United States
Department of
Agriculture

Forest Service

May 2014

Environmental Assessment

South Bridger Interface Project

Bozeman Ranger District, Gallatin National Forest
Gallatin County, Montana

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, an where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or part of an individual's income is derive from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).

To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410, or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

South Bridger Interface Project
Environmental Assessment

Gallatin County, Montana

Lead Agency: USDA Forest Service

Responsible Official: Mary Erickson, Forest Supervisor
Gallatin National Forest
PO Box 130
Bozeman, MT 59771

Summary: The Bozeman District, Gallatin National Forest proposes to commercially thin up to 250 acres of national forest system lands within and adjacent to Bridger Bowl to reduce susceptibility to damage from western spruce budworm, Douglas-fir beetle and mountain pine beetle, and to enhance growth, quality, vigor, and composition of treated stands. Units would be tractor logged on sustained slopes that are less than 35 percent. Up to one half mile of temporary road may be required to implement the project.

The South Bridger Interface project area (approximately 1847-acres) is located approximately 15 miles northeast of Bozeman in Gallatin County, located within and immediately south of Bridger Bowl Ski Area in the vicinity of Slushman Creek. The area is considered wildland urban interface, and lies between private residential and forested/agricultural lands to the east and Inventoried Roadless to the west. The area is visible by recreationists skiing at Bridger Bowl, as well as local residents and travelers through Bridger Canyon.

Forest vegetation in the project area primarily consists of mature and over-mature stands of Douglas-fir and lodepole pine. Douglas-fir have experienced epidemic levels of mortality from western spruce budworm. Budworm has been impacting all size and age classes of Douglas-fir and subalpine fir in the area around Bridger Bowl for many years. Many large trees have been almost completely defoliated and in some cases subsequently attacked by Douglas-fir beetle. Mountain pine beetle has killed about half of the lodgepole in mixed stands and in some cases has caused 100 percent mortality in lodgepole pine dominated areas. The mixed species composition has resulted in variable levels of mortality and live tree densities across the project area.

The purpose of the South Bridger Interface Project is alter forest stand conditions using vegetation management treatments that reduce tree mortality from ongoing insect infestations and improve the overall health, productivity and resiliency of forest vegetation within and adjacent to Bridger Bowl and adjacent to private land.

Comment Process: Public review and comment on this Environmental Assessment will be accepted for 30 days, from the date of legal notice appearing in the Bozeman Daily Chronicle. Please submit comments electronically to: FS-comments-northern-gallatin@fs.fed.us or hard copy to: Amy Waring, ID Team Leader; Gallatin National Forest, Bozeman Ranger District; 3710 Fallon Street, Suite C; Bozeman, MT 59718.

Upon the conclusion of the 30-day comment period, the Gallatin National Forest will publish a final Environmental Assessment, which will include a Response to Comments and Draft Decision Notice that is subject to the 36 CFR 218 Objection Process.

ERRATA

CHANGES MADE TO THE SOUTH BRIDGER INTERFACE EA BETWEEN FEBRUARY 2014 AND MAY 2014 VERSIONS.

CHAPTER 1

No changes were made.

CHAPTER 2

Page No.	Change
2.1	Proposed Action: Clarified 3rd paragraph to note that debris pile burning would be used to reduce fuels and recycle nutrients (instead of the less descriptive word prescribed burning).
2.1	Proposed Action: Added page number reference to forest plan consistency in the 4th paragraph about a non-significant forest plan amendment.
2.2	Design/Mitigation: Clarified #4 Burning to note: *All burning of machine or hand-piled material will comply with regulations and reporting requirements set forth by the Montana Department of Environmental Quality (DEQ).* Clarified #6 BMPS to reference Appendix C instead of B.
2.6	Added monitoring item #12 that was in Chapter 3: *The fuel management specialist or fire management personnel will be on-site to assist in determining the placement of machine and/or hand piles within treatment units for efficiency of burning. The fuel management specialist or fire management personnel will monitor the curing (drying out) of the piles and recommend when they should be burned. The fuel treatment specialist will monitor smoke during pile burning. Areas that have been burned will be monitored and treated if noxious weed growth is discovered.*
2.13-14	Clarified Table 2.1, Comparison of Alternatives for fire-fuels
2.14	Clarified Table 2.1, Comparison of Alternatives for sediment yield
2.14	Clarified Table 2.1, Comparison of Alternatives for stream channel stability
2.18	Clarified Table 2.1, Comparison of Alternatives for sensitive species
2.19-20	Clarified Table 2.1, Comparison of Alternatives for Summary of effects to MIS and MA 11 focal species
2.20	Clarified Table 2.1, Comparison of Alternatives for Migratory Birds

CHAPTER 3

Page No.	Change
3.17	**Forest Vegetation:** Corrected error in Table 3.8. Noted regeneration harvest acres on private land totals *761 acres*, not 7,761 acres.
3.32-40	**Fire – Fuels:** This section was revised to simplify and clarify the information presented, as it relates to an insect/disease project. The following changes were made: • **Issues:** Clarified issues and removed impacts to air quality as an indicator. Only pile burning of activity fuels is proposed. • **Methods:** Shortened methods section. Removed Figure 3.8 and Table 3.11

	regarding fire behavior and suppression responses. • **Affected Environment:** Information was revised for clarity. Added a heading for Fire Behavior and Fire Regimes (added a new Table 3.11 displaying Fire Regime Groups), and a heading for Fuel Condition. • **Environmental Consequences:** Design/Mitigation Measures (reference to the 15 tons per acre) was moved to a discussion under Consistency with the Gallatin Forest Plan. Information was rewritten for clarity. • **Monitoring:** This information was added to the list of monitoring items in Chapter 2. • **Cumulative Effects:** Information was revised for clarity. • **Regulatory Framework and Consistency:** Information was revised for clarity. Deleted information that is not relative to an insect/disease project under Other Fire & Fuels Policy. Note, the original version of the fire-fuels analysis in the February 2014 EA is retained in the project record as the fire-fuels specialist report.
3.180	**Wildlife:** Corrected error to note: *There is potential nesting and foraging habitat for the northern goshawk in the analysis area, but goshawks have not recently (i.e. within 20 years) been documented within the project area.*

CHAPTER 4

Page No.	Change
4.1-2	List of Preparers was moved from Appendix E to Chapter 4, and information describing consultation/coordination with Forest Service partners was summarized from various places in the EA and record.

APPENDIX E

Page No.	Change
E.14	The List of Preparers was moved to Chapter 4.

APPENDIX F

Page No.	Change
App F	Added citations used in response to comments

APPENDIX G

Page No.	Change
App G	A Response to Comments on the EA was added as Appendix G

TABLE OF CONTENTS

TABLE OF CONTENTS ..... **VI**
CHAPTER 1 - PURPOSE AND NEED FOR ACTION **1.1**
Introduction 1.1
Project Area 1.1
Existing Condition 1.2
Purpose and Need 1.2
Proposed Action 1.3
Public Involvement and Scoping 1.3
Issues 1.4
Decision to be Made 1.7
Applicable Laws and Executive Orders 1.7
Permits 1.8
Information Sources 1.8
CHAPTER 2 - ALTERNATIVES CONSIDERED **2.1**
Introduction 2.1
No Action 2.1
Proposed Action 2.1
Other Alternatives Not Studied in Detail 2.7
Cumulative Effects 2.7
Forest Plan Management Direction 2.11
Comparison of Effects 2.12
CHAPTER 3 AFFECTED ENVIRONMENT & ENVIRONMENTAL CONSEQUENCES **3.1**
INTRODUCTION 3.1
FOREST VEGETATION **3.2**
VEGETATION ISSUES 3.2
ANALYSIS AREA 3.2
METHODS 3.3
AFFECTED ENVIRONMENT 3.6
ENVIRONMENTAL CONSEQUENCES 3.17
REGULATORY FRAMEWORK AND CONSISTENCY 3.25
DESIGN CRITERIA 3.29
MONITORING 3.29
CUMULATIVE EFFECTS 3.29

FIRE - FUELS **3.32**
Issues 3.32
Analysis Area 3.32
Affected Environment 3.34
Environmental Consequences 3.35
Regulatory Framework & Consistency 3.38
ECONOMICS **3.41**
INTRODUCTION 3.41
REGULATORY FRAMEWORK 3.41
ANALYSIS AREA 3.42
AFFECTED ENVIRONMENT 3.42
ENVIRONMENTAL CONSEQUENCES 3.45
HYDROLOGY **3.51**
WATER QUALITY RELATED ISSUES 3.51
ANALYSIS AREA 3.51
METHODS 3.52
AFFECTED ENVIRONMENT 3.54
ENVIRONMENTAL CONSEQUENCES 3.63
REGULATORY FRAMEWORK & CONSISTENCY 3.73
DESIGN/ MITIGATION 3.78
MONITORING 3.79
CUMULATIVE EFFECTS 3.79
AQUATIC SPECIES **3.82**
AQUATIC SPECIES RELATED ISSUES 3.82
AFFECTED ENVIRONMENT 3.83
APPLICABLE LAWS, REGULATIONS, POLICY AND FOREST DIRECTION 3.84
ENVIRONMENTAL EFFECTS 3.87
BIOLOGICAL EVALUATION 3.92
SOILS **3.93**
SOILS ISSUES 3.93
ANALYSIS AREA 3.93
METHODS 3.94
AFFECTED ENVIRONMENT 3.96
ENVIRONMENTAL CONSEQUENCES 3.98

REGULATORY FRAMEWORK AND CONSISTENCY 3.105
DESIGN/ MITIGATION 3.108
MONITORING 3.109
CUMULATIVE EFFECTS 3.109
RANGE 3.111
RANGE ISSUE 3.111
ANALYSIS AREA 3.111
AFFECTED ENVIRONMENT 3.111
ENVIRONMENTAL CONSEQUENCES 3.112
REGULATORY FRAMEWORK AND CONSISTENCY 3.114
WEEDS 3.115
WEEDS ISSUES 3.115
ANALYSIS AREA 3.115
AFFECTED ENVIRONMENT 3.115
ENVIRONMENTAL CONSEQUENCES 3.116
REGULATORY FRAMEWORK & CONSISTENCY 3.118
SENSITIVE PLANTS 3.120
SENSITIVE PLANTS ISSUE 3.120
AFFECTED ENVIRONMENT: 3.120
ENVIRONMENTAL CONSEQUENCES 3.123
REGULATORY FRAMEWORK & CONSISTENCY 3.123
RECREATION 3.125
RECREATION ISSUES 3.125
ANALYSIS AREA 3.125
METHODS 3.125
AFFECTED ENVIRONMENT 3.126
ENVIRONMENTAL CONSEQUENCES 3.127
REGULATORY FRAMEWORK & CONSISTENCY 3.129
DESIGN /MITGIATION 3.129
CUMULATIVE EFFECTS 3.130
SUMMARY CONCLUSION 3.131
ROADLESS 3.132
INVENTORIED ROADLESS AREA ISSUES 3.132
ANALYSIS AREA 3.132

METHODS ... 3.132
AFFECTED ENVIRONMENT ... 3.133
ENVIRONMENTAL CONSEQUENCES ... 3.133
REGULATORY FRAMEWORK & CONSISTENCY ... 3.135
DESIGN / MITIGATION ... 3.136
CUMULATIVE EFFECTS ... 3.136
SUMMARY / CONCLUSION ... 3.137
SCENERY ... **3.138**
SCENERY ISSUES ... 3.138
LAWS, REGULATIONS, POLICY & FOREST PLAN DIRECTION ... 3.138
ANALYSIS AREA ... 3.139
METHODS ... 3.139
AFFECTED ENVIRONMENT ... 3.140
ENVIRONMENTAL CONSEQUENCES ... 3.141
HERITAGE RESOURCES ... **3.144**
HERITAGE RESOURCE ISSUE ... 3.144
ANALYSIS AREA ... 3.144
METHODOLOGY ... 3.144
AFFECTED ENVIRONMENT ... 3.144
ENVIRONMENTAL CONSEQUENCES ... 3.144
REGULATORY FRAMEWORK & CONSISTENCY ... 3.145
DESIGN/MITIGATION ... 3.145
WILDLIFE ... **3.146**
Wildlife Issues ... 3.146
Methodology ... 3.146
THREATENED SPECIES ... **3.148**
Grizzly Bear ... 3.148
Canada Lynx ... 3.148
SPECIES PROPOSED FOR FEDERAL LISTING ... **3.155**
Wolverine ... 3.155
FOREST SERVICE SENSITIVE SPECIES ... **3.162**
MANAGEMENT INDICATOR SPECIES ... **3.167**
Landscape Scale Assessment ... 3.167
Grizzly Bears and Bald Eagles ... 3.168

Elk & Big Game 3.169
Northern Goshawk 3.179
American Marten 3.183
Summary/Conclusion – MIS and MA 11 focal species 3.186
MIGRATORY BIRD SPECIES 3.189
Project Design Features 3.196
Mitigation Measures 3.196
Monitoring 3.196
CHAPTER 4 – COORDINATION 4.1
List of Preparers 4.1
Coordination 4.1

APPENDICIES

Appendix A – Project Area Map
Appendix B1 – Wildland Fire History Map
Appendix B2 – Flaming Arrow Fire Map
Appendix C – Water Best Management Practices
Appendix D – Soil Best Management Practices
Appendix E – Literature Cited
Appendix F – Mailing List
Appendix G – Response to Comments

CHAPTER 1- PURPOSE AND NEED FOR ACTION

INTRODUCTION

The Bozeman District, Gallatin National Forest proposes to commercially thin up to 250 acres of national forest system lands within and adjacent to Bridger Bowl to reduce susceptibility to damage from western spruce budworm, Douglas-fir beetle and mountain pine beetle, and to enhance growth, quality, vigor, and composition of treated stands. Units would be tractor logged (sustained slopes are less than 35%) and whole tree yarded.

Council on Environmental Quality (CEQ) regulations provide that:

> *An environmental assessment (EA) shall be prepared for proposals as described in § 220.4(a) that are not categorically excluded from documentation (§ 220.6) and for which the need of an EIS has not been determined (§220.5). (36 CFR 220.7(a)).*

The Forest Service has prepared this Environmental Assessment (EA) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. The purpose of this EA is to:

(1) Briefly provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact.
(2) Aid an agency's compliance with the Act when no environmental impact statement is necessary.
(3) Facilitate preparation of a statement when one is necessary. (40 CFR 1508.9(a)).

This EA describes the direct, indirect and cumulative environmental impacts of the proposed action and no action, and discloses these impacts to the public and the decision maker. An EA displays analysis that speaks to the context and intensity of environment effects of the proposed action and all alternatives.

The document is organized into four parts. **Chapter 1** describes the purpose and need for action and public participation / scoping efforts. **Chapter 2** describes an action and no action alternative, as well as alternatives that were considered but not examined in detail. This chapter also lists Design Criteria and describes any monitoring that will occur**. Chapter 3** describes the existing condition and potential environmental effects of implementing the Proposed Action and no action alternative. This chapter is organized by resource area. Appendices to the EA include a Proposed Action Map – Appendix A, Fire History Maps – Appendix B1 and B2, Water Best Management Practices (BMPs) – Appendix C, Soils BMPs – Appendix D, Literature Cited /List of Preparers – Appendix E, and a mailing list- Appendix F.

PROJECT AREA

The approximately 1847-acre South Bridger project area is on the Bozeman District of the Gallatin National Forest and is located approximately 15 miles northeast of Bozeman in Gallatin County. It is geographically located within and immediately south of Bridger Bowl in the vicinity of Slushman Creek. Specifically, the project is located in Section 30, Township 1 North, Range 7 East and Section 6, Township 1 South, Range 7 East, Gallatin County, Montana. See Appendix A.

EXISTING CONDITION

The project area lies partially within and adjacent to Bridger Bowl Ski Area, which has been operating since 1954. The area is considered wildland urban interface, and lies between private residential and forested/agricultural lands to the east and Inventoried Roadless to the west. The area is visible by recreationists skiing at Bridger Bowl, as well as local residents and travelers through Bridger Canyon.

Forest vegetation in the project area primarily consists of mature and over-mature stands of Douglas-fir and lodepole pine. Forest structure is generally single-storied, with small areas of two storied vertical structure where remnant overstory trees exist above an understory. Tree densities are high, and are being affected by insect related mortality.

Douglas-fir has experienced epidemic levels of mortality from western spruce budworm. Budworm has been impacting all size and age classes of Douglas-fir and subalpine fir in the area around Bridger Bowl for many years. Many large trees have been almost completely defoliated and in some cases subsequently attacked by Douglas-fir beetle. Mountain pine beetle has killed about half of the lodgepole in mixed stands and in some cases has caused 100 percent mortality in lodgepole pine dominated areas. The mixed species composition has resulted in variable levels of mortality and live tree densities across the project area. Mountain pine beetle, western spruce budworm, and Douglas-fir beetle mortality have increased the amount and distribution of standing dead snags throughout the area. Estimates range from zero to 117 dead trees per acre greater than 5" DBH (Konen, 2013). Refer to the Forest Vegetation analysis in Ch 3 for additional information.

In 2010 and 2013, the Gallatin National Forest, in cooperation with the Bridger Bowl ski permittee and Forest Health Protection, Forest Service Northern Region, sprayed approximately 500 acres of both Forest Service and private lands with *Bacillus thuringiensis* (*B.t)* to reduce damage and tree mortality caused by western spruce budworm. Subseqently, the Forest and ski permittee have been implementing a vegetation management plan for the Bridger Bowl ski area that involves salvaging dead and dying trees and planting young trees in areas that are suitable to establish a younger size class. These activities are being completed within the ski area boundary in Gallatin Forest Plan, Management Area 2 (MA 2).

PURPOSE AND NEED

The purpose of the South Bridger Interface Project is alter forest stand conditions using vegetation management treatments that reduce tree mortality from ongoing insect infestations and improve the overall health, productivity and resiliency of forest vegetation within and adjacent to Bridger Bowl and adjacent to private land. Treatments are designed to alter stand micro-environments creating conditions less favorable for western spruce budworm (*Choristoneura occidentalis*), mountain pine beetle (*Dendroctonus ponderosae*), and Douglas-fir beetle (*Dendroctonus pseudotsugae*) and enlarge the growing space of remaining trees allowing for improved tree growth, vigor, and resiliency.

Although western spruce budworm is a native insect, extensive damage and mortality from budworm can occur especially during drought periods and in areas where fire has been suppressed. Without treatment, there is a high probability that many more trees would be severely impacted by budworm and Douglas-fir beetles.

According to recommendatons provided by Region 1 Forest Health Protection entomologists (Sturdevant et. al. 2010 and Sturdevant and Jackson 2012), protecting foliage with *B.t.* is a temporary solution to reducing defoliation, growth loss, deformation, and tree mortality, and that silvicultural treatments that

reduce stocking density, number of canopy layers, and increase individual tree vigor and species composition are the only long-term solution to budworm management.

The Gallatin Forest Plan provides direction to manage insect and disease populations, and to use integrated forest pest management to reduce long-term losses caused by insects and diseases. Forest wide standards direct the Forest Service to employ silvicultural systesms to improve the diversity of tree species and the size and age of trees, and to reduce long-term losses of lodepole pine stands to insects, while protecting other resource values. Silvicutural systesms that decrease resistance to attack may include harvesting susceptible stands to gain diversity in age and size between stands, controlling the levels of planting and the ages of trees in even-aged stands to maintain the vigor of the stand, and changing the composition of the forest to favor species that are not susceptible to insects.

This project is needed to a maintain healthy, resilient forest in the wildland urban interface in the Bridger Canyon corridor adjacet to Bridger Bowl. The area contains lands suitable for timber management, and presents an opportunity to manage vegetation for epidemic levels of insects in accessible areas with very limited temporary road construction.

PROPOSED ACTION

The Forest Service, Bozeman Ranger District, proposes to thin up to 250 acres of mature/over mature forest vegetation on NFS lands adjacent to Bridger Bowl to a basal area ranging between 80 and 100 square feet per acre. Trees that would be removed include dead/dying trees infested with spruce budworm, Douglas-fire beetle, and/or mountain pine beetle, as well as live trees, to achieve an average spacing of 15 to 20 feet between crowns. In some cases, this could mean removing up to 50 to 65% of existing dead and live trees. Residual live tree spacing will be influenced by the distribution of existing trees.

Approximately 2,500 feet of temporary road construction may be required to reduce long skids. Potential products may include saw logs and fire wood. Timber harvest would be implemented by tractor logging and occur on slopes less than 35 percent.

The proposed action would result in timber sales that are expected to be implemented in 2014. Harvest activities are anticipated to be completed within a 3-year timeframe, followed by burning of slash piles, rehabilitation of temporary roads and monitoring.

A nonsignificant Forest Plan Amendment would be required to address a reentry standard in MA 11.

PUBLIC INVOLVEMENT AND SCOPING

36 CFR 220.4 requires scoping on all proposed actions. Scoping consisted of both internal and external efforts to identify important issues, concerns, and analysis needs related to the South Bridger Interface Project. Among other things, the scoping process is used to invite public participation, to help identify public issues, and to obtain public comment during the EA process.

On November 21, 2012, the Bozeman District mailed a scoping letter to 85 individuals/groups that may be interested in the project, which included adjacent landowners. Additionally, the District issued a press release about the project on November 26, 2012, published the project in the Forest's Schedule of Proposed Actions, and posted the scoping letter on the Gallatin National Forest website. Public comments were accepted at the Bozeman Ranger District through December 24, 2012. The District

received eight comments on the project in response to scoping. The District completed content analysis on scoping comments and identified issues of concern that were considered in the effects analysis.

ISSUES

The Interdisciplinary (ID) Team reviewed and compiled a list of potential issues based upon internal review and discussion, and from comments received 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 relevant to and within the scope of the Purpose and Need, the decisions being made, and does it pertain directly to the Proposed Action?
- 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, avoiding the impact by not taking action, minimizing the impact by limiting the action, rectifying the impact by rehabilitation, reducing the impact by maintenance, or compensating for the impact by replacement?
- Issues representing an unresolved conflict with the Proposed Action may be considered a "key issue" to help formulate the alternatives to the Proposed Action.

Information in the project file provides a detailed description of the issues identified during the scoping process and describes how those issues were accounted for during the analysis process. No issues were identified that led to the development of another action alternative. A brief discussion of several issues that warrant further analysis is this EA follows.

Forest Health

Forest health is the key issue driving the proposed action. The purpose of the South Bridger Interface Project is alter forest stand conditions using vegetation management treatments that reduce tree mortality from ongoing insect infestations and improve the overall health, productivity and resiliency of forest vegetation within and adjacent to Bridger Bowl and adjacent to private land. Treatment is proposed to reduce susceptibility to damage from western spruce budworm, Douglas-fir beetle, and mountain pine beetle. The public raised many questions and concerns about the need for treatment, including some of the following:

- Address current levels of spruce budworm, mountain pine beetle, and other insects/diseases.
- Define Forest Health. How is it measured? Why are forests with insects and diseases considered unhealthy?
- What beneficial ecological roles do beetles and spruce bud worms play? Can the forest survive without beetles or spruce bud worms?
- What scientific evidence is being relied upon to support the assumption that commercial thinning is the best solution to the problem? What is the effectiveness of proposed treatment?
- Emphasizing individual tree health subverts the goal of ecosystem management integrity and long-term sustainability of forests.

These issues were explored in detail in the Forest Vegetation analysis in Chapter 3. The indicator used to analyze forest health is:

- Effects of the alternatives on forest insect conditions, specifically western spruce budworm (*Choristoneura occidentalis*), mountain pine beetle (*Dendroctonus ponderosae*), and Douglas fir beetle (*Dendroctonus pseudotsugae*).

Stand susceptibility to these insects were modeled for the proposed action and no action using the Forest Vegetation Simulator model, and hazard ratings were reported over a 50 year time frame as low, moderate or high.

Old Growth

The Forest Plan contains an old growth related standard stating that the Forest will strive to develop a diversity of vegetation sizes and ages, including 10% minimum area of old growth in timber compartments containing suitable timber. All proposed treatments associated within this project are located in timber compartment 504. The 2005 Bridger Bowl Special Use Permit and Master Development Plan Final EIS indicated that timber compartment 504 contained 7 percent old growth. The selected alternative reduced the percent of old growth from 7 percent to 6.95 percent in the timber compartment, and a Forest Plan Amendment was included in the Record of Decision providing that development within the Bridger Bowl Ski Area boundary is exempt from the forest wide 10 percent old growth standard.

The public raised many questions and concerns that old growth would be affected, including some of the following:

- Disclose the current level of old growth forest in the Project area, and the method used to quantify old growth forest acreages;
- Please disclose how stands to be treated compare to Forest Plan or Regional old-growth criteria.
- Disclose the amount of mature and old growth forest that will remain after implementation;
- How does the FS intend to maintain 10% old growth in "timber compartments containing suitable timber" when it has no old growth management standard and no plan for old growth recruitment where old growth is less than 10%.

These issues were explored in detail in the Forest Vegetation analysis in Chapter 3, and additional information is provided in the project file. The Forest Service completed additional field reviews and analysis to determine if proposed treatment units met the Green et al definition of old growth. Analysis was conducted to ensure that no treatment units associated with this project outside of the ski area permit boundary meet the Green et al. definition of old growth. Existing stand data was analyzed and additional plots were installed in seven proposed units during winter 2013 to sample tree ages. No proposed units outside the ski area boundary were determined to meet the minimum old growth criteria; detailed analysis of these data is included in the project record. Three units fell within the ski area permit boundary. This area is exempt from the Forest Plan old growth standard and existing available stand exam data did not indicate that the units within the ski area boundary met the Old Growth criteria. As such, this issue is vetted through analysis.

Water Quality/Riparian Areas

Proposed treatment units include a minimum of ten Streamside Management Zones (SMZs). SMZ laws restrict (but do not prohibit) timber harvest within a 50-foot buffer zone measured from the ordinary high water mark and extends out to include adjacent wetlands.

The Forest Service identified protection of water quality and fisheries as an important issue, but identified a concern that excluding treatment of riparian areas could reduce the effectiveness of proposed treatment, and funnel insects into the riparian areas, causing increased mortality. The public raised many questions and concerns regarding impacts to fisheries and water quality, including some of the following:

- Riparian goals, objectives, standards seem to have been abandoned.
- Disclose WQLS streams or TMDL streams in the project area. Disclose location of seeps, springs, bogs, and other sensitive wet areas and effects to them. If there are 303d listed steams, a TMDL needs to be in place before a ROD is signed.
- What are impacts to fisheries and water quality, including considerations of sedimentation, increases in peak flow, channel stability, risk of rain-on-snow events, and increases in stream water temperature? There should be no degradation of Beneficial Uses.
- Discuss BMP effectiveness and failures and the Gallatin National Forest's record of compliance with best management practices regarding stream sedimentation from ground-disturbing management activities.

On December 11, 2012, the Forest Service met with Trout Unlimited to discuss the proposed action for the South Bridger project, and to what extent and under what conditions timber harvest may occur in the SMZs and still protect riparian values and water quality. The Forest Service determined that riparian areas, water quality, and fisheries could be protected though design/mitigation. See design/mitigation section. There are no unresolved conflicts regarding riparian areas and water quality that led to the development of additional action alternatives.

Big Game Habitat

Within MA 11 (the majority of the project area), timber harvest is allowed, provided big game habitat objectives are met following timber harvest. There is a concern that proposed treatment could negatively impact big game hiding cover, security areas, and winter range. The public provided comments about big game, including some of the following:

- Disclose the amount and location of big game (moose, elk and mule deer) hiding cover, winter range, and security currently available in the area, during implementation, and post project.
- Disclose the method used to determine big game hiding cover, winter range, and security, and its rate of error as determined by field review;
- What are the effects of thinning on winter range per best science, and how will these impacts meet Forest Plan direction for MA 11.
- Map elk security using Hillis et al 1991
- Define Habitat Effectiveness that will occur during project implementation and if these meet the management emphasis for MA 11.

Additional information concerning this issue is provided in the Forest Plan consistency section in Chapter 2 and in the big game analysis in Chapter 3. There are no unresolved conflicts regarding big game that led to the development of additional action alternatives.

Lynx

The public commented that the Bridger Mountains are historic lynx habitat and noted that the project should comply with the Lynx Conservation and Assessment Strategy. The lynx analysis unit (LAU) encompasses all of the Bridger and Bangtail mountain ranges. The project area is considered secondary, unoccupied habitat. The Forest Service originally proposed a 7-acre shelterwood regeneration harvest (unit 18) within the Bridger Bowl ski area boundary. This harvest system would contribute to habitat that is considered temporarily unsuitable for lynx, as it is considered regeneration. Rather than increase unsuitable lynx habitat these 7 acres of treatment, the proposed treatment for unit 18 was simply modified to a commercial thin, which does not contribute to unsuitable habitat for lynx, but does meet the purpose and need for the project. Detailed information concerning the lynx analysis is provided in Chapter 3, and the Forest Service is consulting with the Fish and Wildlife Service on this project. There are no unresolved conflicts regarding lynx that led to the development of additional action alternatives.

Scenery

An overall Forest Plan Goal is to provide Forest visitors with visually appealing scenery.The project area has a specific Forest Plan visual quality standard of Partial Retention. There is a concern that timber harvest may negatively impact the visual quality around Bridger Bowl, as well as views from private lands and travelers through Bridger Canyon. The public noted that the impacts of the project on important access corridors and other sensitive viewing areas should be considered.

The Forest Service considered additional treatment areas in the project area on slopes in excess of 35% that would have to be cable logged. However, the nature and extent of the visual impacts that would have been highly visible from the Bridger Canyon Road were included as part of the rationale for not carrying these units forward for treatment. The proposed action leaves these areas untreated. There are no unresolved conflicts regarding scenery that led to the development of additional action alternatives. Effects to scenery are discussed in Chapter 3.

DECISION TO BE MADE

The Responsible Official for this project is the Forest Supervisor, Gallatin National Forest. After the close of the EA review and comment period, the Forest Service will consider comments submitted by the public, interested organizations and government agencies and respond to these comments. A draft decision will be made available to the public and the project will proceed through the 36 CFR 218 objection process. Based on the findings in the EA, the Forest Supervisor will decide whether or not to implement the project, and if so, under what conditions.

APPLICABLE LAWS AND EXECUTIVE ORDERS

A list of Federal and state laws and Executive Orders (EO) pertaining to project specific planning and environmental analysis on Federal lands follows. While most pertain to all Federal lands, some of the laws are specific to Montana. Disclosures and findings required by these laws and orders are contained in Chapter 3 of the EA.

- Montana Water Quality Act

- Montana Streamside Management Zone Law and Rules
- Multiple-Use Sustained Yield Act of 1960.
- National Historic Preservation Act of 1966 (as amended).
- National Environmental Policy Act of 1969 (as amended).
- Clean Air Act of 1970 (as amended).
- Endangered Species Act of 1973 (as amended).
- Forest and Rangeland Renewable Resources Planning Act of 1974 (as amended).
- National Forest Management Act of 1976 (as amended).
- Clean Water Act of 1977 (as amended).
- American Indian Religious Freedom Act of 1980.
- Archeological Resource Protection Act of 1980.
- Executive Order 11593 (cultural resources).
- Executive Order 11988 (floodplains).
- Executive Order 11990 (wetlands).
- Executive Order 12898 (environmental justice).
- Executive Order 12962 (aquatic systems and recreational fisheries).
- Migratory Bird Treaty Act of 1918 (as amended) and associated Executive Order 13186

PERMITS

Wetlands, riparian areas, and streams will be protected through design/mitigation measures, and it is unlikely that water quality permits would be needed. If necessary, the Forest Service would obtain the following permits to comply with Federal and state laws:

- **Montana Streamside Protection Act (SPA 124 Permit) -** Any project including the construction of new facilities or the modification, operation, and maintenance of an existing facility that may affect the natural existing shape and form of any stream or its banks or tributaries (Montana Department of Fish, Wildlife, and Parks).
- **Federal Clean Water Act (Section 404 Permit) –** Any activity that will result in the discharge or placement of dredged or fill material into waters of the United States, including wetlands (U.S Army Corp of Engineers).
- **Short-Term Water Quality Standard for Turbidity (318 Authorization) –**Any activity in any State water that will cause unavoidable short-term violations of water quality standards. "State water" includes any body of water, irrigation system, or drainage system, either surface or underground, including wetlands, except for irrigation water where the water is used up within the irrigation system and the water is not returned to other state water (Montana Department of Environmental Quality).

INFORMATION SOURCES

The analysis and decision processes for this project are based on the consideration of the best available science. The manner in which best available science is addressed can be found within the disclosure rationale throughout the EA, biological assessments (BA), biological opinions (BO), and the project file.

CHAPTER 2- ALTERNATIVES CONSIDERED

INTRODUCTION

This chapter describes a no action alternative and the proposed action for the South Bridger Interface Project, as well as provides a rationale for alternatives not studied in detail. This Chapter also summarizes project design/mitigation features to protect resources, proposed monitoring, past, present, and reasonably foreseeable future actions considered in a cumulative effects analysis in Chapter 3, and consistency with the Gallatin Forest Plan.

NO ACTION

No management action would occur under this alternative, allowing the processes of vegetation succession and forest insect dynamics to continue. Additional mortality associated with spruce budworm and mountain pine beetle is anticipated. Very little natural regeneration is anticipated to occur until the majority of the stands have lost a significant portion of their biomass and/or impacts from western spruce budworm to seed production are minimized. Firewood gathering, Christmas tree cutting, and continued wildfire suppression consistent with Gallatin Forest Plan direction is expected.

PROPOSED ACTION

Commercial thinning is proposed on up to 250 acres to enhance growth, quality, vigor, and composition of treated stands. This treatment is designed to reduce susceptibility to damage from western spruce budworm, Douglas-fir beetle, and mountain pine beetle. Units would be tractor logged on sustained slopes less than 35 percent.

The existing tree density would be reduced from current levels to a target residual density ranging from 80 to 100 square feet of basal area per acre on average. Trees to be removed include sawtimber and pole timber sized trees that are dead and/or dying and infested with western spruce budworm, Douglas-fir beetle, and/or mountain pine beetle, as well as live trees to achieve an average spacing of 15-20 feet between crowns. Smaller sub-merchantable sized trees will not be targeted for removal, however it is expected that some mortality to these trees is likely as a result of operations. Residual live tree spacing will be influenced by the distribution of existing trees and the variable and dynamic nature of mortality in the project area. The purpose of this treatment is to alter the stand micro-environment and enlarge the growing space of desirable trees allowing for improved tree growth, vigor, and resiliency. Treatments will be designed to minimize post-harvest wind damage.

Post-harvest mechanical treatments and debris pile burning would be used to reduce activity-generated fuel conditions and recycle nutrients. Mechanical treatments could include whole tree yarding and/or hand or excavator piling.

A nonsignificant Forest Plan Amendment would be required to address a reentry standard in MA 11. Refer to the Forest Plan consistency section (p. 2.11 – 2.12).

Design / Mitigation Measures

Forest Vegetation / Fuels

1. **Leave Tree Protection -** The Forest Service would take all reasonable care to implement measures that avoid damage to the roots, bole and crown of trees to be reserved from cutting. No more than five percent of the trees designated to be reserved should be damaged beyond recover by operations. Any tree damaged beyond recovery (will die within one year due to damage) may be removed or otherwise treated by a contractor as instructed by the Forest Service.

2. **Down Woody Material** - A minimum of fifteen tons per acre of three-inch diameter or larger debris (if available) would be left scattered after machine site preparation and/or hazard reduction within harvest units.

3. **Snag Retention** - Designate for leave an average of 30 snags (greater than 18 ft. in height and greater than 10 inch DBH) per 10 acres within harvest units. If there are not sufficient dead trees meeting these size criteria, the largest available dead trees will be left as snags.

4. **Burning:** All burning of machine or hand-piled material will comply with regulations and reporting requirements set forth by the Montana Department of Environmental Quality (DEQ). The determinations for burning will consider timing of fall or spring burning windows and air dispersal forecasts to avoid impacting the air quality in the surrounding areas.

Hydrology – Aquatic Species

5. Standard timber sale protection provisions would be applied to the commercial harvest activities to protect against soil erosion and sedimentation. Standard Best Management Practices or BMP's (DNRC 2006) including Montana SMZ compliance rules (DNRC 2006a) would be applied during design and implementation of all commercial activities.

6. Current Best Management Practices (BMP) for the Gallatin National Forest as well as State of Montana Forestry BMPs would be applied (see Appendix C).

7. No trees would be cut within 15 feet of the Ordinary High Water Mark along any Class 1 or Class 2 (DNRC 2006) stream segment within any treatment unit.

8. The fisheries biologist would be allowed the discretion to widen the 15 foot no cut zone to ensure stream bank stability in situations where channel migration or instability may occur.

9. A fisheries biologist would be present during marking of all treatment unit boundaries adjacent to streams and marking of leaning leave trees outside the 15 foot no cut zone.

10. Retain all bank-edge trees and trees leaning toward streams that can provide large woody debris within treatment units.

11. Vehicles and logging machinery would not be operated within wetland areas.

12. Materials would not be deposited in streams or wetland areas.

Soils

13. Require a systematic skid trail pattern during logging.

14. Ground-based harvest systems would be used only on slopes having sustained grades less than 35 percent.

15. Maintain an average separation distance of at least 75 feet between skid trails.

16. Lay out skid trails in a manner that minimizes or eliminates sustained grades steeper than 15%.

17. All skid trails will be constructed with water erosion control and drainage measures installed as required by standard timber sale provisions.

18. Minimize the depth of blading in construction of temporary roads to the extent reasonable within the constraints of Forest Service standards for temporary road construction.

19. Ground based skidding and mechanical harvesting equipment may travel off of the established skid trails but only to the extent reasonably necessary to harvest the available timber and only when the top 6 inches of soil is sufficiently dry to minimize soil compaction problems. (See Soil BMP's in Appendix D for details). Repeat passes over the same ground would be minimized.

20. Landings with Burn Piles --- Exposed areas of landings around burn piles would be ripped (scarified) to a depth of 6 to 8 inches. (See Soil BMP's for details of rock fragment exclusion to ripping due to abundant large rock fragments) Note: This exclusion would likely not apply for most of the South Bridger Project area. Broadcast seed all disturbed areas with the appropriate seed after ripping.

21. Temporary Roads --- Rip the road prism to a depth of 6 to 8 inches along the entire length of all temp roads at the conclusion of this project. (See Appendix C for details of rock fragment exclusion to ripping due to abundant large rock fragments.) Broadcast seed all disturbed areas with the appropriate seed mix after ripping.

22. Skid Trails --- Rip skid trails to a depth of 6 to 8 inches at the completion of timber harvesting only where detrimentally compacted mineral soil is exposed at the surface or where wheel ruts have formed at least 2 inches deep on grades of 15% or greater or continuous to grades of 15% or greater. Broadcast seed all disturbed areas with the appropriate seed mix after ripping.

23. Coarse Woody Debris --- No pre-existing, downed coarse wood material would be removed from treatment units during timber harvesting from stands where the 15 tons per acre standard cannot be reasonable met because of a lack of available coarse woody material.

24. All temporary roads would be slashed at an approximate rate of 10 to 15 tons per acre along those portions of the road that run through forest stands. Slash left should be oriented at primarily right angles to the road corridor. Where needed, additional leave trees would be left standing adjacent to the temporary roads during harvesting to facilitate slashing the road prism at the end of the project.

Range / Weeds / Sensitive Plants

25. The existing gates would be left closed if cattle are in the allotment.

26. Any fences or structures damaged from the timber harvest would be repaired. The structure would be replaced in a similar condition that it was prior to the harvest. The cost of repairing the structure will be bore by those that caused the damage.

27. All off road vehicles would be power washed and inspected prior to entering Forest Service land.

28. Previously treated weeds would be retreated prior to implementation of this project, and would continue until the weeds are eradicated.

29. Reseed bare soil created by the harvest activities with native grass seed mix recommended by the Forest Service (certified noxious weed seed free). Establishing native grasses on disturbed sites may occur quickly but sometimes it takes multiple years. If seeds are not established with in the first year, the site will need to be reseeded in the following year.

30. If sensitive plants are found during implementation, do not disturb the area. Consult with the biologist to develop additional mitigation measures to protect the site.

Recreation / Roadless

31. Hauling/Access would be coordinated with Bridger Bowl Ski Area such that Bridger management is aware of expected traffic in the area.

32. Road #538 through the Bridger Bowl Permit Area would not be plowed between November 1st and the closure of the ski area in the spring.

33. All structures (Bridger Bowl gun mount, trail signs, ski area signs, etc.) would be protected from damage.

34. For public safety and understanding of the activity, post information at appropriate access points to inform the public of project activities. Provide local media with updates about project work that may affect the recreating public. Post warning signs notifying forest users of potential hazards from fuel treatment activities when occurring adjacent to dispersed areas, roads, and trails. If necessary, issue special orders that temporarily close some areas or routes to protect the public.

35. Holders of special use permits (such as recreation event organizers and outfitters) would be notified prior to treatment in the vicinity of their authorization.

36. No equipment use, staging or storage, nor the decking or piling of slash would occur at trailheads or on Forest Service trails or roads.

37. Location of slash piles for units 1 and 18 would be coordinated between the Bridger Bowl permit administrator and the timber sale administrator.

38. No roads or skid trails would be constructed within the (Inventoried Roadless Area (IRA). No treatment units or areas would be located in the IRA.

39. Cutting unit boundaries adjacent to the IRA would be clearly marked and mapped to avoid the IRA.

Scenery

40. Units #1 and #18 would be cut-tree marked because they would be in the visual immediate foreground of skiers.

41. In units #1, 2, 3 and 18, exact on-center leave tree spacing would be avoided. Instead, leave trees would be selected based upon their desirability and spacing distance from other leave trees, aiming for 15-20 feet between crowns. This method for selection of leave trees would create a more natural-looking appearance when viewed by skiers.

42. Along the northern and eastern edges of unit #1 and the eastern edge of unit #3, care would be taken to avoid abrupt, straight, unnatural-appearing transitions.

Cultural Resources

43. If, in connection with operations under this decision, any historic or prehistoric resources are encountered, activities must cease in the vicinity of the find and the District Ranger and Forest Archeologist notified. Plans designed to avoid or reduce further disturbance or to mitigate existing disturbance will be formulated in consultation with the MT SHPO, affected tribes, and the Forest Service. The discovery must be protected until notified in writing to proceed by the authorized officer (see 36 CFR 800.100,112:43 CFR 10.4).

General Wildlife Design Criteria

44. No public motorized use of temporary roads constructed for this project would be allowed. During project implementation, gates or other physical barriers would be maintained to prevent public motorized access.

Migratory Bird Species

45. Trees and snags with broken tops, obvious large nest structures, or cavities would be targeted to meet snag retention standards.
46. If discovered, there would be no treatment within 250 yards of an known active black-backed woodpecker nest between May 1 and July 15.
47. If discovered, there would be no treatment within a minimum buffer of 40 acres around known occupied goshawk nest trees.
48. If discovered, there would be no ground-disturbing activities within known occupied post fledging area (PFA) between April 15 and August 15. The PFA is the area roughly 420 acres surrounding an active goshawk nest.

Big Game

49. Within treatment units, maintain at least two thirds of the existing hiding cover associated with key habitat features such as wet sites and foraging areas. This would be accomplished through implementation of SMZs in riparian areas, and maintaining at least 40% canopy cover in forested habitat within 50 feet of natural meadows for at least 2/3 of the meadow perimeter.

50. Restrict timber sale activities to no longer than five consecutive years.

51. In MA 11, maintain a minimum of two years inactivity following 1-3 years of consecutive sale activity, or a minimum of five years inactivity following 4-5 years of consecutive sale activity.

Proposed Monitoring

1. Develop NEPA to Implementation crosswalk to assure layout complies with NEPA decision (see Chapter 3 - Forest Vegetation analysis)

2. Review Marking Guide compliance to insure trees are marked to achieve conditions described in NEPA decision(see Chapter 3 - Forest Vegetation analysis)

3. Review contract prior to advertisement to assure project implementation complies with NEPA decision (see Chapter 3 - Forest Vegetation analysis)

4. Monitor and oversee vegetation treatments throughout and post operations to assure compliance with contract specifications, and that treatment objectives were achieved. Complete activity through sale administration and post treatment vegetation monitoring exams. (see Chapter 3 - Forest Vegetation analysis)

5. Complete reviews throughout and post operations to evaluate effectiveness of mitigation measures, Best Management Practices (BMP's), and compliance with State of Montana SMZ Rules. (See Hydrology analysis)

6. Assess detrimental soil disturbance in vegetation treatments units for two years and five years after timber harvesting and remediation actions are complete in accordance with the Region 1 sampling protocol (USFS-R1 2009) and detrimental soil disturbance criteria for the Gallatin National Forest defined by Keck (2012). (See Chapter 3 – Soils)

7. Monitor coarse woody debris at the completion of timber harvesting approximately 2 years after timber harvesting and mitigation actions have been completed. (See Chapter 3 – soils analysis).

8. Before and during project implementation, conduct surveys for black-backed woodpeckers and northern goshawks during the breeding season to identify needs for protective measures associated with potentially occupied nests.

9. Survey treatment units upon completion to evaluate effectiveness of snag and woody debris retention measures.

10. Monitor project road closures during implementation to ensure physical barricades are effective in precluding public motorized use on temporary roads. Monitor temporary project roads upon project completion to ensure permanent and effective closure.

11. Survey treatment units upon completion to evaluate effectiveness of measures to maintain hiding cover associated with key habitat features.

12. The fuel management specialist or fire management personnel will be on-site to assist in determining the placement of machine and/or hand piles within treatment units for efficiency of burning. The fuel management specialist or fire management personnel will monitor the curing (drying out) of the piles and recommend when they should be burned. The fuel treatment specialist will monitor smoke during pile burning. Areas that have been burned will be monitored and treated if noxious weed growth is discovered.

OTHER ALTERNATIVES NOT STUDIED IN DETAIL

Shelterwood Harvest

The Forest Service originally proposed a shelterwood regeneration harvest on 5 acres within the ski area boundary. This regeneration harvest would have reduced timber to a basal area ranging between 20 and 40 square feet per acre (which averages 20 to 25 trees per acre and average spacing of 45 feet between crowns). Trees that would have been retained included the largest, most vigorous Douglas-fir with good capability of producing seeds to initiate new stand growth. The shelterwood harvest was proposed as a test case, to see if the prescription would successfully start a new age class of Douglas-fir that would improve forest resiliency over time. Upon further consideration of wildlife issues; e.g. further reducing available cover for big game and creating unsuitable habitat for lynx, this prescription was changed to a commercial thin, in order to retain more cover for wildlife and would not contribute to unsuitable habitat for lynx.

Cable Logging

The Forest Service considered including about 20 acres of cable logging units on slopes in excess of 35%. This would have allowed additional vegetation treatment to further reduce tree mortality and improve forest health on additional acres. These units were not carried forward in detail to due visual sensitivity and economic feasibility.

Insecticide Treatment

The use of B.t. in lieu of vegetation management was considered but dismissed as a long term solution to budworm management as it would require repeated treatment to be effective. *B.t*. is a safe alternative to traditional pesticides and provides between 85-88% foliage protection (Reardon 1984). *B.t*. is non-toxic to mammals, birds, fish and humans.

A 2010 study found that there was approximately a one third reduction in defoliation for the treated trees when compared to trees in the nearby untreated area. However, the study concluded that protecting foliage with *B.t.* is a temporary solution to reducing defoliation, growth loss, deformation, and tree mortality. Silvicultural treatments that reduce stocking density, number of canopy layers, and increase individual tree vigor and species composition are the only long-term solution to budworm management. The need for spraying in the future should be greatly reduced if silvicultural treatments continue to be implemented at Bridger Bowl. Therefore, this alternative was not considered in detail.

CUMULATIVE EFFECTS

Cumulative effects result from incremental effects of actions, when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative effects can result from individually minor, but collectively considerable, actions taking place over a period of time. A cumulative effects analysis area can vary between issues / resource, and may encompass a larger area than the project area. Cumulative effects are discussed by resource in Chapter 3. Past, present, and reasonably foreseeable activities generally considered in the effects analysis are summarized below.

Past Forest Management

Past actions that have affected vegetation on NFS lands include past harvests and other management activities. The Forest Service database of past activities was queried for activities that relate to ground disturbing activity, inclusive of invasive weeds treatments and insect and disease treatments for the extended Upper Bridger Creek HUC. A map of the FACTS area queried and spreadsheet of activities are available in the project file.

Private land harvest

Forsted lands surrounding the South Bridger Project area were partially harvested in the 1960s-1970s (primarily clearcuts). Many of these lands remain in private ownership, while other lands that were clearcut under private ownership were later obtained by the Forest Service in land exchanges. The amount of harvest ranges form about 10 percent to upwards of 30 percent of project area watersheds (Maynard, Slushman, Pine, and 3 smaller drainages), which equates to about 1700 acres extending out about ½ mile from the project area. A map of past harvest is available in the project record. Refer to Hydrology and Soils analysis in Ch 3 for additonal information.

More recently, the following data was available from DNRC Records regarding the amount of harvest on private lands: HRA database for Sec. 29-T1N-R7E. All commercial harvest from private lands includes:

- 2001 90 ac
- 2002 12 ac
- 2010 73 ac

Bridger Bowl Ski Area

The ski resort operates under a special use permit (SUP) with the Gallatin NF. The 2005 Bridger Bowl Master Development Plan EIS/Record of Decision serves as the guidance document for the life of the permit. The comfortable carrying capacity (CCC) of the ski area is 6,100 skiers. Comfortable carrying capacity is the number of skiers an entire ski area can reasonably accommodate at any one time, including active skiers and those using guest accommodations such as lodges and food services.

The decision expanded the special use area into Slushman Drainage (337 acres) and into Meadow Creek (274 acres), and authorized construction of 16 new trails with 96 additional acres of developed ski terrain. The decision also authorized modification/replacement of the Bridger and Deer Park lifts, removal of the Alpine lift, construction of six new lifts, and increased the mountain road network by 1.8 miles in eight new road segments to facilitate lift construction and maintenance access on both NFS and private lands.

Additional development on private land owned by Bridger Bowl could occur at a later time without a requirement for Forest Service approval or NEPA analysis. Construction of the Limestone Chalet, modification of the Virginia City Lift, and expansion of the parking area are not considered part of Bridger Bowl's site-specific NEPA proposal, but have been considered as connected actions in the analysis disclosed in the FEIS. The guest services capacity could increase to 6,200 upon completion of the Limestone Chalet. However the capacity of the lifts and terrain will limit the overall resort CCC of Bridger Bowl to 6,100 patrons.

Reasonably foreseeable actions relating to forest vegetation proposed in the Bridger Bowl Vegetation Management Plan include:

- Removal of dead and dying hazard trees adjacent to ski runs/glades and resort infrastructure
- Establishment of regeneration of younger age class of trees through shelterwood harvests
- Thinning of conifer stands throughout the ski area to increase resiliency and reduce insect impacts
- Thinning of conifer stands in in future skiing areas to north and east
- Aerial application of insecticide and application of MCH and verbenone pheromones (see below),
- Planting of tree seedlings

Insect Control Activities

Insect control activities within the Bridger Bowl permitted ski area included the following: attaching pheromones such as verbenone and MCH on individual trees to discourage attacks from mountain pine beetle and Douglas-fir beetles. The pheromones do not kill the insects; rather they cause the insect to avoid the immediate area. Since this treatment only protects the immediate area, only high valued trees and trees at high risk to the insects are targeted for pheromone treatments. Treatments are only effective for a short time, usually less than a couple of months, at the most. Pheromones have been used in this area for the last ten years, and are expected to continue into the future if insect populations remain high.

Other insect control activities have included the application of Bt (*Bacillus thuringiensis*) a naturally occurring soil dwelling bacterium which is used to reduce spruce budworm defoliation on Douglas-fir trees and sub-alpine fir. One treatment occurred in 2010, another in 2012. Treatment effectiveness on budworm is very short term, usually less than a couple of weeks, so the timing of application is critical. If the budworm population remains high, future applications may occur.

Additionally, trees that are dead or dying and adjacent to ski runs are removed from the ski area. This individual tree removal of hazard trees has been occurring for the past 10 years or more, and is expected to continue into the foreseeable future. The number of trees removed each year is variable and depends on the severity of insect outbreak. No carbaryl has been sprayed in Bridger Bowl or in the project area.

Bridger Ridge Communications Site

The Bridger Ridge Communications Site located in Gallatin County, Montana in the SW¼ Section 24 and NW¼ Section 25, T. 1 N., R. 6 E., P.M., MT above the Bridger Bowl Ski Area was originally developed by Montana State University in the 1960s as a research location to study snow and water conditions and other scientific topics. From the crest of the Bridger ridge, the site offers good radio coverage with access to commercial electrical power and reasonable access. Because of its desirable location various radio users began to utilize the site. The facility continued to grow with the multiple users having separate authorizations from the Forest Service. In 1986, the Bridger Ridge Radio Users Association was formed with some fourteen (14) members. At that time a Communication Site Lease was issued by the Forest Service to the Association.

The Bridger Ridge Site was designated as an Electronic Site in 1987 Gallatin Forest Plan and encompasses approximately 2 acres of NFS lands. The site is also utilized under permit by Bridger Bowl, Inc. Both Bridger Bowl and the Bridger Ridge Radio Users Association work closely together and share some of the same facilities.

Currently, the Radio Association operates a radio repeater facility at the site for fifteen (15) different private, commercial and governmental organizations. There are two buildings on site, one a two story ‘A’ frame owned by the Radio Association. This building houses about twenty (20) radio repeaters for the various users. The other building is owned by Bridger Bowl but is also utilized by the Radio Association for electric panels, equipment, standby diesel electric generator and its fuel tank and a standby battery

system. AC power is provided by two (2) lines from Bridger Bowl Ski Area. Several antenna towers are onsite and a helicopter pad.

