan represents the community fire plan used to define the boundaries of the wildland-urban interface used in the analysis of the Hungry Lion Project.

To minimize the impact of this incidental take, terms and conditions in the Incidental Take Statement limited the number of acres per Forest that could be treated in ways that adversely affect lynx habitat. These acres were allocated to each Forest subject to the Northern Rockies Lynx Management Direction Record of Decision. The U.S. Fish and Wildlife Service analyzed the effects of such projects on lynx in their first-tier biological opinion and provided an Incidental Take Statement for these activities. Forest allocations of activity acres approved in the biological opinion for the 2007 decision are reported annually to the U.S. Fish and Wildlife Service.

The U.S. Fish and Wildlife Service issued a biological opinion on the effects of amending forest plans of 18 National Forests with the Northern Rockies Lynx Management Direction. The U.S. Fish and Wildlife Service determined in its biological opinion (USDI Fish and Wildlife Service, 2007a) that the Northern Rockies Lynx Management Direction would substantially reduce or eliminate adverse effects to lynx from NFS land management activities. In the first-tier biological opinion, the U.S. Fish and Wildlife Service analyzed the effects of timber management/fuel reduction projects and provided an Incidental Take Statement for those activities based on explicit estimates on the number of acres that would be impacted under the exceptions and exemptions that were provided by the Forest Service (e.g., acres of probable treatment in existing wildland-

urban interface at the time of analysis). These acres were allocated to each Forest subject to the Northern Rockies Lynx Management Direction Record of Decision. In the biological opinion on the Northern Rockies Lynx Management Direction, the U.S. Fish and Wildlife Service anticipated fuels reduction treatment of 103,800 acres of lynx habitat within wildland-urban interfaces on the Flathead National Forest and 1,460 acres of precommercial thinning of snowshoe hare habitat for vegetation management for other resource benefits (under the exemptions and exceptions to standards VEG S1, S2, S5 and S6). Proposed commercial and noncommercial treatments in lynx habitat in the project Lynx Analysis Units would be conducted under exceptions to standards VEG S1, S2, S5, and S6 (for treatments in the wildland-urban interface) and would utilize exemption acres outside the wildland-urban interface for restoration of western white pine.

The Record of Decision for the Northern Rockies Lynx Management Direction (USDA Forest Service, 2007) incorporated goals, objectives, standards, and guidelines into existing plans of all National Forests in the Northern Rockies Lynx Planning Area, including the Flathead National Forest, where the Hungry Lion Project is proposed. In their biological opinion on implementation of the Northern Rockies Lynx Management Direction (USDI Fish and Wildlife Service, 2007a), the U.S. Fish and Wildlife Service determined that the Northern Rockies Lynx Management Direction would result in application of management direction on nearly 12.2 million acres of occupied lynx habitat, including all lynx habitat delineated in the recovery outline, and would substantially reduce or eliminate adverse effects to lynx from NFS land management activities. The project is consistent with Northern Rockies Lynx Management Direction (Project File Exhibit H-6).

Proposed commercial and noncommercial treatments in lynx habitat in the project Lynx Analysis Units would be conducted under exceptions to standards VEG S5 and VEG S6 (for treatments in the wildland-urban interface). Under alternative 2, 758 acres of existing lynx forage, both sapling and multistory structures, would be negatively affected, primarily through the removal of the horizontal structure. In alternative 3, 345 acres of lynx forage would be negatively affected. In alternative 4, 520 acres would be negatively affected. None of the alternatives would result in regeneration of more than 15 percent of lynx habitat in a Lynx Analysis Unit in a 10 year period. These acreages under each of the action alternatives would occur within the wildland-urban interface, using the exceptions described above in the Northern Rockies Lynx Management Direction (e.g., anticipated reduction of 103,800 acres). The negative effects to lynx habitat described in this analysis were included as those anticipated and analyzed in the 2007 biological opinion on the Northern Rockies Lynx Management Direction (USDI Fish and Wildlife Service, 2007a).

Northern Rockies Lynx Management Direction Veg S5 applies to precommercial thinning projects outside the wildland-urban interface to stand initiation habitat for daylight thinning of rust-resistant white pine where 80 percent of the winter snowshoe hare is retained. The Northern Rockies Lynx Management Direction defines precommercial thinning as: “mechanically removing trees to reduce stocking and concentrate growth on the remaining trees, and not resulting in immediate financial return.” The prescriptions in the Hungry Lion Project are consistent with this definition (Project File Exhibit H-6). The proposed treatments under alternatives 2, 3, and 4 would not exceed those allotted to the Flathead National Forest through consultation with U.S. Fish and Wildlife Service before implementation. The negative effects to lynx habitat for effects to lynx habitat inside the wildland-urban interface and outside the wildland-urban interface as described in this analysis, were included as those anticipated and analyzed in the 2007 biological opinion on the Northern Rockies Lynx Management Direction (USDI Fish and Wildlife Service, 2007a).

Canada Lynx Critical Habitat

Summary of Findings

Alternative 2 would have the greatest impact to critical habitat Primary Constituent Elements (PCE) in the Hungry Lion Project Lynx Analysis Units by negatively impacting the greatest acreage of both foraging and denning habitat. Alternative 3 would have the least impact of the action alternatives and would negatively affect the least amount of PCE1a (lynx foraging habitat). Table 90 summarized the differences in effects to lynx critical habitat Primary Constituent Elements by alternative. All alternatives would continue to provide for a diverse mosaic of forest conditions capable of supporting lynx throughout the project Lynx Analysis Units.

Table 90. Comparison of effects to critical habitat primary constituent elements for project alternatives

Alternative	PCE1a - Acres	PCE1c - Acres	PCE1d - Acres
Alternative 1	0	0	0
Alternative 2	757	408	1,963
Alternative 3	191	214	841

Analysis Area

In accordance with the LCAS (2000; 2013), 109 Lynx Analysis Units were identified and mapped on the Flathead National Forest. These areas approximate the size of a female's home range and contain year-round habitat components (USDA Forest Service et al. 2000). The Lynx Analysis Units are the geographic area used to analyze direct, indirect, and cumulative effects for Canada lynx. The proposed project is located across four Lynx Analysis Units – Coram Abbot, Emery Creek, Hungry Horse Creek, and Lake Five. In determining impacts to lynx critical habitat, this analysis considered all designated lynx critical habitat in these four Lynx Analysis Units.

Temporal Bounds

The length of time for the activities associated with the proposed fuels reduction and forest health treatments is approximately five years. This is based on the probable contract length for the proposed project, and the timeframes for related activities. The temporal scale of the effects analysis extends 100 years into the future, enough time for dense forest conditions and mature multistory stands to develop and trees to die and/or fall over and create denning habitat. Temporal bounds for specific activities are discussed below.

Methodology

Data used included aerial photography, stand exams, VMAP data, field surveys of downed logs, old growth surveys, project area field visits to verify lynx habitat classification, review and application of the best available science, and GIS and dataset information for features such as general forest attributes, slope, aspect, habitat type, forest type, elevation, and mapped lynx critical habitat.

Habitat

The conservation role of lynx critical habitat is to support viable core area lynx populations (USDI Fish and Wildlife Service 2009:2014). In 2008, critical habitat was proposed for Canada

lynx. A Final Rule for Revised Designation of Critical Habitat for the Contiguous United States Distinct Population Segment of the Canada lynx was effective on March 27, 2009. The designation of critical habitat for lynx was based on the best assessment of areas: (1) determined to be occupied at the time of listing; (2) that contained the physical and biological features in the appropriate spatial arrangement and quantity essential for the conservation of the species; and (3) that may require special management considerations or protection.

On September 12, 2014, the U.S. Fish and Wildlife Service revised critical habitat in the contiguous United States. Northwest Montana is in Critical Habitat Unit 3: Northern Rocky Mountains. This unit includes most of northwest Montana, as well as a small portion of northeastern Idaho, and encompasses approximately 9,783 square miles (approximately 6,261,095 acres). The Unit 3 area is essential to the conservation of lynx because it appears to support the highest density of lynx populations in the northern Rocky Mountain region of the lynx's range. It also likely acts as a source for lynx and provides connectivity to other portions of the lynx's range in the Rocky Mountains (USDI Fish and Wildlife Service 2009, 2014).

As of the 2014 revision, on the Flathead National Forest, there are approximately 2,273,340 acres of designated critical habitat for lynx. The entirety of the Hungry Horse Creek and Emery Creek Lynx Analysis Units are designated critical habitat, while only portions of the Lake Five and Coram Abbot Lynx Analysis Units contain critical habitat. A map of the proposed units, project Lynx Analysis Units and critical habitat is located in Project File Exhibit H-6.

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).

Table 91 summarizes the estimated distribution of stand conditions that provide primary constituent elements within lynx critical habitat across the Lynx Analysis Units in the project area. Additionally, Table 91 summarizes the estimated denning habitat (PCE1c) within the project Lynx Analysis Units. The estimated PCE1c is likely an underestimate. Only late-seral stands that had high amounts of coarse woody debris were included in this estimate. Other PCE1c conditions exist within the project area in the form of root wads, slash piles, blow down etc.; however, the estimated PCE1c is likely the best quality denning habitat available.

Table 91. Estimated existing stand conditions that contribute to PCE1a and PCE1d within Canada lynx critical habitat

LAU name	LAU Total Acres	Total Critical Habitat Acres	PCE1a - Stand Initiation currently Hare Habitat ¹ (% of LAU Critical Habitat)	PCE1a -Multistory currently Hare Habitat ² Acres (% of LAU Critical Habitat)	PCE1d Matrix ³
Coram Abbot	15,449	7,534	863	2,458	1,160
Emery Creek	13,951	13,951	1,643	5404	2,091
Hungry Horse Creek	14,891	14,891	531	6,015	3,717
Lake Five	16,912	3,522	146	1,440	1,266
Total	61,203	53,288	3,183	15,317	8,234

¹Stand initiation structural stage with dense young trees, shrubs or overhanging boughs that protrude above the snow.

²Multistory structural stage with many age classes, vegetation layers, a dense understory of young trees and conifer boughs touching the snow surface that provides snowshoe hare habitat, which may also provide denning habitat.

³Matrix: hardwood forest, dry forest, non-forest, or other habitat types that do not support snowshoe hares.

Squires et al. (2008) found that female dens were primarily located in spruce-fir stands with abundant coarse woody debris and high horizontal cover; however, denning did occur in stands with coarse woody debris but insufficient cover for snowshoe hares. Table 92 summarizes the estimated denning habitat in designated critical habitat within the project Lynx Analysis Units. This habitat includes some multistory hare habitat and some stem exclusion habitat with high amounts of down woody debris.

Table 92. Estimated stand conditions that contribute to PCE1c within Canada lynx critical habitat

LAU Name	LAU Total Acres	Total Critical Habitat Acres	PCE1c Denning Habitat ¹ Acres
Coram Abbot	15,449	7,534	3,139
Emery Creek	13,951	13,951	5,812
Hungry Horse Creek	14,891	14,891	6,149
Lake Five	16,912	3,522	1,468
Total	61,203	53,288	15,568

¹Sites for denning that have abundant coarse woody debris, such as downed trees and root wads. Stands that include these features include both multistory forage and stem exclusion stands with high amounts of coarse woody debris.

Environmental Consequences

Alternative 1 (no-action alternative) – Direct, indirect, and cumulative effects

Under the no-action alternative, there would be no vegetation treatments or associated activities proposed. There would be no direct effects to Canada lynx critical habitat as a result of implementing this alternative; there would be no reduction of PCE1a or PCE1c from the management activities proposed in the project Lynx Analysis Units. Stands that may only provide summer forage for lynx now (early stand initiation), because they are too short to protrude above the snow in winter, would be expected to continue to grow, becoming good winter hare habitat (PCE1a). Red squirrel habitat (alternate prey for lynx) would be maintained in old growth and other mature forest stands across the project Lynx Analysis Units.

Indirectly, not implementing the proposed vegetative treatments could increase the risk of a wildfire burning more intensely in the project area in the future, which could result in changes in available PCE1a, PCE1c, and PCE1d. Fires have historically produced both positive and negative effects for lynx; loss of hiding cover and/or loss of PCE1a conditions would be a potential negative effect. On the positive side, PCE1a would be potentially increased as stands regenerate over time and stands regenerate from wildfire disturbance.

Established human activities would continue including road maintenance, firewood cutting and development on private lands. Alternative 1 would not contribute negative cumulative effects to Canada lynx critical habitat.

Alternative 2, 3, and 4 – Direct & indirect effects

The Final Rule for Revised Designation of Critical Habitat (2014) described three types of Federal actions that may affect critical habitat:

- Actions that would reduce or remove understory vegetation within boreal forest stands on a scale proportionate to the large landscape used by lynx.
- Actions that would cause permanent loss or conversion of the boreal forest on a scale proportionate to the large landscape used by lynx.
- Actions that would increase traffic volume and speed on roads that divide lynx critical habitat, or, in matrix habitat, activities that change vegetation structure or condition in such a way as to create a barrier or impede lynx movement.

For Canada lynx critical habitat, quantification at the Lynx Analysis Unit scale of the vegetation management effects is displayed in Table 93. This analysis is separate from that applied to the lynx analysis as the focus is on impacts on the components of the primary constituent elements for lynx critical habitat.

Within lynx critical habitat in the Hungry Lion Project Lynx Analysis Units, there would be a decrease of approximately four percent in overall PCE1a conditions under alternative 2, a one percent decrease under alternative 3 and a two percent decrease under alternative 4. Table 92 displays the amount of habitat providing PCE1a that would be affected by the proposed activities by Lynx Analysis Unit.

Table 93. Summary of effects to lynx critical habitat primary constituent elements (PCEs) by alternative and Lynx Analysis Unit

LAU	Acres Treated in Lynx Forage (PCE1a)			Acres Treated in Lynx Denning (PCE1c)			Stem Exclusion / ESI Acres Treated in Lynx Habitat			Acres Treated in Matrix Habitat (PCE1d)		
	Alt 2	Alt 3	Alt 4	Alt 2	Alt 3	Alt 4	Alt 2	Alt 3	Alt 4	Alt 2	Alt 3	Alt 4
Coram Abbot	244	45	63	176	45	45	824	480	496	686	16	19
Emery Creek	326	84	326	43	21	21	1,009	667	603	825	801	781
Hungry Horse Creek	13	0	13	15	0	5	341	200	11	35	24	40
Lake Five	174	62	0	174	148	0	0	0	0	417	0	0

LAU	Acres Treated in Lynx Forage (PCE1a)			Acres Treated in Lynx Denning (PCE1c)			Stem Exclusion / ESI Acres Treated in Lynx Habitat			Acres Treated in Matrix Habitat (PCE1d)		
	Alt 2	Alt 3	Alt 4	Alt 2	Alt 3	Alt 4	Alt 2	Alt 3	Alt 4	Alt 2	Alt 3	Alt 4
Total	757	191	402	408	214	71	2174	1,347	1,110	1,963	841	840

Reduction in PCE1a would not be permanent. Natural regeneration and planted seedlings would grow back and provide snowshoe hare habitat. However, it should be noted that where regeneration harvest is proposed, PCE1a stand conditions would return in approximately 20 years. The Hungry Lion Project does not propose to treat early stand initiation habitat in any of the action alternatives.

PCE1c would be reduced by approximately 408 acres in alternative 2, approximately 214 acres in alternative 3, and approximately 71 acres in alternative 4. Stand conditions with PCE1c attributes were considered for both multistory forage and stem exclusion habitats with high amounts of down woody debris. The reduction of PCE1c would be approximately 0.4 to three percent of the estimated PCE1c conditions in project critical habitat area. Project design features would retain 10 tons per acre of down woody debris where available in treatment units and retain large diameter snags under forest plan amendment 21. These features would retain denning structures for lynx in treated stands. As treated stands regenerate, sufficient cover combined with lynx denning structures (fallen snags, root wads) would create denning habitat over time.

PCE1b (deep fluffy snows) would not be affected by this proposal.

Alternative 2 proposes 1,584 acres of vegetation management and fire activities in matrix habitat while alternative 3 and alternative 4 propose 1,560 and 1,540 acres respectively (Table 92). All of the proposed upland fire units would occur in matrix habitat. Lynx movement patterns may change as a result of treatment, but PCE1d (matrix habitat) would continue to support the ability of lynx to travel within their home range.

Road work including road construction, maintenance, reroute, rehabilitation, reclamation, and recontouring may remove some saplings or individual trees, but would have negligible impact to critical habitat primary constituent elements. This work would not be permanent with natural regeneration of forest conditions able to occur over time. Recreational improvements at Lion Lake would occur outside of critical habitat. Proposed historic trails under alternatives 2 and 4, would occur both inside and outside critical habitat. Similar to road work, maintenance or use on these trails would have negligible impact to critical habitat primary constituent elements.

The effects on Canada lynx critical habitat would occur on a small portion of Critical Habitat Unit 3. The sum of critical habitat in the project Lynx Analysis Units comprises approximately 0.9 percent of Critical Habitat Unit 3. Table 94 displays effects to primary constituent elements relative to critical habitat within the project Lynx Analysis Units, as well as relative to critical habitat in Unit 3 for the action alternatives.

Table 94. Effects of action alternatives on the primary constituent elements for designated lynx critical habitat

Primary Constituent Element		Effect within the Project LAUs
PCE1a	Presence of snowshoe hares and their preferred habitat conditions, which include dense understories of young trees, shrubs or	The approximately 191-757 acres of hare habitat that would be affected by vegetation management activities, is approximately 1-

Primary Constituent Element		Effect within the Project LAUs
	overhanging boughs that protrude above the snow, and mature multistoried stands with conifer boughs touching the snow surface.	4% of the available hare habitat (PCE1a) in the project LAUs.
PCE1b	Winter snow conditions that are generally deep and fluffy for extended periods of time.	The presence of deep fluffy snow would not be affected by this proposal.
PCE1c	Sites for denning that have abundant coarse woody debris, such as downed trees and root wads.	The approximately 71-408 acres of denning habitat that would be affected by vegetation management and fire activities is at most about 3% of the available denning habitat (PCE1c) in the project critical habitat area.
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. Travel patterns may change to avoid opening; however, a mosaic of conditions exist in the project LAUs to allow travel between patches of boreal forest. There would be no negative impacts on any lynx linkage area (Squires et al. 2013).

There would be no permanent loss (such as paving or building construction) of habitat or conversion of the boreal forest as a result of proposed activities. The physical and biological features would not be altered to an extent that would appreciably reduce the conservation value of critical habitat for lynx and the primary constituent elements would continue to function at the scale of the Lynx Analysis Unit and across Critical Habitat Unit 3.

The proposed use of existing roads and temporary roads would not create barriers to, or impede movements of lynx.

Determination

The Canada lynx critical habitat was designated under the Endangered Species Act (ESA). A biological assessment was submitted to the U.S. Fish and Wildlife Service.

Alternative 2, 3, and 4 – Cumulative effects

Past timber management and road building on all ownership lands in the Hungry Lion Lynx Analysis Units have occurred; it is anticipated that timber management activities would continue into the future. Other on-going activities include hunting, trapping, firewood cutting, recreational activities, existing special use permits, road maintenance activities, noxious weed treatments, residential development, and land conversion on private lands. Timber management and road building, along with conversion of private lands in the area, have an effect on the availability of forage and denning habitat for Canada lynx. In addition, the combination of each of the activities described above could affect the ability of Canada lynx to move across the landscape securely. Landscapes in which hare habitat is more contiguous, or where good patches of hare habitat are surrounded by other patches of similar habitat quality, support more snowshoe hare (lynx forage) than landscapes that are more fragmented or include dry habitats that are poorer quality (USDA Forest Service et al. 2000).

There have been past harvest activities within the project Lynx Analysis Units including the Hungry Horse/West Glacier Fuels Reduction, Paint Emery, Firefighter, and Belton Fuels. These projects have decreased lynx foraging habitat, altered the forest mosaic and juxtaposition of travel cover within the project Lynx Analysis Units. The Firefighter project is still active in the Hungry

Horse Creek Lynx Analysis Unit. The remaining harvest units would occur in stem exclusion habitat. No winter harvest would occur. Prescribed fire from the Belton project would not affect lynx foraging habitat in the Lake Five Lynx Analysis Unit. Completed work from past projects was incorporated in the habitat baseline. Regeneration harvest from these projects greater than 20 years old has likely recruited stand initiation winter foraging conditions in lynx habitat. Combined with the effects of these past projects, the Hungry Lion alternatives would not regenerate more than 15 percent of lynx habitat in any project Lynx Analysis Unit in a 10 year period. A mosaic of conditions still exist and mature multistory foraging habitat is still well distributed in the project Lynx Analysis Units and connected by a network of forest cover to provide lynx traveling conditions.

Squires et al. (2013) characterized major highways and permanent development as the major barrier to connectivity between two lynx populations. The Hungry Lion Project does not propose any improvement to the highway adjacent to the project area or urbanization on private land. Future highway improvement or development on private land on the western edge of the project Lynx Analysis Units (Coram Abbot and Lake Five). The U. S. Highway 2 corridor and the majority of private lands occur in non-lynx habitats; while the distribution of lynx potential habitat and lynx foraging conditions to the east these developed areas.

Effects of past harvest on private land to lynx habitat were characterized using stand attributes in recent VMAP data, NAIP imagery, and field verification. These data sources were used to characterize the area within the four Lynx Analysis Units including NFS and private lands. This information was considered in the habitat baseline. Grazing from livestock is ongoing at Coram pasture in the Coram Abbot Lynx Analysis Unit. This use occurs in non-lynx habitat and does not have effects to lynx or lynx habitat.

Groomed snowmobile trails exist in the project area and approximately 27 percent of the critical habitat area in the project Lynx Analysis Units are open to motorized over-the-snow travel from December 1 to March 31, conditions permitting. Winter harvest operations would restrict snowmobile use while harvest operations and hauling were occurring during the winter months. No additional grooming is proposed in the Hungry Lion Project. Winter harvest is not expected to combine with existing motorized winter travel to have negative effects.

There would be local negative effects to critical habitat primary constituent elements in the Hungry Lion action alternatives. At the landscape scale, considering the large amount of critical habitat in Unit 3 (Northern Rocky Mountains), sufficient densities of snowshoe hares would be produced to support lynx presence. Hodges (2000) recommended maintaining some minimum density of snowshoe hares across a broad landscape, e.g., greater than 0.5 hare/hectare (0.2 hares per acre), to support a self-sustaining population of lynx. Griffin et al. (2004), and Mills et al. (2005) estimated density and relative abundance of snowshoe hares throughout Montana. Hare densities generally were low, ranging between 0.1 to 0.6 hares per hectare (0.24 to 1.48 hares per acre). In western Montana, Griffin and Mills (2004) found the highest snowshoe hare densities in regenerating forest stands with high sapling density and in uncut, mature multistory stands with abundant saplings. Given that hares are a forest stand disturbance dependent species and the legacy of forest management across ownerships within the project Lynx Analysis Units that have maintained a mosaic of stands, hare densities would remain sufficient within remaining patches of hare habitat while regenerating forest structure would provide preferred hare habitat into the future. The primary constituent elements would continue to be available within Canada lynx critical habitat across the Flathead National Forest and proposed activities would not cause a

permanent loss or conversion of the boreal forest on a scale proportionate to the large landscapes used by lynx.

Grizzly Bear

Introduction

Grizzly bears have a large home range 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, leads to their omnivorous or generalist feeding habit, and an adaptable ability to eat a wide variety of plant and animal foods. Various articles on grizzly bear food habits and habitat use in the Northern Continental Divide Ecosystem indicate bears use a diverse array of habitats, consume a variety of foods which can vary substantially by location and season. 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, and meadows in spring and fall, and higher elevation habitats, such as subalpine forests, alpine tundra, and boulder fields in summer, early fall and winter.

Grizzly bears have been shown to have a negative relationship with human development and activity. Roads and their associated motorized 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, R. D. Mace and J. S. Waller (1997) showed substantive blocks of unroaded habitat as a component of adult female home ranges. Approximately 67.5 percent of composite home range for eight female bears was greater than 0.3 miles (0.5 kilometer) from a road. The least amount of core area used in the South Fork Study was roughly 55 percent (USDA Forest Service, 1994). In summary, vast areas of limited human access, moist, open-land habitats in combination with timbered areas are essential for optimum grizzly bear habitat.

Summary of Findings

Potential for grizzly bear displacement from motorized activity is greatest under alternative 2 due to the acres treated and proposed road construction. This potential for displacement from motorized activity is least under alternative 4. Both alternative 2 and 4 propose road work on NFS Road 1614 in security core during the non-denning period that would result in a short-term temporary reduction in security core of approximately 10 percent in the Emery Firefighter Subunit. Design, location, and management of proposed historic trails under alternative 2 and 4 are expected to result in low potential for human-bear conflict due to recreational use. Overall, the impacts to grizzly bears are least under alternative 3 there is only a one percent temporary influence to security core during project activities and historic trails would be rehabilitated, thereby minimizing human access in bear habitat and further reducing the low risk of grizzly bear mortality due to conflict with trail users.

Analysis Area

The Hungry Lion Project is located in the Northern Continental Divide Ecosystem Grizzly Bear Recovery Area. The Northern Continental Divide Ecosystem has been divided into Bear Management Units Subunits. The Bear Management Unit Subunits approximate the size of a

female grizzly bear's home range. The project lies within the Coram-Lake Five (35,777 acre) and Emery Creek (46,462 acre) Grizzly Bear Subunits. 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 (e.g., IGBC and Forest Plan Amendment 19).

Temporal Bounds

The length of time for effects analysis is approximately five 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. Temporal bounds for specific activities are discussed below.

Methodology

Data used included aerial photography, National Agricultural Imagery Program (NAIP) images, stand exams, VMAP data, and review of the best available science, grizzly bear telemetry data, past grizzly bear mortality information and GIS and dataset information for features, such as general forest attributes, slope, aspect, habitat type, forest type, elevation, and modeled grizzly bear denning habitat on Flathead National Forest Model. In addition, site-specific information on habitat characteristics was collected from 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.

Existing Condition (Affected Environment)

Habitat

Grizzly bears, one of the largest terrestrial mammals in North America, have a large home range and use a wide variety of relatively undisturbed habitats. The grizzly bear occupies less than two percent of its former range south of Canada (USDI Fish and Wildlife Service, 1993).

Grizzly bears have a large home range 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, 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 bears use a diverse array of habitats, 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 Hungry Lion 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 unroaded habitat as a component of adult female home ranges. Approximately 67.5 percent of composite home range 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 (day/night) documenting movements and habitat use day and night. In Alberta, Roeber, 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. Based on grizzly tracks and remote camera detections, the district biologist has frequently observed grizzly bears using restricted (gated or bermed) roads for travel further suggesting no displacement is occurring due to the presence of restricted roads. 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 road densities and administrative travel direction 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 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 21.45 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 clearcuts 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 95 includes the existing Open Motorized Access Density (OMAD), Total Motorized Access Density (TMAD) and security core percentages in the project subunits. It is important to note that because the Coram Lake Five Subunit consists of lands that are less than 75 percent NFS lands and the Emery Firefighter subunits has more than 75 percent NFS lands, they have different road density objectives under A19 (see the Regulatory Framework portion of this section).

Table 95. Amendment 19 existing situation

Grizzly Bear Subunit	Access Density Parameter		
	OMAD (> 1 mi/mi ²)	TMAD (> 2 mi/mi ²)	Security Core
Coram Lake Five (<75% NFS lands)	26%	46%	14%
Emery Firefighter (>75% NFS land)	19%	20%	58%

Denning habitat has been characterized by looking at combinations of elevation, aspect, slope, and vegetation that matched known grizzly bear dens. Denning season in this area is considered to be from December 1 to March 31 each year. Spring (April 1 to July 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 area. In the project subunits, cover exceeds 40 percent in the two grizzly bear

subunits and is well distributed throughout the area (Project File Exhibit H-7). Hiding cover is defined as trees of sufficient size and density to obscure an animal 200 feet (Forest Plan, p.VII-11).

Table 96. Existing conditions within grizzly bear subunits potentially affected

Grizzly Bear Subunit	Acres in Subunit	Potential Key Spring Habitat <4,900 ft. elevation Acres (%)	Potential Denning Habitat >5,900 ft. elevation Acres (%)	Cover Acres (%)
Coram Lake Five	35,777	33,306 (93%)	561 (2%)	29,437 (82%)
Emery Firefighter	46,462	28,071 (60%)	8,776 (19%)	37,691 (81%)

Population

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 included 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 Hungry Lion Project is located on lands that have been designated as management situation 1 (MS-1). MS-2 and MS-3 for grizzly bears. Objectives for MS-1 lands are identified as areas needed for the survival and recovery of the species (USDA Forest Service, 2001a). 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 97 below. The remaining proportion within each subunit not included in Table 97, is the area encompassed by Hungry Horse Reservoir or by private property. Map 3-5 shows a map of MS lands in the project subunits.

Table 97. Summary of management situation lands within the project subunits

Subunit	MS-1 acres (%)	MS-2 acres (%)	MS-3 acres (%)
Coram Lake Five	9,415 (26%)	10,563 (30%)	4,569 (13%)
Emery Firefighter	40,095 (85%)	3,024 (7%)	0 (0%)

In the past 20 years, there have been 17 documented grizzly bear mortalities in the project subunits (not including dependent young; Project File Exhibit H-7). The 12 of the 17 of the mortalities were documented on private lands or were mortalities when a bear was hit by a train. One documented mortality included a bear that was shot and dumped in the South Fork River. It is unknown on what ownership this mortality occurred. Only four of these mortalities are documented on NFS lands. These causes of mortalities within the project subunits on NFS lands included malicious shooting (1), agency removal (1), mistaken identification by a black bear hunter (1) and unknown (1). A summary of these mortalities by year, cause and ownership is located in Project File Exhibit H-7. The distribution and location of these mortalities in the project area suggest that management on MS-1 NFS lands provides secure habitat for grizzly bears (Project File Exhibit H-7).

Environmental Consequences

Alternative 1 (no-action alternative) – Direct, indirect, and cumulative effects

Since there would be no vegetation treatments or associated activities proposed with this alternative, there would be no direct effects to grizzly bear 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 proposed in the Hungry Lion project area. On historic trails, nonmotorized recreational activity would likely continue to occur in the project subunits without defined management, public education or specific, thoughtful design to reduce recreational impacts to grizzly bears. Law enforcement would continue to work to enforce restrictions on unauthorized activities. Impacts of nonmotorized recreational activity may be small as there is no information documenting increased mortality risk or population level impacts to grizzly bears from displacement (NCDE, 2013). Under the no-action alternative, no historic roads would be added to the road system. Activity on private lands including development, timber harvest, road building 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 area. This includes recreational traffic to developed and dispersed sites within the project subunits and log hauling traveling from other projects outside of 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 bear 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 be potentially increased. 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.

Alternative 2 – Direct and indirect effects

Denning habitat

Mace and Waller (1997) found grizzly bear dens to occur on steep slopes, on all aspects and concluded that denning habitat (greater than 5,900 feet) did not appear to be limiting in the South Fork Study area. Using a 1 kilometer distance (3,280 feet) recommended by the project units were buffered to quantify the amount of denning habitat (Project File Exhibit H-7) that may be affected. This distance is a conservative measure drawn from a review of the best available science. Based on this analysis, winter harvest activities would potentially create noise and disturbance to affect 252 acres of denning habitat on Desert Mountain or two percent of available denning habitat in the project subunits. Based on field evaluation and personal observation of grizzly bear denning on the Flathead National Forest, the potential denning habitat affected on Desert Mountain represents the poorest quality denning habitat in the project subunits. Additionally, the mountains within the project subunits provide substantial denning habitat up long drainages and differing aspects that provides seclusion from sound produced by equipment or other activities during the denning period. Upland prescribed fire units would not be implemented during the denning season and would not have effects to grizzly bear denning or

potential denning habitat in the Flathead Range. The winter harvest units in security core would not affect denning habitat because they would occur greater than 1,000 meters from denning habitat.

Hiding cover

Satellite imagery, stand data, and field visits were used to estimate hiding cover within the project subunits. The proposed activities would decrease the amount of hiding cover in the project subunits.

Commercial thinning, understory removal, and precommercial thinning are assumed to continue to provide hiding cover after project implementation. Seed tree, post and pole, and shelterwood treatments would not provide hiding cover. Group selection cuts would result in two to four acre areas that do not provide hiding cover while the remaining area would be commercially thinned retaining cover. These treatments were assumed to reduce hiding cover by approximately 40 percent with cover openings evenly distributed throughout the unit. The estimated percent reduction is based on field evaluation of units and the targets tree species for selection. Within the area treated for shaded fuelbreaks, hiding cover is not expected to be maintained. Exact effects of the special cuts is not known due to differences in stands surrounding recreational areas and the unique individual site treatments. These treatments were assumed not to maintain hiding cover within the developed and dispersed recreation areas where they are located. 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. Project File Exhibit H-8 discusses assumptions and analysis for effects to hiding cover on the proposed activities.

Under alternative 2, the project activities would decrease hiding cover by an approximate total 1,621 acres or two percent in each of the project subunits. Alternative 2 would include 11 units that would result in regeneration harvest over 40 acres. Alternative 2 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 recover, depending on stand conditions.

Foraging habitat

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 bears foraging elevation drop 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.

The project subunits provide potential foraging habitat for grizzly bear throughout the spring, summer, and fall. Proposed treatments in both alternatives would decrease the amount of available forage temporarily due to ground disturbance in cutting units and the construction of

temporary roads. The potential for a decrease in the amount of forage would be greatest in alternative 2, due to the larger amount of acres treated and the amount of proposed temporary road construction. 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; however this analysis conservatively considers only regenerative treatments and prescribed burns to increase forage production over time.

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 area.

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) that 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 treatments under each alternative would help protect important riparian habitats for grizzly bear.

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 areas 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 could 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

High 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). The potential for displacing grizzly bears during implementation of proposed activities is greatest in alternative 2, due to the noise, motorized use and associated human activity for implementation of the greater amount of units, temporary roads, and quantity of restricted roads needed for access. Displacement of bears may occur due to mechanical/motorized activity and crew activities. Potential displacement would be short-term, during the length of the proposed sale activity (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. Project

activities implemented during the denning season, such as proposed units in security core, would not have displacement effects to grizzly bears (see Denning analysis above).

Road construction, road maintenance, and restricted road use

Human and mechanical activity may displace bears from the areas surrounding proposed vegetation treatment units, road and culvert work, haul routes, aquatic improvements on roads, road reroutes and other activities. Alternative 2 proposes to build 6.7 miles of new temporary road and 7.6 miles of road on historic road templates. Temporary, new system and restricted roads used for project activities would remain closed to the public. During project activities Open Motorized Access Density, and Total Motorized Access Density would temporarily increase and security core would temporarily decrease (Table 98).

Table 98. During and post project percentage of subunit area with >1 mi/mi² open motorized access density, >2 mi/mi² total motorized route density and security core, alternative 2

Subunit	During Project			Post-Project		
	OMAD	TMAD	Core	OMAD	TMAD	Core
Coram Lake Five	43%	48%	13%	26%	46%	14%
Emery Firefighter	24%	21%	47%	19%	20%	58%

At completion of project activities, temporary roads would be rehabilitated after project activities and 7.6 miles of new system road (built on historic templates) for project activities, would then be put into storage following harvest and treated to meet the reclaimed definition under amendment 19 of the forest plan (see Regulatory Consistency section). At completion, historic roads added to the system would be impassable to motorized vehicles and 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. Rehabilitated temporary roads and new system roads treated to meet the reclaimed definition of amendment 19 would not count towards Open Motorized Access Density, Total Motorized Access Density or security core calculations after project implementation. After project activities, there would be no net increase in Open Motorized Access Density and Total Motorized Access Density or a net decrease in security core in the project subunits. Road reroutes would not have no net effect on Open Motorized Access Density, Total Motorized Access Density or security core calculations.

Helicopter activity

Helicopter ignition would be used to ignite upland prescribed burning units. A Level I 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 flights for ignition over security core, the displacement effects of this activity would not be prolonged as the low altitude activity would occur for only one to three days. Further aviation activity for monitoring would occur at higher altitudes where sound from the aircraft would likely not affect the bear. Burning would occur during the fall period when bear foods can be widespread and not concentrated on a particular aspect or elevation. Security core would continue to provide security for grizzly bears if the prescribed fire was implemented. The prescribed fire would not increase human access within security core after implementation. The aerial ignition would occur outside of breeding or denning seasons. 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 to security core

No vegetation management activities are proposed in security core outside of the denning season. No temporary roads would be built in existing security core; however road construction and road use within 500 meters of existing core would result in a temporary decrease in security core from the influence of motorized activity within 500 meters of existing core. This reduction would be approximately one percent of core in the Coram Lake Five subunit (see also Recreational Improvements section below) and one percent in the Emery Firefighter subunit (Project File Exhibit H-7). It is unlikely that all these temporary roads would be active simultaneously. During the denning season, five units are proposed for harvest in security core (units 02, 82, 83, 84, and 85). The activity for these units would not affect grizzly bear denning activity.

Alternative 2 proposes 30 days of activity in security core during one summer season for replacement of culverts on NFS Road 1614. Activity would occur in security core only during the non-denning period for up to 30 days. Activity would displace bears and reduce security core in affected project subunits. The 30 days of activity would result in a temporary decrease of 10 percent of security core in the Emery Firefighter subunit. Combined with other project activities and influences on security core (discussed above) there would be a temporary reduction of 11 percent security core in the Emery Firefighter subunit. Displacement of grizzly bears for culvert replacement in security core is expected to be short-term and temporary. Work would occur near the end of the summer when bear foods are distributed widely. NFS Road 1614 bisects the base of some avalanche chutes below Triangle Peak and Great Bear Mountain, however bears would be able to move upslope to avoid human activity on the road at lower elevations. Some berry-producing shrub fields are within 500 meters of NFS Road 1614 where the culvert replacement would occur, however examining GPS data of radio-collared bears in the area, there does not appear to be any aggregations of important food sources used by multiple collared bears in the area of affected core for culvert replacement (Project File Exhibit H-7).

Considering temporary decreases to security core throughout the life of the project (influence from motorized use on roads near core and one season 30-day culvert work in security core), sufficient core area remains for grizzly bears to avoid human activities throughout the implementation of the project activities.

Recreational improvements

Alternative 2 proposes 12 miles of historic trails to be added to the system and improvements to the Lion Lake Day Use area including a fishing pier. These trails would be nonmotorized and be designed for pack and saddle use. The uses on trails would include a number of user groups including horseback riding, hiking and mountain biking. Of the proposed trails, the trail on Desert Mountain bisects a small area of security core (approximately 37 acres). This analysis assumes the trail would be categorized as high use (greater than 20 parties per week) and would reduce security core. It is unlikely that the trail system would receive high use in its inception, however over time the trail may gain popularity as it is located nearby to Coram and Martin City. The reduction in security core would contribute to the temporary reduction of one percent in the Coram Lake Five subunit (previously discussed above), until the berm on NFS Road 590A establishes replacement core. The location and shape of the replacement security core would likely be more functional as it would be aggregated into a larger security core polygon in the Coram Lake Five Subunit. While the location for replacement core is nearby to private property, the location and terrain restrict human access and should provide an area of relatively high security for grizzly bears.

Lion Lake has an existing high level of human activities. Construction activities for a fishing pier or improvements to the parking lot are not expected to impact bears as the area is likely avoided. These improvements are located in MS-3 lands where Flathead National Forest objectives do not manage for grizzly bear occupancy. The improvements would not increase over-night recreational use at Lion Lake.

The inclusion of the historic trails to the Flathead's system would result in nonmotorized 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 (Project File Exhibit H-7). 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 location 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 the 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. The proposed trails are located in a front country setting with the entire proposed system within 4 miles of the developments of Martin City and Coram. The entirety of the proposed trails are within 2 kilometers of open roads within the project subunits. Approximately 1.8 miles of the proposed trails are located on MS-3 designated lands where the Flathead National Forest objectives do not direct for grizzly bear occupancy. These front country areas have consistent levels of human activities. Grizzly bears using the areas would be expected to be wary of human presence.

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). The proposed trails are located in an area with relative low density of female grizzly bears in the Northern Continental Divide Ecosystem (Costello et al., 2016). Based on grizzly bear telemetry data, the trail systems fall outside highly used areas by marked bears indicating that bears may move through the area, but the trails are not proposed in any known habitat with highly localized resident bears (Project File Exhibit H-7).

Bear use of a particular area can be influenced by the presence of high quality foraging habitat, such as berry producing shrub fields or salmon spawning streams, 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). The trail systems do not appear to intersect any known concentrated shrub fields that provide high quality foraging habitat. Lack of high quality foraging habitat is also supported by examination of grizzly bear GPS telemetry data where none of the 23 marked bears that use different parts of the project subunits displayed movement patterns that suggested foraging in habitats near the proposed trails (Project File Exhibit H-7).

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 was the result of a close encounter, generally within about 50 meters. The startled bears then responded in a defensive attack. Visibility along the trail is influence by the habitat type that the trail moves through and management that has influenced the stand structure. 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.” Design features for the proposed trails would maintain sight distances of 50 meters to reduce the likelihood of a human using the trail startling a bear. The trails would not be designed for high-speed nonmotorized activities that could increase the chance of startling a bear.

Some of the common factors that appear to contribute to human-grizzly bear encounters are recommendations that the Forest Service provide, but are the responsibility of the riders to consider and use to reduce their risk when riding in bear country. A recent bear attack that resulted in the death of a mountain biker within one of the project subunits prompted a Board of Review “Report” and “Recommendations” based on investigation of the incident. 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. Examples of these recommendations are located in Project File H-17.

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. 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. The grizzly bear in the mountain biking collision was not caught by management agencies and it is unknown if the bear would have been destroyed had it been captured. 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 nonmotorized userconflict 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 nonmotorized trail use results in disproportionate grizzly bear mortality or population impacts (NCDE, 2013).

Given that the trails are proposed in areas not in known high use areas by bears, relatively close to human developments, in an area of low relative female density, and away from high quality foraging areas the likelihood of a human-conflict is low. Project design features for maintaining sight distances along the trail, educational signage at trailheads, and design of the trails would contribute to decreasing potential human bear conflict and potential for grizzly bear mortality.

Alternative 3 – Direct and indirect effects

Denning habitat

Denning habitat and the analysis of projects effects is described in the alternative 2 analysis. Evaluating denning habitat within 1,000 m of proposed units, winter harvest activities could potentially create noise and disturbance to affect 252 acres of denning habitat on Desert Mountain or two percent of available denning habitat in the project subunits. Based on field evaluation and personal observation of grizzly bear denning on the Flathead National Forest, the potential denning habitat affected on Desert Mountain represents the poorest quality denning habitat in the project subunits. Upland prescribed fire units would not be implemented during the denning season and would not have effects to grizzly bear denning or potential denning habitat in the Flathead Range. The mountains within the project subunits provide substantial denning habitat up long drainages and differing aspects that provides seclusion from sound produced by equipment or other activities during the denning period. Alternative 3 does not contain any proposed winter harvest in security core during the denning season. Relative to alternatives 2 and 4, there is not any less potential for disturbance to grizzly bears as the activities would occur during the denning season and would not occur in or near denning habitat.

Cover

Effects and assumptions for the hiding cover analysis are described in alternative 2. Under alternative 3, the project activities would decrease hiding cover by an approximate total 1,008 acres or two percent in the Coram Lake Five subunit and one percent in the Emery Firefighter subunit. Alternative 3 would include three units that would result in regeneration harvest over 40 acres. Alternative 3 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 recover, depending on stand conditions.

Foraging habitat

Background, effects and design features related to foraging habitat are described in the alternative 2 analysis.

The project subunits provide potential foraging habitat for grizzly bear throughout the spring, summer, and fall. Proposed treatments in both alternatives would decrease the amount of available forage temporarily due to ground disturbance in cutting units and the construction of temporary roads. The potential for a temporary decrease in the amount of forage would be greatest in alternative 2, less under alternative 3 due to the fewer acres treated and the amount of proposed temporary road construction. 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; however this analysis conservatively considers only regenerative treatments and prescribed burns to increase forage production over time.

Displacement/ habitat security/mortality risk

High 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). The potential for displacing grizzly bears during implementation of proposed activities is greatest in alternative 2 and lower under alternative 3, due to the noise, motorized use and associated human activity for implementation of the greater amount of units, temporary roads, and quantity of restricted roads needed for access. Displacement of bears may occur due to mechanical/motorized activity and crew activities. Potential displacement would be short-term, during the length of the proposed sale activity (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. Project activities implemented during the denning season, such as proposed units in security core, would not have displacement effects to grizzly bears (see Denning analysis above).

Road construction, road maintenance, restricted road use

Human and mechanical activity may displace bears from the areas surrounding proposed vegetation treatment units, road and culvert work, haul routes, aquatic improvements on roads, road reroutes, and other activities. Alternative 3 proposes to build 2.8 miles of new temporary road and 4.2 miles of road on historic road templates. Temporary, new system and restricted roads used for project activities would remain closed to the public. During project activities Open Motorized Access Density, and Total Motorized Access Density would temporarily increase and security core would temporarily decrease (Table 99).

Table 99. During and post project percentage of subunit area with >1 mi/mi² open motorized route density, >2 mi/mi² total motorized route density and security core, alternative 3

Subunit	During Project			Post-Project		
	OMAD	TMAD	Core	OMAD	TMAD	Core
Coram Lake Five	38%	47%	14%	26%	46%	14%
Emery Firefighter	23%	21%	57%	19%	20%	58%

At completion of project activities, temporary road would be rehabilitated after project activities and 4.2 miles of new system road (built on historic templates) for project activities that would then be put into storage following harvest and treated to meet the reclaimed definition under amendment 19 of the forest plan (see Regulatory Consistency section). At completion, historic roads added to the system would be impassable to motorized vehicles and 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. Rehabilitated temporary roads and new system roads treated to meet the reclaimed definition of amendment 19 would not count towards Open Motorized Access Density, Total Motorized Access Density or security core calculations after project implementation. After project activities, there would be no net increase in Open Motorized Access Density and Total Motorized Access Density or a net decrease in security core in the project subunits. Road reroutes would not have no net effect on Open Motorized Access Density, Total Motorized Access Density or security core calculations.

Helicopter activity

Effects of helicopter activity are described in alternative 2.

Effects to security core

Alternative 3 would have the least amount of impact to existing security core in the project subunits of the action alternatives. No vegetation management activities are proposed in security core outside of the denning season. No temporary roads would be built in existing security core; however road construction and road use within 500 meters of existing core would result in a temporary decrease in security core from the influence of motorized activity within 500 meters of existing core. This reduction would be approximately one percent in the Emery Firefighter subunit (Project File Exhibit H-7). Security core in the Coram Lake Five Subunit would not be affected. It is unlikely that all these temporary roads would be active simultaneously. No units are proposed in security core under alternative 3.

Alternative 3 does not propose 30 days of activity in security core during one summer season for replacement of culverts on NFS Road 1614. The difference between alternative 3 and the other action alternatives is that core would not be reduced by 10 percent for a 30 day period in a single season. There would be no displacement of grizzly bears from this area. Grizzly bears would continue to move through the area undisturbed by motorized or mechanical activity. A larger percentage of security core would be available to provide an area free of human motorized activities within the Emery Firefighter subunit compared to the short 30 day temporary reduction proposed in alternatives 2 and 4.

Recreational improvements

The Lion Lake area has an existing high level of human activities. Construction activities for a fishing pier or improvements to the parking lot are not expected to impact bears as the area is likely avoided. These improvements are located in MS-3 lands where Flathead National Forest objectives do not manage for grizzly bear occupancy. The improvements would not increase overnight recreational use at Lion Lake.

Alternative 3 would rehabilitate historic trails within the project subunits. There may be small short term displacement to bears due to workers rehabilitating trails; this displacement is expected to be small as the areas around the historic trails do not have any known high quality grizzly bear habitats or frequent use (see description in alternative 2). While the potential for grizzly bear-human conflict is expected to be low on proposed trails under alternatives 2 and 4, alternative 3 provides the lowest risk of human-bear conflict of the project alternatives. Due to the long term potential effects that recreation may have on trails within the project area, alternative 3 maximizes the reduction for grizzly bear conflict by rehabilitating the historic trails and reducing human nonmotorized access in these areas.

Alternative 4 – Direct and indirect effects

Denning habitat

Denning habitat and the analysis of projects effects is described in the alternative 2 analysis. Evaluating denning habitat within 1,000 m of proposed units, winter harvest activities could potentially create noise and disturbance to affect 252 acres of denning habitat on Desert Mountain or two percent of available denning habitat in the project subunits. Based on field evaluation and personal observation of grizzly bear denning on the Flathead National Forest, the potential denning habitat affected on Desert Mountain represents the poorest quality denning habitat in the

project subunits. The mountains within the project subunits provide substantial denning habitat up long drainages and differing aspects that provides seclusion from sound produced by equipment or other activities during the denning period. Upland prescribed fire units would not be implemented during the denning season and would not have effects to grizzly bear denning or potential denning habitat in the Flathead Range.

Cover

Effects and assumptions for the hiding cover analysis are described in alternative 2. Under alternative 4, the project activities would decrease hiding cover by an approximate total 1,056 acres and or two percent in the Coram Lake Five subunit and one percent in the Emery Firefighter subunit. Alternative 4 would include four units that would result in regeneration harvest over 40 acres. Alternative 4 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 recover, depending on stand conditions.

Foraging habitat

Background, effects, and design features related to foraging habitat are described in the alternative 2 analysis.

The project subunits provide potential foraging habitat for grizzly bear throughout the spring, summer, and fall. Proposed treatments in both alternatives would decrease the amount of available forage temporarily due to ground disturbance in cutting units and the construction of temporary roads. The potential for a temporary decrease in the amount of forage would be greatest in alternative 2, least of any action alternatives under alternative 4 due to the smaller amount of acres treated. 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; however, this analysis conservatively considers only regenerative treatments and prescribed burns to increase forage production over time.

Displacement/ habitat security/ mortality risk

High 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). The potential for displacing grizzly bears during implementation of proposed activities is greatest in alternative 2 and lower under alternative 4, due to the noise, motorized use and associated human activity for implementation of the greater amount of units, temporary roads, and quantity of restricted roads needed for access. Alternative 4 would produce disturbance over a fewer number of acres than alternative 3 including road construction, maintenance and motorized activity etc., but would temporarily impact a larger percentage of Security Core than alternative 3. Displacement of bears may occur due to mechanical/motorized activity and crew activities. Potential displacement would be short-term, during the length of the proposed sale activity (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. Project activities implemented during the denning season, such as proposed units in security core, would not have displacement effects to grizzly bears (see Denning analysis above).

Road construction, road maintenance, restricted road use

Human and mechanical activity may displace bears from the areas surrounding proposed vegetation treatment units, road and culvert work, haul routes, aquatic improvements on roads, road reroutes and other activities. Alternative 4 does not propose to build any new road in the project subunits. Restricted roads used for project activities would remain closed to the public. During project activities Open Motorized Access Density would temporarily increase and security core would temporarily decrease (Table 100).

Table 100. During and post project percentage of subunit area with >1 mi/mi² open motorized route density, >2 mi/mi² total motorized route density and security core, alternative 4

Subunit	During Project			Post-Project		
	OMAD	TMAD	Core	OMAD	TMAD	Core
Coram Lake Five	33%	46%	13%	26%	46%	14%
Emery Firefighter	22%	20%	47%	19%	20%	58%

As in alternatives 2 and 3, restricted roads would remain closed to the public and existing road closure devices (e.g. berms) would be reinstalled at the end of project activities. No temporary roads would be constructed and no historic roads would be added to the system. There would be less overall mechanical activity (road building, vegetative treatments) in alternative 4. After project activities, there would be no net increase in Open Motorized Access Density and Total Motorized Access Density or a net decrease in security core in the project subunits. Road reroutes would not have no net effect on Open Motorized Access Density, Total Motorized Access Density or security core calculations.

Helicopter activity

Effects of helicopter activity for proposed upland burning are described under alternative 2.

Effects to security core

No vegetation management activities are proposed in security core outside of the denning season. No temporary roads would be built in existing security core; however alternative 4 would result in a one percent temporary decrease of security core in the Emery Firefighter subunits due to the proximate influence of road use (road use within 500 meters of security core) beyond the berm on NFS Road 1048. Unit 85 is proposed in security core under alternative 4 and would be treated during the denning season. Security core would be temporarily decreased by the addition of the historic trail on Desert Mountain which was categorized as high use based on a conservative assumption in this analysis (see Recreational Improvements under alternative 2 and Regulatory Consistency sections).

Similar to alternative 2, alternative 4 proposes 30 days of activity in security core during one summer season for the removal of culverts on NFS Road 1614. Removal versus replacement of culverts on NFS Road 1614 would have the same effects to grizzly bear displacement. The temporary reduction in security core would occur in the Emery Firefighter subunit and would result in a temporary decrease of 10 percent. Activity would occur in security core only during the non-denning period for up to 30 days. Activity would displace bears and reduce security core in affected project subunits. The 30 days of activity would result in a temporary decrease of 10 percent of security core in the Emery Firefighter subunit. Displacement of grizzly bears for culvert replacement in security core is expected to be short-term and temporary. Work would occur near the end of the summer when bear foods are distributed widely. NFS Road 1614 bisects

the base of some avalanche chutes below Triangle Peak and Great Bear Mountain, however, bears would be able to move upslope to avoid human activity on the road at lower elevations. Some berry-producing shrub fields are within 500 meters of NFS Road 1614 where the culvert replacement would occur; however, examining GPS data of radio-collared bears in the area, there does not appear to be any aggregations of important food sources used by multiple collared bears in the area of affected core for culvert replacement (Project File Exhibit H-7). Considering temporary decreases to security core throughout the life of the project (influence from motorized use on roads near core and one season 30-day culvert work in security core), sufficient core area remains for grizzly bears to avoid human activities throughout the implementation of the project activities.

Recreational improvements

Effects of recreational improvements are described in alternative 2.

Alternative 2, 3, and 4 – Cumulative effects

The South Fork of the Flathead and the project subunits contains established human activities, including vegetation management, road management, private land development, hunting, firewood gathering, hiking, mountain biking, horseback riding, outfitting, camping, and other recreational uses. Human development in the Coram and Martin City areas on private property have increased grizzly bear-human conflict due to increased presence of human attractants to bears. The majority of past grizzly bear mortalities in the project subunits have occurred on private lands. Motorized use and timber hauling may use roads within the project subunits.

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 area. Unauthorized nonmotorized use may occur on trails within the project subunits. Law enforcement continues to work towards legal compliance. Annual monitoring occurs to evaluate effectiveness of road closures to motorized use within the project subunits and on the Flathead National Forest.

There have been past and present harvest activities within the project subunits including the Hungry Horse/West Glacier Fuels Reduction, Paint Emery, Firefighter, and Belton Fuels. These projects have decreased cover, altered the forest mosaic, and juxtaposition of travel cover within the project subunits. Past or proposed burning may increase grizzly bear forage. The present and past projects were incorporated into the habitat baseline for the project. Ongoing vegetation management activities would reduce cover in the project subunits. Based on calculations, the additional effects to cover are small enough that there would be no additional percentage change to cover in either project subunits.

Upcoming prescribed fire for the Belton Project would use helicopter for ignition of the units within the Coram Lake Five subunit. These units may occur at a similar time period as the ignition of the Hungry Lion prescribed fire units. Overall helicopter activities 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 Firefighter Project included vegetation and road management and is ongoing within the project subunits. The project activities will result potential displacement on Firefighter Mountain within the Emery Firefighter subunit. In combination with the Hungry Lion during activity road density calculations (see assumptions above), the ongoing activities for the Firefighter project

would temporarily increase Open Motorized Access Density calculations by an additional 2 percent, temporarily increase Total Motorized Access Density by an additional 1 percent and would not have any reduction in security core. The Firefighter Project has also increased grizzly bear security through road decommissioning or berming 28.7 miles of road and gating 1.3 miles of road. Completion of the project's road work is still ongoing in the Emery Firefighter subunit, primarily around Firefighter Mountain. When activities are completed, the subunit will meet amendment 19 objectives for Open Motorized Access Density, Total Motorized Access Density and security core. The Hungry Lion Project would not affect ongoing access management work included in the Firefighter decision with the exception of NFS Road 1614. NFS Road 1614 was bermed in the Firefighter decision. This road would be used for 30 days in a single season under alternatives 2 and 4 of the Hungry Lion Project. The road would remain closed to the public while work would be ongoing. Berms would be reinstalled at the end of the 30 days of maintenance activity. Alternative 3 would not include the 30 days of culvert maintenance on NFS Road 1614.

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 Hungry Lion Project, would be required to comply with this order.

To further minimize the risk of human-grizzly conflicts in the South Fork of the Flathead, the Forest Service has employed a bear ranger who work at providing information and educational programs on living in grizzly bear country and on food storage techniques to campers and other members of the public. The position provides both education and enforcement of appropriate food storage in bear habitat to minimize human-bear conflicts.

Determination

The grizzly bear is listed as a "Threatened" species under the Endangered Species Act. A biological assessment was prepared and submitted to the U.S. Fish and Wildlife Service.

Regulatory Framework and Consistency

Amendment 19

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 on road on grizzly bear habitat selection. The Interagency Grizzly Bear Committee issued guidance on motorized access management in 1994 and revised this guidance 1998 to provide a consistent approach to motorized access management for grizzly bears.

The Emery Firefighter subunit is composed of more than 75 percent NFS lands and the Coram Lake Five subunit is composed of less than 75 percent NFS lands. 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 road 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). For subunits composed of less than 75 percent NFS lands, amendment 19 direction is to assure that Forest Service activities will not result in a net increase in motorized access density or net decrease in security core areas on NFS lands. The Coram Lake Five subunit is composed of less than 75 percent NFS lands. The Hungry Lion Project would not result in a net increase of Open Motorized Access Density/Total Motorized Access Density or a net decrease of security core. The Emery Firefighter subunit contains greater than 75 percent NFS lands. The existing condition of the subunit does not meet 19/19/68 objectives, however, this ongoing road work still being completed from the Firefighter Project. At the completion of these activities, the subunit will meet 19/19/68 objectives. The Hungry Lion Project alternatives would not change these ongoing access management activities or the decision from the Firefighter Project.

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 or trail (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. Historic roads proposed for storage would receive treatments to meet the “reclaimed” definition under amendment 19 (see design features). These roads 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 and be seeded, 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. In the Hungry Lion Project, stored roads would be managed to meet the reclaimed definition and would not be counted in Total Motorized Access Density or included in security core calculations.

In alternatives 2 and 4, addition of historic trails is assumed to affect security core in the Coram Lake Five subunit. High use trails under amendment 19 (greater than or equal to 20 parties/week) are buffered by 500 meters and the area contained is not counted toward security core. There is no information on the human use the proposed trails in alternatives 2 and 4 would receive. The 4.75 miles of trail on Desert Mountain crosses a small piece of security core habitat (Project File Exhibit H-7). This analysis takes a conservative approach and assumes this trail could become a high-use trail and would reduce security core. Sufficient replacement security core would be created under alternatives 2 and 4 by including a berm on NFS Road 590A. After the completion of project activities, there would be no net reduction of security core in the Coram Lake Five subunit.

Road densities are calculated using a moving window technique. The subunit would continue to meet amendment 19 direction under the proposed project. The during, and post project road densities for the Emery Firefighter and Coram Lake Five subunits are summarized above in Table 98, Table 99, and Table 100 above. The ‘during project’ estimates are a worst case scenario,

assuming all units are active at the same time, all haul routes and temporary roads being used. This scenario is necessary because the analysis cannot predict where/when contractors would implement the proposed activities in the subunit. The event that all units are active simultaneously is highly unlikely especially given the active/inactive subunit schedule which could include limited operating time frames for summer and winter harvest where snow and temperature conditions limit the scale and speed at which contractors can work. Further, contractors are typically awarded groups of units for project activities and are not able to work in all the awarded units simultaneously as the ‘during project’ analysis assumes. Road closures are currently and would continue to be monitored to ensure effectiveness and bear security within the area.

Under alternative 3, no motorized use would occur in security core during the non-denning period. Alternatives 2 and 4 propose a 30 day one-time window for motorized activity to occur in security core during the non-denning period for aquatic improvements. This 30 day period would occur after July 1 to limit effects to spring bear habitat. The window would provide for road construction, road maintenance, temporary road rehabilitation, and road reclamation that could not otherwise be completed during the winter months. Alternatives 2 and 4 would include a site-specific forest plan amendment to permit the 30 day activity window for motorized activities in core during the non-denning period (see chapter 2). All other proposed motorized activity proposed in security core (harvest units in alternative 2) would occur during the denning season (December 1 to March 31) and would be consistent with amendment 19 direction.

The forest plan includes objectives for timber management within MS-1, MS-2 and MS-3 lands. All activities under both alternatives 2, 3, and 4 are consistent with the management situation lands in the Flathead Forest Plan (1986 pg. II-31) (Project File Exhibit H-7). 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. The Hungry Lion Project would favor the bear when resources compete by limiting activities in spring habitats, maintaining road closures to the public during project activities, ensuring cover is well distributed throughout the project area and that no opening is greater than 600 feet to cover. With the exception of proposed road work for 30 days in core, no other activities would occur in security core during the non-denning season. Prescribed upland burning and some vegetative treatments would enhance grizzly bear forage in the project subunits. Recreational improvements are proposed in areas that do not provide high quality forage or are not known high use grizzly bear habitats and design features would increase sight distances and provide education to reduce the likelihood of bear-human conflict. Combined the project alternatives would maintain high quality habitats, free ranging movements, and maintain low risk of grizzly bear mortality throughout the project subunits.

Wolverine

Introduction

The wolverine (*Gulo gulo luscus*) is a proposed sensitive species on the Flathead National Forest. Among other species and habitats, the wolverine is an indicator that the needs of other species that use remote mountainous areas are met, particularly those associated with cirque basins,

avalanche chutes, and deep snow. The wolverine occurs on the Flathead National Forest, in northwest Montana, and is connected to the populations that extend into Canada and Alaska. The U.S. Fish and Wildlife Service in December 2010 (USDI Fish and Wildlife Service, 2010), after review of all available scientific and commercial information, found the North American wolverine occurring in the contiguous United States is a distinct population segment (DPS) and that addition of this distinct population segment to the Lists of Endangered and Threatened Wildlife and Plants was warranted but precluded by higher priority actions to amend the lists.

Federal actions concerning the wolverine date back to 1995 and culminated in a proposal to list the wolverine distinct population segment as threatened on February 4, 2013 (USDI Fish and Wildlife Service, 2013b). After further review of all available scientific and commercial information, the U.S. Fish and Wildlife Service subsequently withdrew that proposal, and published their determination on August 13, 2014 (USDI Fish and Wildlife Service, 2014), that adding the North American wolverine occurring in the contiguous United States as a distinct population segment to the Lists of Endangered and Threatened Wildlife and Plants was not warranted (USDI Fish and Wildlife Service, 2014). However, a district court decision on April 4, 2016 found that the U.S. Fish and Wildlife Service conclusion was arbitrary and capricious and the decision was remanded to the U.S. Fish and Wildlife Service for further consideration. On May 24, 2016, the U.S. Fish and Wildlife Service again listed wolverine as a proposed species on the Flathead National Forest.

Wolverines occur naturally in low densities, and current population levels and trends are not definitely known (USDI Fish and Wildlife Service, 2013b). However, there is evidence that their population is increasing (USDI Fish and Wildlife Service, 2014) and that wolverines are expanding both within areas currently occupied, as well as suitable habitat not currently occupied (USDI Fish and Wildlife Service, 2014).

Summary of Findings

Alternatives 2, 3 and 4 would have little effect on wolverine denning. Only one unit and the proposed upland prescribed fire areas coincide with wolverine denning habitat. These activities would not occur at a time when snow is present or during the wolverine denning season. The potential for displacement or disturbance to wolverine is lowest in alternative 4 due to the acreage of commercial harvest and that no road construction is proposed. Nonmotorized trails proposed under alternatives 2 or 4 would not be expected to disturb or displace wolverine in the long-term.

Analysis Area

The Hungry Lion project area was considered for the evaluation of direct and indirect effects on sensitive species. This approximately 37,090 acre area is large enough to include the home ranges of several individuals or pairs of a species, and is representative of the effects of fire, natural tree mortality, timber harvest, human recreational activity, and road management across the landscape. The actions proposed in the alternatives that could directly or indirectly affect sensitive species are contained within this area. Cumulative effects were considered within the Hungry Lion project area boundary. A multi-scale assessment was also conducted to address population viability concerns.

Temporal Bounds

The length of time for activities proposed by the Hungry Lion Project is approximately five years. This is based on the probable contract length for the proposed project, and the timeframes for

related activities. The length of time for direct, indirect, and cumulative effects is approximately 100 years. This is based on the length of time for natural forest processes to occur and forest vegetation to provide a variety of characteristics suitable for different sensitive species. Specific temporal bounds for different direct, indirect, or cumulative effects are discussed below.

Methodology

Data used included field surveys, timber stand data, VMap data, review and application of the best available science, modeled persistent-spring snowpack, monitoring information collected on wolverine on the Flathead National Forest, and GIS and dataset information for features, such as habitat features existing in the project area including habitat types, canopy cover, etc.

Existing Condition (Affected Environment)

Habitat

In the contiguous United States, wolverine year-round habitat is found at high elevations, especially in cirque basins and avalanche chutes that have food sources such as marmots, voles, and carrion (Jeffrey P. Copeland, 1996; Jeffrey P. Copeland et al., 2007; R. Inman et al., 2007; Magoun & Copeland, 1998; John R. Squires, Copeland, Ulizio, Schwartz, & Ruggiero, 2007). Deep, persistent, and reliable spring snow cover is the best overall predictor of wolverine occurrence in the contiguous United States (Jeffrey P. Copeland et al., 2010; Jeffrey P. Copeland et al., 2007). Deep, persistent spring snow correlates well with wolverine year-round habitat use across wolverine distribution in North America and Eurasia at both regional and local scales (Jeffrey P. Copeland et al., 2010; R. M. Inman et al., 2012). Wolverine year-round habitat use also takes place almost entirely within the area defined by deep, persistent spring snow (Jeffrey P. Copeland et al., 2010).

Natal dens have been found in remote, high elevation cirque basins in late winter and in large woody debris within subalpine forest (Jeffrey P. Copeland, 1996). Young are born in a den among rocks or tree roots, in a hollow log, under a fallen tree, or in dense vegetation, including sites under snow. Cold habitat and a persistent snow layer needed for complex snow tunnels during the denning period (April 15 to May 15) appear to be essential for reproductive dens (Aubry, McKelvey, & Copeland, 2007; Jeffrey P. Copeland et al., 2010) and genetic dispersal paths (Michael K. Schwartz et al., 2009).

Denning has been found to occur in areas of deep persistent spring snowpack. The U.S. Fish and Wildlife Service (USDI Fish and Wildlife Service, 2013b) determined the best available science for wolverine natal denning habitat to be a composite of two models produced by Inman (2012) and Copeland (2010). The Copeland (2010) model was used for this analysis and natal denning was considered to be areas that held deep, persistent spring snowpack three years or more out of seven. This model includes all known wolverine natal dens in the wolverine distinct population segment. On average, most denning occurs at higher elevations within the area defined by the model. Wolverine year-round habitat use also takes place almost entirely within the area defined by deep persistent spring snow (Jeffrey P. Copeland et al., 2010, pp. 242-243). Wolverines rarely, or never, den in lower elevation forested habitats, although they may occupy these habitats occasionally (Magoun & Copeland, 1998). Based on this model, approximately 3,310 acres or roughly nine percent of the Hungry Lion Project contains areas suitable for wolverine denning. This includes modeled deep, persistent, spring snowpack occurring three of seven up to seven of seven years. For additional information on the snowpack model, wolverine security and deep

persistent snowpack throughout the northern region or on the Flathead National Forest, reference the supplemental information for wolverine in the project file (Project File Exhibit H-13).

Wolverine densities and home range size are believed to be closely linked to food availability and differences in habitat quality (Hornocker & Hash, 1981). Wolverines are opportunistic feeders and consume a variety of foods. They primarily scavenge carrion and have an excellent sense of smell that enables them to find food beneath deep snow (Hornocker & Hash, 1981). Female wolverines forage close to den sites in early summer, progressively ranging further from dens as kits become more independent (May, van Dijk, Landa, & Andersen, 2010). Wolverines in Glacier National Park had average adult male home ranges of 496 kilometers² (193 miles²) and adult female home ranges of 141 kilometers² (55 miles²) (J.P. Copeland & Yates, 2006).

“Wolverine home ranges generally do not occur near human settlements, and this separation is believed to be largely due to differential habitat selection by wolverines and humans” (Jeffrey P. Copeland et al., 2007; May, Landa, van Dijk, Linnell, & Andersen, 2006).

Krebs, Lofroth, and Parfitt (2007) examined wolverine habitat use on multiple-use lands in British Columbia. Females were negatively associated with recently logged areas and areas with large amounts of high elevation winter recreation (helicopter and backcountry skiing). The habitat use models suggested habitat associations of female wolverines are complex; they likely involve responses to food, predation risk, and human activity (Krebs et al., 2007). Wolverines have also been documented to use space near areas of high human activity. In one study, wolverines did not strongly avoid developed habitat within their home ranges (May et al., 2006). Scrafford, Avgar, Abercrombie, Tigner, and Boyce (2017) found that wolverines used active logging areas in northwestern Alberta, specifically edges around cutblocks presumably for forage. Wolverines have been documented to persist and reproduce in areas with high levels of human use and disturbance, including developed alpine ski areas and areas with motorized use of snowmobiles (K. Heinemeyer & Squires, 2012). Wolverines may respond positively to human activity and developments that are a source of food. They scavenge food at dumps in and adjacent to urban areas, at trapper cabins, and at mines (Banci, 1994).

In summary, based on the best available science, the U.S. Fish and Wildlife Service concluded that wolverines do not avoid human development of the types that occur within suitable wolverine habitat and that wolverines may disperse or move across areas of human development (USDI Fish and Wildlife Service, 2013b). Wolverines are not thought to be dependent on vegetation or habitat features that may be manipulated by land management activities. They have been documented using both recently logged areas and burned areas (USDI Fish and Wildlife Service, 2013b).

Population

The U.S. Fish and Wildlife Service (USDI Fish and Wildlife Service, 2013b) believes that densities and population levels in the northern Rocky Mountains are not lower today than they were historically.

“The northern Rocky Mountain population (north of Wyoming) was reduced to historic lows or possibly even extirpated during the early 1900s, and then increased dramatically in the second half of the 1900s as predator control efforts subsided and trapping regulations became more restrictive (Aubry et al., 2007). This increase likely indicates a population rebound from historic lows in this period.”

Krebs et al. (2004) conducted a synthesis for wolverine vital rates and sources of mortality across North America. Trapping was the greatest source of man-caused mortalities and starvation was the greatest source of natural mortality. Trapping is managed by Montana Fish Wildlife and Parks and is not currently permitted for wolverine in Montana.

The effective population for wolverines in the Rocky Mountains was calculated to be 35 (Michael K. Schwartz et al., 2009). This effective population size is exceptionally low, which means that this is a species that seems to be able to persist at extremely low numbers. The fragmented nature and distribution of wolverine habitat in the lower United States results in a contiguous United States population that is more vulnerable to extirpation because of lack of connectivity between subpopulations. This contributes to inbreeding and reduces the chances of recolonization of habitat patches after local extinction. In the contiguous United States, 250 to 300 wolverines account for probably less than two percent of the entire *gulo gulo luscus* population. The U.S. Fish and Wildlife Service (USDI Fish and Wildlife Service, 2010) concluded that the wolverine population in the contiguous United States is both discrete and significant under distinct population segment policy.

Wolverine populations in the northern Rocky Mountains appear to be connected to each other at the present time through dispersal routes that correspond to habitat suitability (Michael K. Schwartz et al., 2009). Linkage zones are defined as “places where animals can find food, shelter, and security while moving across the landscape between suitable habitat.” Wolverines prefer to travel in habitat that is most similar to habitat they use for home-range establishment, i.e., alpine habitats that maintain snow cover well into the spring. There is no evidence that wolverine dispersal is affected by infrastructure development (Michael K. Schwartz et al., 2009). In the contiguous United States, wolverines must cross unsuitable habitats to achieve connectivity among subpopulations, which is required to avert further genetic drift and continued loss of genetic diversity (Jeffrey P. Copeland et al., 2007).

On the Flathead National Forest, trapping records and observations of wolverines or their tracks have been received for every major drainage, with over 275 wolverine reports since 1933. During the 10-year period from 2003 to 2012, wolverines have been reported at a minimum of 25 separate locations, distributed across the Flathead National Forest (Project File Exhibit H-13).

During the winters of 2013 through 2017, winter carnivore monitoring was conducted on the Flathead National Forest. Monitoring included snow track transects that were presumed lynx, wolverine, or fisher tracks and were backtracked until hair or scat was collected for species genetic identification. During the winters of 2013 through 2017, bait stations were set up to attract and collect hair samples from carnivores in the area. The deoxyribonucleic acid (DNA) results are still pending from the winter of 2017 and data is still being summarized from 2016; however, monitoring from 2013 through 2015 detected 13 unique wolverine genotypes on the Flathead National Forest (SWCC, 2016; USDA Forest Service, 2017b). The carnivore monitoring is based upon a five by five mile cell intended to distribute survey effort across the forest. Wolverine were detected in overlapping cells with the project area; this detection assumes that wolverine are present within that cell and thus are present within the project area.

Environmental Consequences

Alternative 1 (no-action alternative) – Direct, indirect, and cumulative effects

No forest treatment would be implemented in the project area under this alternative. There would be no direct effect natal denning habitat, displacement of individuals, effects to prey or to wolverine security. Human activity and associated disturbance would be the least under this alternative.

There have been past harvest activities within the project area including the Hungry Horse/West Glacier Fuels Reduction, Paint Emery, Firefighter, and Belton Fuels. These projects have altered the forest mosaic. Wolverine are not known to be associated with any specific vegetative forest conditions. These projects were considered in the habitat baseline. Road closures to meet amendment 19 objectives and have likely benefited wolverine security over time in the project area.

Winter recreational motorized and un-motorized activities would continue to occur in the project area. Motorized traffic would continue to use roads open for public motorized use. Recreation would continue to occur on existing trails and at camp grounds and recreational sites within the project area. Indirectly, under the no-action alternative, it could be anticipated that larger more intense fires could occur within the project area than would have occurred under more historic fire and fuel loading conditions. Large, severe, stand-replacing fire could remove large amounts of forest cover throughout the project area. Effective wolverine habitat is not associated with a specific vegetative type. In the absence of the proposed treatments, natural vegetative succession or an increase in wildfire potential would not produce significant indirect effects on the wolverine or wolverine habitat.

Alternative 2, 3, and 4 – Direct & indirect effects

Natal security

Alternatives 2, 3, and 4 propose upland burning activities within modeled wolverine denning habitat (Project File Exhibit H-13). Spring snow persists into mid-June where units and modeled habitat overlap within the project area (Project File Exhibit H-13). Nearly all vegetation management units, road treatment activities, and proposed recreational improvements would not overlap with wolverine denning habitat and would not affect wolverine denning. Only Unit 78 would overlap with an isolated patch wolverine natal denning habitat on Desert Mountain (Project File Exhibit H-13). This unit would not be implemented until after July 1 and would not impact natal denning. Road maintenance on this road would not likely disturb natal denning. Maintenance would occur after snow is melted and denning habitat is not present. The isolated patch of deep, persistent spring snowpack only is estimated to provide denning habitat three out of seven years and due to the small size, isolation and frequency of snow, this area likely only provides low quality denning habitat. Prescribed burning would occur during the fall outside of wolverine natal denning time periods.

Prey base

As described above, ungulate carrion is an important food for wolverine, as well as a variety of small mammal species. Proposed vegetative treatments in alternatives 2, 3, and 4 would affect ungulates in the area (reference the Management Indicator Species: Big Game section in this EA).

Existing understory vegetation and overstory tree canopies would be reduced to varying degrees as a result of proposed commercial and non-commercial treatments; the greatest reductions would occur in alternative 2. Although there would be no change expected in overall ungulate population numbers in the Hungry Lion project area as a result of the proposed treatments, the vegetative treatments would alter white-tailed deer and elk use patterns in the project area, as the ungulates adjust their behavior to avoid human presence or disturbance in the short-term and as they adjust to changes in forage and cover availability over the short and long term.

Other wolverine prey species may include mountain goat or small mammals like snowshoe hare, ground squirrels and marmots (Eric C Lofroth, Krebs, Harrower, & Lewis, 2007; Yates & Copeland, 2017). Mountain goats are found throughout the summer months in the high, rocky elevations of the project area where no activities are proposed. The proposed activities would not impact mountain goats. Ground squirrels and marmots also exist in the alpine areas of the project and would be not impacted by project activities. Snowshoe hare habitat would remain well distributed throughout the project area as a result of implementing alternatives 2, 3, or 4 (see Canada Lynx section of this EA for discussion of snowshoe hare habitat). Design features for down woody debris would maintain habitat for small mammals distributed to varying degrees in a mosaic across the project area. Woody debris (microhabitat for small mammals) would remain largely unaffected in both the untreated forest stand in the project area and in the high elevations of the Flathead Range where the greatest amount of wolverine summer range occurs.

Overall habitat security

Although wolverine use of lower elevation habitat is uncommon, field surveys for wolverine have detected wolverine in areas adjacent to the project area during the winter months. It is possible that short-term displacement of wolverine could occur in proposed treatment areas on the mid to upper slopes as a result of proposed activities in alternatives 2, 3, or 4; however, this potential displacement is small, considering the majority of the project activities may occur during the summer and fall when wolverines are using high elevation habitat in the Flathead Range. Upland burning activities would have a short duration of activity and are not expected to displace wolverine for more than three or four days each burning season. Winter activities (commercial units) would have the most potential to displace wolverine, as this is when the species is using lower elevations, but activities implemented during the winter would occur over a relatively small portion of the project area and would likely have little impact to wolverine habitat use.

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, such as timber harvest, are a threat to the conservation of the species (USDI Fish and Wildlife Service, 2013b). The majority of security core for grizzly bears would provide an area free from human activity for wolverine during implementation of project activities.

Wolverines are known to successfully disperse long distances between habitats through human dominated landscapes and across developed transportation corridors (USDI Fish and Wildlife Service, 2013b). Road construction is proposed under alternatives 2 and 3. Road maintenance and road reroutes are proposed in all the action alternatives. Wolverine travel patterns may change to avoid human activity associated with the work; however, road work would be completed in the summer months when wolverine select for alpine elevations distant from the road work proposals in the project's action alternatives. Roads used for project activities would remain closed to public use. In alternatives 2 and 3, temporary roads would be rehabilitated following use and historic roads brought back to the system would be reclaimed inhibiting motorized travel. The project would not change the existing motorized access condition at the end of project activities.

The potential for displacement or disturbance to wolverine is lowest in alternative 4 due to the acreage of commercial harvest and that no road construction is proposed. Nonmotorized trails proposed under alternatives 2 or 4 would not be expected to disturb or displace wolverine in the long-term as there is little information to suggest that wolverine avoid nonmotorized linear features. Further these trails would likely receive most use in the summer months and do not coincide with typical summer wolverine habitat in the alpine areas of the project area. Improvements at Lion Lake would occur in low elevations that provide unlikely wolverine habitat in either the summer or the winter months. These improvements would not affect wolverine.

Alternative 2, 3, and 4 – Cumulative effects

On-going activities include hunting, trapping, firewood cutting, recreational activities snowmobiling, backcountry skiing, existing special use permits, road maintenance activities, noxious weed treatments, residential development, and land conversion on private lands. In their proposed ruling, the U.S. Fish and Wildlife Service determined that global climate change is the primary threat to the species, and that legal and incidental trapping of wolverines are substantial threats in concert with climate change. Management activities of land management agencies, for example, winter recreation and timber harvest, were not identified as threats (USDI Fish and Wildlife Service, 2013b).

Regulated trapping in Montana has been managed by Montana Fish Wildlife and Parks through scientifically-based regulations intended to sustain furbearer populations. Traditionally, Montana Fish Wildlife and Parks and the Montana Fish Wildlife and Parks Commission reviewed and refined trapping regulations to ensure the use of best management practices for trapping activities. In the past, licensed trappers provided Montana Fish Wildlife and Parks with important information to assist in state wildlife management programs. Legal trapping of wolverines in Montana in the recent past removed an average of 10.5 individuals from the population each year (USDA Forest Service, 2017b). The 2012-2013 wolverine trapping season was cancelled after a temporary restraining order was issued by a District Court Judge against the wolverine trapping season in Montana (USDA Forest Service, 2017b). Currently, wolverine trapping has not been re-opened by the Montana Fish Wildlife and Parks. Regardless, the Hungry Lion Project would not increase public motorized access within the project area.

The past trapping season for wolverine occurred in the winter months. Trappers can currently travel under their own power over snowed in closed roads, snowed-in trails and on snow cross-country through forest stands in the winter time to deploy traps. The proposed trails would not be groomed and would facilitate little additional access during the winter months based on the trapping season, the terrain, and the snow pack in the project area. Due to these considerations the proposed historic trails in alternatives 2 and 4 would not provide more opportunity for nonmotorized trapper access than already exists in the current condition.

There have been past harvest activities within the project area including the Hungry Horse/West Glacier Fuels Reduction, Paint Emery, Firefighter, and Belton Fuels. These projects have decreased mature forest, altered the forest mosaic for prey species and juxtaposition of travel cover within the project area. Wolverine are not known to have any specific association with forest structure or habitat types.

Groomed snowmobile trails exist in the project area, some of these trails are open year round to over the snow travel, conditions permitting and other areas are open to motorized over-the-snow travel from December 1 to March 31. Winter harvest operations would restrict snowmobile use while harvest operations and hauling were occurring during the winter months. No additional

grooming is proposed in the Hungry Lion Project. Winter harvest is not expected to have negative effects when combined with existing motorized winter travel. Wolverines have been documented to persist and reproduce in areas with high levels of human use and disturbance including developed alpine ski areas and areas with motorized use of snowmobiles (K. Heinemeyer & Squires, 2012). Wolverine presence in the project area with concurrent snowmobile use has been documented with winter monitoring efforts (SWCC, 2015; USDA Forest Service, 2017b).

It is thought that wolverines are conserved through extensive unroaded areas and forest management standards associated with access management in roaded areas (amendment 19), and by providing a connected, undeveloped forest matrix (USDA Forest Service, 2017b). With limited activities at high elevations or within areas of deep, persistent spring snowpack, where the primary habitat of this species is located, there would be little risk of population loss; species viability would be maintained.

Summary of Effects or Statement of Findings

The Hungry Lion Project was analyzed for effects to wolverines based on vegetation changes, movements across the landscape, and disturbance from other associated human activities. A determination was made for wolverine due to the effects of the Hungry Lion Project as part of a programmatic consultation framework (Project File Exhibit H-13). The Hungry Lion Project would not result in jeopardy to wolverine, loss of species viability, or create a significant trend towards listing under any of the project alternatives.

Regulatory Framework and Consistency

The U.S. Fish and Wildlife Service published their determination in 2014, that adding the North American wolverine occurring in the contiguous United States as a distinct population segment to the Lists of Endangered and Threatened Wildlife and Plants was not warranted (79 FR 47522). On April 14, 2016, the district Court found the determination arbitrary and capricious remanded the matter to the U.S. Fish and Wildlife Service for further consideration consistent with order CV 14-246-M-DLC (Consolidated with Case Nos. 14-247-M-DLC and 14-250-M-DLC). On May 24, 2016, the U.S. Fish and Wildlife Service again listed wolverine as a proposed species on the Flathead National Forest. The U. S. Forest Service Northern Region consulted on a variety of routinely conducted project on NFS lands with the U.S. Fish and Wildlife Service determined to not jeopardize the continued existence of wolverine. The U.S. Fish and Wildlife Service concurred with the determination on May 23, 2014 (Project File Exhibit H-13). As part of this programmatic framework, a project programmatic biological assessment for wolverine for the Hungry Lion Project is located in the project file (Project File Exhibit H-13). Supporting documents concerning wolverine as a proposed species are included in the project file (Project File Exhibit H-13).

Considering information in forest plan standards (pg. II-46) as amended by amendment 21 (Appendix A, pg. 23), requirements for the Sensitive Species listed in the table below are met by:

1. Analyzing activities to determine their potential effect on sensitive species,
2. Avoiding adverse impacts to sensitive species, or if impacts cannot be avoided, determining the significance of potential adverse effects on the population or its habitat within the area of concern and on the species as a whole, and
3. Determining that project decisions will not result in the loss of species viability or create significant trends towards federal listing.

The National Forest Management Act (NFMA) requires the Forest Service 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). All alternatives would be consistent with NFMA direction for diversity of plant and animal communities and ecological sustainability (USDA Forest Service, 2017a).

While other factors outside of Forest Service control may affect individuals of these sensitive wildlife species, the direct, indirect, and cumulative effects of the Hungry Lion 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 analysis area that would preclude movements by these species to adjacent populations.

Sensitive Wildlife Species

Introduction

Sensitive wildlife species are those species that may show evidence of a current or predicted downward trend in population numbers or in habitat suitability that could substantially reduce species distribution. Sensitive wildlife species are designated for each National Forest by the Regional Forester (Forest Service Manual 2670.5) and managed under the authority of the National Forest Management Act (NFMA). The Flathead National Forest has 14 species designated as wildlife sensitive species (Project File Exhibit H-9).

Due to the diverse habitats that occur across Flathead National Forest not every sensitive species will occur within each project area. The sensitive species for Flathead National Forest are listed below in Table 101.

Table 101. Sensitive wildlife species on the Flathead National Forest

Birds	Mammals	Amphibians
Harlequin Duck	Fisher	Boreal (Western) Toad
Black-backed Woodpecker	Gray Wolf	Northern Leopard Frog
Flammulated Owl	Northern Bog Lemming	--
Bald Eagle	Rocky Mountain Bighorn Sheep	--
Common Loon	Townsend's Big-eared Bat	--
American Peregrine Falcon	North American Wolverine	--

Based on habitat, species distribution, best available science and field surveys, the harlequin duck, American peregrine falcon, flammulated owl, rocky mountain bighorn sheep, northern bog lemming, Townsend's big-eared bat, and northern leopard frog are unaffected by the proposed project. These species will not be discussed further in this document; however, the rationale for these species is summarized in Project File Exhibit H-9. On February 4, 2013, the U.S. Fish and Wildlife Service issued a proposed rule to list the wolverine in the contiguous United States as a threatened species under the Endangered Species Act (78 FR 7864) (USDI Fish and Wildlife Service, 2013a). The U.S. Fish and Wildlife Service determined that the wolverine was not warranted for listing on August 14, 2014. However, a district court decision on April 4, 2016 found that the U.S. Fish and Wildlife Service conclusion was arbitrary and capricious and the decision was remanded to the U.S. Fish and Wildlife Service for further consideration. On May 24, 2016, the U.S. Fish and Wildlife Service again listed wolverine as a proposed species on the Flathead National Forest. Wolverine is not analyzed a sensitive species, but is included in the Threatened and Proposed species section.

Summary of Findings

Based on the project activities, field validation, best available science, design features and the Flathead National Forest management direction, viability would be maintained for all sensitive species for the alternatives of the Hungry Lion Project. A summary and rationale for sensitive species that would not be impacted by the Hungry Lion Project is located in Table 107 at the end of this section.

Analysis Area

The Hungry Lion project area was considered for the evaluation of direct and indirect effects on sensitive species. This approximately 37,090 acre area is large enough to include the home ranges of several individuals or pairs of a species, and is representative of the effects of fire, natural tree mortality, timber harvest, human recreational activity, and road management across the landscape. The actions proposed in the alternatives that could directly or indirectly affect sensitive species are contained within this area. Cumulative effects were considered within the Hungry Lion project area boundary. A multi-scale assessment was also conducted to address population viability concerns.

Temporal Area

The length of time for activities proposed by the Hungry Lion Project is approximately five years. This is based on the probable contract length for the proposed project, and the timeframes for related activities. The length of time for direct, indirect, and cumulative effects is approximately 100 years. This is based on the length of time for natural forest processes to occur, snags to be created, and forest vegetation to provide a variety of characteristics suitable for different sensitive species. Specific temporal bounds for different direct, indirect, or cumulative effects are discussed below.

Methodology

Data used included field surveys, timber stand data, VMap data, review and application of the best available science, and geographic information system (GIS) and dataset information for features, such habitat features existing in the project area including habitat types, riparian structures, canopy cover, etc.

Regulatory Framework and Consistency

In accordance with Forest Service Manual 2670, determinations have been made on the degree of impact the proposed activities may have on sensitive species (Project File Exhibit H-9). Along with chapter 1, chapter 2, and the subsection below on each species, these determination statements meet the requirements of the biological evaluation (BE) 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. All alternatives are consistent with the National Forest Management Act diversity requirements for wildlife.

Federal laws and direction applicable to Sensitive Species on the Flathead National Forest include the National Forest Management Act and Forest Service Manual 2670. The National Forest Management Act requires the Forest Service 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).

The Flathead Forest Plan provides standards and direction for resource use throughout the forest. Amendment 21 to the Flathead Forest Plan has standards to address snag and downed woody

retention, as well as protection of existing old growth habitat (see Old Growth Associates and Bird Species of Concern).

The proposed project and all of its alternatives are consistent with pertinent legislation and species specific management and recovery plans including:

- Bald Eagle, Golden Eagle Protection Act,
- Migratory Bird Treaty Act,
- Montana Bald Eagle Management Guidelines, and
- Gray Wolf Recovery Plan Direction.

Federal actions concerning the wolverine date back to 1995 and culminated in a proposal to list the wolverine DPS as threatened on February 4, 2013 (USDI Fish and Wildlife Service, 2014). Presently, the wolverine is listed as a proposed species under the Endangered Species Act. The wolverine analysis is located in the Threatened and Proposed species section.

The USDA Forest Service is bound by Federal statutes (Endangered Species Act, National Forest Management Act), regulation (USDA 9500-4), and agency policy (Forest Service Manual 2670) to conserve biological diversity on NFS lands. Federal laws and direction applicable to sensitive species include the National Forest Management Act and Forest Service Manual direction. Forest plan amendment 21 has standards to conduct analyses to review programs and activities, to determine their potential effect on sensitive species, and to prepare a BE. The forest plan also states that “adverse impacts to sensitive species or their habitats should be avoided.” A goal in forest plan amendment 21 is to “ensure that Forest Service actions do not contribute to the loss of viability of native species.”

In accordance with Forest Service Manual 2673.42, determinations have been made as to the degree of impact the proposed activities may have on sensitive species (Project File Exhibit H-9).

Bald Eagle

Existing Condition (Affected Environment)

Habitat

Bald eagles are opportunistic feeders, preying on fish, waterfowl, and small mammals; stealing food from other predators; and scavenging carrion. It can be assumed that the lands surrounding the larger bodies of water provided ample forage opportunities for bald eagles. During the breeding season, important foraging habitat is usually less than 10 miles from their nest. Some eagles stay in the general vicinity of the nesting area while others may wander or migrate up to hundreds of miles to wintering grounds (USDI Fish and Wildlife Service, 2006).

Historically, bald eagle habitat in and near the Flathead National Forest was probably much as it exists now, except that in many areas nesting habitat apparently had relatively frequent low-severity ground fires with occasional large, stand-replacing crown fires. It was probably rare for any potential territory to not encompass some nesting habitat within 0.5 mile of its associated water body. Nesting territory use generally occurs from approximately February through August, with the following activity sequence:

1. Egg laying February to mid-April;
2. Incubation spans 31 to 35 days;
3. Eggs hatch from mid-March to mid-May; and
4. Nestling period lasts 11 to 14 weeks.

Bald eagles tend to nest in the tallest trees within a stand (Swenson, Alt, & Eng, 1986). In Montana, bald eagles nest in stands containing large trees (greater than 30 inches d.b.h.) with uneven canopy structure and in direct line of sight of a large river or lake generally 0.5 mile away (Montana Bald Eagle Working Group, 1994).

Population status

The Flathead National Forest is in the Pacific States Bald Eagle Recovery Area (USDI Fish and Wildlife Service, 1986) and the Upper Columbia Basin Zone (Zone 7). The Bald Eagle Recovery Team recommended a set of criteria to measure recovery that included among other items a minimum of 800 nesting pairs in the seven western state area (USDI Fish and Wildlife Service, 1986). The number of nesting pairs in the Pacific States exceeded the recovery goal of 800 in 1990, and has continued to increase to approximately 1,627 nesting pairs by 2001 (USDI Fish and Wildlife Service, 2006). In the 1986 Recovery Plan, the recovery goal for delisting eagles in Montana was 99 breeding pairs (USDI Fish and Wildlife Service, 1986).

Across Montana in 2014, there were 713 bald eagle territories, of which 376 were known to be active nests (Montana Bald Eagle Working Group, 2016). Montana's nesting population continues to increase well beyond predicted carrying capacity (Montana Bald Eagle Working Group, 2016). Average production for the state was excellent with a mean brood size of 1.63 fledged/successful nest; 78 percent nesting success for observed active nests; and an estimated number of young fledged (based on active nests) at 324 young fledged eagles (DuBois, 2010).

The bald eagle has had large population increases, robust productivity, and has reoccupied most of Montana in recent years. The population continues to increase and has expanded well beyond predictions, and seems biologically secure (USDA Forest Service, 2017a).

There are several known and monitored bald eagle nests in the South Fork of the Flathead. Currently, there are no known nests within the Hungry Lion project area; however bald eagles are known to nest along Hungry Horse Reservoir, the Middle Fork of the Flathead River and use the water bodies for foraging. If a nest is discovered, it would be protected in accordance with the Montana Bald Eagle Management Guidelines (Montana Bald Eagle Working Group, 2010). Potential nesting habitat exists along the Hungry Horse Reservoir, the shores of Lion Lake and along the South Fork and Middle Fork of the Flathead Rivers. Feeding opportunities occur along these same water bodies.

Bald eagles are known to pass through the area, but there are no known concentrated feeding sites or roosting areas. Eagles are known to migrate along the crest of the Swan Mountains to the south of the project area and may stop for resting or foraging within the project area.

Environmental Consequences

Alternative 1 (no-action alternative) – Direct, indirect, and cumulative effects

The no-action alternative would have no direct effect on bald eagle roosting, foraging, or nesting sites. There would be an increased chance of a stand-replacing wildfire that may reduce roosting sites within the project area or burn along Hungry Horse Reservoir, removing potential nesting trees.

The Hungry Lion project area contains established human activities and developments including roads, timber management, numerous recreational opportunities, and residential development. It is expected that these activities would continue on public and private lands. Potential foraging habitat and roosting trees for bald eagles would still be available throughout the project area, along the Hungry Horse Reservoir, the Middle Fork of the Flathead River, and in project area lakes. Alternative 1 would not contribute to these effects.

Alternative 2, 3, and 4 – Direct & indirect effects

Nesting habitat

There are no known bald eagle nesting sites in the Hungry Lion project area. Bald eagle nests are commonly found near water bodies like lakes or rivers. The alternative 2 proposes the largest acreage of harvest treatment activities within 0.5 mi of nesting habitat in the project area, followed by alternative 4 then alternative 3 (Table 102). Vegetation treatment activities using machinery including road maintenance, construction, rehabilitation, tree falling, yarding and hauling has a greater potential for displacement than work completed by hand due to noise. Spring grizzly bear restrictions would diminish potential for eagle disturbance by limiting harvest activity during the egg laying/incubation period (mid-February to the beginning of June) (Montana Bald Eagle Working Group, 2010). Winter harvest operations would have no effect to potential eagle nesting. Upland burning would occur in the fall, outside of eagle nesting time periods. Given that there are no known nests within 0.5 miles of proposed activities and timing activities would have little overlap with potential nesting, there would be little potential effect to eagle nesting under the project activities. Further, potential nesting habitat is widespread throughout the project area, and given the juxtaposition of proposed activities there would be very little potential disturbance to nesting habitat as a whole.

Table 102. Comparison of vegetation treatment acres within 0.5 miles of eagle nesting habitat by alternative

Alternative	Treatment Acres within 0.5 miles of Nesting Habitat	Treatment Acres within 0.5 miles of Nesting Habitat with Machinery
Alternative 1	0	0
Alternative 2	889	675
Alternative 3	675	614
Alternative 4	693	478

Feeding/roosting habitat

There are no known concentrated feeding sites or roosting sites in the vicinity of the proposed project. Typically, bald eagles select the larger, more dominant trees as individual roost trees along lakes or open rivers. Mature forests or old growth habitat areas have the greatest potential

for providing high quality roost trees or feeding habitat. Eagles likely select roost trees along the larger lake/reservoir shores or along the Middle Fork and South Fork of the Flathead Rivers. Project disturbance along the shoreline of Hungry Horse Reservoir and at Lion Lake presents the highest potential for disturbance from potential roosting trees where eagles can perch above the lake between foraging bouts. Potential quantity of roost trees would not be substantially reduced in any action alternative.

The proposed harvest or burning activities would not remove roosting trees adjacent to nesting or foraging water bodies within the project area. Upland burning would reduce some live trees that are killed due to prescribed fire, but standing snags would still provide for eagle perching and roosting.

Displacement may occur from harvesting activities due to noise from machinery or equipment used to implement project activities. Similarly, displacement may occur due to pier construction and parking lot improvements at Lion Lake. Activities that occur during the winter would not have high displacement potential to eagles as the majority of the eagle population would have migrated for the winter. Effects from displacement would likely be small given the amount of roosting habitat available in the project area and the mobility of eagles. Potential displacement would not inhibit a bald eagle's ability to find available feeding or roosting habitat.

Mortality Risk

Possible mortality factors include hazardous structures, such as power lines, collision with vehicles, disturbance during incubation and nesting periods, illegal killing, and use of certain pesticides that could cause reproductive failure. Implementation of the project would not increase the risk of mortality. Hauling on roads would be spread out over time and space and forest roads in the project area do not allow for high vehicle speeds (less than 30 mph). Helicopter activities used for ignition of upland burning would be short term in duration and intensity. Potential eagle collisions with the helicopter are considered highly unlikely. There would be no significant increase in road kills (source of food for eagles along roads) as a result of project implementation.

Alternative 2, 3, and 4 – Cumulative effects

There are part year and yearlong residences in the area, as well as other past established human activities including road building, hiking, fire suppression, firewood cutting, hunting, trapping, and special uses. Private lands in the project area are more developed than these areas were historically. However, the development of homes and logging/clearing on private land is primarily distributed in the lower elevations in the west side of the project area. The majority of the shorelines of the two rivers and lakes in the project area are NFS lands which benefits the long term conservation of potential eagle nesting and roosting habitats.

There have been past harvest activities within the project area including the Hungry Horse/West Glacier Fuels Reduction, Paint Emery, Firefighter, and Belton Fuels. These projects have altered the forest mosaic and reduced roost trees within the project area. These project effects were considered in the habitat baseline. Roost trees along rivers or water bodies are abundant within the project area and distributed throughout the area to provide areas for eagle perching. Large trees are maintained along shorelines to provide potential nesting habitat.

The cumulative effect of past activities, the proposed activities of this project, and future activities, would not preclude eagle use of habitats in the area. There appears to be little risk of population loss, and species viability would be maintained. For additional information on the status of bald eagle on the Flathead National Forest, and the status at broader scales, reference the

document Flathead National Forest Evaluation and Compliance with National Forest Management Act Requirements to Provide for Diversity of Animal Communities (USDA Forest Service, 2017a).

Summary of Effects and Determination

The proposed activities in the project action alternatives were evaluated based on potential disturbance to nesting habitat, displacement from roost trees and potential for morality risk. The project alternative would have very little effect to potential nesting of bald eagles due to timing of activities (spring restrictions; winter harvest) and distribution of nesting habitat within the project area. Roost trees are wide spread and would not be substantially reduced by the project action alternatives. Eagle populations are large, robust and productive in northwest Montana and statewide (Montana Bald Eagle Working Group, 2016).

In accordance with Forest Service Manual 2600, a determination has been made as to the degree of impact the activities proposed might have on bald eagles. Based on available information, surveys from the project area, forest plan requirements, and management strategies, as well as project design and location, the determination for alternative 1 – no-action is “no impact.” The determination for alternatives 2, 3 and 4 is “may impact individuals or their habitat, but will not result in a loss of species viability or create a significant trend toward federal listing.”

Black-backed Woodpecker

Existing Condition (Affected Environment)

Habitat

Based on current knowledge of the life history, biology, and ecology of the black-backed woodpecker, certain elements are thought to be essential to the conservation of the species. These elements include the presence of dead and dying, insect-infested trees (forage), and large snags (nesting). The effects analysis for the black-backed woodpecker focused on the presence of insects and potential nesting trees and the potential effects the action alternatives could have on these habitat characteristics.

Black-backed woodpeckers forage in areas with concentrations of dead or decaying trees and logs, often in recently burned forests. The trees in which they feed have frequently only been dead for two to three years, since these trees harbor the most insects. They use live or dead trees (usually 8 to 12 inches d.b.h.) for nesting. Black-backed woodpecker populations have always been transitory. When an epidemic, windstorm, or fire occurred in the past, black-backed woodpeckers would move into that area. As time went on and the insect numbers decreased, the woodpeckers would move on to another area. There was probably more feeding habitat historically, prior to fire suppression activities. R. L. Hutto (2008) reports that the black-backed woodpecker is “extremely specialized on severely burned forests.” He found that “96 percent of their detections on Landbird plots were in burned forest conditions, where this species was 16 times more likely to occur than anywhere else.”

Between 2001 and 2004, approximately 200,000 acres burned in over 70 fires across the Flathead National Forest. These fires created pulses of habitat suitable for relatively high densities of black-backed woodpeckers. Less than five percent of this habitat had salvage harvest, leaving the

vast majority of habitat available in large tracts. Between 2007 and 2012, approximately 138,632 acres burned (USDA Forest Service, 2013a).

R. L. Hutto (2008), in a study of bird use of habitats burned in the 2003 fires in northwest Montana, found that within burned forests, fire-severity was the dominant variable that influenced the distribution of black-backed woodpeckers. Black-backed woodpecker's are highly specialized to select severely burned forest.

Hutto's results also suggested burned forests that were harvested fairly intensively (seed tree cuts, shelterwood cuts) within a decade or two prior to the fires of 2003 were much less suitable as post-fire forests to the black-backed woodpecker and other fire dependent bird species. Even forests that were harvested more selectively within a decade or two prior to fire were less likely to be occupied by black-backed woodpeckers.