Road Maintenance

Administrative routes in the project area eroded in several areas from 2011 flood events. These areas are noted on the project area map. In 2012, the Forest Service replaced culverts that had washed out on FS Roads 3200 and 3208. In 2013 crews preformed temporary repairs to allow access on the roads for the permanent storm damage repairs to proceed in 2014. The storm damage repair work, specifically repair of eight land slides that blocked or eroded the road, will ensure the long term stability and use of Roads 3200 and 3208 for administrative access and projects. In addition, the Forest Service plans to install a series of drainage dips for minimizing erosion from the roadbeds and conduct project road maintenance to ensure the road conditions are suitable for project vehicle and truck traffic.

Over the past several years, Bridger Bowl ski area has reconfigured several administrative roads within the ski area boundary to minimize sediment production, make a more efficient road system and facilitate their operations by putting roads to bed that intersected ski runs and were located in highly erodible locations. Approximately 2.5 miles of road were decommissioned with one mile of road relocated.

In the foreseeable future, the Forest Service plans to reconfigure the trailhead under easement on Bridger Bowl property at the gate on Road 3200. The trailhead is currently directly adjacent to a stream causing erosion and flooding, and overflow cars often block access on this road.

Recreation

Recreational opportunities in the project area include hiking, horseback riding, mountain biking, back-country skiing, and hunting. Use is highest during the fall hunting season when the area is popular with day use hunters as well as those setting up overnight camps. The Back Country Horseman hosts an annual poker ride in July that heads out from the Bridger Bowl base area and crosses NFS and private lands. This annual 1-day event attracts several hundred riders. Recreationalists utilize Forest Road #3200 and Trail #538 to access the area. These routes are open only to non-motorized travel. Trails #538, #532 and #539 are also being maintained, reconfigured and, in places, relocated to better define the trails through the ski area and better meet user needs. This is part of the implementation of the Gallatin Travel Plan 2006.

Noxious Weeds

Both the Forest Service and Bridger Bowl Inc. have treated weeds in the project area for more than 10 years. Treatments involve spot herbicide applications and hand pulling adjacent to the ski area. The most common weeds are Canada thistle, houndstongue, spotted knapweed and common tansy. In 2013, the weeds adjacent to the road leading into the harvest units was treated with herbicides. Past treatments have been very effective and resulted in a very low weed density (meaning there are now only individual plants in isolated locations). Weed treatments are expected to continue into the foreseeable future.

Grazing

The Pine Creek Cattle Allotment has been in place for more than 20 years and expected to continue into the foreseeable future. The allotment has traditionally involved a two pasture deferred rotation system, 46 cow calf pair, between July 1 and August 15th for one pasture then August 16th to September 30th. A map of the Pine Creek Allotment and proposed harvests is included in Chapter 3. The north pasture overlaps

proposed units in Section 6. The south pasture is south of Pine Creek and not near any of the harvest units. The northern edge of Unit 7 A is close to the fences used to keep cattle from traveling north and outside of the allotment. Regardless of the thinning and harvest activities, cattle are currently wandering off the allotment and up towards the ski area (gate is accidently left open).

FOREST PLAN MANAGEMENT DIRECTION

The Gallatin Forest Plan sets management direction for this project area. The Forest Plan provides forest-wide goals, objectives and standards, as well as Management Areas (MAs) goals and standards. The project area is primarily designated MA 11, with the portion in the Bridger Bowl ski area boundary designated MA 2.

Forest Wide Standards

The purpose of the South Bridger Interface Project is alter forest stand conditions using vegetation management treatments that reduce tree mortality from ongoing insect infestations and improve the overall health, productivity and resiliency of forest vegetation within and adjacent to Bridger Bowl and adjacent to private land. The Forest Plan includes forest wide standards to manage insects and disease (p. II-22), including:

1. Long-term losses caused by insects and diseases will be reduced by integrating forest pest management into project plans.
2. Silvicultural systems will be the primary tool for pest management and will be used to improve the diversity of tree species and the size and age of trees in various stands.
3. Chemical and biological pest control measures will be utilized only when detailed environmental analysis shows justification.
4. A number of techniques will be employed to reduce long-term losses of lodgepole pine stands to insects, while protecting other resource values. This includes increasing resistance to attack by harvesting susceptible stands to gain diversity in age and size between stands, controlling the levels of planting and the ages of trees in even-aged stands to maintain the vigor of the stand, and changing the composition of the forest to favor species that are not susceptible to insects. In areas where timber harvest is not appropriate or where there is now no access, prescribed fire may be used.
5. Insect and disease detection surveys and evaluations will be accomplished routinely. Emphasis will be placed on evaluating risk potential and determining if efforts are needed to prevent or control losses.

The proposed action is consistent with these standards to manage long term losses from insects and disease, and to promote diversity, growth, and vigor of treated stands. Other resource specific Forest wide standards are discussed in Chapter 3 by resource area. No forest wide plan amendments are proposed.

Management Area (MA) 11 – Forest Plan Amendment

The project area includes lands designated as Management Area (MA) 11, which consists of forested big game habitat, and includes productive lands available for timber harvest provided that big game habitat objectives are met. Management goals for MA 11 are:

1. Maintain elk habitat effectiveness following timber harvest.

2. Base vegetative management on vegetative characteristics needed for featured wildlife species.
3. Allow a level of timber harvest consistent with goals 1 and 2.
4. Meet State water quality standards and maintain stream stability.

MA 11 timber standards note that lands in MA 11 are suitable for timber production and provide guidelines for scheduling timber sales that are related to management of big game habitat. One of those guidelines states:

> *Re-entry should not occur unless 40 percent or more of the drainage can be maintained in cover (20% hiding, 10% thermal, +10% in either hiding or thermal cover) distributed throughout the drainage. Refer to the glossary in the final Forest Plan for the definition of thermal and hiding cover.*

On the Gallatin National Forest, studies have been done that indicate 40% or more canopy cover relates to cover. Refer to the Wildlife analysis in Chapter 3.

The Upper Bridger Creek watershed includes a large portion of private residential and agricultural lands. When considering all ownerships, only about 16% of the drainage is currently providing hiding and/or thermal cover. Due to large proportions of naturally non-forested (e.g. rocky terrain, natural meadows) and converted (e.g. residential and/or agricultural) lands, coupled with past timber harvest on public and private lands in the drainage, neither the existing condition, nor the proposed action meets the cover requirement for this standard. The proposed action will reduce existing tree canopy cover in treated areas and result in additional loss of cover. Therefore, in order to meet the purpose and need for the proposed action, a site specific Forest Plan amendment is required for this project. The existing condition coupled with the fact that insect activity will continue to reduce hiding and thermal cover in the project area in the absence of prescriptive treatment, all lead to a logical conclusion that a site-specific amendment to allow re-entry for the purpose of limiting adverse impacts from continued insect activity would not have significant effects to big game species.

Other resource specific MA 11 standards are discussed in Chapter 3 by resource area. No additional MA 11 plan amendments are proposed.

Management Area (MA) 2

MA 2 consists of those portions of the Bridger Bowl ski area under special use permit. Timber standards note that land is classified as unsuitable for timber production, but allows tree removal for reduction of safety hazards, to maintain a healthy and diverse vegetative pattern, or to permit construction or expansion of facilities and ski runs.

The proposed action seeks to reduce mortality from spruce bud worm, Douglas-fir beetle, and mountain pine beetle, which promotes healthy and diverse vegetation. Other resource specific MA 2 standards are discussed in Chapter 3 by resource area. No MA 2 plan amendments are proposed.

COMPARISON OF EFFECTS

Chapter 3 discusses the effects of no action and the proposed action by resource area. Additional information about effects to these resources is available in the project record. Table 2.1 below compares the effects of no action and the proposed action.

Table 2.1: Comparison of Alternatives

Resource / Indicator	No Action	Proposed Action
Health of Forest Vegetation		
Western spruce budworm	Spruce budworm will continue to cause significant defoliation, tree damage and mortality across size classes. Very little natural regeneration will occur until the majority of stands have lost a significant portion of their biomass. Defoliation can result in almost 100% cone and seed destruction. Hazard ratings remain high.	Proposed commercial thinning treatments are designed to reduce stand susceptibility by affecting species composition, density, tree vigor, and stand microenvironments. Available literature suggest that thinning to 80 square feet or less per acre is a way to reduce the inter-competition between trees and reduce mortality caused by bark beetles. Hazard ratings pre-treatment are High (3) for all modeled units and decrease post-treatment for all units. Overtime, hazard in some units increases but never reaches High (3) again during the 50-year simulation period.
Douglas-fir beetle (DFB)	With the significant level of budworm-caused defoliation, DFB would probably begin to build up in heavily defoliated trees. Large, older trees that were heavily defoliated may be attacked and killed by secondary insects such as wood borers.	Modeling notes that DFB hazard decreases in five units and remains constant in three others. It also shows that overtime hazard increases (during the 50-yerar simulation period). This is expected due to the dynamic nature of forests and continued tree growth.
Mountain pine beetle (MPB)	Continued susceptibility and mortality is expected. MPB populations will continue to increase as long as environmental conditions allow and susceptible trees are present. At some point it is likely that suitable host trees will be reduced through mortality to a point where mountain pine beetle populations and related mortality is self-limiting.	Model results suggest that MPB hazard will decrease immediately following treatment in some units, and remain constant in others. In three units, hazard increases from No Host (0) to Low (1) and this can be attributed to the model estimating that lodgepole pine regeneration would become established following thinning.
Fire-Fuels		
	Fuel Models would transition from FM 8 - 10 to FM 10 - 12. There would be a greater possibility of the project area supporting high intensity wildland fire, either starting inside the project area spreading out, or visa-versa.	While the primary focus for the proposed treatments is insect activity mitigation, there will be beneficial results from the thinning actions for management of current standing and down woody fuel conditions. Fuel Models in treated areas which currently range from fuel models 8 to 12, would be reduced, reflecting FM 8. A FM 8 generally burns at lower intensity and with lower flame heights than a FM 10 or 12. In the event of a

Resource / Indicator	No Action	Proposed Action
		wildland fire, there would be less chance of intense fire behavior post treatment, which may result in a safer environment for suppressing wildland fire compared to no action.
Economics		
Present Net Value	0	$36,465.00
Jobs	0 jobs	Maintain approximately 6 jobs over the life of the project.
Hydrology		
Water Yield	Nature recovery from past timber harvest in the analysis area would continue, although it might be slowed due to tree mortality associated with the western spruce budworm, Douglas-fir beetle and mountain pine beetle. The water yield analysis indicated that existing water yields within the assessment area are slightly elevated with respect to, but not measurably different from, pre-disturbance condition water yields.	Projected increases in water yields due to the proposed actions plus existing land management activities and development are estimated to be within the range 1.2% to 2.8% percent. Changes in water yield of less than 5-10% are considered too small to be measurable.
Sediment Yield	Sediment yields for Maynard and Slushman Creeks, and the three un-named creeks within the watersheds, would be expected to remain at current levels. At Pine Creek, sediment yield would continue its natural recovery to pre-2011 flood levels. Current levels are elevated between 8 – 22% with respect to reference conditions but remain far below the 50-percent-above-reference rates allowable under GNF guidelines for Class B streams.	Predicted sediment yield in the first year after implementation of the proposed project would range between 14.9% and 26.0% (a net gain of roughly 4-6%) above the reference level depending on the watershed. These levels would be well within the allowable limit of 50% above reference level set forth in Forest Plan.
Stream Channel Stability	Continued natural recovery from the effects of the 2011 flood should yield a slight improvement in channel stability throughout the assessment area. However, stream channel stability would not be expected to improve in a significant manner except perhaps in Pine Creek where the effects of the 2011 flooding were most pronounced.	Based on field surveys and review of applicable literature, it is anticipated that the effects of the proposed action on stream channel stability would be negligible. Natural recovery would continue similar to no action.
Aquatic Species		

Resource / Indicator	No Action	Proposed Action
Wild Trout	There would be no change to existing sediment delivery rates and fine sediment in spawning gravels. Populations of wild trout, would remain the same.	It is predicted that fine sediment would increase slightly, by 0.84% along Maynard Creek, 1.10% along Slushman Creek and 0.60% along Pine Creek. Project generated sediment delivery is projected to cease in approximately six years or 2020. Rainbow trout embryo survival is expected to decrease slightly although population trends are expected to remain stable. The proposed action would meet Forest Plan standards within the Maynard, Pine, and Slushman drainages, and is consistent with all Applicable Laws, Regulations, Policy and Forest Direction to protect fish and fish habitat, including fish Sensitive and Management Indicator Species.
Soils		
Detrimental Disturbance (DSD)	Existing low levels of activity caused detrimental soil disturbance will remain in the project area.	Total activity-caused DSD levels by treatment unit are predicted to range at the end of harvesting activities from a low of 12.2% in Treatment Unit 15 to a high of 17.8% in Treatment Units 6 and 11. These levels are prior to the implementation of any remediation steps. The predominant types of DSD expected are soil compaction and some rutting in most of the treatment areas with soil erosion and loss of the thin topsoil layer the biggest concern. Expected levels of DSD two years after remediation ranges from a low of 8.1% DSD in Treatment Unit 15 to a high of 11.8% DSD in Treatment Units 6, 11, and 14, which meets Regional guidelines for detrimental disturbance.
Range		
Allotment infrastructure & forage	No effect to forage, fences, or gates.	Because of design/mitigation measures, the Proposed Action is not expected to impact the Pine Creek Allotment infrastructure. Thinning forest vegetation would increase the area where cattle can forage.
Noxious Weeds		
Weed spread	Other areas would have a higher priority for treatment. Existing weeds would likely continue to spread into areas with suitable habitat. The No Action Alternative would not necessarily result in fewer	There is a risk that the proposed action would spread weeds in this area. The proposed mitigation measures are very effective at reducing the risk of spreading weed. The presence of people actively managing weeds in this area would help to reduce

Resource / Indicator	No Action	Proposed Action
	weeds.	weeds in this area.
Sensitive Plants		
	No effect.	No effect. The project area was surveyed. No sensitive plants were identified.
Recreation		
Access and Recreational setting	No effect.	There is a potential for a reduction in public access during timber harvest activities. Depending on the season of operation and the level of public use, it may be necessary to limit access for periods of time. The impact would be of a short duration and not affect the long term availability of recreational opportunities in the area. The proposed action may improve the recreational setting a Bridger Bowl by reducing the impact of insect and disease outbreaks.
Roadless Areas		
Roadless Characteristics	No effect.	The Proposed Action would have no long-term or cumulative effects to roadless characteristics within the Bridger IRA, and would allow the roadless lands within the Bridger IRA to retain the roadless character necessary to be considered for wilderness designation in the future. There may be short term indirect effects associated with noise from harvest activities or road maintenance work that may reduce the opportunities for solitude in the Bridger IRA.
Scenery		
Compliance with Forest Plan Standard for visual quality	No short term direct effects. With continued insect related tree mortality, more of the mature trees and understory trees may die and drop their needles resulting in an opening up of the mosaic pattern, and a grey tinge where entire stands of trees have died. The patterns, in terms of line, form, color and texture, would still appear natural. Meets Forest Plan standard for Partial Retention.	There would be more diversity in the age, size and spacing of the trees. In the short term, the increased openness would be most noticeable by viewers within the south part of the ski area. Because the ski area and surrounding areas are a mosaic of open (both natural and regenerating after being harvested) and forested areas, this openness will not appear as a visually dominant anomaly. Meets Forest Plan standard for Partial Retention.
Cultural Resources		
Effect to cultural sites	No effect	No effect. Project area was surveyed. No sites were identified.
Wildlife		

Resource / Indicator	No Action	Proposed Action
Grizzly Bear	Grizzly bears are not known to be present north of I-90 on the Gallatin National Forest. No effect.	Grizzly bears are not known to be present north of I-90 on the Gallatin National Forest. The proposed action is in an area that may be suitable as a travel corridor for grizzly bears sometime in the future. Implementation of the project is not expected to result in any impediments or barriers to grizzly bear movement. Therefore, the proposed action would have ***no effect*** on grizzly bears.
Canada lynx	Indirect effects of no action would result in increased tree mortality over time. Dead trees will eventually fall, resulting in a greater abundance of coarse woody material that could eventually provide denning structure for lynx. However, with the overall patchy distribution of boreal forest conditions throughout the LAU, it does not seem likely that the area would support residential use by lynx. Continued insect related tree mortality would continue to produce high fuel loads that if ignited, could result in stand-replacing fire that would more drastically affect habitat suitability for lynx and snowshoe hare than would the proposed treatment. Short-term impacts of no action could result in large areas of habitat that would be unsuitable for use by lynx and their prey species for 15 to 30 years.	Given the naturally fragmented distribution of boreal forest types within the Bridger/Bangtail LAU, coupled with the lack of verified historic or recent lynx occurrence within the LAU, it is a logical conclusion that the Bridger/Bangtail area contains marginal lynx habitat at best, and past events (natural or man-caused) have not likely changed the overall nature of this area for lynx use. The primary utility of this LAU appears to be as connective habitat to facilitate lynx dispersal between core areas. The proposed action would have minor impacts on lynx habitat, but would not notably change the utility of the area for connectivity.
Wolverine	Indirect effects of no action would result in increased tree mortality over time. Coarse woody material would provide some degree of screening cover for wolverines. If left untreated, insect-related tree mortality would continue, adding to already high fuel loads, that if ignited, could result in large-scale stand replacement fire that could have a much greater impact on security cover for wolverines than would the proposed treatment. Indirect effects of no action could result in large areas of habitat with limited security cover for dispersing wolverine. Once insects and disease have run their course, or if a fire results	The proposed action ***is not likely to jeopardize the continued existence*** of wolverines. This determination is based on the following rationale: Proposed treatment would generally occur below the elevation zone typically used by resident wolverines, and would not affect reproductive denning or foraging habitat, or prey bases. Treatment is unlikely to occur during the wolverine reproductive season, or when subadults are likely to disperse (winter/spring). Proposed treatment and associated infrastructure would not pose a barrier to wolverine movement during or after project implementation.

Resource / Indicator	No Action	Proposed Action
	from fuel buildup associated with high levels of tree mortality, it would take approximately 15 years for natural regeneration to replenish vegetative structure that would once again provide high quality security cover for wolverines.	
Sensitive species Gray wolf Bald eagle Peregrine falcon Black-backed woodpecker	Indirect effects of no action would result in increased tree mortality over time. If left untreated, insect-related tree mortality would continue, adding to already high fuel loads, that if ignited, could result in large-scale stand replacement fire. The no action alternative could potentially improve habitat conditions for black-backed woodpeckers, since they feed on insects, and are highly selective for recently burned areas. However, fire is not a guaranteed result of no action. No action would have no obvious benefits for other sensitive species known to occur in the project vicinity.	The proposed treatment would alter habitat conditions in the project area, and added human presence associated with project activities would contribute disturbance impacts to sensitive species. However, given the relatively small scale (<= 250 acres of treatment), and limited duration (<= 5 consecutive years of activity), coupled with ongoing insect activity that would continue to alter habitat in the absence of treatment, project impacts would be minor and may impact individuals, but would be limited enough in scope and scale so as to have no notable impacts on any sensitive wildlife species at the population level. Therefore, the proposed action ***may impact individuals or habitat, but would not lead to a trend toward federal listing*** for any of these species.
Management Indicator Species		
Elk & Big Game	Indirect effects of no action would result in increased tree mortality over time. Standing dead trees provide some degree of screening cover for big game, but generally less so than live trees with needles. Natural regeneration is expected to provide some degree of replacement cover over time. Excessive tree mortality would significantly reduce hiding and thermal cover for big game. If left untreated, insect-related tree mortality would continue, adding to already high fuel loads, that if ignited, could result in large-scale stand replacement fire, which would have even more severe impacts on the mature forest structure that provides hiding and thermal cover for big game.	The proposed action would likely have some short-term negative impacts on big game resulting from habitat alteration due to reductions in cover, as well as short term disturbance impacts due to noise from equipment and added human presence. These impacts may affect individual animals, but are not expected to affect population levels for elk (MIS), moose or mule deer (MA 11 focal species) across the Forest. The major impact to deer and moose would be a reduction in hiding and thermal cover. While reductions in cover are not desirable, they are occurring anyway due to epidemic levels of insect activity. Proposed treatment is designed to reduce tree mortality from insects and improve overall forest health in the project area. Therefore, the proposed action, while imparting short-term negative impacts, would benefit elk, moose and deer over time by maintaining habitat integrity and providing cover to a higher degree than is

Resource / Indicator	No Action	Proposed Action
		expected under the no action alternative.
Northern goshawk	Indirect effects of no action would result in increased tree mortality over time. Standing dead trees do not provide canopy cover associated with high quality goshawk nesting habitat, but could still provide foraging habitat if sufficient nesting habitat remains intact in the vicinity. If left untreated, insect-related tree mortality would continue, adding to already high fuel loads, that if ignited, could result in large-scale stand replacement fire, which could have severe impacts on the forest structure that provides nesting habitat for goshawks. Burned areas could still provide potential foraging habitat.	There are no known occupied goshawk nests in the project area. Commercial thinning can alter forest habitat and thus affect suitability as nesting, post fledging and foraging habitat for goshawks. Thinning would not change the overall size class of trees in treatment units, but would reduce canopy cover and horizontal structure in treatment units, which could affect prey species composition, distribution and abundance. Only 20 acres of proposed treatment out of the 2,439 acres of existing nesting habitat in the analysis area would reduce canopy cover to a point where it would no longer be considered potential nesting habitat (< 1% reduction) (Nesting habitat analyzed using Eastside Assessment). The 6,376 analysis area includes 1,387 acres of foraging habitat, and the proposed action would reduce the proportion of forest with at least 40% canopy cover by 220 acres to 1167 acres. The amount of foraging habitat pre and post treatment is below the range of 37-69% reported in the Northern Region Goshawk Overview.
American marten	There would be only minor changes in forest structure due to human activities. Persistent insect activity would continue to reduce live tree canopy cover. Standing dead trees do not provide canopy cover associated with high quality marten habitat, but dead and down trees do provide coarse woody debris, which is a key component for reproductive denning habitat and also facilitates access through winter snow cover. If left untreated, insect-related tree mortality would continue, adding to already high fuel loads that if ignited, could result in large-scale stand replacement fire, which could have severe impacts on the forest	Commercial timber harvest is associated with declines in marten occupancy of affected areas, and alters habitat structure by removing overhead cover and coarse woody debris. Overhead cover provides martens protection from predators and coarse woody debris is used for travel, resting and denning purposes. Thinning is proposed to reduce tree mortality from insect activity and improve overall stand health. Therefore, the proposed action has greater potential to preserve suitability of treated stands than does the no action alternative. Under the proposed action, snag management direction would be implemented to retain a proportion of standing dead trees and down logs, which are important components of marten habitat.

Resource / Indicator	No Action	Proposed Action
	structure important to martens.	
Summary of Effects for MIS and MA 11 focal species	Minor changes would occur from human activities (such as ski area management & firewood gathering). No action would result in increased tree mortality over time, which would reduce live tree canopy cover and greater abundance of course woody debris. Excessive tree mortality would reduce hiding and thermal cover for big game, nesting habitat for goshawk, and high quality marten habitat. Coarse woody debris would provide reproductive denning habitat and facilitate access through winter snow cover for marten. It would also contribute to high fuel loads that could result in stand replacement wildfire.	Forest level monitoring has indicated that MIS populations are generally stable to increasing on the Gallatin Forest. The proposed treatment is designed to improve stand health within treatment units by reducing tree mortality from insects. This project is intended to maintain healthy, resilient forest habitat over the short and longer term. Most of the MIS and MA 11 focal species depend upon intact forest structure for at least some part of their life cycle. Therefore, while this project may have short term negative effects through habitat alteration and/or disturbance, in the long run, it would maintain habitat suitability for MIS to a greater degree than would the no action alternative. While the proposed action may have short-term negative effects and long-term benefits for individual animals, these effects would be too minor to have impacts at the population level for MIS.
Migratory birds		
Species of Concern: • Brown creeper • Cassin's finch • Clark's nutcracker • Evening grosbeak • Golden eagle • Great gray owl • Olive-sided flycatcher • Pileated woodpeckers • Williamson's sapsuckers	There would be only minor changes in forest structure due to human activities. Habitat modification from insect activity is expected to continue, which would provide an important prey base for a variety of insectivorous migratory bird species. No action would result in increased tree mortality over time, resulting in a greater abundance of coarse woody material. Standing dead trees provide nesting and foraging habitat for snag-dependent bird species, and also provide perch trees for habitat generalists. Tree mortality would promote growth of grass, forbs and shrubs, which would favor some migratory bird species that prefer to nest and forage near the ground. Other species that require forest interior for breeding habitat, or require large, live trees for nesting or foraging, would be negatively impacted by continued tree mortality.	Given the extreme variation in habitat needs across the spectrum of migratory bird species that may use the project area at some point, habitat modification resulting from the proposed action could have negative impacts on some individual birds while at the same time benefiting or having no effect on others. Noise and disturbance from equipment and increased human presence would have negative impacts on birds of species likely to be present. Considering the limited geographic scope & scale (up to 250 acres treated over three to five consecutive years), neither habitat alteration (i.e. thinning) nor disturbance impacts (i.e. noise, human presence) are expected to affect (positively or negatively) the numbers of birds that would have impacts at the population level for any of the migratory birds species that may be affected.

CHAPTER 3
AFFECTED ENVIRONMENT & ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter describes general information, location, management direction, and existing conditions for the project area or analysis area. It also describes the environmental impacts of the alternatives described in Chapter 2. Information in this chapter is based on reports written by the Interdisciplinary Team Resource Specialists (Appendix E – List of Preparers). These more detailed reports are kept in the project file located at the Bozeman Ranger District.

Project Area versus Analysis Area

The approximately 1847-acre South Bridger project area is on the Bozeman District of the Gallatin National Forest and is located approximately 15 miles northeast of Bozeman in Gallatin County. It is geographically located within and immediately south of Bridger Bowl in the vicinity of Slushman Creek. Specifically, the project is located in Section 30, Township 1 North, Range 7 East and Section 6, Township 1 South, Range 7 East, Gallatin County, Montana (see Appendix A – project area).

The analysis area is the area used for determining direct, indirect, and cumulative effects for the natural resources considered in this analysis. The spatial and temporal bounds of the analysis area used for the effects analysis is identified and described for each resource, and may vary from resource to resource.

Discussions of each resource include a description of the Affected Environment, Environmental Consequences, and Regulatory Framework associated with that resource. The Affected Environment section describes the existing condition for the resource, which includes past actions that have influenced the present environment. The Environmental Consequences Section details the environmental effects that would occur under no action and the proposed action. Information used to assess effects is based on the consideration of the best available science. The effects of No Action Alternative form a baseline against which the proposed action is evaluated.

Environmental effects can be direct, indirect, or cumulative. They can be long or short duration. Effects can be quantitative or qualitative, adverse or beneficial, actual or potential. Direct effects are those caused by the action and occur at the same time and place. Indirect effects are those 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 other past, present, and reasonably foreseeable future actions (40 CFR 1508.7).

The cumulative effects analysis includes the additive effect of the action being considered when added to the effects of past, present, and reasonably foreseeable future actions. As past actions are already included in the affected environment, cumulative effects analysis builds upon this existing condition assessment by considering the incremental addition of direct and indirect effects of proposed, as well as present and reasonably foreseeable actions. While impacts can be differentiated by direct, indirect, and cumulative, the concept of cumulative impacts takes into account all disturbances since cumulative impacts result in the compounding of the effects of all actions over time.

FOREST VEGETATION

VEGETATION ISSUES

During project development, internal and external discussions revealed several issues and concerns relating to forest vegetation. These issues help frame this forest vegetation analysis and include:

> Effects of the alternatives on forest insect conditions, specifically western spruce budworm (*Choristoneura occidentalis*), mountain pine beetle (*Dendroctonus ponderosae*), and Douglas fir beetle (*Dendroctonus pseudotsugae*).

Detailed information relative to forest vegetation, and effects of the alternatives on other vegetation components such as invasive species, threatened, endangered, or sensitive plants and animal habitats, and fire and fuels are analyzed in respective sections of the South Bridger Interface project file and/or individual stand files located at the Bozeman Ranger District.

ANALYSIS AREA

The scale of the analysis area was chosen to allow sufficient size and time to illustrate the potential effects of the alternatives without those effects diminishing to unnoticeable levels. The following descriptions identify the analysis area for this project.

Spatial Bounds

The spatial boundary for the analysis of direct, indirect, and cumulative effects associated with the proposed activities is the Gallatin National Forest timber compartment #504, henceforth referred to as the analysis area. This 7,750 acre area is large enough to capture tends and patterns of forest vegetation, but not too large to have the potential effects of the approximately 250 acres of proposed actions contained within this so small as to be negligible. This boundary was also chosen because it is relevant to Forest Plan vegetation standards, includes the majority of the Bridger Bowl Ski Area permit boundary (particularly the southern area adjacent to this project), and also includes some adjacent private lands.

Temporal Bounds

The temporal bounds of this analysis are designed to capture the direct, indirect, and cumulative effects of the alternatives to forest vegetation within the analysis area. Activities would most likely begin in 2014 and will likely take two to three years to accomplish. The effects of the proposed activities will likely last between 15 and 100+ years. In general, where intermediate treatments are proposed an effects time frame of 15-20 years is estimated. This length of time was chosen by reviewing forest succession data for habitat types found in proposed treatment areas which describes stand development over time (Arno et al, 1985). After this length of time it is believed that, in the absence of stand replacing disturbance or additional treatments, natural forest succession processes would alter post-treatment stand conditions. This is due to accumulation of surface fuels, height growth of advanced regeneration, ingrowth of shade tolerant species, expansion of residual tree crowns, and individual tree mortality. Some effects, such as shifts in species composition and large down woody material, could last even longer. The temporal bounds of past activities for the cumulative effects analysis is limited to the 1940's by the availability of accurate data relating to forest vegetation conditions.

METHODS

This section will discuss the methodologies, data sources, and assumptions used to compile this report.

Methodologies

Silvicultural Prescription and Diagnosis Process

The silvicultural prescription and diagnosis process provides information with which to move the forest vegetation toward a desired condition and meet management objectives. It is a systematic process which integrates interdisciplinary resource goals and objectives and identifies silviculturally sound treatments to achieve those objectives. The process can be done at both the landscape and stand level. The Forest Service Handbook (FSH 2409.17) provides national and regional direction for the prescription and diagnosis process.

Landscape Level Process

The landscape level diagnosis process normally precedes the stand level process. This helps to place stand level analysis into context with the surrounding ecological conditions. The following steps are typically included in the landscape level diagnosis process:

- Step 1: Characterize the current existing condition of the landscape.
- Step 2: Develop desired landscape conditions based on overall landscape characteristics, capabilities, resource objectives, and land management direction.
- Step 3: Identify treatment options and alternatives that could move the landscape towards the desired condition. This is accomplished by comparing the existing condition to the desired condition.
- Step 4: Develop a silvicultural prescription for the landscape which includes the generalized activities that could achieve the desired condition.

Stand Level Process

As mentioned above, this process commonly follows and closely parallels the landscape level analysis but at a more site-specific scale. The following steps are used in the stand level process to systematically achieve desired stand and ultimately desired landscape conditions.

Step 1: Examine and identify existing stand conditions.

Step 2: Develop desired stand conditions based on site capabilities, site characteristics, resource objectives, and land management direction.

Step 3: Compare the existing stand conditions to the desired stand conditions and consider options that will achieve the desired conditions. The following options should be considered:

(1) **No Action** if the current stand conditions acceptably meet the desired condition.

(2) **Modify** the existing stand through intermediate treatments (thinning, prescribed fire, or other activities which do not replace the current stand) to meet or move closer to the desired stand condition.

(3) **Replace** the current stand if it cannot be reasonably modified to meet the desired stand conditions. All regeneration options should be considered including: uneven-aged, two-aged, and even-aged methods.

(4) **Stabilize or Improve** the existing stand if it cannot be modified or replaced (due to external conditions) to meet the desired conditions at this time. This will essentially hold the stand until replacement can be considered. Treatment options may include sanitation, salvage, or other actions.

(5) **Defer** treatment because conditions external to the stand do not permit any treatment at this time, even though the stand does not currently meet the desired condition.

Step 4: Develop a detailed silvicultural prescription for each treatment area that identifies the area to be treated and the specific activities to be implemented. This step is done following the issuance of a decision by the Deciding Official.

Both a landscape and stand level diagnosis was utilized for this project.

Spatial Analysis

Spatial analysis of the forest vegetation resource for this project was done using the ArcMap 10.0 software. Data from the Gallatin National Forest Geographical Information System (GIS) library was used as the basis for the analysis. A number of project specific GIS layers were also created. Note that slight variations in area calculations may result from spatial analysis.

Remote Sensing

The LANDFIRE biophysical setting and fire regime layers were used to help characterize historical/potential vegetation types and disturbance regimes within the analysis area. LANDFIRE (Landscape Fire and Resource Management Planning Tools Project) is an interagency vegetation, fire, and fuel characteristics mapping project. Detailed descriptions of the biophysical settings and fire regime groups used in this analysis can be obtained at the LANDFIRE website at http://www.landfire.gov/NationalProductDescriptions24.

The 2006 R1 VMAP product, developed by the Forest Service Region One Geospatial Services Group, was used to estimate stand conditions I conjunction with inventory data. VMAP classifies vegetation into spatially distinct polygons with attributes related to life form, dominance type, size class, and canopy cover. VMAP data was used to summarize forest vegetation attributes within the project area.

Forest Stand Dynamics Modeling

The Forest Vegetation Simulator (FVS) was used to model the forest stand dynamics associated with silvicultural treatments. Specifically, Version 2.02 of the Suppose interface and the Eastern Montana variant were used. Due to limitations in data, only a sample of the stands was modeled and results can be extrapolated to stands with similar conditions and proposed treatments.

Data Sources

Landscape Level Analysis

Forest Inventory and Analysis (FIA) plot data was summarized and used to characterize the landscape associated with this project. FIA plots are installed at random locations on all land ownerships across the country. These plots are monumented and re-measured over time. This provides the ability to make estimates of forest conditions over broad areas and at variable times. The Bridger-Bangtail Mountain Range is an isolated mountain range and represents a logical landscape analysis unit.

Insect and Disease aerial detection surveys are conducted annually using fixed wing aircraft and sketch mapping technology. Data associated with these surveys was incorporated.

In addition, the Bridger Bowl Vegetation Management Plan and Master Development Plan Environmental Impact Statement were referenced.

Stand Level Analysis

Individual stand inventory data were used in the stand level silvicultural diagnosis process and in the analysis of the affected environment. Stand level data has been collected over time using Forest Service stand exam protocols. Stand exam data used in this project was collected between the years 1981 and 2012. This stand data is stored in the Field Sampled Vegetation (FSVeg) database.

Stand level data from these sources was also complied into GIS layers and analyzed spatially using the methods described above.

Assumptions

When completing an analysis of a dynamic resource such as forest vegetation at this scale some assumptions are necessary. Assumptions were also made due to variation and interpretation of terminology and standards associated with silviculture and forest vegetation conditions. The following are some assumptions used in this analysis:

- Vegetation data used in this analysis is assumed to represent current on-the-ground conditions. Efforts were made to ensure that this assumption is true including; field verification, new stand survey data collection, and aerial photo interpretation. At the time this report was written, no large scale or catastrophic events were known to have occurred since the data for this analysis was compiled.

- GIS data used in this analysis is assumed to be accurate to within acceptable standards. This includes ownership boundaries, stand delineations, project and analysis area boundaries, etc.

- Modeling of forest stand dynamics using the methods described above gives a reasonable estimate of stand hazard using established methods. The outputs from this modeling can be applied to “un-modeled” stands with similar conditions, existing on similar sites, and within close proximity to the modeled stands.

- Definitions of terminology related to silviculture and forest vegetation for this analysis will come from *The Dictionary of Forestry* (Helms, 1998) and/or the Forest Plan and associated amendments.

- Areas identified as “Old Growth” in this report are only those areas that meet the specifications and descriptions in *Old-Growth Forest Types of the Northern Region* (Green et al., 2007) for the Eastern Montana Zone.

Best Available Science

An internal review of literature was conducted prior to this analysis in order to compile relevant information. Sources included recent and historic peer reviewed publications, past Forest Service

environmental analyses, and contractor and Forest Service specialist reports. If additional information is presented through the public involvement process for this project, it will be addressed in the responses to comments section.

Inconsistency between Resource Effects Analyses

The effects of the alternatives may vary (either positively or negatively) depending on the resource being analyzed. It is possible that this could occur even for a particular measurement indicator. It is also possible that inconsistency could arise between resource areas based on inconsistent use of terminology and variations in quantitative data due to differences in individual resource analysis areas.

AFFECTED ENVIRONMENT

This section will explore and discuss the historic and existing conditions of general forest vegetation within the analysis area. This information is useful in placing the proposed actions into context.

Historic Conditions

Historical forest vegetation conditions provide us with an idea of what the area looked like at various points in time. However, it is important to remember they are limited by the availability and accuracy of historical information and do not necessarily identify desired conditions given today's ecological and social environment.

Historic Disturbances

Disturbance relative to forest vegetation can be defined as a relatively discrete event in time that disrupts ecosystem, community, or population structure and changes resource availability or the physical environment (Helms, 1998). Fire, insects, and diseases have been the most influential historic disturbances in the project area. Fire also provides us a record of its effects to forest vegetation, through fire scars and forest conditions, making it one of the most easily analyzed historic disturbances. Many other natural and human induced disturbance factors have influenced the forest vegetation in and around the analysis area including: wind, floods, invasive species, residential and commercial development, transportation systems, and timber harvest.

Fire. A GIS dataset from the Gallatin GIS library spatially displays the locations of some of the major fires in the vicinity of the analysis area (this GIS data is not a complete fire history record) (Figure 1).

Areas of similar fire severity, frequency, size, and pattern have a similar fire regime (Brown, 2000; Long, 1998). One of the LANDFIRE project products includes a GIS layer identifying fire regime groups. It is important to realize that LANDFIE is a national project developed at a relatively coarse scale. However, local fire and fuels managers feel that data in this fire regime group GIS layer is a reasonable representation of the fire regimes in the landscape. Within the analysis area LANDFIRE reports five fire regime groups. Table 3.1 summarizes theses fire regime groups.

Table 3.1: Fire Regime Groups

Group	Frequency	Severity	Severity description	% Analysis Area
I	0 – 35 years	Low / mixed	Generally low-severity fires replacing less than 25% of the dominant overstory vegetation; can include mixed-severity fires that replace up to 75% of the overstory	18
II	0 – 35 years	Replacement	High-severity fires replacing greater than 75% of the dominant overstory	1
III	35 – 200 years	Mixed / low	Generally mixed-severity; can also include low severity fires	22
IV	35 – 200 years	Replacement	High-severity fires	48
V	200+ years	Replacement / any severity	Generally replacement severity; can include any severity type in this frequency range	2

Insects and Diseases. Numerous forest insects and diseases exist within the analysis area and larger landscape at various levels. They have been interacting with and shaping the forest vegetation in the analysis area for some time. Those currently present and affecting forest vegetation will be discussed in the Existing Conditions section of this report.

It should be noted that a major diseases currently affecting forest trees is non-native and was not historically present within the analysis area. White pine blister rust was introduced in 1910 and has since had an effect on the forest composition within the area. Limber pine in the mid-lower elevations and whitebark pine in the upper elevations have been significantly affected by this disease.

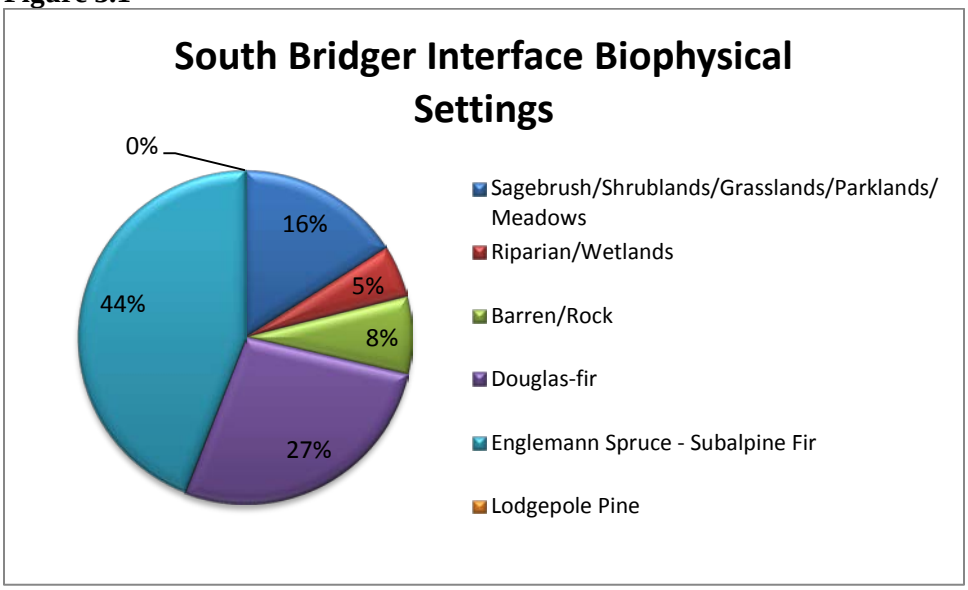
Other Disturbances. Undoubtedly, other natural disturbances have occurred throughout history in the area, such as wind events and avalanches.

Historic Forest Vegetation Conditions

The LANDFIRE project has developed Biophysical Setting data which estimates potential historic forest vegetation.

Biophysical Settings: LANDFIRE define a biophysical setting as the vegetation that may have been dominant on the landscape prior to Euro-American settlement and is based on both the current biophysical environment and an approximation of the historical disturbance regime (LANDFIRE website). Biophysical settings were compressed into 6 represented categories within the analysis area. Figure 3.1 below summarizes the distribution of these biophysical settings within the analysis area.

Figure 3.1



Ownership and Management

The most significant ownership/management activity that has occurred in the project area is the development of the Bridger Bowl Ski Area. This area began operations in 1954 and continues today. Management of the area is consistent with the master development plan.

A summarization of past harvest activities across all ownerships within the analysis area will be discussed in the Existing Conditions section of this report. This is because existing forest conditions are directly influenced by past activities.

Existing Conditions

Using the methods described earlier, the existing condition of the forest vegetation within the analysis area was investigated at all scales from the landscape to individual trees. This section will discuss the existing site conditions, disturbance agents, and various attributes of the forest vegetation.

Site Conditions

A site can be defined as the environment where a tree or forest stand grows (Helms, 1998). As far as tree growth is concerned, the site is controlled by the total physiologically available supply of solar energy, water, carbon dioxide, and various chemical nutrients (Smith et al., 1997). Individual sites are comprised of unique combinations of the physical environment including; landform (elevation, aspect, topography), climate, and geology. Generalizations of sites can be made to characterize the landscape.

Landform. The elevation, topography, and aspects within the analysis area are variable. Elevation ranges from approximately 6,100 feet up to about 9,000 feet at the crest of the Bridger Range. Slopes generally range from 20% to sheer cliffs.

Land Type. The Gallatin National Forest GIS library contains a Land Type coverage which spatially defines areas based on soils, geology, slope, and potential vegetation. Figure 3 displays the Land Type Groups found in the analysis area.

a) Site Classifications

From a silvicultural perspective, it is useful to classify sites. Classification can provide information about a particular site related to susceptibility and vulnerability of trees to damaging agents, problems with competing vegetation, and responses to various silvicultural treatments (Smith et al., 1997). In forestry, sites are typically classified qualitatively by environment or vegetation or qualitatively by their potential for tree growth.

On the Gallatin National Forest, the most common way of classifying sites is by habitat type (potential natural vegetation). All land areas potentially capable of producing similar plant communities at climax may be described as the same habitat type. By focusing on climax plant communities, habitat types account for successional change overtime and thus provide a permanent and ecologically based system of land stratification (Pfister, et al, 1977). Pfister's *Forest Habitat Types of Montana* is the document used to systematically classify sites into habitat types, which are named for the climax vegetation community (dominant tree species followed by dominant undergrowth species, e.g. *Abies lasiocarpa/Clintonia uniflora*). A GIS layer is available for Region 1 that contains potential natural vegetation groups. Figure 4 displays the distribution of these potential vegetation groups within the project area. Appendix A also contains detailed information related to individual stands associated with this project, including habitat type information.

Existing Forest Vegetation Conditions

As previously mentioned analysis of forest vegetation can be done at the landscape and stand level. Here we will discuss various aspects of the existing condition of forest vegetation within the analysis area at multiple scales.

Analysis of stand level existing forest vegetation conditions was accomplished by assessing individual stand conditions using the methods described earlier and then compiling these data and summarizing them for the analysis area. Appendix A has detailed information for individual stands within the analysis area. The stand level analysis and diagnosis process that was discussed in the methods section primarily occurred on lands identified in the Forest Plan as suitable for timber harvest. Areas outside this land base have limited stand level information.

Summary information related to composition, seral stage distribution, and forest structure will be reported below.

a) Composition

Composition refers to the proportion of various species within a stand or area. A variety of species exist within the analysis area. The spatial distribution and proportions of each species is directly related to site condition and inter-species competition.

Cover Types are used to express the dominant species within an area based on plurality (also commonly referred to as Forest Type, Dominance Type or Existing Vegetation). That is, the specie or species presently most abundant in a given area. Again the current composition of the analysis area is the result of past disturbances, site conditions, and the competitive advantages of individual species. Cover type information for the analysis area was summarized using 2006 VMAP data. This provides a consistent data set, in terms of classification and data acquisition, for all lands within the analysis area. Characterization of the analysis area is an appropriate mid-scale application of this remote sensing derived data. Field sampled data has been used for finer/stand level analysis. VMAP uses the Region 1 Existing Vegetation Classification System (Barber et al., 2011) and Table 2 summarizes the cover types within the analysis area using the Dominance 40 classes found in this system. The Non Forested class in

Table 2 is an aggregate of multiple VMAP Dominance 40 classes. In addition, it should be noted that Non-Forested areas could include forested areas where the canopy cover of tree species is less than 10 percent, for example regenerating areas.

Table 3.2: VMAP Dominance 40 Vegetation Classes

VMAP Dominance 40 Classes	General Description	Acres	~Percent Analysis Area
Non-Forested (GRASS, SHRUB, SPVEG, ETC)	Aggregation of areas classified as dominated by herbs, shrubs, sparse vegetation and water	2,825	36
Cottonwood Mix (MX-POPUL)	Cottonwood is the most abundance single species with at least 40% of the total tree abundance	10	0.1
Aspen Mix (MX-POTR5)	Aspen is the most abundance single species with at least 40% of the total tree abundance	1	0.01
Douglas-fir Mix (MX-PSME)	Douglas-fir is the most abundance single species with at least 40% of the total tree abundance	**4,325**	**57**
Lodgepole pine Mix (MX-PICO)	Lodgepole pine is the most abundance single species with at least 40% of the total tree abundance	471	6
Engelmann spruce Mix (MX-PIEN)	Engelmann Spruce is the most abundance single species with at least 40% of the total tree abundance	43	0.5
Subalpine fir Mix (MX-ABLA)	Subalpine fir is the most abundance single species with at least 40% of the total tree abundance	65	0.8
Limber Pine Mix (MX-PIFL2)	Limber pine is the most abundance single species with at least 40% of the total tree abundance	16	0.2
Total		**7,756**	**100**

b) Seral Stage Distribution

Often forests are seen through our eyes as static entities. An example is a stand of trees we have visited many times but continues to appear unaltered. This concept could be no farther from the truth. Change is constant in forest communities. Change occurs at all scales from a seedling sprouting, to a wildfire consuming tens of thousands of acres of trees. This change is multi-dimensional and also occurs at various time scales. Often the timescale of change within a forest is comparatively long, as some trees within the analysis area have existed at the same location and in similar form for a hundred years. At a stand and landscape level, this change is often associated with many of the disturbance factors previously discussed. These disturbances often result in the establishment of a new age class or cohort.
A successive change in species dominance following disturbances is referred to as succession. A seral stage is a temporal and intermediate stage in the process of succession (Helms, 1998). The Forest Plan identifies a desired diversity of five successional stages of forest vegetation by timber compartment (Table 3). Four of these stages are defined by tree size, with Old Growth being defined by tree size, age, and density. Tree size is a more commonly and easily measured attribute than tree age. It is believed, as in the Forest Plan, that there is a correlation between tree size, successional development, and tree ages. Although this correlation does not fit well under certain circumstances, it is generally accepted given the disturbance regimes and patterns of forest communities in the Northern Rockies.

Table 33:Gallatin Forest Plan – desired diversity of successional stages

Successional Stage	Minimum % of Area
Seedlings	10
Saplings	10
Pole	10
Mature	10
Old Growth	10

Three forested successional stages were identified in this analysis to illustrate distribution of successional development and hence tree size and age. These stages are consistent with the Forest Plan and are independent of species composition. Here again, VMAP data was used to characterize tree size distribution within the analysis area. A detailed discussion of Old Growth will follow.

Tables 4 and 5 display the successional stage distribution by conifer forested cover type within the analysis area.

Table 3.4: Distribution of successional stages in analysis area (size)

Successional Stage	General Description	Acres	Percent of Conifer Forest Area
Seedling/Sapling	Dominant/Codominant <5” DBH	130	2.7
Pole	Dominant/Codominant 5”-9.9” DBH	300	6.1
Mature	Dominant/Codominant >= 10” DBH	**4,458**	**91.2**

Table 3.5: Distribution of successional states in analysis area (vegetation)

Cover type	Seedling/Sapling Acres	Pole Acres	Mature Acres	Total Acres/ % Conifer Forested Area
Douglas-fir Mix	**87**	**265**	**3,946**	**4,298/87.9%**
Lodgepole pine Mix	42	31	394	467/9.6%
Engelmann spruce Mix	0	40	3	43/0.9%
Subalpine fir Mix	1	2	61	64/1.3%
Limber pine Mix	0	2	14	16/0.3%
Total	**130**	**340**	**4,418**	**4,888**

(1) Old Growth

As mentioned earlier old growth in this report is defined by Green et al, for the Eastern Montana Zone. Appendix B includes the minimum criteria and associate characteristics used to make old growth determinations.

The distribution of Old Growth within the analysis areas was analyzed at multiple scales including at the forest level, at the timber compartment level, and the treatment unit level.

Statistical estimates of the amount of old growth can be more confidently made at large scales. Forest Inventory and Analysis (FIA) data have been used to produce statistical estimates of old growth for the entire Gallatin National Forest. The estimate of old growth for the Forest is 24.8% with a 90%

confidence interval of 21.1% to 28.5%. The project area falls into the western half of the Forest, the estimate of old growth for this area of the Forest is 26.9% with a 90% confidence interval of 22.1% to 31.7%. The appropriateness of this process is documented by Czaplewski (2004).

As stated, the Forest Plan contains an Old Growth related standard stating that the Forest will strive to develop a diversity of vegetation sizes and ages; including 10% minimum area of Old Growth in timber compartments containing suitable timber. All proposed treatment units associated with this project fall into timber compartment 504 (the analysis area), which contains suitable timber. A recent analysis looked at the amount of Old Growth in timber compartment 504. The 2005 Bridger Bowl Special Use Permit and Master Development Plan Final Environmental Impact Statement indicated that timber compartment 504 contained 7.0 % Old Growth. The selected alternative associated with that project also reduced the percent Old Growth from 7.0% to 6.95%. As a result, a Forest Plan Amendment was included in the Record of Decision stating; development within the Bridger Bowl Ski Area Special Use Permit boundary is exempt from the forest wide 10% old growth successional stage standard.

Given the above, analysis was conducted to ensure that no treatment units associated with this project outside of the ski area permit boundary meet the Green et al. definition of old growth. Existing stand data was analyzed and additional plots were installed in seven proposed units during winter 2013 to sample tree ages. No proposed units outside the ski area boundary were determined to meet the minimum old growth criteria; detailed analysis of these data is included in the project record. Three units fell within the ski area permit boundary. This area is exempt from the Forest Plan old growth standard and existing available stand exam data did not indicate that the units within the ski area boundary met the Old Growth criteria.

Proposed treatments would not necessarily preclude treated areas from meeting minimum old growth criteria (see Appendix B) in the future, given that they are not regeneration harvests intended to establish a new age class. In the absence of additional disturbance, trees will age and increase in size over time moving closer to meeting the minimum criteria.

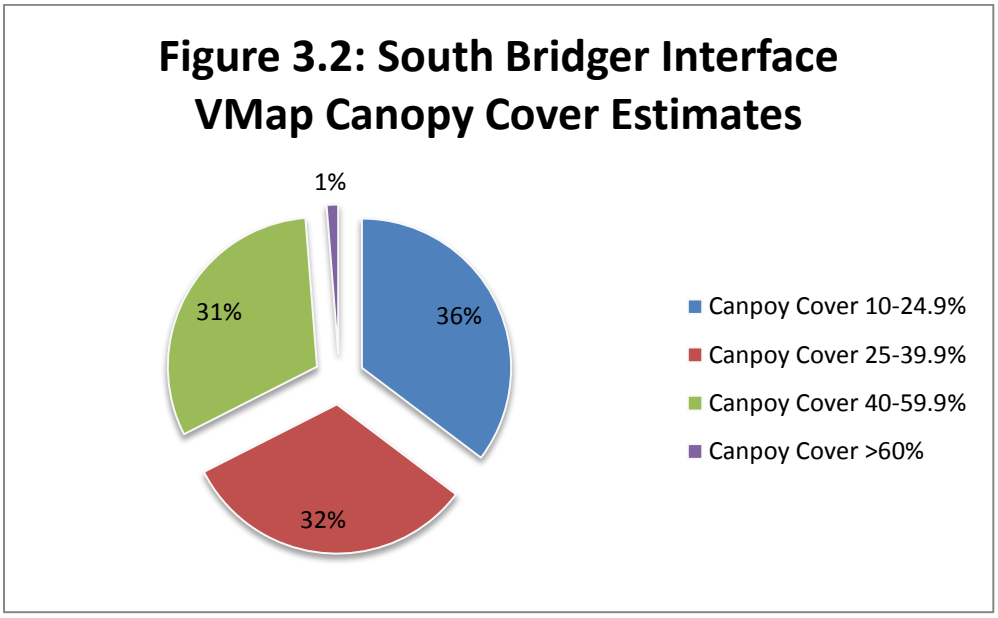
Forest Structure

Forest structure describes the vertical and horizontal distribution of components of a forest. Vertical structure describes the arrangement of trees and their crowns from the forest floor to the top of the forest canopy. This attribute can be classified as either single storied (tree crowns consisting of one main canopy layer), two storied (tree crowns forming two distinct canopy layers), or multi-storied or continuous (where tree canopies occupy three or more distinct canopy layers). Horizontal structure is often referred to in terms of density. In forestry density can be measured in many ways but is most commonly expressed in terms of basal area, trees per acre, or canopy cover.