There is currently no recent severely burned post-fire habitat (within the last 10 years) for black-backed woodpecker in the Hungry Lion project area (see Fire and Fuels section of this EA for more information). Considering the 138,632 acres burned between 2007 and 2012, approximately 4.5 percent was post-fire salvage logged within four years of the fire on Flathead National Forest lands (USDA Forest Service, 2013a). Additionally, within the South Fork of the Flathead drainage, the Bear Creek and Trail Creek fires burned over 81,000 acres in 2015 generating high amounts of black-backed woodpecker habitat within the Bob Marshall Wilderness and near the southern end of Hungry Horse Reservoir (approximately 30 miles to the southeast of the project area). Approximately, 834 acres of the area in these fires were harvested for salvage. Black-backed woodpeckers appear capable of migrating large distances to exploit rich foraging resources such as those that occur in recent burns or other large-scale natural disturbances. In a study that compared percent occurrence of black-backed woodpeckers in burned, mature, and old-growth coniferous forests, black-backed woodpeckers were not detected 31 miles away from large (494 acre) stand-replacement burns (Hoyt & Hannon, 2002) although they were detected in old-growth spruce forests 47 and 62 miles away. Hoyt and Hannon (2002) hypothesized that black-backed woodpeckers were drawn away from the unburned forests within a 31 mile radius of the burn.

Black-backed woodpeckers also do occur in unburned landscapes (Evelyn L Bull, Peterson, & Thomas, 1986). During extended periods of wet, cool summers when few fires burn, black-backed woodpeckers appear to disperse and forage on small bark beetle outbreaks at low densities (Victoria A. Saab & Dudley, 1998). Hoyt and Hannon (2002) reported black-backed woodpeckers in old forest stands long distances from any burned areas, suggesting the species are not "restricted" to post-burn areas.

Nappi and Drapeau (2009) suggested that old growth habitats may allow population persistence between fires in regions with longer fire cycles. Old growth forest has been identified through stand exams on NFS lands in the project area (see Old Growth section). Mid-successional forest habitat may also provide feeding habitat. Portions of the project area have high levels of dead standing trees as a result of mountain pine beetle, root disease, Douglas-fir beetle, and other insect or disease mortality and these may provide both feeding and nesting habitat.

Population

Habitat models based on forest and regional scales suggest that habitat exceeds amounts needed for a minimum viable population (Samson, 2005). Evidence suggests that the black-backed woodpecker is increasing in numbers in the United States (Dixon & Saab, 2000). Virtually all

climate model projections indicate that warmer springs and summers would occur over the region in coming decades. Westerling et al. (2006) states;

“These trends will reinforce the tendency toward early spring snowmelt and longer fire seasons. This will accentuate conditions favorable to the occurrence of large wildfires, amplifying the vulnerability the region has experienced since the mid-1980s.”

These models and trends indicated a surplus of black-backed habitat above historical levels. Black-backed woodpecker populations fluctuate naturally due to variation in insect epidemics and wildfires over time, moving into and out of habitat areas as habitat suitability changes. In northwest Montana, it is likely that black-backed woodpecker populations increased between 2003 and 2008 due to the large number of acres that experienced high-intensity burns during this time period (USDA Forest Service, 2017a). Evidence suggests the black-backed woodpecker is increasing in numbers in the United States (Dixon & Saab, 2000).

An analysis of national breeding bird surveys for 1966 through 1996 indicated a significant increase (6.7 percent change per year) in Black-backed Woodpecker populations in spruce-hardwoods survey routes, a significant increase (6.6 percent change per year) in the United States survey routes, and no significant population trend elsewhere. No route from 1966 to 2004 in the breeding bird surveys database shows a long term decline for Black-backed Woodpecker. In northwest Montana, it is likely that Black-backed Woodpecker populations increased between 2003 and 2008 due to the large number of acres that experienced high intensity burns during this time period. (Bonn, Dixon, Kennedy, & Pengeroth, 2007).

Black-backed woodpeckers are known to occur within the project area, usually in low numbers.

Environmental Consequences

Alternative 1 (no-action alternative) – Direct, indirect, and cumulative effects

Alternative 1 would maintain the existing situation. There would be no direct physical change to the landscape; insects and disease would continue to cause tree mortality in the Hungry Lion project area, and black-backed woodpeckers would respond to insect outbreaks. Indirectly, taking no-action to harvest dead trees, reduce fuels or thin mature forest would increase the potential for high intensity, high severity, stand-replacing fires to occur in portions of the project area in the future. This could result in wildfires, which would create large areas of highly suitable habitat for this species, depending on the size and intensity of fires. Intense wildfires would benefit black-backed woodpeckers by increasing available habitat.

Timber harvest on NFS and private land would continue, probably salvaging a portion of the potential feeder and nesting trees for black-backed woodpeckers. High levels of human activity would continue, with the potential for snags along open roads to be taken out as firewood.

Fire suppression efforts would continue and depending on fire season conditions, fire severity may be moderated by suppression efforts; however, over the long-term, fire suppression will result in larger more severe wildfire. Since 2001, there have been a number of large wildfires on the Flathead National Forest and throughout western Montana. Black-backed woodpecker numbers in the Flathead should remain high (USDA Forest Service, 2017a).

Alternative 1 would not contribute substantial negative cumulative effects on black-backed woodpecker.

Alternatives 2, 3, and 4 – Direct and indirect effects

Forage and nesting habitat

Mature tree harvest and fuels reduction activity would reduce the potential quality and quantity of feeding and nesting habitat for black-backed woodpeckers by reducing the risk of future high intensity fires in the project area.

Alternatives 2, 3 and 4 would harvest some beetle killed trees within the proposed project units. Beetle killed trees currently exist in some stands of the project area at varying levels (see Vegetation section of this EA for information). While black-backed woodpeckers are highly specialized to select burned forest, some information exists that beetle killed trees may provide some potential food source for black-backed woodpeckers (Rota, Millsbaugh, Rumble, Lehman, & Kesler, 2014; Victoria A Saab et al., 2014). This potential food source is not likely high quality, but may be utilized by some woodpeckers during long cycles between fires (Rota et al., 2014). Mountain pine beetle activity and beetle killed snags would still persist in the project area if any of the action alternatives were implemented.

There would be no proposed treatment in old growth under alternatives 2, 3 or 4; these stands also have some potential for providing both nesting and feeding habitat.

The project action alternatives are consistent with the forest plan and would include the retention of a minimum average of six snags per acre that are 12 to 20 inches d.b.h.; all snags greater than 20 inches d.b.h. would be left, as well. If existing snag densities are below these densities, substitute live trees would be left.

An indirect negative effect to black-backed woodpecker could be the decreased chance of a large stand-replacing wildfire. Large scale, severe wildfires on the landscape would be beneficial to black-backed woodpeckers since the fires increase the quality feeding and nesting habitat.

Prescribed fire

Prescribed burning would increase fire killed trees in the project area and may increase low-quality black-backed habitat within the project area. The objective of the proposed burning is for low to moderate severity. The prescribed fire would result in tree mortality across the burn units that may provide some level of black-backed woodpecker feeding or nesting habitat.

Security/mortality risk

Under the project action alternatives, it is possible that project implementation would directly affect individual black-backed woodpeckers through disturbance or incidental mortality if nesting trees are cut down during the nesting period. However, this is unlikely given the current absence of post-fire habitat within the project area. Additionally, the design features for project implementation outside of the spring period (for grizzly bear) would help to mitigate this mortality risk by decreasing the potential for direct disturbance or mortality to nesting birds during the spring season.

Road maintenance, realignment, recreational trails, and fishing pier

Activities associated with road work activities may result in some removal of forest vegetation or snags along road ways. This removal is expected to have relatively small effects to black-backed woodpecker due to the low quality habitat (not in burned forest) and the small amount of vegetation that be removed. Short-term displacement may occur from human activity or noise from equipment or machinery.

Recreational improvements such as trails, parking lot improvements, and the fishing pier are not expected to have measureable effects to black-backed woodpeckers.

Alternatives 2, 3, and 4 – Cumulative effects

Prior to 2001, there were few wildfires of considerable size since 1929. Then, across the Flathead National Forest and most of western Montana, large acreages of black-backed woodpecker habitat were created by wildfires. Between 2001 and 2004, approximately 200,000 acres in over 70 fires burned on the Flathead National Forest, creating a substantial amount of black-backed woodpecker habitat. Less than five percent of this habitat was salvage harvested, leaving the vast majority of potential black-backed woodpecker habitat intact.

There have been past harvest activities within the project area including the Hungry Horse/West Glacier Fuels Reduction, Paint Emery, Firefighter, and Belton Fuels. These projects have altered the forest mosaic and contributed to reducing the potential for severe fire the project area. These project effects were considered in the habitat baseline.

Fire suppression has been a factor limiting the distribution of potential black-backed woodpecker habitat. In the Hungry Lion project area since 1986, there have been 87 fire starts in the project area. All of these fires were extinguished when small and only one exceeded 10 acres (see Map 3-2 and Map 3-3). Beyond wildfire, within the project area and throughout the South Fork, mountain pine beetle and disease have produced a pulse of snags in the past six years (USDA Forest Service, 2017a).

Firewood cutting would continue off of open roads in the project area. The project would not increase public motorized access. Open roads and increased human use on private lands could affect the availability of snag habitat and negatively affect black-backed woodpeckers. Road closures in place for the grizzly bear have improved security for potential black-backed woodpecker habitat in the Hungry Lion project area. The combination of the direct, indirect, and cumulative effects of the project would not result in a decrease in viability for black-backed woodpecker.

Summary of Effects and Determination

The proposed activities in the project action alternatives were evaluated based on potential effects to high quality habitat, distribution of project activities and project activity timing. The project activities would not affect any high quality black-backed woodpecker habitat (moderately or severely burned forest). However, the project would reduce the potential of severe wildfire and future habitat recruitment. No old growth would be treated in the project proposals. Spring timing restrictions would limit disturbance to any nesting activity within the project area, though nesting is likely to occur at very low density due to the absence of post-fire habitat. Recent burned forest conditions are present across the Flathead National Forest and in the South Fork of the Flathead providing suitable habitat conditions for black-backed woodpeckers.

In accordance with Forest Service Manual 2600, a determination has been made as to the degree of impact the activities proposed might have on black-backed woodpeckers. Based on available information, surveys from the project area, forest plan requirements, and management strategies, as well as project design and location, the determination for alternative 1 – no-action is “beneficial” and the determination for alternatives 2, 3 and 4 is “may impact individuals or their habitat, but will not result in a loss of species viability or create a significant trend toward federal listing.”

Common Loon

Existing Condition (Affected Environment)

Habitat

The southern edge of the loon’s breeding range extends into the United States across many of the Eastern states and into the Rocky Mountains. The original extent of the population is unknown, although populations have declined with the settlement of the west.

Loons are completely dependent on water. Loons in Montana are associated with larger bodies of water (lakes greater than 13 acres) (C. A. H. Hammond, 2009). They are disturbed easily, so high quality habitat includes the more secluded lakes or larger lakes with portions of the shoreline that remain relatively undisturbed during the spring and summer months. Residential development has decreased available shoreline nesting habitat on some lakes on the Flathead National Forest.

The Montana Common Loon Conservation Plan (C. A. Hammond, 2009) recommends limiting activity within 0.25 mile of critical foraging lakes or on territorial lakes (Class A and B) during breeding time periods (April 1 to June 15). The plan recommends avoiding activities near brood-rearing areas from May 28 to July 15, unless nesting has completely failed.

The Montana Conservation Plan for the Common Loon uses loon monitoring data and research to prioritize for lakes for conservation. Loon lakes in the South Fork, Middle Fork and North Fork Valleys are monitored each season for loon presence. Within the Hungry Lion project area, only Lion Lake and Hungry Horse reservoir comprise the loon habitat. Lion Lake is surveyed twice a year for loons; however Hungry Horse Reservoir is surveyed only opportunistically. Neither lake is a territorial nor did breeding lake base various considerations including high levels of human disturbance (C. A. Hammond, 2009). Lion Lake has a F2 foraging rating indicating the lake is frequently used by pairs for foraging during the nesting season, but is not critical foraging habitat. The Lion Lake has a probability of occupancy of 54 percent (C. A. Hammond, 2009; Hammond, Mitchell, & Bissell, 2012). Hungry Horse Reservoir has a nesting classification of D and an F3 foraging rating meaning that the reservoir is not critical foraging habitat and that singles or pair of loons have been detected less than 50 percent of the years when observation were made. The reservoir does not have a computed probability of occupancy.

Population

The global population of the common loon is considered secure; however, many local populations are small and isolated, and are vulnerable to extirpation primarily due to habitat loss and human encroachment (Montana Fish Wildlife and Parks, 2005). Northwestern Montana supports the highest density of nesting common loons in the lower 48 states west of the Mississippi River (Montana Fish Wildlife and Parks, 2005). Current statewide cooperative annual surveys (1994

through 2010) indicate approximately 117 to 194 adults in Montana, averaging 40 to 70 territorial pairs annually (C. A. H. Hammond, 2009) and producing 33 to 54 chicks annually (C. A. Hammond, 2009). The loon chick fledging rate in northwest Montana suggests a slightly increasing population (C. A. Hammond, 2009). Statewide, evaluation of the last 14 years of Loon Day results indicates a relatively stable loon population with some degree of fluctuation across their habitat (USDA Forest Service, 2017a).

C. A. H. Hammond (2009) calculated that there is little probability of extinction for the loon population in northwestern Montana if habitat and disturbance conditions are maintained.

A stable loon populations is expressed as a ratio of 0.48 chicks per territorial pair. The observed ratio in northwest Montana in 2014 was 0.8 chicks per territorial pair. For the past 14 years, overall productivity of loons have been observed to be greater than stable (Byrd, Kneeland, Persico, & Evers, 2015). On the Flathead National Forest, 25 lakes are known to be occupied or to have suitable nesting conditions (USDA Forest Service, 2017a). During the 2014 nesting season, Half Moon Lake, approximately two miles north of the project area, hatched two loon chicks (Byrd et al., 2015). No recent (last 10 years) nesting activity has occurred on Lion Lake or Hungry Horse Reservoir.

Environmental Consequences

Alternative 1 (no-action alternative) – Direct, indirect, and cumulative effects

There would be no proposed vegetation treatments, pier construction, trail building, road realignment or road maintenance activities. The occurrence and abundance of different forest conditions would fluctuate and change over time as the area progresses through various successional stages. There would be no direct effects to the vegetation near water bodies or associated activity as a result of implementing the no-action alternative. Security for the common loon would likely remain the same.

Indirectly, the likelihood of stand-replacement fires could be increased under alternative 1 as compared to the action alternatives, with an increased risk of the loss of vegetation along lake shorelines. However, the level of effects would depend on the size and intensity of the wildfire, which would depend on the actual location, intensity, moisture, and weather conditions associated with a presently unknown future fire event.

Human activity on bodies of water is expected to continue. Continued or increased human use would likely increase the potential for disturbance of foraging loons. The best available loon data support that loon lakes in the project area are not critical territorial or foraging lakes. Increased or continued human presence on lakes and lakeshores would likely have low impact to loon and loon populations.

Alternatives 2, 3, and 4 – Direct and indirect effects

Nesting and foraging habitat

None of the proposed vegetation treatment activities would occur within 0.25 mile of a critical foraging or a territorial lake (Class A and B). No effects would occur to nesting loons in the project area.

A potential direct effect on loons would be possible disturbance of an individual or pair that was using Lion Lake or Hungry Horse Reservoir for feeding, or loafing. Given the existing human disturbance on both these bodies of water, additional displacement or disturbance to foraging or loafing loons is not expected. Loons are capable of travel long distances to find lakes suitable for foraging. If loons were displaced from project activities, Hungry Horse reservoir provides a large foraging area away from noise and other near shore activities.

Units 13, 80, and 81 would occur near adjacent to Lion Lake due to spring grizzly bear restrictions, the harvest activities would occur after June 30th minimizing effects of noise and activity to loons foraging on the lake. The Hungry Lion Project proposes to build a fishing pier on Lion Lake and improve parking lot conditions. Lion Lake is located close to Martin City and has a high amount of human activity in the spring, summer and fall. Construction of the pier may result in displacement of foraging loons on Lion Lake. Given the lake is not a critical foraging lake, no adverse effects are expected. The fishing pier may result in persistent human activity at the lake into the future. Considering the existing high amounts of human activity already persist at Lion Lake, the inclusion of the fishing pier would likely result in little additional impacts to foraging loons that use the lake.

Alternatives 2, 3, and 4 – Cumulative effects

As described above under the no-action alternative, the project area contains established human activities and developments. Road building, private land development, recreational activities (on land and water) would continue in the project area. Open roads would continue to be used for recreation, log hauling, and transportation. These activities would continue.

There have been past harvest activities within the project area including the Hungry Horse/West Glacier Fuels Reduction, Paint Emery, Firefighter, and Belton Fuels. These projects have altered the forest mosaic and juxtaposition of cover within the project area. These project effects were considered in the habitat baseline. None of these project contributed to shoreline development or reduction in loon nesting habitat.

Lakeshore and on-the-water recreation could disturb foraging loons in the project area, however the project area does not contain any critical territorial or foraging lakes. Loons are capable of long dispersals and foraging movements. Adverse effects of displacement contributed by the Hungry Lion Project are not expected.

Active conservation across the Flathead National Forest includes implementing nest protection measures to limit human disturbances, such as:

1. Deploying floating signs to reduce boat activity near nest sites or chick-rearing habitat,
2. Using informational signs at bulletin boards and kiosks for anglers and boaters in occupied or foraging habitat and,
3. Conducting public education efforts using Loon Rangers targeted at anglers and other watercraft users to reduce boat activity near nest sites and encourage responsible watercraft use near loon broods.

Considering all the direct, indirect, and cumulative effects, the proposed project would not impact common loon viability.

Summary of Effects and Determination

The proposed activities in the project action alternatives were evaluated based on potential effects to loon nesting territories, critical foraging habitat and potential of displacement. The project activities would not affect any active or potential loon breeding territories. The project would not contribute effects to critical foraging lakes for loons. Displacement may occur on Lion Lake to foraging loons due to pier construction and vegetation management activities. Potential displacement is not expected to have adverse effects to loons or the loon population due the existing high amount of human activities on this lake and the high capability of loons to travel to other foraging habitat. Loon population in northwest Montana are monitored annually and have a stable to increasing trend. The viability of loon populations would be maintained under the Hungry Lion Project.

In accordance with Forest Service Manual 2600, a determination has been made on the impact the proposed activities could have on sensitive species. Based on available information on the common loon's distribution, presence/absence from the project area, habitat requirements, and management strategies, as well as project design and location, the determination for alternative 1 is "no impact;" the determination for alternatives 2, 3, and 4 is "may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or loss of viability to the population or species."

Gray Wolf

Existing Condition (Affected Environment)

Habitat

Gray wolves range across northern North America. In the lower 48 states, populations are primarily found in the northern Rocky Mountains (Montana, Idaho, and Wyoming) and the eastern Great Lakes states. The gray wolf was delisted from the Endangered Species Act on May 4, 2009, as the Northern Rocky Mountains Distinct Population Segment (USDI Fish and Wildlife Service, 2009a).

The gray wolf appears to select landscapes with relatively low elevations, flatter terrain, and close to water and roads (USDA Forest Service, 2017a). Habitat preferences for the species appear more related to prey distribution than cover. In northwestern Montana, white-tailed deer comprised 83 percent of wolf kills, whereas elk and moose comprised 14 and three percent, respectively (K. Kunkel & Pletscher, 1999). Kunkel et al. (2004) found wolves concentrated their hunting in wintering areas of white-tailed deer around Glacier National Park. White-tailed deer are the predominant prey of wolves within the northern Rocky Mountains, but other prey includes moose, elk, and opportunistic small mammals.

The two major components of wolf habitat that provide survival and recovery values are adequate prey base and security from risk of mortality. Additional components include special habitats, such as den sites, rendezvous sites, and travel/dispersal corridors. Wolves commonly den in undisturbed sites, usually within 400 yards of water. Although summer and winter range habitat for the major wolf prey species (white-tailed deer and elk) is probably adequate to maintain wolf population levels, the increased level of human activity and the increased road access has increased hunting vulnerability and likely reduced potential numbers of white-tailed deer and elk in the South Fork of the Flathead.

The wolf was relisted on August 9, 2010, in response to the District Court's ruling that the Montana/Idaho populations could not be separated as a distinct population segment from Wyoming and removed from Federal management (USDA Forest Service, 2015a). Effective May 5, 2011, the U.S. Fish and Wildlife Service removed gray wolves in a portion of the Northern Rocky Mountain Distinct Population Segment encompassing Idaho, Montana and parts of Oregon, Washington, and Utah from the Federal List of Endangered and Threatened Wildlife.

The most important habitat attributes for wolf pack persistence are forest cover, public land, high prey density, and low livestock density (USDA Forest Service, 2017a). Extensive roadless and wilderness habitat reduces the effects of displacement from high-density roads and trails, the risks of mortality due to vehicle collisions and other types of human-related mortalities, and the potential negative effects of fragmenting small populations. These attributes are present on the Flathead National Forest with approximately 67 percent in wilderness or inventoried roadless areas. Amendment 19 improves habitat security through motorized access management. By 2008, the open road density had decreased across the Flathead National Forest to about 0.4 miles per mi² (approximately 1,458 miles/3,688 mi²) and only 2,500 permitted animal unit months on 111,000 acres (actual numbers less due to three allotments in vacant status) limits the negative effects of predator control as a result of damage to livestock permitted on the Flathead National Forest (USDA Forest Service, 2017a).

Population

Wolves have a high fecundity rate and are highly mobile. Even with a hunting season that harvested 72 wolves, a minimum of 166 pups were documented in 2009 and Montana's population continued to increase. Despite the first legal hunt for wolves in Montana, there was a four percent increase from 2008, compared to 18 percent the previous year. The Montana minimum count decreased by 73 wolves from 2013 to 2014 (Bradley et al., 2014). The minimum count of wolves in Montana is estimated to be approximately 554 (Bradley et al., 2014).

Wolves are currently listed as a game species and managed by Montana Fish Wildlife and Parks. Statewide documented wolf harvest included 94 wolves harvest in the 2013/2014 season and 119 taken in the 2014/2015 season. There were an additional 57 wolves killed to reduce livestock depredations. The total number of documented wolf mortalities in the state during 2014 was 308. The Montana Wolf Plan identifies the state's shared legal requirement with the states of Idaho and Wyoming to maintain a minimum total of 30 breeding pairs in the region (Montana Fish Wildlife and Parks, 2002). Montana itself has had more than 15 breeding pairs since 2002 (Bradley et al., 2014). Recovery goals have been exceeded across the entire recovery area.

In 2015, Montana Fish Wildlife and Parks shifted the wolf monitoring program from an attempt to count all packs in Montana to a patch occupancy modeling method. Based on this method, Montana Fish Wildlife and Parks estimated 992 wolves within the state of Montana in 2014 or 61 percent greater than the minimum count of wolves (Boyd et al., 2017).

The project area occurs in Wolf Management Unit 130. Hunting and trapping for wolves is currently permitted in the management unit. In 2016, 10 wolves were harvested in Hunting District 130 which includes the project area. The growth rate is slowing down, in part because of the dampening effect of the combination of public harvest and agency control, and because the best habitat is already occupied (Boyd et al., 2017; Bradley et al., 2013; Sime et al., 2010).

Based on Montana Fish Wildlife and Parks monitoring a pack of wolves is known to be present within the project area (Project File Exhibit H-11). Wolves are known to move through forest

stands in the Hungry Lion project area. There are no known or suspected denning sites, whelping areas, or rendezvous sites in the Hungry Lion area.

As reported by the U.S. Fish and Wildlife Service (USDI Fish and Wildlife Service, 2008a) after severe declines, wolf populations can more than double in just two years if mortality is reduced and adequate food is available. Increases of nearly 100 percent per year have been documented in low density suitable habitat. The literature suggests that in some situations, wolf populations can remain stable despite annual human-caused mortality rates ranging from about 30 to 50 percent.

Environmental Consequences

Alternative 1 (no-action alternative) – Direct, indirect, and cumulative effects

There would be no proposed vegetation treatments, prescribed fire, trail, pier construction road realignment or road maintenance activities. The occurrence and abundance of different forest conditions would fluctuate and change over time as the area progresses through various successional stages. There would be no direct effects to the vegetation near water bodies or associated activity as a result of implementing the no-action alternative. Security and prey density for the gray wolf would likely remain the same.

There would be no changes in the level of general motorized access; there would be no proposed road decommissioning with the no-action alternative.

Indirectly, the likelihood of stand-replacement fires could be increased under alternative 1 as compared to the action alternatives, with an increased risk of the loss of vegetation along lake shorelines. However, the level of effects would depend on the size and intensity of the wildfire, which would depend on the actual location, intensity, moisture, and weather conditions associated with a presently unknown future fire event.

Motorized access and use would continue to occur on roads open to public use within the project area resulting in traffic from log hauling, recreational use and other access. Human activity on public and private lands within the project area would continue. Hunting and trapping would occur within the project area contributing to wolf mortality. Wolf populations would remain stable across the Flathead National Forest.

Alternatives 2, 3, and 4 – Direct and indirect effects

Prey base

Deer and elk movement patterns would change due to implementation of Alternatives 2, 3 or 4. Use patterns for gray wolf prey would change over the short term and long term to respond to changing prey patterns (see Management Indicator Species: Big Game section of this EA for more information on big game species). Project activities on deer and elk winter range (MA 9/MA 13) would maintain a mosaic of cover and forage and continue to meet forest plan direction for thermal cover. Project activities for all of the action alternatives would maintain ungulate populations in and around the project area for adequate wolf prey base.

Key habitat areas (denning sites, rendezvous areas, and whelping sites)

There are no known or historical den sites, rendezvous areas, or whelping sites in the area proposed for treatment under alternative 2, 3, or 4. Project vegetation treatment areas were

surveyed and no denning sites, rendezvous areas, or whelping sites were detected within the project area. If future sites are detected, contract provisions would include measures for their protection. Spring period timing restrictions for grizzly bears would reduce potential displacement to denning wolves within the project area by restricting activities until after June 30. Displacement may occur from proposed project activities including human presence and noise from machinery used recreational improvements, road work activities, vegetative treatments etc. Travel and hunting patterns may change throughout the project area; however effects of displacement are not expected to interfere with denning, rendezvous sites, whelping area or hunting success.

Habitat security

Wolves in the project area could be displaced during project implementation during summer or winter months. In addition to the actual hand or mechanical activity for vegetation management, between 14.3 under alternative 2 and 0 miles under alternative 4 of temporary or specified road would be constructed to access units depending the alternative implemented. Temporary roads would be rehabilitated following use. Newly constructed road would be placed in intermittent stored service and reclaimed under the definition of forest plan amendment 19. The work would include the removal of any culverts, water bar placement, seeding, recontouring, and the placement of woody debris on the reclaimed road. Road built for and restricted roads used for proposed activities would be closed to public motorized use and would limit public access throughout the project area. Public motorized access would not change during project implementation. At the end of project activities there would not be any change to public motorized access from the existing condition.

Wolves are not dependent on any one specific forest vegetation structure or type. A diverse set of forest conditions would continue to exist throughout the Hungry Lion project area if alternative 2, 3, or 4 was implemented. Hiding Cover for concealment and security of gray wolf and gray wolf prey would be reduced under project alternatives. The greatest reduction to cover would occur under alternative 2. Cover would remain well distributed across the project area. Regeneration harvest would reduce cover and decrease wolf security. Regeneration units would be designed so that no point is greater than 600 feet to cover and visual screening would be maintained along open roads adjacent to proposed regeneration harvest units. These features would reduce the impact to gray wolf security from project activities. Ecosystem burns would also remove cover; however burns are proposed up steep slopes away from open roads where security is high.

Because wolves are adaptable animals, the expected increase in human activity within the project area would result in temporary displacement of wolves from habitats that they might otherwise use. Wolves occupying the Hungry Lion project area may move to nearby adjacent areas further away from human development and disturbance.

Implementing alternatives 2, 3 or 4 would not substantially increase the mortality risk for the gray wolf. Any increased chance for an encounter between wolves and humans because of the Hungry Lion project area, would present a low risk of mortality for the wolf. Potential encounters would center on land management activities and not livestock depredation or other high-risk activities commonly associated with wolf mortality. In combination with visual screening and maintaining road closures to the public, the project would not be expected to increase mortality risk to wolves above the existing condition.

Alternatives 2, 3, and 4 – Cumulative effects

Under each of the alternatives, although wolf hunting patterns would undoubtedly change as a result of proposed vegetation management, existing wolf prey base would be maintained. There would be no direct or indirect effects to known or suspected denning, whelping, or rendezvous sites; potential denning, whelping, and rendezvous habitat is not considered limiting across the project area or within the South Fork of the Flathead.

There have been past harvest activities within the project area including the Hungry Horse/West Glacier Fuels Reduction, Paint Emery, Firefighter, and Belton Fuels. These projects have altered the forest mosaic and juxtaposition of cover within the project area. These projects were considered in the habitat baseline.

Road closures in the South Fork that have been implemented to increase grizzly bear security have increased wolf security, as well. Wolf hunting and trapping would continue and is expected to contribute to wolf mortality. Wolves are managed as a game animal by Montana Fish Wildlife and Parks. This management includes sustainable harvest quotas included in population management. Regeneration harvest proposed by the Hungry Lion Project may create openings that reduce wolf security from hunters. This increase in potential mortality risk is considered small because of the design of the openings (no point less than 600 feet to cover), visual screening maintained along open roads adjacent to regeneration harvest units, and adapted behavior by wolves to avoid large openings and use the cover distributed across the project area for travel.

Coram pasture includes grazing for stock within the project area. However, this pasture includes horses and mules which are not known to cause wolf/livestock conflict. There are no livestock (cattle) grazing concerns associated with this project area and no livestock-wolf conflicts have occurred within the project area within the last five years. Considering the past history, the pack stock animals grazing within the project area and current population of wolves in the South Fork and Flathead National Forest, no negative population effects would occur considering the interaction of the proposed activities and the grazing presence in the project area. Mortality risk for gray wolf, as a result of the implementation of any of the proposed alternatives, would be low.

Population viability would not be a concern for gray wolves in Montana or across the Flathead National Forest (USDA Forest Service, 2017a). There appears to be little risk of population loss and species viability would be maintained (USDA Forest Service, 2017a).

Summary of Effects and Determination

The proposed activities in the project action alternatives were evaluated based on potential effects to wolf denning, rendezvous, whelping sites, effects to prey base and habitat security. The project activities would not affect any known denning, whelping or rendezvous sites. Displacement of wolves or wolf prey may occur due to human activities, noise from equipment completing vegetation management, road maintenance or other associated project activities. While hunting and travel patterns may change as a result of implementation of one of the project action alternatives, no adverse effects to wolves are expected. Project action alternatives are estimated to decrease habitat security, but based on design features and project timing, the activities would not substantially increase mortality risk to wolves. Wolf populations are secure across the Flathead National Forest and within northwest Montana. Viability of gray wolf populations would be maintained under the Hungry Lion Project.

In accordance with Forest Service Manual 2600, a determination has been made on the impact the proposed activities could have on sensitive species. Based on available information on the gray wolf's habitat requirements, and management strategies, as well as project design and location, the determination for alternative 1 is "no impact;" the determination for alternatives 2, 3, and 4 "may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or loss of viability to the population or species."

Boreal Toad

Existing Condition (Affected Environment)

Habitat

Adult western toads are largely terrestrial, will travel considerable distances from water, and are found in a variety of habitats from valley bottoms to high elevations. Generally, toads require three types of habitat; breeding ponds, forest summer range or overland dispersal, and overwintering burrows (Keinath & McGee, 2005).

Toads breed in lakes, ponds, and roadside ditches, where they prefer shallow, warm areas with mud bottoms (Maxell, 2000). On the Flathead National Forest, toad reproduction has been found at over 100 locations (annual "Herp Days" surveys). Of the 70 sites where boreal toads were observed on the Flathead National Forest in the annual surveys, there were 76 percent in the NL1E riparian landtype, six percent in the FL1C landtype, four percent on lake margins, one percent each in NL1A, and 11 percent outside riparian landtypes, as defined in the 1995 Riparian Landtype Inventory conducted on the Flathead National Forest (Project File Exhibit H-12). These landtypes are found on all Flathead National Forest ranger districts, but comprise a small fraction of the land base. The dominant riparian landtype, NL1E, is characterized by a low gradient (nearly level, valley bottom, two to four percent slopes), with relatively fine substrates (clays, silts, fine and medium sand), with a willow and sedge (NL1E) potential vegetation community. The majority of incidental observations were of tadpoles in roadside ditches or of adults found upland and away from breeding habitat.

Considering NL1E, NL1A, and FL1C riparian land types, there is an estimated 443 acres of toad breeding habitat in the Hungry Lion project area. This estimate is likely biased and underestimates the amount of breeding habitat in the project area, as it does not include large lake shorelines or unmapped small, nearly stagnant water pools on the edges of the South Fork or Middle Fork of the Flathead Rivers.

Considering summer range or dispersal habitat, toads select habitat based on open canopy sites, south facing slopes, occurrence of water and within proximity to high densities of refugia or microhabitat features (downed woody debris, etc.) (E.L. Bull, 2006). Toads may travel long distances between breeding sites. Bull (2009) documented toad movements of more than 0.6 miles (1,000 meters) from breeding pools in a single season. Schmetterling and Young (2008) found toads to disperse over 1.2 miles (2 kilometers), where dispersal movements occurred predominately in riparian areas. Toads overwinter in borrows of rodents, natural ground cavities, or beneath down woody debris (Keinath & McGee, 2005). All considered, toad habitat should contain a mosaic of features including breeding ponds, wet areas, open forest conditions and dense forest conditions with microhabitat features, such as boulders, root wads, down woody debris littered throughout the mosaic.

Timber management, road building, livestock grazing, residential development, agriculture, and recreational activities may have decreased the amount of functional breeding habitat for the western toad throughout the South Fork. Roads can be obstacles for toads as they are slow moving and vulnerable to being run over by vehicles and could be more susceptible to predation when crossing roads. Small wetlands providing breeding habitat are distributed throughout the South Fork drainage.

Fire has historically been one of these predominate forest disturbance factors in the Rocky Mountains. Fire may have short term negative effects to canopy cover and removal of down woody debris, but long-term fire can create abundant down woody debris and convert forest stages to an early stage around wetlands, thereby enhancing the life of the wetland (Maxell, 2000; Pilliod, Bury, Hyde, Pearl, & Corn, 2003). Hossack and Corn (2007) found that toads occupied wetlands in burned areas after fire and that burned-over wetlands did not have increased water temperatures two to three years after fire. Guscio (2007) found that toads selected burned areas in Glacier National Park the year following the Robert Fire.

Population

Population historical data indicates that boreal toads were widely distributed and very common in Montana and other western states, but the species has apparently undergone severe population declines in the past 25 years (Currim, 1996). Surveys in the late 1990s indicate that they are absent from many historic locations and that they now occupy less than 10 percent of suitable habitat (Maxell, 2000). Factors associated with population declines range from natural population fluctuations to the effects of human-induced factors, such as pollution, pesticides, habitat destruction/alteration, increases in ultraviolet radiation, and the introduction of predators or competitors.

The boreal toad is well distributed across western Montana, with over 1,800 observations recorded (Montana Fish Wildlife and Parks, 2010a). Boreal toads were found in 27 percent (11 of 40) of watersheds surveyed across western Montana, and breeding was observed in 21 percent (7 of 33) of the watersheds that have apparently suitable breeding habitat (Maxell, 2000). In the last 10 years, the Montana Natural Heritage Program database has 62 records of this species on Flathead National Forest, including an estimated 58,000 juveniles and immature toads from about 27 sites (USDA Forest Service, 2017a).

The Flathead National Forest has completed amphibian surveys across the forest since 1994. Flathead National Forest monitoring observations included more than 175,000 tadpoles and over 425 adult toads. The number of observations during these surveys fluctuates 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 (USDA Forest Service, 2017a). Amphibian surveys have documented the occurrence of western toads in the Hungry Lion project area and throughout the South Fork (Project File Exhibit H-12). Overall, Maxell's (2000) conclusion for western Montana was that toads were recovering since a decline in the 1980s or were continuing to decline because populations were small, isolated, and/or subject to one or more factors impacting populations separately or synergistically (Maxell, 2000).

Environmental Consequences

Alternative 1 (no-action alternative) – Direct, indirect, and cumulative effects

Under the no-action alternative, there would be no fuels reduction or forest health treatments. There would be no direct effects on the western toad and less overall human disturbance in the Hungry Lion project area as a result of implementing alternative 1.

Indirectly, there could be an increased risk of a stand-replacement fire occurring in or adjacent to the project area. Depending on the specific location and extent of a stand-replacement fire, there is the possibility that vegetation could change enough to trigger hydrologic effects that could affect boreal toad habitat. However, specific effects are not possible to predict. A wildfire event would not necessarily be a negative effect for western boreal toads; a study of boreal toads in Glacier National Park found that they dramatically increased in numbers after fires in 2001 and 2003 (Guscio, 2007).

There are currently established human activities and developments in the project area and throughout the South Fork watershed that have the potential to negatively affect the western toad. These activities include timber management, road building and maintenance, residential development, agricultural use, and recreational activities. Some of these activities have decreased the amount of functional breeding habitat or decreased the security for western toad on non-breeding habitat in the South Fork.

Alternative 1 would not contribute significantly to these cumulative effects, because there would be no additional cumulative effects to breeding habitat as a result of the no-action alternative and no significant direct or indirect effects.

Alternatives 2, 3, and 4 – Direct and indirect effects

Breeding habitat

Wetland complexes (NL1A, NL1E, FL1C) provide important breeding habitat for the toad. Riparian habitat would include wetlands, ponds, or potholes. There are management guidelines and BMPs in place (e.g., INFISH) that mitigate effects to riparian habitat. Riparian buffers riparian habitat conservation areas (RHCAs) restrict activities within a designated distance from streams, lakes, and wetlands (see Aquatics section of this EA). The riparian guidelines in place would help protect important riparian breeding habitat for boreal toad.

None of the action alternatives propose vegetation management activities within riparian habitat conservation areas. Road realignment in Emery Creek would occur within the riparian habitat conservation area. The realignment would reroute the existing road outside of the riparian habitat conservation area and recontour the original roadbed. These realignments would not occur in or near boreal toad breeding habitat. Work within the toad breeding riparian habitat conservation areas would reduce canopy cover and down woody debris, however as the work would occur on an existing road surface currently free of forest vegetation, reductions to woody debris and canopy would be minimal. This reduction may result in displacement of toads from these treated habitats for an unknown amount of time. Some adult toad mortality may occur from machinery working within riparian habitat conservation areas (Keinath & McGee, 2005).

Construction of the fishing pier on Lion Lake may result in sediment and disturbance to the water body. Monitoring of Lion Lake (Project File Exhibit H-12), in the past five years has not detected any evidence of toad breeding. Construction of the pier is not expected to add adverse effects to breeding toad populations in the project area.

Forest habitats

Vegetative treatments and associated construction of temporary and speculative roads would have direct and indirect effects to forest structure and canopy cover. The Hungry Lion Project would maintain a mosaic of early, mid and late-seral forest stages after treatment under alternatives 2, 3, and 4. Microhabitat features, such as down woody debris, root wads, and large rocks are known to influence toad movement and habitat use (Keinath & McGee, 2005). Commercial harvest and slash treatments would reduce down woody debris across the project area. Design features would retain 10 tons per acre of coarse woody debris where available. Snags and live trees would remain well distributed throughout the project area to provide future recruitment of down woody debris. Precommercial treatments would occur in young stands that do not typically contain large amounts of down woody debris, root wags, snags, or other types of microhabitat features important to toads. Reduction of canopy may benefit toad habitat where high canopy cover exists and permanently shades the forest floor. Toads have been found to select for open forest sites when dispersing from breeding habitats (E.L. Bull, 2006). Reduction of canopy would allow more sunlight to reach the forest floor and may benefit toad habitat by increasing areas for thermoregulation (Maxell, 2000).

Mechanical and human activity associated with vegetative treatments may displace toads or result in some mortality within treatment units. The units that have the highest potential to result in displacement or mortality are those adjacent to riparian areas. The majority of toad movements and habitat use has been found to be associated with riparian land types and wet environments. With consideration of riparian habitat conservation area buffers, juxtaposition of treatment units to riparian habitats in the Hungry Lion area, adult mortality or displacement from harvest activities would be minor. This is because the majority of forest conditions between riparian habitats creates a well-connected network of habitat that toads could use for movement and dispersal from breeding wetlands. This network would be maintained under implementation of all action alternatives. Additionally, spring period restrictions for grizzly bears would limit commercial activities to occur during drier periods of the summer time (after June 30). Implementation of activity during winter months when toads are hibernating and not active or dispersing on the forest floor would decrease likelihood of mortality or displacement (Maxell, 2000).

Prescribed fire

Upland burning would decrease canopy cover and fire would consume down woody debris removing some microhabitat features that toads could use for overwintering or as cover from predators. The proposed burning area would not encompass any toad breeding habitat. In the long term, burning would likely have neutral effects to toads and toad habitat due to the high elevation of the proposed burning sites and the distance to breeding habitat.

Road construction, road maintenance and trails

Construction of temporary and speculative roads or road maintenance may result in some toad mortality or contribute sediment to road-side ditches impacting potential breeding. Roadside ditches are not considered quality breeding habitat by this analysis as these areas only provide shallow water areas that rarely result in functional breeding. Based on monitoring and the

estimated amount of toad breeding habitat in the project area, effects to poor quality road side ditch ponds would not result in adverse impacts to toads in the project area. Alternative 2 would have the greatest impact to boreal toads as it has the largest mileage of road construction. Alternative 4 would have the least impact.

Alternatives 2, 3, and 4 – Cumulative effects

There are currently established human activities and developments in the Hungry Lion project area that have a potential to negatively affect the western toad. These activities include timber management, road building and maintenance, residential development, agricultural use, and recreational activities. Some of these activities have affected the amount of functional breeding habitat or decreased the security for western boreal toad on non-breeding habitat in the project area.

There have been past harvest activities within the project area including the Hungry Horse/West Glacier Fuels Reduction, Paint Emery, Firefighter, and Belton Fuels. These projects have altered the forest mosaic and juxtaposition of cover within the project area. These projects were considered in the habitat baseline.

While other factors outside of the Forest Service control could be associated with toad population declines (such as pollution, bacterial or fungal infection, climate change, and increases in ultraviolet radiation), based on the above analysis, management actions taken on the Flathead National Forest would continue to provide sufficient habitat composition, structure, and processes for the western toad (USDA Forest Service, 2017a). There appears to be little risk of population loss across the Flathead National Forest; species viability would be maintained.

Summary of Effects and Determination

The proposed activities in the project action alternatives were evaluated based on potential effects to toad breeding habitat, impacts to upland forest habitats, and potential to contribute to toad mortality. Based on the project alternatives, alternative 2 would have the largest impact on toads in the project area, alternative 3 the next largest and alternative 4 would have the least, primarily due to the fact that there would be no road construction and the alternative would have the least acres treated. The project activities would minimally affect breeding habitat and other than Lion Lake, no activities would occur within riparian habitat conservation areas adjacent to toad breeding habitat. Monitoring has indicated that Lion Lake is not active breeding habitat and recreational improvements would affect a small portion of the lakes shoreline and contribute minimal disturbance to potential breeding toads. Toad mortality may occur from project activities; however based on literature and monitoring, no negative population effects are likely. Toad breeding and upland forest habitat would remain well connected and distributed across the project area with the implementation of any of the action alternatives. Toad viability would be maintained under all the project alternatives.

In accordance with Forest Service Manual 2600, a determination has been made on the impact the proposed activities could have on sensitive species. Based on available information on the boreal toad's habitat requirements, and management strategies, as well as project design and location, the determination for alternative 1 is "no impact;" the determination for alternatives 2, 3, and 4 is "may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or loss of viability to the population or species."

Fisher

Existing Condition (Affected Environment)

Habitat

Fishers are larger, weasel-like predators that occupy a variety of upland and lowland forests, with an affinity for forested riparian habitats. Fishers occur most commonly in landscapes dominated by mature forest cover, and they prefer late-seral forests over other habitats (Eric C. Lofroth et al., 2010; Powell & Zielinski, 1994). However, in two studies in the northern Rockies, fishers have also been observed using young to medium-age stands of conifers (J. L. Jones, 1991; Roy, 1991). In central Idaho, for example, fishers preferred “mature forest” (13.5 to 18.5 inches d.b.h.) and “old growth forest” (greater than 18.5 inches d.b.h.) in summer, but have been detected in “young forest” (4.5 to 13.5 inches d.b.h.) in winter (J. L. Jones, 1991). While these younger stands may not provide the structural diversity necessary for denning or resting (although they may) especially in stands that are regenerating after fire or timber harvest in which large live and dead trees were retained, prey availability may be high enough to support fishers, particularly in winter months (J. L. Jones, 1991).

Habitat associations vary across the range of fishers. In the northern Rockies, evidence suggests fishers are most commonly associated with mesic mixed conifer forest types (K. S. Heinemeyer, 1993; J. L. Jones, 1991; Powell & Zielinski, 1994). In the Cabinet Mountains of Montana, fishers selected mixed conifer and cedar/hemlock forests and avoided subalpine and hardwood stands; north slopes were selected, whereas south slopes were avoided (K. S. Heinemeyer, 1993; Roy, 1991). In central Idaho, Jones (1991) found that fishers selected sites that were dominated by grand fir, Engelmann spruce, and cedar/hemlock, and avoided drier sites (ponderosa pine, upland subalpine fir, and xeric grand fir), although these sites were rare in the study area, occupying only a small proportion of the sampled area. Schwartz et al. (2013) found that fisher were selecting for habitat at two scales:

1. A stand scale as indicated by stands that have large mean and maximum d.b.h. trees (as well as a large variation in tree size) and
2. A landscape scale as indicated by the preference for landscapes with a high proportion of large trees.

The authors suggested that that while fishers can be detected in riparian stringers that bisect open landscapes, this habitat may not be sufficient for persistence (M. K. Schwartz et al., 2013).

Fisher occurrence in the Rocky Mountain region was positively correlated with canopy cover up to an apparent threshold of 60 percent. Previously, it was thought that fishers in western North America may favor riparian forests (Eric C. Lofroth et al., 2010). The majority of fisher locations from studies in the Northern Rockies were near riparian areas: 65 percent of locations were within 200 meters of water in the Cabinet Mountains (K. S. Heinemeyer, 1993), and 70 percent of locations were within 328 feet (100 meters) of riparian areas in central Idaho (J. L. Jones, 1991). Other research, has found that fishers use forest outside of riparian areas. Although riparian forests were important to fishers in some locales in British Columbia primarily for denning habitat (e.g., black cottonwood [*Populus balsamifera trichocarpa*] forests), Raley et al. (2012) did not detect consistent use or selection for riparian forests. Although riparian habitats may be especially useful for fishers, many upland habitats also offer a combination of the habitat characteristics associated with fisher use.

Hillis and Lockman (2003) mapped fisher habitat in the northern region, where fishers are generally limited to west of the Continental Divide, fisher habitat was defined as low-to-mid elevation, mesic, mature, and old forests, within 328 feet (100 meters) of streams. To address patch size and habitat connectivity relevant for fishers, they excluded any patch of habitat that was less than 160 acres and more than 600 feet from the nearest patch of adjacent cover (J. L. Jones, 1991; Ruggiero, Aubry, Buskirk, Lyon, & Zielinski, 1994). That habitat was compared against levels of habitat that would have been available in pre-fire suppression/pre-logging periods. What they found was that fisher habitat occurs at historically normal levels at both the Flathead National Forest and the U.S. Forest Service Northern Region scales. More recently, Samson (2006) showed that on the Forests and the region as a whole, forested ecosystems are more extensive now than in historic times. Research on fisher is ongoing. Multiple agencies and organizations, including the Forest Service, are currently conducting surveys to detect fisher in the Rocky Mountains. Fishers are more difficult to monitor than most species, and monitoring results are often inconclusive (USDA Forest Service, 2017a). Fisher research is ongoing in the northern region. The goals of current research and monitoring are to:

- Delineate the geographic range of fisher;
- Determine which Rocky Mountain fisher populations have native genes; and
- Index the abundance of fisher in the different populations.

Fishers are thought to need good snow interception in the winter months (Allen, 1983). Structural complexity appears is important to fisher habitat selection (multiple forest layers, abundant down woody debris, and live and dead trees with cavities) (Raley et al., 2012). The fisher preys on small mammals (snowshoe hare, grouse, voles, squirrels, mice, etc.) and carrion. Structural complexity provides habitat for fisher prey in close proximity to sites for resting. Sites used by the fisher for shelter or sleeping include hollow logs, tree cavities, brush piles, and used burrows and/or dens. Reproductive dens tend to be hollow cavities high in trees. These dens are typically in the oldest and largest trees available (Naney et al., 2012).

In the northern Rockies, fishers have existed under a disturbance regime that has created numerous openings in a matrix of mature forested habitats. While fire can result in destruction of some late successional habitat, it is also responsible for maintenance and creation of habitat features important to fisher (Hayes & Lewis, 2006). The denser, coniferous stands near water, which are preferred by fisher, would have experienced longer intervals between fires than drier, more open forest lands. The increased pulse of large logs on the ground that would have followed a fire or insect event would have been beneficial.

Fishers are thought to be among the most habitat-specialized mammals in North America (Hayes & Lewis, 2006). Fragmentation can affect fisher's use of the landscape because moderate to high amounts of contiguous cover are a consistent predictor of fisher occurrence at large spatial scales. In California, Zielinski et al. (2013) examined fisher scat densities as an index of use when comparing two fuels reductions means classified as restorative and extractive. The research found low fisher scat densities in areas with regeneration treatments and relatively high scat densities (used as an index of fisher habitat use) in areas that used thinning, underburning and individual tree selection to accomplish fuel reduction means. Hayes et al. (2006) discuss how fisher may still use forest stands where small patch cuts or light harvest may have little negative impact on fisher if adequate late successional forest habitat is available.

In Idaho, Sauder and Rachlow (2014) found that the landscape scale fisher selected areas of mature forest arranged in more contiguous patches with low abundance of open forests. At

smaller scales, within a home range, fisher selected for some forest heterogeneity with moderate amounts of forest edge (Joel D Sauder & Rachlow, 2015). These home range areas were comprised of approximately 56 percent mature forest with open areas of consisting of approximately six percent of the area.

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). Fishers generally avoid areas with low canopy cover and conversely prefer large areas of contiguous interior forest with vegetative and structural aspects that lead to abundant prey.

Home range size may vary based upon many factors, but the average home range for a female fisher is expected to be about 15 square miles (J. L. Jones, 1991). The project area boundary was used to determine effects of the proposed activities upon fisher. It is large enough to include a few fisher home ranges and is representative of effects of timber harvest, temporary road construction, road management, prescribed and natural fires, natural tree mortality, and other factors across the landscape. It is large enough to evaluate the ability of the habitat to support recovery of this species, but small enough to not obscure effects of the alternatives. All of the actions proposed in the alternatives are contained within this area.

Potential fisher habitat was defined as mature and late seral forests with a dominant spruce/fir or cedar component less than 6,300 foot elevation in the project area (Project File Exhibit H-10). Important resting/denning habitat was further defined as within 328 feet (100 meters) of perennial riparian landtypes and features (Project File Exhibit H-10). There are 5,613 acres of potential fisher habitat within the project area. Within 328 feet (100 meters) of water, there are approximately 2,276 acres of important resting and denning habitats in the project analysis area. These two classifications combine for 7,890 acres of habitat within the project area. Other foraging habitat and forest stands with sufficient canopy (greater than 50 percent) for travel exist within the project area (Project File Exhibit H-10).

Population

Fishers are common in the northeastern and midwestern portions of the United States, but rarer in the west. Restrictions on harvesting, and reintroduction programs in the late 1950s, have contributed to population recovery in portions of the fisher's historic range. In the Rocky Mountains, they occur in Idaho, Wyoming, and Montana. The fisher population in the Northern Rockies was reduced dramatically in the 1800s and early 1900s through overtrapping, predator and pest control, and alterations of forested habitats by logging, fire, and farming. Fishers were presumed extirpated from Montana at one time, as there were no trapping records in Montana from 1920 to 1960 (Vinkey, 2003). Within Montana and Idaho, over a million acres of mature coniferous forest burned in the early part of the 20th century. This may have played a role in the decline of fisher populations.

The fisher was petitioned for listing as a TES in 2009. On April 16, 2010, the U.S. Fish and Wildlife Service found that the petition presented substantial scientific or commercial information indicating that listing a distinct population segment of fisher in the northern Rocky Mountains of the United States could be warranted. Therefore, with the publication of that notice, the U.S. Fish and Wildlife Service initiated a review of the status of the species to determine if listing the fisher in the northern Rocky Mountains of the United States was warranted. After review of all available scientific and commercial information, the U.S. Fish and Wildlife Service found that listing the fisher in the U.S. Northern Rocky Mountains, which includes portions of Montana, Idaho, and Wyoming, as threatened or endangered was not warranted at this time. The fisher was not listed

as endangered or threatened (USDI fish and Wildlife Service, 2011a). Fishers were petitioned again for listing in September 2013. The status of this petition is currently pending.

At the U.S. Forest Service Northern Region scale, Samson (2006) concluded that fishers (as well as the American marten, pileated woodpecker, northern goshawk, black-backed woodpecker, and flammulated owl) were secure in terms of their persistence throughout their range. Potential habitat for the fisher was found to be plentiful throughout the northern region, as Samson (2006) showed that the Forests and the region as a whole had not declined to a critical 20 to 30 percent threshold of historic habitat remaining on the landscape, and forested ecosystems are more extensive now than in historic times (USDA Forest Service, 2017a).

The Montana Fish Wildlife and Parks conducted 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 (USDA Forest Service, 2017a). Winter track surveys are often inconclusive, as well. The size of fisher tracks overlaps with the size of marten tracks, so positive identification is difficult.

On the Flathead National Forest, after 1968, fisher occurrence was verified in the Flathead, Mission, Swan, and Whitefish Ranges (Vinkey, 2003). Hair snares to collect fisher hair for DNA confirmation have been put out in winter on various portions of the Flathead National Forest from 2007 to 2010, and multi-species bait stations have been used across the forest from 2012 to 2016, but fisher presence has not been confirmed (Curry et al., 2016). Fishers are assumed to occur in the Hungry Lion project area for this analysis, however based on monitoring efforts the species is suspected to be absent from the project area. Fisher exist naturally at very low population densities and are difficult to detect through conventional monitoring. Additionally, when using non-invasive sampling techniques, such as hair collection, not every sample will yield quality DNA for analysis (SWCC, 2014).

There is no ongoing fisher research trapping/telemetry effort on the Flathead National Forest. A larger-scale assessment for this species was also conducted to address population viability concerns (USDA Forest Service, 2017a).

Environmental Consequences

Alternative 1 (no-action alternative) – Direct, indirect, and cumulative effects

No forest treatment would be implemented in the project area under this alternative. There would be no direct effect to canopy cover on NFS lands, and any existing or potential resting/denning sites would be maintained. Human activity and associated disturbance would be the least under this alternative.

There have been past harvest activities within the project area including the Hungry Horse/West Glacier Fuels Reduction, West Side Vistas, Paint Emery, Firefighter, and Belton Fuels. These projects have altered the forest mosaic, reduced mature canopy forest and the juxtaposition of suitable forest stands for fisher habitat within the project area. These projects were considered in the habitat baseline.

Indirectly, under the no-action alternative, it could be anticipated that larger more intense fires could occur within the project area than would have occurred under more historic fire and fuel loading conditions. Large, severe, stand-replacing fire could remove large amounts of fisher

habitat throughout the project area. Though precise impacts of such fires would be dependent on location of the fire start, weather conditions at the time, fuel conditions at the fire origin, and many other factors, to the degree that such fires were stand replacing, they would tend to reduce the amount of fisher habitat available due to the high probability these fires would start during the warmest, driest parts of the season.

Alternatives 2, 3, and 4 – Direct and indirect effects

Potential habitat

Alternative 2 would affect the greatest amount of potential fisher habitat in the project area and alternative 4 would affect the least (Table 103). Upland prescribed fire would not occur in areas that provide potential fisher habitat. Various vegetation treatments would have different effects to potential fisher habitat. These are described by alternative and treatment type in Table 104.

Table 103. Acres of potential fisher habitat treated by Hungry Lion alternatives

Alternative	Potential Habitat Affected by Vegetation Treatments	% of Potential Habitat in Project Area
Alternative 2	803	14.3%
Alternative 3	563	10%
Alternative 4	269	4.8%

Table 104. Summary of effects to potential fisher habitat by action alternative

Treatment Type	Alternatives			Potential Effects to Fisher Habitat
	Alt. 2 Acres of Habitat changed	Alt. 3 Acres of Habitat Changed	Alt. 4 Acres of Habitat Changed	
Commercial Thin	486	369	26	Harvest would reduce mature tree density and open up forest stand. Largest trees would be retained, but long-lived fire resistant species would be promoted. Mature spruce and alpine fir would be decreased throughout treatment areas. Areas within 20-30 feet around large diameter long-lived fire-resistant species would be opened up for daylighting. Post-harvest canopy is estimated to be approximately 40%. Forest floor would still provide some prey habitat. Fisher habitat quality would be reduced, and denning/resting sites would be reduced. Fisher travel through stand may occur if the unit has sufficient patches of understory vegetation, down woody debris and structure maintained.
Understory Removal	63	40	63	Understory trees would be removed and forest stand opened up. Understory vegetation density would decrease. Largest trees would be retained favoring long-lived fire resistant species. Fisher habitat quality would be reduced. Post-harvest canopy is estimated to be approximately 40%. Without understory structure present fisher travel and forage is unlikely.
Group Selection	16	16	16	Small areas (few acres) in the unit would be cleared and the result would be small patches of forest

Treatment Type	Alternatives			Potential Effects to Fisher Habitat
	Alt. 2 Acres of Habitat changed	Alt. 3 Acres of Habitat Changed	Alt. 4 Acres of Habitat Changed	
				clearings. These clearings would be avoided by fisher until sufficient trees regenerate to provide cover. The remainder of the stand outside of the selected clearings may still be used for fisher.
Seed Tree/ Shelterwood	235	136	162	Few mature trees would remain after treatment. The acres would become unsuitable fisher habitat after treatment. The acres would be avoided by fisher until sufficient trees regenerate to provide travel cover.
Spec Cut- Recreation	2	2	2	These treatments would occur at recreation sites. Treatments would include a light and very selection removal of trees of all sizes. Snags and denning/resting structures would be reduced within these treatments and forest structure would be modified. These treatments would retain some forest structure for fisher travel or foraging, but based on these specificity of these treatments at recreation sites this analysis assumes the acres would be avoided by fisher after treatment.
Total	803	563	269	--

Fishers evolved in forest types where fire frequency and intensity was mixed, and wind-throw was common, resulting in complex and intricate landscape mosaic of young, mixed-age, and late-seral components (J. L. Jones, 1991). Old growth habitats have a high potential of providing high quality fisher habitat. No old growth would be treated under the project action alternatives. Thinning of forest conditions may reduce habitat conditions for some fisher prey species (e.g. snowshoe hare; voles; mice), but understory structure retained in the form of patches of understory conifers, hardwood trees species, large down woody debris and snags may provide retain for other species, such as squirrels, grouse, etc. Snag retention standards could provide future denning/resting structures as canopy from commercial thinning fills in and forest understory reinitiates over the following 30 years. The units that would most impact fisher potential habitat are units 5, 11, 51, 58, 59, 60, 68, 77 and 83.

Regeneration harvest and group selection treatments would remove potential fisher habitat and would be avoided by fisher. These treatments would result in unsuitable forest conditions for fisher and would be avoided for the next 50 years.

Stand-alone precommercial thinning treatments would occur in young stands typically avoided by fisher. These treatments would not occur in potential fisher habitat, but would release residual trees decreasing the time for these stands to become mature and provide appropriate habitat conditions for fisher travel and foraging. Pole and pole harvest would not affect potential fisher habitat. Shaded fuel breaks would not affect fisher habitat, however fuel breaks would decrease forest cover and result in long linear units along NFS Road 38. These openings would be avoided by fisher and combined with the road area would reduce potential of fisher habitat connectivity between potential habitat to the north and south of Road 38 in the project area. Other mature forest and riparian habitat conservation area would still provide mature forest connection for fisher travel on either side of Road 38 in the project area.

While vegetation treatments may reduce quality of potential habitat by removing spruce/fir, decreasing stand density, and decreasing understory density, the harvest would reduce potential for stand-replacing fire and protect large-diameter trees from wildfire. High-intensity stand-replacing fire could reduce potential fisher habitat over very large forested areas throughout the project area. Indirectly, over time, harvest treatments would increase growth and resilience of large trees to disturbance within the project area. Over the next 30 years, shade-tolerant trees could regenerate in the understory providing multi-story characteristics with large diameter trees in the overstory. The harvest treatments may again develop into potential fisher habitat and denning/resting features over time (Project File Exhibits H-10).

Potential habitat within 100 meters of riparian features

Of the total denning/resting fisher habitat acres affected, alternative 2 would affect approximately 234 acres of denning/resting habitat in the project area through proposed harvest activities. This is approximately 10.3 percent of the total potential habitat within 328 feet (100 meters) of riparian features. Alternative 4 would be the least impactful to denning/resting habitat (Table 105). Table 106 summarizes effects to important denning/resting habitat by treatment type within 328 feet (100 meters) of riparian features.

Table 105. Acres of potential fisher habitat treated by Hungry Lion alternative

Alternative	Potential Habitat Affected by Vegetation Treatments	% of Potential Habitat in Project Area
Alternative 2	234	10.3%
Alternative 3	172	7.6%
Alternative 4	152	6.7%

Table 106. Summary of effects to important fisher denning/resting habitat by treatment prescription

Treatment Type	Alternative			Potential Effects to Fisher Habitat
	Alt. 2 Acres of Habitat Changed	Alt. 3 Acres of Habitat Changed	Alt. 4 Acres of Habitat Changed	
Commercial Thin	106	94	44	Harvest would reduce mature tree density and open up forest stand. Largest trees would be retained, but long-lived fire resistant species would be promoted. Mature spruce and alpine fir would be decreased throughout treatment areas. Areas within 20-30 feet around large diameter long-lived fire-resistant species would be opened up for daylighting. Post-harvest canopy is estimated to be approximately 40%. Forest floor would still provide some prey habitat. Fisher habitat quality would be reduced, and denning/resting sites would be reduced. Fisher travel through stand may occur if the unit has sufficient patches of understory vegetation, down woody debris and structure maintained.
Understory Removal	6	6	6	Understory trees would be removed and forest stand opened up. Understory vegetation density would decrease. Largest trees would be retained favoring long-lived fire resistant species. Fisher habitat quality would be reduced. Post-harvest canopy is estimated to be approximately 40%.

Treatment Type	Alternative			Potential Effects to Fisher Habitat
	Alt. 2 Acres of Habitat Changed	Alt. 3 Acres of Habitat Changed	Alt. 4 Acres of Habitat Changed	
				Without understory structure present fisher travel and forage is unlikely.
Seed Tree/ Shelterwood	115	65	95	Few mature trees would remain after treatment. The acres would become unsuitable fisher habitat after treatment. The acres would be avoided by fisher until sufficient trees regenerate to provide travel cover.
Spec Cut- Rec	7	7	7	These treatments would occur at recreation sites. Treatments would include a light and very selection removal of trees of all sizes. Snags and denning/resting structures would be reduced within these treatments and forest structure would be modified. These treatments would retain some forest structure for fisher travel or foraging, but based on these specificity of these treatments at recreation sites this analysis assumes the acres would be avoided by fisher after treatment.
Total	234	172	152	--

Harvest activities within denning/resting habitats would open forest stands, reduce denning/resting structures, and reduce canopy cover. Units that have the most impact to fisher denning/resting habitat are 11, 59, 60, and 68.

As mitigation for snag and down woody associated wildlife species, including fisher, snags and down woody material would be retained in all cutting units (see design features). The prescriptions for treatment would be designed to retain a minimum average of six snags per acre that are 12 to 20 inches d.b.h.; all snags greater than 20 inches d.b.h. would be left. If existing snag densities are below these densities, substitute live trees would be left. All standing dead western larch, ponderosa pine, and Douglas-fir trees 16 inches d.b.h. or greater would be retained, if possible. Generally, snags to be left would be further than 150 feet from open roads and private land boundaries. Snags that pose a safety hazard to the contractor's operation would be removed. In addition to these snag retention criteria, the minimum retention for down woody material would be approximately 10 tons per acre, where available. To achieve the tonnage required, down woody material, which includes the longest material available (e.g., 16 feet long or longer) with the largest diameters available (e.g., 15 inches d.b.h. or greater), would be retained, in sufficient amounts to achieve the required tons per acre. It should be noted that if the snag/down woody material that is left is not in an area with less than 50 percent canopy cover, it is highly unlikely that the snag or down woody structure would be usable by fisher until sufficient canopy cover and forest structure return.

Where fisher habitat is decreased through harvest, riparian habitat conservation areas and other untreated important denning/resting habitat would still exist throughout the project area. Based on the acres affected and the spatial distribution of the effects, fisher denning/resting habitat would continue to be distributed throughout the project area under all action alternatives. Vegetation treatments would increase open forest and contribute to forest edge within the project area. Outside of both fisher potential and denning/resting habitats closed canopy forest would still exist providing secondary forest areas for fisher travel between habitat patches.

Habitat security

Fisher are assumed to be present in the Hungry Lion project area and it is possible that short-term displacement of fisher could occur in proposed treatment areas during the winter or summer months that activities could be implemented; this short-term displacement would probably be minor as displacement effects would cease once activity is completed. The highest potential for displacement would occur in denning/resting stands within 328 feet (100 meters) of riparian features. Potential displacement from aquatic restoration projects may occur, but is unlikely because these projects would be short-term and not located in potential fisher habitat. Spring timing restrictions would decrease displacement effects. Security core for grizzly bears would still provide large, relatively disturbance free areas for fisher. Fishers are not known to avoid forest roads or nonmotorized trails. Roads used for the Hungry Lion activity activities would remain closed to the public and the project would not increase public access beyond the existing condition. Recreational trails and other recreational improvements are not expected to impact fisher.

Road maintenance, road construction, rehabilitation, recontouring, reclamation and realignment may result in some displacement when occurring in or near fisher potential or denning/resting habitat. Potential displacement would be small and short-term. Road realignment in Emery Creek may remove some trees or snags on road beds when rerouting. The effects to fisher habitat would be small with impact located on along a relatively narrow linear route. Impacts to potential and denning/resting habitat would be obscured by those of unit 68 (discussed above).

Alternatives 2, 3, and 4 – Cumulative effects

Habitat loss and fragmentation have been considered a threat to fisher (Eric C. Lofroth et al., 2010; Naney et al., 2012; Ruggiero et al., 1994). There have been past harvest activities within the project area including the Hungry Horse/West Glacier Fuels Reduction, Paint Emery, Firefighter, and Belton Fuels. These projects have altered the forest mosaic and juxtaposition of cover within the project area. These projects have decreased mature forest and canopy cover within the project area. These projects were considered in the habitat baseline.

Fishers generally avoid areas with significant human disturbance and conversely prefer large areas of contiguous interior forest with vegetative and structural aspects that lead to abundant prey. Other activities are known to occur in the project area including recreational trapping, firewood cutting, and motor vehicle use on open roads within the project area. Fisher are not known to avoid forest roads or trails. Road closures for grizzly bears in the project area have limited access by firewood cutters and recreational trappers in the project area.

Jones (1991), Vinkey (2003), Lofroth et al. (2010) and others have concluded that fishers are extremely vulnerable to trapping, both intentional and incidental trapping with overtrapping in the early history of the United States contributing to the reduction in size and presumed extirpation across the species' range. Montana has a quota system for fishers. The total fisher quota is seven, and fisher trapping is only open in the U.S. Forest Service Northern Region and the U.S. Forest Service Rocky Mountain Region; the Flathead National Forest is in Trapping District One, encompassing most of northwest Montana. This area has a quota of two fishers. Based on the most recent trapping summary available, two fishers were harvested in trapping district one in the winter of 2013-2014. No fisher have been trapped in Flathead County in the past 10 years. Regulated trapping in Montana is managed by the Montana Fish Wildlife and Parks. Motorized access for trappers would not increase above the existing condition due to proposed activities under any alternative. Road storage and rehabilitation would decrease hiking, horseback, or

bicycle access on roads in the project area due to aggressive use of recontouring road entrances, placement of natural debris, and planting on road surfaces. This decrease of access would benefit fisher security. Roads used from project activities would remain closed to the public during project implementation. There would be no net change in road densities after project implementation. Recreational trails would facilitate human access; however, proposed trails would only minimally overlap with small patches of potential fisher habitats in the project area. Given the existing snowmobile access in the project area, recreational trails are not expected to increase public access for trapping from the existing condition.

While other factors outside of the Forest Service's control (such as trapping, predator/pest control, or alteration of private forest habitats) could be associated with fisher population decline, management actions taken on the Flathead National Forest would provide the habitat composition and structure for fisher across the forest. There would continue to be adequate old growth, riparian habitat, and mid- to late-seral forest matrix habitat to maintain connectivity of functional home ranges (USDA Forest Service, 2017a). There appears to be little risk of population loss across the Forest and region due to forest management activities (USDA Forest Service, 2017a).

Summary of Effects and Determination

The proposed activities in the project action alternatives were evaluated based on potential effects to fish potential and denning/resting habitats, design of the project, and existing habitat security in the project area. The project activities would impact approximately five to 15 percent of fisher potential habitat and seven to 10 percent of fisher denning resting habitat in the project area. Alternative 2 would be the most impactful to fisher habitat. Fisher habitat would remain distributed throughout the project area and large contiguous patches of fisher habitat would remain after project implementation under all action alternatives. Riparian areas and dense, mature, closed canopy forest would remain providing travel connections between habitat patches within the project area. There would continue to be a matrix of forest habitat to provide for fisher foraging and denning resting habitat within the project area and throughout the Flathead National Forest. Viability of fisher populations would be maintained under the Hungry Lion Project.

In accordance with Forest Service Manual 2600, a determination has been made on the impact the proposed activities could have on sensitive species. Based on available information on the fisher habitat requirements, and management strategies, as well as project design and location, the determination for alternative 1 is "no impact;" the determination for alternatives 2, 3, and 4 is "may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or loss of viability to the population or species."

Analysis Summary for Sensitive Species with No Impact

Table 107. Sensitive species analysis summary – species with no impact

Species (Status)	Species Presence	Habitat Presence	Determination
Harlequin Duck (S)	Harlequin ducks are monitored on the Flathead National Forest on an annual basis. Harlequin ducks have not been observed in the	In Montana, most harlequin ducks breed and feed in fast moving, low gradient streams. There are no known nests and no suitable harlequin	This project would have "no impact" upon this species because there is no breeding or feeding habitat in the

	Hungry Lion project area. Statewide, harlequins are most abundant in western Montana. Monitoring efforts on the Flathead National Forest and in Glacier National Park indicate that harlequin populations are stable, with at least 159 nesting pairs in Montana (USDA Forest Service, 2017a).	duck breeding streams in the project area.	project area. Further, the project proposes no activities near potential breeding or feeding habitat. Therefore, the project would not result in loss of species viability or create a significant trend toward federal listing.
Peregrine Falcon (S)	The Montana Peregrine Watch monitors peregrine activity in Montana. There are no known nests or territories in the project area. The number of known active peregrine falcon territories in Montana has increased dramatically from 0 in the mid-70s to 84 active territories in 2009 (USDA Forest Service, 2017a).	There is no suitable nesting habitat in the project area. The closest known nest is located outside of Hungry Horse in Badrock Canyon. Peregrines are not likely to feed or travel through the project area, but would be most likely to feed or travel through more open valley habitats to the north or east of the project area.	This project would have “no impact” upon this species because there is no breeding or feeding habitat in the project area. Therefore, the project would not result in loss of species viability or create a significant trend toward federal listing.
Northern Leopard Frog (S)	Historically, this species has been documented at very few western Montana valley-bottom sites near Kalispell/Kila; near Eureka, and near the Nine Pipe National Wildlife Refuge. Due to these adjacent sightings, this species is listed on the Flathead National Forest’s sensitive species list, but none have been documented on the Flathead National Forest since about 1950, despite extensive amphibian surveys on the Flathead National Forest within the past 14 years (USDA Forest Service, 2017a).	Breeding habitats used by northern leopard frogs in Montana include low elevation and valley bottom ponds, spillway ponds, beaver ponds, stock reservoirs, lakes, creeks, pools in intermittent streams, warm water springs, potholes, and marshes with emergent vegetation. In summer, adults and juveniles commonly feed in open or semi-open wet meadows and fields with shorter vegetation, usually near the margins of water bodies. They do not use drier upland habitats. They are inactive in the winter.	This project would have “no impact” upon this species because there are no observations of leopard frog in the South Fork and the project area has no habitat. Therefore, the project would not result in loss of species viability or create a significant trend toward federal listing.
Rocky Mountain Bighorn Sheep (S)	There are no herds that are resident on the Flathead National Forest. The closest resident herd is on Wild Horse Island in Flathead Lake (USDA Forest Service, 2017a). Bighorn sheep populations in the 3 resident herds adjacent to the Flathead National Forest are relatively stable, but may be susceptible to periodic die-offs due to infection (Montana Fish Wildlife and Parks, 2010b). Bighorn sheep are not found in the Hungry Lion project area.	Bighorns prefer cliffs and mountain slopes, as well as rolling foothills. Dispersers will sometimes cross intermountain valleys. Snow depth is most important in the winter and availability of high quality green forage is most important in the spring and summer. Immediate or nearby cliffy-rocky areas are important year-round. Semi-open to open vegetation types with presence of grasses are preferred (Montana Fish Wildlife and Parks, 2010b).	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, the project would not result in loss of species viability or create a significant trend toward federal listing.

Townsend's Big-eared Bat (S)	Extensive bat surveys were conducted on the Flathead National Forest in 2006 and 2007. Specialized equipment that detects night-time echolocations of bats was also used. Researchers encountered difficulty in identifying species using echolocations, so this data is still being analyzed. One male Townsend's big eared bat (COTO) was captured in a mist net in the South Fork subwatershed (USDA Forest Service, 2017a). This location was not in the project area. Townsend's big-eared bats are unusually difficult to survey for because they are "quite effective at avoiding mist-nets" and difficult to detect acoustically because they use low-intensity calls (Hendricks & Maxell, 2005). Statewide, this bat is found at numerous locations in western Montana and also at scattered locations across other parts of the state. Mining sites in other portions of Kerr Mountain, and Big Mountain have been surveyed for big-eared bats and none were detected.	Caves, abandoned mines, and, less frequently, old buildings are used for maternity roosts and hibernacula. There is no habitat suitable for maternity roosts or hibernacula within the project area. The foraging behavior of this bat has not been reported or studied in Montana. In California, the mean center of feeding activity was 3.2 kilometers from their cave for females and 1.3 kilometers for males. Townsend's big-eared bats feed on various nocturnal flying insects near the foliage of trees and shrubs, especially near meadows and streams. Although there are meadows and streams in the project area, this habitat is such a long distance from areas with suitable breeding or roosting habitat that it is highly unlikely to be used by Townsend's big-eared bats.	This project would have "no impact" upon this species because there are no caves, abandoned mines or old buildings that could be used for maternity roosts or hibernacula within 5 miles of project activities. Therefore, the project would not result in loss of species viability or create a significant trend toward federal listing.
Northern Bog Lemming (S)	Reliable detection of bog lemmings requires a trapping effort. Bog lemmings have been documented at 21 widely scattered locations in western Montana (USDA Forest Service, 2017a). They appear to be absent from areas of potentially suitable habitat, but the reasons are not understood. In Montana, the northern bog lemming is at the southern margin of its global distribution and the project area may be beyond its limits.	Northern bog lemmings have a small home range of less than 1 acre. On the Flathead National Forest, potential habitat is identified as a specific subset of riparian landtypes NL1A or NL1E, which includes sphagnum bogs or fens with sphagnum moss, grasses, and sedges. The Hungry Lion project area does not have specific bog or fen sites used by northern bog lemmings and none of the proposed RHCA treatments would occur within bog lemming habitat.	This project would have "no impact" upon this species because there is no breeding or feeding habitat in the project area. Therefore, the project would not result in loss of species viability or create a significant trend toward federal listing.
Flammulated Owl (S)	The Forest Service conducted a regional survey of 243 flammulated owl detections across western Montana and Idaho in 2005. Additional flammulated owl monitoring was conducted in the project area in 2013. No flammulated owls were	In Montana, flammulated owls are associated with mature and old-growth xeric ponderosa pine/Douglas-fir stands. Habitat modeling done by the U.S. Forest Service Northern Region, based on past research findings and using forest	This project would have "no impact" on this species because there is no habitat within the project area and no activities are proposed for old growth stands. Therefore, the project would not result in loss

	detected. Flammulated owls have been detected in the Swan Valley in Dog Creek, but have not been detected in the project area. Flammulated owls are believed to have low abundance on the Flathead National Forest due to low natural occurrence of habitat (USDA Forest Service, 2017a).	inventory and analysis information, produced a summary of habitat estimates for the flammulated owl by national forest (Samson, 2005). At the region-wide and Ecological Province level, habitat for the flammulated owl is abundant and well-distributed in the northern region. Habitat on the Flathead National Forest is estimated to be approximately 5,741 acres (0.3% of the Flathead National Forest), according to an update to Samson's 2005 paper (F. Samson, 2006). On the Flathead National Forest, the stands preferred for nesting by flammulated owls are naturally limited by climate, terrain and soil conditions. The project area is composed of very little warm-dry forest types (see Vegetation section of this EA and has no ponderosa pine cover types that currently contain the forest structure to provided flammulated owl habitat.	of species viability or create a significant trend towards federal listing.

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Management Indicator Species: Big Game Species

Introduction

White-tailed deer, mule deer, and elk are Management Indicator Species (MIS) for commonly hunted big game species on the Flathead National Forest (USDA Forest Service, 2001a). Meeting the habitat needs for white-tailed deer, mule deer, and elk would indicate that the habitat needs for other commonly hunted big game species, such as black bear, mountain lion, and moose, would also be met. Habitat needs that each of these species has in common would include cover (hiding and thermal), forage, and security (Witmer, Martin, & Sayler, 1998).

Natural disturbances, such as fire or major insect infestations, and man-caused disturbances, including timber harvest, road construction, agricultural conversion, or residential development, alter the landscape, changing the amount and juxtaposition of cover and forage. These changes affect big game use patterns as they search out forage and cover, and can also affect habitat security.

Summary of Findings

Alternative 2 would result in the greatest long-term displacement and reduction of security in the project area. This alternative would decrease the most hiding cover, result in a three percent reduction in security and would include historic recreational trails added to the forest system. Alternative 2 would also recruit the highest amount of high quality forage across the project area. Alternative 3 would rehabilitated the existing recreational trails and as a result, would have the lowest potential for long term displacement of ungulate species. Under Alternative 3 the arrangement of fuels treatments in the WUI near Coram would provide more contiguous cover for elk travel and movement than in the other project action alternatives. Under all three action alternatives, impacts to thermal cover on winter range would be the same. Winter range areas would continue to meet forest plan direction after project effects. Motorized access would not change between alternatives 2, 3, and 4 as road construction on historic templates would be reclaimed following project activities inhibiting motorized access on these routes. Ungulate populations would continue to persist within the project area and forestwide.

Analysis Area

The effects analysis area for direct, indirect, and cumulative effects to white-tailed deer, mule deer, and elk are in the area included within the Hungry Lion project area. This area (approximately 37,090 acres) is large enough to be representative of the effects of fire, natural tree mortality, timber harvest, and road management across the landscape. Additionally, the project area represents a good cross-section of seasonal habitats (summer, winter and transitional ranges) used by big game species throughout the year (Project File Exhibit H-4). The actions proposed that could affect white-tailed deer, mule deer, or elk, are contained within this area. In addition, the area is sufficiently large enough to evaluate the ability of the habitat to support other big game species considered under the MIS umbrella.

Methodology

Data used included field surveys, timber stand data, VMap data, review and application of the best available science, population and harvest information, and GIS and dataset information for features, such habitat features existing in the project area including habitat types, riparian structures, canopy cover, etc. The analysis used effects to hiding cover, thermal cover, foraging habitat, security habitat and specific seasonal habitat requirements to evaluate the project alternatives.

Existing Condition (Affected Environment)

Habitat status

White-tailed deer habitat consists of a mixture of various forested communities that provide cover, foraging habitat, and water within a reasonable distance. While elk and mule deer use similar habitats, white-tailed deer are more closely associated with riparian features than elk or mule deer. White-tailed deer exhibit a broad range of summer and fall habitat use, but are commonly associated with warm and moist mixed-species coniferous forest and lowlands interspersed with aquatic wetlands, meadows, and stream bottoms. Habitats favored by elk during the summer months include moist parks, meadows, and riparian areas, offering succulent forage and bedding sites. Elk remain on higher elevation summer ranges until forced down to lower elevations by snow and severe weather. Both elk and mule deer are also commonly associated with shrub, seedling, and sapling habitats. Mule deer have similar seasonal habitat and elevational range preference as elk. Like elk, mule deer elevational range is dictated by food availability and weather conditions.

The use patterns of deer and elk have also shifted as a result of forest succession or natural disturbances, such as wildfire, windfall, and insect infestations, which typically remove or alter hiding cover, thermal cover, and forage. Ungulate populations can fluctuate between mild winter and hard winter years. Vore et al. (2007) studied elk use of winter range on Firefighter Mountain in context to forest treatments and concluded that snow depth was an important factor determining elk habitat selection during the winter months. Thermal cover describes the ability of a forested stand to intercept snow and provide winter protection for deer or elk (e.g., shallow snow depths, warmth). The Flathead Forest Plan defines thermal cover as evergreen coniferous trees which has a minimum average height of 60 feet and has minimum crown canopy closure of 70 percent (Forest Plan, p. III-62). Field surveys within the South Fork of the Flathead conducted in 2009 showed that most winter range areas that had regeneration harvest had returned to a hiding cover condition in 20 to 30 years and returned to a thermal cover condition within 50 to 70 years following logging (depending on the site). Table 108 summarizes the existing condition of thermal cover on winter range MAs in the project area. For this calculation, all contiguous MA 9, 13, or 13A lands within 0.5 miles of the project area were included. MA lands further than 0.5 miles apart were treated as a separated calculation.

Table 108. Existing condition of thermal cover on winter range in the Hungry Lion project area

Winter Range in Project Subunits			Existing Condition	
Winter Range Area	MA	Total Acres	Acres Thermal Cover	% Thermal
Firefighter - Emery Bay	13/13A	5,192	3,103	60
Lion Hill	9	237	221	93
Desert Mountain	13	3,698	3,138	85

Spring and fall months are important “transitional” periods when ungulates give birth to calves and fawns, grow antlers, build body condition, and accumulate fat for winter. During this time period elk may move long distances between summer and winter habitats. In the spring, elk move up in elevation as forage greens up, while in the fall they move down in elevation as snow depths increase. No distinct calving areas are known within the project area, but some calving may occur adjacent to wet sites or areas of dense cover to provide security from predators. Research conducted during the 1970s found that elk calving areas varied from year to year, depending upon snow depth.

Within summer and fall months elk favor habitat that includes moist sites associated with particular forest habitat types as well as meadows and riparian areas. Moist sites are defined by Lyon et al. (1985). The Flathead Forest Plan includes direction that elk summer habitat will be managed “in accordance with moist site and security area recommendations from Coordinating Elk and Timber Management, Final Report of the Cooperative Elk-Logging Study, 1970-1985” (Lyon et al., 1985). This report recommends high priority road closures for elk habitat through “wet meadows and moist areas.” Moist areas defined by Lyon et al. (1985) include *Abies lasiocarpa*/*Clintonia uniflora*, *Picea Engelmannii*/*Clintonia uniflora*, *Abies lasiocarpa*/*Menziesia ferruginea* and *Abies lasiocarpa*/*Alnus sinuate* habitat. These moist sites occur primarily at the headwaters of drainages and at high to mid elevations in roadless and wilderness areas (Lyon et al., 1985). Moist areas in the project area are located away from roads and contain high elk security.

Hiding cover for ungulates is defined by this analysis as trees of sufficient size and density to conceal an animal from view at approximately 200 feet (Forest Plan, p. VII-10). Forage areas, as the name implies, are habitats that provide food for deer and elk. Optimum summer range consists of patches of hiding cover for security from predators interspersed with openings that produce forb, grass and shrub forage species for big game. Thomas (1979) recommended a ratio of 40 percent hiding cover to 60 percent foraging areas for ungulates distributed in a mosaic pattern where no point in a foraging area was greater than 600 feet to cover. Approximately 90 percent of the project area provides cover for ungulates.

As mentioned previously, the pattern across the landscape of cover and forage naturally fluctuated in response to winter severity, wildfire, insect and disease, windstorms, etc. While forage can also be found in the understory of mature forested areas or in riparian areas, recently disturbed forest areas produce large pulses shrubs and grasses otherwise shaded out by mature forest canopy (Fisher & Wilkinson, 2005). As these foraging areas go through succession and become reforested, they again begin to provide cover; first hiding and then thermal cover. Where cover exceeds forage by a wide margin, removal of cover may enhance deer and elk habitat by increasing edge, increasing diversity, and increasing forage. Regenerative timber harvest and or prescribed fire can remove forest cover and create foraging areas by reverting forest succession to its earliest stage. Most ungulate species select for newly created forest openings when foraging, such as clearcuts, prescribed fire or wildfire disturbance (Fisher & Wilkinson, 2005; Patton, 1976; Rempel, Elkie, Rodgers, & Gluck, 1997).

The increase in open miles of road on NFS lands, largely a result of land management activities, has resulted in a decrease in security for ungulates, especially during hunting season (Christensen, Lyon, & Unsworth, 1993; J. Michael Hillis et al., 1991). Security was higher in the absence of road building and recreational hunting. In recent years, road closures for grizzly bear across the Flathead National Forest and including the project area have benefited security for both deer and elk. Elk have been documented to avoid open roads (Christensen et al., 1993; McCorquodale,

2013). Open roads can displace elk from nearby environments and serve as hunter access increasing elk, deer, and moose vulnerability to harvest during hunting season(Christensen et al., 1993; J. Michael Hillis et al., 1991; Proffitt, Gude, Hamlin, & Messer, 2013; Rempel et al., 1997). Hillis et al. (1991) defined elk security areas with hiding cover, greater than 0.5 miles from an open road and larger than 250 acres in size. Applying this definition, approximately 40 percent of the analysis area provides elk security (Project File Exhibit H-4). It is important to note that this analysis did not consider the alpine areas in the Flathead Range as elk security because of lack of hiding cover. These remote areas along the tops of the peaks, functionally provide high elk security during the summer and early fall months due to difficulty of hunter access (Project File Exhibit H-4).

Population status

Exact numbers of deer and elk using the Lower South Fork drainage, or specifically the Hungry Lion project area, are not known. At a broader scale, the State of Montana manages big game species to provide a surplus of animals that can sustain harvest by hunters. A 2016 report by Montana Fish Wildlife and Parks describes the estimated population for white-tailed deer, mule deer, and elk in Montana Fish Wildlife and Parks Region One (northwest Montana), which includes the South Fork of the Flathead. In Montana Fish Wildlife and Parks Region One, the estimated population for mule deer was 6,918 and had a 10-year average (2006-2015) of 10,634. The estimated population for white-tailed deer in 2016 was 75,528, and had a 10-year average of 81,908 (Project File Exhibit H-4).

Hunting District 140 is managed by Montana Fish Wildlife and Parks as part of the Bob Marshall Wilderness Complex Elk Management Unit. The Elk population objective is 150-320 in the Bob Marshall Wilderness Complex Elk Management Unit. The estimated Elk number is 108 (Project File Exhibit H-4). Montana Fish Wildlife and Parks has described elk as “below objective” in Hunting District 130, 140 and 141 by an estimate an approximate estimate of individuals, which includes the project area (Project File Exhibit M-4). In 2016, there were 86 elk counted; assuming that 80 percent of elk are observed, the estimated elk population was 108. However, Montana Fish Wildlife and Parks monitor elk population annually to evaluate harvest quota for sound population management. The 2016 Montana Fish Wildlife and Parks Region One estimate for elk was 4,529 (Project File Exhibit H-4).

Recruitment of young are also monitored within white-tailed deer populations. The Montana Fish Wildlife and Parks Region One 2015 White-tailed Deer Report (Montana Fish Wildlife and Parks, 2015) lists spring classifications for white-tailed deer across Montana Fish Wildlife and Parks Region One. Fawn to adult ratios indicate high winter survival of fawns and subsequent high level of recruitment of deer into the population. Montana Fish Wildlife and Parks analysis shows the population of white-tailed deer in the northern region has experienced a cycle of decline and recover in the last decade and data shows that the population has been steadily increasing since 2012 (Montana Fish Wildlife and Parks, 2015).

Environmental Consequences

Alternative 1 (no-action alternative) – Direct, indirect, and cumulative effects

There would be no proposed treatment under this alternative. The occurrence and abundance of forage and cover would fluctuate and change over time as the area progresses through various successional stages. There would be no direct effects to existing hiding cover and no direct effects

to foraging habitat or thermal cover on winter range as a result of implementing the no-action alternative. Under alternative 1, there would be no prescribed burning and forage would continue to grow. Over time, abundance or quality of forage may change or be reduced as forest over-story canopy develops or it becomes decadent.

Indirectly, the likelihood of stand-replacement fires may be increased under alternative 1 as compared to the action alternatives, with increased risk of cumulative effects to hiding cover. The occurrence of more severe fire could reduce forage and hiding cover under the right conditions. This reduction would depend on the severity and intensity of the fire. A severe, high-intensity fire could eliminate large amounts of cover and increase the return interval of forage species. The level of effects would depend on the size and intensity of the wildfire, which would depend on the actual location, intensity, moisture and weather conditions associated with a presently unknown future fire event.

Human activities such as hunting, hiking, firewood cutting, motorized traffic on open roads, and special uses would continue in the project area. Private lands development may occur in the Hungry Lion area; however, impacts of development may be limited due to the relative small area of private land within the western portions of the project boundary.

Alternative 2, 3, and 4 – Direct & indirect effects

Calving/fawning areas

Deer and elk are known to fawn and calve in the Hungry Lion area. Calving/fawning occurs from May through June (J. M. Vore & Schmidt, 2001). Disturbance from human activity has been linked to disruption of reproductive potential in ungulate populations (Shively, Aldredge, & Phillips, 2005). Calving and fawning typically occurs away from disturbance within areas of high cover and calving/fawning females are known to relocate to specific forest areas (J. M. Vore & Schmidt, 2001). Activities under alternatives 2 and 3 could displace calving and fawning ungulates within the area. Spring period timing restrictions for project activities for grizzly bears would largely reduce disturbance to calving/fawning elk and deer as logging machinery would not be active and road work associated activities would be limited to existing open roads. Hiding cover and blocks of untreated stands would diminish potential for displacement from human activity provide secure and disturbance free areas for calving and fawning.

Hiding cover

Currently, approximately 90 percent of the Hungry Lion project area provides hiding cover for big game species. This percentage includes all lands within the project area boundary.

Project action alternatives would decrease hiding cover within the project area. Project File Exhibit H-8 discusses assumptions and analysis for effects to hiding cover on the proposed activities. Commercial thinning, understory removal, and precommercial thinning are assumed to continue to provide hiding cover after project implementation. Seed tree, post and pole, shelterwood treatments would not provide hiding cover. Group selection cuts would result in 2 to 4 acre areas that do not provide hiding cover while the remaining area would be commercially thinned retaining cover. These treatments were assumed to reduce hiding cover by approximately 40 percent with cover openings evenly distributed throughout the unit. The estimated percent reduction is based on field evaluation of units and the targets tree species for selection. Within the area treated for shaded fuel breaks hiding cover is not expected to be maintained. Exact effects of the special cuts is not known due to differences in stands surrounding recreational areas and the

unique individual site treatments. These treatments were assumed not to maintain hiding cover. Upland prescribed fire is expected to maintain the majority 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. Hiding cover would take up to approximately 20 years to recover, depending on stand and growing site conditions. Table 109 summarized the effects to hiding cover by alternative.

Table 109. Effects to hiding cover within the project area

Alternative	Acres of Hiding Cover Affected	% of Hiding Cover in Project Area
Alternative 2	1,621	5%
Alternative 3	1,008	3%
Alternative 4	1,056	3%

Alternative 2 is proposing eleven regeneration units that are greater than 40 acres, alternative 3 is proposing three units and alternative 4 is proposing four. Regeneration harvest would likely increase available forage in these units in the long term relative to the existing condition. The shape and distribution of hiding cover would provide close proximity to escape cover (less than 600 feet) and security for big game species foraging in openings around these units and the area would remain suitable summer range.

Project design would diminish negative effects of proposed treatments to hiding cover. Vegetative screening would be retained along open roads in the project area and treatments that remove cover (see above) would retain cover such that no point in the unit is more than 600 feet from hiding cover. Additionally, when harvest units are located adjacent to natural or manmade openings, hiding cover would be maintained on approximately 75 percent of the openings' perimeter.

Comparing the action alternatives, both would leave hiding cover distributed throughout the project area; however, alternative 3 is estimated to have the most favorable arrangement of units would maintain travel cover for elk and deer just east of Coram and north of Martin City. Public comment expressed concern about maintaining adequate hiding cover for elk movement in this area. Elk are known to move through this area during the fall and winter months toward lower elevations and other aspects outside of the project area. All project alternatives would result in a spatial arrangement of treatments and cover that allow for ungulate movement within cover with access for foraging areas throughout the project area.

Forage

Several studies on and off the Flathead National Forest have demonstrated that white-tailed deer forage consists mainly of conifer and shrub browse, with Oregon grape (*Berberis repens*) and Douglas-fir by far the most abundant items (Montana Fish Wildlife and Parks, 2006). Forbs, grasses and lichens are also important seasonal food sources (e.g., grasses in the spring). The mature and immature stands where vegetative treatments are proposed offer foraging opportunities for deer and elk (Hildebrand, 1971; Munding, 1982). The forest stands in the Hungry Lion project area have likely missed several natural fire intervals (see Fuels and Fire section). Forage for ungulate species has been found to decline without natural disturbance (Hayden et al., 2008; Smucker, Garrot, & Gude, 2011) as forest canopy or shade tolerant tree

species shade out understory forage species. Although proposed vegetative treatments would initially decrease the amount of available forage due to mechanical ground disturbance, forage opportunities would increase again within five years. The additional sunlight reaching the forest floor would increase forage levels in some stands above existing forage amounts. Using a conservative analysis, the proposed prescribed fire activities and proposed regeneration harvest (40 percent of group selection treatments) activities would increase high quality ungulate foraging areas in the Hungry Lion project area over the next 10 years. Table 110 summarizes the estimated increase in forage by action alternative.

Table 110. Approximate increase in ungulate high quality forage areas by alternative

Alternatives	Estimated Acre Increase in High Quality Forage (% of the Project Area)
Alternative 2	2,180 (6%)
Alternative 3	1,624 (4%)
Alternative 4	1,623 (4%)

Winter range

Proposed activities on winter range would reduce thermal cover on MA 9 lands near Lion Hill (Project File Exhibit H-5). There would be no reduction of thermal cover on MA 13 or MA 13A within the project area. All vegetation treatment prescriptions in stands that provided thermal cover were assumed to result in a reduction of thermal cover. Effects to thermal cover would depend to the prescription. Regenerated stands are estimated to become thermal cover in approximately 70 years. Commercial thinning and understory removal treatments would become or return to thermal cover in approximately 10 years as trees grow and the overstory canopy fills in. Table 111 describes the percentage of thermal cover on winter range after the completion of project activity by action alternative.

Table 111. Effects to thermal cover and post project percentage

Winter Range in Project Subunits			Acres Thermal Affected			Post Project Thermal Cover %
Winter Range Area	MA	Total Acres	Alt. 2	Alt. 3	Alt. 4	All Alternatives
Firefighter - Emery Bay	13/13A	5,192	0	0	0	60
Lion Hill	9	237	42	42	42	76
Desert Mountain	13	3,698	0	0	0	85

Project activities could occur during the winter months on lands that provide ungulate winter range. Some displacement of ungulate species is possible. Evaluating all the units that overlap with MA 9 and MA 13/13A winter range in the project area, under alternative 2, only 21 percent of the MA 9 area and five percent of the MA 13/13A Firefighter/Emery Bay winter range could receive activity. These proportions include activities that likely would occur in the summertime and actual winter operations would be reduced below the above estimates. Based on this conservative calculation, sufficient winter range would remain free from project activities for ungulates to use effectively during the winter months. Based on the distribution of impacts to cover and forage on winter range, a mosaic of conditions would exist to provide ungulates access to both forage areas and thermal cover on winter range.

Habitat security and displacement

Displacement and disturbance of ungulates herds or individuals may result from human activity, motorized use or machinery noise that result from implementation of the action alternatives.

Human activity has been documented to stress animals affecting available energy reserves. There is a potential for short-term displacement (approximately five years) of ungulates from the immediate area during the proposed activities (e.g., mechanical treatment, helicopter activities, burning, commercial logging, machine thinning, hand thinning, and planting crews etc.). It is important to note that ungulates may not be displaced by project activities. Wisdom et al. (2004) found that elk did not avoid cutting units or haul routes while timber harvest was active.

Alternative 2 would have the greater potential for displacement and disturbance to ungulates and other big game species given the greater acreage of activities proposed. Ungulate species may move to avoid human activities or machinery in while some units are active and use areas again once activity has ceased. Based on past implementation of projects on Forest Service lands, not all units in a project would be active simultaneously. The potential for ungulate displacement would occur at small scales within the project area with the effects relaxed after the completion of a particular unit. The project activities would result in small scale displacement and would not prevent individuals or herds from finding forage, calving or reproducing within the project area.

Helicopter activity may result in some displacement of ungulate species, but the displacement is likely to be small and short term (less than five days). Individuals respond differently to human disturbance like aircraft, motorized, or other associated human activity (Mitchell, Newell, Gude, Proffitt, & Emerson, 2014; Northrup, Anderson, & Wittemyer, 2014; Stankowich, 2008). Some ungulate individuals may not react at all to aircraft use where others may choose to move away from the disturbance. The fire ignition would occur in the fall and would not result in disruptive activities during the important calving/fawning periods in the spring. Stankowich (2008) found that ungulates reacted greatest to aircraft in open environments. Forest cover is distributed in and around the prescribed fire areas and would provide ample opportunities for seclusion during short-term aircraft disturbance.

The project alternatives would occur within elk security areas (J. M. Hillis et al., 1991). The distribution of project activities are located primarily around the edges of existing elk security areas (not in the center, Project File Exhibit H-4). Where hiding cover was removed, these acres were removed from the existing security area estimates within the project area (Table 112). Within the prescribed upland fire units, approximately 42 percent of the area does not presently provide hiding cover and is not calculated as providing elk security. The estimated cover reduction from prescribed fire is assumed to be distributed evening throughout the units. None of the existing elk security in the project area would be reduced below patches of 250 acres in size and security areas in the project area would remain well distributed under each of the project's action alternatives.

Table 112. Effects to existing elk security areas by alternative

Alternative	Total Acres of Treatment in Elk Security Areas	Acres of Hiding Cover Reduced in Security Areas	% Elk Security Reduction in Project Area
Alternative 2	717 commercial/non-commercial harvest 439 prescribed fires	501	3%
Alternative 3	505 commercial/non-commercial harvest 439 prescribed fires	402	2.7%

Alternative	Total Acres of Treatment in Elk Security Areas	Acres of Hiding Cover Reduced in Security Areas	% Elk Security Reduction in Project Area
Alternative 4	343 commercial/non-commercial harvest 439 prescribed fires	386	2.5%

Recreational trails

Alternative 2 and 4 would add 12.2 miles of historic nonmotorized trails to the Forest system. Effects of nonmotorized linear recreational routes is not well documented. Impacts to wildlife species depend on intensity and frequency of human use. Human activity has been found to result in some displacement of ungulate species. Naylor et al. (2009) evaluated cow elk response to All-terrain vehicles (ATVs), horseback riding, hiking, and mountain biking in Oregon. Generally, ATV riding had the largest impact to travel, feeding, and resting bouts followed by mountain biking, hiking, and horseback riding. Both hiking and mountain biking was found to effect elk feeding and resting patterns. Wisdom et al. (2004) evaluated displacement effects of the same recreational activities as Naylor et al. (2009), and found that elk displacement was more pronounced from ATV and mountain biking activities than from hiking and horseback riding activities. However, 35 percent of the time an elk did not exhibit a flight response to an off-road activity while mule deer exhibit little measureable response to activities overall (Michael J Wisdom et al., 2004). Taylor and Knight (2003) found that biking and hiking elicited the same response from mule deer, bison and pronghorn in Utah. Mule deer flushed within 100 meters of activity on the trail. Gaines et al. (2003) summarized literature for effects to different species from linear recreational routes such as trails. Displacement reports from hiking for mule deer was approximately 200 meters and for elk, 86 meters. Literature review by Canfield et al. (1999) reported that persistent human activity may lead to displacement of ungulate species, however studies have shown that ungulate individuals may adopt local movement or habitat use patterns that avoid time periods of high human activity.

The proposed system nonmotorized trails in alternatives 2 and 4 would have the potential for displacement of ungulates in the area. Assuming complete displacement within 200 meters of the proposed recreational routes, potential displacement for ungulates may occur on approximately 1,677 acres or one percent of the project area. This analysis is likely overly conservative as human activities currently exist in the project area where the trails are proposed. Ungulates are known to use these areas currently and likely adopt patterns of movement and habitat use that avoid high periods of human use along these routes. Existing cover along or near the proposed system trails also reduce the potential and magnitude of displacement as ungulate individuals may use the security, hidden from human using the trails, to continue resting or feeding near the trails.

The proposed trails would bisect elk security areas; however, would not affect elk security which is influence by motorized access. The trails would allow for nonmotorized recreation. The trails near Lion Lake would overlap with MA 9 and white-tailed deer winter range. Winter recreation may occur on these trails resulting in displacement of ungulate species. However, the area is presently open to over-the-snow motor vehicles during the winter and additional activity may not result displacement effects relative to existing motorized use.

Alternative 3 by contrast would not include new system trails and would rehabilitate historic trails within the project area. Ungulate species may be displaced short term due to the rehabilitation activities, however, over the long term the potential for displacement from human activities would be lower across an additional one percent of the project area. The exact impact on an individual of an ungulate species due to displacement is unknown. Alternative 3 would result in

the least amount of long term displacement due to developed human nonmotorized recreation of all the project alternatives.