Numerous combinations of forest structure exist within the analysis area and vary based on species composition, seral stage, and past disturbance. In terms of vertical structure the following conditions exist. Most of the areas dominated by the Lodgepole cover type, Douglas fir cover type, and the early seral stages for all cover types are single storied. This is primarily due to stand dynamics in the early seral stages, the result of stand replacing disturbances in the Lodgepole cover type, and ongoing western spruce budworm defoliation and understory mortality in Douglas fir areas. Two storied vertical structure exists in areas where remnant overstory trees exist above a smaller cohort. These cases are most commonly the result of mixed severity fire regimes or past harvests. Multi-storied stand structures exist in many of the mesic areas and areas dominated by shade-tolerant species.

Horizontal structure is also variable across the analysis area. Many of the early seral seedling/sapling areas have high tree densities. Densities are also high in many of the pole and mature areas. However in

these areas, live tree densities have been reduced due to insect related mortality. One measure of density is canopy cover, which is proportion of the forest floor covered by the vertical projection of tree crowns (Barber et al., 2011). This attribute of forest vegetation is readily measured using remote sensing technology. A summary of canopy cover for tree dominated areas (areas where tree canopies are greater than 10% of the area) within the analysis area using R1 VMAP data is displayed in Figure 3.2. It should be noted that this data does not reflect mountain pine beetle, Douglas fir beetle, or western spruce budworm mortality that has occurred since 2006.



In areas affected by forest insects (mountain pine beetle, Douglas-fir beetle, and western spruce budworm) the following forest structural conditions exist. Mountain pine beetle mortality is highest in lodgepole pine dominated stands. As mentioned earlier, many of these stands are primarily single storied. At the time this report was produced most insect affected areas still exhibit a single storied structure. Most dead trees are still standing and many have retained their crowns. As time passes, dead needles will fall to the ground followed by the entire tree. At some point it is likely that conditions (increased light penetration and increased growing space) will favor the establishment of a new cohort of trees. At that point vertical forest structure will begin to change.

In some areas all trees have been killed (lodgepole pine dominated areas) and in others mixed species composition has resulted in variable mortality. This has resulted in variable live tree densities and horizontal structure.

The amount of down woody material and the number of standing dead snags are significant elements of forest structure. Mountain pine beetle, western spruce budworm, and Douglas fir beetle mortality have altered the amount and distribution of standing dead snags throughout the analysis area.

Updated quantitative data relating to standing dead snag numbers specific to the analysis area is limited to areas sampled in fall 2012. These new stand inventory data contain standing dead snag information. Estimates range from zero to 117 dead trees greater than 5” DBH per acre.

Similar to the broad estimates of old growth mentioned earlier, statistical estimates of the number of snags per acre and the amount of coarse down woody material per acre can be made analyzing FIA data at varying spatial extents. The confidence of estimates made using FIA data is higher as more data is incorporated. In this case, the Bridger Range was used to characterize these attributes across the landscape within which this project falls. Although this area is broader than the analysis area boundary, it allowed for the incorporation of more data and thus better estimates of the existing condition for snags and coarse woody material. It should be noted that these FIA data incorporate a wide range of forest conditions and sites. Table 6 summarizes the estimates of standing dead snags per acre (greater than 9" DBH) and coarse woody material (tons/acre greater than 3" diameter) for the Bridger Range.

Table 3.6 – FIA Summary Estimates for the Bridger Range (12 (snags) & 7 (cwd) FIA Plots)

Attribute	Estimate	Lower 90% Confidence Interval	Upper 90% Confidence Interval
Standing Dead Snags (trees per acre > 9" DBH)	**11.6**	2.1	24.9
Coarse Down Woody (tons per acre > 3" diameter)	**9.6**	3.9	15.5

Qualitative descriptions regarding down woody material and snags can be made. Although highly variable, down woody material and standing dead snags exist at some level throughout most stands. Down woody material is often discussed as either fine woody material or coarse woody material. Graham and others (1994) define coarse woody material as any wood residue larger than 3" in diameter. Both down woody material and snags are the result of tree mortality. Tree mortality factors such as insects, pathogens, fire, wind, and other disturbances all contribute to the pool of dead trees available as snags and eventually down woody material. Recent insect related mortality has significantly altered the amount and distribution of snags in the analysis area and to a lesser degree down woody material. Needles of killed trees have added to fine down woody loadings, while some killed trees have also fallen to the ground adding to coarse woody debris. These fine and coarse woody debris loadings are highly variable throughout the analysis area and even within proposed harvest units due to species composition, time of mortality, mortality levels, and tree size.

Existing Disturbance

Most, if not all, of the historical disturbance agents that affected the forest vegetation within the analysis area are still present today. The extent and effects of each of these agents varies through time. The following provides a snap shot in time of the existing disturbance agents observed within the analysis area. As can be expected, defoliators and bark beetles have been the most significant recent disturbance agent within the analysis area.

a) Insects and Diseases

Forest insects and diseases are major disturbance processes in forests of the Northern Rocky Mountains. There effects can range from small scale disturbances, killing individual trees, to wide spread outbreaks causing extensive tree mortality. Native forest pests have been part of our forests for millennia and function as nutrient recyclers, agents of disturbance, members of food chains, and regulators of productivity, diversity, and density (Black, 2005). Aerial detection surveys, stand inventories, silvicultural walkthroughs, and regional entomologist field visits have identified which species are currently present and affecting the forest vegetation within the analysis area.

The most recent aerial detection survey conducted by USDA Forest Health and Protection staff and was completed in 2011. Aerial detection surveys are most useful in detecting insect and disease damage that can be easily identified from the air such as mortality and defoliation and report current year evidence. It is important to note that not all insect and disease agents have mortality signals that can be detected (FHMP, 2005). The following summary does not account for populations outside of the analysis area. Table 7 displays the major insect agents observed during 2009, 2010, and 2011 surveys within the analysis area.

Table 3.7: 2009, 2010, 2011 Aerial Detection Survey Results - South Bridger Interface Analysis Area

Species	Acres Mapped	Occurrences
Mountain Pine Beetle	5,582	23
Douglas-fir Beetle	88	12
Western Spruce Budworm	1,562	10

The following paragraphs identify the major agents observed during aerial detection surveys and provide a short discussion of their natural history. Miscellaneous insects and diseases are also mentioned.

Mountain Pine Beetle. Mountain pine beetle is an aggressive bark beetle which feeds in the inner bark of host trees, often girdling and killing the tree. Hosts include most pine species with lodgepole pine being of concern within the proposed treatment areas. Infested trees fade within one year from yellow-green to red-brown. Large scale outbreaks are common, especially in lodgepole pine, when conditions are optimal and the beetles' food supply is abundant.

Currently, Northern Region Forest Service entomologists calculate stand hazard for lodgepole pine utilizing the following criteria: quadratic mean diameter >5", stand basal area, and the proportion of the stand basal area that is lodgepole pine (Randall et al, 2011).

Douglas-fir Beetle. Douglas-fir beetle is a bark beetle which attacks primarily Douglas-fir. Douglas-fir beetle has one generation per year, with a spring emergence typically between mid-April and early June. Douglas-fir beetles are not particularly aggressive. However, they are attracted to wind throw and trees weakened by fire, drought, defoliation, or root disease. Outbreaks typically last 2-4 years (Kegley, 2004).

Stand susceptibility is related to the proportion, density, age, and size of Douglas-fir. High hazard stands are considered to have stocking greater than 250 square feet basal area, greater than 50% Douglas-fir, average stand age greater than 120 years, and average diameter of Douglas-fir greater than 14 inches.

Western Spruce Budworm. Western spruce budworm is a defoliating insect which eats the needles of Douglas-fir and true fir trees, though other species may be defoliated during epidemics. When populations of these insects reach epidemic proportions, they can cause a reduction in growth, top kill, tree mortality, and mortality of regenerating trees. Western spruce budworm outbreaks tend to last long and often cause limited direct tree mortality because budworms preferentially feed on current year foliage.

Stand hazard is calculated by evaluating stand basal area, proportion of susceptible tree species, and the number of trees per acre.

Miscellaneous Insects and Diseases. A number of additional forest insects and diseases were observed in and/or near the analysis area. They are considered here as miscellaneous because they were either

observed infrequently or their effects to forest vegetation are much less significant than the agents listed above.

Regional entomologists were contacted to provide assistance with this project given the purpose and need. One field visits was made within the analysis area on October 1st and 2nd, 2012 and the full report describing the visit is included in the project file for this analysis (Sturdevant and Jackson, 2012). General forest health highlights include the following:

- Western spruce budworm is continuing to cause significant defoliation, damage, and mortality in all size classes of Douglas-fir
- Mountain pine beetle activity has declined in stands where significant beetle-caused mortality has occurred. It continues to cause some mortality in stands that are not as densely stocked and/or have smaller and younger size class lodgepole pine.
- Additional treatments may be warranted in mature Douglas-fir dominated stands that have been declining in large part from western spruce budworm.
- Large tree mortality has occurred over the past few years at Bridger Bowl and in adjacent areas primarily from defoliation from budworm.
- The mature stands remaining on the ski hill and in adjacent forests mostly contain larger trees that are capable of supporting large budworm larval populations.
- The establishment of a younger size class in both pine and fir-dominated stands in critical to the success of forest resiliency over time in the Bridger Canyon drainage.
- Silvicultural treatments such as Shelterwood and thinning treatments can both be used to reduce stand susceptibility to budworm in the Bridger Canyon drainage.

Additional specifics from the trip report will be included later in the environmental consequences section.

Fire. The occurrence of fires within the analysis area is well documented. District fire management staff log all confirmed fire starts on the district. They also keep records related to prescribe fire operations. In 2009, the Flaming Arrow Fire burned roughly 200 acres almost entirely on private land adjacent to the project area. This fire burned mostly non-forest and open forest types, and some of the burned trees have since been salvaged. See the Fire and Fuels section of the project file for detailed information related to fires in the project area.

Wind. Although the effects of wind to forest vegetation are constant, no evidence of recent large scale wind events was observed. Due to observations of individual tree and small patches of blowdown, it is obvious that wind has been a disturbance factor within the analysis area.

Forest Management. Forest Service and private lands total 7,750 acres within the analysis area, 5,598 and 2,152 respectively. The Forest Service keep records of past timber harvest activity, going back to around the 1940's. Although there are 2,152 acres of private land in the analysis sis area, the Forest Service has tracked forest management activities on these lands due to previous land exchanges. Table 8 displays the timber harvest activity by decade for these land owners. In addition to the past timber harvest activities, a variety of forest management practices have affected the existing vegetation within the analysis area. These activities include, artificial regeneration (planting), insect control, site preparation, and fuels treatments (prescribed burning, slashing, piling, etc.). Records of these activities are only available for Forest Service lands and are also reported in Table 8.

Table 3.8 - Past Forest Management Activities

Regeneration Harvest	1940s	1950s	1960s	1970s	1980s	1990s	2000s	2010s	Grand Total
Forest Service Acres	0	58	0	0	559	237	0	0	854
Private Land Acres	0	206	500	0	0	55	0	0	761
Total Acres Treated	**0**	**264**	**500**	**0**	**559**	**292**	**0**	**0**	**1,615**
Intermediate Harvest									
Forest Service Acres	0	0	0	0	21	269	0	0	290
Private Land Acres	17	168	180	4	0	124	0	0	493
Total Acres Treated	**17**	**168**	**180**	**4**	**21**	**393**	**0**	**0**	**783**
Uneven-Aged Harvest									
Forest Service Acres	0	0	0	0	54	0	0	0	54
Private Land Acres	0	0	0	0	0	0	0	0	0
Total Acres Treated	**0**	**0**	**0**	**0**	**54**	**0**	**0**	**0**	**54**
Insect Control									
Forest Service Acres	0	0	0	0	0	0	327	86	**413**
Reforestation									
Forest Service Acres	0	0	0	0	216	0	119	0	**335**
Site Preparation									
Forest Service Acres	0	0	0	0	351	66	0	0	**416**
Fuels Treatments									
Forest Service Acres	0	19	0	0	579	387	56	0	**1,041**
Grand Total (All Activities and Ownership)	**17**	**451**	**680**	**4**	**1,780**	**1,138**	**502**	**86**	**4,657**

ENVIRONMENTAL CONSEQUENCES

This section describes the direct, indirect, and cumulative effects of the no action and the proposed actions to forest vegetation. The potential effects described are based on research, experience, and professional judgment.

Measurement Indicators

One measurement indicator was identified to evaluate the effects to forest vegetation. This was chosen because it is measurable (both qualitatively and/or quantitatively), affected by silvicultural activities, and related to the project purpose and need.

Insect Conditions– This indicator will discuss the effects of the alternatives on western spruce budworm, Douglas-fir beetle, and mountain pine beetle. It will report the alternatives effects to susceptibility of some stands within the analysis area.

Treatment Descriptions

Silvicultural treatments are often defined as either regeneration or intermediate treatments. Regeneration methods are those that purposefully establish a new age class. Conversely, intermediate treatments are meant to enhance growth, quality, vigor, and composition of a stand prior to a regeneration treatment.

Silvicultural Treatments

Commercial Thinning (Intermediate Treatment): This treatment is designed to reduce susceptibility to damage from western spruce budworm, Douglas-fir beetle, and mountain pine beetle. The existing tree density would be reduced from current levels to a target residual density ranging from 80 to 100 square feet of basal area per acre on average. Trees to be removed include sawtimber and pole timber sized trees that are dead and/or dying and infested with western spruce budworm, Douglas-fir beetle, and/or mountain pine beetle, as well as live trees to achieve an average spacing of 15-20 feet between crowns. Smaller sub-merchantable sized trees will not be targeted for removal, however it is expected that some mortality to these trees is likely as a result of operations. Residual live tree spacing will be influenced by the distribution of existing trees and the variable and dynamic nature of mortality in the project area. The purpose of this treatment is to alter the stand micro-environment and enlarge the growing space of remaining trees allowing for improved tree growth, vigor, and resiliency. Treatments will be design to minimize post-harvest wind damage. Mechanical treatments and/or prescribed burning would be used to reduce fuels and recycle nutrients.

Fuel Treatments

Fuel treatments are designed to reduce activity generated fuels within the proposed treatment areas. Mechanical treatments could include whole tree yarding and/or excavator piling. Fuel accumulations at landings would be addressed through burning, chipping/masticating, and/or removal from National Forest lands.

No Action Alternative

Direct and Indirect Effects

The direct and indirect effects discussed in this section pertain primarily to effects that occur as direct or indirect (in time and space) results of the alternative. These may include immediate or longer term effects.

No actions would occur under this alternative, allowing the processes of vegetation succession and forest insect dynamics to continue in a similar fashion as they currently are. Firewood gathering, Christmas tree cutting, and continued wildfire suppression consistent with forest plan direction is expected, although limited due to access. The direct and indirect effects of the no action alternative to western spruce budworm, Douglas-fir beetle, and mountain pine beetle conditions will be discussed below.

Insect Conditions- Western Spruce Budworm, Douglas-fir Beetle and Mountain Pine Beetle. Under this alternative, insect conditions are likely to exhibit a trend similar to the existing conditions previously discussed. Sturdevant and Jackson (2012) discuss no action scenarios in their report of the project area. The following are excerpts that reflect insect conditions for western spruce budworm and Douglas-fir beetle if no management actions are taken:

> "…. budworm will continue to cause significant defoliation, tree damage and mortality will continue across size classes. Outbreaks of SBW will occur between 60 and 100% of the time because Bridger Canyon is in the high budworm outbreak frequency. Eventually as large tree mortality continues and root and butt rots have an increasing impact on aging trees, potential for blow-down will increase. Very little natural regeneration will occur until the majority of stands have lost a significant portion of their biomass. Although, Douglas-fir can regenerate under almost closed

> canopy conditions, even light levels of defoliation can result in almost 100% cone and seed destruction (budworm feed on seed and cones of Douglas-fir in the early larval stage). Also, budworm larvae will feed and kill the majority of the understory."
>
> "…. Douglas-fir beetle (DFB) is also a native insect that has co-evolved with Douglas-fir stands in the West and is considered a primary recycling agent of mature Douglas-fir. Douglas-fir beetle outbreaks usually last between 3-5 years….
>
> …. Douglas-fir beetles usually kill larger diameter trees first and then intermediate-size classes, and toward the end of an outbreak will even attack and kill trees as small as 8 inches in diameter….
>
> …. with the significant level of budworm-caused defoliation, DFB will probably begin to again build up in heavily defoliated trees. More importantly, large, older trees that were heavily defoliated are now attacked and killed by secondary insects such as wood borers. These insects usually only respond to trees that are significantly weakened by fire, drought and bark beetle attacks. This is an indicator of the significant level of stress that large trees are experiencing in the area…."

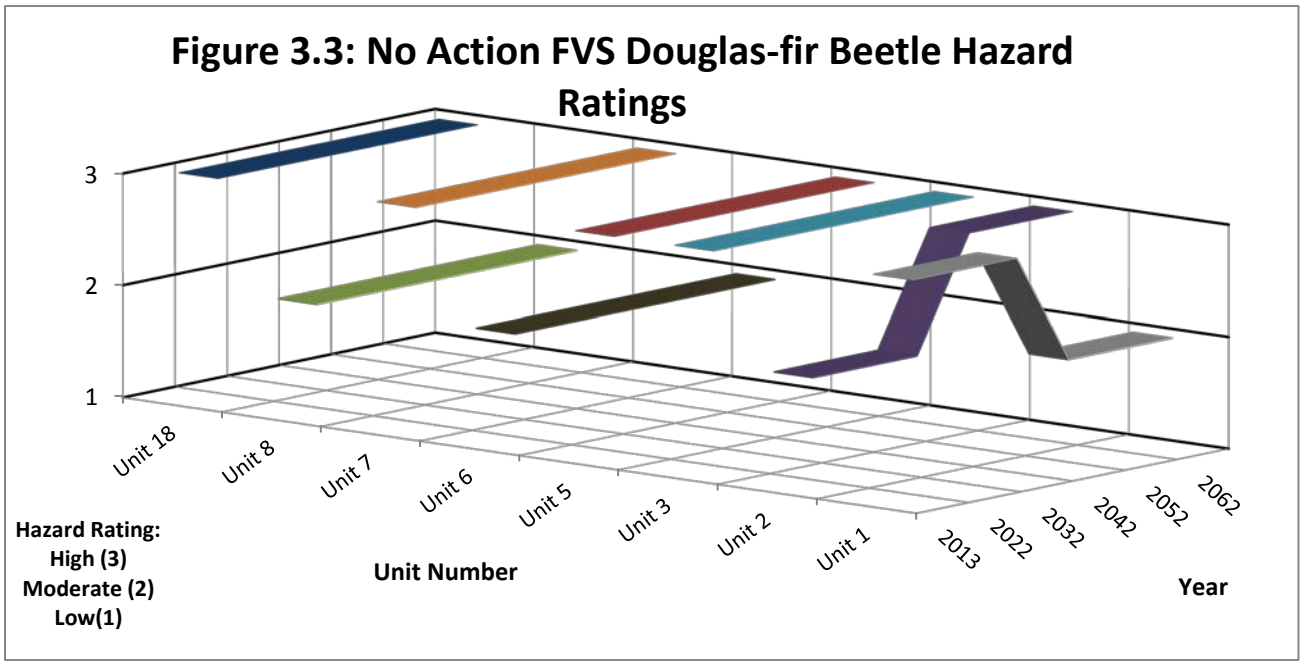
The analysis area includes stands which are susceptible and at risk of loss to lodgepole pine from mountain pine beetle, as evident by beetle caused mortality and beetle populations within the analysis area and on adjacent private lands. Based on this, continued susceptibility and mortality is expected in the lodgepole pine component of the analysis area under the no action alternative. Mountain pine beetle populations appear to be food limited and will continue to increase as long as environmental conditions allow and susceptible trees are present (Black, 2005; Cole and Amman, 1969). At some point in the future it is likely that suitable host tree distribution in the area will be reduced through mortality to a point where mountain pine beetle populations and related mortality is self-limiting.

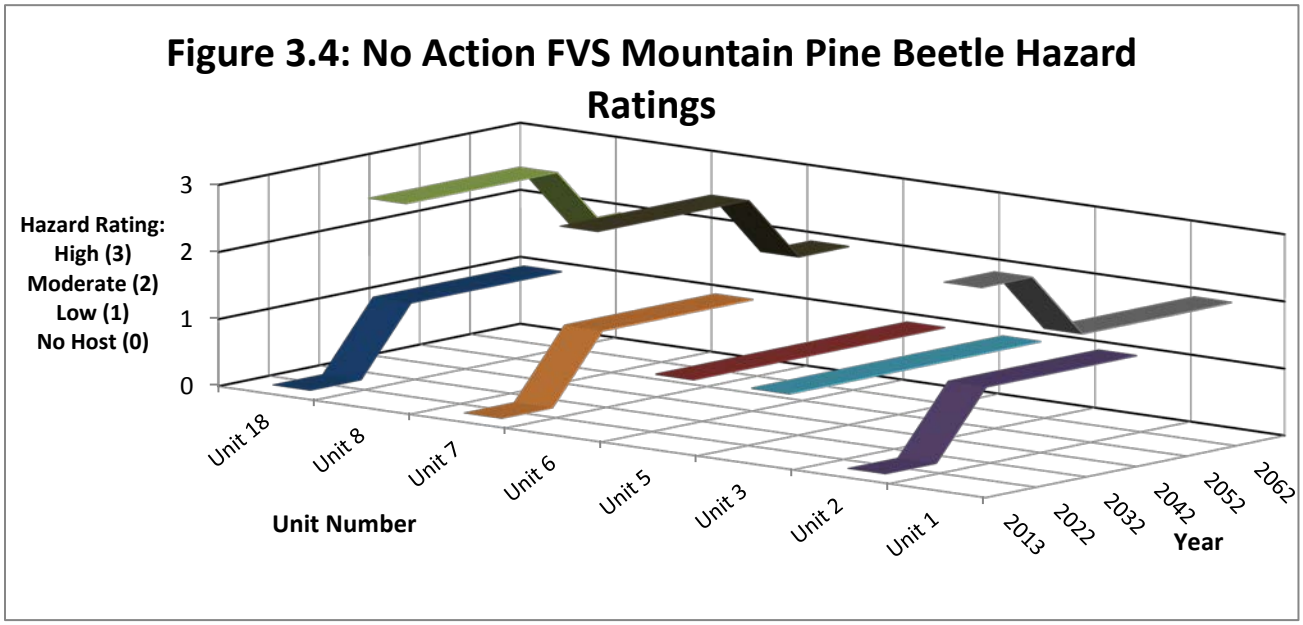
Susceptible trees and stands exist throughout the analysis area. Susceptibility (i.e. hazard) is the inherent characteristics or qualities of a stand of trees that affect its likelihood of attack and damage buy a mountain pine beetle population. In contract, risk is the short term expectation of tree mortality in a stand. Risk is a function of susceptibility and insect pressure (Shore and Safranyik, 1992).

The Forest Vegetation Simulator (FVS) was used to model and assess hazard ratings of proposed treatment areas. It should be noted that all models have limitations and results are not absolute, but offer an opportunity to compare the effects between alternatives. Hazard ratings were calculated per the Region 1 system documented in Randal et al., 2011. Eight proposed treatment areas were modeled and were chosen because they; are a representative sample of the proposed treatment areas and have new stand exam data collected in the fall of 2012. These areas were modeled for a 50 year time period starting in 2013 and had no treatments simulated. This essentially created a condition similar to the no action alternative where no human disturbance occurs. This also implies that stand conditions are not altered by other disturbances (including insects) during the 50 year period. This is situation is unlikely given previous discussions of insect conditions in the analysis area, yet it does allow for analysis of stand conditions as they relate to hazard in the absence of disturbance.

The hazard rating results for Douglas-fir beetle and mountain pine beetle are displayed in figures 3.3 and 3.4. Forest attributes vary among these units and in terms of composition, some units are pure Douglas-fir and others contain a mix of species, primarily Douglas-fir and lodgepole pine. Composition can

strongly influence hazard rating. It can be seen that Unit 1 shows a decrease in Douglas-fir beetle hazard rating overtime and Units 1, 6, and 8 show a decrease in mountain pine beetle over time. This can be attributed to two specific situations. For Unit 1 Douglas-fir beetle hazard is calculated using the proportion of basal area that is Douglas-fir. In this unit as time goes on lodgepole pine basal area increase to the point where Douglas-fir beetle hazard decreases. Units 1, 6, and 8 decrease in mountain pine beetle hazard overtime due to basal area increasing over 250 square feet per acre, creating conditions less favorable for beetles. Western spruce budworm hazard was High (3) in all units modeled both at the beginning and throughout the simulation. The detailed results of this simulation are included in the project file for this report.





Cumulative Effects

Past, current, and reasonably foreseeable actions on all lands within the analysis area were evaluated when considering the cumulative effects to forest vegetation associated with the no action alternative. Past actions which have affected the vegetation resource include forest management and other activities within the analysis area. These activities are discussed in the existing conditions section of this report and provide the baseline vegetation conditions. Given that, the following discussion will focus on the current and reasonably foreseeable activities on all lands in combination with the effects of the no action alternative on Gallatin National Forest Lands. See the cumulative effects worksheet for additional cumulative effects information.

Insect Conditions - Western Spruce Budworm, Douglas-fir Beetle and Mountain Pine Beetle. Reasonably foreseeable actions relating to forest vegetation in the analysis area all involve Bridger Bowl Ski Area. The Bridger Bowl Vegetation Management plan was developed in conjunction with Forest Service staff, Forest Health and Protection entomologists and pathologists, and resort staff. The following activities were identified in the plan and may occur in the future:

- Removal of dead and dying hazard trees in areas adjacent to ski runs/glades and resort infrastructure
- Establish regeneration of younger age class of trees through Shelterwood harvests
- Thin conifer stand throughout the ski area to increase resiliency and reduce insect impacts
- Thin conifer stands in in future skiing areas to north and east.
- Aerial application of insecticide and application of MCH and verbenone pheromones.
- Planting of tree seedlings

All of the above actions would affect forest vegetation and insect conditions. Effects would generally be considered positive in terms of reducing impacts to forest vegetation from insects. Specifically, the effects would be consistent with those discussed below as direct and indirect effects associated with the proposed action.

Action Alternative

This section will discuss the effects to forest vegetation from implementation of the three action alternatives.

Direct and Indirect Effects

The direct and indirect effects to forest vegetation will be discussed relative to the measurement indicator. In addition, some general effects to forest vegetation from the action alternative will be discussed briefly.

Insect Conditions - Western Spruce Budworm, Douglas-fir Beetle and Mountain Pine Beetle. Here again Sturdevant and Jackson (2012) discuss potential effects of management actions in their report of the project area. The following discussion from that repot is relevant to the direct and indirect effects of the proposed actions.

In terms of effects to western spruce budworm conditions, Sturdevant and Jackson note:

> Silvicultural recommendations for SBW have been to treat stands to promote tree vigor because fast growing vigorous trees do not provide favorable habitat for budworm as opposed to stressed trees and they are more likely to recover if defoliated. Also, thinning over time

promotes individual tree vigor and increases mortality of budworm larvae during the dispersal period.

Following severe defoliation on Flesher Pass near Helena Montana, private landowners within the drainage greatly reduced the stocking density of their stands through thinning and removing trees showing the greatest damage from budworm. Affected stands on forest service lands were not treated. In one area, average defoliation for trees in an un-thinned area was 83.5% compared to 41.9% for trees in a thinned area. Forty-two trees in the un-thinned unit had greater than 90% defoliation compared to 11 trees in the thinned unit. In general, trees in thinned units appeared greener and to be more vigorous than trees in un-thinned ones. (Bulaon and Sturdevant 2006).

MacLauchlan and Brooks (2009) found that younger, thinned forests and those that were not selectively harvested in the past suffered the least damage from budworm over time. Intermediate-aged host stands can be thinned to improve stand vigor, reduce amount of host biomass, and increase mortality of dispersing larvae.

Carlson and Wulf (1989) found that in an approximately 75 year old western Montana Douglas-fir stand, lowering density to about 200 to 300 trees per acre (leaving only the most vigorous trees) reduced percent defoliation and allowed affected trees to recover.

Intraspecific genetic resistance to budworm feeding is evident in Douglas-fir stands across Montana and within a stand. Because of the heritability of resistance to feeding, improvement in stand conditions can be made by selecting trees for retention that show little damage from budworm feeding during an outbreak (Brooks et al. 1985).

Thinning susceptible stands directly increases larval mortality as they disperse throughout the forest in search of suitable host material.

Susceptibility to attack from insects is affected by the action alternative. As mentioned, susceptibility is determined by variables including; stand density, proportion of stand that is host species, average stand DBH, elevation, and latitude. Proposed silvicultural treatments will affect these attributes at varying levels. A substantial body of literature exists which supports the theory that silvicultural manipulation is an effective means of reducing stand susceptibility and associated losses. Fettig and others (2007), Gibson (2004), Dix (2006), and Amman and Logan (1998) synthesize the literature which supports the effectiveness of silvicultural control of bark beetles. Much of the research points to two silvicultural strategies which have shown promise, one at the landscape level and one at the stand level. At the landscape level, heterogeneity is thought to be more resistant and resilient to insect damage. Silvicultural treatments designed to create age, size, and species mosaics can increase landscape heterogeneity.

At the stand level, evidence suggests that partial harvesting (thinning) can be an effective deterrent to insect infestation and associated losses. The specific reasons why these effects are seen in thinned stands is still uncertain but likely related to increased tree vigor and/or stand microenvironments less favorable to mountain pine beetle. Despite this research supporting the effectiveness of these strategies, some studies have also shown that at times populations become so large and aggressive that the effectiveness of these treatments is diminished or non-existent. Schmid et al. (2007) and Olsen et al. (1996) suggest that thinning to 80 square feet or less per acre is a way to reduce the inter-competition between trees and reduce mortality caused by bark beetles. Also, Negron et al. (1999) found that stand basal area was the most significant indicator of mortality during a Douglas-fir beetle outbreak.

It is possible to qualitatively discuss the effects of the proposed treatments to susceptibility by treatment at both the landscape and stand level. Proposed Commercial Thinning treatments are designed to reduce stand susceptibility by affecting species composition, density, tree vigor, and stand microenvironments. Specific prescriptive parameters follow suggestions in relevant literature. Although smaller understory trees would not be targeted for removal, some incidental mortality is expected during operations. These

treatments will also increase landscape level heterogeneity by increasing size class diversity within the analysis area.

Similar to the effects analysis for the no action alternative, FVS was used to determine post-harvest hazard rating for some proposed treatment units. The same eight units previously modeled had treatments simulated in them. The above treatment descriptions were used to set proposed activity parameters. Activities were initiated in 2014 and then the stands were modeled for 50 years into the future. Figures 3.5, 3.6, and 3.7 display the results of this modeling. Detailed information associated with this modeling is available in the project record of this analysis.

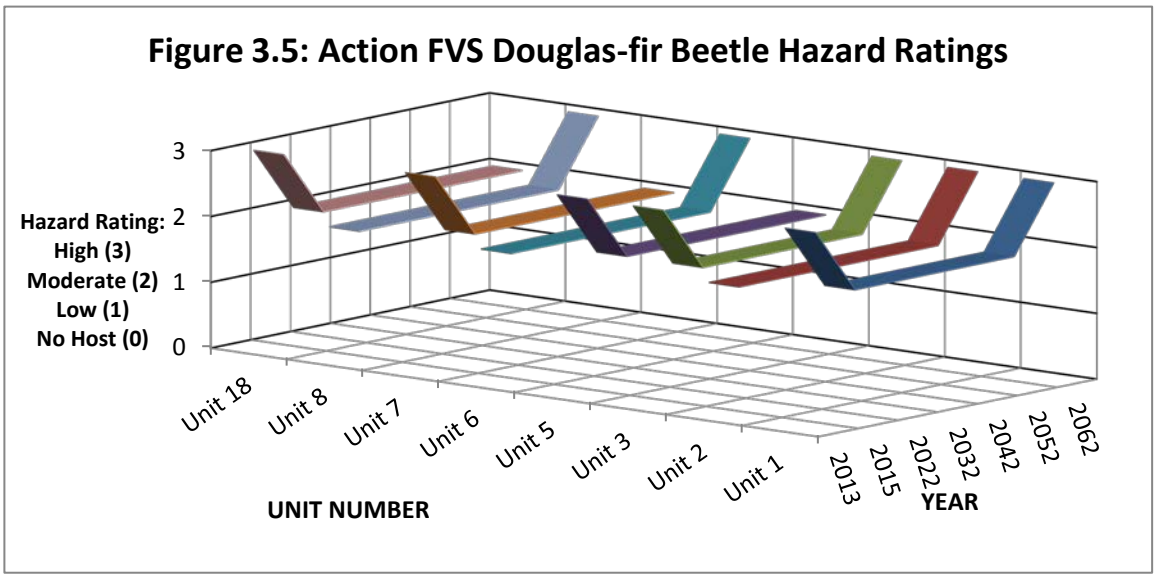


Figure 3.5 illustrates that following the proposed treatments Douglas-fir beetle hazard decreases in five units and remains constant in three others. It also shows that overtime hazard increases. This is expected due to the dynamic nature of forests and continued tree growth.

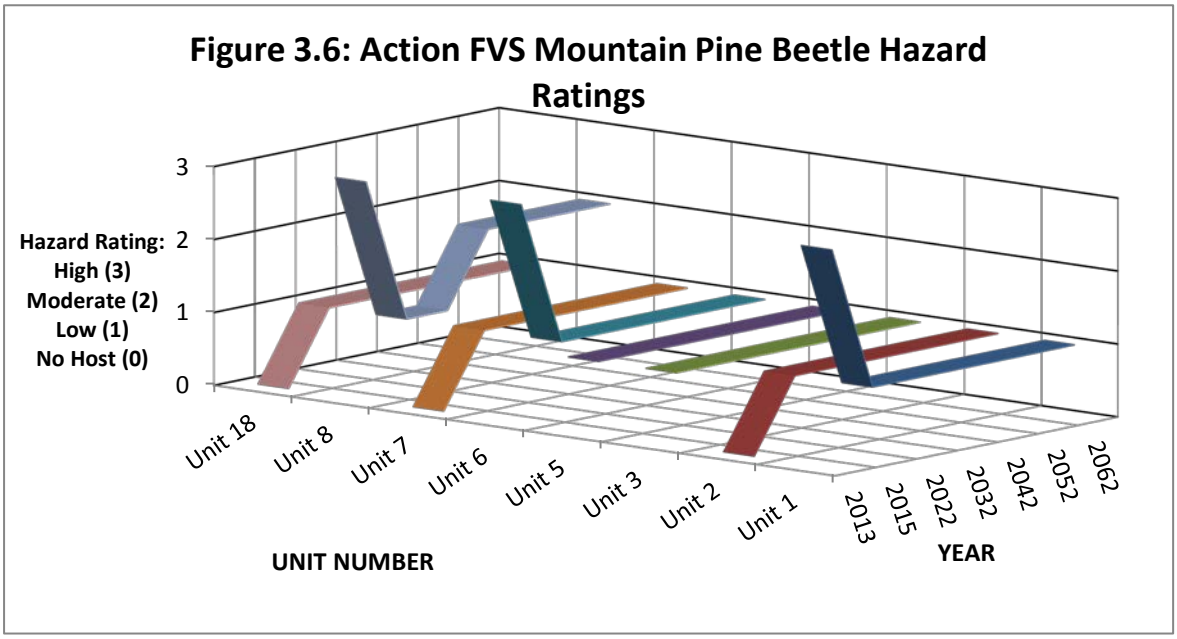


Figure 3.6 displays the effects of the proposed action to mountain pine beetle hazard. Model results suggest that hazard will decrease immediately following treatment in some units, and remain constant in others. In three units, hazard increases from No Host (0) to Low (1) and this can be attributed for the model estimating that lodgepole pine regeneration would become established following thinning.

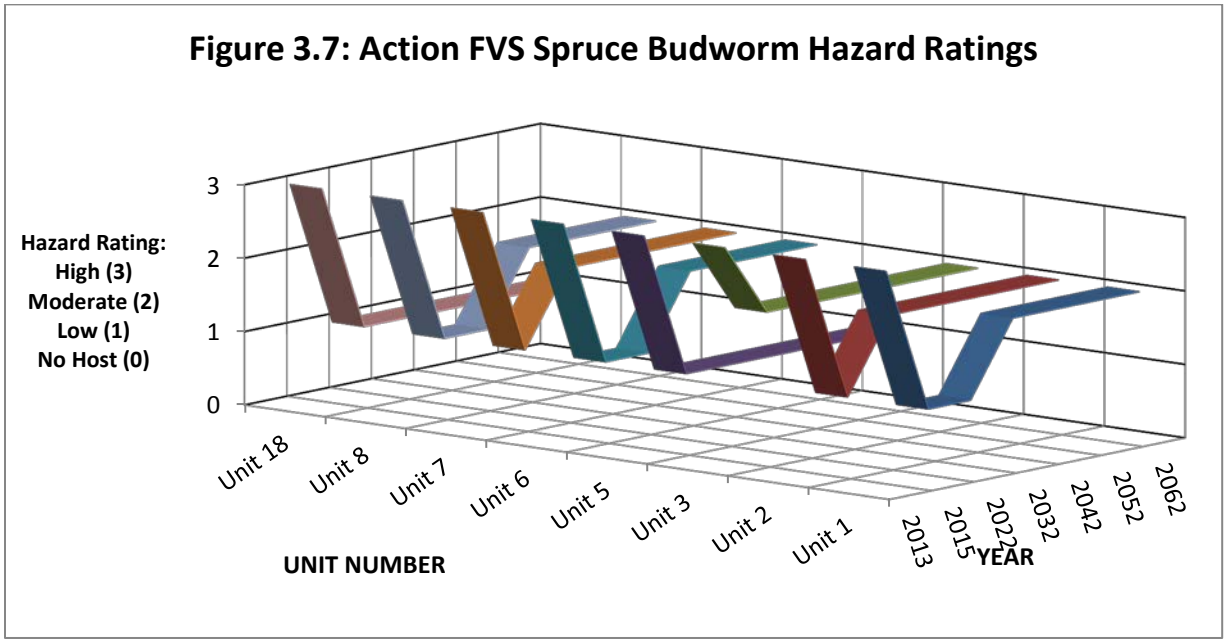


Figure 3.7depicts the simulation results of the effects to western spruce budworm hazard following the proposed action. Western spruce budworm is considered to be the most significant insect agent affecting forest vegetation within the analysis area. As can be seen above, hazard ratings pre-treatment are High (3) for all modeled units and decrease post-treatment for all units. Overtime, hazard in some units increases but never reaches High (3) again during the simulation period.

It should be noted that when stand density is reduced, residual trees can become more susceptible to windthrow. These effects can vary by tree species, tree size and age, residual stand density, and site. Strong south/southwest winds are relatively common in the analysis area and will need to be considered when developing prescriptive parameters. Some generalities can be made regarding the risk of damage associated with windthrow. Of the tree species likely to be reserved, Douglas-fir is considered to be more wind firm than Engelmann spruce or lodgepole pine primarily due to rooting habits (Burns and Honkala, 1990). Where high water tables or rocky soils exist, windthrow is more likely due to shallow rooting depths (Koch, 1996). Younger trees grown in dense stands are susceptible to windthrow when densities are reduced. Larger trees grown under low densities or where their crowns have been exposed to winds are relatively wind firm. The highest probability for windthrow associated with the action alternatives is with intermediate harvesting of lodgepole pine dominated stands (Koch, 1996). Suggestions to mitigate windthrow associated with lodgepole pine have been offered by Koch (1996), Schmidt and Barger (1986), and Alexander (1975). This information will be considered and incorporated where feasible during implementation of this project. Unit 18 is within the boundary of the ski area and used as a ski run, excessive windthrow is not acceptable. Additional strategies will be applied to minimize windthrow in this unit (such as grouping of residual trees).

Where windthrow does occur, increases in bark beetle populations are possible. Primarily Douglas-fir beetle, Spruce beetle, *Ips* spp. and Western Balsam Bark Beetle are attracted to these conditions. Wide spread windthrow is not expected and thus risks should be minimal.

Cumulative Effects

Past, current, and reasonably foreseeable actions on all lands within the analysis area were evaluated when considering the cumulative effects to forest vegetation associated with the action alternative. Past actions which have affected the vegetation resource include forest management and other activities within the analysis area. These activities are discussed in the existing conditions section of this report and provide the baseline vegetation conditions.

As with the cumulative effects discussion for the no action alternative, when considering the cumulative effects of the action alternatives, the direct and indirect effects previously discussed, in combination with current and reasonably foreseeable activities, apply. Activities which discernibly affect forest vegetation are also identified in the cumulative effects worksheet.

Insect Conditions - Western Spruce Budworm, Douglas-fir Beetle and Mountain Pine Beetle). Here again, reasonably foreseeable actions which may affect forest vegetation within the analysis area are those listed in the No Action Cumulative Effects section of this report and are associated with Bridger Bowl Ski Area. As stated, these actions will have similar effects to the direct and indirect effects of the proposed action in terms of insect conditions. Thinning stands and establishing a new cohort of regeneration will reduce susceptibility at both the stand and landscape levels. Applications of insecticides and pheromones are protection strategies which would also reduce impacts from forest insects.

REGULATORY FRAMEWORK AND CONSISTENCY

National Forest Management Act (NFMA)

NFMA and accompanying regulations require that several specific findings be documented at the project level and include the following;

Suitability for Timber Production

NFMA requires 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 or are planned to protect other multiple use values (such as the vegetation within and adjacent to the ski area) using the following criteria:

Meet the definition of forestland
Technological feasibility exists to protect soil productivity and watershed protection. Forest plan standards, project design criteria, and applicable Best Management practices will be used to protect these resource values.
There is reasonable assurance that lands can be restocked within five years of final harvest.
None of the areas considered for harvest have been withdrawn from timber production.

Maintenance of the Diversity of Plant and Animal Communities

Forest Plan goals, objectives, standards, and guidelines address maintaining a diversity of vegetation and habitats across the forest to meet a variety of wildlife species and to provide for sustained yield of timber products. In addition to applying this forest plan direction, project designs prescribed by the project wildlife biologist also address and animal community needs.

Appropriateness of Even-Aged Management and Optimality of Clearcutting

NFMA directs that clearcutting be used only where "it is determined to be the optimum method". Other even aged methods can be used where "determined to be appropriate". As stated in the treatment description section of this report no clearcutting is proposed with this project.

NFMA Findings for Vegetation Manipulation

All proposals that involve vegetation manipulation of tree cover for any purpose must comply with the following requirements.

Best suited to the multiple-use goals stated in the Forest Plan for the area with impact. All proposed treatments are consistent with multiple use Forest Plan direction and address the project purpose and need.

Assure that the lands can be adequately restocked within 5 years. No regeneration harvests are proposed with this project.

Not chosen because they will give the greatest dollar return. Although timber harvest associated with this project will generate revenue, interdisciplinary resources were considered in the development of this project.

Be chosen after considering the effects on residual trees and adjacent stands. The effects to residual trees and adjacent stands were considered in the interdisciplinary development of this project. Residual tree protection measures are included in the design criteria section of this report.

Be selected to avoid permanent impairment of site productivity and to ensure conservation of soil and water resources. The Soils and Water resources sections of the project file include protection and enhancement designs 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 management area direction, an interdisciplinary team considered all of these resources in the context of the surrounding landscape and this project as documented in the project file.

Be practical in terms of transportation and harvesting requirements and total costs of preparation, logging, and administration. Standard logging systems and log hauling is prescribed for this project and has been determined to be practical for this project.

Prior to harvest, stands of trees throughout the National Forest System shall generally have reached the culmination of mean annual increment of growth. Provided, That these standards shall not preclude the use of sound silvicultural practices, such as thinning or other stand

improvement measures: Provided further, That these standards shall not preclude the Secretary from salvage or sanitation harvesting of timber stands which are substantially damaged by fire, windthrow or other catastrophe, or which are in imminent danger from insect or disease attack. Treatments associated with this project are intermediate thinning and all treatments are designed to address insect issues.

Gallatin National Forest Plan Direction

Forest-wide Direction

The Forest Plan includes forest wide direction that relates to vegetation management. Much of this direction can be found in Appendix A-1 Silvicultural Systems; including direction regarding snags and down woody material.

Snags

The following are Forest Plan snag related objectives and the standards and guidelines for meeting the objectives:

- Objective A1: Provide and sustain an average of at least 30 snags per 10 acres in forested areas. Distribution should vary with some located along the edge of openings, some within the interior of harvest units, and some in clumps to meet the needs of a number of bird species. Emphasize snag retention in riparian areas, ridge tops, openings and areas of natural mortality.
    - Standard A1a: For harvest units not scheduled for broadcast burning: During timber sale layout, designate for leave an average of 30 snags (greater than 18 ft. in height and greater than 10 inch DBH) per 10 acres within harvest units. If there are not sufficient dead trees meeting this size criteria, the largest available dead trees will be left as snags.
    - Standard A1b: For harvest units not scheduled for broadcast burning: During timber sale layout, designate for leave an average of 30 live snag replacement trees per 10 acres within harvest units. For Douglas fir and Subalpine fir on rocky or shallow soils designate 60 trees per 10 acres as replacement trees.
- Objective A2: Protect snags, purposefully retained for wildlife use, from loss to firewood cutting. Emphasize snag retention in areas away from easy access for firewood cutting.
    - Guideline A2a: During timber sale layout, mark all designated snags and replacement trees that could be easily accessed by firewood cutters.

Down Woody Material

The following are Forest Plan snag related goals and the standards and guidelines for meeting the goals:

- GOAL A: Maintain sufficient down woody debris habitat components to accommodate the needs of wildlife species in conjunction with the timber harvest program.

- Standard A1a: In timber sale contracts, require that a minimum of fifteen tons per acre of three-inch diameter or larger debris (if available) be left scattered after machine site preparation and/or hazard reduction within harvest units.

- Standard A1b: In timber sale contracts where machine piling is specified, prohibit windrowing of dead and down wood debris.

Project design criteria will address both snags and down woody material standards.

Also of note is forest wide direction related to vegetative diversity. This standard states:

In order to achieve size and age diversity of vegetation, the Forest will strive to develop the following successional stages in timber compartments containing suitable timber:

Successional Stage	***Minimum % of Area***
Grass-forb	*10*
Seedlings	*10*
Saplings	*10*
Pole	*10*
Mature	*10*
Old Growth	*10*

Activities associated with this project will have little effect on successional stages. No treatments are proposed in seedling, sapling, pole, or Old Growth units. Based on treatment design, it is not expected that post-treatment conditions would preclude units from meeting the minimum Green et al. old growth criteria found in Appendix B in the future. Treatment areas fall into the mature successional stage and this successional stage is not expected to shift following treatment. That is, units will be dominated by trees >10" both pre-and post-treatment. At the Forest level, the Forest strives to achieve vegetative diversity through an integrated current and out-year vegetation management program of work.

Management Area Direction. Activities proposed with this project are located within the following management areas (MA):

MA 2 (~ 61 acres) – Areas of Bridger Bowl and Big Sky ski areas under special use permit.

MA 11 (~ 180 acres) – forested big game habitat available for timber harvest.

MA 99 (~ 1 acre) - lands acquired by the Gallatin National Forest and are adjacent to the above management areas.

All planned activities are consistent with forest wide and management area direction as discussed.

Forest Service Manual and Handbook

The Forest Service Handbook 2409.17 *Silvicultural Practices* direction was referenced and applied to the development of this project.

DESIGN CRITERIA

Table 3.9: Management Requirements and Design Features

OBJECTIVE	TASK
Forest Vegetation (Leave Tree Protection and Damaged Residual Treatment)	The Forest Service would take all reasonable care to implement measures that avoid damage to the roots, bole and crown of trees to be reserved from cutting. No more than five percent of the trees designated to be reserved should be damaged beyond recover by operations. Any tree damaged beyond recovery (will die within one year due to damage) may be removed or otherwise treated by a contractor as instructed by the Forest Service.
Forest Vegetation (Down Woody Material)	Require that a minimum of fifteen tons per acre of three-inch diameter or larger debris (if available) be left scattered after machine site preparation and/or hazard reduction within harvest units.
Forest Vegetation (Snag Retention)	Designate for leave an average of 30 snags (greater than 18 ft. in height and greater than 10 inch DBH) per 10 acres within harvest units. If there are not sufficient dead trees meeting this size criteria, the largest available dead trees will be left as snags.

MONITORING

Table 3.10 : Summary of Monitoring Activities

FOREST VEGETATION	
Develop NEPA to Implementation crosswalk	Assure layout complies with NEPA decision
Marking Guide Compliance	Assure marking guide compliance
Review contract prior to advertisement	Assure project implementation complies with the NEPA decision
Monitor and oversee vegetation treatments throughout and post operations (achieve through sale administration and "Post Treatment Vegetation Monitoring " exams (FACTS Code 4346)	Assure compliance with contract specifications and that treatment objectives are achieved

CUMULATIVE EFFECTS

Past, Present, & Reasonably Foreseeable Future Actions:

Following are the past, present and reasonably foreseeable future actions occurring in the analysis area that may have potential cumulative effects with the South Bridger Interface proposal.

Timber Harvest on FS and Adjacent Private Land:

See Existing Disturbance – Forest Management Section and cumulative effects for no action alternative.

Past actions which have affected the vegetation resource include past harvests and other forest management activities within the analysis area. These activities have established the existing vegetation conditions discussed and provide the baseline vegetation conditions. As such, they have been incorporated from a cumulative stand point. As listed above some reasonably foreseeable harvesting and

silvicultural treatments associated with the Bridger Bowl Ski Area are possible. The potential effects of these activities to the forest vegetation resource are discussed above.

Insect Control Activities:

Within the Bridger Bowl permitted ski area included the following: attaching pheromones such as verbenone and MCH on individual trees to discourage attacks from mountain pine beetle and Douglas-fir beetles during years with high insect populations. The pheromones do not kill the insects; rather they cause the insect to avoid the immediate area. Since this treatment only protects the immediate area, only high valued trees and trees at high risk to the insects are targeted for pheromone treatments. Treatments are only effective for a short time, usually less than a couple of months. Pheromones have been used in this area for the last ten years or more, and are expected to continue into the future if insect populations remain high.

Other insect control activities have included the application of Bt (*Bacillus thuringiensis*) a naturally occurring soil dwelling bacterium which is used to reduce spruce budworm defoliation on Douglas-fir trees and subalpine fir. One treatment occurred in 2010, treatment effectiveness on budworm is very short term, usually less than a couple of weeks, so the timing of application is critical. If the budworm population remains high, future applications may occur.

Additionally, trees that are dead or dying and adjacent to ski runs are removed from the ski area. This individual tree removal of hazard trees has been occurring for the past 10 years or more, and expected to continue into the foreseeable future. The number of trees removed each year is variable and depends on the severity of insect outbreak.

No carbaryl has been sprayed in Bridger Bowl or in the project area.

These activities would affect forest vegetation and specifically relate to insect conditions. These activities would be positive in terms of reducing impacts to forests and can be considered components of a protection strategy.

Bridger Bowl Ski Area:

The commercial ski resort is under special use permit with the Gallatin NF. The 2005 Bridger Bowl Master Development Plan EIS expanded the special use area into Slushman Drainage (337 acres) and into Bradly Meadow (274 acres), and construct 16 new trails.

The ski area is busy year around, with winter skiing from November to April, numerous special events in the off season, facilities maintenance activities in the summer / fall months, and hiking / mountain biking.

Aside from the forest management activities previously discussed, expansion of the ski area would affect forest vegetation. Effects would primarily be to forest composition and structure. Clearing of forest areas for ski trails would reduce the amount of forest cover and the corresponding successional stage of cleared areas. As stated, the ski area boundary is exempt from meeting the successional stage/old growth forest plan standard. Therefore, it is possible that some old growth forests would be impacted. Species composition may be altered through selection of reserve tree species and also through the potential establishment of seedlings. Recreational use at Bridger Bowl Ski Area will not inherently affect forest vegetation.

Pine Creek Cattle Allotment:

The allotment has been in place for more than 20 years and expected to continue into the foreseeable future. The allotment has traditionally involved a 2 pasture deferred rotation system, 46 cow calf pair, between July 1 and August 15th for one pasture then August 16th to September 30th. The north pasture over laps proposed units in Section 6. The northern fence relies on natural barrier from thick trees to be effective, but the fences are not directly adjacent to any of the proposed units. The south unit is south of Pine Creek and not near any of the harvest units. A map of the Pine Creek Allotment and the proposed harvest units is in the project file.