Road construction and other resource activities

Road construction, maintenance, rehabilitation, reroutes, AOP installation, and reclamation activities may create noise from human mechanical activity. Potential displacement effects are discussed above. Road work may remove some forage, however this reduction would be too small to be measureable and would not impact ungulates in the project area.

Big game species are most affected by open motorized routes that can result in displacement or result in higher vulnerability to hunters (J. M. Hillis et al., 1991; McCorquodale, 2013; Rowland, Johnson, Wisdom, & Penninger, 2005). However, restricted roads used for project activities would likely not receive the same volume and intensity of motorized use as motorized routes open to the public and ungulate may not avoid this activity (Michael J Wisdom et al., 2004). Restricted and constructed roads used for project activities would remain closed to the public during implementation and motorized public access would not change from the existing condition. Temporary roads would be rehabilitated and roads constructed and added to the system would be reclaimed after project activities. Reclamation would inhibit motorized use on these road templates. The difference of historic roads added to the road system and reclaimed after project activities between alternatives is negligible because these routes would remain impassable to motorized vehicles.

Proposed recreational improvements at Lion Lake would not affect ungulates. This site contains existing consistently high levels of human activity and additional displacement or additional effects to habitat from improvement activities is unlikely.

Alternative 2, 3, and 4 – Cumulative effects

There are yearlong residences on private lands in the area, as well as other past established human activities including road building, hiking, fire suppression, firewood cutting, hunting, and special uses. Private lands in the project area are more developed than these areas were historically. However, the development of homes and logging/clearing on private lands is primarily distributed in the lower elevations of the project area. The Hungry Lion project area still maintains a mosaic of hiding cover and forage areas distributed through the elevations of the project area.

There have been past harvest activities within the project area including the Hungry Horse/West Glacier Fuels Reduction, Paint Emery, Firefighter, and Belton Fuels. These projects have altered the forest mosaic, reduced hiding cover, reduced thermal cover and increased foraging areas through past harvesting disturbance within the project area. These project effects were considered in the habitat baseline. Road closures and past decommissioning have resulted in increased security for ungulates in the project area. All of the Hungry Lion action alternatives would maintain the existing motorized condition for public access. Alternatives 2 and 3 would rehabilitate temporary roads and reclaim historic roads that are added to the system. Reclaimed roads would be treated to be impassable to motorized vehicles. Other projects exist outside the project area in the South Fork and Middle Fork watersheds, but were judged not to contribute cumulative effects to the project with the exception of contributing motorized traffic passing through the project area.

Ongoing vegetation management activities (Firefighter and Belton projects) would reduce cover in the project subunits. Based on calculations, the additional effects to cover are small enough that there would be no additional percentage change to cover in either project subunits.

Upcoming prescribed fire for the Belton Project would use helicopter for ignition of the units outside of the project area, but near the northwest project area boundary. The Belton prescribed fire units are scheduled for ignition in the fall of 2017, with a year or more time between these units and the Hungry Lion prescribed fire units. Overall helicopter activities are expected to be short-term (one to three) days in the fall season. No adverse cumulative effects to ungulates species are expected because effects would be short-term and relaxed after ignition is completed.

The Firefighter project has active units outside the project boundary, but would contribute noise and motorized travel on roads through the project area during the summer months when the harvest for the project is active. Effects of this project to summer and winter range conditions were incorporated in the habitat baseline.

The Adapted Silviculture for Climate Change (ASCC) Research Project includes six Hungry Lion units; these units are in all action alternatives and were considered as part of the projects direct and indirect effects above.

Wildfire suppression activities would continue in the project area. Fire suppression has decreased fire disturbance in the project area and likely increased the amount of shade-tolerant species present in the understory of mature stands. Fire suppression activities have maintained existing mature cover in the project area, providing security for ungulates and other big game species. However, lack of fire disturbance may have decreased other habitat components like forage or aspen stands that typically regenerate after a fire has occurred. Prescribed fire would increase the effects of fire disturbance to forest conditions in the project area.

Hunting would continue in the project area. Removal of hiding cover may contribute to a short-term increase big game vulnerability; however, the project would not increase motorized access to the public and would retain a mosaic of hiding cover and visual screening throughout the project area. Security areas for elk would continue to exceed recommendations of Hillis et al (1991) and project effects would not reduce any security area below 250 acres. Due to these conditions, the increase in vulnerability of deer and elk to hunters would likely be small. Forest conditions would grow over time and hiding cover and security would change as forest regeneration occurs.

Existing recreation exists on closed roads and trails within the project area including mountain biking, horseback riding, hiking, and fishing etc. Additional of system trails would be little departure from the existing condition as these historic trails are currently used by the public. Addition of historic trails would maintain hiker and other recreational nonmotorized access in the project area. Alternative 3 would decrease recreational access and reduce displacement potential in the project area by rehabilitating the trails inhibiting access.

The cumulative effect of past activities, the proposed activities of this project, and future activities would not preclude deer or elk use of habitats in the area. There appears to be little risk of population loss, and species viability would be maintained. For additional information on the status of deer and elk on the Flathead National Forest, and the status at broader scales, please reference the document, Flathead National Forest Evaluation and Compliance with National Forest Management Act requirements to Provide for Diversity of Animal Communities (USDA Forest Service, 2017a).

Regulatory Framework and Consistency

The National Forest Management Act requires that forest plans “preserve and enhance the diversity of plant and animal communities” and that Forest’s manage for maintenance of “viable populations of existing native and desired non-native vertebrate species.” The Hungry Lion Project would maintain viable populations of big game species.

Amendment 21 to the Flathead Forest Plan establishes a forestwide objective to “provide sufficient habitat to contribute to meeting objectives of Montana Department of Fish, Wildlife and Parks Management Plans” (amendment 21, appendix A, p. 2). The forest plan does not have any standards for elk security. However, elk security is high in the project area and would remain high after project implementation. Further, the project alternatives are consistent with maintenance and improvement of quality summer range for big games species and maintenance. Cover/Forage areas are consistent with forest plan direction and road restrictions in the Hungry Lion project area provide for high amounts of big game security and use of the project area. Big game populations are viable across the project area and the Flathead National Forest and would remain so with the implantation of either of the action alternatives.

The Flathead Forest Plan contains direction for both mule deer, elk, and white-tailed deer winter range (MA 13/13A and MA 9 respectively). The forest plan directs that areas of these MAs separated by one-half mile or more are to be considered as separate winter ranges. After project implementation, the amount of thermal cover on MA 9 would remain above 50 percent and the amount of thermal cover on MA 13/13A would remain above 30 percent (Project File Exhibit H-4). Cover and forage on MA 9 would be managed and shaped to provide optimum conditions for ungulates to use cover and foraging areas (Project File Exhibit H-4).

Within summer and fall months, elk favor habitat that includes moist sites associated with particular forest habitat types as well as meadows and riparian areas. Moist sites are defined by Lyon et al. (1985). The Flathead Forest Plan includes forestwide direction that elk summer habitat will be managed “in accordance with moist site and security area recommendations from Coordinating Elk and Timber Management, Final Report of the Cooperative Elk-Logging Study, 1970-1985” (Lyon et al., 1985). This report recommends high priority road closures for elk habitat through “wet meadows and moist areas.” Moist areas defined by Lyon et al. (1985) include *Abies lasiocarpa*/*Clintonia uniflora*, *Picea Engelmannii*/*Clintonia uniflora*, *Abies lasiocarpa*/*Menziesia ferruginea* and *Abies lasiocarpa*/*Alnus sinuate* habitat. These moist sites occur primarily at the headwaters of drainages and at high to mid elevations in roadless and wilderness areas (Lyon et al., 1985). Moist areas in the project area are located away from roads, contain road densities less than an average of 1 mi/mi² and contain high elk security (Project File Exhibit H-4; and H-8).

The Flathead Forest Plan has identified white-tailed deer, elk, and mule deer as Commonly Hunted Big Game MIS that uses general forest habitat. Conditions favorable to these species would generally also benefit other big game species found within the project area such as moose, black bear, and mountain lion, which are considered under the umbrella of MIS evaluations. Goals, objectives, and standards in the forest plan specific to managing white-tailed deer, elk, and mule deer have been met in varying degrees in the preparation and analysis of the Hungry Lion Project.

Wildlife – Old Growth Associates and Bird Species of Concern

Introduction

This section discusses effects to old growth associated wildlife species and bird species of concern, including species that are associated with snag habitat and riparian habitat, and neotropical migrant bird species. Species discussed in this section are not Flathead National Forest sensitive species or management indicator species (MIS). They are considered because the Forest Service's Landbird Conservation Strategic Plan (2000), Executive Order 13186 (USA, 2001), and the Partners in Flight Draft Bird Conservation Plan for Montana (2000) reference goals and objectives for integrating bird conservation into forest management and planning. Within 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.

In 1988, an amendment to the Fish and Wildlife Conservation Act mandated the United States Fish and Wildlife Service to "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act of 1973." The report, *Birds of Conservation Concern 2002*, identified the migratory (including neotropical migrants) and non-migratory bird species (beyond those already designated as Federally threatened or endangered) that represent the highest conservation priority. In the report, the United States is broken down into Bird Conservation Regions (BCR), with bird species of conservation concern identified for each region. The project area is located in BCR 10.

In 2008, the United States Fish and Wildlife Service published updated lists of Bird Species of Conservation Concern. Table 113 displays the birds listed for BCR 10 which may occur or have suitable habitat in the project area (USDI Fish and Wildlife Service, 2008b). In addition, Flathead National Forest Amendment 21 (A21) of the Flathead National Forest Plan (USDA Forest Service, 1999b) provided direction for monitoring of sensitive species as well as old growth and snag habitats/associated species.

Summary of Findings

Alternative 2 would have the largest reduction impact to snags, down woody debris across the project area due to the quantity and types of harvest in the alternative. Alternative 2 would have the greatest benefit to bird species that prefer open forest and grass shrub environments followed by alternative 3, then 4. Alternative 2 regeneration harvest would have the greatest influence to existing old growth habitats, while alternatives 3 and 4 would have similar acres of influence to old growth stands between the two alternatives. Recreational trails proposed by alternatives 2 and 4 would result in disturbance from human activities to migratory bird, old growth, snag, down woody species over an estimated three percent of the project area. Alternative 3 would improve security for these species through rehabilitation of the historic trails reducing potential for long-term disturbance. The project alternatives would not adversely affect habitat or cause a decline in population viability that would contribute to federal listing of bird species, species associated with old growth forests, snags or down woody debris.

Analysis Area

The direct and indirect and cumulative effects analysis area for bird species of concern is the project area of approximately 37,090 acres, encompassing all proposed activities. The project area is an appropriate cumulative effects analysis area because it contains enough of the habitat preferred by birds to support numerous home ranges. This area is large enough to be representative of the effects of natural and prescribed fire, natural tree mortality, timber harvest, thinning, road construction and road management across the landscape.

Methodology

Data used included field surveys, timber stand data, VMap data, review and application of the best available science, geographic information system (GIS), and dataset information for features, such habitat features existing in the project area including habitat types, riparian structures, canopy cover, etc.

Existing Condition (Affected Environment)

Population status

Neotropical migratory birds and birds of concern

The Hungry Lion project area spans a diverse amount of habitats and elevations. The low elevations of the project area contain diverse riparian environments, including stream channels and the shoreline of Hungry Horse Reservoir. The mid-elevations contain mixed-conifer forests and the upper elevations of the project area are dominated by sub-alpine and whitebark pine habitats.

The Flathead National Forest participates in two projects that included monitoring populations of migratory birds;

1. The Northern Region Landbird Monitoring Program, which looks at habitat relationships of landbirds that breed in the Northern Rocky Mountains, and
2. The Monitoring Avian Productivity and Survivorship (MAPS) Program, which was a cooperative effort with the Institute for Bird Populations (Point Reyes Station, California) with the objective of providing broad scale data on productivity and survivorship (USDA Forest Service, 2017a).

Both of these programs were important to landscape and regional distributional and trend information. Table 113 displays some of the population information obtained from these and other local monitoring/inventory projects. A table of detected bird species within and around the Hungry Lion project area is located in Project File Exhibit H-5.

Table 113. Observations on the Flathead National Forest of neotropical migratory birds listed that have conservation concerns

Common Name (and Status)	SOC, TES	Global and State Ranks ¹	R1 Landbird Program on FNF 1994 to 2004 ²		Max. ¼ w/Obs. with Direct Evidence of Breeding, Past 5 Years ³	Maps on FNF ⁴	FNF Lands via FWP Monitoring not Landbird or MAPS
			Abund.	Years			
Black Swift	SOC	G4, S1B	0	--	1-5	Hilary Meadow, 6- mile Creek	2013 (several in Glacier NP); Swan Valley 2012
Black-chinned Hummingbird	--	G5, S4B	2	1	25+	--	--
Bobolink	SOC	G5, S3B	0	--	1-5	(Not expected)	1991 (several in Flathead Valley)
Brewer's Sparrow	SOC	G5, S3B	0	--	1-5	--	--
Cassin's Vireo (Solitary Vireo in 1991)	--	G5, S4B	367	7	30+	--	Abundant and widespread
Clay-colored Sparrow	--	G5, S4B	0	--	6-10	--	1991 (some SE of Flathead Lake)
Cordilleran Flycatcher	--	G5, S4B	8	3	1-5	--	--
Flammulated Owl	Sens, SOC	G4, S3B	0	--	1-5	(Not expected)	--
Grasshopper Sparrow	SOC	G5, S3B	2	1	1-5	--	(many SE of Flathead Lake)
Gray Catbird	--	G5, S5B	2	1	1-5	--	1989, 2001, 2005, 2007, 2008
Hammond's Flycatcher	--	G5, S4B	165	7	10+	--	1994, 1998, 2008
Lazuli Bunting	--	G5, S4B	34	5	1-7	--	1998, 2005
Merlin	--	G5, S4	0	--	1-10	--	1991, 1998
Olive-sided Flycatcher	--	G4, S4B	511	7	35+	--	1991, 1993, 1994, 1996 thru 2009
Peregrine Falcon	Sens, SOC	G5, S3	0	--	14-18	(Not expected)	2 eyries on FNF
Red-eyed Vireo	--	G5, S4B	29	5	5-8	--	1990 thru 95, 1999, 2000
Red-naped Sapsucker	--	G5, S4B	261	7	22-30	--	1999 (commonly seen & not reported)
Rufous Hummingbird	PSOC	G5, S4B	107	7	9-12	--	1990, 1993, 1994, 1999, 2001, 2005, 2008

Common Name (and Status)	SOC, TES	Global and State Ranks ¹	R1 Landbird Program on FNF 1994 to 2004 ²		Max. ¼ w/Obs. with Direct Evidence of Breeding, Past 5 Years ³	Maps on FNF ⁴	FNF Lands via FWP Monitoring not Landbird or MAPS
			Abund.	Years			
Swainson's Hawk	PSOC	G5, S4B	0	--	1-5	(Not expected)	1985, 1997
Tennessee Warbler	PSOC	G5, S3B	0	--	4+	--	1994, 2010
Turkey Vulture	--	G5, S4B	4	3	4-6	(Not expected)	(commonly seen & not reported)
Vaux's Swift	--	G5, S4B	40	7	9-16	--	1991, 1993, 1994, 1998, 2000, 2008
Veery	SOC	G5, S3B	2	1	10-16	Hilary Meadow, Swan Oxbox2, and Simpson Creek	1995
Williamson's Sapsucker	--	G5, S4B	43	6	1-4	--	1989, 1994
Willow Flycatcher	--	G5, S4B	8	4	9-16	--	1990 thru 95 1995, 2001, 2005, 2008

²Avian Science Center's Northern Region Landbird Monitoring Program, University of Montana (http://avianscience.dbs.umt.edu/data_portal/data_portal.php).

³Montana Department of Fish Wildlife and Parks and Montana Natural Heritage Program online "Field guide" as of 9/2010, maximum density in a quarter lat/long area (<http://fieldguide.mt.gov/default.aspx>).

⁴Monitoring Avian Productivity and Survivorship (MAPS) Program as of 9/2010, (<http://www.birdpop.org/nbii/nbiihome.asp>).

The Institute for Bird Populations conducted MAPS surveys from 1992-2001. One hundred forty bird species were observed on the Flathead National Forest 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 1999-2007, Item #19; Fiscal Years 2008-2010 #19).

The northern region 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 (ASC) at the University of Montana conducted habitat and distribution surveys for individual species including Flammulated Owls, Goshawks, and Black-backed Woodpeckers from 1994-2004. The U.S. Forest Service Northern Region Songbird Monitoring Program (R. L. Hutto & Young, 2002) has provided data on population trends, habitat relationships, and effects from past management activities for birds breeding in western Montana. According to Hutto, (Avian Science Center, 2010) "[t]here are not nearly enough years of data to make meaningful use of our population trend data yet, but the

preliminary data suggest that most populations have remained fairly stable during the 12-year period between 1994-2006.”

In 2010, Rocky Mountain Bird Observatory, in conjunction with its partners, conducted landbird monitoring in several bird conservation regions (BCRs), including BCR 10 (Northern Rockies). This project used a spatially balanced sampling design and a survey protocol implemented as part of a program titled “Integrated Monitoring in Bird Conservation Regions”. The Integrated Monitoring in Bird Conservation Regions design allows inferences to avian species occurrence and population sizes from local to BCR scales (Van Lanen, White, McLaren, & Birek, 2014).

In addition to point count surveys, U.S. Forest Service Northern Region conducted a field survey of goshawks during the spring and summer of 2005. The primary purpose of the survey was to use a statistically based approach to define the distribution of goshawks. While the survey did not estimate any goshawk occupancy rates for any individual forest, the results of this survey indicated that the goshawk was relatively common and well-distributed across the northern region including the Flathead National Forest (Forest Plan Monitoring and Evaluation Report: Fiscal Years 2008-2010, Item #19). The project area was last surveyed for nesting goshawk in 2014 using call back survey methods (Project File Exhibit H-5). No nesting goshawks were detected.

Habitat status

The Hungry Lion project area provides diverse habitats, well-distributed across the project area, for a wide variety of bird species including many associated with old growth and snag habitat (Table 113). Some species are positively affected by human-induced landscape changes and some are negatively affected. Hejl et al. (1995) recommended a bird conservation strategy composed of three parts: (1) to maintain, mimic, and restore natural vegetation patterns and processes, (2) to ensure that the specific habitat components required by sensitive species are created and/or maintained, and (3) to monitor the habitats and individual sensitive species. The Montana Partners in Flight Draft Bird Conservation Plan (Casey, 2000) focused on restoring healthy ecosystems to sustain productive and complete bird communities.

Table 114. Birds of conservation concern in the Flathead basin (BCR10)

Species	General Habitat Summary ¹	Assessment
Bald Eagle	Nest in large conifers and deciduous trees; feed near lakes and rivers	See Sensitive Species section
Calliope Hummingbird	Seral shrublands and forest openings to moderate elevations in the mountains	Assessed in shrubland section below
Cassin's Finch	Open conifer forests/early post-fire/mature lodgepole pine	Habitat assessed in black-backed woodpecker section (Sensitive Species section)
Flammulated Owl	Open ponderosa pine/mixed forest	See Sensitive Species section
Lewis's Woodpecker	Open or park-like ponderosa pine; areas with scattered trees	Assessed in flammulated owl (see Sensitive Species section)
Olive-sided Flycatcher	Logged or burned forests	Assessed in black-backed woodpecker section
Peregrine Falcon	Ledges of vertical cliffs, often with a wide view, near water, and close to plentiful bird prey	See Sensitive Species section
White-headed Woodpecker	Open ponderosa pine forests	See Sensitive Species section for flammulated owl

Species	General Habitat Summary ¹	Assessment
Williamson's Sapsucker	Large snags and live trees, especially larch with heartrot. Maintain mixed deciduous-coniferous forest with quaking aspen for feeding.	Assessed as old growth habitat associated species

*Species not in table because no record in the Flathead basin and neighboring areas: McCown's longspur, sage sparrow, and yellow-billed cuckoo. Species not in table because there is no suitable habitat in the project area or habitat would not be impacted by the project: black rosy finch, black swift, Brewer's sparrow, Ferruginous hawk, loggerhead shrike, long-billed curlew, sage thrasher, Swainson's hawk, upland sandpiper, willow flycatcher.

¹Based upon Montana Field Guides (Montana Fish Wildlife and Parks, 2010a) unless habitat information is not available on this site.

With respect to providing a diversity of habitat components, two habitats are especially important to bird species in western Montana (B Riley McClelland, Schmidt, & McDonald, 1995): 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.” Project File Exhibit H-5 displays birds detected in the project area and indicates which species are associated with old growth and snag habitats.

Old growth habitat and associates

The pileated woodpecker and barred owl are not MIS species on the Flathead National Forest and the goshawk is no longer a sensitive species, but amendment 21 of the Flathead National Forest Plan stated that they would continue to be assessed at the project level. Pileated woodpecker is associated with closed-canopy mature or late successional coniferous or deciduous forest that have large down logs and standing dead trees, especially western larch and ponderosa pine with heartrot. Old growth and late seral patches for pileated woodpecker are estimated to be 100 to 250 acres (B. Riley McClelland & McClelland, 1999). Barred owl uses large patches of mature and late successional forest especially near riparian areas with a mix of coniferous and deciduous forest. Effects of project activities to habitat for these species are summaries below in the old growth, riparian and snag section. For additional effects to old growth, late successional forest and snags see the Forest Vegetation section.

The U.S. Forest Service Northern Region protocol for analyzing effects on goshawks uses a home range size of 5,000 acres that includes nesting habitat, post-fledging habitat, and feeding habitat (Project File Exhibit H-5). For the Hungry Lion Project analysis, forest in the mid-seral to late-seral stage with a dominant tree size class exceeding nine inch d.b.h. and greater than 60 percent canopy cover, in patches greater than 40 acres was modeled as potential goshawk nesting habitat. This habitat also provides potential nesting as well as feeding habitat for pileated woodpeckers and barred owls (see Forest Vegetation section). These stands total about 8,647 acres or 23 percent of the project area. Approximately 45 percent of the project area is the Douglas-fir cover type, less than 1 percent is the ponderosa pine cover type and 17 percent is the western larch cover type. Small patches of paper birch also occur within conifer stands and within riparian areas throughout the project area.

Goshawk foraging habitat appears to be heterogeneous and include forest openings, mature forest, early seral forest. Small forest openings and other mature closed-canopied forest (greater than 40 percent) were considered potential foraging habitat (Project File Exhibit H-5). The project area provides approximately five full potential goshawk home ranges.

Project scoping also identified a public concern having to do with habitat connectivity and the impact of fragmentation or “edge effect” adjacent to old growth habitat. Timber harvest and other sources of tree mortality can contribute to short-term fragmentation until harvested stands reach later stages of succession. Problems associated with forest fragmentation include weather-related effects and loss of forest interior habitat, loss of habitat connectivity, and increased vulnerability to predators or nest-parasites (Finch, 1991). Timber harvest in stands immediately adjacent to old growth could cause negative direct/indirect effects. New “edge” is created when stands adjacent to old growth habitat are converted from a late- or mid-seral structural stage to an early-seral (seedling/sapling) structural stage (Harper et al., 2005). The creation of edge adjacent to old growth forest has two negative effects on old growth: It directly affects the adjacent old growth stand or old growth block by reducing the interior integrity of the stand or block (Russell & Jones, 2001), and it narrows or eventually severs the connection between different old growth patches. Weather-related effects have been found to penetrate over 165 feet into a stand; the invasion of exotic plants and penetration by predators and nest parasites could extend 1,500 feet or more (Lidicker & Koenig, 1996). Temple (1986) studied the effects of “edge” on 16 species of forest-interior birds. This study defined the “core area” of a forest as the area more than 100 meters from an edge. In all 16 species, core area was a better predictor of bird species presence and abundance than was the total area of the fragment. Edge features can be beneficial to some species and disruptive to others. Old growth edge also occurs naturally from effects of fire, blowdown, insect and disease, and other natural phenomena (Harper et al., 2005). Edge effects can also create old growth habitat features, such as complex tree features from disease, snags, and blowdown (Harper et al., 2005).

Interior bird species also need corridors that are wide enough to “contain a band of habitat unscathed by edge effects that matter to the targeted species” (Lidicker & Koenig, 1996). For this analysis, new edge created by regeneration harvest adjacent to old growth was used to assess edge effects for each alternative. The amount of identified or potential old growth within 100 meters of adjacent regeneration harvest was assessed. The amount of available forest habitat greater than 100 meters from a regeneration harvest unit was used to assess habitat connectivity for each alternative (see the Project File Exhibit H-3).

At the larger landscape scale, two data sources for two landscape scales have been used to assess the availability of old growth habitat. The forest-wide old growth coverage was used to evaluate old growth at the 6th-code Hydrologic Unit Code scale. FIA data (Forest Inventory and Analysis) were used for a broader scale analysis, including Wilderness areas (incorporated by reference; (USDA Forest Service, 2009)). The amendment 21 analysis (USDA Forest Service, 1998a) looked at available data sources to assess historical old-growth conditions, and historical variability. Historical old-growth conditions were estimated to vary widely over time at irregular intervals, in response to weather patterns, vegetation and fuel conditions. Variability by forest type and position on the landscape (high versus low elevation) were also noted. It was estimated in amendment 21 that old growth across the forest was from 15 to 60 percent historically, with a wide range of conditions occurring. Since the adoption of forest plan amendment 21 in 1999, there has been no harvest of old growth, so changes that have occurred in that timeframe are due to natural processes - in this instance, wildfire.

To find the current amount of old growth on the Flathead National Forest in accordance with Forest Plan Monitoring Item #69 (Project File Exhibit U-12), analysis was done using the FIA summary database. Forest Inventory and Analysis (FIA) data was used for a broad-scale analysis and to cover areas of wilderness. All forested FIA plots that were located on the Flathead National Forest were used to estimate the proportion of old growth. The Green et al. (1995, updated 2005)

definitions were used for this process. The FIA analysis was conducted in 2014 conservative forest estimate of 11.3 percent. There is an additional 630 acres of potential old growth in the project area (See Forest Vegetation section). Approximately three percent of the project area is estimated to be old growth with an additional 12 percent estimated to be late successional forest which contains some of the structural elements of old growth forest (See Forest Vegetation section). The identified old growth occurs in 28 different patches ranging in size from 5 to 238 acre patches. Because wildlife associated with old growth habitats may use a range of forest characteristics, where defined old growth patches border mature or late successional forest, the function patch size or patch of habitat used by an animal, may be much greater than the defined patch size of verified old growth (Project File Exhibit H-3).

Hillis, Pengeroth, and Leach (2003) assessed the status of snag habitat and snag dependent species across the U.S. Forest Service Northern Region. They concluded that the distribution of mature and old forest (that provides snag nesting habitat for pileated woodpeckers and other cavity-dependent species) has not changed substantially since pre-fire-suppression and pre-logging periods. Habitat estimates for the pileated woodpecker based on the regional nest tree habitat model showed that nest habitat is abundant and well-distributed across the forest and northern region. Since 2003, numerous wildfires in the South Fork subbasin and elsewhere on the Flathead National Forest have created abundant, high quality snag habitat including the Trail Creek and Bear Creek fires that burned in 2015.

Environmental Consequences

Alternative 1 (no-action alternative) – Direct, indirect, and cumulative effects

The no-action alternative would have no direct effect on old growth stands, or any successional stages of forest that currently provide a suit of habitat characteristics for different bird species. Patches of different successional and different forest cover types would continue to occur in a mosaic pattern across the project area. Potential goshawk habitat would remain the same. Early successional forest stands would continue to grow and forest openings, where shrub and grass habitats persist may become closed in by forest over time. There would be an increased chance of a stand-replacing wildfire that may reduce old growth stands, late successional forest and potential goshawk habitat within the project area converting large amount of acres into early succession forest habitat types.

The Hungry Lion project area contains established human activities and developments including roads, timber management, numerous recreational opportunities, and residential development. It is expected that these activities would continue on public and private lands. Motorized use and firewood cutting on routes open for motorized access to the public in the project area would continue to occur. Alternative 1 would not contribute to these effects.

Alternative 2, 3, and 4 – Direct & indirect effects

Old growth habitats

As described in the Vegetation section, indirect effects to old growth may occur where openings are created through regeneration harvest in stands that are immediately adjacent to old growth forest. The untreated forest edge adjacent to these openings is more exposed and vulnerable to windthrow. There is likely to be some limited blowdown of trees adjacent to newly created openings, and if these stands are old growth, there is some potential that windthrow may reduce

the old growth qualities through loss of large diameter overstory trees. However, over time windthrown trees may contribute to habitat conditions as large-diameter downed wood would create structurally complex habitat features for old growth associated species that benefit from down woody debris (Project File Exhibit H-3). Table 115 displaces the regeneration units by alternative that are adjacent to identified or potential old growth stands in the project area.

Table 115. Effects of regeneration units adjacent to old growth

Alternative	Units Adjacent to Identified or Potential Old Growth	Perimeter of Identified or Potential Old Growth Affected (% Total Perimeter)	Acres of Identified or Potential Old Growth within 100m of Regen Rx (% Total Acres)
Alternative 2	16, 16a, 17, 32, 34, 34a, 35b, 37, 37a, 38, 40, 46, 54, 56, 56a, 57, and 63.	3.74 miles (6%)	189 (10%)
Alternative 3	17, 32, 35b, 37, 37a, 38, 40, 46, 54, and 63	1.66 miles (2.4%)	101 (5%)
Alternative 4	17, 32, 35b, 37, 37a, 40, 54, and 57	1.85 miles (2.7%)	92 (5%)

Alternative 2 would have the greatest influence to existing old growth stands due to the total perimeter affected and area influenced by adjacent regeneration harvest. Effects to old growth would be similar under both alternatives 3 and 4 and would have approximately the same influence to identified and potential old growth of alternative 2. Under all action alternatives, stands with new edge would still be surrounded by pole or larger habitat on three sides and the majority of old growth habitat in the project area is not affected by edge under any alternative. There is a potential for some blow down of trees in the area impacted by new edge, resulting in a decrease in live trees or snags but an increase in down woody material along the edge. The loss of snags has negative impacts on some species, while the increase in down woody material has positive impacts on others. Edge influence of regeneration harvest adjacent to old growth is expected to be short-lived at abrupt edges because patch contrast declines with forest redevelopment (Harper et al., 2005). The type and speed of canopy cover at regenerating edges is locally specific and dependent on local climate, aspect, and vegetation. In the Hungry Lion project area, high contrast edge is assumed to last for approximately 30 years. Untreated late seral stands occur near and adjacent to identified and potential old growth in the project area. These stands would continue to progress towards old growth and would contribute to the objective of increasing old growth patch size over time. Sufficient habitat would remain to provide for pileated woodpecker.

No temporary roads would be constructed in identified old growth stands under any alternative. Under alternative 2, a historic road would be reconstructed through approximately 200 meters of identified and potential old growth stands to access units 62, 62A, 56, and 46. Historic road templates currently exist and constructed activities may remove some shrubs or small trees, but would have minimal impact on the habitat characteristics to the old growth stand. Alternatives 3 and 4 would not reconstruct any historic roads through old growth stands. Under alternatives 2 and 3, historic roads added to the system would be reclaimed with the road entrances recontoured, stream aligned culverts removed, and slash pulled across the road template. While these reclaimed roads would have a number in the forest system database, on the ground they would be treated the same as a historic template.

For all proposed activities near or adjacent to old growth habitat, displacement of some species may occur from noise of mechanical equipment or human activity. Road work and motorized use would occur on existing roads in the project area that occur in and adjacent to old growth habitats. This displacement is likely to be short and temporary with the effects relaxed when work is completed. Impacts to springtime nesting old growth associated birds would be minimized by restrictions on activities on closed roads until after July 1.

Riparian habitat

Potential effects to important riparian habitats would be greatly minimized through forest management standards and design features associated with INFISH and RHCAs. No vegetation management activities would occur within project area RHCAs. Road reroutes on Emery Creek and construction of the fishing pier on Lion Lake would occur in RHCAs. Construction of the fishing pier would not affect any forest vegetation, hardwoods or snags that songbirds or other bird species use in riparian habitats. Road reroutes would relocate existing road away from Emery Creek to benefit aquatic habitat. Some forest vegetation may be removed during the reroute work and riparian associated wildlife species may be displaced in the short-term during road construction or when recontouring is occurring. Including both Lion Lake and Emery Creek reroutes, approximately one percent of the RHCA acreage in the project area would have disturbance. Potential displacement would be short-term and unaffected riparian habitat features would remain abundant and well-distributed throughout the project area.

Canopy cover and forest density

The proposed project activities would include intermediate treatments which would reduce overstory and/or understory forest density. Alternative 2 proposes the largest amount of thinning acres including commercial thin, understory removal, post and pole, and special cuts, followed by alternative 3 and 4 respectively. Forest thinning would have positive effects for some bird species and negative effects for others. As an example, there would be immediate negative effects to the ruby-crowned kinglet, which prefers closed canopy conditions. Opening up the overstory, however, would produce positive effects for the yellow-rumped warbler and the western tanager. Understory patches described in design features would provide some security for small mammals and security for traveling species that prefer dense forest conditions.

Snag and down wood habitat

Wildlife species associated with snag and down woody debris are listed in Project File Exhibit H-14. Old growth habitats and riparian habitats are very important to snag and down woody dependent wildlife species. These habitats frequently have an abundance of larger snags and down woody material. Wisdom and Bate (2008) found a strong relationship between snag density and seral stage; snag density was highest in late-seral stands. None of the action alternatives proposed treatment to old growth habitats and effects of actions to riparian habitat are described above.

Approximately 14 percent of the project area is estimated to be functioning at or above full snag potential (see Forest Vegetation section). Snags would be reduced through project activities in all action alternatives. Wisdom and Bate (2008) found that snag densities were 19 times higher in unharvested stands compared to harvested stands. Reducing the amount of snags or down woody material can remove habitat features that are essential or very important to many bird species (Evelyn L. Bull, Clark, & Shepherd, 2005). Research suggests that retaining the bulk of the largest material may decrease these effects (Evelyn L. Bull & Blumton, 1999; Porter, St. Clair, & de Vries, 2005). Although snags are not targeted for removal, they are sometimes removed

inadvertently to increase logging efficiency, or if they are deemed a hazard to the woods workers, they are removed for safety reasons. If snags are recently dead, they could be removed for commercial reasons. In cutting units near private property, where the main purpose is fuel reduction, snags could be removed to meet the objective of reducing the potential fuels in an area. Down woody material suitable for wildlife use would usually be reduced during logging activity as a result of heavy equipment use, purposeful removal to reduce fuels, or removal to facilitate reforestation.

Project design features would include site specific prescriptions to retain snags and down woody debris within proposed units. Additionally, identified old growth stands, and potential old growth and late seral forest would continue to be distributed throughout the project area. Based on distribution of old growth, riparian and late seral habitat types, retention of snags and down woody debris through design features, snags and down woody debris for small mammals, snag dependent carnivores such as marten and cavity nesting birds such as Williamson's sapsucker, red-naped sapsucker, mountain chickadee, pileated woodpecker, and barred owl would continue to exist as sufficient levels to provide species occupancy in the project area.

Open, shrub, grass, and sparsely forested habitat

The project area has a low percentage of open grass/shrub or sparsely forest habitats. These are primarily located on the south facing slopes and the high alpine areas of the Flathead Ranges within the project area. Upland prescribed fire would burn in a mosaic pattern within these habitats and would result in a mix of tree mortality across the unit areas. The results would recruit snags and reduce conifer encroachment in these open areas. Burning would decrease tree competition for white bark pine in the alpine areas and could indirectly benefit Clark's Nutcracker.

Approximately 77 percent of the project area has forest canopy cover greater than 40 percent. Seed tree, shelterwood, and group selection harvest would create openings in the forest. Alternative 2 would increase these habitats by approximately four percent, alternatives 3 and 4 would increase these habitats by approximately two percent. These openings would develop shrubs and grasses as the forest regenerates. These openings would benefit species like calliope hummingbird. Alternative 2 would produce the greatest amount of openings of the action alternatives.

Goshawk habitat

For this analysis, harvest in potential goshawk nesting habitat, foraging habitat and impacts to potential post-fledgling habitat (Project File Exhibit H-5) was evaluated. The mosaic of habitat affected and remaining in the project area was evaluated across the project area by 5,000 acres generated territorial grid. This process was used to evaluate how habitat for goshawk was distributed throughout the project area.

Regeneration harvest, shaded fuel breaks, group selection treatments would remove forest canopy and decrease potential habitat and foraging habitat in the project area. For group selection, some habitat may remain amongst the small opening created by the prescriptions, however this analysis considered these units the same as regeneration harvest. Regeneration units may still serve as foraging habitat for goshawk. The most likely parts would likely be adjacent to mature closed canopy forest. Large leave trees in regeneration units would provide perching sites for foraging goshawk. Regeneration harvest, shaded fuel breaks and group selection treatments are estimated to again provide foraging habitat or potential nesting habitat in approximately 40 years.

Intermediate harvest (commercial thin and understory removal) would retain mature forest canopy and large trees for nesting. These treatments are assumed to reduce potential nesting habitat in the short-term (5 to 10 years) until canopy cover matures and exceeds 40 percent. These treatments would likely still provide foraging habitat after implementation as these forest stands would likely retain squirrel, grouse and some species of small mammals as goshawk prey. Reynolds et al. (1992) and Graham et al. (1999) have suggested that the use of thinning may improve habitat for goshawks by creating favorable habitat conditions (e.g., promoting diameter growth in overstory trees and/or creating open understories). Further, reduced tree density and more open canopy created by harvest, remaining trees would be subject to less competition for limited water and nutrients, improving their growth, ability to withstand long-term drought, and improving their resilience to stand replacing wildfire and to other causes of a changing environment (see Forest Vegetation section).

Upland prescribed fire would have would not affect goshawk potential nesting habitat. The burn units would affect open grass/shrub environments and open canopied forest with multiple size classes that does not provide potential nesting or foraging habitat conditions for goshawk.

Alternative 2 would reduce goshawk nesting habitat in the project area by 744 acres or by 8.6 percent in the project area. Alternative 3 would reduce potential habitat by approximately 5.5 percent and alternative 4 would reduce potential nesting habitat by 3.1 percent (Table 116). Nesting habitat would remain well distributed across the project area (Project File Exhibit H-5). Habitat in the project area would continue to be able to support five potential goshawk territories and each goshawk territory would continue to have more than 240 acres of nesting habitat (Clough, 2000).

Table 116. Acres of potential goshawk habitat affected by alternative

Prescription	Alternative 2		Alternative 3		Alternative 4	
	Acres Potential Nesting Habitat	Percent of Potential Nesting Habitat	Acres Potential Nesting Habitat	Percent of Potential Nesting Habitat	Acres Potential Nesting Habitat	Percent of Potential Nesting Habitat
Commercial Thin	458	5%	331	4%	57	0.7%
Group Selection	1	0%	1	0%	1	0%
Shaded Fuelbreak	4	0%	0	0%	4	0%
Seed Tree	216	2.5%	90	1%	140	1.6%
Understory Removal	65	0.7%	53	0.6%	65	0.7%
Total	744	8.6%	475	5.5%	267	3.1%

With all action alternatives, increased disturbance during the nesting period due to logging and related activities could cause nest abandonment or reduced occupancy of suitable nesting habitat. However, Grubb et al. (2012) detected no negative effects to nesting goshawk in response to logging truck activity. There are no known or suspected nest sites in any of the proposed treatment units, but if an active goshawk nest is located in or adjacent to a treatment unit, logging and related activities in the immediate vicinity would be subject to timing restrictions delaying adjacent activities until July 1, making it unlikely that management activities would disturb a nesting pair of birds and cause them to abandon their nest site.

A mosaic of forest conditions would continue to exist for post-fledgling areas surrounding any potential nesting sites under all the action alternatives. Suitable nesting habitat surrounded by

sufficient mature canopied forest with some structural diversity would be present across the project areas in all action alternatives. Goshawks have been found to forage in numerous different forest environments (Project File Exhibit H-5). These conditions would continue to be diverse and distributed in close juxtaposition to potential nesting habitat across the project area.

Recreational improvements

Under alternative 2 and 4, proposed nonmotorized trails would bisect identified and potential old growth stands. Human activity presently exists on these trails. Human presence may disrupt some species and result in displacement of some birds or mammal species associated with old growth habitats. Riffell et al. (1996) found declines in richness for core bird species in Colorado coniferous forest due to nonmotorized human intrusion. While motorized-use likely has more impact than nonmotorized, Zeilinski et al. (2008) found that OHV use on trails did not displace marten. Disturbance in forest habitat to nesting birds, old growth, snags, or down woody associated species has been estimated to extend 100 meters (Hamann et al., 1999). This includes reduction of habitat features through trail clearing, trail maintenance, or enhancement of sight distances as well as displacement from human activities occurring on the trail. Intensity of human activity is an important factor in analyzing disturbance to wildlife. Present and future human intensity of use on these trails is unknown. Conservatively, this analysis assumes that intensity will be moderate to high. Buffering proposed trails by 100 meters, the estimated effect of these trails would result in nonmotorized human disturbance over approximately three percent of the project area. Associated wildlife species may still use habitats within this buffer and displacement could be intermittent and short-term as recreationists pass by on the trail or it could mean longer term avoidance of the trail due to known human activity.

Alternative 3 would rehabilitate the existing historic trails. There would be some short term disturbance associated with trail rehabilitation activities; however, long-term habitat security for wildlife would be greatest under alternative 3.

Special recreational site cuts and other recreational improvements around Lion Lake may have limited effects on migratory birds, snag and down woody debris, and old growth associated species. Existing human disturbance associated with open campgrounds is well documented to have displacement impacts to birds and other wildlife species (Hamann et al., 1999). These activities may displace some species still using habitats immediately adjacent to the recreational sites.

Alternative 2, 3, and 4 – Cumulative effects

There are existing as well as other past established human activities including road building, hiking, fire suppression, firewood cutting, hunting, and special uses. Private lands in the project area are more developed than these areas were historically. However, the development of homes and logging/clearing on private lands is primarily distributed in the lower elevations of the project area. Firewood cutting can be done by member of the public along open motorized routes. This activity contributes to snag reduction in the proposed project reducing habitat structures for associated wildlife species. Road closures for grizzly bear security under amendment 19 have limited open road access for the public decreasing susceptibility of snags to be cut for firewood.

There have been past harvest activities within the project area including the Hungry Horse/West Glacier Fuels Reduction, Paint Emery, Firefighter, and Belton Fuels. These projects have altered the forest mosaic, reduced snags, opened forest canopy and regenerated forest stands. None of these projects has treated old growth habitat. These project effects (past and ongoing) were

considered in the habitat baseline. These projects were consistent with the Flathead National Forest Plan direction for snag conservation. Considering the past influence of these projects, as well as the Hungry Lion Project, snags would remain well distributed throughout the project area. Evaluating snag abundance and distribution across the Flathead National Forest, FIA data supports that the Flathead National Forest has been relatively successful for managing for similar snag densities that occur in unmanaged wilderness areas (Project File Exhibit H-12).

The Adapted Silviculture for Climate Change (ASCC) Research Project includes six Hungry Lion units; these units are in all action alternatives and were considered as part of the project direct and indirect effects above.

Road closures and past decommissioning have resulted in increased security for neotropical migratory birds, old growth, and snag and down woody associated species in the project area. The Firefighter Project has increased security through road decommissioning and installation of berms to obstruct motorized use of roadways. Public motorized use would not change with project activities. All of the Hungry Lion action alternatives would not result in a net increase of Open Motorized Access Density, Total Motorized Access Density or net decrease in security core. Alternatives 2 and 3 would rehabilitate temporary roads and reclaim historic roads that are added to the system. Reclaimed roads would be treated to be impassable to motorized vehicles. Other projects exist outside the project area in the South Fork and Middle Fork watersheds, but were judged not to contribute cumulative effects to the project with the exception of contributing motorized traffic passing through the project area.

Wildfire suppression activities would continue in the project area. Fire suppression has decreased fire disturbance in the project area and likely increased the amount of shade-tolerant species present in the understory of mature stands. Fire suppression activities have likely increased forest canopy cover, density and patch size of dense forest stands over time. Hardwood tree species such as aspen that typically regenerates in forest openings after fire may have decreased over time with the influence of fire suppression activities. Prescribed fire would increase the effects of fire disturbance to forest conditions in the project area. Harvest activities under all action alternatives would increase forest openings and decrease forest density within proposed units.

Existing recreation exists on closed roads and trails within the project area including mountain biking, horseback riding, hiking, and fishing etc. Additional miles of system trails would have little departure from the existing condition as these historic trails are currently used by the public. Addition of historic trails would maintain hiker and other recreational nonmotorized access in the project area. Alternative 3 would decrease recreational access and reduce displacement potential in the project area by rehabilitating the trails. Firewood cutting would continue in adjacent areas to roads open to public motorized travel in the project area. The proposed project alternatives would not increase public motorized access above the existing condition. Road closures under amendment 19 have increased security for snag associated species through the forest and the project area by limited open road densities.

While factors outside of the U.S. Forest Service's control, (e.g., deforestation of tropical wintering grounds, drought, exotic species, and parasitic species) may have negative effects on neotropical migrants. The actions taken under any of the alternatives proposed with the Hungry Lion project are not expected to contribute to negative effects on migratory birds because sufficient habitat for a broad suite of neotropical migrant birds would be maintained. Habitats shift over time with dynamics in age class, composition, and structure changing naturally. Bird populations in the South Fork and on the Flathead have adapted to this change with numbers of

different species increasing or decreasing, depending on the availability of open forest, dense cover, old growth, snags, riparian habitats, or brush.

Summary of Effects or Statement of Findings

The cumulative effect of past activities, the proposed activities of this project, and future activities, would not preclude neotropical migratory birds, old growth, snag, or down woody associated species use of habitats in the area. There appears to be little risk of population loss, and species viability would be maintained. For additional information on the status of old growth associated, snag and down woody associated, neotropical migratory bird species on the Flathead National Forest, and the status at broader scales, please reference the document, Flathead National Forest Evaluation and Compliance with NFMA Requirements to Provide for Diversity of Animal Communities (USDA Forest Service, 2017a). The project would not adversely affect habitat or cause a decline in population viability that would contribute to federal listing of bird species, species associated with old growth forests, snags or down woody debris.

Regulatory Framework and Consistency

The National Forest Management Act (NFMA) requires that the U.S. Forest Service “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.” In addition, NFMA regulations 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.” According to NFMA, “This will satisfy the statutory requirement to provide for diversity of plant and animal communities based on suitability and capability of the specific land area in order to meet multiple use objectives.”

Implementation of all alternatives would be consistent with the standards in the forest plan related to old growth management. There would be no timber harvest or fuel reduction in any areas of existing old growth habitat under any alternative (also see the Forest Vegetation section of chapter 3). Forest plan amendment 21 was signed in January 1999. It has a goal to “maintain and recruit old growth forests to an amount and distribution that is within the 75 percent range around the median of the historical range of variation. Where current conditions are below this amount, actively manage to recruit additional old growth.” This standard states that “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 2) reduce risks to sustaining old growth composition and structure.”

Amendment 21 has objectives to “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.” 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) would be left to provide for future wildlife movement through the matrix surrounding old growth forests. Snags and down woody debris would be retained in units, were available, consistent amendment 21 direction (see Design Features). All action alternatives maintain a variety of patch sizes distributed across the project area, provide for recruitment of old growth, and provide for movement, making them consistent with this direction.

Amendment 21 direction includes, “road construction activities associated with vegetation management actions shall avoid or minimize impacts to old growth to the extent feasible.”

Alternatives 2 and 3 propose road construction on a historic template which bisects approximately 100 meters of identified and potential old growth stands. This historic route would include construction on an existing road template which does not contain mature trees or other vegetation adding to old growth habitat value and reconstruction of the road would minimally effect the character of the identified and potential old growth stands.

At larger scales than the Hungry Lion project area, a multi-scale evaluation of compliance with NFMA requirements to provide a diversity of plant and animal communities on the Flathead National Forest (USDA Forest Service, 2017a) stated that the Flathead National Forest provides a considerable diversity of habitats for a variety of bird species and that when sufficient downed wood, understory trees, windfirm live trees, and snags are retained and available, adequate habitat can be maintained with timber management. All action alternatives are consistent with this direction.

The 1988 amendment to the Fish and Wildlife Conservation Act mandates the United States Fish and Wildlife Service to “identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act of 1973.”

The Migratory Bird Treaty Act implements various treaties and conventions between the United States, Canada, Japan, Mexico, and the former Soviet Union for the protection of migratory birds. Under the Act, taking, killing, or possessing migratory birds, including nests and eggs, is unlawful. A list of neotropical migrant birds protected by the Migratory Bird Treaty Act is provided in 50 CFR 10.13.

In January 2001, an executive order was signed outlining responsibilities of Federal agencies to protect migratory birds under Migratory Bird Treaty Act (Executive Order 13186). The report, “Birds of Conservation Concern 2002,” amended most recently in 2008, is the United States Fish and Wildlife Service’ most recent effort to carry out this mandate and to meet their responsibilities under the 1988 amendment. The overall goal of this report is to accurately identify the migratory and non-migratory bird species (beyond those already designated as federally threatened or endangered) that represent the highest conservation priority. In the report, the United States is broken down into Bird Conservation Regions (BCR), with bird species of conservation concern identified for each region. The Flathead National Forest is located in BCR 10. It is recommended that the Bird Conservation Regional lists, with bird species of conservation concern, be consulted in accordance with Executive Order 13186, “Responsibilities of Federal Agencies to Protect Migratory Birds.”

As a complimentary measure to Executive Order 13186, the Forest Service and the United States Fish and Wildlife Service entered into a memorandum of understanding in 2008. The purpose of this memorandum of understanding is to strengthen migratory bird conservation through enhanced collaboration between the agencies, in coordination with State, Tribal, and local governments. While this memorandum of understanding has since expired, the Hungry Lion Project would be consistent with the direction included in the memorandum of understanding.

Some migratory birds are covered by state hunting regulations; others are protected by non-game status with the Montana Fish Wildlife and Parks. There are currently no Flathead National Forest Plan standards specific to migratory birds. The flammulated owl and the peregrine falcon (neotropical migratory bird species) are also Forest sensitive species, and are discussed in the

biological evaluation for the Hungry Lion Project, as well as in the Sensitive Wildlife Species section of this EA. Six of the neotropical migrants are old-growth associates, at least 13 are associated with snags or downed wood, and 43 are associated with riparian habitats. Forty seven of the 73 species (64 percent) have Montana ranking of S5 which is “Common, widespread, and abundant-although it may be rare in parts of its range; not vulnerable in most of its range.” Based on Flathead National Forest management direction that applies to the habitats used by the 26 species that have some level of conservation concern, there appears to be little risk of population loss due to Flathead National Forest actions.

No substantial loss of migratory bird habitat is expected by implementing this project. The intent of the Migratory Bird Treaty Act, the 2001 Executive Order, and the memorandum of understanding to conserve and protect neotropical migratory bird species, would be met under the action alternatives. Implementation of the project alternatives would not result in a loss of viability to NTMB species. Therefore, while factors outside of Forest Service control (such as deforestation in tropical wintering grounds, global climate change, drought, subdivision and housing development, exotic and parasitic wildlife species) may have negative effects on these species, the project would not adversely affect habitat or cause a decline in population viability that would contribute to federal listing of bird species, species associated with old growth forests, snags, or down woody debris.