Where the northern pasture overlaps with proposed units, it is possible that some affects could occur. Principally these effects would be damage to tree seedlings. Trampling of seedlings by cattle could occur. However, treatments are not regeneration treatments

In summary, the findings of this analysis conclude that all past, current, and reasonably foreseeable activities within the project area would not cumulatively alter the findings of the direct and indirect effects to Forest Vegetation disclosed above. Although some current and reasonably foreseeable activities would measurably affect forest vegetation; they were not of sufficient magnitude to create negative trends or threats to the overall Forest Vegetation resource.

FIRE - FUELS

ISSUES

As stated in Chapter 1 of this EA, the proposed actions include thinning up to 250 acres of mature forest vegetation, followed by burning of machine and hand-piled slashed debris. During project development, several issues and concerns regarding existing and post-thinning fuel conditions were raised:

- What is the current standing and down woody fuel amounts and configurations associated with the forested stands affected by insect activity?
- What is the potential wildland fire type and behavior to be expected, and the potential for impacts to adjacent wildland urban interface areas (WUI) – specifically Bridger Bowl and surrounding private land inholdings?

The influences and modifying forces of topography, fuel condition (amount and configuration), and weather determine fire behavior. The analysis area has a wide range of vegetative, topographical and weather attributes that can support fire behavior of low, moderate and high intensity.

The project area is located within wildland urban interface (WUI) as defined in the Gallatin County Community Wildfire Protection Plan (GCCWPP-2006), and is bordered by private property to the east, and Bridger Bowl to the north. Firefighter and public safety are the number one issues for fighting wildland fires. Wildland fire suppression in WUI can be uniquely hazardous; hazards may include access (or lack thereof), power lines, propane tanks, and septic systems to name a few. Even though many of the adjacent private land owners have thinned their forest vegetation, there is always a possibility of a fire start moving off private property onto the Forest or vice versa. Existing heavy standing dead and down fuels could support a fire start that could transition from a ground fire into a crown fire. Crown fires could be difficult for ground resources to suppress with direct attack, and could lead into indirect attack and/or aerial suppression.

This analysis assesses the effects of no action and proposed action using the following indicators:

- Fuels models to characterize fire behavior (flame lengths, fire line intensity, surface v. crown fires)

ANALYSIS AREA

Spatial Bounds

Timber compartments are used to describe spatial bounds. The proposed project area is within timber compartment 504. This compartment is 7,750 acres which is large enough to show the past disturbances and treatments that may have affected the project area. This boundary, includes the majority of the Bridger Bowl Ski Area permit boundary (southern side adjacent to the project), and also includes some adjacent private lands.

Temporal Bounds

The temporal bounds of this analysis are designed to capture the direct, indirect, and cumulative effects of the alternatives to fire and fuels resource within the analysis area. The temporal bounds are 15 to 20 years for the fire and fuels resource. The rational is that the vegetation could take that amount of time to regrow to the similar vegetation cover that exists.

In general, where intermediate treatments are proposed an effects time frame of 15-20 years is estimated. After this length of time it is believed that, in the absence of stand replacing disturbance or additional treatments, natural forest succession processes would alter post-treatment stand conditions. This is due to accumulation of surface fuels, height growth of advanced regeneration, expansion of residual tree crowns, and individual tree mortality. Some effects, such as shifts in species composition and large down woody material, could last even longer.

Methods

The fuels specialist conducted site visits to verify the current vegetation and existing standing and down woody fuel conditions. Using the Photo Guide for Appraising Downed Woody fuels in Montana Forests (Photo Guide) (Fisher, 1991), the fuels specialist then compared the photo guide to the existing condition, and determined fuel loading (tons per acre of coarse woody debris [CWD]) and associated fuel models for the project area.

Computer programs, Fire-Family Plus and Fire Statistics System (FIRESTAT), were used to determine the recent fire history, which showed the Flaming Arrow Fire (2009) and Bostwick Fire (1991) burned within and/or adjacent to the analysis area (refer to fire history maps in Appendix B).

The Behave Plus fire modeling system (computer based program) was used to model fire behavior for the no action and proposed action alternatives. Behave Plus is a collection of mathematical models that describe fire and the fire environment (Andrews, 2009). The models were run using fuel models associated with Douglas fir –mix and Lodgepole pine-mix. The Behave program takes into consideration factors such as fuel models, down and dead woody debris, predicted weather, crown bulk density, surface fuel, and crown base height to estimate fire behavior. For detailed information on how fire behavior influences the decision on appropriate fire suppression actions, refer to the Fire and Fuels Analysis (Anderson 2014) found in the project file.

Aids to Determining Fuel Models for Estimating Fire Behavior, Hal E. Anderson (1982). This publication was used as a guide in estimating fuel models when walking through and analyzing the units. It describes 13 different fuel models, broken down into four groups of grasses, brush, timber and slash. The differences in fire behavior among these groups are basically related to the fuel load and its distribution among the fuel particle size classes. There is also photo guides within this publication.

The Effects of thinning and similar stand treatment on fire behavior in Western Forest, Graham (1999). This publication was used as a reference for fire behavior and thinning treatments and to verify the importance of treating the activity created fuels.

The information gathered from site visits, fire history, Behave modeling, and information about types of fire behavior was used to assess risk to public and firefighter safety for no action and the proposed action.

AFFECTED ENVIRONMENT

Fire Behavior & Fire Regimes

The influences and modifying forces of topography, fuel, and weather determine fire behavior. The analysis area has a wide range of vegetative, topographical and weather attributes that can support fire behavior of low, moderate and high intensity. The vegetation consists of mature and over-mature stands of Douglas-fir and lodepole pine that are not sustainable over the long-term. Douglas-fir have experienced epidemic levels of mortality from western spruce budworm. In addition, mountain pine beetle has killed about half of the lodgepole in mixed stands. The elevation, topography and aspects within the analysis vary. There are elevations from 6,100 feet up to 9,000 feet with slopes range from 20% to 90% and aspects of east, northeast and south east. The topography has a major influence on wind speed and direction. The local weather systems usually approach from the south and winds can be unpredictable give the local terrain.

Areas of similar fire severity, frequency, size, and pattern have a similar fire regime (Brown, 2000; Long, 1998). A natural fire regime is a general classification of the role fire would play across a landscape in the absence of modern human mechanical intervention but including the influence of aboriginal burning. Fire regimes and fire regime condition class (FRCC) were defined and mapped by Hardy and others (2001), Hann and Bunnell (2001), and Schmidt and others (2002). The five natural fire regimes are classified based on the average number of years between fires (fire frequency or Mean Fire Interval [MFI]) combined with the severity of the fire (the amount of vegetation replacement) and its effect on the dominant overstory vegetation. There are five fire regime groups found within the South Bridger Interface analysis area (2012 LANDFIRE Rapid Refresh data). Table 3.XXX summarizes theses fire regime groups.

Table 3.11: Fire Regime Groups

Group	Frequency	Severity	Severity description	% Analysis Area
I	0 – 35 years	Low / mixed	Generally low-severity fires replacing less than 25% of the dominant overstory vegetation; can include mixed-severity fires that replace up to 75% of the overstory	18
II	0 – 35 years	Replacement	High-severity fires replacing greater than 75% of the dominant overstory	1
III	35 – 200 years	Mixed / low	Generally mixed-severity; can also include low severity fires	22
IV	35 – 200 years	Replacement	High-severity fires	48
V	200+ years	Replacement / any severity	Generally replacement severity; can include any severity type in this frequency range	2

Fuel Condition

Based on field examinations, existing down, woody fuel loads range from 8 tons per acre to 42 tons per acre. This amount of downed woody debris is comparable to a Fuel Model 8 to 10, with the low end

representing FM 8 (8-12 t/a), and fuel model 10 exceeding 12 tons per acre. A Fuel Model 10 has higher potential to transition from surface to crown fire with a higher rate of spread and intensity, and may be more difficult to suppress. A wildfire in a FM 10 can be a high risk to public and firefighter safety. Fire behavior would be active to very active (refer to figure 3.8).

The project area is situated adjacent to Bridger Bowl Ski Area and numerous private land inholdings. Due to the proximity to WUI, any detection of fire triggers an immediate fire suppression response by the Forest Service and cooperating local fire departments. For example, in 2009, the Flaming Arrow Fire burned roughly 200 acres almost entirely on private land adjacent to the project area. This wildland fire burned in similar vegetation structure to the project area. The fire behavior was high intensity (moved from a ground fire to a crown fire). The Bostwick Fire burned 1,113 acres adjacent to analysis area, which also has similar vegetation and topography, and presented fire behavior of high intensity. Fortunately, much of the private land has been logged, thinned, dead and down woody material has been cleaned up and landscaped.

ENVIRONMENTAL CONSEQUENCES

No Action Alternative

Direct and Indirect Effects

No actions would occur under this alternative, allowing the processes of vegetation succession, standing and down woody fuel accumulation, and forest insect dynamics to continue in a similar fashion as they currently are. Firewood gathering, Christmas tree cutting, and continued wildfire suppression consistent with forest plan direction is expected, although limited due to access.

Table 3.12 shows Behave Plus run outputs for the possible fire behavior with the existing condition (i.e., no action alternative). The vegetation/fuels are represented in Fuel Model 10 (timber and understory) and 12 (natural fuel loadings and configurations equivalent to moderate logging slash). Fire behavior would be active to very active. Fires would have to be indirectly attacked with heavy equipment (dozers, excavators) and aerial suppression resources.

Table 3.12: Fire Behavior under No Action

Fuel Models	Rate of spread (ch/h) on ground	Fireline intensity (BTU's)	Flame Length (feet)	Type of fire/ROS	Fire behavior safety for fire fighters and public
10	7-12	197-297	5-8	Surface to Crown 39.9-62.7ch/hr	Fires are too intense for suppression actions using hand tools. Use of dozers, excavators and aerial firefighting resources are more effective. Accessibility could be challenging with these flame lengths and fireline intensity.
12	15-23	649-982	8-10	surface to Crown 118.3 ch/hr	Fire may present serious control problems: torching, crowning, and spotting, limiting suppression actions to use of heavy equipment and aerial firefighting resources. Accessibility could be challenging with these flame lengths and fireline intensity.

There could be a greater probability of the project area supporting high intensity wildland fire under the no action alternative. If current vegetation and fuel conditions (standing dead and dying trees, dead and down fuel loadings and increased ladder fuels) are allowed to persist and increase in magnitude, high fire intensity (high flame lengths, rapid rates of fire spread and long spotting distance for fire brands) could be expected. Smoke, fast moving fire spread and high flame lengths can be hazardous to firefighting resources and the public. There would be a high potential for wildland fire to move onto private land with structures.

Action Alternative

The proposed action would reduce existing tree densities to a target residual density ranging from 80 to 100 square feet of basal area per acre on average. Trees to be removed include sawtimber and pole timber sized trees that are dead and/or dying and infested with western spruce budworm, Douglas-fir beetle, and/or mountain pine beetle, as well as live trees to achieve an average spacing of 15-20 feet between crowns. Mechanical treatments and burning of machine and hand-piled woody material are designed to reduce project-generated fuels within the proposed treatment areas to 15 tons per acre (Gallatin Forest Plan, p. A-13). Mechanical treatments could include whole tree yarding and/or excavator piling. Fuel accumulations at landings would be addressed through burning, chipping/masticating, and/or removal from National Forest lands.

Direct and Indirect Effects

Depending on the type, intensity, and extent of thinning, or other treatments applied, fire behavior can generally be improved (less severe and intense) or exacerbated within the proposed project area. Thinning in general would have a beneficial effect of lowering crown bulk densities, increasing crown base heights, and redistribute fuel loads significantly, thus decreasing fire intensities if the surface fuels are treated (Graham, 1999; Graham, 2004).

Table 3.13 shows Behave Plus run outputs for the possible fire behavior post treatment. The vegetation/fuels conditions are represented with a Fuel model 8 (timber and understory). Fire behavior is more likely to remain a surface fire with lower flame lengths and lower intensity. There is a smaller chance of transitioning to a crown fire compared FM 10 and 12 under no action.

Table 3.13: Fire Behavior under the Action Alternative

Fuel Models	Rate of spread (ch/h) on ground	Fireline intensity (BTU's)	Flame Length (feet)	Type of fire/ROS	Fire behavior, suppression , safety for fire fighters and public
8	1.8-3.1	7-12	1-3	surface	Fires can generally be approached/managed at the head or flanks by firefighter using hand tools. Handline construction may hold fire spread. Accessibility would be less difficult with these lowered flame lengths and fireline intensity.

Within the treated areas, there would be less chance of intense fire behavior during a wildland fire event, which may result in a safer working environment for suppressing wildland fire compared to no action. The initial management response to a wildland fire exhibiting lower fireline intensity, (FM 8 fuel conditions, for example), can be more rapid, with the fire generally kept smaller in size, thus reducing the chance of it growing into a crown fire. For the public there will be less of a chance of a high intensity wildland fire and heavy smoke threatening or impacting there recreational use activities, access, egress or private property.

Monitoring

The fuel management specialist or fire management personnel will be on-site to assist in determining the placement of machine and/or hand piles within treatment units for efficiency of burning. The fuel management specialist or fire management personnel will monitor the curing (drying out) of the piles and recommend when they should be burned. The fuel treatment specialist will monitor smoke during pile burning. Areas that have been burned will be monitored and treated if noxious weed growth is discovered.

Cumulative Effects

Past, Present, & Reasonably Foreseeable Future Actions:

1. **Timber Harvest on FS and adjacent private land –** Past harvest on FS land occurred in the 60s to the 70s, and consisted of mostly clear-cuts. In the 1990s and 2000s most of the adjacent private lands were harvested, consisting of individual tree selection.

Past harvest areas on NFS lands provide a changed vegetation pattern, both in terms of species type, size class and continuity across the landscape within the Bridger Canyon corridor. As such, the potential future wildland fire events may vary in fire behavior and spread depending on fuels and vegetation conditions, the age and size of new growth, the standing dead and down woody debris accumulations. Those older harvested areas may have little dead and down fuel loading which would not support a high intensity fire. The past harvest areas could act as fuels breaks for areas of the Bridger Canyon. Under normal weather conditions, a rapid moving wildland fire may be modified from a high intensity crown fire to a moderate surface fire once it reaches these older harvest units. These areas may have a lower fire behavior than the areas that have not had logging or thinning.

Firewood gathering, Christmas tree cutting, and continued wildfire suppression consistent with forest plan direction is expected, although limited due to access.

2. ***B*idger Bowl Ski area** – The commercial ski resort is under special use permit with the Gallatin National Forest. The 2005 Bridger Bowl Master Development Plan EIS authorizes expanding the special use area into Slushman Drainage (337 acres) and into Bradley Meadow (274 acres). The ski area is busy year around, with winter skiing from November to April, numerous special events in the off season, facilities maintenance activities in the summer / fall months, and hiking / mountain biking.

With human activity during the fire season months (May through October) there is always a possibility of human caused wildland fire starts. There is no difference between the no action or proposed action alternatives.

3. **Other recreation –** hiking trails, mountain biking, hunting. There are a number of user created trails around the Bridger Bowl Ski area (for mountain biking and hiking). These trails are used frequently in the summer and fall.

With human activity during the fire season months (May through October) there is always a possibility of human caused wildland fire starts. There is no difference between the no action or proposed action alternatives.

4. **Invasive Weeds control projects -** Both the Forest Service and Bridger Bowl Inc. have treated weeds in the project area for more than 10 years. Treatments involve spot herbicide applications and hand pulling. The most common weeds are Canada thistle, houndstongue, spotted knapweed and common tansy. Past treatments have been very effective and have resulted in a low weed density (meaning there are now only individual plants in isolated locations).

Landings and burn piles that have been burned could support noxious weed growth and spread. It is important that these areas that have been burned are monitored and treated if there is noxious weed growth. Refer to the monitoring section described above and in Chapter 2.

REGULATORY FRAMEWORK & CONSISTENCY

Gallatin Forest Plan:

The Gallatin National Forest Plan (1987), has the following goals, objectives and standards statements pertaining to the use of fire for managing dead/down woody debris, Chapter II: Forest Management Direction.

Forest-Wide standards:

Standard A.13

- 15 tons per acre will be left after treatment activities for nongame wildlife species.

Standard E.14.

3. Activity created dead and down woody debris will be reduced to a level commensurate with risk analysis.
4. Treatment of natural fuel accumulations to support hazard reduction and management area goals will be continued

The SBI Project is consistent with these forest-wide standards. Activity-related fuel accumulations would be reduced to 15 tons per acre. Wildland fire starts in an area that have 15 tons/acre or less of 3-inch plus dead and down fuels will result in less fireline intensity.

Other Fire and Fuels Policy

The **2001 Review and Update of the 1995 Federal Wildland Fire Management Policy** states the following from the 1995 Report remain valid:

1. Protection of human life is the first priority in wildland fire management.

2. Every firefighter, every fire line supervisor, every fire manager, and every agency administrator takes positive action to ensure compliance with established safe firefighting practices.
3. Where wildland fire cannot be safely reintroduced because of hazardous fuel build-ups, some form of pretreatment must be considered, particularly in Wildland Urban Interface areas.

The South Bridger Interface Project is consistent with Federal Wildland Fire Management Policy. The proposed treatments will assist in lowering the potential high intensity fire behavior- within the treated areas, thus providing a safer working environment for wildland firefighters. The treatments will mitigate the fuel conditions created by insect-killed trees.

The Gallatin County Montana Wildfire Protection Plan (CWPP March 2006) defines Gallatin County wildland urban interface areas and Fire districts. This project is consistent with the goals and objectives as stated. "Protect life and human safety, prevent or limit the loss of property and restore and preserve and ecology. Identify WUI areas. Inform and educate public and private land owners of hazardous or potentially hazardous WUI areas".

CWPP plan was designed and reviewed by Gallatin County fire, rural fire departments and service areas, Gallatin National Forest, Montana state Department of Natural Resources and Conservation, and US Bureau of Land Management. The South Bridger Interface Project is consistent with the CWPP by proposing treatment that addresses goals of the CWPP.

Smoke Management

The majority of the legal entities in Montana and Idaho (including the Forest Service) that create particulates as a result of burning activities have formed the Montana/Idaho State Airshed Group. Through a Memorandum of Understanding, this group has established a smoke monitoring system that provides air quality predictions restrictions to its members. In Montana, the MTDEQ issues an annual burn permit to the Forest Service. Issuance of this permit is based on participation and compliance with burning restrictions set by the Montana/Idaho Airshed Group.

Smoke management is regulated through the State of Montana's Department of Environmental Quality (DEQ). The DEQ has established a protocol and monitors emission standards rates for all prescribed burns in affected airsheds. All prescribed burns (large-scale broadcast burning or pile burning) are input into a smoke database approximately 24 hours before ignition occurs and on the day of ignition. If emissions are likely to exceed the NAAQS rates, burning may not be approved, operations may cease, or implementation may be postponed. All prescribed machine and/or hand pile burning implemented within the analysis area would comply with the State Requirements for burning.

The proposed action includes whole tree yarding, chipping, and/or pile burning to reduce activity fuels. The smoke created by pile burning could potentially impact air quality in the surrounding area; however, the impacts to air quality are expected to be minimal as all burning will be done in compliance with DEQ regulations as described in the burn plan developed for this project.

Some of the piled activity-created fuels may be green material with high fuel moistures when piled and needing time to cure (dry out) for the best consumption. Depending on the materials' drying rate, it could take up to one full summer season after harvest to cure enough for appropriate burning and consumption to be achieved. Local fire department, agency fire personnel and the public will be advised when pile burning occurs.

This page was intentionally left blank.

ECONOMICS

INTRODUCTION

The management of the natural resources on the Gallatin National Forest (GNF) has the potential to affect local economies. People and economies are an important part of the ecosystem. Use of resources and recreational visitation to the national forests generate employment and income in the surrounding communities and counties, and generate revenues returned to the Federal treasury or used to fund additional on-the-ground activities to accomplish resource management objectives.

This report delineates the affected area and outlines methods to analyze the economic effects of the project, including the project feasibility, financial efficiency, and economic impacts. Project feasibility and financial efficiency relate to the costs and revenues of doing the action. Economic impacts relate to how the action affects the local economy in the surrounding area.

REGULATORY FRAMEWORK

The preparation of NEPA documents is guided by CEQ regulations for implementing NEPA [40 CFR 1500-1508]. NEPA requires that consequences to the human environment be analyzed and disclosed. The extent to which these environmental factors are analyzed and discussed is related to the nature of public comments received during scoping. 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].

OMB 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 and prescribes “present net value” as the criterion for the efficiency analysis.

The development of timber sale programs and individual timber sales is guided by agency direction found in Forest Service Manual (FSM) 2430. Forest Service Handbook (FSH) 2409.18 guides the financial and, if applicable, economic efficiency analysis for timber sales. Forest Service Handbook (FSH) 2409.19, chapter 60 – Stewardship Contracting, provides direction for applying revenues generated from timber sales to achieve restoration and land management activities.

Many of the costs and benefits associated with a project are not quantifiable in financial terms. For example, the benefit to wildlife from habitat improvement from a project is not quantifiable in financial terms. These costs and benefits are described qualitatively in the indicated resource sections of this document. Title 40, Code of Federal Regulations for NEPA (40 CFR 1502.23) indicates:

> For the purposes of complying with the Act, the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis and should not be when there are qualitative considerations.

Additionally, the Gallatin Forest Plan (page II-1) directs the Forest to “Provide a sustained yield of timber products and improve the productivity of timber growing lands.”

ANALYSIS AREA

The analysis area for the efficiency analysis is the project area. The approximately 1847-acre South Bridger project area is on the Bozeman District of the Gallatin National Forest and is located approximately 15 miles northeast of Bozeman in Gallatin County. All costs and revenues associated with the project decision were included in the analyses.

Timber management activities within the project area have the potential to impact the economic conditions of local communities and counties. To estimate the potential effect on jobs and income, a zone of influence (or economic impact area) was delineated. The impact area was chosen using suggested USDA Forest Service protocols for delineating economic impact areas (Meti Corp 2010), which bases the selection of the impact area on commuting data and where the timber is likely to be processed (log flows). This analysis suggested that Gallatin and Park Counties were the appropriate counties to include in the economic impact analysis area.

AFFECTED ENVIRONMENT

The combination of small towns and rural settings, along with people from a wide variety of backgrounds, provides a diverse social environment for the geographical region around the GNF, including the Bozeman Ranger District. Local residents pursue a wide variety of life-styles but many share a common theme—an orientation to the outdoors and natural resources. This is reflected in both vocational and recreational pursuits including employment in logging and milling operations, outfitter and guide businesses, hiking, hunting, fishing, camping, and many other recreational activities.

Timber, tourism, and agricultural industries are important to the economy of local areas. Despite the common concern for, and dependence on, natural resources within the local communities, social attitudes vary widely with respect to their management. Local residents hold a broad spectrum of perspectives and preferences ranging from complete preservation to maximum development and utilization of natural resources.

Socioeconomic measures used to describe the affected environment were obtained from the Headwater Economics' Economic Profile System – Human Dimensions Toolkit (EPS-HDT 2011), which compiles and summarizes primary population and economic data from a variety of government sources into a report. Key measures used in this report include land ownership, population, income, and economic diversity.

Land Ownership

A large percentage of the land area encompassed by two-county impact area, 47.9% is managed by various federal public agencies. The Forest Service manages the majority of that federal land or 43% percent of the land area within the impact area. Park County has the largest share of Federal public lands (52.5%), and Gallatin County has the smallest (43.1%). By comparison, 8.2% percent of the land area of the United States is managed by the Forest Service (figure 3.9).

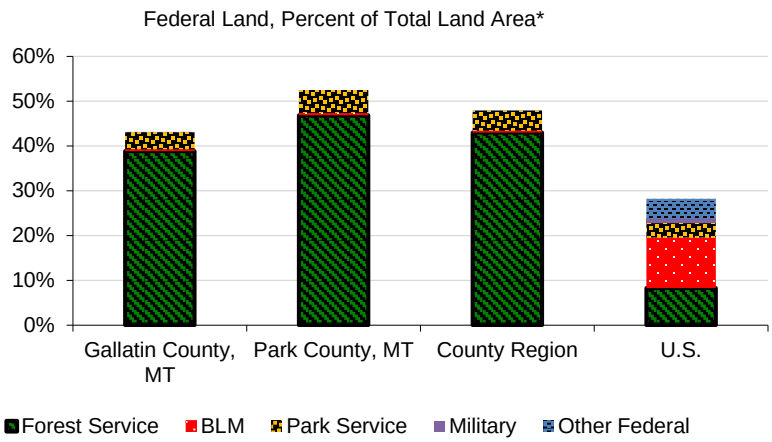


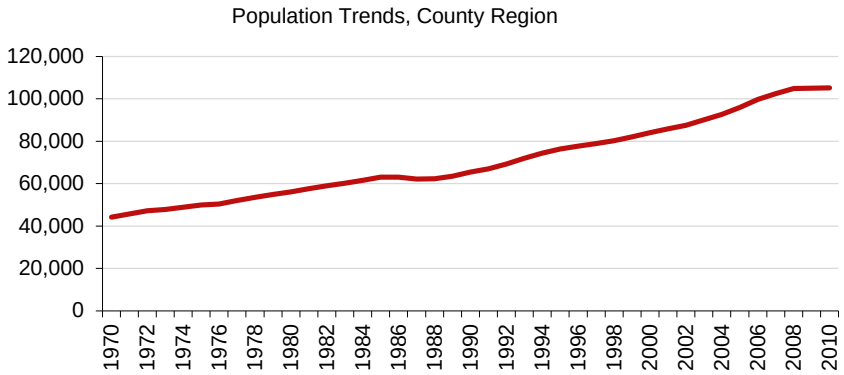
Figure 3.9: Land ownership, by percent of land area

Source: Land Ownership 2008, Montana Natural Heritage Program

Population, Employment, and Income

Population. From 1970 to 2010, the population of the Gallatin-Park County impact area grew from 44,119 to 105,203, a 138% increase. However, almost all of this growth was associated with Gallatin County. Gallatin County's population increased rather steadily during this period, growing from 32,754 in 1970 to 89,616 in 2010, an increase of 174% percent. During this same period, the population of Park County grew 37%, from 11,365 in 1970 to 15,587 in 2010 with both periods of rise and growth. The rate of growth in Gallatin County outpaced both the State of Montana (42.1 percent) and the Nation (51.8 percent). While the birth rate outpaced deaths in the county impact area; the rate of migration of people moving into the area, exceeded the birth rate as well. From 2000 to 2011, migration contributed to 73% of population growth in the county impact area.

Figure 3.10: County Impact Area, Population Trends



Employment. Employment in the two-county impact area increased by 56,431 jobs (312%), rising from 18,088 jobs in 1970 to 74,519 jobs in 2010. This was a higher rate of growth than either the state of Montana (107.2 %) or the nation (90.4 %). Wage and salary employment (people who work for someone else) in the county impact area grew from 14,148 to 52,021, a 268% increase, while proprietors (the self-employed) grew from 3,940 to 22,498, a 471% percent increase. In 2010 the three industry sectors with the largest number of jobs were Government (10,779 jobs), Retail trade (9,159 jobs) and Construction (6,367 jobs). From 2001 to 2010, the three industry sectors that added the most new jobs were Real estate and rental and leasing (1,831 new jobs), Professional and technical services (1,791 new jobs), and Health care and social assistance (1,474 new jobs).

EPS-HDT (EPS-HDT 2011) describes commodity sectors as industrial sectors that have the potential to use Federal public lands for the extraction of commodities. Commodity sectors include timber, mining (including oil, gas, and coal), and agriculture. In 2010, agriculture was the largest component of commodity sector employment in the impact area, accounting for 2.2% percent of total jobs compared to 1.53% in the U.S. Timber accounted for only 1.0% of the commodity sector employment, with Park County leading the way with 2.1%. Timber employment in the U.S. accounts for 0.71% of employment. Mining accounted for even less commodity sector employment at 0.6%.

Currently, the service sector accounts for the majority of jobs created in the U.S. The service sector includes a wide variety of jobs, ranging from lower-wage occupations such as restaurant workers and retail store clerks to high-wage, high skilled occupations such as doctors and software developers. Some service sectors, such as utilities and architecture, are closely associated with goods-producing sectors. From 2001 to 2010, employment in services in the county impact area increased by 11,458 jobs, while employment in non-services increased by 61 jobs. In 2010, the top three service sectors in terms of employment were Retail Trade (9,159 jobs), Accommodation and food services (7,253 jobs), and Professional and technical services (6,081 jobs). In terms of growth, the three service sectors that had the most job growth from 2001 to 2010 were Real estate and rental and leasing (from 3,012 to 4,483 jobs, a 60.8% change); Professional and technical services (from 4,290 jobs to 6,081 jobs, a 41.7% change) and Health Care and Social Assistance (from 4,348 to 5,822 jobs, a 33.9% change).

Government employment is often an important component of the overall mix of jobs in an area, especially for rural economies. From 1970 to 2010, government employment in the impact area increased from 4,474 to 10,779 jobs, an increase of 140.9%. During this same period, non-government employment grew from 13,618 to 63,434 jobs, an increase of 365.8%. Due to the much larger growth in non-government employment during this period, government employment's share of the total went from 24.7% of total employment in 1970 to 14.5% in 2010. In 2010, Gallatin County had the largest percent of total jobs in government (15.3%), and Park County had the smallest (8.9%).

In 2011, the unemployment rate in the impact area was 6.3 percent. Park County had the highest unemployment rate (7.5%), and Gallatin County had the lowest (6.1%). Since 1990, the annual unemployment rate for the impact area ranged from a low of 2.4% in 2006 to a high of 6.8% in 2010.

Income. Labor income and total personal income are often used as proxies for standard of living. Total personal income is comprised of labor earnings (employee compensation and proprietor income) and non-labor income. From 1970 to 2010, total personal income in the two county impact area grew from $630.7 million to $2,681 million (in real terms), a 325% increase. From 2000 to 2010 Gallatin County had the largest percent increase in personal income (418%) and Park County had the smallest (55%). Non-labor income consists of dividends, interest and rent (collectively often referred to as money earned from investments), and transfer payments (payments from governments to individuals, such a welfare; and age-related payments including retirement, Medicare, and disability insurance). Non-labor income is an

important part of many economies and is often both the largest single component of personal income and the source of most of the growth. From 1970 to 2010, dividends, interest, and rent grew from $159 million to $962 million, an increase of 504%. During that same timeframe, transfer payments grew from $71 million to $524 million, an increase of 638%. From 1970 to 2010, non-labor personal income increased from 28.2% in 1970 to 38.3% in 2010, for the two county impact area. Labor income grew from $586 million to $2,390 million (in real terms), a 308% increase. In 2010, dividends, interest and rent were the largest source of non-labor income in the economic impact area (24.8% of total personal income), and Transfer payments were the smallest (13.5%).

Average earnings are often used as an indicator of the quality of local employment, in terms of high-wage jobs. From 1970 to 2010, average earnings per job in the two county impact area increased 3% from $34,871 to $35,978 (in real terms). In 2010 Gallatin County had the highest average earnings per job in the impact area, $37,233, while Park County had the lowest $27,102. In 2011 mining jobs paid the highest wages ($61,262) and leisure and hospitality jobs paid the lowest ($16,432). Manufacturing, including forest products, paid $38,503.

ENVIRONMENTAL CONSEQUENCES

Economic Analysis Methodology

The economic measures used for this report are project feasibility and project costs. These measures, including methodologies, are described below.

Project feasibility is used to determine if a project is feasible, that is, will it sell, given current market conditions. The determination of feasibility relies on a residual value (stumpage = revenues - 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 that the project is not feasible, the project may need to be modified. Infeasibility indicates an increased risk that the project may not attract bids and may not be implemented.

Financial efficiency provides information relevant to the future financial position of the program if the project is implemented. Financial efficiency considers anticipated costs and revenues that are part of Forest Service monetary transactions. Present net value (PNV) is used as an indicator of financial efficiency and presents one tool to be used in conjunction with many other factors in the decision-making process. PNV 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 PNV indicates that the alternative is financially efficient. 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 document.

Management of the forest is expected to yield positive benefits, but not necessarily financial benefits. Costs for various vegetation, recreation, wildlife, road and burning activities are based on recent experienced costs and professional estimates. Non-harvest related costs are included in the PNV analysis, but they are not included in appraised timber value.

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 one to examine the effect of a change in one or several economic activities on an entire economy, all else constant. This examination is called impact analysis. The IMPLAN modeling system (MIG 2003) allows the user to build regional economic models of one or more counties for a particular year. The model for this analysis used the 2008 IMPLAN data. 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 the 1) processing of the timber volume from the project, and 2) dollars resulting from any restoration activities of the project into the local economy affected by the treatments proposed. 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. Together the direct and multiplier effects comprise the total economic impacts to the local economy.

The 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 (Morgan et al. 2007). This national data is broken into multi-state regions and is considered more accurate than that which is available from IMPLAN. The Northern Rockies BBER region (Montana and Idaho) is used for this analysis. The BBER data represents the results of mill censuses that correlate production, employment, and labor income. The economic impact area used for this analysis consists of Gallatin and Park counties in Montana.

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.

Project Feasibility

The estimation of project feasibility was based on a residual value appraisal model, which took into account logging system, timber species and quality, volume removed per acre, lumber market trends, costs for slash treatment, and the cost of specified roads, temporary roads and road maintenance. The predicted high bid is compared to the base rate, which in this case is $3.00/CCF (the legal minimum rate for sawtimber material). The predicted high bid and minimum rate are displayed in Table 2. The predicted high bid for the proposed alternative ($53.83/CCF) suggests that the project is likely to sell (feasible), since it exceeds the minimum rate. The revenue estimates from the feasibility analysis are used in the financial efficiency analysis discussed below.

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). Costs for sale preparation, sale administration, regeneration, and ecosystem restoration are included. All costs, timing, and amounts were developed by the specialists on the project's interdisciplinary team. The expected revenue is the corresponding predicted high bid from the transaction evidence appraisal equation times the amount of timber harvested. The PNV was calculated using Quicksilver, a program for economic analysis of long-term, on-the-ground

resource management projects (Vasievich et al. 2008). For more information on the values or costs, see the project file.

This analysis is not intended to be a comprehensive benefit-cost or PNV 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 sections of this report. For instance changes in fire risk are described in terms of changes in fire behavior, while fish and wildlife resource changes are described in terms of changes to habitat conditions.

Table 3.14 summarizes the project feasibility and financial efficiency, including the minimum rate, predicted high bid (or estimated stumpage value), total revenue and PNV calculations. Because all costs of the project are not related to the timber sale, two PNVs were calculated. One PNV indicates the financial efficiency of the timber sale, including all costs and revenues associated with the timber harvest and required design criteria. A second PNV includes all costs for the proposed action, including other activities not associated with the commercial harvest. A 4 percent discount rate was used over a period of 3 years (2014-2016), the estimated time required for full implementation of the project.

Table 3.14 indicates that the proposed alternative is financially efficient for the timber harvest and required design criteria, as well as for all activities. The PNV for the proposed action is $36,465.00 for the timber harvest and required design criteria and the same for all planned activities. The No Action Alternative would not harvest, implement BMPs on haul routes, return fire to the landscape or take other restorative actions and, therefore, incurs no costs.

The predicted high bid is the basis for the timber revenue estimate. The actual timber value will depend on the market when the timber is sold, and may be higher or lower than the predicted high bid. The analysis included a relatively low Western Wood Products Association (WWPA) average value per thousand board feet (MBF).

Table 3.14 – Project Feasibility and Financial Efficiency Summary (2013 dollars)

Category	Measure	No Action Alternative	Proposed Action
Timber Harvest Information	Acres Harvested	0	242
	Volume Harvested (CCF)	0	1,872
	Minimum Rate ($/CCF)	0	$3.00
	Predicted High Bid ($/CCF)	0	$53.83
	Total Revenue	0	$101,499.84
Timber Harvest & Required Design Criteria	Present Net Value	0	$36,465.00
Timber Harvest & All Other Planned Activities	Present Net Value	0	$36,465.00

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, such as effects on wildlife, impacts on local economies, and restoration of watersheds and vegetation. The decision maker takes many factors into account in making the decision.

Table 3.15 lists the costs included in the PNV analyses, which includes all estimated project costs except for those already included in the timber appraisal. Planning costs (NEPA) were not included in any of the alternatives since they are sunk costs at the point of alternative selection. Sale preparation costs of $13.50/CCF and sale administration costs of $4.50/CCF were included.

Table 3.15. Activity Costs Associated with Timber Harvest, Required Design Criteria, and Restoration (2013$)

Project Costs	No Action Alternative	Proposed Action
Sale Preparation*	0	$25,272
Sale Administration*	0	$8,424
Regeneration Exams*	0	$14,040
Weed Spraying and Monitoring*	0	$11,232
Fireline reconstruction**	0	$0.00
Prescribed burning**	0	$0.00
Slashing **	0	$0.00
Total, Timber-harvest and required design criteria costs	0	$56,741.00
Total, Timber-harvest and other planned activities	0	$56,741.00

*Associated with the timber sale, but not included in appraisal
**Not associated with the timber sale

Economic Impact Effects (Jobs and Labor Income)

Timber production from this proposed GNF project would have direct and indirect effects on local jobs and labor income. An input-output model, IMPLAN (Impact Analysis for Planning), was used to estimate effects on employment and labor income within the impact area.

For timber harvest, the direct employment and labor income response coefficients (e.g., jobs and labor income per million cubic feet) were derived by the University of Montana's Bureau of Business and Economic Research. The indirect and induced multiplier effects were estimated using the IMPLAN model for the economic impact area.

For restoration and reforestation activities, the direct, indirect and induced effects were derived using IMPLAN. The resulting direct, indirect and induced employment and labor income coefficients have been incorporated into a spreadsheet developed by the Regional Economist for the USFS, Northern Region.

The analysis calculated the jobs and labor income associated with timber harvest, reforestation, and restoration activities. In order to estimate jobs and labor income associated with timber harvest, the timber harvest levels were proportionally broken out by product type (see Table 3.16). In order to estimate jobs and labor income associated with reforestation and restoration activities, expenditures for these activities were developed by the resource specialists.

Table 3.16 – Proportion Timber Harvest by Product Type by Alternative

Product Type	Proposed Action
Sawmills	100
Log Homes	0
Post & Poles	0
Pulp	0

Table 3.17 displays both direct and total estimates for employment (part and full-time) and labor income that may be attributed to the proposed action. Since the expenditures occur over a three-year period, the estimated impacts of jobs and labor income would be spread out over the life of the project. Most of the timber harvest and wood processing jobs would occur over the first two years of the project. These are not new jobs or income, but rather jobs and income that can be attributed to this project. It is important to note that the proportion of the harvest designated as pulp was not included in the impact analysis since that material will most likely be exported out of the impact area. Since pulp is not being produced from this project, it is therefore not applicable.

Table 3.17 – Total Employment and Income (2010 dollars) Over the Life of the Project

Analysis Item	No Action Alternative	Proposed Action
Direct Employment	0	6
Indirect and Induced	0	6
Total Employment	0	12
Direct Labor Income (Thousands of $)	0	287
Indirect and Induced (Thousands of $)	0	194
Total Labor Income (Thousands of $)	0	481

Definitions:

1. Employment is the total full- and part-time wage, salaried, and self-employed jobs in the region.
2. Labor income includes the wages, salaries and benefits of workers who are paid by employers and income paid to proprietors.

Estimates in Table 5 indicate that the Proposed Action would maintain approximately 6 direct jobs spread over the life of the project. It is anticipated that the majority of the activity will be spread out over a three-year period, equating to an average of 2 direct jobs per year. These direct jobs would lead to an additional 6 indirect and induced jobs spread over the life of the project or roughly 2 jobs for each of the three years. All together, these jobs would provide roughly $287,000 of direct labor income and $481,000 in total labor income over the life of the project.

The analysis assumes the timber volume processed (with the exception of pulp) would occur within the designated impact area. However, if some of the timber were processed outside the region, then a portion of the jobs and income would be lost by this regional economy.

Environmental Justice and Civil Rights

Neither of the alternatives would restrict nor alter opportunities for subsistence hunting or fishing by Native American tribes. Tribes who may be affected by activities on the Gallatin National Forest are included on project mailing lists and have the opportunity to comment on project proposals.
This analysis shows that, overall, when all activities are considered, the proposed action would produce more jobs and income than the no-action alternative. It is unlikely, that implementation of the proposed action would adversely affect minority or low-income populations.

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. Many activities listed Chapter 2 the EA have the potential to contribute cumulatively to jobs and labor income provided by implementing this project.

HYDROLOGY

WATER QUALITY RELATED ISSUES

During project development, internal and external discussions revealed a number or issues and relating to water quality. These issues, which helped frame this water quality analysis, include increased sediment levels in streams, reduced stream channel stability, increase in water yield, increased peak flows, risk of rain on snow events, effects on identified water quality limited streams, effects upon wetlands and floodplains, and effectiveness of mitigation measures/Best Management Practices. Potential effects related to these issues include the following:

Water yield. The proposed action has the potential to increase water yield in the project area through reduced transpiration due to vegetation removal and increased drainage efficiency due to construction of temporary road segments. Significant increases in water yield can affect stream morphology and sedimentation.

Sediment Yield. Sediment yield in streams is a useful indicator of water quality, particularly with respect to stream channel stability and impacts on aquatic organisms which can be affected by excessive sedimentation.

Stream channel stability. Stream channel stability is an indicator of existing channel condition resiliency to disturbance.

Peak flows. Timber harvest, road building, and other land management activities have the potential to affect peak flows in streams by altering a variety of hydrological variables including interception, snowmelt rates, snowpack distribution, and runoff pathways. Significant increases in water yield can affect stream morphology and sedimentation.

Risk of rain on snow events. Field research in the Pacific Northwest has shown that timber harvest can increase the magnitude of peak flow due to rain-on-snow events. Significant increases in peak flows can affect stream morphology and sedimentation.

Effects on wetlands and floodplains. Forest management actions can result in detrimental impacts to wetlands and floodplains.

Effects on identified water quality listed streams. Forest management activities could potentially exacerbate identified existing water quality problems in streams within and downstream of the analysis area.

Detailed information relative to forest past land use in the project area which is not included in this report is located in the project record.

ANALYSIS AREA

Spatial and Temporal Bounds

The proposed project is located on the east side of the Bridger Mountain Range northeast of Bozeman, MT. Proposed action includes commercial sanitation harvest on up to 250 acres of tractor logging units and up to an associated 0.5 miles of temporary road construction. The area affected by the proposed

action is encompassed by three primary watersheds (Maynard Creek, Slushman Creek, and Pine Creek) and the upper portions of three smaller watersheds drained by un-named perennial tributaries to Bridger Creek. These un-named tributaries are identified as UNK2655, UNK2639, and UNK2605. A map of the streams and associated catchment basins that form the water quality analysis area is shown in Figure 3.11.

Water resources analysis included sediment modeling, water yield analysis, stream channel stability assessment, and consideration of effects upon floodplains and wetlands within the area affected by the proposed action. For the purpose of water resources analysis the spatial bounds of the analysis area were defined as the watersheds of the six streams mentioned above. The lower ends of the analysis area watersheds were located at the Gallatin National Forest boundary for five of the six streams per established protocol for sediment analysis accounting points. For the remaining stream (UNK2605), the lower end of the catchment area was located slightly east of the Forest Boundary, on private land, in order to more completely capture the effects of proposed action in that area. Defined as such, the watershed boundaries capture the effects of the proposed action with the exception of minor portions of Units 6 and 16. Both of these areas are located at ridgetop (or near-ridgetop) locations, are minor in size, and would be expected to have negligible effects on the results of the water resource effects analyses.

The temporal bounds used for water resources analysis included past, present, and reasonably foreseeable future activities and within the analysis area from 1966-2020 (see Facts record in project file).

METHODS

The following methods were used to assess potential water quality issues.

- Water yield. A water balance technique (the ECA Method) was utilized to calculate potential water yield increase.
- Sediment Yield. Sediment modelling using the R1R4 model was used to quantify potential effects on stream sediment yield.
- Stream channel stability. Existing stream channel stability and the potential effects of the proposed action on stream channel stability were analyzed based on field measurements of current stream conditions, stream channel classification, and on the likely effects of a potential increase in peak stream flows.
- Peak flows. The potential for the proposed action to affect peak flows in the analysis area was assessed based on details of the proposed action, available literature, and site characteristics.
- Risk of rain on snow events. This issue was assessed based on examination of available literature and on the role that rain-on-snow events have historically played in the analysis area.
- Effects on wetlands and floodplains. Wetlands and floodplains were identified and potential effects due to the proposed action were assessed based on proximity to proposed cutting units and expected effectiveness of mitigation measures.
- Effects on identified water quality listed streams. Predicted effects of the proposed actions were examined in conjunction with water bodies listed as impaired (and associated TMDL's) in order to assess the potential effects of the proposed action on water quality listed streams.

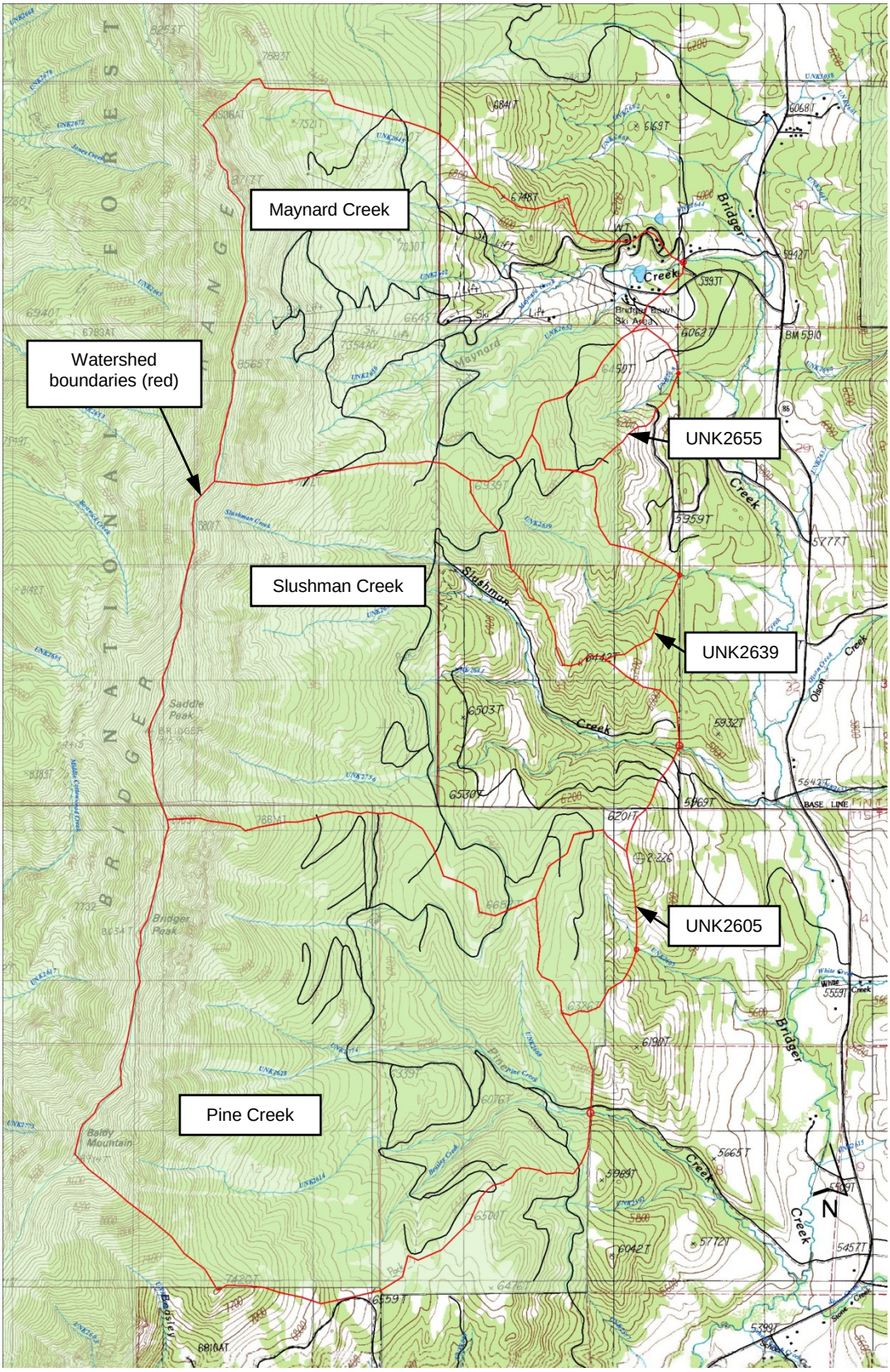


Figure 3.11: Project Area Watersheds

Assumptions

All water quality analyses included the assumption that all existing roads used in project implementation would be brought up to current maintenance standards appropriate to their road class prior to project implementation.

AFFECTED ENVIRONMENT

This section will discuss the historic factors affecting water quality and existing conditions within the analysis area. This information is useful in placing the proposed actions into context.

Historic Conditions

Historical conditions provide us with an idea of the condition of the assessment area at various points in time. However, it is important to remember they are limited by the availability and accuracy of historical information and do not necessarily identify desired conditions given today's ecological and social environment.

Historic Disturbances. Fire, mass wasting, and floods have likely been the most influential historic natural disturbances affecting water quality in the analysis area. Historic human actions most likely to have affected water quality within the analysis area in include the following:

- Private development including Bridger Bowl Ski Area development and operations. Activities have included land clearing, construction and maintenance activities, transportation system construction and maintenance, and vegetation alteration and removal.
- Timber harvest operations and associated construction/maintenance of associated transportation system on private and public lands.
- Cattle grazing on private and public land.

Existing Conditions

Using the methods described earlier, the existing condition of water quality within the analysis area was investigated. This section will discuss the existing conditions/levels of important water quality parameters.

The stream network within the assessment area consists primarily of Maynard Creek, Slushman Creek, and Pine Creek (Figure 1). In addition, three small unnamed streams drain catchment areas along the eastern boundary of the assessment area. These unnamed tributaries include one tributary to Maynard Creek (UNK2652), two tributaries to Bridger Creek (UNK2655 and UNK2639), and three tributaries to Slushman Creek (UNK2634, UNK2641, and UNK2756). Stream gradients range from over 30% in headwater areas to 8% near the assessment area boundary. All streams in the assessment area are ultimately tributary to Bridger Creek, which flows south through Bridger Canyon to the confluence with the East Fork of the Gallatin River approximately one mile north of Bozeman.

Water Yield

Average annual precipitation within the assessment area varies significantly with elevation, from about 27 inches at the mouth of Maynard Creek to about 50 inches at the crest of the Bridger Range. According

to information published by NOAA in 1973, rainfall intensities at lower elevations within the assessment area are 1.2 inches for a 2 year-6 hour event and 2 inches for a 25 year-6 hour event. Higher elevations have estimated rainfall intensity of 1.3 inches for a 2 year-6 hour event and 2.2 inches for a 25 year-6 hour event. Average annual snowfall varies from about 100 inches to 400 inches. Approximately 60 to 70 percent of the total annual precipitation occurs as snow. Annual hydrographs are sharply influenced by snowmelt with most of the runoff occurring as snowmelt during May and June and low flows occurring in February (USFS, 2005).

The ECA (equivalent clearcut area) water balance method was utilized to estimate effects on water yield due to past road construction, land clearing, and harvest activities in the assessment area watersheds. Estimated average annual water yields under "reference" (pre-human disturbance) conditions and under existing conditions are shown in Table 3.18.

Table 3.18
Existing Annual Water Yield in Analysis Area

Parameter	Maynard Creek	Slushman Creek	Pine Creek	UNK2655 Creek	UNK2639 Creek	UNK2605 Creek
Watershed Area (mi^2)	2.10	2.60	3.06	0.20	0.39	0.24
"Reference" Conditions Water Yield (acre ft./yr)	1205.5	1438.3	1683.1	96.0	187.5	114.0
Existing Conditions Water Yield (acre ft./yr)	1220.7	1448.8	1710.1	97.9	191.2	114.9
Existing % Above Reference	1.3%	0.7%	1.6%	2.0%	2.0%	0.8%

Under existing conditions, annual water yields in all six watersheds are elevated slightly above natural levels. This is because existing watershed developments (e.g., roads, parking lots, ski trails) are more efficient at conveying overland flow to the stream system than natural conditions and because past tree harvest and land clearing has reduced transpiration by vegetation. Increases in water yields due to existing land management activities and existing development in the watersheds are estimated to be within the range 0.7% to 2% percent (Table 3.18). Changes in annual water yield of less than 5-10% are considered too small to be measurable. Based on this analysis it was concluded that existing water yields within the assessment area are likely to be slightly higher than pre-disturbance water yields, but that any increases in water yields are below detectable levels.

Sediment Yield

Sediment yield in streams is a useful indicator of water quality, particularly with respect to stream channel stability and impacts on aquatic organisms. Annual sediment yields for the three major streams (Maynard, Slushman, and Pine Creeks) and three un-named perennial streams draining the assessment area were evaluated using the R1R4 sediment model (Cline et al. 1981).

Sediment yields estimated by the model took into account the distribution of land types and associated basic erosion rates in each soil type assuming average annual precipitation. Effects of past actions on sediment yield were incorporated based on a number of input variables describing the type of action, aerial extent, associated mitigation measures, land types affected, year(s) the past actions took place, and location of the actions within the watershed.

To assess compliance with forest-wide sediment standards, the analysis incorporated a comparison between the "reference" sediment yield in tons/year and the estimated existing sediment yield. The "reference" sediment yield represents annual watershed sediment yield under pre-management conditions (no antropogenic disturbance past or present), and thus represents a baseline condition based on land types within the watershed and associated basic erosion rates. Using extensive sediment data collected on Gallatin National Forest streams, the R1R4 model has been calibrated to calculate "reference" sediment yield for all Gallatin National Forest watersheds.

Existing sediment yield takes into account all known past human activities/impacts within the assessment area. In order to protect water quality and aquatic species, Gallatin National Forest standards set an allowable limit of 50% above reference level for sediment in Class B streams (all streams in the assessment area are Class B streams).

For each watershed the reference sediment yield and existing sediment yield (year 2013) are shown in Table 3.19. In year 2013 sediment yields in assessment area streams range between 8% and 22% above reference levels, with Maynard Creek being the most highly impacted due to clearing and roads associated with Bridger Bowl Ski Area (Table 3.19).

Table 3.19: Existing Conditions Sediment Yield in Watersheds within the Assessment Area

Parameter	Maynard Creek	Slushman Creek	Pine Creek	UNK2655 Creek	UNK2639 Creek	UNK2605 Creek
Reference sediment yield (tons/year)	116.3	123.4	153.0	5.5	10.9	8.1
Existing (2013) sediment yield (tons/year)	142.5	136.0	171.9	6.1	11.9	8.8
Percent above "reference" under existing conditions (2013)	22.5%	10.3%	11.5%	11.2%	9.4%	8.2%

During late May 2011 much of western Montana including Gallatin National Forest was impacted by significant flooding. Localized flood magnitude varied, with the west side of the Forest (including the Bridger Mountains) generally experiencing flood events in the range 25-yr to 50-yr return period. On five of the sixassessment area streams (Maynard Creek, Slushman Creek, and the three un-named tributaries of Bridger Creek), observed effects of the 2011 flood primarily included sediment deposits on the floodplain, woody debris jams/deposits, and cut banks. Due to the minor and infrequent nature of the observed cut banks, the observed colonization of cut banks and sediment deposits by stabilizing vegetation, and the generally excellent vigor and density of stream bank vegetation, effects of the 2011 flood on existing and future sediment yield in these streams was assumed to be insignificant and predicted sediment yields shown in Table 3.19 were considered to be accurate.

On Pine Creek significant, continuous, and relatively high (2-4 foot tall) cut banks were observed at a number of locations. These factors indicate that sediment yield on this creek may remain affected by 2011 flood impacts and may continue to be affected in the future as channel form adjusts toward greater stability and streamside vegetative cover becomes more robust. The R1R4 model used in the sediment yield analysis does not have the capability to calculate sediment load associated with stream channels that

have been significantly affected by large, recent flood events. For this reason, the modeled sediment yield for existing conditions shown in Table 3.19 may underestimate the existing condition sediment yield. However, since the R1R4 model cannot account for the contribution that the 2011 flood effects may make towards existing sediment yield, the extent to which the model may be underestimating that sediment yield, if any, was not known.

Based on R1R4 sediment model analysis, sediment yield resulting from the past actions is far below the 50-percent-above-reference rates allowable under GNF guidelines for Class B streams. For Maynard Creek, Slushman Creek, and the three un-named creeks within the Project Area, field observations and data indicated that the effects of the 2011 flood on existing and future sediment yield in these streams is insignificant, and predicted sediment yields determined by the R1R4 sediment model were accepted as accurate. Due to sediment model limitations, potential effects of the 2011 flood on Pine Creek sediment yield (measured as "percent-above-reference") could not be determined with certainty.

Stream Channel Stability

Streams within the Project Area were identified using USGS topographic maps and field reviews. Perennial streams which exit Forest Service Lands were surveyed at the property boundary between National Forest land and adjacent private land. Stream channel stability is an indicator of existing stream condition and resilience of a channel to disturbance and, as such, represents an indicator of water quality with respect to sedimentation. Channel stability was assessed using a method established by Pfankuch (1975). The results of the Pfankuch channel stability assessments are presented in Table 3.20. In accordance with the Phankuch protocol, a higher score indicates lower stability. Stream stability scores less than 38 indicate "excellent" stability, 39 to 76 indicate "good" stability, 77 to 114 indicate "fair" stability, and over 115 indicate "poor" stability.

Streams were also classified using geomorphic definitions as described in the Rosgen Stream Classification system (Rosgen, 1996) and Montgomery and Buffington (1997). Stream channel class is an indicator of existing stream condition and can be utilized to predict channel response to disturbance. The Rosgen and Montgomery/Buffington channel classes for stream survey sites are shown in Table 3.20.

Table 3.20 - Stream Channel Stability Assessment Data

Stream	Catchment Area Above Survey Site (sq. miles)	Channel Gradient (%)	Rosgen Channel Type	Montgomery Buffington Channel Type	Pfankuch Stability Rating Score	Pfankuch Stability Rating Class
Maynard Creek	0.6	8	A2/A3	Cascade	65	GOOD
UNK2652 (tributary to Maynard Cr.)	0.3	8	A3	Cascade	74	GOOD
UNK2655 (tributary to Bridger Cr.)	0.1	11	A3	Cascade	47	GOOD
UNK2639 (tributary to Bridger Cr.)	0.2	11	A3	Cascade	62	GOOD
Slushman Creek (main channel)	0.3	12	A2	Cascade	53	GOOD

Stream	Catchment Area Above Survey Site (sq. miles)	Channel Gradient (%)	Rosgen Channel Type	Montgomery Buffington Channel Type	Pfankuch Stability Rating Score	Pfankuch Stability Rating Class
UNK2634 (tributary to Slushman Cr.)	0.5	12	A2	Cascade	67	GOOD
UNK2756 (tributary to Slushman Cr.)	0.5	10	A3	Cascade	73	GOOD
UNK2641 (tributary to Slushman Cr.)	0.1	8	A2	Cascade	64	GOOD
Pine Creek	3.1	11	A2/A3	Cascade	96	FAIR

As seen in Table 3.20 the surveyed streams were Rosgen Type A2, A3, or A2/A3 channels with gradients ranging from 8% to 12%. Type A2 and A3 channels are predominantly composed of boulder or cobble sized elements, respectively. The A2/A3 channel type refers a channel midway between A2 and A3, composed of an equal mixture of boulders and cobbles. In terms of the Montgomery-Buffington type classification scheme all channels were "cascade" type channels. All of the channels surveyed received a Pfankuch stability rating of "good," with the exception of Pine Creek which was rated as "fair."

As mentioned previously, during late May 2011 much of western Montana including Gallatin National Forest was impacted by significant flooding. Localized flood magnitude varied, with the west side of the Forest (including the Bridger Mountains) generally experiencing flood events in the range 25-yr to 50-yr return period. Evidence of the 2011 flooding was present to some degree in all stream channels surveyed within the Project Area. Evidence included sediment deposits on floodplains, cut banks, and woody debris deposits attributable to the flood. Flood effects were particularly evident in Pine Creek, where cut banks were encountered in a number of areas and channel incision apparent in one area. It was also evident in all Project Area streams that natural recovery is underway, primarily in the form of vegetative colonization of eroded stream banks and flood-deposited sediments. This vegetation provides stability and surface roughness to stream banks and will increase in effectiveness over time as the vegetation matures.

On the majority of the Project Area streams including Maynard Creek and its tributary, Slushman Creek and its tributaries, and the two un-named tributaries of Bridger Creek, observed effects of the 2011 flood included sediment deposits on the floodplain and eroded stream banks. Minor, infrequent and intermittent stream bank cutting was observed on five of these streams, with few or no cut banks observed on the remaining three streams. Vegetative colonization was observed to be under way at the majority of locations where cut banks were present. Banks of all eight streams were protected by vigorous vegetation with density estimated at 90% or better in most locations.

Along the remaining surveyed stream (Pine Creek), significant, continuous, and relatively high (2-4 foot tall) cut banks were observed at a number of locations. Apparent channel incision, an estimated 2 feet in depth, was also observed in one channel reach. Although vegetative colonization was observed on cut banks in Pine Creek, the severity and continuous nature of the cut banks and the presence of incision set this stream apart from other streams in the assessment area with respect to severity of 2011 flood effects. These factors indicate that sediment yield, and thus water quality, on this creek is likely still affected by 2011 flood impacts and may continue to be affected in the future as channel form adjusts.

Despite observed effects of the 2011 flood on stream channels, field observations indicate the flood had only minor effects on Pfankuch channel stability ratings and did not cause any changes in Rosgen or Montgomery-Buffington channel type. It is estimated that Pfankuch stability rating scores would have been slightly lower had the survey been completed prior to the flood. However, none of the Pfankuch rating class results reported in Table 3.20 would have changed due to the flood. All of the channels surveyed would have received a Pfankuch stability rating of "good," with the exception of Pine Creek which would have been rated as "fair," just as under existing conditions.

The Pine Creek Cattle Allotment is located within the Pine Creek drainage and the southern portion of the Slushman Creek drainage. No grazing effects on channel morphology or stability were observed on any of the assessed assessment area streams. It is possible that the steep, rocky nature of the stream channels and their narrow floodplains offers little browse or resting habitat for cattle. Neither are cattle likely to be drawn to streamside areas for thermal refuge, as most areas within the Pine Creek Allotment are forested and shade is readily available. In addition, a stock tank near proposed Unit 17 allows stock in the vicinity to water without accessing streams.

Based on field observation, Pfankuch channel stability ratings, and stream channel type, the analysis area stream channels possess a relatively high level of stability and resiliency under existing conditions.

Peak Flows

Peak flow is the maximum stream water level reached during a flow event. The flow event may be associated with a period of rapid snowmelt (such events generally produce *annual* peak flows in Southwest Montana,) or it may simply be associated with a precipitation event. None of the streams in the assessment area are gauged, so there is no data available to calculate existing peak flows for these streams. Regional regression equations are often used to estimate the 2-yr through 500-yr return period discharges on ungauged streams in Montana. However, peak flows for assessment area streams were not estimated in this analysis. Existing peak flows in the streams were assumed to be at or near pre-disturbance levels unless the following existing conditions assessment, which took into account historic human activities within the watersheds, indicated otherwise. It did not.

Timber harvest, road building, and other land management activities have the potential to affect peak flows in streams by altering a variety of hydrological variables including interception, snowmelt rates, snowpack distribution, antecedent groundwater conditions, and runoff pathways. The observed response by peak flows varies widely, as documented in extensive reviews conducted by MacDonald *et al.* (1997) and Austin (1999). Austin (1999) reviewed 39 paired watershed studies and found that observed effects of harvest on peak flow magnitude ranged from -36% to 563% (Scherer and Pike, 2003). A similarly wide range of observed effects was reported by MacDonald *et al.* (1997), who reviewed over 120 publications representing 60 research sites and 120 treated catchment study areas. Neither MacDonald *et al.* (1997) nor Austin (1999) were able to identify a consistent relationship between any single variable, such as percentage of a watershed harvested or harvesting method, and corresponding changes in peak flows (Scherer and Pike, 2003). Based on the work of these authors and others, however, the following generalizations can be made:

- Harvest activities can increase peak flows, and may in some cases increase peak flows significantly enough to affect stream morphology (Austin, 1999, Guillemette *et al*., 2004).

- Peak flow increases due to logging tend to be larger, in terms of percentage, for smaller return period peak flows than larger return period peak flows (MacDonald et al., 1997, Guillemette *et al*., 2004).

- Percentage increase in peak flow tends to decrease with time after logging, and can persist for 10 years or more after logging (Thomas and Megahan, 1998, Grant *et al.*, 2008).

- As a general rule 15-20 percent of the forest cover within a basin must be harvested in order to generate a detectable change in peak flow or water yield (MacDonald *et al*. 1997).

- In a comprehensive "Synthesis of Current Science Regarding Cumulative Watershed Effects of Fuel Reduction Treatments," Rocky Mountain Research Station concluded that "both the available data and our understanding of hydrologic processes indicate that thinning should generally have little or no effect on the size of peak flows" (RMRS, 2010).

To aid in assessing whether past management activities have affected peak flows within the assessment area a list of activity type, aerial extent, and date of implementation was compiled. A summary of past land management activities within the assessment area watersheds is shown in Table 3.21.

Table 3.21: Summary of Past Land Management Activities for the Watershed Model Analysis Area

Parameter	Maynard Creek	Slushman Creek	Pine Creek	UNK2655 Creek	UNK2639 Creek	UNK2605 Creek
Percent of watershed area roaded or clearcut	3%	6%	28%	3%	20%	4%
Percent of watershed "special cut," shelterwood preparation, or sanitary cut	7%	2%	1%	28%	4%	12%
Percent of watershed area thinned or single-tree selective cut	<1%	7%	<1%	0%	4%	0%
Total percent of watershed area affected by past land management activities.	10%	15%	29%	31%	28%	16%
Average time elapsed since implementation of past land management activities	18 yrs.	21 yrs.	25 yrs.	25 yrs.	21 yrs.	29 yrs.

Applying the general rule that15-20 percent of the forest cover within a basin must be harvested in order to generate a detectable change in peak flow (MacDonald *et al*. 1997) it is unlikely that past management activities in Maynard, Slushman, UNK2655, or UNK2605 drainages ever affected peak flows, particularly since clearcutting (full canopy removal) affected only minor portions of those watersheds. Sometime in the past there may have been a measurable change in peak flows in the Pine Creek or UNK2639 drainages due to management activities. However, based on the available studies demonstrating that peak flow increases generally decrease with time after harvest, and the average elapsed time since harvest of 21-25 years in those drainages, it is unlikely that detectibly peak flow increases (if any ever occurred) have persisted to the present. Based on this analysis it was concluded that existing conditions peak flows within the assessment area are unlikely to differ from pre-disturbance conditions peak flows.

Wetlands

An assessment of existing wetland type and extent was carried out using wetland and riparian mapping information obtained from the Montana Heritage Heritage Program (MTHP) Website (MTNHP 2012). The MTHP map layers provide locations of wetlands and riparian areas one acre or larger based on 2005 aerial photography. In the creation of these maps, wetlands were identified and classified using the Cowardin classification system (Cowardin, 1979) adopted by the National Wetland Inventory. Similarly, riparian areas were delineated and classified using the U.S. Fish and Wildlife Service's system for mapping western riparian areas.

Wetlands in the assessment area provide water quality protection via sediment filtration, habitat for aquatic and terrestrial life, flood storage, groundwater recharge and discharge, sources of primary production, recreation, and aesthetics. There are a total of 72.2 acres of mapped wetland within the assessment area. Because most of the assessment area is well drained with limited areas of groundwater emergence, the wetlands found within the assessment area are primarily stream-fed riparian shrub and emergent wetlands that have unconsolidated bottom and rock bottom classes and are located adjacent to stream channels (Cowardin, 1979). Other wetland types represented within the assessment area include freshwater shrub, freshwater emergent, riverine, and freshwater pond. Wetland types and acreages for the six catchment areas within the assessment area are listed in Table 3.22. Figure 3.12 shows wetland types and locations within the assessment area.

Table 3.22: Summary of Existing Wetlands in the Assessment Area

Watershed	Wetland Type and Acreage						
	Riparian Shrub (acres)	Riparian Emergent (acres)	Freshwater Shrub (acres)	Freshwater Emergent (acres)	Riverine (acres)	Freshwater Pond (acres)	Total (acres)
Maynard	5.4	-	2.4	0.8	-	1.4	10.0
Slushman	16.8	3.0	-	2.9	2.4	-	25.1
Pine	21.7	8.3	-	-	3.2	-	33.2
UNK2655	0.6	-	-	-	-	-	0.6
UNK2639	2.6	-	-	-	-	-	2.6
UNK2605	0.7	-	-	-	-	-	0.7
Total:	47.8	11.3	2.4	3.7	5.6	1.4	72.2

Floodplains

Based on field assessment, floodplains within the assessment area form relatively narrow strips adjacent to the stream channel. This observation is consistent with Rosgen (1996) which states that floodplains associated with A2 and A3 channel types found in the assessment area are typically relatively narrow strips adjacent to the stream channel and are tightly confined by the valley walls or depositional soils in which the adjacent stream is entrenched. Floodplains in the assessment area are generally well-vegetated and their function does not appear to be impeded. No human-caused disturbance to floodplains was noted in the field, with the exception of encroachment by road embankments at culvert crossings.

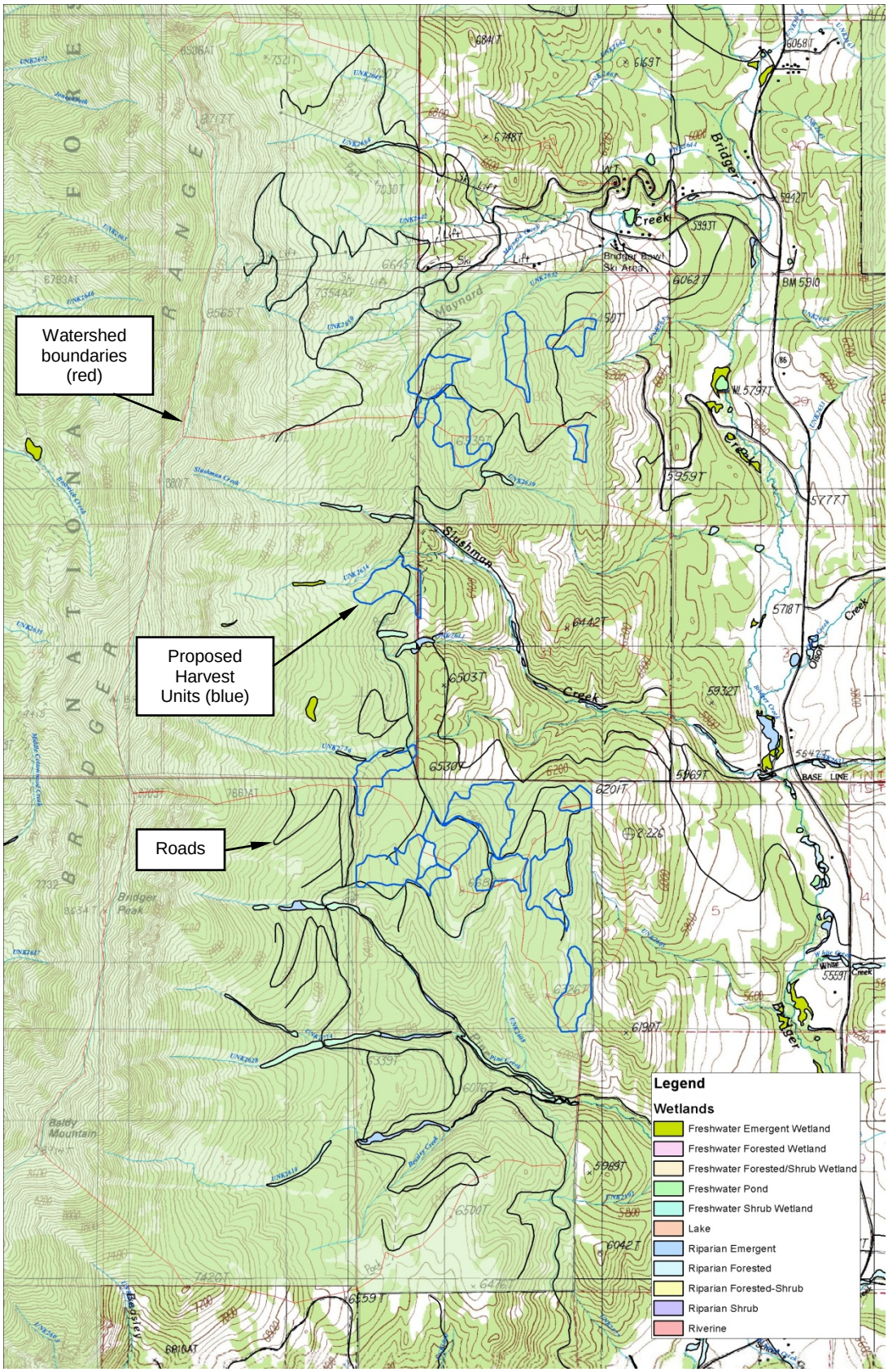


Figure 3.12. Project Area Wetlands

ENVIRONMENTAL CONSEQUENCES

This section describes the direct, indirect, and cumulative effects of the no action and the proposed action to water quality. The potential effects described are based on research, experience, and professional judgment.

Measurement Indicators

Three measurement indicators which correlate closely with stream geomorphic and aquatic ecosystem condition were utilized to evaluate the effects to water quality. The indicators can be determined by field measurement, or calculated by means of modeling, and have the potential to be affected by the proposed action.

a. Water yield – This indicator will assess the effects of the alternatives on water yield in assessment area watersheds, which has the potential to increase through reduced transpiration due to vegetation removal and increased drainage efficiency due to construction of temporary road segments. Significant increases in water yield can affect stream morphology and sedimentation.

b. Sediment Yield – This indicator will assess the effect of alternatives on sediment levels in assessment area streams, which have the potential to increase due to ground-disturbing activities associated with the proposed actions. Sediment Yield is a useful indicator of impacts on stream morphology and aquatic organisms.

c. Stream Channel Stability – This indicator will assess the condition of stream channels in the assessment area, which will allow assessment of existing channel condition and the resiliency of those channels to disturbance including increases changes in water yield, sediment yield, or peak flows which are potential effects of the proposed actions.

Treatment Descriptions

Silvicultural Treatments

Commercial Thinning: This treatment is designed to reduce susceptibility to damage from western spruce budworm, Douglas-fir beetle, and mountain pine beetle. The existing tree density would be reduced from current levels to a target residual density ranging from 80 to 100 square feet of basal area per acre on average. Trees to be removed in dead and dying trees infested with western spruce budworm, Douglas-fir beetle, and/or mountain pine beetle, as well as live trees to achieve an average spacing of 15-20 feet between crowns. Residual live tree spacing will be influenced by the distribution of existing trees and the variable and dynamic nature of mortality in the project area. The purpose of this treatment is to alter the stand micro-environment and enlarge the growing space of desirable trees allowing for improved tree growth, vigor, and resiliency. Treatments will be design to minimize post-harvest wind damage. Mechanical treatments and/or prescribed burning would be used to reduce fuels and recycle nutrients.

Fuel Treatments

Fuel treatments are designed to reduce activity generated fuels within the proposed treatment areas. Mechanical treatments could include whole tree yarding and/or excavator piling. Fuel accumulations at landings or in units would be addressed through burning, chipping/masticating, and/or removal from National Forest lands.

Site Preparation

Depending on existing vegetation and ground conditions, site preparation may be prescribed to help create favorable conditions to help ensure adequate regeneration. These treatments are often prescribed in both artificial and natural regeneration situations and typically address competing vegetation, seed bed preparation, fuel accumulations, and duff reduction. Site preparation can be accomplished through hand, mechanical, or prescribed fire methods. Hand methods usually involve creating favorable conditions at the time of planting using hand tools. Mechanical treatments are often accomplished during harvest operations or shortly afterwards and involve scarification and seed bed preparation through the use of mechanized equipment.

No Action Alternative

Direct and Indirect Effects

The direct and indirect effects discussed in this section pertain primarily to effects that occur as direct or indirect (in time and space) results of the alternative. These may include immediate or longer term effects.

No actions would occur under this alternative, allowing the processes of vegetation succession and forest insect dynamics to continue in a similar fashion as they currently are. Firewood gathering, Christmas tree cutting, and continued wildfire suppression consistent with forest plan direction is expected.

Water yield – In the northern Rocky Mountains water yield elevated by timber harvest activities typically returns to pre-harvest level about 45 years after logging (Tobin-Scheer, 1992). This recovery process is still underway in most of the previously logged areas within the assessment area. Under the no action alternative this recovery process would continue, although it might be slowed due to tree mortality associated with the Western Spruce Budworm, Douglas-fir Beetle and Mountain Pine Beetle. Note that water yield analysis indicated that current (existing) water yields within the assessment area are slightly elevated with respect to, but not measurably different from, pre-disturbance condition water yields.

Sediment Yield – Existing conditions sediment yields in the assessment area watersheds are above reference (pre-disturbance) levels due to the existing road network. Due to the time elapsed since past timber harvest within the assessment area, however, modeled sediment yields have ceased to be influenced by past logging. Under the no action alternative sediment yields for Maynard and Slushman Creeks, and the three un-named creeks within the watersheds, would be expected to remain at current levels. These current levels are elevated with respect to reference conditions but remain far below the 50-percent-above-reference rates allowable under GNF guidelines for Class B streams. At Pine Creek, where potential effects of the 2011 flood on existing Pine Creek sediment yield could not be determined with certainty, sediment yield would continue its natural recovery to the pre-flood level. The modeled sediment yield for this stream is elevated with respect to reference conditions but remains far below the 50-percent-above-reference rates allowable under GNF guidelines for Class B streams.

Stream Channel Stability – Based on field surveys and analysis of the literature cited above, analysis area stream channels possess a relatively high level of stability and resiliency under existing conditions. Under the no action alternative continued natural recovery from the effects of the 2011 flood should yield a slight improvement in channel stability throughout the assessment area. However, stream channel stability would be not expected to improve in a significant manner except perhaps in Pine Creek where the effects of the 2011 flooding were most pronounced.

No grazing effects on channel morphology or stability were observed on any of the assessed assessment area streams. It is expected that this would remain the case under the no action alternative.

Cumulative Effects

The effects of all known past and current actions were included in the direct and indirect effects analysis presented above. There are no known reasonably foreseeable actions on all lands within the analysis area which are expected to have cumulative effects with the no action alternative.

Action Alternative

This section will discuss the effects to water quality from implementation of the action alternative.

Direct and Indirect Effects

The direct and indirect effects to forest water quality will be discussed relative to the measurement indicators. In addition, other potential effects to water quality from the action alternative will be discussed briefly.

Water yield - The proposed action has the potential to increase water yield in the assessment area through reduced transpiration due to vegetation removal and, potentially, increased drainage efficiency due to construction of temporary road segments. The ECA (equivalent clearcut area) water balance method was utilized to calculate effects on water yield due to the action alternative in assessment area (Belt, 1980). Estimated average annual water yield under "reference" (no human disturbance) conditions, under existing conditions, and the first year following project implementation is shown in Table 3.23.

Table 3.23: Annual Water Yield for the Watershed Model Analysis Area

Parameter	Maynard Creek	Slushman Creek	Pine Creek	UNK2655 Creek	UNK2639 Creek	UNK2605 Creek
Watershed Area (mi^2)	2.10	2.60	3.06	0.20	0.39	0.24
"Reference" Conditions Water Yield (acre ft./yr)	1205.5	1438.3	1683.1	96.0	187.5	114.0
Existing Water Yield (acre ft./yr)	1220.7	1448.8	1710.1	97.9	191.2	114.9
Existing % Above Reference	1.3%	0.7%	1.6%	2.0%	2.0%	0.8%
Predicted Water Yield, First Year after Implementation of Proposed Action (acre ft./yr)	1225.2	1456.4	1712.2	98.6	192.0	117.2
Percent Above Reference, First Year after Implementation of Proposed Action	1.6%	1.3%	1.7%	2.7%	2.4%	2.8%

Projected increases in water yields due to the proposed actions plus existing land management activities and development are estimated to be within the range 1.2% to 2.8% percent (Table 3.23). Changes in water yield of less than 5-10% are considered too small to be measurable.

It should be noted that the estimated water yield increase discussed above was calculated based on complete project implementation during a single year (2014). Should the project take more than one year

to complete, the increase in water yield would be slightly smaller due to initiation of water yield recovery on the first-harvested units.

Based on this analysis, effects of the proposed project on water yield would be minor and of a magnitude which is not measureable.

Sediment Yield – Sediment yield in streams is a useful indicator of water quality, particularly with respect to stream channel stability and impacts on aquatic organisms. For each watershed the reference sediment yield, existing sediment yield (year 2013), and predicted sediment yield in the first year after implementation of the proposed project is shown in Table 3.24. In the year 2013 sediment yield to the steams within the Project Area ranged between 8% and 22% above reference levels due to past road building and timber harvest on NFS land and privately owned land, with Maynard Creek being the most highly impacted due to clearing and roads associated with Bridger Bowl Ski Area.

Table 3.24: Sediment Yield in watersheds within the Project Area

Parameter	Maynard Creek	Slushman Creek	Pine Creek	UNK2655 Creek	UNK2639 Creek	UNK2605 Creek
Reference sediment yield (tons/year)	116.3	123.4	153.0	5.5	10.9	8.1
Existing (2013) sediment yield (tons/year)	142.5	136.0	171.9	6.1	11.9	8.8
Percent above "reference" under existing conditions (2013)	22.5%	10.3%	11.5%	11.2%	9.4%	8.2%
Predicted sediment yield in first year after implementation of proposed action (2014). (tons/year)	146.5	141.8	171.4	6.9	13.0	9.8
Predicted percent above "reference," in first year after implementation of proposed action (2014)	26.0%	14.9%	12.1%	25.5%	19.3%	21.0%

As shown in Table 3.24, predicted sediment yield in the first year after implementation of the proposed project would range between 14.9% and 26.0% above the reference level depending on the watershed. These levels would be well within the allowable limit of 50% above reference level set forth in *Forest Plan Standard E-4 Water, Fisheries, and Aquatic Life* in all of the watersheds. In general the smaller watersheds (UNK2655, UNK2639, and UNK2605) would tend to see the highest relative increases in sediment yield because of the proposed action would affect a proportionally larger portion of these basins. Effects of the proposed harvest activities would be expected to diminish relatively quickly, with sediment yield in all watersheds expected to return to pre-project levels approximately 6 years after project activities cease. Table 3.25 shows post-project recovery sediment yield (expressed in "percent above reference") for the timeframe 2013-2020.

It should be noted that the estimated sediment yield increase discussed above was calculated based on complete project implementation during a single year (2014). In reality, if the project implementation

period lasts more than a year, as expected, the effects on sediment yield would be less than shown in Table 3.25 due to initiation of sediment yield recovery during the harvest period.

Table 3.25: Sediment Yield to watersheds within the Project Area

Parameter	Maynard Creek	Slushman Creek	Pine Creek	UNK2655 Creek	UNK2639 Creek	UNK2605 Creek
Pre-project percent above "reference" under existing conditions (2013)	22.5%	10.3%	11.5%	11.2%	9.4%	8.2%
Predicted percent above "reference" in first year after implementation (2014) of proposed action	26.0%	14.9%	12.1%	25.5%	19.3%	21.0%
Predicted percent above "reference" in year 2016	23.9%	12.1%	11.7%	12.1%	10.1%	11.1%
Predicted percent above "reference" in year 2018	22.9%	10.7%	11.6%	11.5%	9.6%	8.9%
Predicted percent above "reference" in year 2020	22.5%	10.1%*	11.5%	11.2%	9.4%	8.2%

* This value is smaller than the "existing conditions" value due to the diminishing effects of the Slushman ski lift road that was constructed in 2008 (Slushman Watershed).

As previously noted the Project Area was impacted by flooding in May, 2011. On the majority of the Project Area streams (including Maynard Creek and tributary, Slushman Creek and tributaries, UNK2655, UNK2639, and UNK2605), observed effects of the 2011 flood included sediment deposits on the floodplain, woody debris deposits, and cut banks. Due to the minor and infrequent nature of the observed cut banks, the observed colonization of cut banks by stabilizing vegetation, and the generally excellent vigor and density of stream bank vegetation, effects of the 2011 flood on existing and future sediment yield in these streams are assumed to be insignificant and predicted sediment yields shown in Table 3.24 to be accurate.

On Pine Creek significant, continuous, and relatively high (2-4 foot tall) cut banks were observed at a number of locations. These factors indicate that sediment yield on this creek may remain affected by 2011 flood impacts and may continue to be affected in the future as channel form adjusts toward greater stability. The R1R4 model used in the sediment yield analysis does not have the capability to calculate sediment load associated with stream channels that have been significantly affected by large, relatively recent flood events. For this reason, the modeled sediment yield for existing conditions shown in Table 3.24 may underestimate the existing condition sediment yield for Pine Creek. However, since the R1R4 model cannot account for the contribution that the 2011 flood effects may make towards existing or future sediment yield, the extent to which the model may be underestimating that sediment yield, if any, was not known.

The R1R4 model calculated the existing (2013) Pine Creek sediment yield to be 11.5% above reference level and predicted that implementation of the proposed action would increase Pine Creek sediment yield by 0.6%. The effect of such a minor sediment contribution on Pine Creek channel function or its rate of natural recovery from the 2011 flood would be negligible. Nonetheless a separate analysis was carried out utilizing the Disturbed Watershed Erosion Prediction module of the Watershed Erosion Prediction

Project (WEPP) model to estimate the probability that sediment originating from the proposed harvest units will reach Pine Creek . WEPP is the state of the art model for estimating potential erosion and sediment effects at the hillslope-scale level for timber harvesting, fuels treatments, and roads (Elliot, 2004). The model predicts the probability of sediment delivery to the base of the hillslope analyzed, and the annual average volume of sediment delivery produced by runoff events, based on the modeled local climate and site conditions. In any given year and location, real world erosion values will most likely vary because of site specific conditions and the precipitation regime particular to that year. The modeled average erosion/sediment delivery rate prediction can account for this variability to some degree, although this value becomes much more useful when combined with a predicted probability that erosion will occur at all.

The WEPP model simulates natural climatic variability by incorporating climate data tailored to the individual site using PRISM data (Daly et al., 2000) to simulate daily precipitation events for a multi-year period. The modeled precipitation events are then used to determine the probability of sediment delivery to the base of the hillslope. The model incorporates individual precipitation event characteristics and antecedent conditions as well as site characteristics into its prediction of event-scale runoff, erosion, and sediment yield values.

The Disturbed WEPP module was used to calculate the predicted sediment delivery and probability of occurrence for the portions of proposed harvest that lie within the Pine Creek watershed (Units 8, 9, 11, 12, 16, and 17). For each Unit's geometry and proximity to a watercourse, a "worst case" scenario representing the probable path of maximum sediment erosion and delivery to Pine Creek tributary streams was determined and analyzed. The model was run with a simulation period of 100 years. Model results indicate there is a 97% probability that no project-related sediment will reach Pine Creek tributary streams the first year after harvest. The probability that no project-related sediment will be delivered to Pine Creek tributaries in the long term is approximately 95%.

The R1R4 and WEPP models are very different models with dissimilar capabilities and limitations. However, both models predict a very low likelihood of the proposed action appreciably affecting Pine Creek sediment yield. In the case of the R1R4 model analysis, which examined the issue at a watershed-level scale, the results indicated that the proposed action would raise sediment yield in Pine Creek watershed a mere 0.6% with respect to the reference level. The WEPP model, which provided a process-based assessment of sediment delivery at the hillslope scale, indicated the probability of *any* sediment delivery to stream channels from the proposed harvest units to be extremely low. Examined together, the results of the two modeling analyses strongly indicate that effects on Pine Creek sediment yield resulting from the proposed action would be unlikely, and if they were to occur, would be negligible.

Based on field data and the R1R4 sediment model analysis, impacts on sediment yield resulting from the proposed action would be minor on most assessment area streams, negligible on Pine Creek, and temporary on all streams. The R1R4 analysis results indicate that post-project sediment yields on all assessment area streams would be far below the 50-percent-above-reference rates allowable under GNF guidelines for Class B streams. For Maynard Creek, Slushman Creek, and the three un-named creeks within the assessment area field observations and data indicated that the effects of the 2011 flood on existing and future sediment yield in these streams is insignificant, and predicted sediment yields determined by the R1R4 sediment model were accepted as accurate. Due to sediment model limitations, potential effects of the 2011 flood on Pine Creek sediment yield (measured as "percent-above-reference") could not be calculated with certainty. However, both R1R4 model and WEPP model analyses strongly support the conclusion that harvest activities proposed within the Pine Creek watershed would likely result in negligible effect on Pine Creek annual sediment yield and would not affect the stream channel's function or rate of natural recovery from the 2011 flood.

None of the assessment area streams are listed as impaired waterways by the Montana Department of Environmental Quality.

Sediment yield would recover to pre-project levels in all watersheds within the assessment area approximately six years after completion of the project.

Peak Flows – No measurement indicators directly associated with peak flows were defined in this analysis, but the potential for the action alternative to affect peak flows warrants discussion.

Timber harvest, road building, and other land management activities have the potential to affect peak flows in streams by altering a variety of hydrological variables including interception, snowmelt rates, snowpack distribution, and runoff pathways (Anderson *et al*, 1976). There have been a long series of controlled paired watershed studies conducted in the Rocky Mountain Region which have provided information about the relationships between timber harvest, water yield, and peak flows. However, most of these studies have been based on clearcutting or patch/strip clearcutting of relatively large portions of the study watershed areas. Relatively few studies examining the effects of thinning or partial cutting are available.

The potential for the action alternative to affect peak flows in the assessment area was assessed primarily based on available literature relevant to thinning or partial cut treatments. Table 3.26 shows the proposed acreage treated and proportion of watershed treated for each watershed within the assessment area. The proposed treatment is thinning.

Published studies and related assessments specific to the proposed action include the following:

In *Fowler et al. (1987)* runoff from four small (0.09-0.46 mi^2) calibrated watersheds on the Umatilla National Forest in Eastern Oregon was monitored during a six year post-harvest period. Harvest treatments and percent of watershed treated (in parentheses) included shelterwood (50%), large patch clearcut (43%), and small patch clearcut (22%). The Umatilla study included shelterwood cuts which can be assumed to be a conservative indicator of potential effects due to thinning. The Umatilla study also included clearcut units, which can be assumed to represent a highly conservative indicator of potential effects due to thinning. Nonetheless, in the Umatilla study there was no significant increase in peak flows detected as a result of the harvest treatments.

The Umatilla study is particularly relevant to the current analysis because the South Bridger Interface Project Area and Umatilla Study Area are both dry, east-side forest types with very similar elevation and annual precipitation characteristics. In addition, both areas are within the snow-dominated hydrologic zone. No significant increases in water yield or peak flow were detected in any of the treated watersheds in the Umatilla Study Area.

In *Troendle and King (1987)* runoff was measured as part of a paired watershed study at Deadhorse Creek, Colorado. The harvest was a shelterwood preparation cut covering 15% of the 1 mi^2 study watershed. This harvest amounted to removal of 10% of the total basal area of the study watershed. The Deadhorse study examined shelterwood cuts which involved more intensive timber harvest practice in terms of treatment type, basal area removal, and/or percent of watershed area treated than the treatments included in the action alternative. Streamflow was monitored for five years pre-harvest and three years post-harvest, and there was no significant increase in peak flows detected as a result of the harvest. Like the South Bridger Project Area, the Deadhorse study area lies within the snow-dominated hydrologic zone.

MacDonald et al. (1997), who reviewed over 120 publications representing 60 research sites and 120 treated catchment study areas, suggested as a general rule that 15-20 percent of the forest cover within a basin must be harvested in order to generate a detectable change in peak flow (MacDonald *et al*. 1997).

RMRS (2010), in a broad-based and comprehensive document titled *Synthesis of Current Science Regarding Cumulative Watershed Effects of Fuel Reduction Treatments*, Rocky Mountain Research Station concluded that "both the available data and our understanding of hydrologic processes indicate that thinning should generally have little or no effect on the size of peak flows."

The action alternative would call for thinning of timber stands composing between 1.5-21% of the total watershed area, however thinning will involve removal of only a portion of the forest cover in the treatment units. For instance in Pine Creek, the watershed most heavily clearcut in the past, the action alternative would thin only 1.5% of total basin area. This would equate to the removal of approximately 0.75% of forest cover in that watershed. The watershed which would be most affected, proportionally by area, by the action alternative is UNK2605. Approximately 21% of this basin would be thinned, which would roughly equate to removal of 10.5% of forest cover. The proportional area that would be thinned in other watersheds within the assessment area would fall between that of Pine Creek and UNK2605. Based on the literature cited above, none of the assessment area watersheds would likely respond to this proposed level of forest cover removal by exhibiting a detectable change in peak flows, including when the potentially cumulative effects of past management activities (addressed in Section IV) are taken into account. It is anticipated that effects of the proposed action on peak flows would be non-existent or negligible.

Table 3.26: Proposed Treatment Areas

Parameter	Maynard Creek	Slushman Creek	Pine Creek	UNK2655 Creek	UNK2639 Creek	UNK2605 Creek
Watershed Area (mi^2)	2.1	2.6	3.1	0.2	0.4	0.2
Watershed Area (acres)	1343.7	1664.0	1961.0	128.0	250.0	154.0
Proposed Treatment Area (acres)	53.7	93.8	28.4	9.2	9.5	32.9
Proportion of Watershed area to be Treated	4.0%	5.6%	1.5%	7.2%	3.8%	21.4%

Stream Channel Stability – The potential for the action alternative to affect stream channel stability was addressed based on current stream condition and classification and on available literature. The primary mechanisms by which the proposed action has the potential to affect stream channel stability is through affecting peak flows and sediment yield.

Grant *et al*. (2008) presented a state-of-the-science synthesis of the effects of forest harvest activities on peak flows and the resulting effects on channel morphology. The authors based their study on thirty-four existing research studies including long-term, experimental watersheds and modeling/ process studies. Using data from these existing studies, the authors evaluated the potential for channel response to peak flow increase based on channel type and gradient. Conclusions by Grant et al (1990) included the following.

- The information and analysis provided by the reviewed studies "do not provide evidence that forest harvest increases peak flows for storms with recurrence intervals longer than 6 years."

This conclusion is relevant because study of channel-forming processes in steep channels such as those found in the assessment area has found channel feature forming flows to lie in the 20-50 year recurrence interval range (Grant *et al*., 1990). Given that the effect of forest harvest on such large, low frequency peak flow events is likely to be small or negligible (Guillemette *et al*., 2004), it is unlikely that forest harvest practices will induce sufficient increase in peak flows to affect channel morphology in the cascade type channels found in the assessment area (Grant *et al*, 2008).

Grant *et al*. (2008) came to the following general conclusions with respect to peak flow effects on high gradient channels.

- "Peak flow effects on channel morphology can be confidently excluded in high-gradient systems (slopes >0.10) and bedrock channels, and are likely to be minor in most step-pool systems."
- Differentiating between cascade and step-pool channels, the authors concluded that peak flow increases would have "little potential to effect" the cascade channel type and would have "little potential to affect primary channel structure" but "may affect transport and deposition of fine sediment" in step-pool systems.

Thus, Grant *et al*., (2008) concluded that the cascade channel type, which was the channel type found on all assessment area streams, is not likely to be significantly affected by peak flow increases. This conclusion agrees with Montgomery and Buffington (1997) and Rosgen (1996) who state that the "cascade" channel type (Montgomery/Buffington classification system) and Type A2, A3, and A2/3 channels (Rosgen classification system) are relatively stable channel forms that are resilient to changes in discharge and sediment supply. All of these conclusions are fully supported by the stability assessment field data reported in Section IV of this report.

Based on field surveys and analysis of the literature cited above it is anticipated that the effects of the proposed action on stream channel stability would be negligible for the following reasons:

1. effects of the proposed action on peak flows are expected to be non-existent or negligible, and;
2. even if peak flows *were* to increase significantly, assessment area stream channels possess a high level of stable and resiliency and would be unlikely to be affected by increased peak flows.

Rain on snow events – Field research in the Pacific Northwest has shown that timber harvest can increase the magnitude of peak flow associated with rain-on-snow events by altering a variety of hydrologic processes including increased snow accumulation on the forest floor, increased direct radiation upon the snowpack, and increased wind-aided transfer of heat to the snowpack (Harr and Coffin, 1992). Rain-on-snow events are prevalent in the west Cascade and Sierra mountain ranges and in other areas subject to maritime weather patterns and are considered to be a dominant hydrologic force in these regions (Berg et al, 1991; Harr, 1981). Rain-on-snow events can also occur in Montana, particularly west of the Continental Divide. In six study basins located in northwestern Montana and northeastern Idaho MacDonald and Hoffman (1995) found rain-on-snow events to be a frequent cause of annual maximum flows and record high flows. However, the authors found that climatic differences rather than differences in forest harvest practices exert the dominant influence on peak flows in that region. The authors further concluded that accurate prediction of the synergistic effects of forest harvest and rain-on-snow events in northwestern Montana would be, in most situations, prohibitively difficult due to extensive data needs (MacDonald and Hoffman, 1995).

Rain-on-snow events exert far less hydrologic influence on Montana watersheds located east of the Continental Divide than they do upon watersheds to the west. Although rain-on-snow events occasionally occur on the Gallatin National Forest they are historically quite rare due to several factors.

- To exert significant influence on peak flows in this region, rain-on-snow events typically must occur during the May-June period. By that time of year the lower elevation snowpack has generally melted or exists only in remnant form.
- Within the May-June period the only storms large enough to generate significant precipitation tend to be cold, frontal storms. Such storms typically yield snow in areas above 6000-7000' elevation, bolstering the snowpack in these locations, and rain at lower elevations where the snow pack tends to be already melted.

This temporal disconnect between rainfall and lower elevation snowpack availability causes rain-on-snow events to be very rare on the Gallatin National Forest.

Accurate prediction of rain-on-snow events, or the potential effects of timber harvest upon them, on the Gallatin National Forest is not feasible due to the rarity of rain-on-snow event occurrence, the variety of hydrologic and climatic variables involved (MacDonald and Hoffman, 1995), and a general lack of predictive methodology. Historically, such events have been very rare and it is likely that if the proposed actions are implemented they will continue to be very rare. Based on this analysis it is anticipated that the effects of the proposed action on rain-on-snow events would be non-existent or negligible.

Wetlands - Direct or indirect impacts to wetlands would be prevented by the project mitigation measures prohibiting operation of vehicles or logging machinery, or deposition of materials, in wetland areas. Streamside wetland areas would be additionally protected by the 15-ft no-cut zone adjacent to streams. Streamside Management Zone boundaries would be extended to include wetland areas adjacent to streams in accordance with the Montana SMZ laws. Under the proposed action there would be negligible impacts to wetlands in the analysis area. Wetlands would continue to provide the same ecological functions as they do under existing conditions.

Floodplains - Standard Best Management Practices or BMP's (DNRC 2006) including Montana SMZ compliance rules (DNRC 2006a) would be applied to all harvest activities. These rules would forbid operating wheeled or tracked or tracked machinery within the SMZ (except on established roads) and burning within an SMZ of minimum width 50 feet on either side of the stream. Additional mitigation measures would forbid the harvest of trees within 15 feet of the Ordinary High Water Mark along any perennial streams. It is expected that all, or nearly all, portions of the naturally narrow floodplains found within the assessment area will be included within the 15 foot no-cut zone along each side of streams. The fisheries biologist would be allowed the discretion to widen the 15 foot no cut zone to insure stream bank or floodplain stability in a rare situation where 15 feet was deemed inadequate.

Under the proposed action there would be negligible impacts to floodplains in the assessment area. Floodplain areas would be protected by the project mitigation measures.

Cumulative Effects

Past, current, and reasonably foreseeable actions on all lands within the analysis area were evaluated when considering the cumulative effects to water quality associated with the action alternative. Past actions which have affected the water resource include forest management and other activities within the analysis area. These activities were included in the existing conditions analysis and are discussed in the existing conditions section of this report.

The effects of all known past and current actions were included in the direct and indirect effects analysis presented above. There are no known reasonably foreseeable actions on all lands within the analysis area which are expected to have cumulative effects with the no action alternative.

REGULATORY FRAMEWORK & CONSISTENCY

Montana Water Quality Act

The State of Montana maintains primacy with respect to water quality standards and pollutant discharge management programs. The primacy status requires that the provisions of the State of Montana Water Quality Act meet or exceed all requirements of the Federal Clean Water Act. The State of Montana Water Quality Act requires the state to protect, maintain, and improve the quality of water for a variety of beneficial uses. Defined beneficial uses can be grouped into three broad categories: recreation, aquatic life, and water supply. Section 75-5-101, Montana Code Annotated (MCA) established water quality standards based on these beneficial uses.

The Montana Department of Environmental Quality (MDEQ) has classified all streams within the Project Area as Category B-1 Streams (MDEQ 2012). The B-1 Classification is designed to protect a variety of beneficial uses including drinking (after treatment), recreation, growth and propagation of salmonid fisheries, and agricultural and industrial water supply. These Montana water quality standards require the use of effective BMP's so that water quality changes, if any, would be considered "naturally occurring." The Montana water quality standards (ARM 17.30.602 (19)) define naturally occurring as "conditions or material present from runoff or percolation over which man has no control or from developed land where all reasonable land, soil, and water conservation practices have been applied". The Montana water quality standards (ARM 17.30.602 (25)) define reasonable land, soil, and water conservation practices as "means, methods, measures, or practices that protect present and reasonably anticipated beneficial uses. These practices include but are not limited to structural and non-structural controls and operation and maintenance before, during, or after pollution producing activities." Best Management Practices (BMPs) and other mitigation measures are examples of such practices.

Every two years the MDEQ compiles a list of water bodies that fail to meet water quality standards. This document is known as the 303(d) list after the section of the Federal Clean Water Act that requires states to report impaired waters. The 303(d) list identifies the probable causes of impairment as well as the suspected sources of the pollutant.

MDEQ is required to develop Total Maximum Daily Load guidelines (TMDLs) for all water bodies on the 303(d) list. A TMDL is *the total amount of a pollutant that a water body may receive from all sources without exceeding water quality standards.* As such, the TMDL can be viewed as a pollutant budget identifying the maximum amount of a particular pollutant that a water body can assimilate without causing applicable water quality standards to be exceeded.

None of the streams in the Project Area are classified as water quality limited segments by the MDEQ 2012 version of the 303(d) list (MDEQ 2012a) or listed as segments in need of total maximum daily load (TMDL) development by the MDEQ (MDEQ 2012b).

All streams within the Project Area are tributaries to Bridger Creek. The 2012 Montana 303(d) database identifies Bridger Creek (MT41H003_110) from its headwaters to its mouth at East Gallatin River as partially supporting aquatic life, cold water fishery and primary contact recreation. This stream was identified as impaired due to chlorophyll-a, total phosphorus, and total nitrogen (MDEQ 2012c). Listed

sources of impairment were grazing in riparian/shoreline zones, impacts from resort areas, and unspecified unpaved roads or trails.

Assessment of Bridger Creek was included in the *Lower Gallatin Planning Area TMDLs & Framework Water Quality Improvement Plan* (MDEQ 2013). In this document MDEQ concluded that the 303(d) listing of Bridger Creek for total phosphorus and total nitrogen were not supported by data. Extensive water quality sampling did indicate NO_3+NO_2 impairment, with this impairment being limited to the segment of Bridger Creek lying downstream of its confluence with Lyman Creek. The TMDL developed for Bridger Creek includes only NO_3+NO_2 and applies only to the segment of Bridger Creek lying downstream of its confluence with Lyman Creek. The nearest tributary draining the Project Area is Pine Creek, which enters Bridger Creek approximately 10 miles upstream from the confluence of Bridger and Lyman Creeks. Thus, streams from the Project Area do not intersect the portion of Bridger Creek subject to TMDL allocation load guidelines. TMDL allocations for NO_3+NO_2 for Bridger Creek below the Lyman Creek confluence are presented in the *Lower Gallatin Planning Area TMDLs & Framework Water Quality Improvement Plan* (MDEQ 2013).

Bridger Creek is tributary to the East Gallatin River. The two segments of the East Gallatin River lying downstream of its confluence with Bridger Creek delineated by MDEQ include: East Gallatin River Bridger Creek to Smith Creek (MT41H003_020), and; East Gallatin River Smith Creek to mouth (MT41H003_030). The upstream segment, Bridger Creek to Smith Creek, is identified as partially supporting aquatic life, cold water fishery and primary contact recreation. This stream segment is identified as impaired due to alteration of stream-side or littoral vegetative covers, excess algal growth, low flow alterations, total phosphorus, pH, and total nitrogen (MDEQ 2012c). Listed sources of impairment are grazing in riparian/shoreline zones, irrigated crop production, municipal point source discharges, and yard maintenance.

The MDEQ has produced TMDL allocations for total nitrogen and total phosphorous for East Gallatin River from Bridger Creek to Smith Creek. These allocations, which differ for the segments Bridger Creek-to-Hyalite Creek and Hyalite Creek-to-Smith Creek, are presented in *Lower Gallatin Planning Area TMDLs & Framework Water Quality Improvement Plan* (MDEQ 2013).

The stream segment delineated as East Gallatin River - Smith Creek to mouth is identified as partially supporting aquatic life and cold water fishery and fully supporting primary contact recreation. This stream segment is listed as impaired due to alteration of stream-side or littoral vegetative covers, pH, and total nitrogen (MDEQ 2012c). Listed sources of impairment are grazing in riparian/shoreline zones and municipal point source discharges.

The MDEQ has produced TMDL allocations for total nitrogen and total phosphorous for East Gallatin River from Smith Creek to mouth. These allocations are presented in *Lower Gallatin Planning Area TMDLs & Framework Water Quality Improvement Plan* (MDEQ 2013).

The proposed project is consistent with State of Montana Water Quality Act requirements to protect, maintain, and improve the quality of water for a variety of beneficial uses for the following reasons.

- The streams within the project area have not been identified by the Montana DEQ as impaired. During recent TMDL development the East Gallatin River MDEQ found no reason to develop TMDL's for the Project Area streams or the Upper Bridger Creek HUC6 watershed in which they are located.

- The proposed project activities will employ effective BMP's to ensure that water quality changes, if any, would be negligible and would be considered "naturally occurring" under Montana water quality standards (ARM 17.30.602 (19)).

- Based on the water quality analysis presented in this report, the proposed activities will not further degrade downstream impaired waters.