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Recreation

Introduction

The Hungry Lion project area includes the land surrounding the communities of Hungry Horse, Martin City and Coram. It includes the Hungry Horse Dam and portions of the Hungry Horse Reservoir, which is a popular recreation area. It also includes the Coram Experimental Forest, which allows dispersed recreational activities, but prohibits recreation development. The project area includes a variety of recreational opportunities. These include open forest roads, developed recreation sites for day use, developed and dispersed recreation sites for overnight use, nonmotorized trails, boat launches, and groomed snowmobile trails.

Summary of Findings

Alternative 1 would result in no change to the recreational management within the project area. This alternative does not meet current public demand for recreation in the project area and has potential for increased user conflict, and a high likelihood of continued use of unapproved trails.

The action alternatives 2 and 4 would provide a more sustainable trail system that would better meet current public demand while reducing user conflicts and allow for proactive agency management of trails and resources.

Alternative 3 proposes to decommission the historic trails in the project area. This would result in fewer nonmotorized recreational opportunities in the project area and may result in the proliferation of unapproved trails on the landscape as users continue to recreate in the project area.

Analysis Area

This analysis of the recreational resource will focus on recreational activities specific to National Forest System lands within the Hungry Lion project area as described in chapter 1.

Methodology

This analysis used historical documents and maps to determine the presence of historical trails in the project area, these documents can be found in the project file. The report draws information from special use permits and the special uses database to report information on special uses in the project area.

Existing Condition (Affected Environment)

Road use

Driving for pleasure is one of the most popular recreation activities occurring on the Flathead National Forest. 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 Eastside Reservoir Road, NFS Road 38, is a popular road used to access NFS lands along the east side of Hungry Horse Reservoir and the Spotted Bear Ranger District. The Desert Mountain Road, NFS Road 497, is another popular year round access route as is the Emery Creek Road,

NFS Road 546. Other NFS roads in the project area are used for motorized and nonmotorized access to NFS lands, including the Coram Experimental Forest. Some of the roads in the project area allow over the snow vehicle use and will be discussed later in this section.

Recreationists also use closed roads for nonmotorized access into the forest for a myriad of activities such as hiking, bicycling, stock use, huckleberry picking, hunting, wildlife viewing, or just walking in the woods.

Developed and dispersed recreation areas/sites

There are four developed recreation sites within the Hungry Lion project area; Abbot Bay Boat Launch, Emery Bay Boat Launch and Campground, North Lion Lake Day Use Area, and South Lion Lake Day Use Area. There is a popular dispersed recreation site known as FK&L that is also in the project area. Proposed renovations to the Abbot Bay Boat Launch, the Emery Bay Boat Launch and Campground, and FK&L were analyzed in the Eastside Hungry Horse Recreation Site Renovation Project (EHHRSP) 2011 (Project File Exhibit O-10) and continues to be implemented as funding becomes available.

- Abbot Bay Boat launch is located off the Eastside Reservoir NFS Road 38 at the end of NFS Road 5301 and was an established boat launch prior to 1968. The boat launch area is used for dispersed camping and to park vehicles from launched boats when the water level is down. The existing use at Abbot Bay consists of boat launching, day use recreating (swimming), and overnight camping. This launch site provides the opportunity to launch a boat without driving very far off the paved road and continues to draw a high number of visitors to the site. This site serves as the main reservoir boat launch at low-pool in the shoulder seasons.

Due to the Anna Creek Cabin Rental Decision (2015) the road accessing the five campsites at the Abbot Bay Boat Ramp has been closed (summer 2016), to be consistent with the draft Grizzly Bear Conservation Strategy (USFWS 2013) regarding overnight capacity in the Hungry Horse Bear Management Unit. Other improvements to the Abbot Boat Launch were analyzed in the EHHRSP and have yet to be implemented.

- Emery Bay Campground is located at milepost 5.8 on the Eastside Reservoir Road 38. It is the only concession campground in the project area. Constructed in 1965, the campground consists of 26 sites and two large group sites, one host site and boat launch open from May 15th to September 30th each year. Each of the 27 campsites has a fiberglass tabletop, metal fire ring, and parking spur. There are six accessible sweet smelling toilet type vault toilets and a drinking water system. The boat launch parking area can accommodate 10 vehicles. This is a group use area designed with two loops and can accommodate up to 150 people. Use at the campground is moderate from May 15th to June 30th and high from July 1st through September 30th. Since Glacier National Park is nearby, people from all across the United States come to this campground as well as local people using the reservoir for a weekend getaway. The forest recently installed bear-resistant food lockers at this site and analyzed other improvements to the Emery Bay Campground in the EHHRSP which will be implemented as funding becomes available.
- The Lion Lake Day Use Areas are located about 1.5 miles southeast of Hungry Horse along the paved Westside Reservoir Road 895, just below the Hungry Horse Dam. The water level of this 35 acre lake is regulated by a small check dam on the outlet to Whelp Creek. The Lion Lake Day Use Area is composed of two separate sites for day use recreation, North Lion Lake and South Lion Lake. Both of the areas receive high levels of use by both locals and tourists throughout much of the summer. Many of the tourists stop at this area enroute to Glacier

National Park, the Hungry Horse Dam, or to visit the facilities along the reservoir. Lion Lake is part of the greater Hungry Horse recreation complex that offers a wide variety of recreation opportunities near the 23,750 acre Hungry Horse Reservoir. There are also a series of trails, open and closed roads, and old skid trails that visitors use to hike and ride horses and bicycles out of the parking areas. Parking for horse trailers is difficult at both North and South Lion Lake areas.

- FK & L log landing is a popular dispersed recreation site located off the Eastside road at the end of NFS Road 2802 and is at the end of same main access road as Emery Bay Campground. This dispersed site was developed as a log landing, not a recreation site, but this site has had moderate to high levels of recreation use since about 1968. There are 12 parking/camping areas that are occupied at various times through the summer. The existing use at FK&L consists of overnight dispersed group camping in camper and large RV's, and day use, with the majority of use being large group camping. The site has a large open parking area adjacent to a cove on the north side of Emery Bay. The forest recently installed a sweet smelling toilet at this site and analyzed other improvements to FK&L in the EHRSRP which will be implemented as funding becomes available.

There are several other dispersed undeveloped sites within the project area. Campers, anglers, hunters, and day users enjoy these sites. For the most part, they are located at the end of a road, or near a road closure device.

Trails

There are several NFS system trails within the project area. Ousel Peak trail 388 passes starts at road 546 and climbs 7.2 miles towards Ousel Peak in the Great Bear Wilderness. The Lion Lake trail 611 is a short trail (0.72 mi) that connects North Lion Lake to the South Lion Lake picnic area. The Hungry Horse Motorcross Track, is a series of motorized trails located behind the Hungry Horse Ranger Station on Lower Dam road. There are several short trails located within the Coram Experimental Forest that were constructed for educational purposes and are maintained by the district, these trails include trail 685, 687, 688, and 689.

There are also several historical trails and social trails within the project area that are not currently designated system trails. Two historical trails in particular are old phone line corridor trails that serviced the old lookout on Desert Mountain and the old trail that serviced the lookout site on Lion Hill, adjacent to Lion Lake (Project File Exhibit O-13, O-14, O-20). Neither location serves as a current lookout site, but the trail corridors have remained and continue to be used by nonmotorized recreationists including, hikers, horse riders, and bicyclists. For unknown reasons both of these trails stopped receiving regular maintenance and over time were removed from the NFS trail system displayed on visitor maps. Some social trails have been created by repeated dispersed use, these social trails branch off of these historic trails to create loop networks.

The non-system trails in the Lion Lake area are accessed via either of the Lion Lake day use sites and are currently managed as dispersed recreation. These trail segments were not constructed to Forest Service trail standards and do not receive annual maintenance. Lack of annual maintenance contributes to potential erosion, or creates other management issues that were not anticipated at the time of original construction. The historic Desert Mountain Lookout trail, known as the 'Trough Trail #44' is located primarily in the Coram Experimental Forest which is jointly managed by the Flathead National Forest and the Rocky Mountain Research Station. Dispersed recreation is allowed in the Coram Experimental Forest, but does have more restrictions than the general forest area. Management responsibilities are outlined in the Letter of Agreement between

the Flathead National Forest and the Rocky Mountain Research Station (Project File Exhibit O-11).

Winter motorized

The Flathead National Forest Winter Motorized Recreation Plan Record of Decision was signed November 17, 2006 and added to the Flathead Forest Plan as Amendment 24. This plan designates winter-motorized routes, play areas, and seasons for snowmobile recreation throughout the Flathead National Forest depicted on the Hungry Horse/Spotted Bear Ranger Districts & Glacier View Over Snow Vehicle Use Map (Project File Exhibit O-12). A portion of the project area allows for snowmobiling during the general snowmobile season from December 1st through March 31st. In the project area, NFS Roads 38, 497, 497A, and the lower portion of 546 are open yearlong roads and may be used by over snow vehicles as long as adequate snow cover exists. NFS Roads 1614, 1615, and the upper portion of road 546 are open to over snow vehicle access from December 1 to March 31, conditions permitting. Some of these roads allow snowmobile grooming under a challenge cost share agreement and some are open to use but not groomed, these areas are depicted in the Hungry Horse/Spotted Bear & Glacier View Over Snow Vehicle Use Map. The Flathead Snowmobile Association operates under a Challenge Cost Share Agreement and grooms a 28 mile trail system located on NFS roads, as described in the roads section. Some general forest areas outside the Coram Experimental Forest, Firefighter winter range area, and Great Bear Wilderness are available for snowmobiling during the general season, as depicted by the Over Snow Vehicle Use map. Approximately 28 miles of NFS roads are groomed by a local snowmobile club and is known as the Desert Mountain Winter Trail System.

Special uses

There are special use authorizations within the project area for monitoring sites, communication equipment, facility lines for landowners adjacent to NFS lands, and recreational use permits. A list of all special use permits in the project area is located in Project File Exhibit O-1. The Coram Experimental Forest does not allow the issuance of new special use permits on the experimental forest (Project File Exhibit O-11).

There is an authorization for a Snotel site issued to the United States Geological Survey at the end of the Emery Creek Road 546 (Project File Exhibit O-5 and O-6). There is also an electronic site at the end of NFS Road 497 on Desert Mountain (Project File Exhibit O-1, O-2, and O-3).

There are two outfitter and guide special use permits authorized to provide snowmobile trips on the Desert Mountain Winter Trail System. There is also one summer outfitter and guide permit that offers day horse rides in the northwestern part of the project area. There are other recreation events that have been permitted in the project area.

One of the developed sites, Emery Bay Campground is authorized under permit to the Forest wide Campground Concessionaire. The permittee are responsible for the operation and maintenance of the facility from mid-May through September.

Other special use permits have been granted to private landowners for road access, installation and maintenance of powerlines, phone lines, fiber optic lines, water lines, and other private uses for landowners adjacent to NFS lands. A list of special use permits can be seen in Project File Exhibit O-1, O-2, and O-3.

Desired Condition

The desired recreation condition of the Hungry Lion project area, as stated in the purpose and need statement will be to increase recreational opportunities and improve visitor safety at developed and dispersed recreation sites. The ‘special cut’ units around Lion Lake, Abbot Bay Boat Launch, the FK & L dispersed camping area, and the Emery Bay Campground will address hazard trees and vegetation management at these recreation sites to provide for visitor safety and forest management as it benefits the recreation experience. The proposed accessible fishing pier/pad at South Lion Lake will offer a new recreation opportunity and will address the lack of accessible access to any of the shorelines. Accessibility improvements proposed for the Lion Lake trail 611 will also provide improves recreational opportunities for a day use site that is popular with a variety of user groups. In addition, improved parking at North Lion Lake, particularly for horse trailer parking and turnaround space will improve traffic flow as well as visitor safety.

The network of non-system trails in the vicinity of Lion Lake and Desert Mountain are not currently being managed by the Forest Service. Although no resource damaged has been documented, the opportunities for degradation of resources will increase if unmanaged use also continues to increase. By bringing the segments of historical and social trails that are currently receiving the highest use back onto the National Forest System, the Forest Service can bring these trails up to standard for future resource protection. Management can help to reduce user conflict, provide a trail system commensurate with public demand, and reduce unapproved trail proliferation. Adding these trails to the NFS trail system also creates opportunities to partner with local user groups for management and maintenance of these trails over time. It also addresses the concerns of the managers in the Coram Experimental Forest who have requested that the Trough Trail #44 be returned to the NFS trail system and managed to Forest Service Trail standards.

It is also desired to maintain the groomed winter routes currently approved and used in the project area.

Environmental Consequences

Alternative 1 (no-action alternative) – Direct, indirect, and cumulative effects

Alternative 1 (no-action) provides a baseline from which to analyze the effects of the action alternatives. “No-action” assumes ongoing use and management of the current trail system and recreation sites within the project area.

Road Use

Road use in the project area would not change under alternative 1 (no-action) alternative. Ongoing maintenance would occur as funding allows.

Developed and dispersed recreation areas/sites

At the Lion Lake picnic areas, the lack of accessible access to Lion Lake would continue and trailer parking and general parking congestion will persist at North Lion Lake. No vegetation management activities will take place at developed and dispersed recreation sites and hazard trees will be addressed on a case by case basis.

Trails

Specifically, under alternative 1, the Forest Service would continue to manage system trails in the project area in accordance with current management plans and Forest Service Handbook 2309.18 (Project File Exhibit O-15). Existing historic and unapproved trails would not be incorporated as system trails. The Forest Service would continue to discourage use and proliferation of unapproved trails through monitoring and enforcement of managed uses within the project area. However, because of the uncertainty regarding the removal of unapproved trails in the short term and the lack of staffing available to monitor and enforce the managed uses, this decision conservatively assumes that no trails would be decommissioned under alternative 1, and that impacts associated with their continued use would continue. The potential for newly created trails and spur trails will continue, particularly in the Coram Experimental Forest where non-system trails are discouraged.

Winter motorized

Winter motorized recreation would continue as currently managed and would not be impacted by winter operations and logging activity under alternative 1 because no vegetation management would take place.

Special uses

Operations for special use permit holders will continue as currently managed.

Alternative 2, 3, and 4– Direct & indirect effects

Road use

The public's use of the roads in the project area may be affected in the short term by logging activities occurring on the open roads in the project area. These effects are expected to be of short duration during the life of the timber sale. The public may also be potentially affected by the proposed aquatic organism passage structure proposed for Hungry Horse Creek in all alternatives. This structure is located on NFS Road 38, which is a very busy road for visitors recreating along the eastside of the Hungry Horse Reservoir and accessing the Spotted Bear Ranger District. The structure would take approximately 3 weeks to install, between July 15 through November 1, and during this time, all traffic on the eastside of the Hungry Horse Reservoir would be stopped at the installation site and redirected to NFS Road 895 on westside of Hungry Horse Reservoir. This would be a short term negative effect for forest visitors and forest seeking to use NFS lands and recreation sites on the eastside of the Hungry Horse Reservoir during the operating period for the aquatic organism passage (AOP) installation.

The project will not change public motorized access.

Developed and dispersed recreation areas/sites

The primary effect caused by these action alternatives to recreational opportunities would be a result of improved accessible access at the South Lion Lake picnic area through the installation of an accessible fishing pier and improved accessibility on the Lion Lake trail 611. The improved parking and traffic flow at North Lion Lake picnic area would allow for expanded recreational use in the Lion Lake area by equestrians and other nonmotorized recreationists.

Vegetation management is proposed in all of the developed sites in the project area and may affect other popular dispersed sites as well. The development of vegetation management plans for these sites will help managers plan for future vegetation management needs at each site and allow

managers to implement management recommendations as part of a timber or stewardship sale that results from the Hungry Lion Project. The purpose of vegetation management in the recreation sites is to manage vegetation for public safety and to enhance the recreation experience. It may result in short term closure of these areas outside the primary recreation season to allow for operations to occur, see chapter 2-design features for recommendations to minimize the effects to forest visitors. Visitors will see a change in vegetation following these activities and it is possible that it will take more than one season for brush disposal and planning to be completed.

Trails

Alternative 2 and 4

Alternatives 2 and 4 reflects the trail design proposed by the Forest Service during public scoping. This alternative was designed to meet the purpose and need of the proposed action, and reflects a majority of the comments received by the public. Approximately 12 miles of trails, both existing historic trails as well as existing non-system trails, would be incorporated into the forest trail system in the project area. These trail segments were selected through collaboration with the district recreation staff and the Coram Experimental Forest staff to bring the routes receiving the highest use into compliance with Forest Service trail standards. The goal of bringing trails onto the forest system is to provide the public with more nonmotorized trail opportunities as public comment expressed a desire for, to discourage unauthorized trail proliferation, and to provide for a safe, sustainable, and managed recreation opportunity.

Public comments expressed a concern about conflicts between different types of recreationists and potential conflicts between recreationists and wildlife. This desire to reduce user conflict in the project area would be addressed under alternatives 2 and 4 by improving trail design to increase sight distance on trails and incorporating trail design techniques that can slow down user groups to reduce the opportunities for high speed encounters between different types of recreationists and between recreationists and wildlife. Trail improvements would also include signage and educational materials about how people can reduce user conflicts and avoid wildlife conflicts while using trails (see chapter 2-design features).

The proposed trail system would be managed for nonmotorized uses and would create a nonmotorized travel system that enhances recreation experience, safety, environmental protection, and operational efficiency. All trails will be maintained in compliance with the Trails Management Handbook and Forest Service Handbook 2309.18. Consistent with the current forest plan and Forest Service trail standards, these proposed system trails will be brought up to the design standard of the trail class three, pack and saddle stock (Project File Exhibit O-15).

The designed use of a trail reflects the managed use that requires the most demanding design, construction, and maintenance parameters and that, in conjunction with the applicable trails class, determines which design parameters will apply to the trail. While there can only be one design standard for a trail, there can be more than one managed use per trail or trail segment.

“The Managed Uses for a trail are usually a small subset of all the allowed uses on the trail, that is, uses that are allowed unless specifically prohibited. For example, on a trail that is closed to all motorized use but open to all nonmotorized use, the Managed Uses could be Hiker/Pedestrian and Pack and Saddle. The allowed uses, however, would also include bicycles and all other nonmotorized uses.”(Forest Service Handbook 2309.18, page 10, Project File Exhibit O-15).

All trails within the project area would be managed for nonmotorized uses, including hiker/pedestrian, bicycle, and equestrian uses, in a manner designed to minimize user conflict and the future creation of additional, unapproved trails (see chapter 2-design features).

In 2010, the Forest Service's Recreation, Heritage, and Volunteer programs prepared a strategy for developing sustainable outdoor recreational opportunities that meet the environmental, social, and economic needs of present and future generations. As provided in *A Framework for Sustainable Recreation* (Project File Exhibit O-16), the strategy is intended to "...unite diverse interests, create and strengthen partnerships, focus scarce resources on mission-driven priorities, connect recreation benefits to communities, provide for changing urban populations, and most importantly, sustain and expand the benefits to America that quality recreation opportunities provide."

Broadly, the goals of a sustainable recreation program are to:

- Provide a diverse range of quality natural and cultural resource based recreation opportunities in partnership with people and communities;
- Protect the natural, cultural, and scenic environment for present and future generations to enjoy;
- Partner with public and private recreation benefit providers to meet public need and expectations; and
- Perform and plan by implementing systems and processes to ensure effective decisions, sound investments, and accountability; collaborative approaches to integrated solutions across the landscape; and enhanced professionalism of the Forest Service workforce.

The framework identifies 10 "high leverage" focus areas for achieving sustainable recreation programs on Forest Service lands by 2019. Alternative 2 addresses several of these focus areas by collaborating to develop the scope of the proposed action with advocacy groups in and around the Flathead Valley; working to resolve "unmanaged recreation" through a planned and properly designed trail system; providing updated and accurate signage; and utilizing volunteer and youth organizations to assist with maintenance and management of the trail system and promote citizen stewardship.

The need to reduce user conflict in the project area would be addressed under these alternatives by designating specific uses, providing signage to clearly mark those uses, and the designated uses would guide trail design standards.

Alternative 3

Under this alternative, the Forest Service would decommission the historic and non-system trails on Desert Mountain and Lion Hill.

This alternative was developed to address the public comment received expressing concern that if these trails were added to the system, they would be used by mountain bike riders and would contribute to increase conflicts between user groups, such as horseback riders or hikers and mountain bike riders. Other commenters expressed concern that there would be an increase potential for conflict between mountain bike riders and wildlife on these trails.

Trail decommissioning is the physical treatment of an existing trail to rehabilitate it to a relatively natural condition so that it cannot be used again, will not erode, and will quickly regrow native vegetation. Although typically associated with the rehabilitation of Forest Service System Trails,

for simplicity purposes, the term decommissioning is used in the EA to refer to the closure and removal of both existing historic and exiting unapproved trails, despite the fact that existing unapproved trails have never been “commissioned” by the Forest Service.

For the purposes of this EA, decommissioning work may include:

- Installing waterbars in the trail tread to limit further erosion and deter use;
- Recontouring the trail tread;
- Covering the trail tread with locally available brush and rocks;
- Installing signs;
- Constructing rock or log barriers; and/or
- Planting and seeding appropriate vegetation, as prescribed by the Forest Service botanist.

All of these trail segments are located in close proximity to the towns of Hungry Horse, Coram, and Martin City where their loss would likely contribute to increased opportunity for user conflicts on the remaining recreation areas. Additionally there are concerns that users who disagree with the decommissioning of trails would attempt to re-construct the trails or build additional trails, which would result in additional resource damage. Because of limited law enforcement capacity, it would be difficult for the Forest Service to enforce these trail closures and to prevent unauthorized trail construction in a timely manner.

Winter motorized

Alternative 2, 3, and 4 do not propose any changes to winter motorized access, but project activities may affect winter motorized use of these areas.

Alternative 2, 3, and 4 proposes vegetation management activities adjacent to NFS Road 38, 497, 497A, and 546, all of these roads allow over the snow vehicle use and some of these roads are permitted for grooming activities. If some of these logging activities require winter logging or allow winter logging, this will likely limit snowmobile access in these areas during harvest and hauling activities to provide for public safety during operations. It is difficult in the planning stage to know when these activities will occur and for how long, but these could occur sometime between 2018–2023.

Alternative 2 and 4 proposes a forest plan amendment to conduct 30 days of culvert work in grizzly bear security core habitat on NFS Road 1614, a bermed road that allows snowmobile grooming between December 1 and March 31. Alternative 3 does not propose to do any culvert work on NFS Road 1614.

Alternative 2 proposes to replace the culverts on this road. This work will involve removing vegetation from the road bed to allow equipment access to culvert sites, then replacing culverts and reestablishing the road bed. This work will provide a benefit to snowmobile grooming activities in the short term by reducing vegetation on the closed road bed and would maintain the road bed in its current condition for snowmobile grooming.

Alternative 3 does not propose any activities on NFS Road 1614 so there will not be any vegetation removed nor will the road bed be modified.

Alternative 4 proposes to remove the culverts from the road. This work will involve removing vegetation from the road bed to allow equipment access to culvert sites, then the culvert would be

removed and the edges of the culvert location would be contoured to allow for over the snow vehicle use and grooming to occur. This work could create a short term benefit for snow grooming by reducing vegetation on the road bed, but could create a long term impact to snow grooming access. The removal of the culverts will create challenges for snow grooming and over the snow vehicle use by creating large dips in the roadbed where the culverts were once located. These locations would also be dependent on snow conditions to allow for continued snow coverage across the riparian areas for equipment passage and would create challenges if rain-on-snow events were to occur during the snowmobile season.

Special uses

Special uses in the project area would not be affected by proposed activities.

Alternative 2, 3, and 4 – Cumulative effects

Road use

Past activities have reduced the number of road available for forest visitors to drive. This project will not change public motorized access from current levels.

Developed and dispersed recreation areas/sites

Forest management of developed and disperse sites will allow managers to plan for the future use of these sites, which is expected to increase with the increase in visitation to the Glacier National Park and other natural attractions on the Flathead National Forest. This forest management will be a long-term benefit to recreation resources in combination with the future improvements to Abbot Bay Boat Launch, Emery Campground, and FK&L analyzed in the EHHRSRP. Accessibility improvements to Lion Lake Day Use Areas will provide more recreation opportunities to forest users, and forest management in these day use areas will enhance visitor safety.

Forest users will still continue to have dispersed recreation opportunities throughout the project area, with special restrictions in the Coram Experimental Forest as described on the Hungry Horse & Spotted Bear Ranger Districts Map (November 2014).

Trails

Adding 12 miles of trails to the existing NFS trail system in the project area will enhance the nonmotorized recreational opportunities in the project area. Public comment has indicated that local residents and visitors would like have more nonmotorized trails in the project area. Because Forest Service trail maintenance budgets are not expected to increase, trail managers will also explore opportunities for management through partnerships with local user groups to bring new and existing trails to NFS trail standards.

Winter motorized

NFS Road 38 was closed to over the snow vehicle use during the week in the winters of 2015/2016 and 2016/2017 to allow for post-fire logging to occur on the Spotted Bear Ranger District. Possible winter road closures to conduct vegetation management in the Hungry Lion Project could result in additional effects to over the snow vehicle users in the project area. It is difficult to predict when these closures will occur and how long they will last, but they will affect the public that uses these winter routes for recreation and the over the snow outfitters permitted to use these routes.

Special uses

As was described above, the outfitters permitted to use the over the snow trails in the project area may be affected by winter logging operations if they require use of the groomed snowmobile routes for log hauling. Other special uses are expected to continue into the future and project activities will not result in cumulative effects to these special uses.

Summary of Effects or Statement of Findings

Alternatives 2 will be most beneficial for recreation in the project area. It will allow maintenance and management of popular trails so that they can be brought up to Forest Service standards and managed in a manner that seeks to minimize recreation user conflict and potential recreation conflict with wildlife. It allows for an accessible fishing access site at the South Lion Lake Day Use Area and accessibility improvements to the Lion Lake trail. It allows for vegetation management to occur at the popular developed and dispersed sites in the project area. The culvert work conducted on NFS Road 1614 will be most beneficial for the over the snow vehicle users and grooming activities. Winter activities still may affect over the snow users due to log hauling on snow routes for an unknown period of time.

Alternative 3 is the least beneficial for recreation in the project area due to the decommissioning of the historic and non-system trails. This may result in additional resource damage as users seek to re-establish access and Forest Service seeks to terminate these activities, creating a proliferation of user created trails.

Regulatory Framework and Consistency

The recreation management activities proposed in alternative 2 and 4 would help to contribute to the 1986 Forest Plan goals for recreation to:

“Provide a range of quality outdoor recreation opportunities within a forest environment that can be developed for visitor use and satisfaction.”

“Provide a range of quality recreation opportunities, including motorized and nonmotorized, in an undeveloped forest environment.”

It also contributes to the forest plan objective to: “Provide a system of trails in a variety of settings.”

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Inventoried Roadless Areas

Introduction

A portion of the Hungry Lion project area lies within the Bear-Marshall-Scapegoat-Swan Inventoried Roadless Area (#1485). The inventoried roadless area is approximately 866,330 acres in size and surrounding the Bob Marshall, Great Bear, and Scapegoat wildernesses. It also includes portions of the Swan Range north of the Bob Marshall Wilderness near Inspiration Point and Alcove Mountain to the Columbia Mountain locale near Columbia Falls, Montana.

Approximately 349,000 acres of this inventoried roadless area (IRA) lies on lands administered by the Flathead National Forest; the remainder are located on the Lolo, Helena, and Lewis and Clark National Forests (USDA Forest Service, 1985). The approximately 39,078 acre Hungry Lion project area contains approximately 6,563 acres within the inventoried roadless area shown on Map 3-7. Six prescribed burn units included in alternatives 2, 3, and 4 are within the inventoried roadless area and four proposed harvest units in alternative 2 and 3 are directly adjacent to the inventoried roadless area boundary.

This analysis will disclose the effects of the prescribed burn units on roadless characteristics within the inventoried roadless area.

Summary of Findings

The six prescribed burn units located in the Bear-Marshall-Scapegoat-Swan Inventoried Roadless Area would not affect the natural integrity and apparent naturalness of the inventoried roadless area. The prescribed burning activities would have a short term effect on solitude, remoteness, and primitive recreation opportunities during burning operations but would return quickly. The prescribed burn may affect the scenic features of the inventoried roadless area, but would be natural in appearance. The prescribed burn would have no effect on the manageability or boundaries of the inventoried roadless area.

Methodology

Information used to develop this analysis includes a visual review of National Agriculture Imagery Program (NAIP) aerial images, surveying the Forest Service Activity Tracking System (FACTS) database activity information for past harvesting activities, and GIS tools to overlay a variety of resource layers.

Roadless characteristics

When considering effects of projects on inventoried roadless areas or other unroaded areas, the following roadless characteristics should be considered.

Natural integrity

This characteristic related to the physical setting of an area. Natural integrity is the extent to which long-term ecological processes are intact and operating. Impacts to natural integrity are measured by the presence and magnitude of human induced change to an area. Such impacts include physical developments (e.g. roads, fences, cabins, etc), recreation developments, domestic livestock grazing, mineral developments, wildlife/fisheries management activities, vegetative manipulation, and fire suppression activities.

Apparent naturalness

This characteristic means that the environment looks natural to most people using the area. It is a measure of importance of visitors' perceptions of human impacts to the area. Even though some of the long-term ecological processes of an area may have been interrupted, the landscape of the area generally appears to be affected by the forces of nature. If the landscape has been modified by human activity, the evidence is not obvious to the casual observer, or it is disappearing due to natural processes.

Remoteness

This characteristic is a perceived condition of being secluded, inaccessible, and out of the way. The physical factors that can create remote settings include topography, vegetative screening, distance from human impacts such as roads and logging operations (sight and sound), and difficulty of travel. A user's sense of remoteness in an area is also influenced by the presence or absence of roads, road condition, and whether the roads are open to motorized vehicles or not.

Solitude and primitive recreational opportunities

This characteristic is a personal, subjective value defined as isolation from the sights, sounds, and presence of others, and from the developments of man. Common indicators of solitude are numbers of individuals or parties one may expect to encounter in an area during a day, or the number of parties camped within sight and sound of other visitors. A primitive recreation experience includes the opportunity to experience solitude, as sense of remoteness, closeness to nature, serenity, and spirit of adventure through the application of woodsman skills in an environment that offers a high degree of challenge and risk.

Special features

These characteristics are those unique geological, biological, ecological, cultural, or scenic features that may be located in roadless areas. Unique fish and wildlife species, unique plants or plant communities, potential research natural areas, outstanding landscape features such as unique rock formations, and significant cultural resource sites are some of the items that should be considered when analyzing this element.

Manageability and boundaries

This element relates to the ability of the Forest Service to manage an area to meet size criteria and the elements discussed above. Changes in the shape of an area influence how it can be managed. If broken into narrow corridors or small islands interspersed with areas of non-conforming management practices, many of the above elements may be compromised. To meet the requirements of size, the area must be at least 5,000 acres. This is an especially important element to address if a proposed activity would essentially road the interior of a small roadless area. Changes in shape of roadless areas and the location of other proposed projects outside of the area are also factors that should be considered. Boundary management impacts relate to such factors as need to change boundaries to terrain features that can easily be located and the provision of access to the remainder of the roadless area (changes in trailhead locations, motorized access patterns, etc.).

Analysis Area

This analysis assesses effects to the inventoried roadless area within the Hungry Lion project area from proposed prescribed burns.

Existing Condition (Affected Environment)

This inventoried roadless area has many features that exist in and near the project area, including undisturbed natural processes, minor improvements (e.g. trails), opportunities for solitude, rugged terrain, threatened, endangered, and proposed species (e.g. grizzly bears, lynx, and wolverine), and contiguous habitat for many wide ranging species of wildlife. This area is also partially visible from US Highway 2 headed towards Glacier National Park (see Scenic Resources section for analysis of scenic resources).

The portion of the inventoried roadless area that would be affected by prescribed burn units is a west facing ridgeline in the Emery Creek drainage that meets the Great Bear Wilderness Boundary on its eastern edge along the ridge line. The prescribed burn units are located on south or southeast aspects and range from about 4,800 feet in elevation near the bottom of the units, to nearly 7,400 feet elevation at the upper portions of some units. They have been specifically located to take advantage of natural barriers and to prevent undesired fire spread.

Prescribed burning has occurred on this ridge in the past in the Paint Emery Project. The Paint Emery Project was signed in 1999 but the prescribed burning associated with the project occurred in the fall of 2005 and spring of 2006, resulting in approximately 2,983 acres of burning along the Great Bear Wilderness boundary (Project File Exhibit K-10). These past burns were intended to encourage natural regeneration of whitebark pine seedlings; enhance forage for elk and deer; and increase general forest health conditions.

As a result of these past treatments, the ridgelines and south facing slopes that are currently proposed for burning do not have a dense timber canopy. Some areas appear to have scattered trees and shrubs, but the prescribed burning will largely be located in existing openings (Project File Exhibit 0-8).

There is one trail, Trail #388, located in the inventoried roadless area which goes to the Ousel Peak area.

Environmental Consequences

Alternative 1 (no-action alternative) - Direct, indirect, and cumulative effects

No management activities are proposed in alternative 1. Therefore, there would be no direct or indirect effects from any activities within the inventoried roadless area. Natural processes would continue to occur without much human intervention. Existing manmade features in the inventoried roadless area would continue as they are.

Alternative 2, 3, and 4 - Direct and indirect effects

Natural integrity and apparent naturalness

Fire within these landscapes is the main natural disturbance feature of this landscape. Fire history records show that wildfires were documented on portions of the inventoried roadless area in 1929 and then a small fire in 1988. The prescribed fires in 2005 and 2006 helped to maintain or reestablish the openings in the canopy on portions of this ridgeline (Project File Exhibit 0-7). The current proposed burns were designed to maintain these openings to provide forage for ungulates

and to provide suitable habitat for whitebark pine regeneration. The proposed burning is designed to produce effects similar those expected in a historic natural fire.

Solitude, remoteness, and primitive recreation opportunities

Effects to solitude and remoteness would be expected to be very minimal as a result of introducing fire by helicopter. Helicopter use is expected to occur over a one to three day period during the ignition process. This noise could impact those who expect solitude during those few days.

Prescribed burns would minimally affect primitive recreational opportunities. People who use the area for primitive recreation opportunities would still be able to use the area as they did before, although Trail #388 will be closed during the time that the area is actively burning. Additionally, instead of the area being “green” as it was before, portions of the area would now be considered “black”, but this should not affect their recreational use of the area. Effects to trails are discussed in the Recreation section.

Special features

The dominating feature of the inventoried roadless area where the burns are proposed is the scenic value from a Class 1 travel corridor. This feature and the effects of burning is addressed in the Scenic Resources section of this EA.

Manageability and boundaries

The prescribed burns should not affect the manageability or boundaries of this inventoried roadless area.

Cumulative effects

Proposed burning would minimally impact the inventoried roadless area as discussed above. Periodic helicopter use by the Forest Service or others would not appreciably add to the disruptions to solitude that may temporarily result from the prescribed burning operation.

Regulatory Framework and Consistency

On January 21, 2001 Roadless Conservation Rule (Roadless Rule) was established by the Forest Service. The Roadless Rule prohibited road construction, road reconstruction, timber cutting, sale and removal in inventoried roadless areas with some exceptions.

In May 2010, the Secretary of Agriculture provided direction allowing some road and timber cutting activities under certain criteria to be approved under Forest Service authority. Prescribed burning in inventoried roadless areas was not prohibited under the Roadless Rule nor is discussed in the Secretary of Agriculture’s Memorandum regarding the authority to approve road construction and timber harvesting in certain lands administered by the Forest Service.

The Flathead Forest Plan does not have specific inventoried roadless area direction. Instead, direction is provided through overall forestwide goals, objectives, standards, and more site-specific management area direction (specific areas across the Forest that are differentiated by goals, resource potential, and limitations). The prescribed burns are compliant with forest plan direction for the affected MA 2A and MA 16.

Scenery

Introduction

Research has shown that public acceptance of forest management practices is heavily based on the visual appearance of the forest (Ribe, 2002). Thus this section documents the Scenery resource effects of the proposed Hungry Lion Resource Management Project. Viewshed visibility analysis through use of geographic information system (GIS) and field based photo modeling was applied as a management indicator for scenery analysis.

Scenery analysis is conducted to assess the ability of the project area to absorb management practices while retaining the scenic character of the forest. Through the analysis, design features are applied to assist in achieving this goal. This analysis measures dominance, scale/scope, and intactness of the scenic character compared to management induced deviations through the Visual Management System and the assigned Visual Quality Objectives (VQOs) mapped across the Hungry Lion Resource Management Project and as defined in the 1986 Forest Plan (Forest Plan). The visual absorption capability, viewshed analysis and proposed prescriptions within the project area is the basis for determining whether or not the project will meet the assigned Visual Quality Objectives within their defined timelines. The visual absorption capability is determined by examining the topography, slope, vegetation screening, vegetation diversity and soil/geology and the ability of those features to blend deviations into the landscape.

Summary of Findings

The Hungry Lion Resource Management Project will meet Forest Plan direction, be consistent with management areas (MAs) and the assigned Visual Quality Objectives with the design features fully applied. While a few of the proposed vegetation treatment units would create visual contrast in visually sensitive areas, if the design features are applied, the treatments can be consistent with the Forest Plan direction. Alternatives 3 and 4 would incur the least amount of visual impacts while alternative 2 would incur the most, due to the intensity and size of the treatments within sensitive viewsheds. Units 8, 16, 16a, 22, 30, 35, 35a, 35b, 37, 37a, 38, 40, 43a, 46 and 86 of alternative 2 would potential create the highest visual impacts.

Analysis Area

Spatial bounds

The total project area encompasses approximately 37,090 acres. Views into the project area from sensitive areas and non-Forest lands (i.e. private lands) are documented. Visibility analysis from proposed sensitive travel-ways and use areas for this are described in Table 117. The project boundary and surroundings, visible from the sensitive areas, make up the seen area spatial boundary for assessing direct, indirect and cumulative effects.

Temporal bounds

The effects are measured in three time periods: upon project completion (immediate), five years (short-term), more than five years (long-term). Cumulative effects are analyzed for a 25-year period, which is the approximate time necessary for vegetation regrowth. It is expected that at that time, impacts would appear negligible within the characteristic landscape. The criteria below are used to determine whether the visual quality objective duration of impact is met for each

visual quality objective upon implementation of a management activity. Definitions are taken from the Visual Management System volumes 1 and 2, USDA, Forest Service, 1973.

- Retention Visual Quality Objective - “Immediate reduction in form, line and color, texture contrast... ..during operations or immediately after...” (USDA Forest Service, 1973, p. 30).
- Partial Retention Visual Quality Objective - “As soon after project completion as possible or at a minimum within the first year” (USDA Forest Service, 1973, p. 32).
- Modification Visual Quality Objective - “Reduction in the form, line, color, and texture should be accomplished in the first year or at a minimum should meet existing regional guideline” (USDA Forest Service, 1973, p. 34).
- Maximum Modification Visual Quality Objective - “Reduction of contrast should be accomplished in five years.” (USDA Forest Service, 1973, p. 36).

Methodology

Data sources

The Hungry Lion Resource Management Project inventory and analysis is consistent with the principles of, all of the following sources of guidance which direct the methodology for Scenery resource analysis:

- Scenery Management System (SMS) (USDA Forest Service, 1995b).
- Visual Management System volumes 1 and 2 (USDA Forest Service, 1973) and (USDA Forest Service, 1974).
- Forest Service Manual 2300-Recreation, Wilderness, and Related Resource Management Chapter 2380-Landscape Management.

Terminology used in this analysis follows the SMS. However, because the Forest Plan has not been updated to follow this system, Visual Quality Objectives are described using the Visual Management System. Scenery analyses of the Hungry Lion Resource Management Project were conducted in spring and early summer of 2017. Some of the units in Hungry Lion Resource Management Project are within MA 7 which directs that a visual analysis be performed prior to implementing any landscape altering activities (USDA Forest Service, 1986). Project effects on Scenery resources are assessed by determining the potential for change to the Visual Quality Objective relative to forest plan direction from the 1986 Forest Plan. Key components of the assessment include evaluating existing and existing scenic character, visual quality objectives, visibility and visual absorption capacity. Concern levels and distance zones, from identified high concern level routes and observation points define visibility.

The primary criterion for determining the project’s effect is by evaluation of whether or not the prescriptions meet the Visual Quality Objectives. To determine Hungry Lion Resource Management Project’s effects, the potential change in visual quality is measured against the Visual Quality Objectives. Failure to achieve the Visual Quality Objective, in the assigned timeframe, as specified in the forest plan would result in an adverse effect.

Achievement of or meeting the specified Visual Quality Objective would result in a no effect finding, and meeting a Visual Quality Objective higher than specified would be a beneficial effect. Additional terms used to describe intensity of impacts include:

- **Negligible:** A majority of visitors would not notice any effects or changes to the landscape. Design features 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 features were necessary to offset adverse effects on Scenery resources, it 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 five year timeframe or less based on visual quality objective. Design features 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 features may help reduce impact but impacts would remain evident or even dominant.

Visual quality objectives (VQOs)

Within the forest plan, Visual Quality Objectives are identified geographically by management area and described in narrative form in the forest plan. The Visual Quality Objectives assigned to lands within the project area are shown in Figure 10. Visual Quality Objective definitions in the Hungry Lion Resource Management Project with proposed treatments include the following as defined in National Forest Landscape Management (United States. Forest Service, 1974):

Retention (R): Management activities are not visual evident. Activities may only repeat form, line, color, and texture which is frequently found in the characteristic landscape, Change in their qualities, pattern, etc., should not be evident. Timeframe to achieve or return to this visual quality objective is immediately at implementation.

Partial Retention (PR): Management activities remain visually subordinate to the characteristic landscape when managed according to the partial retention visual quality objective. Activities may repeat form, line, color, or texture common to the characteristic landscape but not change in the qualities of size, amount, intensity, direction, pattern, etc. Activities remain subordinate to the visual strength of the characteristic landscape. Timeframe to achieve or return to this visual quality objective is as soon as possible after implementation.

Modification (M): Management activities may dominate the original characteristic landscape. However, activities of vegetation and landform alteration must borrow from the naturally established for, line, color, or texture so completely and at such a scale that its visual characteristics are those of natural occurrences within the surrounding character type. Additional parts of these activities such as structure, road, slash, root wads, etc., must remain visually subordinate to the proposed composition. Timeframe to achieve or return to this visual quality objective is within the first year after implementation or as stated by regional guidance.

Maximum Modification (MM): Vegetation and landform alterations may dominate the characteristics landscape. However, when viewed as background, the visual characteristics must be those of natural occurrence within the surrounding area or character type. When viewed as foreground or middleground, they may not appear to completely borrow from the natural established form, line, color, or texture. Alterations may also be out of scale, or contain detail which is incongruent with the natural occurrences as seen in foreground and middleground.

Introduction of additional parts of these activities such as structures, roads, slash, root wads must remain visually subordinate to the proposed composition as viewed in background. Timeframe to achieve or return to this visual quality objective is within five years of implementation.

Measurement indicators

Measurement indicators for the Scenery resource evaluate the effect of project implementation on visual quality. Scenery resource indicators to be evaluated are:

1. Treatment prescription driven change in scenic character.
2. Achievement of Visual Quality Objective in the assigned Visual Quality Objective timeframe.

Existing Condition (Affected Environment)

Existing scenic character

The existing scenic character describes the project area within the context of the larger landscape scene. It provides a framework for predicting the degree of scenery alteration and creating design features to reduce or limit that alteration.

The project area is located within the Hungry Horse geographic area. The project area lies just north and east of the northern extent of Hungry Horse Reservoir and just west of Great Bear Wilderness and Glacier National Park. It is within the Flathead Mountain Range and is notable for its outstanding scenic beauty, dominated by glaciated mountains, still alpine lakes and rock outcrops. The slopes in the project area are relatively steep rising out of the valley defined by Hungry Horse Reservoir. There are some areas of exposed rock cliff but most of the project area is heavily vegetated. Aside from Hungry Horse Reservoir and Lion Lake there are few bodies of water in the project area. Mountain top trees in the Flathead Range are slow-growing and have a short growing season. Trees are much thicker on the valley and lower mountain slopes. Common trees and shrubs in the lower elevations are subalpine fir, Douglas-fir, grand fir and Engelmann spruce with occasional pockets of aspen and western larch. Contrasting past harvest units on nearby and distant hillsides can be seen as evidence of timber harvest activity in the Flathead Mountain Range. Other projects within the Hungry Lion Resource Management Project boundary have also influenced the existing scenic character.

Viewshed visibility

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

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

Visibility is assessed through observer points chosen along travel-ways or in use areas (outlined in Table 117. 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 10 identifies areas screened by topography using GIS and 10 meter Digital Elevation Models. Map areas shown 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, structures, or topography not within the limits of the 10 meter elevation accuracy. Areas on the map shown within the 300 foot and ½ mile buffer's off of Concern Level 1 routes/areas would also likely be visible to observers. Therefore Figure 11 helps identify units that are highly visible and focuses the analysis on these units with higher potential Scenery resource impacts.

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** 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 Hungry Lion Resource Management Project area is visible from several areas of high concern (Level 1). Routes and areas in the project area, as well as their justification for their assigned Concern Levels are outlined in Table 117. In some cases, while the user context and number of viewers might justify a higher concern level, screening by vegetation and topography conceals some units within the project area, reducing the concern level for those areas and thus increasing the visual absorption capability of those units. Table 117 identifies use areas and travel-ways not completely screened from the proposed treatment areas by topography and/or vegetation.

Table 117. Summary of travel-way/use area based observer points and their visual quality objectives, distance zones to project units and concern levels

#	Observer Point Name	Justification/Visibility	VQO ¹	Distance Zone ²	Concern Level ³
1	Coram City	Personal importance; partially screened	R, MM	Mg	3
2	U.S. Highway 2	International importance; open	MM	IFg, Fg	1
3	Martin City	Personal importance; partially screened	R, M, MM	Mg	3
4	Spotted Bear Road	Personal importance; partially screened	MM	IFg	3
5	Eastside South Fork Rd (38)	Regional/local importance; open	PR, M, MM	IFg, Fg	2
6	Lion Lake Day Use	Regional/local importance; open	PR	IFg	2
7	Hungry Horse Dam Overlook	National/regional importance; open	PR	Fg	1
8	Abbot Bay Boat Launch	Regional/local importance; open	MM	Fg	2
9	Emery Creek Road	Regional/local importance; open	PR, MM	IFg, Fg	2
10	Emery Bay Campground	Regional/local importance; open	PR, M	IFg	2
11	Westside South Fork Rd (895) north of Doris Point	National/regional importance; open	R, PR, MM	Mg	1
	Westside South Fork Rd (895) south of Doris Point	Local importance; partially screened	R, PR, MM	Mg	2
12	Doris Point Boat Launch	Regional/local importance; open	R, PR, M, MM	Mg	2
13	Lost Johnny Point Campground	Local importance; partially screened	R, PR, M, MM	Mg	3
14	Lost Johnny Camp Campground	Local importance; partially screened	R, PR, M, MM	Mg	3
15	Lid Creek Campground	Local importance; partially screened	R, PR, M, MM	Bg	3

¹Visual Quality Objective: (R= retention, PR= partial retention, M= modification, MM= maximum modification)

²Distance Zones: (IFg= Immediate Foreground, Fg= Foreground, Mg= Middleground, Bg= Background)

³Concern Level: (1= High, 2= Moderate, 3= Low)

Views into the project area, from U.S. Highway 2 are mostly screened by topography and trees or other vegetation adjacent to the road except Unit 8 which is directly adjacent to the road and therefore has immediate foreground views. The Eastside South Fork road (NFS Road 38) is also heavily vegetated, but again there are units directly adjacent to the road which would provide immediate foreground views of higher concern level. Portions of the Westside South Fork Road (NFS Road 895) between the Hungry Horse Dam and Doris Point has open middleground views into the project area while the remainder of the road beyond Doris Point has sufficient vegetation that partially to fully screens views into the project area. This road also passes adjacent to Unit 13, where immediate foreground views are possible. Therefore this road has higher concern levels

on its northern vs. southern portions. Views into the project area from Hungry Horse Reservoir and from overlooks at Hungry Horse Dam provide open and unobstructed foreground views of the closest units. Views looking out from the campgrounds on Hungry Horse Reservoir generally have partially to fully screened views. The exception to this is Emery Bay Campground, where treatments are within the campground and are therefore in the immediate foreground viewshed and has higher concern levels. The Abbot Bay boat launch is also within a treatment unit and will therefore have immediate foreground views and higher concern levels. Lastly, the Doris Point boat launch provides open middleground views across the reservoir and into some of the units.

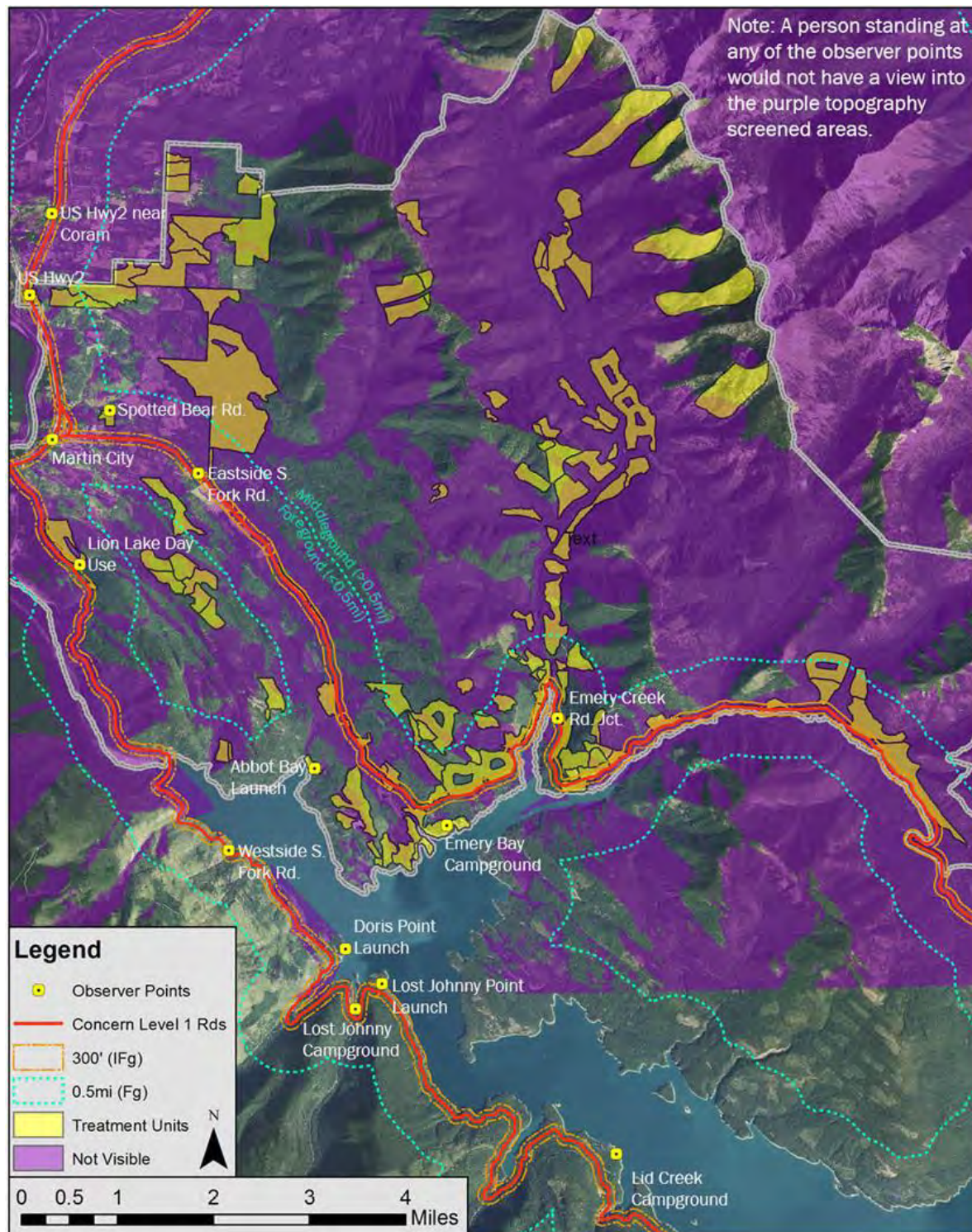


Figure 10. Visibility and observer point location map. Immediate foreground (IFg) and foreground (Fg) distance zones from the concern level 1 & 2 roads and concern level 1 reservoir are also indicated

Existing Visual Quality

Existing visual quality is determined on the basis of visual changes that detract from the scenic character of the area. The existing visual quality is determined through review of the historic range of variability for vegetation found within the project area. Historic records/images and computer modeling exercises of the project area and adjacent lands inform this. Viewed from the use areas and travel-ways documented earlier, the project area has moderate to high visual quality based on the intactness of the scenic character, naturalness and the low amount of noticeable by the average visitor management induced deviation. Exceptions are areas along the forest boundary with private and state lands, where previous treatments edges create vegetation changes and in Coram Experimental Forest, where deviations are more dominant. Additionally there are localized areas of disturbance due to past vegetation harvests, utilities, roads, and housing which have low intactness. However, on a landscape scale the project analysis area has moderate to high visual quality.