Gallatin National Forest Plan Direction

Gallatin National Forest Plan forest-wide standards that apply directly to the proposed project, located on pages II-23 and 24, of USFS (1987) and in the Gallatin National Forest Travel Management Plan. Detailed Description of Decision – Chapter 3 (USFS, 2006) include the following Forest-wide standards:

Water and Soils BMP's. Best Management practices (BMP's) will be used on all Forest Watersheds in the planning and implementation of project activities. *The action alternative would be consistent with this standard because appropriate and effective BMP's would be employed.*

Feasibility Analysis. Require a watershed cumulative effects feasibility analysis of projects involving significant vegetation removal, prior to including them on implementation schedules, to ensure that the project, considered with other activities, will not increase water yields or sediment beyond acceptable limits. *Analysis of water yield and sediment effects of the action alternative indicate that any increases in water yield or sediment associated with the project will be within acceptable limits established by the Gallatin National Forest Plan as ammended.*

Maintain land productivity and protect beneficial uses. All management practices will be designed or modified as necessary to maintain land productivity and protect beneficial uses. *Due to project design and prescribed mitigations the proposed project would maintain land productivity and protect beneficial uses.*

Sediment Standard. Standard E-4. Water, Fisheries, and Aquatic Life: Proposals for road and trail construction, reconstruction, maintenance, and other ground disturbing projects (timber sales, fuel treatment projects, mineral activities, etc.) will be designed to not exceed annual sediment delivery levels in excess of those in Table 3.27. Sixth-code Hydrologic Unit Codes (HUCs) are the analysis unit for sediment delivery (and other habitat parameters), except where a sixth code HUC artificially bisects a watershed and is therefore inadequate for analysis of impacts to aquatic habitat and aquatic organism metapopulations. In such cases, appropriate larger units will be analyzed (e.g. 5th code HUCs). Within the analysis unit, sediment delivery values in Table 3.27 will serve as guidelines; however, sediment delivery values denoted in individual 7th code HUCs may only temporarily exceed sediment delivery rates denoted in Table 3.27 in the following circumstances:

1. The 7th code HUC does not contain a fragmented **fish population of special management designation**;
2. The majority of 7th code HUCs in the analysis unit remain within sediment delivery values listed in Table I-4;
3. Other core stream habitat (e.g. pool frequency, pool quality) or biotic (e.g. macroinvertebrates, fish populations) parameters within the 7th code HUC do not indicate impairment as defined by Montana Department of Environmental Quality (MDEQ); and

4. Sediment delivery levels will return to values listed in Table 3.27 within 5 years of project completion, and thereby do not lead to stream impairment as defined by Montana Department of Environmental Quality (MDEQ).

Table 3.27. Substrate sediment and sediment delivery by Forest stream category. Bold values are provisional pending final analysis of Forest reference data.

Category	Management Objective (% of reference*)	% Fine Substrate Sediment (<6.3mm)	Annual % > Reference* Sediment Delivery
A Sensitive Species and/or Blue Ribbon fisheries	90%	**0 – 26 %**	**30%**
B All other streams (formerly Classes B, C, D)	75%	**0 – 30 %**	**50%**

* % of reference = % similarity to mean reference condition

Analysis of sediment effects of the action alternative indicate that increases in sediment associated with the project within five of the six defined assessment area watersheds will be minor, temporary, and will fall within acceptable limits established by the Gallatin National Forest Plan as amended by the Gallatin National Forest Travel Management Plan Detailed Description of Decision – Chapter 3 (USFS, 2006). Within the sixth defined watershed (Pine Creek) sediment modeling was unable to quantify the existing sediment level, which may be elevated due to the effects of flooding in 2011. However, analysis indicated that the incremental effect of the action alternative on sediment yield in the Pine Creek drainage would be negligible.

Forest Service Manual and Handbook

Executive Order 11990 – Protection of Wetlands. Executive Order 11990 calls for the identification, assessment, and protection of wetlands by requiring Federal agencies to avoid, if possible, and practicable, adverse impacts to wetlands and to preserve and enhance the natural and beneficial values of wetlands. *The proposed project would be consistent with these requirements because operation of vehicles and logging machinery as well as deposition of materials within wetland areas would prohibited.*

Executive Order 11988 – Floodplain Management. Executive Order 11988 requires federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of flood plains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. *The proposed project would be consistent with these requirements since no occupancy or modification of floodplains is proposed. Furthermore, the 15 ft no-cut zone adjacent to streams and State-mandated SMZ requirements will ensure that little or no disturbance will occur within the narrow floodplain areas associated with the Project Area streams.*

Forest Service policy in FSM 2500 (USFS 2010). *Project design and prescribed mitigations would ensure the project would be consistent with FSM 2500, which includes protection of wetlands and floodplains among other requirements.*

Watershed Condition Framework Guidance

The Watershed Condition Framework established a new consistent, comparable, and credible process for improving the health of watersheds on national forests and grasslands (USFS, 2011). Watershed condition classification, priority watershed designation, and Watershed Restoration Action Plans are the first three steps in the program. Watershed condition classification was completed on National Forest System lands in May of 2011. Hyalite Creek, Bozeman Creek, and Pass Creek Watersheds were designated as the three Gallatin National Forest priority watersheds, and completion of associated watershed restoration action plans was accomplished in early 2012.

The South Bridger Interface Project assessment area lies within the headwaters of the Bridger Creek Watershed, which has not been identified as a priority watershed for the Gallatin National Forest. The Forest Service manages 20% of the Upper Bridger Creek Watershed with the remaining 80% being under private ownership and management. Current activities on Forest Service land primarily include non-motorized recreational use and permitted use by Bridger Bowl Ski Area. Activities on private land primarily include industrial timber harvest, agriculture, and operation/maintenance of numerous private residences and roads.

The Upper Bridger Creek Watershed condition class rating is "functioning at risk." All condition indicators are either "fair" or "good" with the exception of Aquatic Biota Condition and Water Quality Condition indicators, both of which are rated as "poor." The primary reason behind the "poor" rating for Aquatic Biota Condition is the presence of non-native fish species (addressed in fisheries specialist report). The primary reason for the "poor" Water Quality Condition rating was that, at the time the condition indicators were developed in 2011, Upper Bridger Creek was identified as impaired due to chlorophyll-a, total phosphorus, and total nitrogen (MDEQ 2012c). Listed sources of impairment were grazing in riparian/shoreline zones, impacts from resort areas, and unspecified unpaved roads or trails. Subsequent TMDL development by the Montana Department of Environmental Quality, presented in *Lower Gallatin Planning Area TMDLs & Framework Water Quality Improvement Plan* (MDEQ 2013), concluded that the 303(d) listing of Bridger Creek for total phosphorus and total nitrogen was not supported by data. Extensive water quality sampling did indicate NO_3+NO_2 impairment, with this impairment being limited to the segment of Bridger Creek lying within the Lower Bridger Creek HUC6 downstream of its confluence with Lyman Creek. The TMDL developed for Bridger Creek includes only NO_3+NO_2 and applies only to the segment of Bridger Creek lying downstream of its confluence with Lyman Creek, which lies approximately 10 miles downstream of the Project Area and outside of the Upper Bridger Creek HUC6 Watershed. Thus, the streams in the Project Area are not listed as impaired by the MDEQ, are located in the headwaters of a HUC6 watershed found by the DEQ to be unimpaired, and lie far upstream from where the NO_3+NO_2 impairment has been identified in the Bridger Creek TMDL.

The proposed action does not attempt to remedy the factors affecting Watershed Condition Framework indicators for aquatic biota and water quality. It would have negligible effects upon those factors. However, aquatic biota and water quality would be adequately protected by the project mitigation measures. The 15-ft no-cut zone, together with the State-mandated SMZ rules, would provide an adequate buffer to prevent project related sediment from reaching streams. Stream crossing permits and associated mitigations would protect from sedimentation at these vulnerable locations. Therefore, the project would have negligible effects on aquatic biota and water quality.

State and Federal Permit Requirements

All required water quality permits will be acquired by the Gallatin NF prior to any ground disturbance activities for the proposed action including 124 permits and Nationwide 404 permit compliance

validations for stream crossings. However, at this time, there has been no need identified for these permits.

Summary

Based on the analyses detailed in this document, effects of the proposed project on water quality and hydrologic factors would be as follows:

- Effects of the proposed project on water yield would be minor and of a magnitude which is not measureable.
- Effects of the proposed action on peak flows would be non-existent or negligible.
- Effects of the proposed action on stream channel stability would be non-existent or negligible.
- Effects of the proposed action on rain-on-snow events would be non-existent or negligible.
- Analysis of sediment effects of the action alternative indicate that increases in sediment associated with the project within five of the six defined assessment area watersheds will be minor, temporary, and will fall within acceptable limits established by the Gallatin National Forest Plan as amended by the Gallatin National Forest Travel Management Plan Detailed Description of Decision – Chapter 3 (USFS, 2006). Within the sixth defined watershed (Pine Creek) sediment modeling was unable to quantify the existing sediment level, which may be elevated due to the effects of flooding in 2011. However, analysis indicated that the incremental effect of the action alternative on sediment yield in the Pine Creek drainage would be negligible.
- There would be negligible impacts to wetlands or floodplains within the Project Area.

These conditions are consistent with the requirements of applicable law, policy, and direction listed above.

DESIGN/ MITIGATION

The following mitigation measures would be applied during project design and implementation.

- Standard timber sale protection provisions would be applied to the commercial harvest activities to protect against soil erosion and sedimentation. Standard Best Management Practices or BMP's (DNRC 2006) including Montana SMZ compliance rules (DNRC 2006a) would be applied during design and implementation of all commercial activities.
- Current Best Management Practices (BMP) for the Gallatin National Forest as well as State of Montana Forestry BMPs would be applied (see Appendix B).
- No trees would be cut within 15 feet of the Ordinary High Water Mark along any Class 1 or Class 2 streams.
- Vehicles and logging machinery would not be operated within wetland areas.
- Materials would not be deposited in streams or wetland areas.

- Temporary roads would be rehabilitated by ripping, re-contouring, and slashing upon completion of harvest activities.

A formal project implementation review process has been used on the Gallatin NF since 2005 to review a wide variety of projects and document conclusions and recommendations relevant to future projects. Among items evaluated in the implementation reviews are mitigation measures, or Best Management Practices (BMP's). In general, rating of the application and effectiveness of mitigation measures has shown them to be very effective. The vast majority of mitigation measures have been found to meet requirements and provide effective and adequate protection of resources. In cases where application objectives or effectiveness goals have not been fully met, improvements to mitigation measures have been devised and instituted.

Several of the mitigation measures listed above were based on the Montana Forestry BMP's, which form the nucleus of the Montana BMP audits, augmented by more stringent SMZ guidelines used on the Gallatin NF due to Trout Unlimited Settlement Agreement provisions.

MONITORING

A formal project implementation review, following a process has been used on the Gallatin NF since 2005 to review a wide variety of projects and document conclusions and recommendations relevant to future projects, would be conducted in association with project implementation. Items evaluated in the implementation review would include mitigation measures, Best Management Practices (BMP's), and State of Montana SMZ Rules.

CUMULATIVE EFFECTS

Following are the past, present and reasonably foreseeable future actions occurring in the analysis area that have have potential cumulative effects with the South Bridger Interface proposal.

Timber harvest on FS and adjacent private land – Past harvest on FS land occurred in the 60s to the 70s, and consisted of mostly clear-cuts. In the 1990s and 2000s adjacent private lands were harvested, consisting of individual tree selection. DNRC records indicate the following levels of harvest in recent years: 2001 - 90 acres, 2002 - 12 acres, and 2010 - 73 acres. All known past, current, or planned future harvest activities within the assessment area were incorporated into the existing conditions and effect analyses presented previously and all cumulative effects with the action alternative have been accounted for within these analyses.

The Bridger Bowl Ski Area felling and remove trees which succumb to disease or pests is not expected to adversely affect water quality or have cumulative effects with the action alternative due to its small scale.

Insect control activities - Insect control activities within the Bridger Bowl permitted ski area included the following: attaching pheromones such as verbenone and MCH on individual trees to discourage attacks from mountain pine beetle and Douglas-fir beetles during years with high insect populations. Other insect control activities have included the application of Bt (*Bacillus thuringiensis*) a naturally occurring soil dwelling bacterium which is used to reduce spruce budworm defoliation on Douglas-fir trees and sub-alpine fir. One treatment occurred in 2010, treatment effectiveness on budworm is very short term, usually less than a couple of weeks, so the timing of application is critical. If the budworm population remains high, future applications may occur. No carbaryl has been sprayed in Bridger Bowl or in the project area.

Additionally, trees that are dead or dying and adjacent to ski runs are removed from the ski area. This individual tree removal of hazard trees has been occurring for the past 10 years or more, and expected to continue into the foreseeable future. The number of trees removed each year is variable and depends on the severity of insect outbreak.

It is not expected that insect control activities within the Bridger Bowl permitted ski area will affect water quality or have cumulative effects with the action alternative.

Bridger Bowl Ski Area – The commercial ski resort is under special use permit with the Gallatin NF. The 2005 Bridger Bowl Master Development Plan EIS expanded the special use area into Slushman Drainage (337 acres) and into Bradly Meadow (274 acres), and construct 16 new trails. The ski area is busy year around, with winter skiing from November to April, numerous special events in the off season, facilities maintenance activities in the summer / fall months, and hiking / mountain biking.

Effects of past and ongoing Bridger Bowl Ski Area activities, including past timber harvest, land clearing, and road building on both FS and private land, have been incorporated into all water quality assessments presented previously and any cumulative effects with the action alternative have been accounted for in these analyses. There are no known plans for future expansion of, or significant alteration of, Bridger Bowl operations.

Other recreation – There are a number of trails around the Bridger Bowl Ski area which are used primarily for hiking, horseback riding, and mountain biking. These trails are used frequently in the summer and fall. Although there are a few segments of trails (such as at stream crossings) which make minor, localized sediment contributions to streams their effects are insignificant at the scale of the assessment area. This would not represent a significant cumulative effect with the action alternative.

Invasive weeds control projects - both the Forest Service and Bridger Bowl Inc have treated weeds in the project area for more than 10 years. Treatments involve spot herbicide applications and hand pulling. Weed treatments are expected to continue into the foreseeable future. Weed control hand pulling or spot herbicide application is not anticipated to affect water quality issues or have cumulative effects with the action alternative.

Pine Creek cattle allotment – The allotment has been in place for more than 20 years and expected to continue into the foreseeable future. The allotment has traditionally involved a 2 pasture deferred rotation system, 46 cow calf pair, between July 1 and August 15th for one pasture then August 16th to September 30th. The north pasture over laps proposed units in Section 6. The northern fence relies on natural barrier from thick trees to be effective, but the fences are not directly adjacent to any of the proposed units. The south unit is south of Pine Creek and not near any of the harvest units. A map of the Pine Creek Allotment and the proposed harvest units is in the project file.

Cattle grazing has the potential to affect stream stability and sedimentation and therefore the potential to have cumulative effects with the proposed action. However no grazing effects on channel morphology were observed during field assessment of the Project Area streams. It is likely that the steep, rocky nature of the stream channels and their narrow floodplains offer little browse or resting habitat for cattle. Neither are cattle likely to be drawn to streamside areas for thermal refuge, as most areas within the Pine Creek Allotment are forested and shade is readily available. In addition, a stock tank near proposed Unit 17 allows stock to water without accessing streams. For these reasons, cattle grazing is not expected to have significant cumulative effects in conjunction with the proposed action.

Road Maintenance - Administrative routes in the project area eroded in several areas from flood events in 2011, and are noted on the project area map. Areas that sloughed would need road maintenance prior

to use for project implementation. The sloughed road sections currently pose a potential sediment source. Road repairs, which are scheduled to be completed during summer 2014, will decrease the availability of sediment in these areas and thus will have a potentially positive impact on the Project Area. No cumulative effects are expected with the action alternative.

Bridger Ridge Communications Site – The Bridger Ridge Communications Site is located in Gallatin County, Montana in the SW¼ Section 24 and NW¼ Section 25, T. 1 N., R. 6 E., P.M., MT above the Bridger Bowl Ski Area. It was originally developed by Montana State University in the 1960s as a research location to study snow and water conditions and other scientific topics. The Bridger Ridge Site was designated as an Electronic Site in 1987 Gallatin Forest Plan and encompasses approximately 2 acres of NFS lands. Currently, the Radio Association operates a radio repeater facility at the site for fifteen (15) different private, commercial and governmental organizations. There are two buildings on site, one a two story 'A' frame owned by the Radio Association. AC power is provided by two (2) lines from Bridger Bowl Ski Area. Several antenna towers are onsite as well as a helicopter pad.
The radio site and buildings are located on the top of Bridger Ridge, far from any watercourses, and do not affect water quality issues or parameters. No cumulative effects with the action alternative are expected.

AQUATIC SPECIES

AQUATIC SPECIES RELATED ISSUES

This analysis addresses standard aquatic resource issues identified for timber harvest projects and those identified by public scoping that have the potential to affect populations and habitats these populations are dependent upon. Detailed information which is not included in this report is located in the project record.

Timber harvest and associated activities, including construction of temporary roads, hauling, skidding, landings, and prescribed fire have the potential to affect aquatic species, including Management Indicator Species (wild trout) and Region 1 sensitive species (westslope cutthroat trout, Yellowstone cutthroat trout, western toad, northern leopard frog, and western pearlshell mussel). These activities have the potential to:

Fisheries (including MIS and sensitive species)

- disturb soils and overland flow regimes, which in turn increases the potential for erosion and sediment transport to streams and other water bodies. Increased fine sediment in streams and other water bodies can reduce habitat quality and cause adverse effects to fish and other aquatic biota. For example, elevated levels of fine sediment (material < 6.35 mm in diameter) have been shown to affect salmonid habitat used for spawning, rearing and overwintering (Chapman and McLeod 1987).

    - Increasing proportions of fine sediment in substrates have been associated with reduced intra-gravel survival of embryos for brook trout (Hausle and Cobble 1976; Alexander and Hansen 1986), and rainbow trout (Witzel and MacCrimmon 1981; Irving and Bjornn 1984). The effects of fine sediment on survival of incubating cutthroat trout has been studied less than for other salmonid species. In laboratory studies, Irving and Bjornn (1984) found that elevated fine sediment (less than 6.35 mm) levels significantly reduced survival of cutthroat trout.

    - Pools are areas of higher velocity during peak flows, but at low flows their depth creates a depositional environment for fine sediment. Increased sediment from timber harvest and road construction could influence the amount and quality of juvenile and adult pool habitat if sediment increases are sufficient to alter channel morphology by filling in pools. For lower gradient sensitive stream channel types with high sensitivity to increased sediment, excessive sediment loading can reduce maximum pool depth and residual pool volume.

- affect fish habitat and biological productivity by reducing the number of larger trees that fall in to mountain streams. Large woody debris is the primary pool-forming feature in forested, moderate gradient stream channel types. Removal of riparian trees can reduce the potential to recruit trees into the stream channels and alter stream temperatures.

- increase water yield and the magnitude or duration of peak flow by altering a variety of hydrologic processes. This hydrologic imbalance may adversely affect aquatic habitat through increased scour potential, channel incision, bank erosion and increased sediment transport capacity.

The South Bridger Interface Project incorporates design and mitigation measures that will protect riparian corridors (see design/mitigation below). All stream channels (both perennial and intermittent) would be buffed by at least 50 feet (with the exception of four small stream channels within treatment units 1, 2, 7, 12 and 13; therefore there should be no effect to local fish populations from changes to water temperature, stream bank stability, riparian cover, and large woody debris recruitment. As a result, the effects analysis for aquatic species focuses on sediment delivery, and the other indicators will not be analyzed further.

Amphibians and Mussel Sensitive Species - (Western Toad, Northern Leopard Frog and Western Pearlshell Mussel

- change vegetative structure to the point that both thermal and moisture conditions are altered. Western toads use terrestrial habitat in ways that allow them to conserve body water (Bartelt et al. 2004). It has been shown that western toads tend to avoid clear cuts (Bartelt et al. 2004).

- increase the risk of direct mortality from burning and heavy equipment. Western toads have been shown to use slash pile for their hibernacula (Bartelt et al. 2004) and road prisms of for basking and feeding (Bryce Maxwell, personal communications).

- change watershed conditions that could potentially increase the frequency of landslides and rate of erosion burying mussel beds or negatively affecting individual's ability to filter food or a combination of events that could destabilize stream channels enough to cause bedload movement crushing these immobile organisms.

Western toads or northern leopard frogs have not been observed within the project area or reported to occur within the project area by the Montana Natural Heritage Program database. No direct surveys have been conducted within the project area looking for western pearlshell mussels. No shells from dead individuals have been observed along any of the project area streams while conducting other aquatic surveys or site visits. The project area falls outside the native range for pearlshell mussel based on a predicted habitat use model developed by the Montana Natural Heritage Program. Since western toads, northern leopard frogs, and western pearlshell mussels are not reported to occur in the project area, and have not been observed, there should be no effect and this EA does not include additional analysis for these species.

Indicators

As mentioned above, the effects analysis focuses primarily on sediment effects to MIS fisheries, and evaluates projected incremental changes in fine sediment deposition in spawning gravels associated with predicted sediment yield changes. There are no known populations of sensitive fish species within the project area. Resulting values are not considered definitive or absolute; rather they are used to evaluate the relative magnitude and direction of incremental change in spawning habitat and as a means to make relative comparisons between alternatives.

AFFECTED ENVIRONMENT

It is expected the fishery along the lower reaches of all three streams on private land closely resembles that of Bridger Creek which includes brown trout, rainbow trout, brook trout, longnose dace, mottled sculpin and mountain whitefish. No westslope cutthroat trout populations have been documented within the project area or within the larger Bridger Creek watershed.

Maynard Creek is a second order tributary to Bridger Creek which is a tributary to the East Gallatin

River. Maynard Creek is a high gradient stream channel (> 4%) dominated by cobble substrate. According MFISH (Montana Fish, Wildlife and Parks on-line database), no fish were captured during a 1992 survey made by MFWP. There is a small reservoir located along lower Maynard Creek on private land. It has been reported that rainbow trout are periodically stocked in this reservoir.

Slushman Creek consists of three forks which join downstream of the Forest boundary. Slushman Creek is a tributary to Bridger Creek. All three forks are very high gradient (> 4%), small first-order streams dominated by cobble substrate. All three forks were surveyed using electrofishing equipment early-July 2013. No fish were collected or observed during these surveys. According MFISH (Montana Fish, Wildlife and Parks on-line database), no other population surveys have been conducted along Slushman Creek including downstream on private land. All three forks were dry later during the late-summer months including into the fall during time periods of heavy rain.

Pine Creek is a second order, moderate gradient (2-4%) stream at the Forest boundary dominated by small cobble and gravel. Pine Creek is also a tributary to Bridger Creek. A massive flood scoured the entire length of Pine Creek in 2011 including a couple its tributaries. Riparian vegetation is recovering along lower Pine Creek. The old road system near the Forest boundary has been washed out leaving several segments of impassible road coming from private land. Rainbow trout, brown trout and mottled sculpin were captured during 2009 and 2011 fisheries population surveys.

APPLICABLE LAWS, REGULATIONS, POLICY AND FOREST DIRECTION

Clean Water Act and Montana Water Quality Act

The Clean Water Act provides the overall direction for the protection of waters of the United States, from both point and non-point source of water pollution. The Montana Water Quality Act establishes general guidelines for water quality protection in Montana. It requires the protection of Montana's water, as well as the full protection of existing and future beneficial uses. All of the streams within the analysis area are classified as B1 streams under the Montana Water Classification system. The Administrative Rules of Montana (ARM 17.30.623) require that waters classified as B1 are suitable among other things for the "growth and propagation of salmonid fishes and associated aquatic life."

Presidential Executive Order 12962

Presidential Executive Order 12962, signed June 7, 1995, furthered the purpose of the Fish and Wildlife Act of 1956, the National Environmental Policy Act of 1969, and the Fish and Wildlife Coordination Act, seeking to conserve, restore, and enhance aquatic systems to provide for increased recreational fishing opportunities nationwide. This order directs Federal agencies to "improve the quantity, function, sustainable productivity, and distribution of aquatic resources for increased recreational fishing opportunity by evaluating the effects of Federally funded, permitted, or authorized actions on aquatic systems and recreational fisheries and document those effects relative to the purpose of this order."

Sensitive Species

Sensitive species are those plant and animal species identified by a Regional Forester for which population viability is a concern as evidenced by a significant current or predicted downward trend in population numbers or density, and significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution (FSM 2670.5).

The objective of the Sensitive Species Policy is to maintain viable populations of all native and desired non-native vertebrate species in habitats distributed throughout their geographic range on National Forest System lands. The sensitive species program is intended to be pro-active by identifying potentially vulnerable species and taking positive action to prevent declines that will result in listing under the Endangered Species Act.

As part of the National Environmental Policy Act (NEPA) decision-making process, proposed Forest Service programs or activities are to be reviewed to determine how an action will affect any sensitive species (FSM 2670.32). The goal should be to avoid or minimize impacts to sensitive species. If impacts cannot be avoided, the degree of potential adverse effects on the species (and habitat) within the project area and for the species throughout its range must be disclosed. A given project can be approved even if it may adversely affect a sensitive species, but it must not result in the loss of species viability or create significant trends toward federal listing.

Westslope cutthroat trout, Yellowstone cutthroat trout, western toad, northern leopard frog, and pearlshell mussel are all classified as a sensitive species within the Northern Region of the U.S. Forest Service. The project area falls outside the native range of Yellowstone cutthroat trout. Yellowstone cutthroat trout occupy habitat on the Yellowstone River side of the divide, not in the upper Missouri River drainage. The project area also falls outside the native range for pearlshell mussel based on a predicted habitat use model developed by the Montana Natural Heritage Program. Although the following species will not be analyzed throughout this EA, a sensitive species policy determination will be made for each species within the following Biological Evaluation (westslope cutthroat trout, western toad, northern leopard frog and western pearlshell mussel).

Most likely all fish bearing streams within project area were once occupied habitat by westslope cutthroat trout. Because of negative impacts of non-native trout (i.e, competition, predation, hybridization, etc.), westslope cutthroat trout have become extirpated. There are no known documentation (formal or grey literature) citing cases where any of the various sub-species of cutthroat trout have returned to a stream or lake facing continued threats of non-native trout. Human intervention is required to flip waters from non-native back to native.

Forest Direction

Forest-wide:

Fish and Wildlife A-14: The Forest will be managed to maintain and, where feasible, improve fish habitat capacity to achieve cooperative goals with Montana Fish, Wildlife and Parks and to comply with State water quality standards.

Management Area 7 (Riparian Areas – III-19 to 23):

- Wildlife and Fish 2: Provide for optimum water temperatures for cold-water fish species.
- Wildlife and Fish 3: Maintain minimum instream flows.
- Wildlife and Fish 4: Maintain suitable habitats for those species of birds, mammals, and fish that are totally or partially dependent upon riparian areas for their existence.
- Timber 3: Design timber harvest to meet needs of riparian zone-dependent species.
- Timber 4: Maintain sufficient trees within 30 feet of the stream to provide snag recruitment to create pools and enhance spawning gravesl for fish habitat.
- Timber 5: Emphasize special logging practices which minimize soil disturbacne.
- Timber 6: Perform directional felling of timber where needed to protect the stream or associated riparian vegetation.

- Timber 7: Yarding across perennial streams will require special mitigation measures. Trees or products shall not be hauled or yarded across stream courses unless fully suspended or when designated crossings are used.
- Timber 8: Machine piling will not be allowed.
- Timber 9: Commercial thinning may be used to meet management area goals.
- Timber 10: A natural mix of species is desirable.
- Timber 13: Shade tolerant tree species which occur as an understory in sapling stands will be left during precommercial thinning to promote mult-storied stands.

In a Settlement Agreement (Gallatin National Forest 1990) with the Gallatin National Forest, the Madison/Gallatin Chapter of Trout Unlimited (MGTU) settled their appeal of the Gallatin National Forest Plan. The Gallatin National Forest agreed to the following language: vegetative manipulation within riparian areas will occur only for the purpose of meeting riparian dependent resource objective such as watershed, wildlife, or fisheries. For the purpose of this agreement, a riparian area was defined as the land and vegetation for approximately 100 feet from the edges of perennial streams, and intermittent streams of sufficient size, to include a distinct riparian vegetation community and rock substrate stream channel. MGTU and GNF have had an open and continuing dialog about this agreement and how to design new projects. This coordination and dialog meets the intent of the agreement that is binding only with the MGTU organization. Members of the South Bridger IDT met with MGTU members on 12/11/12 to specifically discuss this proposed project. Recommended aquatic mitigation measures listed in Chapter 2 are a result of this dialog.

Management Indicator Species (MIS) are species identified in the forest planning process that are used to monitor the effects of planned management activities on populations of wildlife and fish including those that are socially or economically important (Forest Plan, page VI-14). Under the Gallatin Forest Plan, population trends of indicator species and relationships to habitat changes are to be monitored (id., pages II-18 and IV-6). The expected precision and reliability for this monitoring is “moderate” and the reporting interval is 5 years. Therefore, this requirement is accomplished by observing the consequences of multiple management actions over time. A species group including all redd (or intra-streambed nests) spawning wild trout was selected and referenced in the Gallatin National Forest Plan (GNF 1987) as Management Indicator Species (MIS) on page II-19. This species group was selected as Management Indicator Species because it has been shown that spawning habitat can be affected by forest management activities thereby serving as indicators of habitat quality. Overall, wild redd spawning trout are widespread and common or abundant on the Gallatin National Forest within the Yellowstone and upper Missouri River drainages (GNF 2010). These factors combine to indicate that, in general, aquatic habitats are being maintained sufficient to support coldwater fisheries as required by the Clean Water Act. Sediment related impacts on this species group are discussed under each alternative.

Forest Travel Plan Direction

The following sediment standard has been incorporated as part of the Gallatin National Forest Travel Management Plan signed December 18, 2006 (GNF 2006). In the past, the sediment standard consisted of four categories of streams (A, B, C, and D). Fishless headwater streams (i.e., Category C and D streams) were managed at a level below what Montana Department of Environmental Quality (MDEQ) considers as maintaining beneficial uses. This new direction formalizes a single standard for all B streams and previously classified C and D streams.

Standard M-1: Water, Fisheries, and Aquatic Life. In watersheds with streams currently at or above fish habitat management objectives, proposals for road and trail construction, reconstruction and maintenance

will be designed to not exceed annual sediment delivery levels in excess of those in Table 3.28. Sixth-code Hydrologic Unit Codes (HUCs) are the analysis unit for sediment delivery (and other habitat parameters), except where a sixth code HUC artificially bisects a watershed and is therefore inadequate for analysis of impacts to aquatic habitat and aquatic organism meta-populations. In such cases, appropriate larger units will be analyzed (e.g. 5th code HUCs). Within the analysis unit, sediment delivery values in Table 3.28 will serve as guidelines; however, sediment delivery values denoted in individual 7th code HUCs may temporarily exceed sediment delivery rates denoted in Table 3.28, in the following circumstances:

1. The HUC does not contain a fragmented sensitive or MIS fish population;
2. The majority of HUC's in the analysis unit remain within sediment delivery values listed in Table 3.28;
3. Other core stream habitat (e.g. pool frequency, pool quality) or biotic (e.g. macro-invertebrates, fish populations) parameters within the HUC do not indicate impairment as defined by Montana Department of Environmental Quality (MDEQ); and
4. Sediment delivery levels will return to values listed in Table 3.28 within five years of project completion.

Table 3.28: Substrate sediment and sediment delivery by Forest stream category.

Category	Management Objective (% of reference*)	% Fine Substrate Sediment (<6.3mm)	Annual % > Reference** Sediment Delivery
A Sensitive Species and/or Blue Ribbon fisheries	90%	0 – 26 %	30%
B All other streams (formerly Classes B, C, D)	75%	0 – 30 %	50%

*% of reference = % similarity to mean reference condition; reference conditions range.

**Reference = observed relationship between substrate % fines and modeled sediment delivery in reference (fully functioning) GNF watersheds.

Class A streams are those streams supporting a sensitive fish species or provide spawning or rearing habitat to the Gallatin, Madison, or Yellowstone Rivers, or Hebgen Lake. Class A streams are to be managed at a level which provides at least 90 percent of their inherent fish habitat capability. Class B streams are those streams that are regionally or locally significant and support both a quantity (substantial quantities of harvestable fish) and quality (numerous fish over 10 inches in length) fish populations. Class C streams are characterized as having limited local significance and provide a diversity of lower quality dispersed fishing opportunity.

Maynard, Slushman and Pine creeks are considered Class B streams.

ENVIRONMENTAL EFFECTS

The following analysis describes predicted direct, indirect and cumulative effects to wild trout populations and their habitat. The primarily potential effect to fish populations and their habitat would be

a result of sediment delivery. These effects are described for each alternative. The analysis characterizes the direction of effect, the magnitude of the anticipated effect and the duration of the effect.
Direct effects are defined as those effects that occur at the same time and place as the triggering action. For fisheries, it is those actions that result in immediate mortality to fish such as fuel spills, acute sediment delivery, etc. Indirect effects are defined as those effects that occur later in time and distance from the triggering action. For fisheries, it is those actions that affect fish populations and habitat as a result of chronic sediment sources, reduction in stream shading, reduction in large woody debris recruitment, etc. Because little vegetation manipulation or associated activities (landings, roads, etc.) are being planned within riparian areas, most effects would be indirect in nature.

Spatial analysis for this project was delineated into six associated catchment areas (See Figure 3.11) including: Maynard Creek, Slushman Creek, Pine Creek, UNK 2655, UNK 2639 and UNK 2605 above the Forest boundary. Because there are no live surface waters within the three UNK catchment areas, the following fish effects analysis will not discuss these three catchment basins.

The temporal analysis includes those activities from 1950's when large-scale mechanical timber clearing and associated road construction started in these upper drainages until five years into the future. Beyond 10 years, it is not reasonable to foresee possible activities and impacts.

Methodology for Analysis

Potential effects of the South Bridger Interface Project on fish and fish habitats were analyzed by a quantitative assessment. This assessment includes evaluating the combined effects of all treatments and associated activities including log hauling by alternative on sediment delivery rates on salmonid spawning and rearing habitat. Incremental changes in fine sediment deposition in spawning gravels associated with predicted sediment yield changes was used as an indicator to compare between alternatives.

Natural, existing and post-project sediment delivery (or yield) rates were calculated by the Gallatin National Forest Hydrologist (White 2013) for all alternatives using a modification of the R1/R4 sediment model (Cline et al. 1981). The actual effects of additional delivery of fine sediment on salmonid spawning and rearing habitat will be dependent on precipitation, stream flow, how quickly exposed soil is stabilized, and how the sediment is delivered to, and routed within the stream during project activities. The effects of this additional sediment delivery on salmonid spawning and rearing habitat was estimated for all alternatives using a modification of the Fish/Sed model (Stowell et al. 1983) which estimates the change in substrate composition resulting from changes in sediment delivery rates. This modification more accurately reflects sediment routing relationships of geologies found on the Gallatin National Forest.

This model assumes a linear relationship between estimated percent sediment yield over natural (from the R1/R4 sediment model) and fine sediment accumulation in spawning gravels, the latter value calibrated from actual data from Gallatin National Forest streams. The predictive regression equation is {$y= s + 0.24(x)$}, where x is the predicted incremental increase in percent of sediment yield over natural on an annual basis, y is the predicted percent of fine sediment less than 6.35mm deposited in the spawning gravels, s is the existing percent of fine sediment in the substrate and 0.24 is the slope of the relationship. The coefficient of 0.24 best reflects this relationship from an annual perspective. This equation was developed by regressing measured instream sediment concentrations with predicted increases in sediment yield from the R1/R4 sediment model. Application of this model provides an estimate of incremental change in fine sediment deposition in spawning gravels associated with predicted sediment yield changes. The estimated sediment concentrations are then compared to sediment/survival curves developed for cutthroat trout embryos (Irving and Bjornn 1984).

Both the R1/R4 sediment delivery and sediment/routing models are very simplified approximations of complex natural processes that affect sediment production and fish embryo survival, due to the models inability to predict all aspects of natural variation associated with sediment delivery and routing. Because of this, resulting values are not considered definitive or absolute; rather they are used only to evaluate the relative magnitude and direction of incremental change in spawning habitat and as a means to make relative comparisons between alternatives.

Alternative 1 (No Action Alternative)

Direct and Indirect Effects

There would be no change to existing sediment delivery rates and fine sediment in spawning gravels (Table 3.29.). Populations of wild trout, would remain the same.

Summary Conclusion

The No Action Alternative is consistent with all Applicable Laws, Regulations, Policy and Forest Direction. There would be no irreversible or irretrievable commitment of aquatic resources including fish and amphibians.

Alternative 2 (Proposed Action)

Direct and Indirect Effects

Commercial harvest activities occurring within the various riparian areas within proposed harvest units 1, 2, 7, 12 and 13 would be implemented within accordance to State of Montana Streamside Management Zone (SMZ) compliance rules with one limiting exception: No trees would be cut within 15 feet of any Class 1 and 2 stream channel segments.

It is predicted that fine sediment would increase slightly by 0.84% along Maynard Creek, 1.10% along Slushman Creek and 0.60% along Pine Creek (Table 3.29- Comparison of Alternatives). Project generated sediment delivery is projected to cease in approximately six years or 2020 (White 2013). Projected decreases in percent fry emergence are also displayed in Table 3.29.

Table 3.29: Comparison of alternatives for projected maximum changes in fine sediment and projected maximum changes in rainbow trout survival.

Catchment Area	Predicted Percent above "reference" under Existing Condition	Predicted Percent above reference" in 1st year after Implementation of Proposed Action	Predicted Maximum Increase in Fine Sediment	Predicted Decrease in Rainbow Trout Survival*
Alternative 1				
Maynard Creek	22.5%	22.5%	0.0	0.0
Slushman Creek	10.3%	10.3%	0.0	0.0
Pine Creek	11.5%	11.5%	0.0	0.0
Alternative 2				
Maynard Creek	22.5%	26.0%	+ 0.84%	- 2.0%
Slushman Creek	10.3%	14.9%	+ 1.10%	- 2.6%
Pine Creek	11.5%	12.1%	+ 0.60%	- 1.4%

* = Assumes existing percent fine sediment = 25%, which is = 67.5% rainbow trout survival.

Cumulative Effects

The R1/R4 sediment modeling was run in a cumulative mode accounting for all roads (existing, previously decommissioned and proposed temporary), previous and proposed timber harvest, previous and proposed prescribed and wild fires, and residential and recreational developments in the four analysis drainages (White 2013).

Following are the past, present and reasonably foreseeable future actions occurring in the the analysis areas or catchment areas that have have potential cumulative effects with the South Bridger Interface proposal. Five of the eight may have cumulative effects with the proposed action including: road maintenace, Pine Creek C&H grazing allotment, other recreation, Bridger Bowl ski area and timber harvest on Forest Service and adjacent private land.

Timber Harvest on FS and adjacent private land – Past harvest on FS land occurred in the 60s to the 70s, and consisted of mostly clear-cuts. Refer to the FACTS query for the upper Bridger Creek HUC filed in the South Bridger project folder on the O drive.) In the 1990s and 2000s adjacent private lands were harvested, consisting of individual tree selection. DNRC records indicate the following levels of harvest in recent years: 2001 - 90 acres, 2002 - 12 acres, and 2010 - 73 acres.
Effects of past timber harvest, land clearing, and road building on both FS and private land have been incorporated into all assessments carried out including sediment in streams, stream channel stability, water yield, peak flows, risk of rain on snow events, effects on identified water quality limited streams, and effects upon wetlands and floodplains (White 2013), and as such have been incorporated into the existing condition.

Bridger Bowl Ski area – The commercial ski resort is under special use permit with the Gallatin NF. The 2005 Bridger Bowl Master Development Plan EIS expanded the special use area into Slushman Drainage (337 acres) and into Bradly Meadow (274 acres), and construct 16 new trails.

The ski area is busy year around, with winter skiing from November to April, numerous special events in the off season, facilities maintenance activities in the summer / fall months, and hiking / mountain biking.

Effects from Bridger Bowl Ski Area activities including past timber harvest, land clearing, and road building on both FS and private land have been incorporated into all assessments carried out including sediment in streams, stream channel stability, water yield, peak flows, risk of rain on snow events, effects on identified water quality limited streams, and effects upon wetlands and floodplains (See Water Effects Analysis report). Future Bridger Bowl Ski Area activities may have cumulative effects with the proposed action in any or all of the above-mentioned categories depending upon the nature of the future activities. Depending on the nature of any future proposed activities, additional environmental analysis may be required.

Other Recreation – hiking trails, mountain biking, hunting. There are a number of user created trails around the Bridger Bowl Ski area (for mountain biking and hiking). These trails are used frequently in the summer and fall.

The effects of user created trails and other recreation activities are likely to be insignificant compared to the effects of past timber harvest, land clearing, and road building within the study area.

Pine Creek Cattle Allotment – The allotment has been in place for more than 20 years and expected to continue into the foreseeable future. The allotment has traditionally involved a 2 pasture deferred rotation system, 46 cow calf pair, between July 1 and August 15th for one pasture then August 16th to September 30th. The north pasture over laps proposed units in Section 6. The northern fence relies on natural barrier from thick trees to be effective, but the fences are not directly adjacent to any of the proposed units. The south unit is south of Pine Creek and not near any of the harvest units. A map of the Pine Creek Allotment and the proposed harvest units is in the project file.

The Pine Creek Cattle Allotment is located within the Pine Creek drainage and the southern portion of the Slushman Creek drainage. Cattle grazing has the potential to affect stream stability and sedimentation and therefore the potential to have cumulative effects with the proposed action. However, no grazing effects on channel morphology were observed during field assessment of the project area streams. It is likely that the steep, rocky nature of the stream channels and their narrow floodplains offer little browse or resting habitat for cattle. Neither are cattle likely to be drawn to streamside areas for thermal refuge, as most areas within the Pine Creek Allotment are forested and shade is readily available. In addition, a stock tank near proposed Unit 17 allows stock to water without accessing streams. Light cattle use was observed around this stock tank.

Road Maintenance - Administrative routes in the project area eroded or slumped in several areas from flood events in 2011, and are noted on the project area map. Road segments that sloughed would require major work to insure access for large trucks. Additional surfacing is also required to insure all season traffic because of the poorly drained soils.

Planned road maintenance activities after the 2011 floods even though designed to be long-term beneficial will result in short-term increases in sediment delivery.

Summary Conclusion

Alternative 2 would meet the Forest-wide and Management Area standards as required by the Forest Plan within the Maynard, Pine, and Slushman drainages. Alternative 2 is consistent with all Applicable Laws, Regulations, Policy and Forest Direction to protect fish and fish habitat, including fish Sensitive and Management Indicator Species. Alternative 2 would have “No Impact” on the westslope cutthroat trout population, because of the fact they are not present.

Impacts to wild trout in terms of predicted decrease in rainbow trout embryo survival are displayed in Table 3.29. Similar reductions in embryo survival would be expected for other redd spawning wild trout inhabiting the three analysis areas (or catchment areas) including brown trout and eastern brook trout. Rainbow trout embryo survival is expected to decrease slightly with the implementation of Alternative 2. Although, population trends of these Management Indicator Species (MIS) or species group are expected to remain stable. Overall on the Gallatin National Forest, trout are widespread and generally common or abundant (GNF 2010). At the same time, populations of these MIS are stable or increasing overall. These factors combine to indicate that, in general, aquatic habitats are being maintained sufficient to support coldwater fisheries, as required by the Clean Water Act for most GNF streams.

Alternative 2 as planned is not expected to impact individual western toads, northern leopard frogs or their habitat. No western toads or northern leopard frogs have been observed within the project area or reported to occur within the project according to the Montana Natural Heritage Program database. Alternative 2 would have “No Impact” on either western toad or northern leopard frog and is consistent with all Applicable Laws, Regulations, Policy and Forest Direction to protect amphibians and their habitat, including Sensitive Species.

Western pearlshell mussels are native to western Montana (upper Missouri River, Clark Fork, and Flathead River drainages). This species as do most mussels require an intermediate fish host to be present (Montana's State Official Website 2010) to fulfill their life cycle. The nearest known population of western pearlshell mussel is located in the East Gallatin River, nearly 20 miles downstream from the project area. The project area falls outside the predicted native range for pearlshell mussel based on a model developed by the Montana Natural Heritage Program. Even though no direct surveys have been conducted within the project area, no shells from dead individuals have been incidentally observed along any project area streams while conducting other fisheries or aquatic habitat surveys. Alternative 2 would have "No Impact" on western pearlshell mussels.

Recommended Mitigation Measures

- No trees would be cut within 15 feet of the Ordinary High Water Mark along any Class 1 or Class 2 (DNRC 2006) stream segment within any treatment unit. This mitigation measure is designed to protect streambanks, provide thermal regulation overhead cover, augment debris recruitment, and reduce or prevent sediment delivery.

- The fisheries biologist would be allowed the descretion to widen the 15 foot no cut zone to ensure stream bank stability in situations where channel migration or unstability may occur.

- Retain all bank-edge trees maintaining stable stream banks and trees leaning toward streams that can provide large woody debris within treatment units.

- A fisheries biologist would be present during marking of all treatment unit boundaries adjacent to streams and marking of leaning leave trees outside the 15 foot no cut zone.

BIOLOGICAL EVALUATION

Fisheries

The project area lies outside the native range of Yellowstone cutthroat trout. No known populations of westslope cutthroat trout occur within the larger Bridger Creek watershed. Alternative 2 would have "No Impact" on either sub-species of cutthroat trout.

Amphibians and Mussels

Alternative 2 implemented as planned would have "No Impact" on individual western toads, northern leopard frogs or western pearlshell mussel. See discussion above under Alternative 2 (Summary Discussion).

SOILS

SOILS ISSUES

Potential soil issues associated with the South Bridger Interface Project include the level of soil disturbance from past and currently proposed forest management activities within treatment units of the project. More specifically, the total level of detrimental soil disturbance (DSD) that will be present in treatments units after harvesting and remediation activities have been completed needs to meet the Region One standard of 15% maximum allowable DSD. Given that nearly all of the area within proposed treatment units has previously not been harvested, this soil issue can be reduced to concern about the level of DSD that might be created by the proposed tractor logging, partial overstory removal, and slash processing within the treatment units.

A related concern is the cumulative level of detrimental soil disturbance in a larger contiguous area surrounding the proposed treatment units where substantial past harvesting has occurred. Some of these lands remain in private ownership while other lands that were clearcut under private ownership prior being obtained by the Forest Service in land exchanges.

ANALYSIS AREA

The overall project area encompasses approximately 1850 acres within and immediately south of Bridger Bowl in the vicinity of Slushman Creek. Proposed vegetation treatments within this area are limited, however, to a maximum combined acreage of 250 acres in Section 30 and the east edge of Section 36 in Township 1 North, Range 7 East and Section 6 in Township 1 South, Range 7 East, Gallatin County, Montana.

Spatial Boundaries

The spatial boundaries for direct and indirect effects of the proposed project on soils are the individual treatment unit boundaries. “Because productivity effects are spatially static and productivity in one location does not influence productivity in another location, it is appropriate to limit the direct, indirect, and cumulative effects analysis to the actual activity area where land disturbance will likely occur” (USFS-R1 2009). Disturbance from temporary roads constructed between treatments units are prorated to those units served by the road. Along the same lines, any landings or portion of landings that extends beyond the existing treatment boundaries are also included in the analysis of direct and indirect effects for the specific treatment unit or units for which they are used.

The proposed treatment units, as designed, have little or no overlap with past timber harvests yet the surrounding area as a whole has had substantial amount of past timber harvesting. As a result, the spatial boundary for soil cumulative effects analysis for this project has been expanded to include a buffer area extending one half mile out from the primary areas of proposed treatment units, Sections 6 and 30. This additional analysis goes beyond what is required in the Region 1 protocol for NEPA analysis of the “project area” However when a specific concern exists about other soil functions, a different appropriate scale may be chosen for assessment and analysis (USFS-R1 2009). This expansion of the cumulative effects analysis area is therefore appropriate given the special circumstances of the proposed project area and the interconnectedness of soil-landscapes in the immediate area.

Temporal Boundaries

Past timber harvesting in the general area of the South Bridger project includes clearcutting as far back as 1950. The temporal analysis for this project will include those past harvests along with more recent timber harvesting. Thus, the temporal boundary going backward will be 64 years to include any past clearcutting occurring as far back as 1950.

The temporal boundary going forward will be 30 years from the date all remediation actions are complete. Partial cutting in the proposed treatment units will create less severe soil disturbance than clearcutting. The combined effects of proposed mitigation measures for this project and natural recovery in a fairly moist, forested environment should ensure that soil disturbance impacts from the proposed treatments will have been largely eliminated 30 years after remediation has been completed. Any residual detrimental disturbance at that time will be substantially below the maximum 15% DSD standard for Region One and restricted to locations that could potentially be used again in the future management of forest resources.

METHODS

Preliminary Analysis – Data Sources

The initial, preliminary soil and land resource assessment of the proposed South Bridger Interface Project area was made based on a review of the available, map-based, resource information for the area. Resources consulted included: the 1:24,000 topographic map of the Saddle Peak Quadrangle, USGS Geologic Map of the Livingston 30' x 60' Quadrangle (Berg, et.al. 2000), the Soil Survey of the Gallatin National Forest (USDA-GNF 1996), and 2005 color (resource inventory) aerial photography, and several GIS project maps, including the a map of past timber harvests within the project area and surrounding Gallatin National Forest lands. Information gained from these sources provides a start towards interpreting local relationships between landscape topography, geologic parent materials, soil resources, and vegetation patterns within the proposed treatment units as well as for the project area as a whole. These data sources provide valuable information to assist in the analysis of soil and land resources. They supplement information gained during field assessments but in no way do they replace actual on the ground field assessments.

Initial Field Analysis

Initial, field analysis involved getting oriented within the project area to the existing road system and observable patterns in the 2005 aerial photographs. Field observations were made while traversing through treatment units of the relationships among site conditions, landscape features, geologic parent materials, plant communities, and soil properties. A limited amount of standard soil sampling was conducted during this phase of the analysis to assess the relative accuracy of soil survey information for the project area, and to gain some sense of the correlation between observable landform and geologic features and the resulting soil attributes. Special attention was paid to the access road that runs through the eastern portion of Section 25. This road connects proposed treatment units in the northern half of the South Bridger Project with those in the southern half. A series of slumps along portions of this route were a concern so sampling was conducted to determine what specific geological factors were contributing to their occurrence. A similar assessment was made in the area where Pine Creek crosses the old Forest Service road on the east side of Section 1.

Finally, the distribution of selected weed species of concern, specifically houndstongue, Canada thistle, and spotted knapweed were of interest during initial field investigations as there distribution appears to be

strongly related to soil and landscape factors, geologic strata, and the density of canopy coverage as well as the level of soil disturbance.

DSD Transecting

The use of transect sampling to assess prior activity related, detrimental soil disturbance within proposed treatment units was unwarranted due to the very low levels of prior activity caused soil disturbance within the proposed treatment units. The purpose of this project is to change stand conditions in selected, mature conifer stands in a manner that disrupts the continued spread of insect pests. Thus by design, this project does not include previously harvested sites within treatment units. Use of site visits and traversing through proposed treatment units was sufficient to assess the level of pre-treatment DSD level due to the low level of pre-existing disturbance, in accordance with the Region One protocol for NEPA analysis in forested areas (USFS-R1 2009). Follow-up transecting will be conducted in years 2 and 5 after timber harvesting and post harvest mitigations have been completed to assess the level of treatment caused DSD associated with this project.

Predictions of Treatment Caused DSD

Predictions of remediation effectiveness used in this analysis are process driven based on specific properties of the local soil resource, the type of soil disturbance expected (eg: compaction, rutting, soil erosion, etc.) as a result of the proposed activities within treatment units, and the level to which specific types of soil disturbance would be remediated under various, potential remediation actions. This approach results in conservative estimates of remediation effectiveness that will ensure compliance with the regional standard. Details of this approach are described more fully in Keck (2010) and Keck (2012a).

Assessment of Past DSD – Cumulative Effects

An assessment of past DSD associated with past harvesting outside of the proposed treatment units was made to assess cumulative effects over a larger area than the individual treatment units. This analysis was based on soil monitoring conducted along transects of past harvest areas in the northern portion of the project area. Sampling along transect segments was conducted in accordance with Region One (USFS-R1 2009; USFS-R1 1999) and Gallatin National Forest (Keck, T. J. 2012) protocols for identifying and monitoring DSD in the field. Auxiliary data on landscape, soil, and vegetation attributes were collected as part of field data collection.

Information in the Forest Service FACTS database, both map data and tabular data, were used to extrapolate field transect data into cumulative soil disturbance levels over a larger area. Distinctions were made in the analysis between the impacts of past clearcut or comparable harvest types with the highest level of soil disturbance and partial harvest cuts (intermediate levels of soil disturbance), and selection harvests (least soil disturbance) in order to calculate the expected level of DSD by harvest area or land parcel.

Best Available Science

Field assessments made of soil properties, soil-landscape-vegetation interactions, and site stability assessments for this project, while utilizing available auxiliary data such as the Soil Survey of the Gallatin National Forest, far and away exceeds use of the Soil Survey alone to assess field conditions. Combining the use of available color aerial photography (not satellite imagery), topographic map data, and bedrock geology data provides a solid basis for spatial modeling. Once again this approach used in the assessment of land resources for the South Bridger area far exceeds the information that would be available from canned data sources.

It is beyond the scope of this document to assess whether or not the Region One 15% maximum DSD standard is or is not the best available means for measuring potential changes in soil or site productivity. Based on field experience, however, it does provide a reasonable yardstick for measuring disturbance impacts on soil resources, provided a consistent set of criteria are used to identify when detrimental soil conditions are present. Specific criteria developed for the Gallatin National Forest (Keck 2012) are in accordance with the more general Region wide criteria (USFS-R1 1999) and provide consistent criteria with which to correlate the degree of soil disturbance to observable changes in site productivity for soils of the Gallatin National Forest.

AFFECTED ENVIRONMENT

Soils and Landscape Attributes

The proposed South Bridger project is located on the east flank of the Bridger Mountains, mainly south of Bridger Bowl Ski Area. The crest of the Bridger Mountains is comprised almost entirely of limestone, primarily from the Madison Group (Berg, et.al. 2000) creating the spectacular ridgeline above the project area. On east flank of the Bridger Mountains, however, limestone gives way gives way to numerous mixed strata of sedimentary beds in a more subdued landscape. These sedimentary beds are comprised of primarily of sandstone, mudstone, and shale with lesser amounts of limestone, siltstone, and volcanic tuff (Berg, et.al. 2000). The area of mixed sedimentary beds includes all portions of the proposed South Bridger project.

Soil properties, such as soil texture, the amount and kind of rock fragments in the soil, and soil chemistry are all directly related to the underlying rock type or types in residual (formed in place) soil areas and to the upslope rock types in colluvial (deposited by gravity) soil areas. *(Note: The above description leaves out alluvial soils along creek bottoms.)* Soil drainage in moist areas of mixed sedimentary rock layers is often controlled by the sequence of rock types and differential permeability between the different layers and by landscape position. The distribution of plant species in both the overstory and understory is strongly influenced by all of the above factors: geology, soils, landscape position, and drainage.
For the South Bridger project area, stands of nearly pure lodgepole pine occur along ridges and on mountain slopes floored primarily by hard sandstone. Associated soil textures are primarily sandy loams. Soils in these areas are well drained, with low to moderate fertility. They also may contain a high proportion of shallow or very shallow soils and often have abundant rock fragments in subsoil horizons. This soil-landscape association makes up a relatively small but significant proportion of the total area within the proposed treatment areas for this project.

In contrast, much of the area supports stands of nearly pure Douglas-fir that are present on mountain flanks and footslope areas that have mixed sedimentary parent materials with sandstone, mudstone, and shale in various combinations. Limited amounts of limestone, siltstone, and/or volcanic tuff may also be present. Soils textures tend more towards loams or clay loams with moderate to high soil fertility. Based on field observations, oftentimes these stands are growing on deep colluvial deposits where site productivity has benefitted from the prevailing downslope winds depositing largely rock-free, loam to clay loam soil surface layers in the same manner as how the prevailing winds help pile up snow in the winter at Bridger Bowl. Calcium carbonate will likely to be present in the soil at some depth in these areas. Abundant rock fragments of primarily sandstone and mudstone are present at greater soil depths.

Lush grassland and wet areas occur in swales, on moderately sloping bench areas, or in some headslope positions. These sites as well as areas of hummocky ground are almost always be floored with shale or shale and mudstone combined. Shale parent materials are characteristically impervious to water thus creating areas of perched groundwater. Soil textures inherited from mudstone and shale in these areas

range from clay loam to clay, with or without abundant rock fragments. The more shale that is present, the heavier the soil texture. Soil fertility is high which enhances the relative competitiveness of lush grasses and forbs in comparison to conifers in these areas and soil drainage is variable ranging from moderately well drained to very poorly drained. Engelmann spruce has a definite competitive advantage over other conifers species in the wet areas. Soils along the margins of wet areas can support healthy aspen stands with proper vegetation management. Shale areas are prone to slumping on steep slopes when the underlying shale is sitting at an angle more or less parallel to ground surface and is covered by more porous materials such as accumulated colluvium or sandstone bedrock. Landslide or slumping potential increases when such sites are disturbed due to natural or management related causes.

Relevant USGS Geology Information

The Geologic Map of the Livingston 30' x 60' Quadrangle (Berg et.al. 2000) identifies a series of different sedimentary strata running more or less parallel north to south along the east side of the Bridger Mountains within the general area of the South Bridger project. Sedimentary rock types identified in various combinations are the same as those noted above. Of greatest interest is a transition that occurs along the western boundary of the South Bridger project. East of the section line in Section 30 (project area), 31 (private), and 6 (project area), geologic strata are identified as primarily hard sandstone and mudstone. West of the section line in Sections 25, 36, and 1, the predominant rock type changes to shale with several shale members of Cody Formation as well as Mowry Shale and Thermopolis Shale described as interbedded shale and sandstone. These geologic strata greatly increase the likelihood for landslides and slumps west of the proposed project area.

The above transition is significant in two obvious areas of past and present landslide activity. The first is above the Pine Creek Road in Section 1 just south of the southernmost treatment units and the second is in the head of the South Fork of Slushman's Creek area in Section 25 along the access road connecting the north and south portions of the project area. Both these areas are located within the area of interbedded shale and sandstone bedrock.

Soil Survey Information

The landtype based, Soil Survey of the Gallatin National Forest provides a reasonable characterization of soil properties in general within the proposed project area but lacks the level of specificity needed for making local management decisions. Most of the area was mapped as occurring on "structurally controlled, mountain slopes" with "interbedded sandstone and shale" parent materials (USDA-GNF 1996). Surface textures are identified as primarily loams with lesser amounts of clay loam surface textures. Missing is the delineation of shallow sandstone bedrock areas or the influence of wind born sediments to surface soil layers.

Only one landslide area was identified within the project boundary by the Soil Survey (USDA-GNF 1996). Unit 71-1D identified as occurring "on landslides" has been is mapped as occurring in the northern portion of the South Bridger project in the Maynard Creek area. The same map unit covers much of the Bridger Bowl Ski Area Bedrock controlled knobs and ridges exist throughout much of this area that are not prone to landslides or slumping nor do they occur on an old landslide. The access road leading into the South Bridger project area in Section 30 follows along a ridge that has little or no potential threat of landslide activity despite having a high landslide rating in the Soil Survey. At the same time, the Soil Survey fails to identify previously noted areas of land instability along the access road to Section 1 or upslope from the road crossing on Pine Creek. Clearly the Soil Survey for the Gallatin National Forest cannot be relied on to provide accurate information about landslide potential.

Landslide Potential

Investigations of existing landslides on the Gallatin National Forest initiated by Keck in 2012 have identified buried shale layers to be the bedding surface on which overlying material has slid in the vast majority of slides or slumps investigated. Impervious shale layers provide an ideal bedding surface for landslides whenever the dip of these beds roughly parallels the ground surface. Another way of saying that is provided the shale layer was deposited prior to uplift.

Signs of past landslide activity in sloping areas include the presence of hummocky ground without obvious bedrock control, deranged drainage patterns, excess moisture including seeps and pockets of somewhat poorly to very poorly drained soils, i.e.: persistent groundwater within 0 to 42 inches of the ground surface), and changes in vegetation patterns with more mesic (water loving) species present in wet areas. Species used to help identify past landslide areas in forested areas may range from lush grassland species, to aspens to other wetland or transitional wetland species. Evidence of recent landslide activity provides conclusive proof of future site instability unless some mitigation action is used to stabilize the site.

Once a historic landslide area has been identified in the field, the boundary of the historically unstable area can often be seen and mapped by the "crumply" pattern of topographic lines on 1:24,000 USGS topographic quads.

Shale areas mainly upslope (west) of the project area are prone to landslide activity and/or slumping. The access road running along the east edge of Section 36 below Saddle Peak, between northern and southern portions of the South Bridger project crosses one such unstable area in the headwaters of the South Fork of Slushman's Creek. This issue appears to be limited to some extent by relatively short slope lengths where shale is the underlying bedrock in sloping areas. Often there is a bench area of shale bedrock not too far downslope. See the Notes to Implementers section of this write-up for potential mitigations in this area.

Of the proposed treatment units, the majority appear to be located on stable landscape positions. This assessment is based on both field observations and interpretation of topographic lines on USGS topographic maps. Only portions of two treatment units will likely require some additional field assessment to be made in the spring. These are Treatment Unit #1 and Treatment Unit #15. Concerns noted in this section with regard to landslide or slumping potential may could potentially require some minor adjustment of treatment unit boundaries in these areas or marking of sensitive areas to avoid with mechanical equipment during the implementation phase of this project. These adjustments will certainly not be prohibitive with respect to the project as a whole.

ENVIRONMENTAL CONSEQUENCES

Existing Conditions

Currently the proposed treatment units in the South Bridger Interface project area have very limited amounts of activity caused, detrimental soil disturbance. This is partly by design since treatments required to achieve the desired reduction in insect pest populations are targeted at more mature forest stands. Stands harvested previously between 1950 and 1999, which correspond to those areas currently having significant amounts of existing DSD, are not yet mature enough to benefit from the proposed treatments.

Extensive past timber harvesting has occurred, both within and adjacent to the South Bridger project area, primarily during the period from 1950 through 1999. Residual impacts of DSD from past timber

harvesting are still present at this time. A more detailed assessment is provided in the administrative record for this project. A synopsis of those data follows. Levels of DSD within the overall area on maximum past timber harvesting are calculated to average 7.5% DSD on a per acre basis. The highest level of predicted DSD on a per unit of land area basis is 15.9% for the north ½ of Section 7 (R. 7 E. T. 1 S.) an area of former private land that was harvested prior to being transferred into Forest ownership.. Sections that actually contain treatment units proposed for the South Bridger Project have a range in the predicted level of pre-existing DSD from 1.3% for the East half of Section 36 (R. 6 E. T. 1 N.) up to 2.8% pre-existing DSD for the West ¾ of Section 30 (R. 7 E. T. 1 N.).

Portions of the landscape within the project area that currently have noxious weed populations most often coincide with existing areas of soil disturbance, most notably old landings and old temporary roads that were inadequately reclaimed and deposition areas on the downhill side of the existing road system roads through past timber harvest areas. Weed species of greatest concern in areas adjacent to proposed treatment units houndstounge and Canada thistle in areas of mixed sedimentary beds, shale areas, and areas of sediment deposition. Along sandstone benches or on convex, rocky knobs, spotted knapweed appears to be the best adapted weed species. Oxide daisy is reported to be abundant in clearcut portions of Section 7 south of the proposed treatment units.

Existing slumps along the access road in Section 36 connecting the northern half of this project with the southern half could be a concern relative to keeping the roadway functional for log hauling. This road has been repaired at this time but instability remains. The level of soil disturbance associated with the slumps along this road is small in large part because shale bench areas exist not too far downslope which act as a local base level controlling the extent to which slumps in this area can move. Thus, ongoing repairs to this roadway during timber harvesting may be an ongoing road maintenance concern but large slumps or landslides are unlikely to occur due to local base level controls.

No Action Alternative

Direct and Indirect Effects

Existing low levels of activity caused detrimental soil disturbance will remain in proposed treatment units. Any benefits of potential reduced spruce budworm, Douglas-fir, or mountain pine beetle activity would not be realized. Noxious weed species that favor more open forest or grassland conditions would continue to be excluded from treatment units provided the conifer stands in these areas remain healthy. If however, the lack of vegetation management treatments resulted in a major die-off of the overstory trees, weed control issues could become endemic in the relic, conifers that remain.

The No Action Alternative will do nothing to help alter existing levels of DSD in past harvest areas outside of the proposed treatment units. These areas will remain more or less in the same in a semi-degraded state caused by the inadequacy of post-harvest remediation after timber harvesting. Noxious weed issues will continue to be a problem in selected portions of prior past timber harvest sites until canopy closure is nearly complete.

Section 7 south of the project area, which has the highest predicted level of DSD and likely the most severe weed infestation levels, will remain isolated from direct Forest Service road access that will be needed to address these critical, land degradation issues.

Action Alternative

Direct and Indirect Effects

The metric used here to assess negative impacts to soil resources and the likelihood for reduced soil productivity is detrimental soil disturbance (DSD). Steps in the analysis include: 1) an assessment of existing conditions prior to the proposed management action, 2) prediction of the DSD that will potentially be created by proposed treatments, 3) calculation or prediction of the effectiveness of proposed remediation actions to reduce or eliminate the specific type and amount of DSD present after harvesting treatments are complete (prior DSD + treatment DSD), 4) calculation of final DSD levels at a specific time after remediation actions have been completed, and finally 5) monitoring of final DSD levels at a specified time or times after all initial remediation actions have been completed. See the Methods section of this report for further details. Ideally, all of the above are based on site specific physical measurements and/or physical properties of the soil resource. The section below provides specific details of soil resources within the South Bridger Project area with respect to the potential to create DSD and the soil's ability to recover from different types of DSD.

Soil Factors Influencing Disturbance Effects: As noted previously, treatment units associated with this project have had little if any past harvesting on them. Other sources of activity related DSD are limited. Thus, the major source of concern is the level of DSD that could potentially be created as a result of proposed timber harvesting activities. Soils throughout most of the proposed treatment units are deep to very deep, have loam to clay loam surface textures, and are moderately well drained or well drained. Soils in these areas also tend to be quite fertile with neutral to slightly basic soil pH, high basic cation levels, and substantial soil organic matter in the upper mineral soil layers. Soils throughout most of the proposed treatment units are very well suited for Douglas-fir trees and less so for lodgepole pine.

The majority of treatment units have north or north-tending aspects. North aspects will tend to have greater amounts of understory vegetation than south or south-facing treatment units. The extra understory vegetation will help limit the level of dispersed DSD cause during the controlled use of harvested equipment or skidding equipment off of established trails. North facing treatment units, however, will also be more likely to have higher soil moisture levels when they are harvested that may increase the potential for creating detrimental soil compaction or rutting. Ideally these two factors would cancel each other out but that is not certain.

A number of the treatment units, Unit 2, 3, 5, 12, and 17, possibly other units include ridgetop areas within their boundaries. These areas most likely have sandstone bedrock that may occur at shallow depths. Soils in these areas will likely vary in depth from shallow to deep, are well to somewhat excessively well drained, have sandy loam surface soil textures, inherently lower soil fertility, and lower soil organic matter levels. Soil pH levels will still likely to be neutral but overall soils in the area of sandstone floored bench areas will be better suited for growing lodgepole pine than they are for Douglas-fir. Detrimental soil disturbance that might occur in these areas would most likely be related to limited ground cover, loss of shallow surface soil horizons, and soil erosion, especially in areas of shallow soils. They would be much less prone to soil compaction or rutting than soils covering most of the area.

Predicted Levels of Treatment Caused DSD: Table 3.30 below provides levels of soil disturbance that are predicted to occur at landings, along temporary roads and skid trails, and in dispersed areas for the partial timber harvest treatments proposed. Assumptions made are that 100% of the landing area will be detrimentally disturbed at the end of timber processing and that the average landing size will be approximately ½ acre in most instances. Assumptions for temp roads are that the entire length of the temp road will be detrimentally disturbed after road construction and that the width of disturbance will be 14 feet.

The acreage of skid tails has been calculated based on an average spacing between skid trails of 75 feet and an average skid trail width of 10 feet. Skid trails are assumed to be detrimentally disturbed over 60% of the skid trail area immediately after timber harvesting has been completed. This 60% figure is higher than what has been used on other portions of the Gallatin National Forest and reflects the fact that upper mineral soil layers over much of the treatment area have loam to clay loam soil textures with only limited amounts of rock fragments present. Much of the area proposed for timber harvesting is also on moist, north-tending slopes.

Based on the above values used, total treatment caused DSD levels by treatment unit are predicted to range at the end of harvesting activities from a low of 12.2% in Treatment Unit 15 to a high of 17.8% in Treatment Units 6 and 11. These levels are prior to the implementation of any remediation steps. The estimates for post-harvest DSD are very conservative as are the assumptions on which they are based, i.e.: there is only a very low probability that actual DSD levels on the ground will exceed predicted, post-harvest DSD levels.

Table 3.30: Expected maximum levels of detrimental soil disturbance at the completion of timber harvesting, prior to remediation

Treatment		Landings		Temp. Roads		Skid Trails			Disp.	Total
No.	Acres	Number	DSD	Dist.	DSD	Landing Overlap	Total Area Percent	DSD	DSD	DSD
1	9	1	5.6%	0	0	-0.8%	11.0%	6.6%	3.0%	15.2%
2	21	1	2.4%	920 ft.	2.0%	-0.3%	11.5%	6.9%	3.0%	14.3%
3	15	1	3.3%	0	0	-0.5%	11.3%	6.8%	3.0%	13.1%
5	9	1	5.6%	0	0	-0.8%	11.0%	6.6%	3.0%	15.2%
6	4	1†	8.3%	0	0	-1.0%	10.8%	6.5%	3.0%	17.8%
7	18	1	2.8%	0	0	-0.4%	11.4%	6.8%	3.0%	12.6%
7A	11	1	4.5%	0	0	-0.6%	11.2%	6.7%	3.0%	14.3%
8	16	1	3.1%	0	0	-0.4%	11.4%	6.8%	3.0%	13.0%
9	20	1	2.5%	0	0	-0.3%	11.5%	6.9%	3.0%	12.4%
11	4	1†	8.3%	0	0	-1.0%	10.8%	6.5%	3.0%	17.8%
12	18	1	2.8%	0	0	-0.4%	11.4%	6.8%	3.0%	12.6%
13	27	2	3.7%	0	0	-0.5%	11.3%	6.8%	3.0%	13.5%
14	6	1	8.3%	0	0	-1.1%	10.7%	6.4%	3.0%	17.8%
15	22	1	2.3%	0	0	-0.3%	11.5%	6.9%	3.0%	12.2%
16	18	1	2.8%	760 ft.	1.3%	-0.4%	11.4%	6.8%	3.0%	13.9%
17	12	1	4.2%	0	0	-0.6%	11.2%	6.7%	3.0%	13.9%
18	7	1	7.1%	0	0	-1.0%	10.8%	6.5%	3.0%	16.6%

Most of the variation in treatment caused detrimental soil disturbance relates primarily to treatment unit size and how large the resulting treatment area is per landing. Thus, an 18 acre unit with one ½ acre landing results in a prediction of 2.8% initial DSD attributed to the landing (Treatment Unit 16) while a 9 acre treatment unit with one ½ acre landing results in a prediction of 5.6% DSD attributed to landings (Treatment Unit 5). Bottom line is that soils in this area are susceptible to DSD, more than soils in many other portions of the Gallatin National Forest but for most of them, they also well suited to recover quickly if adequate remediation procedures are followed. The predominant types of DSD expected are soil compaction and some rutting in most of the treatment areas with soil erosion and loss of the thin topsoil layer the biggest concern on sandstone floored, ridge areas.

Remediation Effectiveness: Characteristics of the local soil resource will play a major role in the trajectory natural soil recovery follows after disturbance. The soil resource also plays a major role in the effectiveness of any remediation actions. Analysis of expected remediation effectiveness for this project has considered the variability of soil properties in this area. Two distinctly different soil-landscapes account for the majority forest areas within the proposed treatment units for this project.-Analysis presented here for expected restoration effectiveness is based on the forest soils in the area that are both most prevalent and most likely to be detrimentally disturbed due to the proposed timber harvesting. This includes the finer textured forest soils present on mountain sideslopes, headslopes, and colluvial footslope areas. Forested shallower, sandy soils along sandstone floored ridges are not expected to have as much soil disturbance from the proposed treatments and cover much less of total area within treatment units. Wetter grassland/wetland/Engelmann spruce areas, with shale bedrock in swales, on benches, and in slump areas has not been considered here as mechanical harvesting and skidding equipment will be expected to stay away from potential wet areas.

Landings with Burn Piles

Assumptions: Average landing size is approximately ½ acre with the burn pile covering 50% of the total landing area. Most landing areas will be on relatively flat ground. Percent of landing area detrimentally disturbed at the end of timber processing will be 100% (Note: This assumption likely overestimates the amount of DSD based on recent timber harvests where use of large processing equipment with a long boom reach resulted in 75 to 80 % of the total landing area and approximately 50% of the area outside of the burn pile having DSD after timber processing was complete. Diversion of any water flowing across the landing will be effectively accomplished by BMP's provided by the Forest Hydrologist and Forest Engineer for the Gallatin National Forest.

Major Sources of DSD: Soil compaction, possible blading of a portion of the landing area to increase area of level ground, lost topsoil, moderate to severe soil burning beneath the burn piles, loss of litter layer and soil organic matter, especially beneath the burn pile.

Site Conditions: Loam and clay loam soil textures in upper mineral soil layers with limited amounts of rock fragments. Increasing amounts of rock fragments in subsoil layers. Soils primarily deep and very deep over mixed sedimentary parent materials; mainly hard sandstone and mudstone.

Table 3.31: Expected mitigation effectiveness on landings 2 years and 5 years after remediation actions have been completed.

Mitigation Measure	Remediation Effectiveness †	
	2nd Year	5th Year
Rip 6 to 8 inches deep on portion of landing outside of the burn pile perimeter; broadcast seed native grasses as needed †† (40% x 0.5 of total area in year 2)	20%	40%
Add slashing of entire landing area at 10 to 15 tons/acre woody debris after burning of main slash pile complete (60% x 0.5 + 10% x 0.5 at the end of year 2)	35%	50%
Slash entire landing area at 10 to 15 tons/acre with woody debris after burning of main slash pile is complete	10%	15%

† *Remediation effectiveness refers to the extent DSD is expected to be reduced within the specified time period.*

†† See text in soil mitigation section of below for details on ripping and seeding landings

Temporary Roads

Assumptions: Average road width is 14 feet. Average percent DSD after construction is 100%. Diversion of any water flowing down the road will be effectively accomplished by BMP's provided by the Forest Hydrologist and Forest Engineer for the Gallatin National Forest.

Major Sources of DSD: Loss of a portion of the topsoil resource along bladed sections of road, soil compaction, loss of soil organic matter, and potential soil erosion due to rutting along the road or down borrow ditches.

Site Conditions: Same as for landings.

Table 3.32: Expected mitigation effectiveness along temporary roads, 2 years and 5 years after remediation actions have been completed.

Mitigation Measure	Remediation Effectiveness †	
	2nd Year	5th Year
Ripping †† and re-contouring road prism	35%	50%
Slashing road corridor at 10 to 15 tons/acre CWD upon road closure	45%	65%
Broadcast seeding with appropriate seed mix	50%	75%
Only slashing road corridor	10%	20%

Predictions are based on local soil conditions, the type(s) of detrimental soil disturbance expected, and effectiveness of the proposed remediation actions to reduce the specific DSD conditions anticipated.

† Remediation effectiveness refers to the extent DSD is expected to be reduced within the specified time period.

†† See text in soil mitigation section for details on ripping and seeding landings

Skid Trails

Assumptions: Average skid trail width equals 10 feet. Sixty percent of the skid trail area will have some type of detrimental soil disturbance (mainly along wheel or tread tracks). Diversion water from rainfall or snow melt that could potentially run downhill at grades steeper than 8% on a skid trail will be effectively diverted off of the skid trail through BMP's provided by the Forest Hydrologist and Forest Engineer for the Gallatin National Forest.

Major Sources of DSD: Soil compaction, erosion of surface soil layer(s), loss of forest litter layer, loss of soil organic matter due to soil erosion, rutting if used when wet.

Site Conditions: Same as for landings and temporary roads.

Table 3.33: Expected mitigation effectiveness on skid trails roads 2 years and 5 years after remediation actions have been completed.

Mitigation Measure	Remediation Effectiveness †	
	2nd Year	5th Year
Standard water erosion control measures on skid trails with grades steeper than 8%	10%	20%
Add: Ripping 6 to 8 inches deep along sections with detrimental soil compaction; broadcast seed native grasses as needed ††	40%	50%
Add: Slashing trail corridor at a rate of 10 to 15 tons/acre woody slash	60%	80%
Standard water erosion control measures plus slashing skid trails at a rate of 10 to 15 tons per acre woody material	20%	35%

† *Remediation effectiveness refers to the extent DSD is expected to be reduced within the specified time period.*
†† See text below for details on ripping and seeding skid trail requirements

Predictions of Post Remediation DSD Levels

Table S5 below shows the predicted total levels of DSD by treatment unit and source area at the conclusion of timber harvesting. A contribution of 0.5 DSD has been added for prior DSD to account for any pre-existing DSD that may exist in selected treatment units that was not documented captured during reconnaissance sampling. As in Table S1, 3% DSD has been allocated for dispersed DSD to account for any DSD that may occur as a result of mechanized harvesting of skidding equipment operating off of skid trails. This DSD has been added even though it is not expected to occur provided the GNF soil moisture restrictions for use of equipment off skid trails are followed. It is an acknowledgement that soils in this area are more susceptible to detrimental compaction or rutting than soils in many other areas of the Forest.

On the right side of the table, are the reductions in DSD by source area due to remediation actions specified for this project. Value on this side of the table follow directly from the total DSD levels on the left side and remediation effectiveness values highlighted in yellow on the remediation tables. A reduction of 1% overall DSD associated natural recovery of dispersed DSD has been included. Processes of natural recovery associated freeze-thaw and wet-dry cycles will be quite active within treatment units in this area as will root growth and overall biological activity due to the highly fertile soil resource. A caveat to this is that any soil erosion or spread of noxious weeds must be controlled. In a strict technical sense, any DSD that disappears due to processes of natural recovery in a short 2 year period is not really detrimental soil disturbance. It fails the test of “persistence” to truly be considered detrimental. It is counted, however, as detrimental until such time as it no longer the specific criteria for DSD on the Gallatin National Forest.

Table 3.34. Expected level of detrimental soil disturbance at the end of timber harvesting prior to remediation

Treatment Unit		Detrimental Soil Disturbance by Source (%)						Reduction in DSD by Year 2 After Remediation Complete				DSD
No.	Acres	Prior	Landings	Temp Roads	Skid Trails	Disp.	Total	Landings	Temp Roads	Skid Trails	Disp.	Total
1	9	0.5	5.6	0	6.6	3	15.7	-1.9	0	-2.6	-1.0	10.2
2	21	0.5	2.4	2.0	6.9	3	14.8	-0.8	-1.0	-2.8	-1.0	9.2
3	15	0.5	3.3	0	6.8	3	13.6	-1.2	0	-2.7	-1.0	8.7
5	9	0.5	5.6	0	6.6	3	15.7	-1.9	0	-2.6	-1.0	10.2
6	4	0.5	8.3	0	6.5	3	18.3	-2.9	0	-2.6	-1.0	11.8
7	18	0.5	2.8	0	6.8	3	13.1	-1.0	0	-2.7	-1.0	8.4
7A	11	0.5	4.5	0	6.7	3	14.8	-1.6	0	-2.7	-1.0	9.5
8	16	0.5	3.1	0	6.8	3	13.5	-1.1	0	-2.7	-1.0	8.7
9	20	0.5	2.5	0	6.9	3	12.9	-0.9	0	-2.8	-1.0	8.2
11	4	0.5	8.3	0	6.5	3	18.3	-2.9	0	-2.6	-1.0	11.8
12	18	0.5	2.8	0	6.8	3	13.1	-1.0	0	-2.7	-1.0	8.4
13	27	0.5	3.7	0	6.8	3	14.0	-1.3	0	-2.7	-1.0	9.0
14	6	0.5	8.3	0	6.4	3	18.3	-2.9	0	-2.6	-1.0	11.8
15	22	0.5	8.3	0	6.9	3	12.7	-0.8	0	-2.8	-1.0	8.1
16	18	0.5	2.8	1.3	6.8	3	14.4	-1.0	-0.7	-2.7	-1.0	9.0
17	12	0.5	4.2	0	6.7	3	14.4	-1.5	0	-2.7	-1.0	9.2
18	7	4.2%	7.1	0	6.5	3	17.1	-2.5	0	-2.6	-1.0	11.0

Expected levels of DSD two years after remediation ranges from a low of 8.1% DSD in Treatment Unit 15 to a high of 11.8% DSD in Treatment Units 6, 11, and 14 (Table 3.34). All of these are well within the Region One maximum allowable DSD standard of 15% despite the fact that assumptions made in this analysis are intended to ensure that predicted levels of DSD exceed actual levels that occur on the ground. Until we have sufficient post-treatment monitoring data for current projects, taking such a conservative approach, i.e. has a low probability that actual DSD levels exceed predicted, appears to be the only prudent approach. Once again, variations in total predicted DSD levels by treatment unit after remediation are mainly due to differences in treatment unit size and the resulting number of acres served by a single landing.

Remediation actions proposed for this project are designed to ensure that the level of soil disturbance continues to decrease over time beyond the second year after remediation. Thus, the level of DSD in year 5 is expected to be less than in year 2, the level of DSD in year 10 less than in year 5, and so on moving forward.

REGULATORY FRAMEWORK AND CONSISTENCY

National Laws: Sustained Yield, Soil Productivity, and Soil Quality

National Forests are intended to be managed for the production of goods and services. The Multiple-Use, Sustained-Yield Act of 1960 (P.L. 86-517, 74 Stat. 215: 16 S.S.C. 528-531) indicates that a high-level of annual or regular periodic output of renewable resources will be produced. The concepts inherent in the Multiple-Use, Sustained Yield Act are upheld in the Forest and Rangeland Renewable Resources Planning Act (RPA) of 1974 (16 U.S.C. 1600-1614) and the National Forest Management Act (NFMA) of 1976 (16 U.S.C. 472a). Forest Service Manual Chapter 2550 - Soil Management (WO Amendment

2500-2009-1) refers to "providing goods and services as outlined in forest and grassland management plans". *Proposed timber harvest treatments for this project utilize the production and harvesting of merchantable timber in a sustained manner to help fund forest health improvements on lands bordering and within the Bridger Bowl Ski Resort. The project directly supports both timber management and recreation objectives.*

Since sustained-yield cannot exist without maintaining land productivity, the importance of protecting soil and land productivity are inherent in all of the above documents. Direct references to maintaining productivity are made in the Sustained Yield Act "…coordinated management of resources without impairment of the productivity of the land" and in the Forest and Rangeland Renewable Resources Act "…substantial and permanent impairment of productivity must be avoided". Maintaining soil qualitity as a surogate for protecting land productivity is a more recent addition to Forest Service Standards. The ultimate goal of all soil assessments and Best Management Practices for this project is to maintain soil and land productivity as an essential component for the long-term sustained use of natural resources.

The Forest and Rangeland Renewable Resources Act (1974) appears to be the first legal reference made to protecting the "quality of the soil" in Forest Service directives. Since that time the relationship between soil productivity and soil quality from a regulatory standpoint appears to be somewhat fuzzy. The fundamental laws that directly govern policies of the U.S. Forest Service, noted above, clearly indicate that land productivity must be preserved. Yet increasingly during the last two decades, references to land or soil productivity in Forest Service directives have been replaced by references to soil quality. These two concepts are related but are not synonymous. Refinements made to soil quality standards for the Gallatin National Forest have been designed to improve the correlation between soil quality criteria used on the Gallatin Forest and observable soil productivity responses specific to the local environmental conditions. The second objective of the revised DSD standards for the Gallatin National Forest is to provide quantitative criteria appropriate to field conditions to ensure consistency in field monitoring results.

Finally in the 2009 and 2010 amendments to the Forest Service Manual, Chapter 2550 – Soil Management, the relationship between soil productivity and soil quality are clarified in section 2550.43-5, "Coordinate validation studies of soil quality criteria and indicators with Forest Service Research and Development staff to ensure soil quality measurements are appropriate to protect soil productivity." This same statement also concedes that the relationship between these two concepts is not yet completely understood.

Whether "completely understood" or not, the sole focus of soils analysis for the South Bridger Project has been to understand the relationships between soils, landscapes, and vegetation resources within and adjacent to the South Bridger Project area and to utilize that information along with the application of soil quality criteria to project long-term soil productivity from potential negative impacts that could occur from vegetation treatments proposed in this project.

Regional Direction

R-1 Supplement: The primary direction given by Region 1 with regard to maintaining soil productivity and maintaining soil quality comes from two documents. The first is the R-1 Supplement 2550-99-1 to the Forest Service Manual titled 2554 Soil Quality Monitoring (USFS-R1 1999). This document established the concept of "Detrimental Soil Disturbance" (DSD) by defining it in terms of specific soil quality indicators that would be used to recognize when DSD was present. This same document established the Region 1 DSD Standard which directs land managers to "Design new activities that do not create detrimental soil conditions on more than 15 percent of an activity area". It also discusses the consideration of prior DSD in project level soil analyses, and when the DSD standard is to be applied.

The implied assumption is that soil productivity will be maintained provided treatment area DSD levels kept below 15% of the total area of the unit. The R-1 supplement also spells out that, "Research guidelines such as those contained in Graham et. al. 1994" for coarse woody debris "should be used if more specific local guidelines are not available".

Detrimental soil disturbance is the yardstick used in this analysis to assess but soil quality and potential treatment effects on soil and land productivity. Although the soil quality criteria used have been refined to be both more consistent and readily applicable to conditions on the Gallatin National Forest (Keck 2012), the approach used is still based on original concepts as defined in the R-1 Supplement. The R-1 15% maximum allowable DSD in treatment units remains the standard for which all soil mitigation measures and soil BMP's are designed.

With regard to coarse woody debris (CWD), current wildlife standards in the Forest Plan require a higher level of coarse woody debris be retained in forest stands after harvesting than is interpreted from the data provided in Graham et. al. (1994). As a result, the soils standard for CWD (8-12 tons per acre) in partial harvest areas has been replaced by the higher standard recommended for wildlife benefit (15 tons per acre).

Region 1 Approach to Soils NEPA Analysis Regarding Detrimental Soil Disturbance in Forested Areas: This Region 1 document provides technical guidance covering a wide range of issues on how the DSD standards are to be applied for NEPA analyses in the Region. It can be thought of as a user's guide to DSD application. Among the technical issues addressed by this document are recommended sampling intensity levels based on pre-existing and proposed activity DSD levels.

Criteria from Table 2 in the above noted document provides the basis for using either observations during a walk through or limited field sampling during a traverse to assess prior DSD in treatment units of this project based on limited prior, activity related disturbance in the treatment units. Soil disturbance monitoring along transects will be used for post-treatment DSD assessments due to potentially high post-harvest DSD levels. Close attention has been paid to details of the Region 1 protocol for DSD monitoring and analysis for the South Bridger Project.

Gallatin National Forest Direction

Forest Plan: The Forest Plan for the Gallatin National Forest (USFS-GNF 1987) provides only limited direct guidance with regard to the management of soil resources. For Objectives B.1.i.: Water and Soils the Forest Plan states that "Watersheds will be managed by application of best management practices…" Under Forest-Wide Standards E.8.c.: Timber – Site Preparation and Activity Debris Disposal the Forest Plan identifies the need to "maintain an adequate nutrient pool for long-term site productivity through retention of topsoil and soil organisms. Water and Soils Forest-Wide Standards indicate in E.10.1. "The Forest Soil Survey will be incorporated into resource area analyses", E.10.2 "Best management practices (BMP's) will be used…", and E.10.8. "All management practices will be designed or modified as necessary to maintain land productivity and protect beneficial uses".

Best management practices have been specified for the South Bridger Project and are described in the section below. Maintaining an adequate nutrient pool for long-term productivity is accomplished by ensuring that topsoil is not lost or degraded during implementation of the proposed treatments, controlling any potential soil erosion losses of topsoil, and through the wildlife BMP of maintaining 15 tons per acre coarse woody debris on the ground in all treatment units with closed or partially closed canopy coverage of conifers prior to timber harvesting.

The Soil Survey for the Gallatin National Forest was included as part of the initial soils analysis for this project and has been substantially supplemented by field analysis of the Forest Soil Scientist. All management practices in this project have been designed to maintain forest productivity and will be modified if needed to meet the Standard of maintaining land productivity.

Refinement of Detrimental Soil Disturbance Criteria: The document titled Detrimental soil disturbance and revised best management practices for the Gallatin National Forest by Keck 2012 is the third edition of this document following 2010 and 2011 versions. The goal in creating these documents (ongoing) is to make the identification of DSD on Gallatin National Forest Lands more consistent, more practical and quantitatively reproducible, and more closely tied to levels of disturbance that exhibit observable reductions in site productivity on Gallatin National Forest lands.

Criteria established for identifying DSD provided in the above noted GNF documents have been consistently applied to all assessments of DSD on the Gallatin National Forest since 2010. Field procedures used include standard soil sampling procedures for upper soil layers, modified soil quality procedures that follow rigorous point sampling criteria, collection of selected landscape and plant community data at point sample locations, and recognition that field sampling is a continuous process between sample points as well as at sample point locations. The objective of more closely tying soil quality criteria used for the identification of DSD to land and soil productivity changes is completely in line with Forest Service Manual 2009 and 1010 Amendments in section 2550.43-5 "…to ensure soil quality measurements are appropriate to protect soil productivity".

DESIGN/ MITIGATION

1. Require a systematic skid trail pattern during logging.
2. Ground-based harvest systems would be used only on slopes having sustained grades less than 35 percent.
3. Maintain an average separation distance of at least 75 feet between skid trails.
4. Lay out skid trails in a manner that minimizes or eliminates sustained grades steeper than 15%.
5. All skid trails will be constructed with water erosion control and drainage measures installed as required by standard timber sale provisions.
6. Minimize the depth of blading in construction of temporary roads to the extent reasonable within the constraints of Forest Service standards for temporary road construction.
7. Ground based skidding and mechanical harvesting equipment may travel off of the established skid trails but only to the extent reasonably necessary to harvest the available timber and only when the top 6 inches of soil is sufficiently dry to minimize soil compaction problems. (See Soil BMP's in **Appendix D** for details). Repeat passes over the same ground would be minimized.
8. Landings with Burn Piles --- Exposed areas of landings around burn piles would be ripped (scarified) to a depth of 6 to 8 inches. (See Soil BMP's for details of rock fragment exclusion to ripping due to abundant large rock fragments) Note: This exclusion would likely not apply for most of the South Bridger Project area. Broadcast seed all disturbed areas with the appropriate seed after ripping.
9. Temporary Roads --- Rip the road prism to a depth of 6 to 8 inches along the entire length of all temp roads at the conclusion of this project. (See Appendix C for details of rock fragment exclusion to ripping due to abundant large rock fragments.) Broadcast seed all disturbed areas with the appropriate seed mix after ripping.
10. Skid Trails --- Rip skid trails to a depth of 6 to 8 inches at the completion of timber harvesting only where detrimentally compacted mineral soil is exposed at the surface or where wheel ruts have formed at least 2 inches deep on grades of 15% or greater or continuous to grades of 15% or greater. Broadcast seed all disturbed areas with the appropriate seed mix after ripping.

52. Coarse Woody Debris - A minimum of fifteen tons per acre of three-inch diameter or larger debris (if available) would be left scattered after machine site preparation and/or hazard reduction within harvest units.
11. Coarse Woody Debris --- No pre-existing, downed coarse wood material would be removed from treatment units during timber harvesting from stands where the 15 tons per acre standard cannot be reasonable met because of a lack of available coarse woody material.
12. All temporary roads would be slashed at an approximate rate of 10 to 15 tons per acre along those portions of the road that run through forest stands. Slash left should be oriented at primarily right angles to the road corridor. Where needed, additional leave trees would be left standing adjacent to the temporary roads during harvesting to facilitate slashing the road prism at the end of the project.

MONITORING

Soil Detrimental Soil Disturbance

An assessment of DSD levels in vegetation treatments units for this project will be conducted in year 2 and year 5 after timber harvesting and remediation actions are complete. This assessment will be conducted in accordance with the Region 1 sampling protocol (USFS-R1 2009) and detrimental soil disturbance criteria for the Gallatin National Forest defined by Keck (2012). Soil monitoring at least in year 2, will likely be conducted along transects in representative treatment units in accordance with the Regiom One protocol. Predicted levels of potential DSD are projected to moderately high at year 2 in range of 8 to 12% DSD. This level of disturbance, if verified in a preliminary assessment at year 2, would necesitate the use of transect sampling. Actual levels of DSD found in the second year assessment will dictate the intensity of DSD sampling required in year 5.

Coarse Woody Debris

Monitoring of coarse woody debris at the completion of timber harvesting will be based on four square meter, visual plots with photo documentation along transect sample locations in representative treatment units. The visual plots at all sample locations will be coupled with weight measurements of CWD at every 5th sample location. Coarse woody debris in these more precisely sampled plots will be cut and weighed in the field using a sling and a hanging scale. Visual estimates made in the field will be adjusted afterwards based of the correlation to weighted results within individual treatment units. As with the DSD monitoring, representative sampling of individual treatment units for CWD will be conducted approximately 2 years after timber harvesting and mitigation actions have been completed.

CUMULATIVE EFFECTS

Past, Present, & Reasonably Foreseeable Future Actions: Following are the past, present and reasonably foreseeable future actions occurring in the analysis area that have potential effects on the South Bridger Interface Project:

Timber Harvest on FS and adjacent private land – Past harvest on FS land occurred in the 60s to the 70s, and consisted of mostly clear-cuts. Refer to the FACTS query for the upper Bridger Creek HUC filed in the South Bridger project folder on the O drive.) In the 1990s and 2000s adjacent private lands were harvested, consisting of individual tree selection. DNRC records indicate the following levels of harvest in recent years: 2001 - 90 acres, 2002 - 12 acres, and 2010 - 73 acres.

A soils cumulative effects analysis has been run for this project that includes the South Bridger project area and adjacent lands, in both Forest Service and private ownership, where a substantial past timber harvesting has occurred. This analysis goes well beyond the level of analysis mandated by the Region One protocol (USFS-R1 2009) for the assessment of DSD outside "activity areas". It was completed due to the special conditions of substantial past harvesting in the area as a whole and to provide documentation of results from a more comprehensive area-wide analysis of predicted DSD levels. This analysis in no way sets a precedent for the Region but does provide valuable documentation of how DSD levels become diluted when the analysis is expanded to a larger area.

The total contiguous area in this analysis equals 3,520 acres with 1707 with past timber harvesting included within that area. The analysis run was based on FACTS data for the upper Bridger Creek HUC and includes data in the DNRC records for more recent timber harvests. The analysis is also based on soil monitor data collected along transects through past harvest areas in Section 30 or the South Bridger Project area. See the South Bridger project record for further details.

The calculated DSD average on a per acre basis for the entire cumulative effects area used equals 7.54%. Thus, from a cumulative effects standpoint, the average level of DSD is well below the maximum 15% DSD standard that would be used for an activity area. This does not mean that there are no-cumulative effects associated with having a larger area with moderate levels of DSD. It does show, however, that based on the Region 1soil DSD standard those effects do not reach the level where additional remediation actions would be required. Since no large scale cumulative effects issues were found in this analysis, the final assessment defaults to cumulative effects being separated in space from the proposed action.

Other recreation – hiking trails, mountain biking, hunting. There are a number of user created trails around the Bridger Bowl Ski area (for mountain biking and hiking). These trails are used frequently in the summer and fall.

Some detrimental soil disturbance will likely be caused within treatment units of the South Bridger Project by other recreational activities. The level of disturbance within treatment units, however, will be extremely low given the much more popular areas nearby. Looked at from a larger scale, the potential for any significant cumulative effect is non-existent.

Pine Creek Cattle Allotment – The allotment has been in place for more than 20 years and expected to continue into the foreseeable future. The allotment has traditionally involved a 2 pasture deferred rotation system, 46 cow calf pair, between July 1 and August 15th for one pasture then August 16th to September 30th. The north pasture over laps proposed units in Section 6. The northern fence relies on natural barrier from thick trees to be effective, but the fences are not directly adjacent to any of the proposed units. The south unit is south of Pine Creek and not near any of the harvest units. A map of the Pine Creek Allotment and the proposed harvest units is in the project file.

Livestock grazing has the potential to create additional DSD in treatment units located in the southern portion of the project area either directly or indirectly through potential grazing effects on the spread of weeds. The level of grazing caused DSD in proposed treatment units is extremely low at the present time but could increase if reduced stand density were to result in a temporary increase of understory grass and forb productivity.

RANGE

RANGE ISSUE

There is a concern that timber harvest may reduce the effectiveness of the natural forested barricades (that function like fences) or the gate would be left open, and cattle would wander outside the Pine Creek allotment. There is also a concern that cattle may forage in the thinned harvest units, and trample new seedlings. Additional information concerning effects to range is available in the range specialist report in the project file.

ANALYSIS AREA

Spatial and Temporal Boundary

The direct, indirect and cumulative effects spatial boundaries follow the northern boundary of Pine Creek Allotment then follows the east and west side of the allotment, and follows the Pine Creek drainage along the south side. A map of the spatial boundary is attached to the end of this document. Limiting the analysis to where the allotment and the proposed harvest overlap makes sense because the activities are spatially connected. Both activities occur in the same area.

The temporal boundaries are from the present (the current condition) to 10 years into the future (expect the project to be finished within this time). The rationale for this time frame is based on the effects of the timber sale on range allotments are minor and of short duration. For example, leaving enough trees in Unit 7A along the edges of the unit would prevent cows from wandering off the allotment. Likewise, keeping the gates closed during the timber sale would keep the cows on the allotment. Finally, since the existing vegetation within the units is not very palatable to livestock there would be only minor impact.

AFFECTED ENVIRONMENT

The Pine Creek allotment has been in place for more than 20 years and it's expected to continue into the foreseeable future. The allotment has traditionally involved a 2 pasture deferred rotation system, 46 cow calf pair, between July 1 and August 15th for one pasture then August 16th to September 30th for the second pasture. The north pasture overlaps ten of the proposed harvest units in Section 6 (see map below). There are fences along the private property, and leading up to gates on the roads (see map below); these function to keep cattle inside the allotment. Cattle have occasionally been found in the Bridger Bowl area, outside of the allotment. It is likely that the cows are from the Pine Creek Allotment but the brands have never been identified so ownership is uncertain. It is very likely that recreational users may have left the gates open and the cattle wandered outside of the allotment.

ENVIRONMENTAL CONSEQUENCES

Project Design/Mitigation Measures

The proposed action incorporates the following design features to minimize impacts to the Pine Creek grazing allotment.

1. The existing gates would be left closed if cattle are in the allotment.

Effectiveness: The people associated with the timber harvest would close the gate. Occasionally, other people (recreationalist) may not close the gate but that is outside the control of this project. The effectiveness of this mitigation measure depends on the compliance level. Keeping fences closed if cattle are in the pasture can be controlled by a standard timber sale contract provision.

2. Any fences or structures damaged from the timber harvest would be repaired. The structure would be replaced in a similar condition that it was prior to the harvest. The cost of repairing the structure will be bore by those that caused the damage.

Effectiveness: This mitigation measure is highly effective at protecting existing structures. Protecting existing structures is a standard contract clause in the all timber sale contracts.

Direct/Indirect Effects

The no action alternative would not affect the Pine Creek Allotment.

Because of design/mitigation measures described above, the Proposed Action Alternative is not expected to impact the Pine Creek Allotment. For example: the fences along the northern edge of the allotment rely on natural barrier from thick trees to keep cattle within the allotment. The boundary of unit 7A would be placed in a location that would retain the effectiveness of the trees to function like a natural barrier. Likewise, many of the units are adjacent to existing fence line. If a fence is damaged from timber harvest it would be rebuilt by the person who damaged the fence. The gates on the roads would be kept closed during the timber harvest. This is a standard timber sale contract provision and easy to enforce.

There is also a concern that cows would graze in the thinning units and damage young trees or shrubs. With the Proposed Action alternative it is very likely that the cows would use the harvest units, they would forage on some of the grass/forbs and trample some of the conifer seedlings. Existing vegetation within the units currently provides very little palatable forage. Thinning the forest would cause some species to increase but not introduce new more desirable forage species. Table 3.35 below lists the habitat type and indicator grasses/forbs with more than 5 percent canopy cover by units (within the allotment) (Pfister et al 1983, pages 154 through 159). Other species are present in the units besides those listed below, these are just species used in habitat typing forest environments. Of the species listed, only *Agropyron spicatum* (AGSP) is considered desirable forage for livestock. It is present in Units 9 and 15 but in very limited amounts (about 5 percent canopy cover).

Table 3.35: Units within the Pine Creek Allotment, Habitat Type and acres; type of grasses and forbs within the habitat type and percent canopy cover

Unit #	Habitat Type (acres)	Understory indicator grass / forbs (average canopy cover)
7A	ABLA/VAGL	CARU (7), CAGE (6), ARCO (5), ARLA (12),
8	ABLA/CAGE/PSME	CAGE(42), ARCO (15), ARLA (63), THOC (18)
9	PSME/SYAL/CARU (11.5 ac) PSME/VAGAL (4 ac) PSME/CARU (4 ac)	AGSP (5), CARU (26), CAGE (12), ADBI (8), ARCO (8), THOC(7) CARU(12), CAGE (7), ARCO (9), ARLA (27), THOC (9), CARU (45), CAGE (13), ARCO (16), ARLA (8), THOC (7)
11	PSME/CAGE	CAGE (44), ARCO (23), STAM (5)
12	ABLA/GATR	CARU (7), CAGE(11), ARCO (10), ARLA (25), COOC (19), COCA (19), THOC (6),
13	ABLA/GATR	CARU (7), CAGE(11), ARCO (10), ARLA (25), COOC (19), COCA (19), THOC (6),
14	PSME/SYAL/SYAL (2 ac) ABLA/VAGL (2.6 ac)	None CARU (7), CAGE (6), ARCO (5), ARLA (12)
15	PSME/SYAL/ SYAL (11 ac) PSME/SYAL/CARU (11 ac)	None AGSP(5), CARU (26) CAGE (12) ADBI (8), ARCO (8), THOC (7)
16	PSME/VAGL/VAGL	CARU(12), CAGE (7), ARCO (9), ARLA(27), THOC (9)
17	PSME/SYAL/SYAL	none

ABLA – *Abies lasiocarpa* (subalpine fir)
ADBI – *Adenocaulon bico*lor (pathfinder)
AGSP – *Agropyron spicatum* (bluebunch wheatgrass)
ARCO – *Arnica cordifolia* (heartleaf arnica)
ARLA - *Arnica latifolia* (mountain arnica)
CAGE – *Carex geyeri* (elk sedge)
CARU – *Calmagrostis rubescens* (pine grass)
COOC - *Coptis occidentalis* (yellow threat)
COCA - *Cornus Canadensis* (bunchberry dogwood)
GATR – *Galium triflorum* (sweet scented bedstraw)
PSME – *Pseudotsuga menziesii* (Douglas-fir)
VAGL - *Vaccinium globulare* (blue huckleberry)
VASC - *Vaccinium scoparum* (grouse wortleberry)
STAM-*Streptopus amplexius* (twisted stalk)
SYAL – *Symphoricarpos albus* (snow berry)
THOC – *Thalictrum occidentale* (western meadowrue)

Conclusion

As described above, project design/mitigation features would be effective at keeping cattle within the allotment boundary. The commercially thinning would increase the area where cattle can forage. Therefore, the proposed actions would have no impact to the range allotments in this area. Neither the Proposed Action Alternative nor the No Action Alternative would impact the range allotments.

Cumulative Effects

Past, Present, & Reasonably Foreseeable Future Actions:

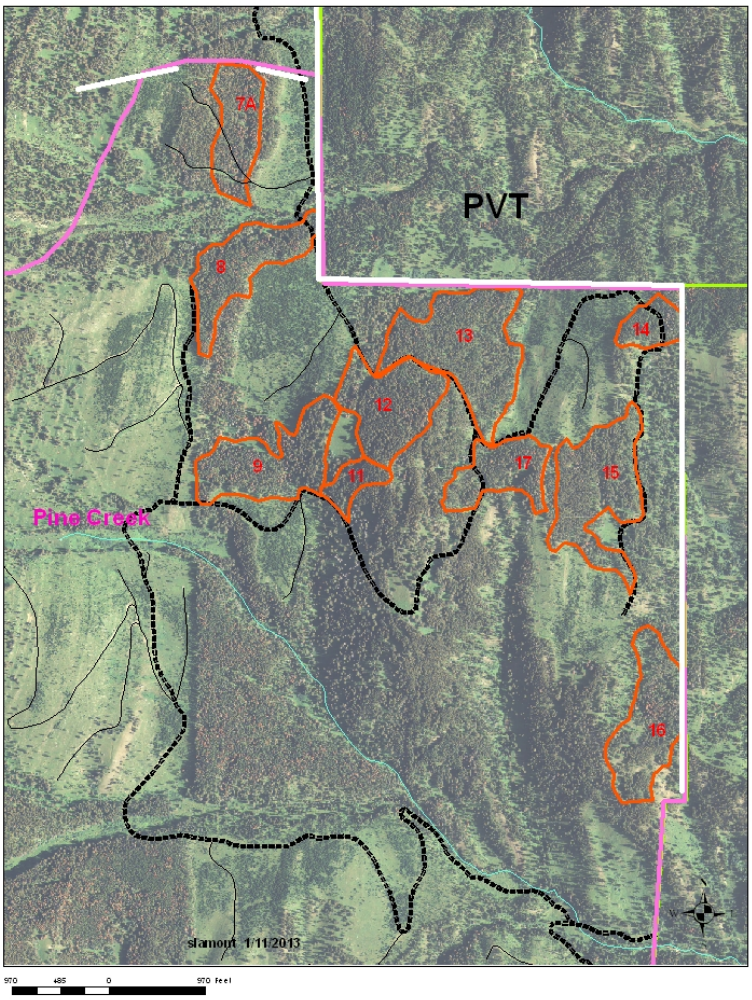
Fences have been constructed in locations to keep cattle on the allotment, and the proposed action would not impact the allotments. Occasionally a gate is left open and cattle wander off the allotment; this would occur regardless of the proposed harvest. Occasionally the cows spread weeds in this area while grazing; this occurs regardless of the proposed harvest. Weeds in this area would be treated with herbicides so the weed density would decrease over the next few years.

REGULATORY FRAMEWORK AND CONSISTENCY

The proposed timber sale would not impact the Pine Creek Allotment (no impact on structures and no measurable impact to the forage capacity in this area). This project is consistent with the Pine Creek Allotment Management Plan.

Figure 3.13

South Bridger Interface -
Proposed Units (red polygons), Pine CK Allotment (pink line), Fence (white line)



WEEDS

WEEDS ISSUES

1. There is a concern that timber harvest may spread existing invasive weeds or introduce new weeds into the area. This issue can be mitigated with prevention activities. The effectiveness of the mitigation measures would be considered.
2. There is a concern that when weeds are present then the productivity of the soil may be decreased. Some of the research papers that documented a change in soil characteristics would be examined to see what weed density level were used in the study, then compare with existing density levels in the project area.
3. Also, there is a concern that invasive weeds may have impacts on other resources such as aesthetics, social and biological systems. Review literature discussion regarding this issue, review the current density level within the project area, and consider the effectiveness of the mitigation measures to prevent weed spread.