Visual absorption capacity

Visual absorption capability refers to the ability of the landscape to absorb treatments without a loss of its scenic character. Visual absorption capability assessment provides a basis for predicting future scenic conditions that could result from project proposals. Slope, vegetation screening, vegetation diversity and soil/geology are primary factors incorporated into visual absorption capability determinations. Reduced visual absorption capability occurs in treatment units with steep slopes, contrasting soil, and monoculture tree species dominance. Better visual absorption capability occurs in flatter terrain, areas with more diverse vegetation, and/or in areas where vegetation and topography provide screening.

Overall the visual absorption capability for the project area is high. Those routes and areas with middleground and background views into the project area (Hungry Horse Reservoir and Westside South Fork Road) have oblique angle views and/or the slope is flatter, increasing the visual absorption capability. Those routes and areas with foreground views into the project area (Hungry Horse Dam and Eastside South Fork Road) are generally screened by the steepness of the slope and/or the density of the vegetation, increasing the visual absorption capability. The lowest visual absorption capability areas coincide with those units in the immediate foreground (U.S. Highway 2, Lion Lake Day Use, Emery Bay Campground and Abbot Bay Boat Launch) where treatments would reduce or eliminate screening.

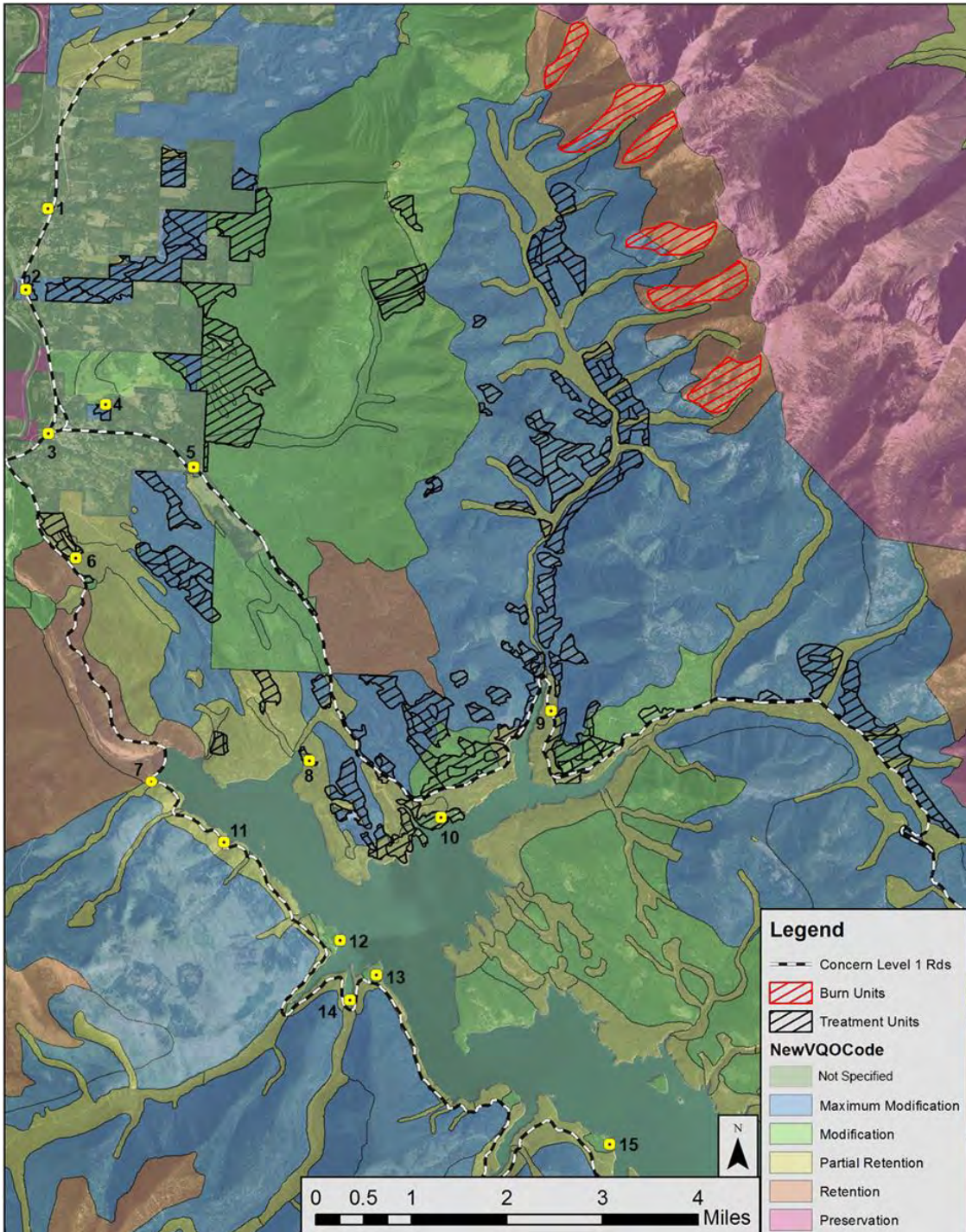


Figure 11. Treatment units by management area and visual quality objective relative to observer points.

Desired Condition

The Scenery resource desired condition for the project is that the Visual Quality Objectives be met or exceeded within their assigned timeframes, treatment units visible from high concern level routes/areas retain their scenic character and the project area reflects the natural historic range of variability for scale, edge, form, line, color and texture.

Environmental Consequences

The Scenery resource was analyzed for alternative 1 (no-action), alternative 2, 3 and 4. Analysis for assessing impacts resulting from the alternatives to Scenery resources were measured through assessment of representational observer points at various locations (see Figure 11 and Table 117) towards proposed treatment areas. The alternatives are analyzed for potential short-term (less than five years) and long-term (five years or more) effects.

As noted in Table 117, three areas (U.S. Highway 2, Hungry Horse Reservoir and Hungry Horse Dam) were identified in the analysis area as needing additional design features to reduce impacts because of high concern levels, visual quality objectives and their associated timeframes. Emery Bay Campground and Abbot Bay Boat Launch also require additional design features because they are within treatment units. While units adjacent to Martin City and Coram City are not of high concern to the general public, they are likely of high concern to the residents whose properties abut or have foreground views of the project area. Therefore design features should be applied to these units to ensure landowners' scenic needs are addressed. With design features implemented, treatment units seen from these concern areas would meet or exceed their visual quality objectives as identified in the forest plan as well as address their special needs based on their higher concern levels.

Alternative 1 (no-action alternative) – Direct, indirect, and cumulative effects

If no action is taken there would be no direct effect to scenic character associated with the Hungry Lion Resource Management Project area. Therefore there would be no direct change in future scenic integrity of the project area from current conditions. The no-action alternative would meet forest plan visual quality objectives.

Potential indirect effects on scenic character and visual quality would be probable continued loss of whitebark pine and western white pine trees because of white pine blister rust as well as potential infestations of other diseases to these species. In addition, the potential fire hazard would increase due to the density of trees in some stands as well as in stands infested by the white pine blister rust which have higher concentrations of standing dead trees and trees' with red-brown dead branches which are fire susceptible. In the event of a fire, the fire scar could potentially damage visual quality for the long-term as seen from viewing areas with high concern; including those from private lands with views onto the adjacent wildland-urban interface (WUI) lands. The impact of fire or infestation could lower the intactness of the landscape and create a dominance of short-term contrasting color or long-term contrast if the infestations and fire occurred on a scale larger than the historic range of variability.

The no-action alternative cumulative effects analysis for Scenery resources examines the no-action impacts in addition to past, probable future and ongoing alterations in the project area and surroundings within the context of viewers at the observer points and or at one of the concern level 1 travel-ways or areas. Several past vegetation modifications including intermediate and

regeneration harvest treatments and prescribed burns have occurred and are ongoing on both private and state lands within the viewshed of U.S. Highway 2 corridor and Hungry Horse Reservoir. Reasonably foreseeable future actions, if the no-action alternative is selected, are a continuation of these treatments within the viewshed. The cumulative effects of these potential risks could adversely affect the scenic character and visual quality within the Hungry Lion Resource Management Project viewshed.

Alternative 2 – Direct & indirect effects

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. This analysis references the representational observer points (see Table 117) 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 features as needed.

Prescribed burn units: 759 acres are proposed as prescribed burn units. All of these units will be treated by helicopter. Thus no road development would occur with these units.

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 prescribed 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. These units are all either fully or mostly in retention visual quality objective. Those portions in of the units in maximum modification visual quality objective are the least visible parts of the units. 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 integrity unless abnormal appearing fire barriers or lines disrupt the overall texture of the landscape. However, according to research low intensity burns can actually improve the scenic integrity of an area as an indirect effect (Ryan, 2005). The proposed treatments could have a long-term indirect beneficial impact to scenery. The retention visual quality objective should be met and possibly enhanced over time by the added diversity of the stands.

Intermediate harvest units: Approximately 2,679 acres of commercial thin (1,660 acres), sapling thin (608 acres), understory removal (278 acres), shaded fuel breaks (49 acres), recreation area special cut (77 acres) and post and pole (7 acres) are proposed as intermediate harvest. All sapling thin units and the post and pole unit, would receive hand treatments. All other units would receive tractor or mechanical treatments, which could include whole tree yarding, yarding of tops, lop and scatter, mastication, and/or piling. Some pile burning to address fuel accumulations at log landings may occur.

A higher percentage of overhead tree canopies would be retained in these intermediate harvest units however a limited number of units would have negative visual effects from viewing areas with high concern such as roadways and private lands. Views into these intermediate harvest units are generally screened unless directly adjacent to a road or private properties. The travel-ways and use areas analyzed adjacent to or within treatments that show the greatest concern to viewers located in immediate foreground views include: U.S. Highway 2, Eastside South Fork Road (NFS Road 38), Emery Bay Campground and private property around Coram and Martin City. Intermediate harvest units with the greatest potential for impacting immediate foreground, sensitive views, creating minor impacts in the short-term include the following units: 1, 2, 4-6, 9,

11, 13, 14, 25, 26, 77, 78, 89-93 (including a & b), 100-104. Visual impacts along the edge of these units would have potential to contrast in form, line and texture with existing vegetation density from roadways, campgrounds and private property. Removal of the understory vegetation, which acts as screening, may allow visibility farther into the units. Stumps and slash would potentially also contrast and appear unnatural. Retaining higher quantities of vegetation adjacent to the roadways, campground and private properties when feasible economically and practically will help meet the visual quality objectives for these areas and they are assigned design features (see chapter 2-design features). However, as new vegetation grows, the majority of these impacts would lessen and within the first year and within five years would not be evident as a visual deviation in the landscape from sensitive areas.

Table 118. Summary of impacts with views of moderate concern from intermediate harvest treatment

Unit	Description of Visual Impact
1, 2, 4, 5, 6, 9, 11, 13, 14, 23, 25, 26, 39, 43a, 45, 76, 77, 78, 89a, 89b, 90, 91a, 91b, 92, 100, 101, 102, 103, and 104	These units and associated temporary roads would potentially have minor effects because of contrasting line, texture, color, edge and form with the surrounding vegetation in the short-term. Within 5 years regrowth of vegetation would reduce the visual deviation.

Regeneration harvest units: Approximately 1,457 acres of harvest units including Seedtree (1,321 acres), and Shelterwood (76 acres) and Group-Select (60 acres) are proposed as regeneration harvest. These treatments would include tractor, and skyline harvesting. Visual impacts associated with the above treatments could be potentially greater because of the level of vegetation removed and the harvesting methods used for removal. This could create a stronger visual contrast between the treated and untreated units due to more exposed ground and noticeable differences in scale, color, form, edge, texture and line.

Immediate foreground and foreground views would result in negative effects from contrasting skyline corridors (as regrowth and transition to intermediate harvest occurs), skid trails, landing areas, and temporary road construction, as well as unit shape and edge contrast. Additional exposure would occur from marking paint, slash and stumps visible from roads and trails (predominantly on the upslope). Post-harvest logging and scattering of the slash/fuels or hand piling and mechanical treatments including whole tree yarding (or possibly yarding of tops), excavator piling, or chipping/mastication broadcast burning, and pile burning would all have short-term negative impacts from viewing areas with high concern. The unnatural contrast in line, shape, edge, color, texture and form would dominate the scenic character in the short-term from foreground views. After five years there will likely continue to be dominate contrasting features and in the case of units transitioning to intermediate harvests the contrast may even increase over time. Unnatural vegetation forms like skyline corridors or straight boundary unit edges may take up to 25 years to become significantly regrown to be subordinate to the scenic character and meet the Visual Quality Objective. The travel-ways and use areas analyzed adjacent to or within treatments that show the greatest concern to viewers located in immediate foreground views include: U.S. Highway 2, Eastside South Fork Road (NFS Road 38), Hungry Horse Reservoir and Dam. Units in the immediate foreground and foreground of these locations that are also in partial retention Visual Quality Objective require design features to meet the Visual Quality Objective and its timeframe which states that the deviations should be subordinate to the expression of the scenic character as soon as possible after implementation.

Regeneration harvest units with the greatest potential for impacting sensitive views, creating moderate or major impacts, because of the concern level and close proximity to viewers, include

the following units: 8, 16, 16a, 22, 30, 35, 35a, 35b, 37, 37a, 38, 40, 43a, 46, and 86. Negative effects from contrasting skyline corridors, skid trails, landing areas, and temporary road construction, as well as unit shape, texture, edge and form would be dominate. The greatest potential for contrast would occur during the winter months because of the high contrast of texture associated with snow cover and would appear as a dominate feature. Table 119 outlines the impacts on these units and why design features are necessary to the extent feasible, economically and practically. Implementing design features would ensure compliance with forest plan, assigned Visual Quality Objectives and/or address high levels of concern for scenery with these units. In the long-term, with design features implemented, the effect of the proposed treatments would not be substantial enough to alter the scenic character.

Table 119. Summary of impacts with views of high concern from regeneration harvest treatment

Unit	Distance Zone	VQO	Concern Level	Description of Visual Impact
22, 35b, 37, 37a, 40, and 86	IFg	PR	1 (High), 2 (Moderate)	These units would potentially have major effects because of contrasting line, texture, color, edge and form with the surrounding vegetation. These impacts would occur from immediate foreground and foreground views from Hungry Horse Reservoir and NFS Road 38. Many of these units are also in the middleground views from NFS Road 895.
16 and 16a, 30	Fg	PR	1 (High), 2 (Moderate)	These units would potentially have major effects in the foreground of Hungry Horse Reservoir and Dam because of contrasting line, texture, color, edge and form with the surrounding vegetation as a result of heavy alteration of vegetation. These units are also in the middleground view from NFS Road 895.
8	IFg	MM	1 (High)	This unit would potentially have major effects in the immediate foreground of U.S. Highway 2, because of stumps, slash, edge, texture and color contrast as a result of heavy alteration of vegetation. These major effects are acceptable within the assigned VQO but design features to reduce the dominance of these treatments to achieve a higher VQO is preferable.
35, 35a, 38, 43a, and 46	IFg	M/M M	2 (Moderate)	These units would potentially have major effects in the immediate foreground of NFS Road 38, because of stumps, slash, edge, texture and color contrast as a result of heavy alteration of vegetation. These major effects are acceptable within the assigned VQO but design features to reduce the dominance of these treatments to achieve a higher VQO is preferable.

The remaining regeneration harvest units are within middleground and background views and/or Modification/Maximum Modification Visual Quality Objective which allows the treatments to dominate the scenic character. Design features improve the visual absorption capability of these units and will help make the deviations imperceptible over time.

Alternative 2 – Cumulative effects

The Scenery resource cumulative effects analysis for alternative 2 includes analysis of the Hungry Lion Resource Management Project area and the land area encompassing the viewsheds of the project area from the observer points and travel-ways. Several past vegetation modification projects including intermediate and regeneration harvests and prescription burns have occurred within the past 25 years and are ongoing on both private and public lands within the Hungry Lion

Resource Management Project viewshed. These vegetation management activities have created contrast in color, texture, form and line, although many have begun to regenerate or have regenerated over the past 25 years; reducing the visual impacts from them. Other management activities including utilities (i.e. power lines, and roads) have also influenced the visual quality of the landscape. 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 visual quality of the viewshed but these deviations would reduce over the long-term as vegetation regrowth occurs. These impacts would still meet the forest plan direction.

Alternative 3 and 4– Direct & indirect effects

Visual effects from alternative 3 and alternative 4 will be described in comparison to alternative 2 using the same representational observer points.

Prescribed burn units: There is no change to the prescribed burn units between alternative 2, 3 or 4. The visual impacts would therefore be equivalent between these three alternatives.

Intermediate harvest units: Alternative 3 (1,825 acres) and alternative 4 (1,428 acres) reduce the number of units and acres being treated through intermediate harvest prescriptions. The units that are eliminated in alternative 3 and/or 4 would create the same visual impacts as alternative 1, the no-action alternative. There would be no visual impact to these units. Three units are proposed to be modified in size in alternative 3. The visual impacts of these three units would reduce the size of the visual impact of these units but would otherwise not change any of the visual quality of the project. The same design features would apply as outlined for these units in alternative 2. Visual impacts from all other units, are equal to the impacts outlined in alternative 2 and are therefore equivalent across alternatives. See Table 120 for a comparison of the units impacting high concern viewsheds by all alternatives.

Regeneration Harvest Units: Alternative 3 (842 acres) and alternative 4 (841 acres), reduce the number of units and acres being treated through regenerative prescriptions. The units that are eliminated in alternative 3 and/or alternative 4 would create the same visual impacts as alternative 1, the no-action alternative. There would be no visual impact to these units. Unit 3 which is reduced in size in alternative 3, would see a reduction in its visual impact, although the portion of the unit eliminated was not the portion adjacent to private land. Therefore the portion of the unit with the highest visual concerns would remain the same as in alternative 2. The same design features would apply as those outlined for these units in alternative 2. Visual impacts from all other units are the equal to the impacts outlined in alternative 2 and are therefore equivalent across alternatives. See Table 120 for a comparison of the units impacting high concern viewsheds by alternative.

Alternative 3 and 4 – Cumulative effects

As with alternative 2, the same past, ongoing and future projects are likely to occur with alternative 3 and alternative 4. The reduction in units in these alternatives will cumulatively reduce the impacts to the Hungry Lion Resource Management Project visual quality. While alternatives 3 and 4 propose fewer overall units, units that are highly visible and would create moderate to high visual impacts are present.

Alternative 3 would alter the visual quality of the landscape, the cumulative effect of these alterations would be less than alternative 2 in particular due to the elimination of units 16, 16a and 22 (Partial Retention, foreground/middleground view units). The removal of all shaded-fuel break units along NFS Road 38, would also reduce the short-term visual impacts of this project in

the immediate foreground of this roadway. Units 8, 30, 35, 35a, 35b, 37, 37a, 38, 40 and 86 would create the highest amounts of visual impacts from sensitive areas based on their proposed treatments. While adversely affecting the scenic integrity in the short-term, alternative 3's proposed units would meet forest plan management areas with design features applied in the long-term. Design features will ensure the Visual Quality Objectives are met for these units. Therefore the past, present, and reasonably foreseeable short-term and long-term impacts from alternative 3 would be lower than alternative 2. With design features applied, alternative 3 would not conflict with the Visual Quality Objectives or forest plan.

In alternative 4, the elimination of units 8, 16, 22, 35, 35a and 38 would reduce the visual impacts from project implementation. Units 22, 30, 35b, 37, 37a, 40 and 86 would create the most contrasting visual impacts based on their proposed treatments. The past, present, and reasonably foreseeable short-term and long-term impacts from alternative 4 would be lower than alternative 2 and with design features, alternative 4 would not create a long-term visual quality change and the proposed treatments would meet forest plan Visual Quality Objectives.

Summary of Effects or Statement of Findings

The Hungry Lion Project is located in a highly visible area on the Flathead National Forest. Not all units within the project are sensitive visually. Especially those at middle elevations which are screened by topography and vegetation or are low angle or oblique angle from sensitive viewing locations. 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 the Scenery resource are the units directly adjacent to one (or more) of the sensitive areas since the treatments are in the immediate foreground or foreground of these areas and the 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 120. Units impacting high concern viewsheds by alternative

Treatment Category	Alternative ¹		
	2	3	4
Prescribed Burn Units (minor, short-term impacts)	301, 302, 303, 304, 305, and 306	301, 302, 303, 304, 305, and 306	301, 302, 303, 304, 305, and 306
Intermediate Harvest Units (minor, short-term impacts)	1, 2, 4, 5, 6, 9, 11, 13, 14, 23, 25, 26, 39, 45, 76, 77, 78, 89a, 89b, 90, 91a, 91b, 92, 100, 101, 102, 103, and 104	6, 13, 23, 25, 26, 39, 45, 77, 78, 102, and 104	1, 6, 13, 23, 25, 26, 39, 45, 89a, 89b, 90, 91a, 91b, 92, 100, 101, 102, 103, and 104
Regeneration Harvest Units ² (moderate/major, long-term impacts)	8, 16, 16a, 22, 30, 35, 35a, 35b, 37, 37a, 38, 40, 43a, 46, and 86	8, 30, 35, 35a, 35b, 37, 37a, 38, 40, 43a, 46, and 86	22, 30, 35b, 37, 37a, 40, 43a, 46, and 86

¹Alternative 1 would not be expected to have visual impacts.

²Regeneration harvest typically has greater visual impacts than intermediate harvest and prescribed burn units.

The Hungry Lion Project will meet forest plan visual quality objectives with design features applied. 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 features applied, visual impacts would be reduced. Alternative 3 and 4 would incur less Scenery resource impacts than alternative 2. Alternative 2 would incur the most visual impacts

due to the intensity of the treatments and to the amount of acreage seen within sensitive viewsheds. Units 8, 16, 16a, 22, 30, 35, 35a, 35b, 37, 37a, 38, 40, 43a, 46, and 86 of alternative 2 would potentially create the highest visual impacts because of the following combination of factors: regeneration treatment harvest units, high concern level adjacency and highly visible from concern level 1 areas. Of these units 16, 16a, 22, 35a, 35b, 37, 37a, 40, and 86 are also within partial retention visual quality objective and MA 7 which requires a visual analysis be completed before implementing any landscape altering activities. MA 7 also specifically outlines the goal of generally maintaining natural appearing vegetation by limiting even-aged timber management practices to 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, 2001). Some of these units are greater than 10 acres in size (16, 35b, 37, 40 and 86) and will require design features so that leave areas generally address this size restraint. Before project implementation a visual analysis of all units in MA 7 will be conducted and changes to the project implementation may be made to address these sensitive viewing areas.

Regulatory Framework and Consistency

Scenic character goals, objectives, and standards

The Flathead Forest Plan contains direction for managing the scenic resources of the Forest. Direction is contained in both Forestwide and management area specific sections of the Plan. Direction relevant, with respect to scenery, to the proposed treatment units are summarized below.

Forestwide scenery standards

- In each management area, meet or exceed the recommended visual quality objective. Where management area goals and objectives can be fully achieved and a higher visual quality objective met without increased costs or reduced future options, the higher visual quality objective should be achieved (United States. Flathead National Forest, 1986, pp. II-22).
- 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, 1986, pp. II-23).

Management area scenery standards and goals

- MA 2A Retention (prescribed burning may depart from visual quality objective)
- MA 4 Modification (developed recreation site, maintain visual quality objective)
- MA 7 Partial Retention (even aged units shall generally not exceed 10 acres in size harvests; visual analysis will be completed before implementation)
- MA 9 Partial Retention
- MA 10 Modification (administrative site)
- MA 12 Partial Retention

- MA 13 Modification
- MA 14 Modification (Coram Experimental Forest)
- MA 15 Modification or Maximum Modification
- MA 16 Modification or Maximum Modification

Handbook direction pertaining to the scenic resources:

In addition to forest plan direction, the following handbooks apply to National Forest Service lands under the Visual Management System. 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.

(The above references are located at: http://fsweb.r1.fs.fed.us/rmlhw/scenery_mgmt/scenery.htm)

Air Quality

Introduction

The primary air quality concerns associated with forest management activities include road dust and smoke from prescribed burning. The main air quality concern associated with this specific project would be the amount and concentration of particulate matter (PM) produced by proposed prescribed burning. Wood smoke produces particles too small to be seen by the human eye, measuring 10 microns (one micron equals a millionth of a meter) and smaller. Larger particles tend to settle out of the air quickly, and are less likely to affect public health. Particles 10 microns and smaller may be inhaled deep in the lungs, posing a threat to public health and visibility. Particles 2.5 microns and smaller are of the highest concern for potential health effects.

The basic framework for controlling air pollutants in the United States is the 1970 Clean Air Act, as amended in 1990 and 1999 (42 U.S.C. 7401 et seq.). The Clean Air Act was designed to protect and enhance the quality of the Nation's air resources. The Clean Air Act encourages reasonable federal, state, and local government actions for pollution prevention. State Implementation Plans are developed to implement the provisions of the Clean Air Act. The State Implementation Plans describe the actions the state takes to achieve and maintain the "national ambient air quality standards" Under the Clean Air Act, the Environmental Protection Agency sets standards for air quality to provide both health and visibility protection. Montana has also set standards to help protect air quality.

The Environmental Protection Agency has established national ambient air quality standards for six criteria pollutants that have been determined harmful to the public and environment, including carbon monoxide, lead, nitrogen dioxide, sulfur dioxide, ozone, PM_{2.5} and PM₁₀. The major pollutant of concern in smoke from wildland fire is fine particulate matter, both PM₁₀ and PM_{2.5}. Smoke from prescribed fire must meet the ambient air quality standards for PM₁₀ and PM_{2.5}. In Montana, the state standard for PM₁₀ is the same as the federal national ambient air quality: 50 mg/m³ (micrograms per cubic meter, which is 1/1,000,000 of a gram per cubic meter) for the annual arithmetic mean, and 150 mg/m³ for the 24-hour average. For PM_{2.5}, no state standard has been established; the federal national ambient air quality is 15 mg/m³ for the annual arithmetic mean and 35 mg/m³ for the 24-hour average. Fine particulate matter, generally less than 2.5 microns in diameter (PM_{2.5}), is the primary cause of visibility impairment although gases also contribute. Emissions from wildland burning include both gases and particulate matter ranging in size from 0.1 to 2.5 microns which greatly impacts visibility. For more information or a listing of the national ambient air quality standards, please see the Environmental Protection Agency's website at <https://www.epa.gov/learn-issues/learn-about-air>.

Information Sources

The evaluation of direct, indirect and cumulative effects on air quality utilized the most recent and available information and data related to past, present and reasonably foreseeable events that have occurred or may occur in the air quality analysis area.

Analysis Methods

Consume 2.1 was used for estimating pile burning emissions, as well as FOFEM 5.9 (First Order Fire Effects Model) to estimate material available for burning. BlueSky playground 2.0 beta was used to estimate PM₁₀ and PM_{2.5} emissions and airborne concentrations downwind of prescribed

burning. BlueSky playground incorporates Fuel Characteristic Classification System fuelbeds representative of the vegetation types and the latest version of Consume.

Analysis Area Description

The Montana Air Quality Bureau divides the State of Montana into 10 airsheds. Airshed 2 is the primary analysis area for assessing the influence of the Hungry Lion 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 comprises Flathead, Lake, Sanders, and the northern portions of Missoula and Powell counties. Please see map of Airshed 2 (Figure 12).

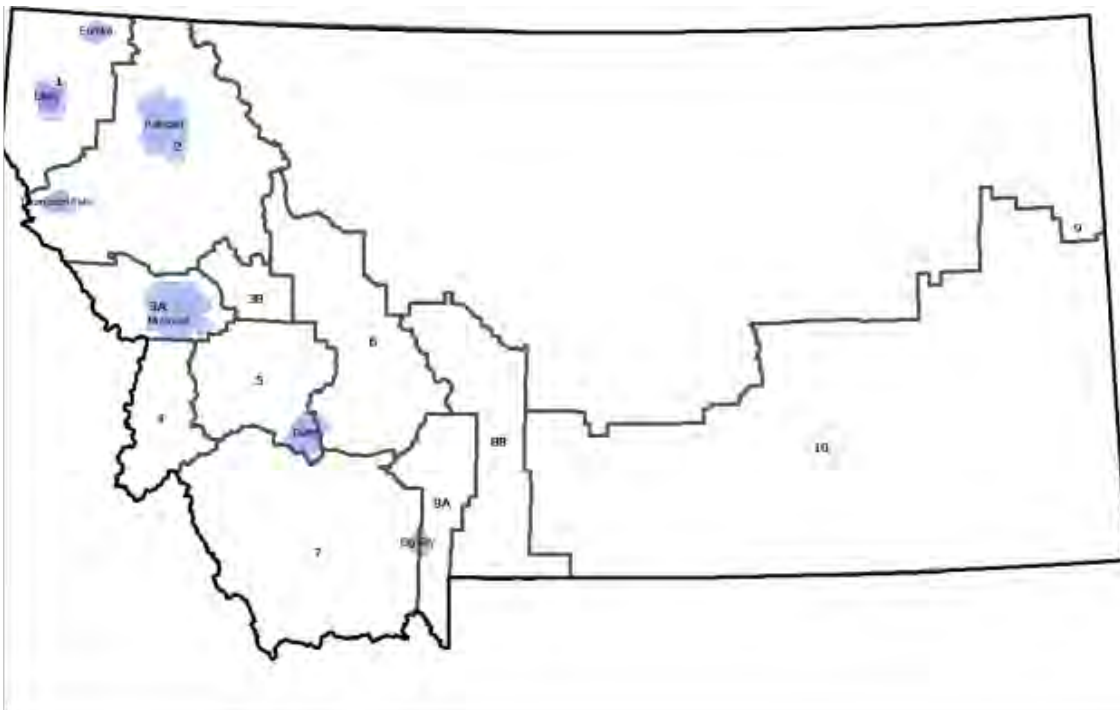


Figure 12. Montana/Idaho airshed group map, airshed 2

Affected environment/existing condition

Meteorology

Smoke dispersion is primarily determined by transport winds and mixing height. Transport winds determine the direction of a smoke plume and the speed at which it travels, while mixing height controls the ability of smoke to mix into an air mass. In the spring and summer, solar heating of the earth surface is much more intense, increasing the amount of warm air contributing to an unstable atmospheric condition. The more unstable the atmosphere the higher the likely mixing height would be, and the greater the dispersion. During the fall and winter, stable atmospheric conditions prevail as cooler air pools in the valley bottoms. Solar heating is not enough to heat this pooled air, so the stable conditions remain, reducing dispersion until a frontal passage “scours” out the valley air.

Forest Service management prescribed and wildland fire use contributes smoke that may cause short-term deterioration of air quality in the area. Management prescribed fires contribute smoke

to the airshed, though prescribed fires tend to produce less smoke than wildfires of equal size since fuel consumption is typically lower in prescribed burns. On the Flathead National Forest, prescribed burning is generally accomplished when dilution, dispersal and mixing conditions are considered fair to excellent. Prescribed burning requires approval from the Montana/Idaho Airshed Group 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. More information on the Montana/Idaho Airshed Group can be found online at www.smokemu.org.

Airshed characteristics

Fire has historically been a part of the vegetative dynamics in the Northern Rockies as evidenced by the burn mosaics of the surrounding forested lands. Fires continue to be a part of the natural forest ecosystem and produce local short-term impairment of air quality. The 2001, 2003, 2007 and 2015 fire seasons are extreme examples of wildland fire smoke effects on air quality.

The air quality of the Flathead River Valley is considered good to excellent throughout most of the year and meets Montana air quality laws and the Clean Air Act.

Air quality may be affected and various amounts of pollutants may occur from the following:

- Prescribed burning in the spring and fall by the Flathead National Forest, Glacier National Park, Montana Department of Natural Resources, and timber and land development companies.
- Prescribed burning to the west and south by other National Forests, other agencies, and private companies or citizens.
- Wildland fire use for resource benefit occurring in the summer months in the Flathead National Forest, Bob Marshall Wilderness, Great Bear Wilderness, and Glacier National Park.
- Wildland fires burning upwind to a distance of 200 miles depending on the size of the fire.
- Agricultural field burning in the Flathead Valley and Idaho.
- Weather patterns, which help cause degradation when low pressure systems over Idaho pull suspended pollutants (dust and smoke) from large metropolitan airsheds and farms in Oregon, Washington, and Idaho.

Sensitive areas

The Environmental Protection Agency designates communities that do not meet air quality standards (national ambient air quality standards) over a period of time as “non-attainment areas.” States are then required to develop a plan to control source emissions and ensure future attainment of the standards. The emissions from prescribed fire may be considered as contributing emissions. Three cities in the Flathead Valley are considered sensitive areas because they are non-attainment areas for PM₁₀: Kalispell, Columbia Falls and Whitefish. Kalispell is considered an area of concern, though not formally designated a non-attainment area for carbon monoxide.

The Clean Air Act provides for additional measures “to preserve, protect, and enhance the air quality” in larger national parks, wilderness areas and other areas of special national significance. These areas are designated Class I airsheds. Of particular concern under this requirement is visibility or haze. The Prevention of Significant Deterioration provisions of the Clean Air Act require measures “to preserve, protect, and enhance the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or

regional natural, recreation, scenic, or historic value.” Stringent requirements are therefore established for areas designated as Class I areas (42 U.S.C. 7475 (d)(2)(B)). Designation as a Class I area permits only very small increments of new pollution above existing air pollution levels. There are several Class I airsheds in the vicinity. The Great Bear Wilderness and Glacier National Park are located east/northeast of the project area and are Class I airsheds most vulnerable to project activities affecting air quality since prevailing winds often blow from west to east.

A requirement of Prevention of Significant Deterioration is that new major stationary sources, or major modifications of existing stationary sources, must first receive a Prevention of Significant Deterioration permit from the appropriate air regulatory agency before implementing construction or modification. A stationary source is one that is well defined, such as the smokestack of a coal-fired power plant or smelter. Prescribed burning from the Hungry Lion Project is not considered a major stationary source and therefore is not subject to the Prevention of Significant Deterioration permitting process.

Environmental Consequences

Introduction

The indicator used to evaluate the effects of each alternative on smoke production are particulate matter less than 2.5 microns in diameter. The total amount of $PM_{2.5}$ and the estimated 24 hour concentrations of $PM_{2.5}$ were modeled for alternative 2, which treats the most acres. $PM_{2.5}$ was chosen because while more than 90 percent of the mass of particulate matter produced by wildland fires is less than 10 microns in diameter, 80 to 90 percent is less than 2.5 microns in diameter. For this reason, some models only predict $PM_{2.5}$ emissions. These small particles are inhalable and respirable. Respirable suspended particulate matter is that proportion of the total particulate matter that, because of its small size, has an especially long residence time in the atmosphere and penetrates deeply into the lungs. Small smoke particles also scatter visible light and thus reduce visibility (National Wildfire Coordinating Group, 1993).

Alternative 1 (no-action alternative) – Direct, indirect, and cumulative effects

No prescribed burning would occur in this alternative, therefore no prescribed burning smoke emissions would be produced by this alternative.

Alternatives 2, 3, and 4 – Direct, indirect and cumulative effects

Prescribed burning, including pile burning would occur in each of these alternatives, however the type of materials burned and the amount vary. The amount of prescribed burning is displayed based on the number of piles or acres per burn type. This analysis considered five different groups based on the forest type.

Group 1: Mature larch stands with larch and Douglas-fir understory occupying greater than 50 percent of stocking. Stands range from 40 to 75 and 80 to 120 plus years old; and 5 to 15 plus inches d.b.h. commercial thin treatments.

Group 2: Mature stands dominated by Englemann spruce and subalpine fir. Stands are about 80 to 120 plus years old, with high tree densities (500 plus trees per acre). D.b.h from 10 inches to 15 plus inches. Some stands have minor amounts of other species, usually larch or Douglas-fir, occasionally western white pine. Understory removal treatments.

Group 3: Mature Douglas-fir stands. Stands are 80 to 120 years old. D.b.h. from 10 to 15plus inches. Some stands have minor amounts of other species, usually western larch or occasionally western white pine. Regeneration harvest including seedtree, shelterwood and group selection.

Group 4: This group is the same as group 3. The units have been whole tree yarding and have a landing pile per 15 acres. Landing piles were evaluated in Group 3, Broadcast burns for site prep of western white pine or ponderosa pine and will treat the fuel that still exists in the unit and are evaluated in group 4.

Group 5: Natural fuels, high elevation prescribed fire.

For a more thorough description of these forest types, please see the vegetation portion of this document.

Prescribed burning would consist of pile burning materials that result from mechanical fuels reduction treatments and broadcast burning following harvest in some units. It is anticipated that all units would have piles to be burned, however only units in group 3 proposed broadcast burning which are evaluated in group 4. In addition 759 acres of prescribed landscape burning is included in all action alternatives. The acres of burning are displayed in Table 121 by stand group and burn pile type (piles only or broadcast burning).

Table 121. Alternative 2 air quality emissions

Group	Number of Units	Acres	Number of 10' Piles	Number of 25' Piles	Tons of PM _{2.5} /total
1	28	1,652	45	110	16.35
2	5	278	22	19	18.82
3	52	1,458	20	97	19.21
4	24	555	0	0	80.22
5 Prescribed Burn Units	6	759	0	0	300.22
Total	--	--	--	--	434.82

All burning would occur under conditions designed to ensure adequate smoke dispersal, following the requirements of the Montana Air Quality Bureau. Prescribed burning would produce some smoke emissions. The national ambient air quality standards PM_{2.5} is 35 mg/m³ for the 24-hour average. Smoke from prescribed burning could cause short-term impacts on recreation and transportation in and near the project area. The size and location of a prescribed burn and weather conditions determine how much and in what direction smoke travels. Weather and smoke dispersion conditions outlined in the prescribed burn plan should alleviate any adverse smoke effects.

Pile burning

Pile burning would be used in this project to dispose of slash that resulted from commercial harvesting, producing direct smoke emissions. It is assumed for this analysis that all units in categories 1, 2, 3, and 4 would be whole tree yarded, leaving treetops at the landing, which are machine piled at a rate of one 25 foot tall pile per 15 acres. Units designated as white pine restoration units will be machine piled throughout the unit instead of having landing piles. These

piles are assumed to be smaller 10 foot tall at a rate of one pile per acre or are broadcast burned. It is also assumed that there will be landing piles resulting from harvest even within the units proposed for broadcast burning, however more slash material may be left in the units to increase horizontal continuity of fuels and thus allow for the proposed broadcast burning.

Smoke emissions vary with combustion efficiency and quantity of fuel burned. Machine piles and hand piles tend to produce more smoke than other burns because much of the consumption occurs during the inefficient smoldering phase of combustion. Potentially, pile burning would be conducted over the course of one to three years after harvest activities, so impact would not be concentrated. Areas where fuels have been treated under conditions selected to minimize effects on air quality should be less vulnerable to future intense wildfires where smoke effects are unpredictable.

Modeling assumed that transport winds would blow from the south, west or southwest, and that burning would occur over several days in the fall over a one year period. Pile burning allows management to control the number of piles burned on any given day. All broadcast burning would be spread out over a minimum of two years and would be expected to last three or more years.

Broadcast burning

Broadcast burning of slash and natural fuels would be included in each action alternative, although the location and number of acres to be burned varies. It is not likely that these would be burned all in one day, however to display the worst case scenario, modeling was completed to show all the acres being burned in one day. It would be very unlikely that these units would be burned on the same day or even in the same year. As in the pile burn modeling, a general worst case example was assumed to display smoke emissions and dispersion. This included a daytime stability rating of slightly unstable (unstable would be ideal) and a nighttime stability rating of neutral. These stability ratings resulted in poor smoke dispersion assumptions, representing a worst case scenario.

All proposed units were analyzed to show the worst case scenario.

BlueSky Playground was used to model smoke dispersion and concentrations for the proposed activities. Predicted ground level concentrations of PM_{2.5} emissions dispersed almost completely by midnight the day of ignition. Predicted ground level concentrations were less than 35 µg/m³, the 24-hour average. Managers are unlikely to burn that many piles so close together in one day, especially when smoke dispersion conditions are poor. However, if they did, the 24 hour concentration average would not be violated (Project File Exhibit K-21, K-22, K-23).

Conclusions

BlueSky playground was used to model smoke dispersion and concentrations for alternative 2. Alternative 3 and 4 would produce less PM_{2.5} matter because there are fewer harvest units than alternative 2. Predicted ground level concentrations of PM_{2.5} emissions dispersed almost completely by midnight the day of ignition in all action alternatives. Dispersion models indicate that all areas over one half mile from concentrated burning are well below 35 mg/m³ for the 24-hour average. Managers are unlikely to burn that many piles so close together in one day, especially when smoke dispersion conditions are poor. However, if they did, the 24 hour concentration average would not be violated (Project File Exhibit K-21, K-22, K-23). Modeling indicates that air quality in the Flathead Valley would not be adversely affected in the long term by the prescribed burning proposed in these alternatives. If an unpredicted wind with an eastern component occurred during burning, the Flathead Valley may experience short term impacts.

Cumulative effects

This section discloses past, present and reasonably foreseeable effects from federal, state, tribal and private land fire use activities. The cumulative air resource analysis is unique in that past impacts to air quality are not usually evident. However, present and foreseeable effects could include impacts from other prescribed forestry burning, agricultural burning, residential wood combustion, traffic exhaust, fugitive road dust or point sources of pollution. Because of the complexity and uncertainty of timing associated with other agencies burning, coordination with the Montana/Idaho State Airshed Group is critical to minimize cumulative air quality impacts within Idaho and Montana.

The cumulative effects area is Airshed 2. Smoke emissions produced by the implementation of the project, road dust, and vehicle emissions could combine with air pollutants from other projects in the area such as other prescribed burning and particulates produced west of the project area. Implementation effects could contribute to the cumulative impact of air pollutants within the Flathead Valley. Prescribed burning would be implemented during good smoke transport and dispersion conditions and would be accomplished over time; minimizing any adverse effects from prescribed burning smoke emissions.

The cumulative impacts of all private and agency burning are assessed daily during the burning season, through the coordination of the Montana/Idaho State Airshed Group. This group also considers other sources of smoke such as wildfires, wildland fire use events and industrial sources. Any prescribed burning in the Hungry Lion project area would require approval on a daily basis through the Montana/Idaho State Airshed Group. The Montana/Idaho State Airshed Group is able to review all prescribed burning proposed in a given area. Based on current and forecasted weather, burns are approved or disapproved based on their cumulative impact on the airshed. This regulatory mechanism helps ensure that the cumulative effects of prescribed burning do not lead to a violation of air quality standards. The USDA Forest Service is an active participant in the Montana/Idaho State Airshed Group.

Wildland fires locally, or anywhere in the northwest and Canada, can affect regional haze in the Flathead Valley. Wildland fires are anticipated to continue to produce smoke, primarily during the summer months.

The 1990 air quality rules relate to fine particulates ($PM_{2.5}$), and visibility (regional haze). Additionally, Environmental Protection Agency has issued the Interim Air Quality Policy on wildland and prescribed fire. The Interim Policy encourages states to develop and certify to Environmental Protection Agency smoke management programs to address emissions from prescribed fire and wildland fire use for resource benefits. The operations of the Montana/Idaho Airshed Group are critical to minimize cumulative air quality impacts within Idaho and Montana. The daily operation of the Montana/Idaho Airshed Group considers and tries to minimize impacts from prescribed fire, wildland fire and wildland fire use.

Regulatory Framework and Consistency

As designated by law, state air quality rules, and the Flathead Forest Plan, the Flathead National Forest cooperates with the State Air Quality Bureau. The U.S. Forest Service is a member of the Montana/Idaho Airshed Group. This coordination ensures that during project implementation burning only occurs under conditions that would protect air quality and meet state and national standards.

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Heritage Resource

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 Hungry Lion Resource Management 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 fuel break construction, are proposed. Activities that only involve the use of hand crews and no heavy equipment, such as prescribed burning, would typically receive less consideration from Heritage resource personnel.

Analysis Area

Spatial bounds

The analysis area used to discuss the effects on Heritage resources is the Hungry Lion 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 800.4] for the Hungry Lion 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. 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 and use of the greater South Fork area, in general, and within boundaries of the proposed Hungry Lion project area, specifically, has probably spanned the past 10,000 years. Evidence of those prehistoric hunters and gatherers, however, forest wide, is rare. The prehistory of western Montana is characterized by roughly 10,000 years of hunter-gatherer land use resulting in numerous occupational sites, lithic scatters, rock cairns, burials, game drives/traps, and culturally modified trees. Major occupational sites are usually limited to the major river drainages such as the North Fork and South Fork of the Flathead River. Hunter-gatherers frequented higher elevation mountainous areas during the summer months, such as those within the Hungry Lion proposed area. Prehistoric travel routes were 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, seeds and berries, to deer, elk and mountain sheep (Frison, 1978; McLeod & Melton, 1986; Munger, 1993). Typical Heritage

resource sites or artifacts that one might encounter during pedestrian inventories would include tepee rings, scarred trees, pictographs or petroglyphs, lithic (stone) scatters of flint/chert debris from the production of stone tools, isolated projectile points such as arrowheads or spear, dart, and lance points, travois trails, hearths or roasting pits, bone tools, stone scrapers, awls, bifaces, knives, and cores.

Historic era Euro-American settlement of the Flathead Valley, in general, and the South Fork of the Flathead area, in particular, came more than 50 years after fur trader/trapper David Thompson's early ventures into Northwest Montana, circa 1810. Introduction of the Northern Pacific Railroad in the late 1800s opened up the Flathead River drainage and its arterial waters, including the North, Middle, and South Fork of the Flathead. Multiple oil, coal, and other valuable mineral exploration and extraction activities occurred in the region starting around 1890 and continuing into the early 20th century. However, all of the exploration and early extraction attempts proved unprofitable and mining and extraction ended by the 1920s. Homesteads in the South Fork of the Flathead were very rare during the early mining exploration period but increased some after the passage of the Forest Homestead Act of June 11, 1906 (McKay, 1994). Evidence of early white settlers that might be discovered during Heritage resource surveys include trappers lean-tos, metal traps, log cabins, rifles or other firearms, and various metal tools from plows to saws to metal cables left from early logging activity.

Existing Condition

Pre-survey files search

As the first part of a two-phase inventory, which will be accomplished before project implementation, the Forest's Heritage resource staff conducted an in-house files search for information on known, previously recorded heritage sites in the Hungry Lion project areas. General Land Office plat maps, homestead entry survey plats, Bureau of Land Management land status records, historic forest maps, local history texts, the Forest's Historic Overview, studies on Native American use of western Montana, the draft Hungry Horse Archaeological Project Investigation, and Historic Property Management Plan completed for the Bureau of Reclamation and the Bonneville Power Administration, 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 Hungry Lion project area identified four recorded heritage properties in the analysis area and several previous inventories going back to 1998. An additional six sites were identified within 1 mile of the project area boundaries but fall outside of the analysis area. Previous heritage surveys covered less than 20 percent of the acreage in the Hungry Lion 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.

Consultation with the Salish and Kootenai Tribes Historic Preservation Department has not been completed but in-house files research has identified a portion of a historic Native American travel route known as the South Fork Trail near and possibly within the analysis area. The South Fork Trail originates in the vicinity of Martin City and proceeds south/southeast until it is inundated by the Hungry Horse Reservoir. The trail followed the course of the South Fork of the Flathead and emerges from the Hungry Horse Reservoir again near the Crossover Campground.

Pedestrian survey

The second phase of the two-part strategy requires the staff conduct a pedestrian-based, stratified-sample survey (inventory) of the proposed Hungry Lion project area. The survey strategy will be taken from the Forest's Site Identification Strategy, which is part of the northern region Programmatic Agreement 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 are not complete, but the historic South Fork Trail has been identified and discussions with the Confederated Salish and Kootenai Tribes are ongoing and would continue to insure that their concerns for the protection of the trail are satisfied. Surveys will be completed prior to implementation of activities.

Environmental Consequences

Alternative 1 (no-action alternative) – 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 under alternative 1(no-action alternative) 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.

Alternative 2, 3, and 4 (action alternatives) – Direct, and indirect effects

The Flathead National Forest is working with the Confederated Salish and Kootenai Tribes and the Montana State Historic Preservation Office to insure there are no adverse effects to the historic Native American travel route. Potential adverse effects to the trail would be avoided through project re-design and or specific design features.

The Flathead National Forest participates in the northern region Programmatic Agreement 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 northern region Programmatic Agreement, 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, 3, and 4 (action alternatives) – Cumulative effects

There would be no cumulative effects to identified Heritage resources in the Hungry Lion project area from any past, present, and reasonably foreseeable activities as presented at the beginning of this chapter. Refer to the Cumulative Effects Worksheet (Project File Exhibit P-1) for more information.

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 tribes also have 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 Tribes were contacted in the initial planning stages of the Hungry Lion 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. 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 (USDA Forest Service, 1986, pp. II-18 to II-21)

Inventory procedures

"Cultural resource inventories will be conducted on all ground disturbing projects that are generated, licensed, permitted, or allowed to occur by the Forest Service."

Evaluation procedures

"Identified cultural resources will be evaluated in relation to published criteria for eligibility to the National Register of Historic Places."

Protection/preservation measures

"Known, significant cultural resource sites on the Forest will be protected from inadvertent or intentional damage or destruction."

Coordination/consultation procedures

"The Forest will make an effort to coordinate cultural resource issues and concerns with appropriate Native American groups, 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 Hungry Lion 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.

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Social and Economic Resource

Introduction

The management of the Flathead National Forest has the potential to affect local economies. Humans are also part of the ecosystem. Use of resources and recreational visitation to the Flathead National Forest generates employment and income in the surrounding communities and counties and generates revenues that are returned to the federal treasury.

This section presents concepts used to delineate an affected area and methods used to analyze the economic effects of the project, including project feasibility and financial efficiency.