ANALYSIS AREA

Spatial and Temporal Boundary

The direct and indirect effects spatial boundaries are limited to the haul routes and the timber sale unit boundaries because this area is likely to have soil disturbance as a result of the project. The cumulative effects spatial boundaries are larger to account for adjacent weeds and activities that may have an effect on this project. The spatial boundaries in include the following:the main road into Bridger Bowl on the north edge (access for weed treatment along the road makes this an effective boundary to control weeds), up to the Bridger Mountain Ridge and down the ridge line (this is another logical control line because weeds are being treated inside the ski area and the ridge line is a physical barrier that would stop most weeds), south along Pine Creek (the stream is another control line, weeds would be treated up to the stream banks), and along the private boundary line along (access for weed treatment is along the Forest Service side, and weeds do not appear to be abundant on the private side). A map of the cumulative effects boundaries is attached to the end of this document.

The temporal boundaries are from 2 years previously (important to understand the extent of current weed problem in this area) to 5 years after the project is finished (natural re-vegetation is usually well established within 5 years after disturbance and then the area is less susceptible to weed infestations). Plus this is a reasonably foreseeable time frame for estimating the future weed treatments and the effectiveness of weed treatments.

AFFECTED ENVIRONMENT

Within the South Bridger Interface area the following weeds have been inventoried (based on the 2013 weed inventory data). There are 6.1 acres of spotted knapweed, 11.8 acres of Canada thistle, 8.2 acre of houndstongue, and 7.2 acres of common tansy, and 0.6 acre of hoary alyssum. A map showing the 2013 weed inventory data and the proposed units is attached below. Species specific maps are in the project file. Most of the weeds in the Bridger Bowl Ski area are treated every year by the managers at the ski resort. In the summer of 2013 the weeds along travel routes in the project area were treated with herbicides. The herbicide treatment appeared to be effective (tops were drooping, leaves were turning brown). This was the first time many of these weeds have ever been treated and a repeat application is

anticipated. The weeds often have extensive root systems and dormant seeds that require multiple years of weed treatments before the plants are eradicated. The effects of using herbicides to treat weeds were disclosed in the 2005 Gallatin NF Noxious and Invasive Weed Treatment Project EIS. Please refer to that EIS for additional information related to herbicide impact on the environment and human health.

ENVIRONMENTAL CONSEQUENCES

Design / Mitigation Measures

The proposed action incorporates the following design features to minimize noxious weed spread.

1) All off road vehicles would be power washed and inspected prior to entering Forest Service land.

Effectiveness: A recent study from Montana State University looked at the effectiveness of different type of washing equipment and found them to remove 66 to 95 % of the soil (Taylor et al. 2011). The duration of wash seemed to be as important as the type of washing equipment, longer duration removed more soil than shorter. Clearly the effectiveness of this mitigation is dependent of the thoroughness of the implementation. This suggests that cleaning equipment does help to reduce the spread of invasive weeds but is not 100 % effective. Cleaning off-road equipment is a required mitigation measure in the FSM2080-Noxious Weed Management (page 2081.2(6.a.1.b).

2) Previously treated weeds would be retreated prior to implementation of this project, and would continue until the weeds are eradicated.

Effectiveness: This mitigation measure would provide current information about weed locations, and would kill plants before they are allowed to seed. The West Zone weed crew has been very effective at treating and killing weeds. The 2012 monitoring report documented an average of 90 to 92 % effective. The 2011 monitoring report found treatments effectiveness ranged from 50 to 95 %. These reports are included in the project file. Pretreating existing weeds is a recommended mitigation measure in the FSM2080-Noxious Weed Management (page 2081.2(6.b.2.b).

3) Reseed bare soil created by the harvest activities with native grass seed mix recommended by the Forest Service (certified noxious weed seed free). Establishing native grasses on disturbed sites may occur quickly but sometimes it takes multiple years. If seeds are not established with in the first year, the site will need to be reseeded in the following year. . A recommended seed mixture is as follows:

- 20 % Thickspike wheatgrass (*Elymus lanceolatus)*
- 20 % Mountain brome (*Bromus marginatus)*
- 20 % Idaho Fescue (*Festuca idahoensis)*
- 20 % Alpine timothy (*Phleum alpinum*)
- 20 % Columbia needlegrass (*Stipa Columbiana*)

Plant grass seed at a rate of 20 pounds per acre, broadcast seed into recently ripped soil or hand rack seed into soil. This mixture may be modified if necessary (based on availability of seed) and if changes are approved by Forest Service native plant specialist.

Effectiveness: Planting desirable native grasses on disturbed soil would help displace invasive weeds. This is a required mitigation measure in the FSM2080-Noxious Weed Management (page 2081.2(6.a.2).

Direct/Indirect Effects

Invasive weeds are spread by a wide variety of sources (wind, water, roads, humans, and wildlife). Most of the inventoried weeds (53%) on the Gallatin NF are within 100 feet of roads (Gallatin Travel Plan EIS, page 3-352); however, there are also numerous patches next to rivers and some adjacent to non-motorized trails; and a few patches in remote isolated locations.

Direct effect of logging is that the activity may spread invasive weeds within the units by dragging seeds or root stock while skidding trees or while maintaining the roads. This risk is extremely low because the existing weeds were treated with herbicides in 2013, and treatments would be repeated until the weeds are eradicated. The risks associated with herbicide treatments on the environment and on human health were addressed in the 2005 Gallatin NF Weed Treatment Project EIS and ROD (refer to that document for the associated effects analysis of herbicides).

Indirect effects of logging on weed spread might occur if the opening of the forest canopy allows for more sunlight to reach the forest floor, and creating more suitable habitat for growing weeds. This is mainly a problem if the weeds are currently present growing in a sunny patch, the forest canopy is removed, and then the weeds would likely spread into the new habitat. The existing weeds in the project area are mostly along existing roads and trails, which are easily treated with herbicides. The risk of weeds growing into the units is not likely because the existing weeds have been treated prior to harvest.

Another indirect effect of logging is the risk of introducing new weeds into the area by using equipment contaminated with weed seeds. The mitigation measure of washing all off-road equipment prior to entering National Forest land is reasonably effective are minimizing this risk.

Proposed Action Alternative - There is a risk that the proposed action would spread weeds in this area. The mitigation measures incorporated into this project are very effective at reducing the risk of spreading weed. The presence of people actively managing weeds in this area would help to reduce weeds in this area.

No Action Alternative – If no logging were to occur in this area there would be less need to monitor and treat weeds in this area. Other areas would have a higher priority and the existing weeds may not receive as much attention. The existing weeds would likely continue to spread into areas with suitable habitat. This is a case where the No Action Alternative would not necessarily result in fewer weeds.

Alternative with Units that are Weed Free. The public often requests that the Forest Service considers an alternative only treats units free of weeds. This type of alternative is not meaningful because the weeds are along the roads leading to all of the units (see map at the end of this document). This is essentially the same as the No Action Alternative. None of the units have weeds currently inside the units.

Impacts of weeds on social, aesthetic and biological systems. All noxious weeds are capable of out-competing the native plants and are capable of forming dense monocultures. When invasive weeds are at high densities, research studies have found that invasive weeds can impact social, aesthetic and biological systems. High densities of weeds may displace native plants, and reduce the diversity of wildflowers. When weeds dominate the landscape and displace native plants, they can be visually un-appealing. A landscape dominated by noxious weeds would reduce the abundance of native plants that wildlife depends on forage during winter months. These social, aesthetic and biological impacts of weeds are more

pronounced at high densities. Most of the weed patches on the Gallatin are at very low densities (less than 1 % canopy cover per acre, based on Susan LaMont's, Gallatin NF Weeds Specialists, ocular estimates in 2013 while working in this area). Low canopy densities of weeds do not displace native plants to a measureable level, and consequently, they have a very low level of impact on social and aesthetic values. The weeds in the project area were treated in 2013 and would be re-treated until eradicated.

Impacts of weeds on site productivity. For a good description of how weeds can impact the ecosystem see Bret Olsen's article, The Impacts of Noxious Weeds on Ecological and Economic Systems (Sheley and Petroff, 1999, pages 4-11). Most of the research studies that document impacts soil characteristics and site productivity are located in places with very high weed densities. For example, changes in phosphorus were detected when spotted knapweed canopy cover was at 60 to 80 % (Thorpe, et al. 2006). Likewise, research studies that found an increase in surface runoff and sediment compared areas with knapweed infested sites (90 % cover) to those dominated with native grasses (Lacey et al 1989). The current weed densities in the project area are at very low density levels, less than 1 percent canopy cover and have not measurably displaced native plants (based on Susan LaMont's, Gallatin NF Weeds Specialists, ocular estimates in 2013 while working in this area). The current weed population levels in the project area are not expected to increase as a result of this timber harvest because of effective mitigation measures and because this area is a high priority are for weed treatment over the next five years.

Effectiveness of previous weed treatments and long term treatment strategy. Starting in 2011, the Gallatin NF has monitored the effectiveness of treatments based on an ocular estimate on weed mortality. The 2012 monitoring report documented an average of 90 to 92 % effective. The 2011 monitoring report found treatments effectiveness ranged from 50 to 95 %. These reports are included in the project file. To help maintain a long term and consistent treatment strategy, the West Zone weed program maintains a spreadsheet that lists weed patches and documents the prioritization of different areas. A copy of the spreadsheet is in the project file. This helps to ensure that weed treatment strategies are implemented consistently over many years. Long term funding of weed treatment is provided by funds appropriated by congress, plus funds from other sources would be pursued. The area was re-inventoried for weeds in 2013 and would be re-inventoried periodically in the future during weed treatments.

Cumulative Effects

Past logging and road constructions may have introduce weeds into this area. However, weed treatments have managed to keep the population levels at very low levels. Current and future weed treatments would eradicate some of the weed patches and would keep other patches at low densities. Low densities of weeds would not alter the biodiversity or productivity of the site. Bridger Bowl manages invasive weeds in the ski area, weeds are not allowed to spread from Bridger Bowl to adjacent land. The area which has high weed density (common tansy – next to Pine Creek) is not impacted by the project (because there are no harvest units are in this area). However, since the roads are being repaired in this area, improved access had allowed for more weed control next to Pine Creek, and would reduce the density of weeds in this area.

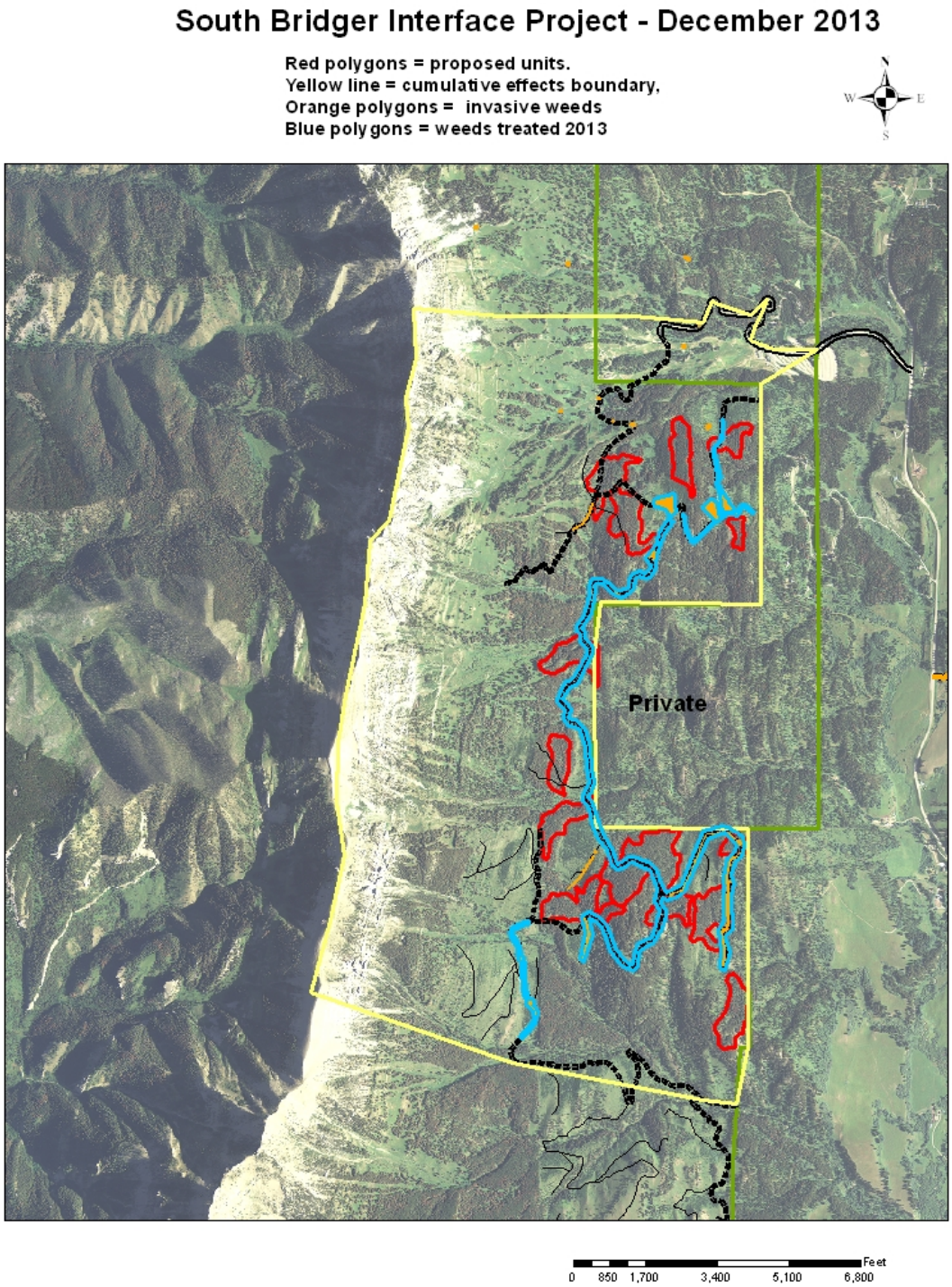
REGULATORY FRAMEWORK & CONSISTENCY

All applicable noxious weeds standards listed on page II-28 of the Gallatin Forest Plan would be incorporated into this project. Weed treatments would emphasize spot herbicide treatments. The funding for weed treatment would come from the timber sale and the invasive weed programs.

The applicable weed prevention activities identified in the FSM2080-Noxious Weed Management have been incorporated into this project (see mitigation measures listed above).

The treatment of weeds is consistent with Executive Order 13112 (1999) which directs all agencies to prevent introduction of invasive species, provide for their control, and to minimize economic, ecological, and human health impacts that invasive species cause.

Figure 23.14



SENSITIVE PLANTS

SENSITIVE PLANTS ISSUE

There is a concern that harvest may damage rare or sensitive plants. To analyze this issue the following actions would be completed: 1) review past FS survey data to see if surveys have been completed in this area, 2) complete the Pre-field Habitat Assessment form which develops a list of potential plant species based on the plant's preferred habitat and elevation and 3) complete a field survey for the plants in areas that may be disturbed by the project. Additional information about sensitive plants is provided in the specialist report in the project file.

Spatial and Temporal Boundary

The direct, indirect and cumulative effects spatial boundaries are limited to the treatment units, because this is the area of disturbance.

The temporal boundaries are from 2012 the year of the sensitive plant survey for this project and for the next 5 years (the project should be finished by that time).

AFFECTED ENVIRONMENT:

The project area is located on the east side of Bridger Range between 6200 and 6800 feet. The units are in forested habitats and logging equipment would not occur within 50 feet from water.

Table 3.36 below lists plants listed as sensitive on the Gallatin National Forest, the plants expected habitat type and elevation. For the plant to occur in this area it would need to have both the preferred habitat and the preferred elevation.

Based upon the information in the table below, there are two potential sensitive plants that may occur in the project area- northern rattlesnake plantain and California false hellebore. Both of these species are distinctive and relatively easy to identify. The northern rattlesnake plantain has distinctive leaf patterns color which makes it relatively easy to identify. The California false hellebore has white flowers with green marks at the base, and stalkless; while the false hellebore (*Veratrum viride*) has greenish flower and arranged on drooping branches

Table 3.36: Gallatin National Forest Sensitive Plants, Habitat Information and Biological Determination

Species	Preferred Habitat	Potential habitat in project area?	Preferred Elevation	Potential Elevation in project area?	Species potentially present in project area	Biological Determination
musk root - *Adoxa moschatellian*	moist mossy slopes at bottom of undisturbed rock slides	No	4,400-5,400 feet	No	No	No Impact
short-styled columbine - *Aquilegia brevistyla*	Open woods and streambanks, limestone sites, northern aspect	No	5,000 -6,000 feet	No	No	No Impact
large leaved balsamroot - *Balsamorhiza macrophylla*	Open hills associated with bunch grasses	No	7,000 – 8,500 feet	No	No	No Impact
small yellow lady's slipper - *Cypripedium parviflorum*	Damp, mossy woods, seeps, moist forest-meadows	No	3,000 – 6,200 feet	No	No	No Impact
English sundew - *Drosera anglica*	Peat lands on sphagnum bogs	No	3,000 – 9,000 feet	Yes	No	No Impact
beaked spikerush - *Eleocharis rostellata*	bogs	No	2,700 – 6,100 feet	No	No	No Impact
Giant helleborine - *Epipactis gigantea*	Streambanks springs often near thermal waters	No	2,000 – 5,750 feet	No	No	No Impact
Slender cottongrass *Eriophorum gracile*	Peat land, fen, bogs	No	3,000- 7,600 feet	yes	No	No Impact
Hiker's gentian - *Gentianopsis simplex*	Fens, meadows, bogs, seeps	No	4,400 -8,400 feet	yes	No	No Impact
Northern rattlesnake plantain - *Goodyera repens*	Open mossy forests. Limestone, shale, Douglas-fir, north aspects, spruce/twinflower or subalpine /twinflower habitat types	yes	5,700- 6,800 feet	yes	yes	May impact individuals or habitat but would not likely contribute to a trend towards federal listing or cause a loss of viable populations or species.

Species	Preferred Habitat	Potential habitat in project area?	Preferred Elevation	Potential Elevation in project area?	Species potentially present in project area	Biological Determination
Discoid goldenweed - *Haplopappus macronema*	Rocky open or sparsely wooded slopes talus above timberline	No	7,640 + feet	No	No	No Impact
Hall's rush - *Juncus hallii*	Moist to dry meadow and slopes	No	6,900 – 8,400 ft	No	No	No Impact
Dwarf purple monkeyflower - *Mimulus nanus*	Dry gravelly or sandy soild, may prefer bare areas with minimal competition	No	6,565 feet	yes	No	No Impact
Whitebark pine - *Pinus albicaulis*	Forest, lodgepole subalpine fir	yes	7000 feet +	No	No	No Impact
Austin's knotweed - *Polygonum douglasii*	Open gravelly shale soils with eroding slopes and banks.	No	5,800 – 6,600 feet	yes	No	No Impact
Barratt's Willow *Salix barrattiana*	Boggy meadows, moist areas, cold moist soils range from calcareous to acidic	No	6,800 – 10,500 feet	No	No	No Impact
Shoshnea *Shoshonea pulvinata*	Open windswept linestone ridgetops in thin rocky soils	No	6,800 – 9,000 feet	No	No	No Impact
Alpine meadowrue *Thalictrum alpinum*	Hummocks with low shrubs moist alkaline meadows subalpine	No	6,500 – 7,000 feet	yes	No	No Impact
California False Hellebore – *Veratrum californicum*	Wet meadows and stream banks, montane, subalpine, alpine, meadows, spruce and Douglas-fir	yes	5,000 – 8,500 feet	yes	yes	May impact individuals or habitat but would not likely contribute to a trend towards federal listing or cause a loss of viable populations or species.

ENVIRONMENTAL CONSEQUENCES

Design/Mitigation Measures

The proposed action incorporates the following design features to minimize impacts to any potential sensitive plants that may occur in the project area.

1.) If sensitive plants are found during implementation, do not disturb the area. Consult with the biologist to develop additional mitigation measures to protect the site.

Effectiveness – This mitigation measure is very effective at protecting all know sites.

Direct/Indirect Effects:

A sensitive plant field survey was conducted in 2012 (survey documentation in project record). Neither northern rattlesnake plantain, nor California fall hellebore, or any other sensitive plant species were identified in the proposed harvest units. If any sensitive plants are found at a later date, the site would be protected from disturbance (this is a common mitigation measure that is included in most timber contracts that require the site to be protected until a biologist determines the correct course of action).

It is not very probable that whitebark pine occurs in the harvest units because this is below the usual elevation range and none were observed during the sensitive plant survey. Therefore, there would be no impact to whitebark pine. Occasionally whitebark pine grow at elevation lower than preferred, but these trees do not grow larger than saplings and do not produce cones (Arno and Hoff, 1989),

The biological evaluation effects determination for the proposed action alternative is a "May impact individuals or habitat but would not likely contribute to a trend towards federal listing or cause a loss of viable populations or species" for northern rattlesnake plantain and California false hellebore, two sensitive species that might occur in this area.

For the No Action Alternative the effects determination is "No Impact" because there would be no disturbance.

Cumulative Effects

Past, Present, & Reasonably Foreseeable Future Actions:

No sensitive plant species have been discovered in this area, and it is very likely they did not occurred here before the previous timber harvest. Weed crews are trained to recognize sensitive plant species.

REGULATORY FRAMEWORK & CONSISTENCY

Forest Service Sensitive Species (FSSS) are those that are listed by the Regional Forester as "sensitive" in Region 1 because there is concern for population viability across their range, and all occurrences contribute significantly to the conservation of the species. FSM 2670.32 directs that a biological evaluation be prepared to determine potential effects on species designated as "sensitive" by the Regional Forester. United States Department of Agriculture Regulation 9500-4 directs the Forest Service to avoid actions that may cause a sensitive species to become threatened or endangered (FSM 2670.12).

Populations of all FSSS wildlife, fish, and plants must be maintained at viable levels in habitats distributed throughout their geographic range on National Forest System lands (FSM 2670.22). The viability of populations of FSS species becomes a concern when downward trends in population numbers or habitat capability are predicted. When the Forest Service undertakes or approves an activity on NFS land, the agency seeks to avoid or minimize impacts to FSSS. This project would not impact any known sensitive plants, because all new sites if discovered would be protected from disturbance.

RECREATION

RECREATION ISSUES

During project development, the following issues were raised concerning effects to recreational opportunities:

- Potential for a change in sense of place, displacement of recreationalists, or the creation of conflicts at recreation sites in the Bridger Range.
- Disruption of Bridger Bowl Ski Area use or management.

Additional information related to recreation is in the recreation specialist report in the project file.

ANALYSIS AREA

The following descriptions identify the analysis area for this project.

Spatial and Temporal Bounds

The spatial boundary for the analysis of direct, indirect, and cumulative effects associated with the proposed activities is the area of the Gallatin National Forest on the eastern slope of the Bridge Range including the Bridge Bowl Ski Area Permit Area south to the Pine Creek drainage. This area includes the roads, trails, a trailhead, and the ski area.

The temporal bounds of this analysis are designed to capture the direct, indirect, and cumulative effects of the alternatives to recreational opportunities within the analysis area. Project activities would most likely begin in 2014 and will likely take two to three years to accomplish. The effects of the proposed activities will likely last between 15 and 100+ years. This length of time was chosen by reviewing information provided by the Forest Silveculturalist; who used professional knowledge to determine stand development over time. After this length of time it is believed that, in the absence of stand replacing disturbance or additional treatments, natural forest succession processes would alter post-treatment stand conditions.

METHODS

This section will discuss the methodologies and data sources used to compile this report.

Methodologies

The following methodologies were utilized to determine direct, indirect, and cumulative effects of the proposal:

- Review of the Gallatin National Forest Plan direction and the Recreational Opportunity Spectrum (ROS) to be managed for in the area.
- Review of the Gallatin National Forest Travel direction for the spatial area.
- Review of the Bridger Bowl Master Plan.

Data Sources

Data concerning the management of recreational opportunities was compiled from the following sources:

- Gallatin National Forest Plan
- Gallatin National Forest Travel Plan
- Bridger Bowl Master Plan and Vegetation Management Plan

AFFECTED ENVIRONMENT

Recreational opportunities in the South Bridger Interface Project are managed utilizing goals, standards, and objectives outlined in the Gallatin National Forest Plan, the Gallatin National Forest Travel Plan and the Bridger Bowl Master Plan and Vegetation Management Plan. The existing recreational use is best described in relation to these management tools.

Gallatin National Forest Plan (2007)

Management Area Descriptions:

The South Bridger Interface Project falls within two Forest Plan Management Areas (MA): MA 2 and MA 11. MA 2 areas are managed for winter sport resort areas and are managed in accordance with approved master plans. All goals and standards for this MA are designed to facilitate the ski area management. Standards for timber allow for tree removal for reduction of safety hazards, to maintain a healthy and diverse vegetative pattern, or to permit construction or expansion of facilities and ski runs (FP, pg III-4).

MA 11 areas are managed for forested big game habitat. Recreation standards include providing a variety of dispersed recreation activities with moderate levels of investment in trail and recreational road maintenance, trailhead facilities, and in the event of disruption from timber harvest activities, trail relocation (FP, pg. III-33).

Existing Recreation Opportunity Spectrum (ROS) Classifications:

The Forest defines recreation opportunity by utilizing the ROS classification/setting for the proposed treatment areas. The ROS in the South Bridger Interface Project area is classified as Rural (R) or Roaded Natural (RN) in the summer and Rural (R) and Semi Primitive Non-Motorized (SPNM) in winter.

R settings are natural environments that are culturally modified yet attractive. Backdrop modifications range from obvious to dominant. Self-reliance on outdoor skills is of little importance, and there is little challenge and risk. Interaction between and evidence of other users may be high. This is the existing setting of the proposed project area within the Bridger Bowl Ski Area permit area in the summer and winter seasons. Winter use is high during the Bridger Bowl Ski Area operating season. Use includes day skiers and 10 to 15 recreational events such as races. Summer use is moderate and is characterized by predominately hiking and mountain biking use. One recreation event occurs every June hosted by the Gallatin Valley Backcountry Horsemen. The event attracts 100 to 150 riders for a poker ride event which utilizes trails and roads in the project area on alternating years (the event uses trails to the north in intervening years).

RN settings are predominately natural appearing settings, with moderate sights and sounds of human activities and structures. Evidence of human activities varies from area to area and includes improved highways, railroads, developed campgrounds, small resorts and ski areas, livestock grazing, timber harvesting operations, and watershed restoration activities. Roads and motorized equipment and vehicles are common in this setting. This setting characterizes the area south of Bridger Bowl Ski Area in the spring/summer/fall season. Recreational use during this season is relatively low and is mostly associated

with hiking, mountain biking, horseback riding and hunting. No outfitters operate in this area during summer months.

SPNM settings are predominately natural-appearing environments where there is often evidence of other users and moderate probability of solitude. Vegetation alterations are very small in size and number and are widely dispersed and visually subordinate. This setting characterizes the area south of Bridger Bowl Ski Area in the "winter" season when snow prevents access and covers the landscape. Recreational use in the drainage at this time of year is relatively low and consists mostly of occasional backcountry skiers skiing beyond the Bridger Bowl boundary. During the winter, the only public access trailhead is closed due to Bridger Bowl operations; thus access to areas south of the ski area is limited to Bridger Bowl customers. Two outfitters, American Avalanche Institute and Montana Mountaineering Association may operate in this area during the winter but most of their activities take place to the west, upslope, of the project area.

Gallatin National Forest Travel Plan Direction (December 2006)

The South Bridger Interface Project lies within the Bridger Canyon Travel Planning Area. Goals for this area include providing opportunities for experienced users for mountain biking in the summer and hiking in conjunction with the mountain biking, and to provide limited opportunities for experienced users for cross-country skiing in the winter.

Bridger Bowl Master Plan Direction (January 2005)

The Bridger Bowl Master Plan has three goals: 1) To continue to provide uncrowded skiing by better accommodating high demand periods; 2) To retain existing skiers and attract new skiers by authorizing new trails and lifts and providing terrain variety and a range of trails for all ability levels; 3) To accommodate anticipated growth while maintaining the desired uncrowded slope conditions. Since 2008 Bridger Bowl Ski Area has averaged approximately 200,000 skier visits per year. Four new lifts have been installed and two old lifts removed since 2008.
The Bridger Bowl Vegetation Management Plan was developed in 2010 to better define vegetation management goals for Bridger Bowl Ski Area. The plan looks to support the goals of the Bridger Bowl Master Plan by retaining vegetation which:

- facilitates the maintenance of uncrowded slope conditions,
- provides snow/wind fence effects along runs,
- provides contrast and visual reference in low or flat light conditions,
- provides screening between runs,
- defines runs and glades,
- reduces hazards from falling trees, and
- retains the visual experience skiers expect.

ENVIRONMENTAL CONSEQUENCES

This section describes the direct, indirect, and cumulative effects of the no action and the proposed actions to recreation opportunities. The potential effects described are based on research, experience, and professional judgment.

No Action Alternative

Direct and Indirect Effects

Direct effects are those activities that would occur within the project area that would alter current recreational opportunities. Indirect effects would cause changes to the area's setting, including ambiance and sense of place, which is usually caused by the change in scenery and screening from vegetative treatment.

The No Action Alternative would have no effect on recreational opportunities outside the Bridger Bowl permit area. All current recreational activities managed for through the Gallatin National Forest Plan and Travel Plan would continue.

The No Action Alternative may have indirect effects to the recreational opportunities within the Bridger Bowl permit area. Forest vegetation has experienced recent severe insect and disease outbreaks in this area (see Forest Vegetation Report for details). Forest silviculturalists have recommended vegetative treatments to reduce the severity of these outbreaks and their long term effects on forest health. The recreation opportunity at Bridger Bowl relies on healthy forest vegetation for wind protection of runs, the opportunity to provide "glade skiing" experiences, and retain the sense of place the forested areas provide. Vegetation management is critical in order for Bridger Bowl Ski Area to meet the goals outlined in the Bridger Bowl Master Plan and Vegetation Management Plan.

Cumulative Effects

The No Action Alternative would have no long-term or cumulative effects to recreational opportunities in the project area. The no action alternative would allow all existing recreational opportunities to continue.

Action Alternative

Direct and Indirect Effects

Direct effects are those activities that would occur within the project area that would alter current recreational opportunities. Indirect effects would cause changes to the area's setting, including ambiance and sense of place, which is usually caused by the change in scenery and screening from vegetative treatment.

Direct effects to recreational opportunities may include:

- The potential for a reduction in public access during timber harvest activities. Depending on the season of operation and the level of public use it may be necessary to limit access for periods of time. The impact would be of a short duration and not affect the long term availability of recreational opportunities in the area.

Indirect effects to recreational opportunities may include:

- A change to the visual setting, and glade skiing in unit 18. This change may occur naturally as forest health declines due to insect and disease outbreaks. The action alternative will allow for a controlled method of modifying the visual setting to attempt to reduce impacts to skiers.
- The long term improvement of vegetative health for a portion of the Bridger Bowl permit area; thus retaining the sense of place, wind protection, and glade skiing opportunities the forest provides.
- A change in the visual setting and sense of place for hikers, mountain bikers, horseback riders and hunters using the area south of Bridger Bowl.

The action alternative will have limited, short duration, direct effects on recreational opportunities and indirect effects from the action alternative may improve the recreational setting a Bridger Bowl by reducing the impact of insect and disease outbreaks.

Cumulative Effects

The Action Alternative would have no long-term or cumulative effects to recreational opportunities. The no action alternative would allow all existing recreational opportunities to continue.

REGULATORY FRAMEWORK & CONSISTENCY

National Forest Management Act (NFMA)/Gallatin National Forest Plan Direction

See the Affected Environment Section for a discussion of consistency with Gallatin National Forest Plan Direction.

Gallatin National Forest Travel Plan

See the Affected Environment Section for a discussion of consistency with the Gallatin National Forest Travel Plan.

Bridger Bowl Master Plan

See the Affected Environment Section for a discussion of consistency with the Bridger Bowl Master Plan.

DESIGN /MITGIATION

Table 3.37

OBJECTIVE	TASK
Recreation Protection	Hauling/Access will be coordinated with Bridger Bowl Ski Area such that Bridger management is aware of expected traffic in the area.
Recreation Protection	Road #538 through the Bridger Bowl Permit Area would not be plowed between November 1st and the closure of the ski area in the spring.
Recreation Protection	All structures (Bridger Bowl gun mount, trail signs, ski area signs, etc.) would be protected from damage.
Recreation Protection	For public safety and understanding of the activity, post information at appropriate access points to inform the public of project activities. Provide local media with updates about project work that may affect the recreating public. Post warning signs notifying forest users of potential hazards from fuel treatment activities when occurring adjacent to dispersed areas, roads, and trails. If necessary, issue special orders that temporarily close some areas or routes to protect the public.

OBJECTIVE	TASK
Recreation Protection	Holders of special use permits (such as recreation event organizers and outfitters) would be notified prior to treatment in the vicinity of their authorization.
Recreation Protection	No equipment use, staging or storage, nor the decking or piling of slash would occur at trailheads or on Forest Service trails or roads.
Recreation Protection	Location of slash piles for units 1 and 18 would be coordinated between the Bridger Bowl permit administrator and the timber sale administrator.

CUMULATIVE EFFECTS

Past, Present, & Reasonably Foreseeable Future Actions:
Following are the past, present and reasonably foreseeable future actions occurring in the analysis area that may have potential cumulative effects with the South Bridger Interface proposal.

Timber Harvest on FS and Adjacent Private Land:

Reasonably foreseeable actions relating to forest vegetation in the analysis area all involve Bridger Bowl Ski Area. The Bridger Bowl Vegetation Management plan was developed in conjunction with Forest Service staff, Forest Health and Protection entomologists and pathologists, and resort staff. The following activities were identified in the plan and may occur in the future:

- Removal of dead and dying hazard trees in areas adjacent to ski runs/glades and resort infrastructure
- Establish regeneration of younger age class of trees through Shelterwood harvests
- Thin conifer stand throughout the ski area to increase resiliency and reduce insect impacts
- Thin conifer stands in in future skiing areas to north and east.
- Aerial application of insecticide and application of MCH and verbenone pheromones.
- Planting of tree seedlings

Vegetation management actions within the Bridger Bowl Ski Area have the potential to have positive cumulative effects with the proposal. Improved forest health may help retain forested cover to provide wind breaks to ski runs, provide enhanced glade skiing, and retain the sense of place skiers expect at Bridger Bowl.

Insect Control Activities:

Within the Bridger Bowl permitted ski area included the following: attaching pheromones such as verbenone and MCH on individual trees to discourage attacks from mountain pine beetle and Douglas-fir beetles during years with high insect populations. The pheromones do not kill the insects; rather they cause the insect to avoid the immediate area. Since this treatment only protects the immediate area, only high valued trees and trees at high risk to the insects are targeted for pheromone treatments. Treatments are only effective for a short time, usually less than a couple of months. Pheromones have been used in

this area for the last ten years or more, and are expected to continue into the future if insect populations remain high.

Other insect control activities have included the application of Bt (*Bacillus thuringiensis*) a naturally occurring soil dwelling bacterium which is used to reduce spruce budworm defoliation on Douglas-fir trees and subalpine fir. One treatment occurred in 2010, treatment effectiveness on budworm is very short term, usually less than a couple of weeks, so the timing of application is critical. If the budworm population remains high, future applications may occur.

Additionally, trees that are dead or dying and adjacent to ski runs are removed from the ski area. This individual tree removal of hazard trees has been occurring for the past 10 years or more, and expected to continue into the foreseeable future. The number of trees removed each year is variable and depends on the severity of insect outbreak. No carbaryl has been sprayed in Bridger Bowl or in the project area.

Insect control activities and the proposed action will have short term cumulative effects on the visual setting and sense of place in the project area. The placement of pheromone packets on trees is visible to the visiting public resulting in a less natural appearing setting. Bt spraying operations create short term noise impacts to recreationalists and site specific temporary closures for safety. Insect control activities may overlap temporally and spatially with the proposed activities and for the duration of the proposed project. A change in the visual setting and sense of place for hikers, mountain bikers, horseback riders and hunters using the area south of Bridger Bowl may result. These cumulative effects will have limited, short duration, effects on recreational opportunities, the visual setting and the sense of place; but the action alternative is designed to ultimately improve the visual setting and sense of place by reducing the impact of insect and disease outbreaks.

SUMMARY CONCLUSION

In summary, the findings of this analysis conclude that all past, current, and reasonably foreseeable activities within the project area would not cumulatively alter the findings of the direct and indirect effects to recreational opportunities disclosed above. Although some current and reasonably foreseeable activities would measurably affect recreational opportunities; they were not of sufficient magnitude to create negative trends or threats to overall recreation uses.

ROADLESS

INVENTORIED ROADLESS AREA ISSUES

During project development, the following issue was raised concerning effects to the Inventoried Roadless Area (IRA) resource:

- Potential for acres to be treated in the Bridger Inventoried Roadless Area (IRA); resulting in changes to natural integrity, apparent naturalness, remoteness, solitude, special features, and manageability of boundaries of the defined area.

Additional information related to roadless areas is in the specialist report in the project file.

ANALYSIS AREA

The following descriptions identify the analysis area for this project.

Spatial and Temporal Bounds

The spatial boundary for the analysis of direct, indirect, and cumulative effects associated with the proposed activities is the area of the Gallatin National Forest on the eastern slope of the Bridge Range including the Bridge Bowl Ski Area Permit Area south to the Pine Creek drainage. This area includes the portion of the Bridger IRA adjacent to the proposed project area.

The temporal bounds of this analysis are designed to capture the direct, indirect, and cumulative effects of the alternatives to IRA within the analysis area. Activities would most likely begin in 2014 and will likely take two to three years to accomplish. The effects of the proposed activities will likely last between 15 and 100+ years. This length of time was chosen by reviewing information provided by the Forest Silverculturalist; who used professional knowledge to determine stand development over time. After this length of time it is believed that, in the absence of stand replacing disturbance or additional treatments, natural forest succession processes would alter post-treatment stand conditions.

METHODS

This section will discuss the methodologies, data sources, and assumptions used to compile this report.

Methodologies

Unit prescriptions were reviewed relative to potential effects to roadless character and identified in the the field and office during initial planning stages of this project. There are no treatments proposed within the Bridger IRA. See the Forest Service Manual FSH 1909.12 (72.1) for definitions of wilderness characteristics.

The following five “wilderness” attributes are the basis for evaluation of the effects of the alternatives. These characteristics are those used to define wilderness attributes of an area and are the basis for evaluating actions or proposals that could affect future wilderness designation.

1) Natural - the extent to which long-term ecological processes are intact and operating.
2) Undeveloped - means the environment appears natural to most people.

3) Outstanding opportunities for solitude or primitive unconfined recreation - a personal, subjective value defined as the isolation from the sights, sounds, and presence of others and development of man. Primitive recreation is characterized by meeting nature on its own terms, without modern comfort or conveniences.

4) Manageability and Boundaries - ability to manage a roadless area to meet the minimum size criteria, which is 5,000 acres, for wilderness.

5) Special Features or Values - refers to attributes of the area that are special or valuable to stakeholders, and are often less tangible than the previous 6 attributes. Special features can include such factors as unique ecological, scientific or geologic features; significant cultural or historic resources; or outstanding scenic resources. Special values are often intangible and not clearly articulated by inventories or data relating to the natural environment.

Many roadless characteristic features pertain to resource specific issues that were analyzed by other resource specialists for this project (i.e. water quality, wildlife, vegetation, scenery, and soils). Please refer to those sections for a more complete effects analysis for each resource.

Data Sources

Data concerning the location and descriptions of the Bridger IRA was compiled from the following sources:

1) Gallatin National Forest Plan
2) The Final Environmental Impact Statement for the Gallatin National Forest Plan

AFFECTED ENVIRONMENT

The Bridger Roadless Area #1-543 (approximately 45,000 acres), as identified in the Gallatin NF Plan (FP, pg. V-9-10) and the associated Final Environmental Impact Statement (Appendix C-94) is located in the Bridger Range north of Bozeman, Montana, and adjacent to portions of South Bridger Interface Project Area.

The portion of the Bridger Roadless Area adjacent to the project area has a moderate level of natural integrity. In the Pine Creek drainage past timber harvest has occurred within the IRA and one low standard, administrative road travels through the east edge of the IRA. To the north of the project area both the Bridger Ridge Communications Site and the Bridger Bowl Ski Area are located on the eastern edge of the IRA. Noise from avalanche control at Bridger Bowl also affects the opportunities for solitude and natural integrity of the IRA. None of the alternatives for the project include proposed activities or treatments in the IRA.

ENVIRONMENTAL CONSEQUENCES

This section describes the direct, indirect, and cumulative effects of the no action and the proposed actions to inventoried roadless areas. The potential effects described are based on research, experience, and professional judgment.

No Action Alternative

Direct and Indirect Effects

Direct effects are those activities that would occur within the IRA that would alter the roadless characteristics to prevent them from future consideration for wilderness designation. Indirect effects

would cause changes to roadless character that would impact Remoteness, Solitude, Natural Integrity, Apparent Naturalness, Special Features, or Manageability and Boundaries, as well as the effects of any proposed activity that would substantially alter these characteristics as to render the area unsuitable for future wilderness designation.

The no action alternative would have no effects to existing roadless characteristics within the Bridger IRA. The no action alternative would allow for the roadless lands within the Bridger IRA that retain roadless character to be considered for wilderness designation in the future.

Cumulative Effects

The No Action Alternative would have no long-term or cumulative effects to roadless characteristics within the Bridger IRA. The no action alternative would allow the roadless lands within the Bridger IRA to retain the roadless character necessary to be considered for wilderness designation in the future. Likewise, there would be no irretrievable or irreversible commitment of resources, which would eliminate possibility of the Bridger IRA to be designated as wilderness at some future date.

Action Alternative

This section will discuss the effects to the inventoried roadless area

Direct and Indirect Effects

Direct effects are those activities that would occur within the IRA that would alter the roadless characteristics to prevent them from future consideration for wilderness designation. Indirect effects would cause changes to roadless character that would impact Remoteness, Solitude, Natural Integrity, Apparent Naturalness, Special Features, or Manageability and Boundaries, as well as the effects of any proposed activity that would substantially alter these characteristics as to render the area unsuitable for future wilderness designation.

No Direct effects would occur within the IRA since the proposal does not include road building or forestry improvement units within the Bridger IRA boundaries.

Indirect effects would be limited to the period of operation for the project. Noise from harvest activities or road maintenance work may reduce the opportunities for solitude in the Bridger IRA. This loss of solitude will be of short duration and will not persist into the future thus not compromising the future suitability for wilderness designation.

Cumulative Effects

The Proposed Action would have no long-term or cumulative effects to roadless characteristics within the Bridger IRA. The action alternative would allow the roadless lands within the Bridger IRA to retain the roadless character necessary to be considered for wilderness designation in the future. Likewise, there would be no irretrievable or irreversible commitment of resources, which would eliminate possibility of the Bridger IRA to be designated as wilderness at some future date.

REGULATORY FRAMEWORK & CONSISTENCY

National Forest Management Act (NFMA)/Gallatin National Forest Plan Direction

The National Forest Management Act, and associated agency policy directs the agency to evaluate all roadless lands for their suitability for designation as wilderness within the Wilderness Preservation system. The Final Environmental Impact Statement for the Gallatin National Forest Plan approved in 1987 evaluated roadless characteristics for all inventoried roadless lands on the forest (at that time), and made recommendations for future inclusion in the wilderness preservation system (Appendix C, Final Environmental Impact Statement, Gallatin National Forest Plan).

The following five "wilderness" attributes are the basis for evaluation of a project on the future suitability of roadless lands for designation as wilderness. These characteristics are those used to define wilderness attributes of an area and are the basis for evaluating consistency with the National Forest Management Act and the Gallatin National Forest Plan.

Table 3.38: Wilderness Characteristics

Wilderness Characteristic	Consistency
Natural – intact and operating long-term ecological processes	The proposed action does not include road building or forestry improvement units within the IRA boundaries and thus would not impact the existing long-term ecological processes in the IRA.
Undeveloped – appears natural to most people	The proposed action does not include road building or forestry improvement units within the IRA boundaries and thus would not change the appearance of the setting.
Outstanding opportunities for solitude or primitive unconfinded recreation.	The proposed action may have a short duration impact on finding opportunities for solitude due to noise from project activities outside the IRA. Since these activities will not persist into the future there will be no impact to the future suitability of the Bridger IRA for designation as wilderness.
Manageability and Boundaries - ability to manage a roadless area to meet the minimum size criteria, which is 5,000 acres, for wilderness	The proposed action does not include road building or forestry improvement units within the IRA boundaries and thus would not change the manageability or boundaries of the Bridger IRA.
Special Features or Values	The proposed action does not include road building or forestry improvement units within the IRA boundaries and thus would not impact any special features or values in the Bridger IRA.

Code of Federal Regulations

36 CFR Part 294, Roadless Area Conservation Rule (2001 Roadless Rule) establishes prohibitions on road construction, road reconstruction, and timber harvesting in inventoried roadless areas on National Forest System lands. The intent of this final rule is to provide lasting protection for inventoried roadless areas within the National Forest System in the context of multiple-use management. The Secretary's Memorandum 1042-154 (5/28/09) is intended to assure the careful evaluation of actions in inventoried roadless areas while long term roadless policy is developed. Sine the proposed action includes no road construction, road reconstruction, or timber harvesting in the Bridger IRA it is consistent with the Roadless Area Conservation Rule.

DESIGN / MITIGATION

Table 3.39

OBJECTIVE	TASK
Roadless Protection	No roads or skid trails would be constructed within the IRA. No treatment units or areas will be located in the IRA.
Roadless Protection	Cutting unit boundaries adjacent to the IRA would be clearly marked and mapped to avoid the IRA.

CUMULATIVE EFFECTS

Past, Present, & Reasonably Foreseeable Future Actions:

Following are the past, present and reasonably foreseeable future actions occurring in the analysis area that may have potential cumulative effects with the South Bridger Interface proposal.

Timber Harvest on FS and Adjacent Private Land:

Reasonably foreseeable actions relating to forest vegetation in the analysis area all involve Bridger Bowl Ski Area. The Bridger Bowl Vegetation Management plan was developed in conjunction with Forest Service staff, Forest Health and Protection entomologists and pathologists, and resort staff. The following activities were identified in the plan and may occur in the future:

- Removal of dead and dying hazard trees in areas adjacent to ski runs/glades and resort infrastructure
- Establish regeneration of younger age class of trees through Shelterwood harvests
- Thin conifer stand throughout the ski area to increase resiliency and reduce insect impacts
- Thin conifer stands in in future skiing areas to north and east.
- Aerial application of insecticide and application of MCH and verbenone pheromones.
- Planting of tree seedlings

Timber harvest activities in areas adjacent to IRAs may temporarily reduce opportunities for solitude in the IRA. As listed above some reasonably foreseeable harvesting and silvicultural treatments associated with the Bridger Bowl Ski Area are possible. The potential effects would be of short temporal duration and would not negatively impact the IRA's potential for wilderness designation.

Other Recreation Uses:

Hunting, fishing, camping, motorized travel (vehicles, OHV and snowmobile), horseback riding, hiking, bicycling would continue. There are a number of user created trails around the Bridger Bowl Ski area (for mountain biking and hiking). These trails are used frequently in the summer and fall.

The cumulative effects of dispersed recreational use and the proposed action may affect opportunities for solitude within the Bridger IRA. New project units will have a more open understory which may allow for increased use by hunters, hikers and skiers thus increasing access to the Bridger IRA. Only 2 units

border the IRA and new opportunities for access to the roadless area should be minimal and not adversely impact the wilderness character of the Bridger IRA.

SUMMARY / CONCLUSION

In summary, the findings of this analysis conclude that all past, current, and reasonably foreseeable activities within the project area would not cumulatively alter the findings of the direct and indirect effects to the inventoried roadless area disclosed above. Although some current and reasonably foreseeable activities would measurably affect the inventoried roadless area; they were not of sufficient magnitude to create negative trends or threats to the overall inventoried roadless resource.

SCENERY

SCENERY ISSUES

The steep, rugged alpine faces and the more gently sloping partially forested foothills of the east side of the Bridger Range form an impressive viewshed that is highly valued by drivers, recreationists and residents along and near Highway 86 (the Bridger Canyon Road) and by winter recreationists at Bridger Bowl Ski Area.

Tree removal and associated activities have the potential to negatively affect the scenery by lowering the quality of the scenery as a result of residual visual effects such as unnatural-appearing vegetation patterns or straight harvest unit edges that are visually dominant from critical viewing areas. If this were to happen, it would be visually discernible immediately after project completion.

The proposed actions also could have the potential to positively affect the scenery in the longer term by reducing the vulnerability of the trees to widespread mortality due to a variety of insects and diseases and thus help to maintain the desirable diversity of the forest mosaic on the foothills.

Additional information related to scenery is in the specialist report in the project file.

LAWS, REGULATIONS, POLICY & FOREST PLAN DIRECTION

The visual or scenery resource is regulated by a few different references in the Code of Federal Regulations, one of which is 36 CFR part 219, subpart A that requires the consideration, treatment and protection of "intangible" resources such a scenery and aesthetics. These citations are also listed in the Forest Service Manual 2380 Landscape Management.
The Gallatin National Forest Plan emphasizes the visual resource by providing direction for management activities that alter the natural landscape (FP, pg. II-3). Forest-wide direction is to "Provide visitors with visually appealing scenery" (FP, pg. II-1).

During the development of the current Forest Plan, a Visual Management System inventory (VMS) (USDA Forest Service, 1974 National Forest Landscape Management, Vol. 2, Ch. 1, Ag Handbook #462) was conducted on the Forest. That survey considered three factors: the sensitivity of the observation points (which is the concern level of viewers); the distance of the landscape from the observation points; and the landscape character and variety class (which are the physical characteristics and visual diversity of the landscape). The resulting Forest Plan Visual Quality Objectives, (VQOs) are a blending of the results from the VMS Inventory and other resource considerations. The VQOs serve as the Forest Plan standards for visual quality that provide large-scale guidance for the degree of acceptable landscape change for all management initiated landscape-altering activities (FP, pg. II-16). The five VQOs that are assigned to specific landscapes in the Forest Plan are Preservation, Retention, Partial Retention, Modification, and Maximum Modification.

In 1995, the Forest Service updated the scenery management principles, concepts and terminology with the Scenery Management System (SMS) (Landscape Aesthetics: A Handbook for Scenery Management, USDA Forest Service, Agriculture Handbook Number 701, December 1995). However, until the current Gallatin National Forest Plan (1987) is revised, the current Forest Plan VQOs are still applicable to this project. However, some of the SMS concepts and terms, such as scenic integrity and landscape character are being incorporated into this project since they tend to make the analysis more meaningful. Additionally, the concepts of visual absorption capability and visual magnitude, from "A Handbook for

Scenery Mangement, Agriculture Handbook No 701" help to clarify the expected effects. Visual absorption capability describes the relative ability of a landscape to accept human alterations without loss of character of the scenic quality. Visual magnitude denotes the relative visibility of a landscape element, when viewed in its context, factoring in distance from the viewer, slope and aspect relative to the viewers, and number of times seen.

All NF land where this project is proposing harvest/treatment units were assigned a VQO of "Partial Retention" (PR) by the Forest Plan. The definition of PR, as shown on page VI-44 of the Gallatin National Forest Plan, is:

> Partial Retention: means that human activities may be evident, and the characteristic landscape may appear to be altered slightly. Any noticeable deviations must remain visually subordinate to the landscape character being viewed.

ANALYSIS AREA

Spatial and Temporal Boundary

The spatial boundary of this project is the viewshed along the west side of the Bridger Mountains, which is defined by Pine Creek on the south and the north edge of Bridger Bowl Ski Area on the north, and from the Bridger Canyon Road on the east to the top of Bridger Ridge on the west.

For determining compliance of potential negative visual impacts of the alternatives with the Forest Plan standard for visual quality, the time frame is one year from the time that all project activities have been completed, as specified by the FS Visual Management System for a VQO of PR. For purposes of analyzing cumulative effects of the alternatives, the time frame looks back to include all visually discernible activities such as timber harvests, implemented in approximately the last 60 years.

METHODS

Methodologies

To analyze the existing condition of the scenery in the viewshed potentially affected by this project, and to determine the direct, indirect and cumulative effects of the alternatives being considered, the scenery was viewed and photographed on-the-ground, winter and summer, from the Bridger Canyon Road, from within the ski area and from along existing internal roads and trails.

To analyze the effects of the project alternatives on the scenery as viewed from the Bridger Canyon Road, four representative viewpoints along it were selected:

- At its junction with the Stone Creek Road;
- At its junction with the Olson Creek Road;
- At its junction with the Flaming Arrow Ranch Road; and
- At its junction with the Bridger Bowl Ski Area Road.

A GIS layer of the proposed unit boundaries was laid over Google Earth (imagery date of 2011). Oblique angle views were created in Google Earth to approximate which units would be visible and if so, how much would be visible to viewers from each of the four viewpoints. The Google Earth oblique angle

views were matched with stitched panorama photos taken at each of the four representative viewpoints to determine accuracy and apparent visual magnitude of the visible units and to analyze the probable resulting visual appearance, within the context of the surrounding topography, vegetation and overall view.

Data Sources

The GIS layer with the proposed unit outlines that was used for the visual resource analysis was created by a project team member and is the same map with proposed unit outlines displayed in this document. The Google Earth data (imagery date 2011) is publicly available free software. Photographs that were taken are available in the project file.

References for the FS Visual Management System are listed in the "Laws, Regulations, Policy & Forest Plan Direction" paragraph of the Scenery Resource section.

AFFECTED ENVIRONMENT

The overall landscape character of the east slope of the Bridger