National Environmental Policy Act (NEPA) requires that consequences to the human environment be analyzed and disclosed, based on issues. NEPA does not require a monetary benefit-cost analysis. If an agency prepares an economic efficiency analysis, then one must be prepared and displayed for all alternatives [40 CFR 1502.23]. The preparation of NEPA documents is also guided by Council on Environmental Quality regulations for implementing NEPA [40 CFR 1500-1508].

Office of Management and Budget Circular A-94 promotes efficient resource use through well-informed decision-making by the Federal Government. It suggests agencies prepare an efficiency analysis as part of project decision-making. It prescribes present net value as the criterion for an efficiency analysis.

The development of timber sale programs and individual timber sales is guided by agency direction found in Forest Service Manual 2430. Forest Service Handbook 2409.18 guides the financial and, if applicable, economic efficiency analysis for timber sales.

Analysis Method

Three measures are appropriate for this economic analysis:

1. Project feasibility,
2. Financial efficiency, and
3. Economic impacts.

These measures, including methodologies, are described below.

Project feasibility

Project Feasibility is used to determine if the timber sale portions of a project are feasible, that is, will it sell, given current market conditions. The determination of feasibility relies on a residual value (stumpage equals revenues minus costs) feasibility analysis that uses local delivered log prices, and stump to mill costs to determine if a project is feasible. The appraised stumpage rate from this analysis is compared to the base rate (revenues considered essential to cover regeneration plus minimum return to the Federal Treasury). The project is considered to be feasible if the appraised stumpage rate exceeds the base rates. If the feasibility analysis indicates the project is not feasible, the project may need to be modified or supplemented with other funds if actual bids do not exceed base rates at the time of project award. Infeasibility indicates an increased risk that the project may not attract bids and may not be fully implemented. Greater

stumpage amounts generated mean that additional project activities not generating revenue or affecting feasibility of timber sale portions of the project can be accomplished using that value as allowed given stewardship authorities.

Financial efficiency

Financial Efficiency considers anticipated costs and revenues that are part of Forest Service monetary transactions. Present net value is used as an indicator of financial efficiency and is one tool to be used in conjunction with many other factors in the decision-making process. Present net value combines benefits and costs that occur at different times and discounts them into an amount that is equivalent to all economic activity in a single year. A positive present net value indicates that the alternative is financially efficient. Present net value was calculated using a four percent real discount rate. Costs for non-timber harvest activities, such as precommercial thinning, are based on recent experienced costs and professional estimates. Non-harvest related costs are included in the present net value analysis, but they are not included in the appraised timber value.

Financial efficiency analysis is not intended to be a comprehensive analysis that incorporates monetary expressions of all known market and non-market benefits and costs. Many of the values associated with natural resource management are best handled apart from, but in conjunction with, a more limited financial efficiency framework. These non-market benefits and costs associated with the project are discussed throughout the various resource sections of this document.

Economic impacts

Economic Impacts are used to evaluate potential direct, indirect, and cumulative effects on the economy. Economic impacts are estimated using input-output analysis. Input-output analysis is a means of examining relationships within an economy, both between businesses and between businesses and final consumers. It captures all monetary market transactions for consumption in a given time period. The resulting mathematical representation allows examination of the effect of a change in one or several economic activities on an entire economy, all else are constant. This examination is called Impact Analysis. The models for this analysis include the 2010 IMPLAN Modeling System (Meti Corporation, 2010) and USDA Forest Service Northern Region Sale Feasibility Spreadsheet (see Project File Exhibit S-2). The IMPLAN Modeling System allows the user to build regional economic models of one or more counties for a particular year. IMPLAN translates changes in final demand for goods and services into resulting changes in economic effects, such as labor income and employment of the affected area's economy.

The economic impact effects are measured by estimating the direct jobs and labor income generated by:

1. Processing of the timber volume from the project, and
2. Forest Service expenditures for contracted restoration activities included as part of the proposed treatments.

The direct employment and labor income benefit employees and their families and, therefore, directly affect the local economy. Additional indirect and induced multiplier effects (ripple effects) are generated by the direct activities. Indirect effects are felt by the producers of materials used by the directly affected industries. Induced effects occur when employees of the directly and indirectly affected industries spend their wages. Together the direct and multiplier effects comprise the total economic impacts to the local economy.

Data used to estimate the direct effects from the timber harvest and processing were provided by the University of Montana's Bureau of Business and Economic Research (Colin B Sorenson, Keegan, Morgan, McIver, & Niccolucci, 2016). This national data is broken into multi-state regions and is considered more accurate than that which is available from IMPLAN. The Northern Rockies Bureau of Business and Economic Research Region (Montana and Idaho) is used for this analysis. The Bureau of Business and Economic Research Data represents the results of mill censuses that correlate production, employment, and labor income.

Potential limitations of these estimates are the time lag in IMPLAN data and the data intensive nature of the input-output model. Significant changes in economic sectors since the latest data for IMPLAN have been adjusted using information from the University of Montana's Bureau of Business and Economic Research.

Analysis Area

Spatial and temporal bounds

The efficiency analysis includes all proposed activities and locations described for the Hungry Lion project area. All costs and revenues associated with the project were included. The time frame for this analysis is from the beginning of implementation of activities to the completion of the project. This project is expected to be completed over a seven year period, with the harvest activity occurring primarily within the first three years.

To estimate the potential impact on jobs and income, a zone of influence (or economic impact area) consisting of a group of counties was delineated. Counties were selected based on commuting data suggesting a functioning economy and where the timber is likely to be processed (log flows). Recent data on log flows from the Flathead National Forest was provided by the University of Montana's Bureau of Business and Economic Research (Colin B. Sorenson, McIver, Keegan, & Morgan, 2012). Based on the functional economic area and flow of timber from the Flathead National Forest, the economic impact area for this project was designated as Flathead, Lake, Lincoln, and Sanders Counties in northwest Montana.

Affected Environment/Existing Condition

The Flathead National Forest includes parts of six Montana counties: Flathead, Lincoln, Lake, Missoula, Powell, and Lewis and Clark. About three-fourths of the area of the Flathead National Forest and most of the economic effects of Flathead National Forest programs and projects occur in Flathead County. The Flathead National Forest has lesser effects in Lake County and only minimal effects in the other four counties.

The Flathead National Forest is an important part of the Northern Continental Divide Ecosystem, which covers most of northwest Montana. This area has substantial economic value on a regional, national, and international scale when recreation and tourism, wildlife, and aesthetic values are considered along with a substantial timber management program. However, the emphasis of this analysis is on the economic effects that the alternatives would have on the timber industry and the local communities that would be primarily affected.

Timber industry trends

Historical production and capacity

Historically, annual timber harvest from NFS land in Montana peaked at greater than 800 million board feet (1,600,000 hundred cubic feet) at the end of the 1960s. In the period of 2000 to 2004, the timber harvest dropped to around 100 million board feet (200,000 hundred cubic feet) per year, slightly greater than 10 percent of the past peak level. In 2009, the annual timber harvest from NFS lands in Montana was about 86 million board feet or about 25 percent of the total harvest in the state (C. P. McIver, Sorenson, Keegan, Morgan, & Menlove, 2013).

In 1998, of the 227 million board feet (454,000 hundred cubic feet) of timber delivered to processing facilities in Missoula, Lake, and Granite Counties, approximately 41 million board feet, or about 18 percent, came from NFS lands. In 1998, of the 293 million board feet (586,000 hundred cubic feet) of timber delivered to processing facilities in Flathead County, approximately 38 million board feet, or less than 13 percent, came from NFS land (Spoelma et al., 2008).

Since 1980, Flathead County has had the largest wood products manufacturing industry of any county in Montana. Since 1976, the county's capacity to process saw timber has varied from a low of 265 million board feet (530,000 hundred cubic feet) as of 2001 to a high of 395 million board feet (790,000 hundred cubic feet) in 1983. However, according to The University of Montana's Bureau of Business and Economic Research, current capacity, as of 2011, in Flathead, Lake, and Missoula Counties is down to 303 million board feet (606,000 hundred cubic feet) for sawtimber, veneer, and house logs. Actual sawtimber processed since 1976 has varied from a low of 185 million board feet (370,000 hundred cubic feet) in 1982 to a high of 332 million board feet (664,000 hundred cubic feet) in 1988. Processing facilities utilization capacity has varied from a low of 51 percent in 1982 to a high of 97 percent in 1999. In 2000, the last year for which there are data, utilization capacity was at 94 percent. The plywood industry in Montana is presently (2001) at 93 percent of plant capacity. County level information on the plywood industry is generally not available because of data disclosure constraints (Keegan Charles et al., 2004).

The percentage of milling capacity that is actually used or remains available for use affects the demand for logs and is a variable affecting log prices, which in turn, affects the quantity of logs supplied to mills.

Timber industry outlook

A global economic downturn in 2008 caused significant impacts to the timber industry in northwest Montana. The impacts have been extensive and include the loss of timber processing infrastructure, which reduces the ability to conduct fuels reduction and vegetation restoration work on NFS lands. In response to ongoing declines in housing, lumber prices dropped nearly 50 percent from 2005 to 2009. In 2010, however, lumber prices rose approximately 27 percent from 2009 levels due to rising exports and small gains in housing (Keegan, Sorenson, Morgan, Hayes, & Daniels, 2011).

Total sales value of wood and paper products in Montana in 2010 decreased approximately \$850 million since 2005 and \$225 million since 2009 (Keegan et al., 2011). At the end of 2010, estimated total employment in the wood products industry was about 6,840 workers, down about three percent from the revised estimate for 2009 of 7,060. Lumber production in Montana in 2009 fell to 415 million board feet (830,000 hundred cubic feet), down by almost 60 percent from 2005, and was at the lowest level in more than five decades. However, in 2010 lumber production increased to approximately 480 million board feet (Keegan et al., 2011).

At the beginning of 2011, national forecasts were calling for a modest uptick in the U.S. economy, housing starts and consumption of wood and paper products, though recent downturns in the global economy may temper this optimism. Some optimism was also reflected in the outlook of Montana's wood products industry executives in early 2011, with 46 percent expecting 2011 to be better than 2010 (Keegan et al., 2011).

Environmental Consequences

The following effects indicators were used to focus the economic analysis and disclose relevant environmental or social effects:

- Project Feasibility.
- Effects on Financial Efficiency.
- Effects on Employment.

Project feasibility

The estimation of project feasibility was based on a residual value appraisal model for the timber harvest portion of the Hungry Lion Project and associated activities only, which is based on logging system, timber volume removed per acre, delivered log prices, costs for slash treatment, cost of specified road construction and reconstruction, temporary road construction, and road maintenance. The appraised stumpage rates (a conservative estimate of the timber value), predicted high bid (which incorporates competition factors and average experienced overbid), and base rates for each alternative are displayed in Table 122 below. The appraised stumpage rate is negative for alternative 2, positive for alternative 3 and negative for alternative 4. Alternative 3 indicates that the timber harvest portions of the project would not require additional modification or funding to be feasible given current markets. This estimate is based upon a strengthening weighted average delivered log price (\$200.10 per hundred cubic feet) indicating good feasibility given current (Q4 2016) estimates. Additionally, the predicted high bid (the best estimate of the high bid resulting from the timber sale auction) for all alternatives is greater than the adjusted base rate, indicating that these alternatives would most likely sell and generate revenue.

Several factors affect the feasibility of these alternatives: lower reforestation costs with expectation for natural regeneration are costs affecting the bottom line feasibility of alternative 3. The revenue estimates (based upon the predicted high bid) from the feasibility analysis are brought forward for use in the Financial Efficiency Analysis. Revenue estimates are based upon the Montana Sawlog and Veneer Log Price Report for September/December 2016.

It should be mentioned that the Hungry Lion Project has the potential to provide resources that could be converted into a variety of wood products. This could include but would not be limited to sawlogs, biomass, posts and poles, rails, bio-char, house logs, bio-fuels, hog fuel, utility poles, and specialty beam products. Due to a variety of current limitations in those markets ranging from extreme restrictions in production to non-existent re-sale markets in the Hungry Lion economic area, these products and possible revenues are not included in this analysis. However, the actualization of these products could occur as a result of prospective purchaser marketing and ingenuity, thus positively affecting the feasibility of the project. Conversely, a prospective purchaser may find that prices have lowered, or markets have declined, which could negatively affect the feasibility.

Direct and Indirect Effects

Alternative 1 (no-action alternative)

Under the no-action alternative, no timber harvest, fuels reduction, prescribed burning or reforestation activities would occur. Therefore, this alternative would not incur financial costs or revenues.

Alternative 2, 3, and 4

Direct and indirect effects of the action alternatives

Financial efficiency

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). All costs, timing, and amounts were developed by the specialists on the project's interdisciplinary team (ID team). The expected revenue for each alternative is displayed in a range between the appraised stumpage value and corresponding predicted high bid from the sale feasibility analysis. The present net value was calculated using a four percent real discount rate over the seven-year project lifespan (2017-2023). For more information on the values or costs, see the project file.

This analysis is not intended to be a comprehensive benefit-cost or present net value analysis that incorporates a monetary expression of all known market and non-market benefits and costs that is generally used when economic efficiency is the sole or primary criterion upon which a decision is made. Many of the values and costs associated with natural resource management are best handled apart from, but in conjunction with, a more limited benefit-cost framework. Therefore, they are not described in financial or economic terms for this project, but rather are discussed in the various resource specialists' reports (e.g., refer to the Fire and Fuels, Wildlife, and Forested Vegetation Specialists' Reports for specific benefits of the project).

Table 122 summarizes the project feasibility and financial efficiency, including the appraised stumpage rate, predicted high bid, total revenue, and present net value calculations. For alternative 2, net timber revenue should range from the appraised stumpage rate of -\$1.24 per hundred cubic feet to a predicted high bid of \$17.97 per hundred cubic feet or -\$22,578 to \$325,257 in timber revenue. Total costs of the non-timber proposed project activities is \$1,438,115. For alternative 3, net timber revenue should range from the appraised stumpage rate of \$7.82 per hundred cubic feet to a predicted high bid of \$27.03 per hundred cubic feet or \$97,632 to \$335,172 in expected timber revenue. Total costs of the non-timber proposed project activities is \$1,120,755.

For alternative 4, net timber revenue should range from the appraised stumpage rate of \$0.04/hundred cubic feet to a predicted high bid of \$19.25 per hundred cubic feet or \$460 to \$167,475 in expected timber revenue. Total costs of the non-timber proposed project activities is \$1,261,115.

Table 122 indicates that alternative 3 is the most financially efficient of the proposed alternatives for the timber harvest and required design features, and the most financially efficient for all proposed activities. The stumpage net present value for alternative 3 is -\$1,023,123 and the high bid net present value is -\$785,583 for all planned activities.

Table 122. Project feasibility and financial efficiency summary

Measure	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Timber Harvest and Required Design Features				
Acres Harvested	0	3,243	2,226	1,333
Sawtimber Volume Harvested (*CCF)	0	18,100	12,400	8,700
Ave. Delivered Log Price per *CCF	0	\$200.10	\$200.10	\$200.10
Stump to Mill Logging Costs per *CCF	0	\$108.50	\$105.26	\$109.16
Specified Road Costs per *CCF	0	\$20.04	\$22.36	\$10.26
Temporary Road Costs per *CCF	0	\$4.25	\$3.39	\$0
Erosion Control and Weed Spraying per *CCF	0	\$2.60	\$2.76	\$2.89
Snow Plowing per *CCF	0	\$1.85	\$0.64	\$1.01
Brush Disposal and Site Prep per *CCF	0	\$23.26	\$19.13	\$28.22
Total Logging Costs per *CCF	0	\$160.50	\$153.54	\$151.54
Appraised Stumpage Rate (\$ per *CCF)	0	\$39.59	\$46.56	\$48.56
Predicted High Bid (\$ per *CCF)	0	\$58.80	\$65.77	\$67.77
Base Rates per *CCF	0	\$40.83	\$38.74	\$48.52
Net Revenue based on Appraised Stumpage Rates per *CCF	0	-\$1.24	\$7.82	\$0.04
Timber Harvest Net Revenue or Cost	0	-\$22,578	\$97,632	\$460
Net Revenue based on Predicted High Bid per *CCF	0	\$17.97	\$27.03	\$19.25
Timber Harvest Net Revenue	0	\$325,257	\$335,172	\$167,475
Other Project Activities				
Sapling Thin (PCT)	0	\$109,440	\$43,380	\$109,440
Understory Removal	0	\$125,100	\$86,400	\$125,100
Prescribed Ecosystem Burning	0	\$18,975	\$18,975	\$18,975
Shaded Fuelbreaks	0	\$29,600	\$0	\$29,600
Historic Trail Added to System	0	\$5,000		\$5,000
Decommission Historic Trail	0	0	\$24,000	0
Lion Lake Accessible Fishing Pier	0	\$50,000	\$50,000	\$50,000
Aquatic Improvements to System Road	0	\$1,002,000	\$800,000	\$825,000
Reroute of Road 546	0	\$98,000	\$98,000	\$98,000
Total Cost of Project Activities	0	\$1,438,115	\$1,120,755	\$1,261,115
Stumpage Value **NPV	0	-\$1,460,693	-\$1,023,123	-\$1,260,655
Predicted High Bid **NPV	0	-\$1,112,858	-\$785,583	-\$1,093,640

*CCF = hundred cubic feet

**NPV = net present value

A range of values from the appraised stumpage rate to the predicted high bid is the basis for the timber revenue estimate. The actual timber value would depend on the market when the timber is sold, and may be higher or lower than the predicted high bid.

When evaluating trade-offs, the use of efficiency measures is one tool used by the decision maker in making the decision. Many things cannot be quantified financially, such as effects on wildlife, impacts on local economies, and restoration of watersheds and vegetation. The responsible official takes many factors into account in making the decision, including but not limited to measures such as financial efficiency.

Economic impacts

The analysis calculated the jobs and labor income associated with the processing of 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 70 percent to be processed as sawlogs, 20 percent as pulp and 10 percent 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 Bureau of Business and Economic Research (Colin B 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. 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 123 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 impacts of jobs and labor income would be spread out over the expected seven-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 three year period, with other activities spread out over the full seven years. However, total implementation could take longer or be accomplished earlier.

Table 123. Economic impacts - employment and labor income, total and annual (Thousands of 2014 \$)

Hungry Lion Project	Alternative 1 (No-Action)		Alternative 2		Alternative 3		Alternative 4	
	Total	Annual	Total	Annual	Total	Annual	Total	Annual
Part- and Full-Time Jobs Contributed for Non-timber Harvest Activities								
Direct	0	0	30	6	27	6	17	3
Indirect and Induced	0	0	16	3	15	3	9	2
Total	0	0	46	9	42	9	26	5
Labor Income Contributed (Thousands of 2014 \$) for Non-timber Harvest Activities								
Direct	\$0	\$0	\$1,001	\$51	\$896	\$50	\$562	\$59
Indirect and Induced	\$0	\$0	\$619	\$31	\$557	\$31	\$351	\$37
Total	\$0	\$0	\$1,620	\$82	\$1,453	\$81	\$913	\$96
Part- and Full-Time Jobs Contributed for Timber Harvest Activities								
Direct	0	0	56	20	39	12	27	9

Hungry Lion Project	Alternative 1 (No-Action)		Alternative 2		Alternative 3		Alternative 4	
--	Total	Annual	Total	Annual	Total	Annual	Total	Annual
Indirect and Induced	0	0	66	23	45	15	32	11
Total	0	0	122	43	84	27	59	20
Labor Income Contributed (Thousands of 2014 \$) for Timber Harvest Activities								
Direct	\$0	\$0	\$2,798	\$933	\$1,921	\$640	\$1,345	\$448
Indirect and Induced	\$0	\$0	\$2,040	\$680	\$1,396	\$465	\$981	\$327
Total	\$0	\$0	\$4,838	\$1,613	\$3,317	\$1,105	\$2,326	\$775
Part- and Full-Time Contributed for All Activities								
Direct	0	0	85	23	65	18	44	11
Indirect and Induced	0	0	82	28	60	18	41	13
Total	0	0	167	49	125	36	85	24
Labor Income Contributed (Thousands of 2014 \$) for All Activities								
Direct	\$0	\$0	\$3,798	\$1,266	\$2,813	\$938	\$1,906	\$635
Indirect and Induced	\$0	\$0	\$2,660	\$887	\$1,956	\$652	\$1,332	\$444
Total	\$0	\$0	\$6,458	\$2,153	\$4,769	\$1,900	\$3,238	\$1,079

Alternative 2 results in the most jobs created or maintained on a total and annual basis, as well as the highest labor income. Of the 167 jobs projected for the life of the project for alternative 2, 45 are contributed from non-timber harvest activities, and 122 are contributed from timber harvest activities. Alternative 3, the more financially feasible of the alternatives, would harvest fewer quantities of timber but contributes 125 jobs over the life of the project. Alternative 4 was estimated to contribute 85 jobs and \$3.2 million in labor income for all activities over the life of the project.

A job (as defined in IMPLAN) is an annual average of monthly jobs. Thus, one job lasting 12 months equals two jobs lasting six months each equals three jobs lasting four months each. Each of those examples would appear as one job. That one job lasting 12 months can be either full-time or part-time; but it does last for 12 months. When jobs are counted this way, one cannot tell from the data the number of hours worked or the proportion that are full or part-time or anything about seasonality; only that they are yearlong. These jobs are different than full time equivalent jobs. However, they can be converted to average full time equivalent jobs by using industry-specific full time equivalent to employment ratios (number of full time equivalent jobs in an industry divided by total employment in the industry). These ratios are all less than one because employment contains part-time jobs (so there are more jobs than there are full time equivalents).

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.

Regulatory Framework and Consistency

All alternatives comply with the Flathead National 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 (USDA Forest Service, 1986). 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.

Civil Rights and Environmental Justice

This project is in compliance with Executive Order 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 action alternatives

Appendix A – List of Individuals who Received Notification

Organizations and Individuals Who Received Notification of the Hungry Lion EA

Organizations and Individuals Who Received Notification of the Hungry Lion EA			
Jim Barrus	Carol Edwards	Rick Murphy	Jeremy Strey
Marion Foley	Edd Blackler	Ryan McGinnis	Ryan Brown
John Helton	Patricia Jaquith	Stephen Willis	Peter Francisco
Jan Lord	Paul Edwards	Paul Alsippi	Brian Peck
Tyler Tourville	Diann Heivilin	Sarah Light	Skip Repetto
Marc O'Brien	Larry Campbell	Chris Miller	Jason Hanchett
Rebecca Briber	Courtney Feldt	Pete Thomas	Chad Corah
Olson	Paul feldt	Susan Brueggeman	Mathew O'Brien
Brad Kuzmic	Kevin Jacks	Amy Contrada	Mary Via
John Carter, Yellowstone to Uintas Connection	Keith Hammer, Swan View Coalition	Willie, Great Northern Cycle and Ski	John Hanson, Flathead Electric Coop.
Ed Newman	T. Michael Basciano	Chris Gotschalk	Virginia Zielinski
Alan Myers-Davis, Whitefish Legacy Partners	Erin Bodman, Flathead Area Mountain Bikers	Greg Dyson, Wild Earth Gaurdians	Greg and Deborah Schatz
Karen South	Parker Squires	Keith Pool	Jessica Downing
Nelson Grant	Almer Casile	Rocco Russo	Eric Anderson
Neil Miner	Marc Grubert	R. Whitekettle	Mack
Josh Knight	Jeff Flammang	Jean Marshall	Martha Hunt
John Dewar	Ben Osburn	Ty Nelson	Antonio Thomas
Noah Bodman	Kelly Jorschumb	Tim O'Brien	Troy Kasper
Jamie Storrs	Patrick Michael	Norman Petersen	Amanda Batty
Zeb Burke	Benedict Treglia	Anders	Matt Hightower
Henry Wong	Michael Whitesel	Jon Tomas	David Garzoli
Aaron Parmet	Kevin Strongin	Tishia Stew	Cam McRae
Heidi Van Everen, Whitefish Legacy Partners	Katiera and Francisco Rivera	Jerry Sidie/ Betz McKenzie	Arlene Montgomery, Friends of the Wild Swan
Camas Ellingson	Bret Huffaker	Pete Byl	Beau Miller
Brett Haverstick	Michael Plunkett	Nick McKethen	Michael Oshier
Andrew Hunter	Molly and Larry Bruce	Kristina Counts	Vincent Edwards
Wayne Nussbaum	Andy Morsell	Reid Sabin	W. Lee Duncan
Ned Cameron	Paige Ramsey	Zoe Morris	David Boyer
Robert Pierce	Artie Regan	Vivian Allen	Lynn Foster
Mike Wiseman	Ben Clemens	Jeremiah Croswhite	Matt Counts
Sean Cooksey	Ron Brandt	Stephen Kenan	Scott Marksbury
Brittani Marquand	Bear Barinowski	Mary Magee	Carrie Johnson
Daniel Hansen	Patrick Brady	John Cochrane	Willie Hobbs

Organizations and Individuals Who Received Notification of the Hungry Lion EA			
Matt Lessmeier	Danny McIntosh	Jeff Juel	John Vance
Walter Tabb	Michael Garrity, Alliance for the Wild Rockies		

List of Preparers

Preparer	Contribution	Title
Sarah Canepa	Project Leader	Planning Team Leader
Robert Davies	Line Officer Lead	District Ranger
Kendra Roark	Writing/Editing	Writer Editor
Amanda Smiley	Forest Vegetation	Silviculturist
Toby Thompson	Fire/Fuels and Air Quality	Fuel AFMO
Chantelle Delay	TES and Invasive Plants	Botonist
Derek Milner	Soils	Soils Scientist
Nathan Dieterich	Aquatics	Hydrologist
Mark Ruby	Wildlife	Wildlife Biologist
Tad Wehunt	Recreation	Recreation, Special Uses Supervisor
Autumn Ela	Scenery	Landscape Architect
Michael Flowers	Heritage	Forest Archeologist
Mitch Guenther	Transportation	Transportation Planner
Eric Trimble	Economics	Forester
Beth Gardner	Fisheries	Fisheries Biologist
Taylor Greenup	Maps	GIS Specialist

Appendix B – Literature Cited

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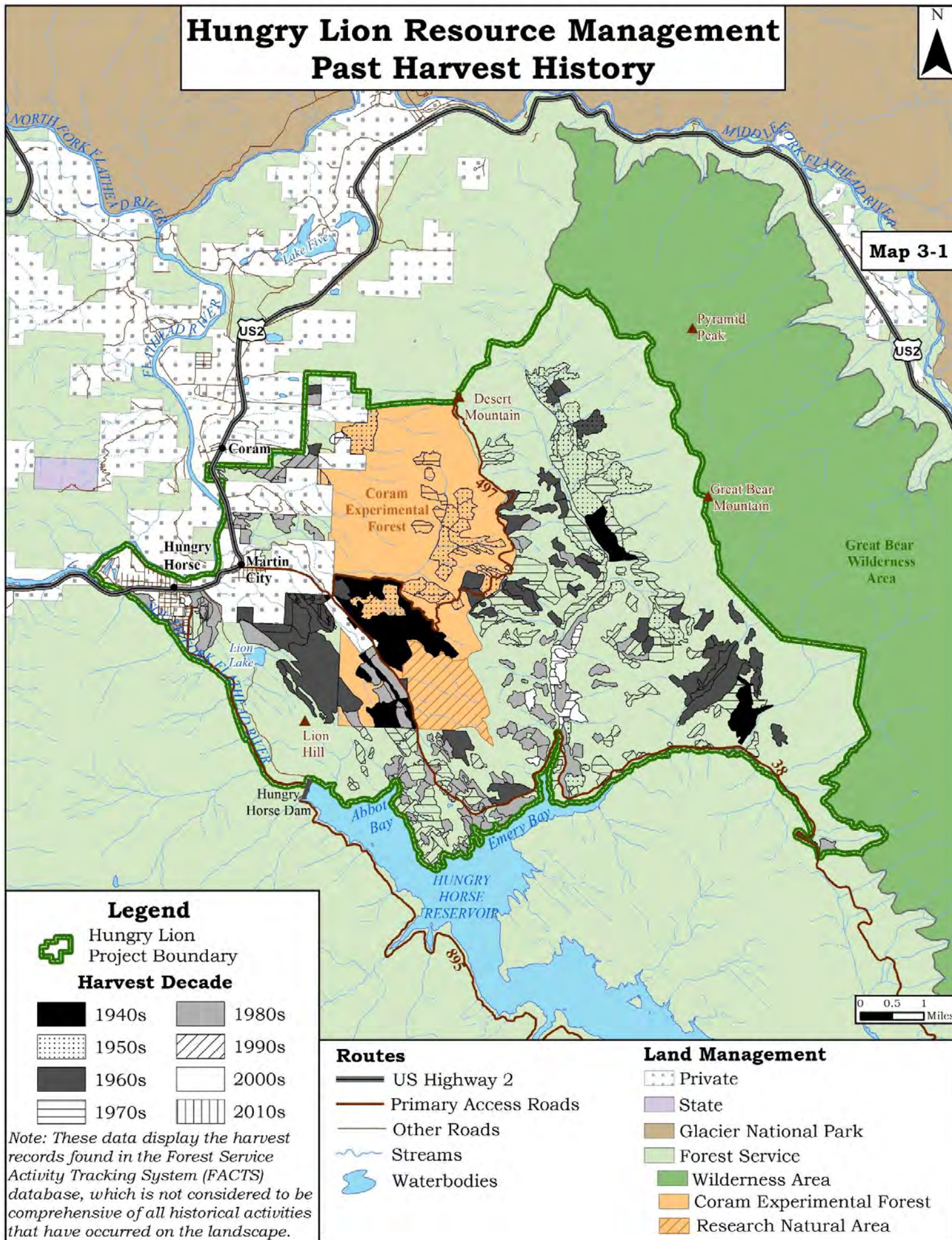
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Hungry Lion Resource Management Past Harvest History



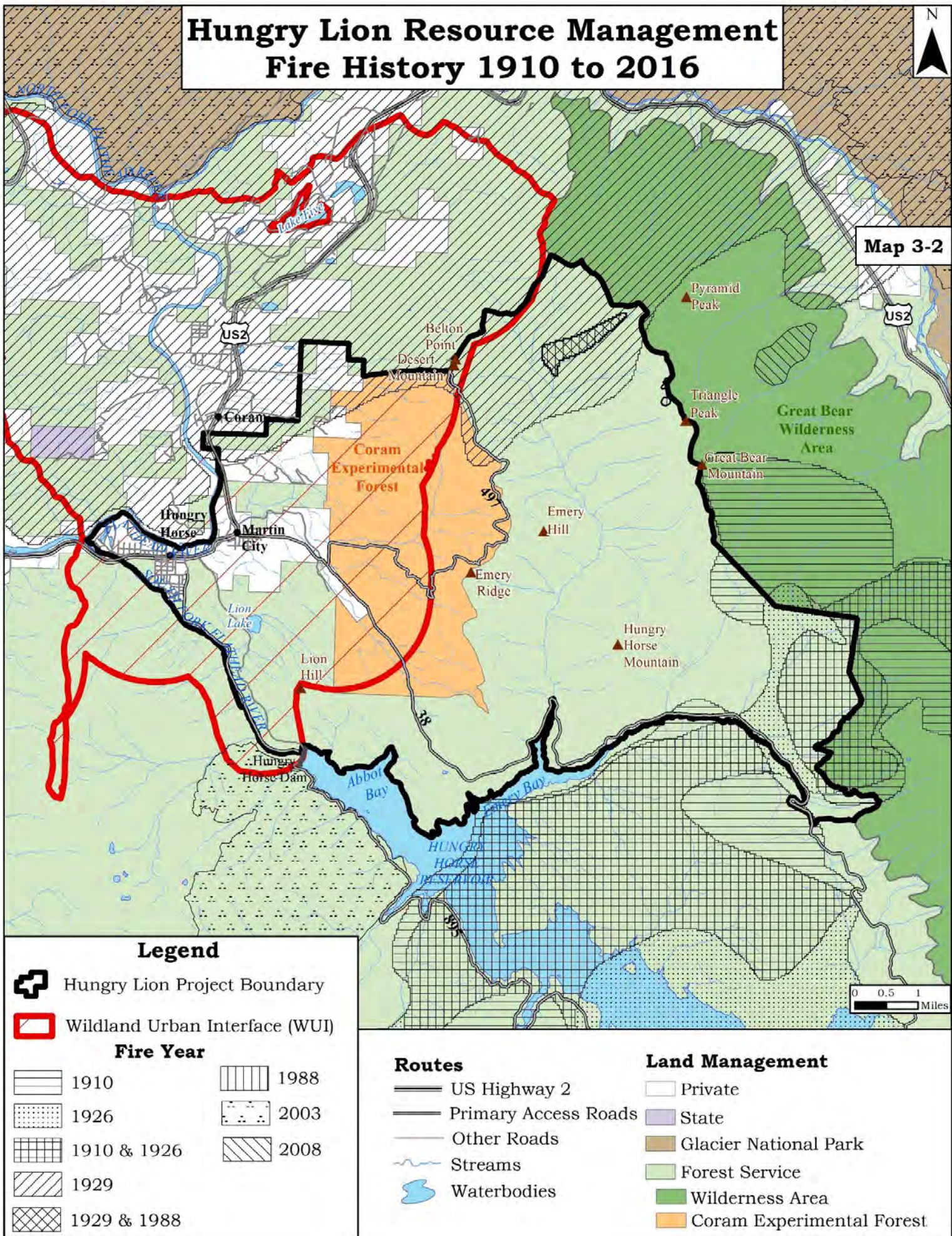
Map 3-1



Hungry Lion Resource Management Fire History 1910 to 2016



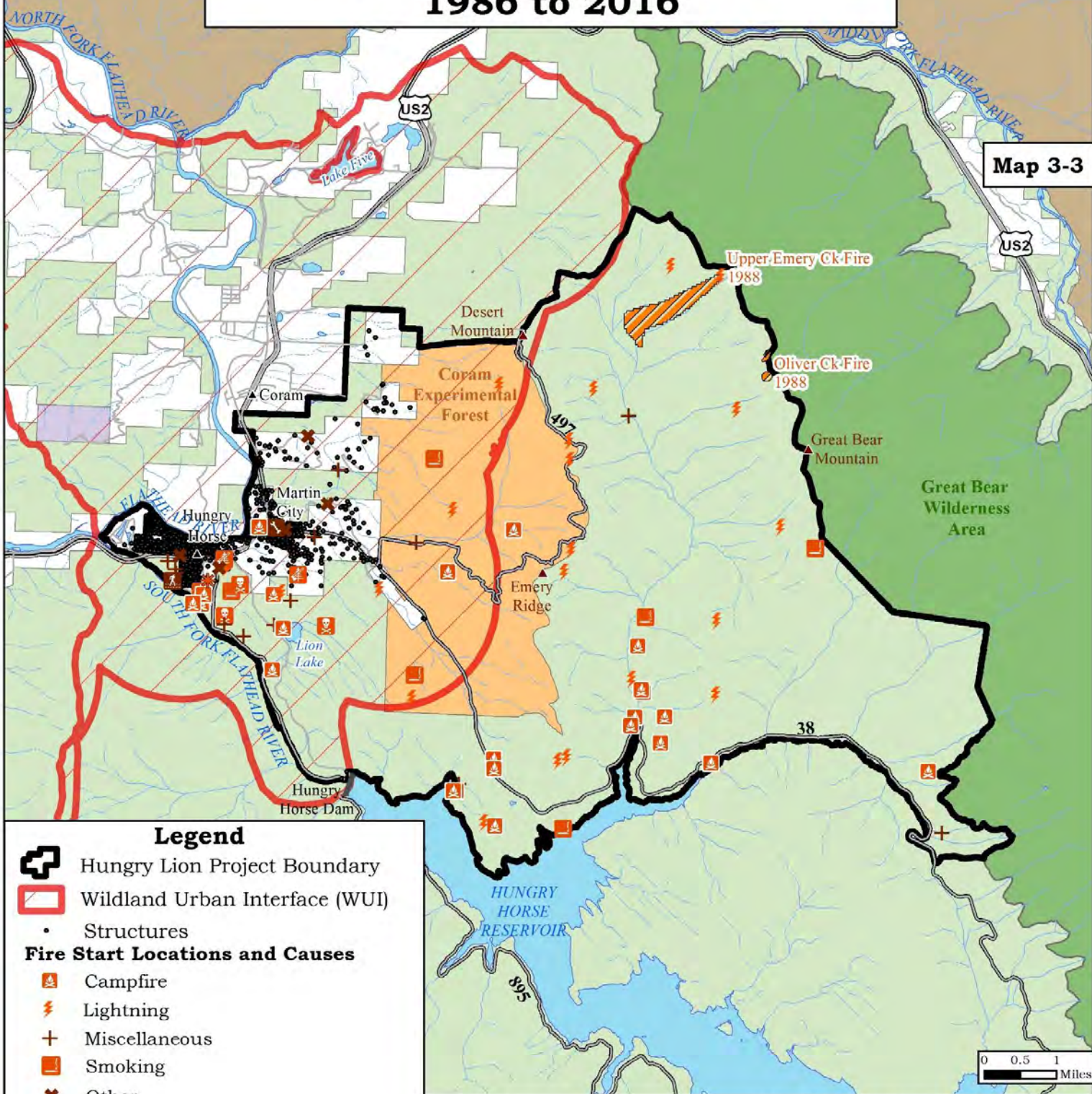
Map 3-2



Hungry Lion Resource Management Large Fires and Fire Starts 1986 to 2016



Map 3-3



Legend

- Hungry Lion Project Boundary
- Wildland Urban Interface (WUI)
- Structures
- Fire Start Locations and Causes**
- Campfire
- Lightning
- Miscellaneous
- Smoking
- Other
- Debris Burning
- Arson
- Children
- Fireworks
- Equipment Use
- Project Area Large Fires post-1986

Routes

- US Highway 2
- Primary Access Roads
- Other Roads
- Streams
- Waterbodies

Land Management

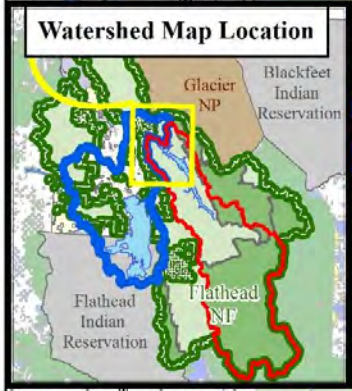
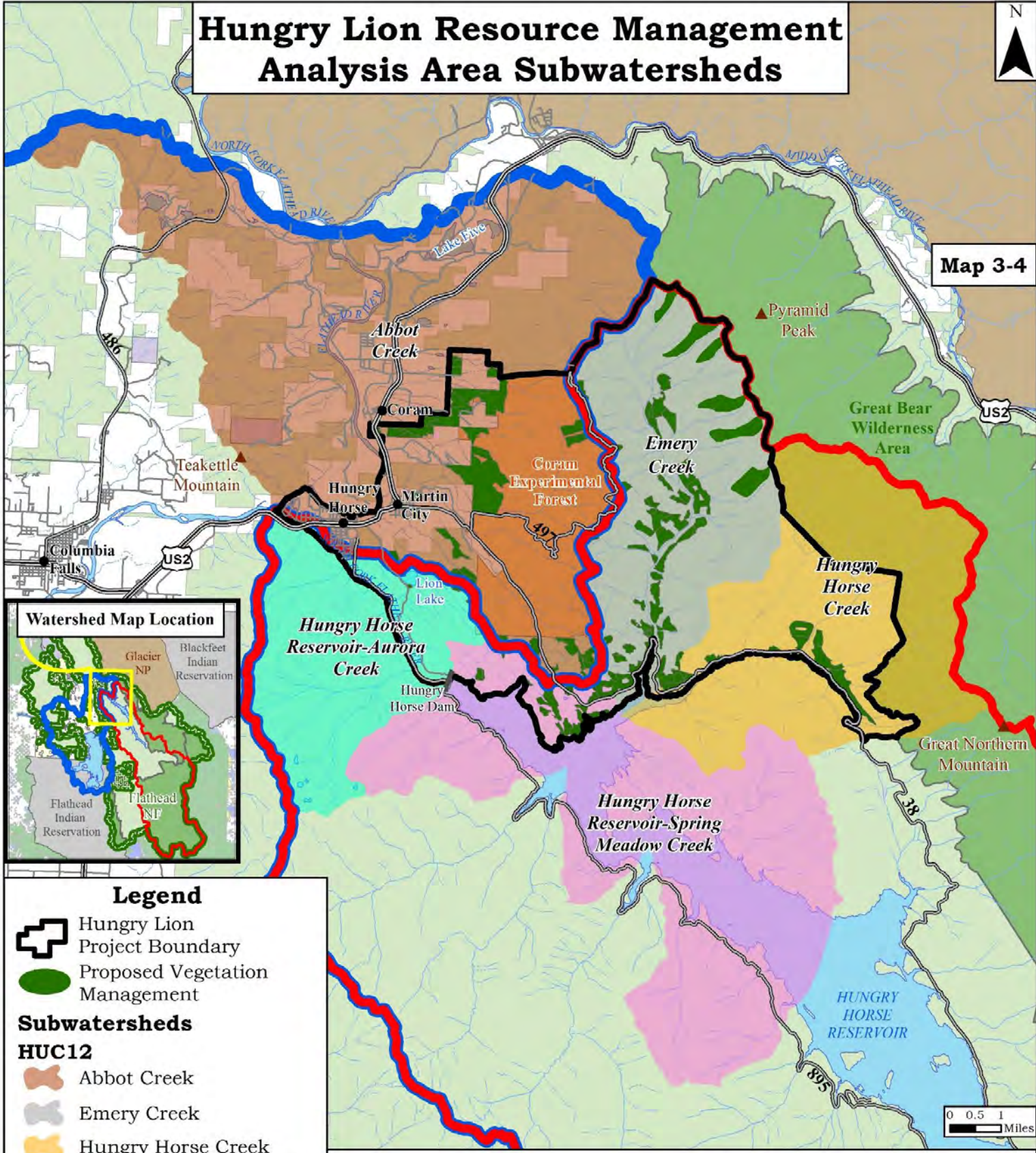
- Private
- State
- Glacier National Park
- Forest Service
- Wilderness Area
- Coram Experimental Forest

0 0.5 1 Miles

Hungry Lion Resource Management Analysis Area Subwatersheds



Map 3-4



Legend

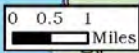
- Hungry Lion Project Boundary
- Proposed Vegetation Management
- Subwatersheds**
- HUC12**
- Abbot Creek
- Emery Creek
- Hungry Horse Creek
- Hungry Horse Reservoir Spring Meadow Creek
- Hungry Horse Reservoir Aurora Creek
- HUC8**
- South Fork Flathead
- Flathead Lake

Routes

- US Highway 2
- Primary Access Roads
- Other Roads
- Streams
- Waterbodies

Land Management

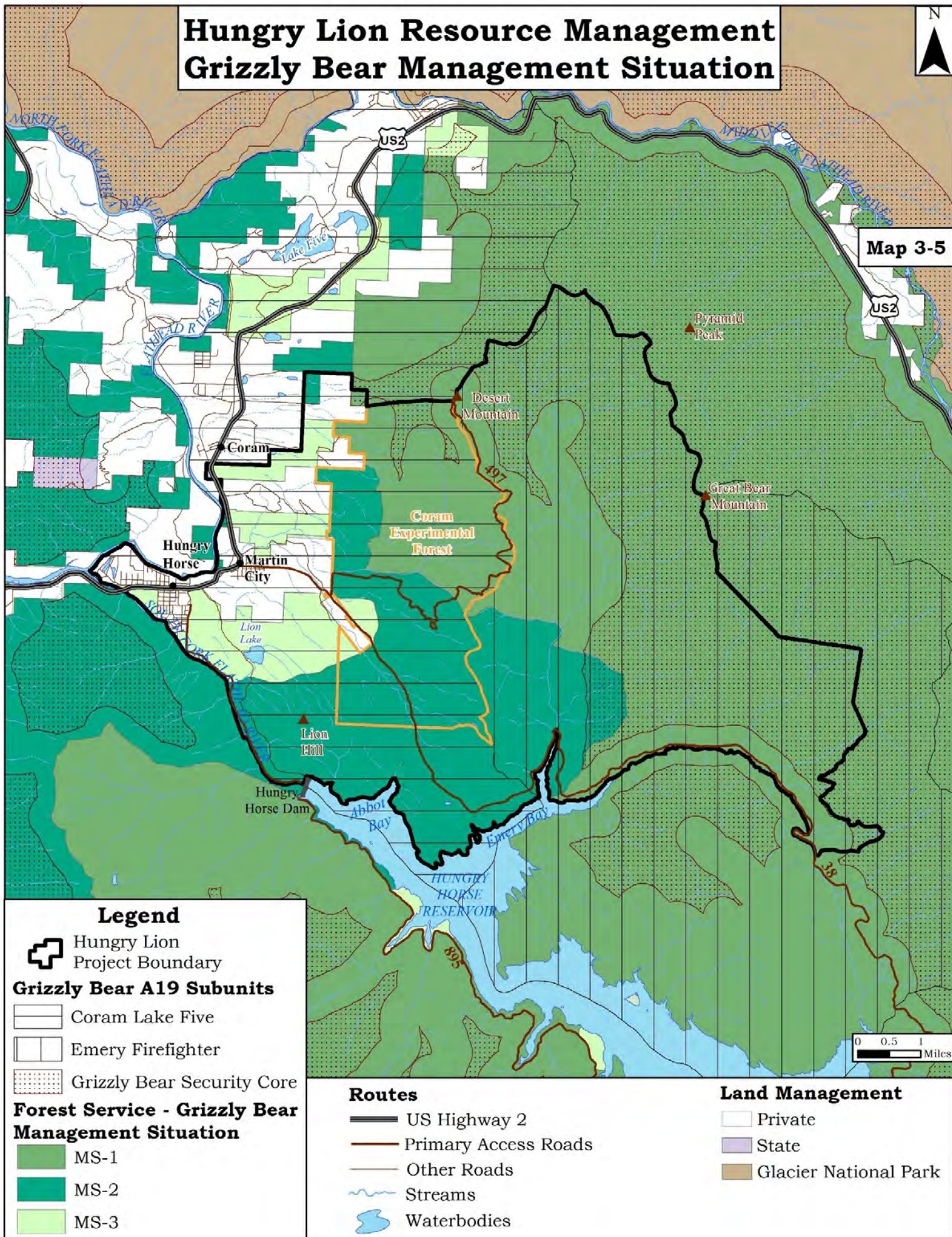
- Private
- State
- Glacier National Park
- Forest Service
- Wilderness Area
- Coram Experimental Forest



Hungry Lion Resource Management Grizzly Bear Management Situation



Map 3-5



Legend



Hungry Lion
Project Boundary

Grizzly Bear A19 Subunits



Coram Lake Five



Emery Firefighter



Grizzly Bear Security Core

Forest Service - Grizzly Bear Management Situation



MS-1



MS-2



MS-3

Routes



US Highway 2



Primary Access Roads



Other Roads



Streams



Waterbodies

Land Management



Private



State



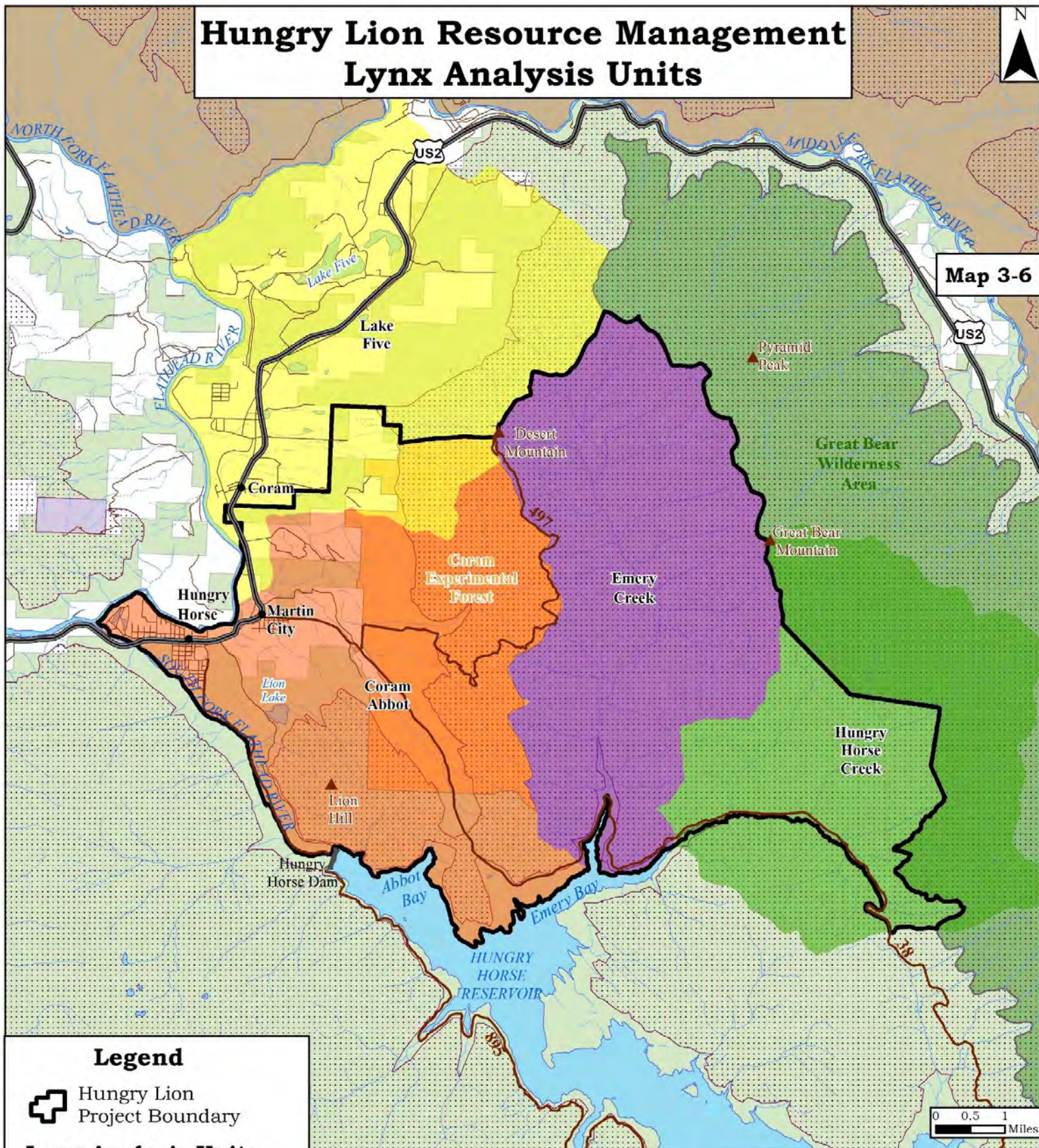
Glacier National Park

0 0.5 1
Miles

Hungry Lion Resource Management Lynx Analysis Units



Map 3-6



Legend



Hungry Lion
Project Boundary

Lynx Analysis Units

- Coram Abbot
- Emery Creek
- Hungry Horse Creek
- Lake Five
- Lynx Critical Habitat

Routes

- US Highway 2
- Primary Access Roads
- Other Roads
- Streams
- Waterbodies

Land Management

- Private
- State
- Glacier National Park
- Forest Service
- Wilderness Area
- Coram Experimental Forest

0 0.5 1 Miles

Hungry Lion Resource Management Recreation Sites

Map 3-7

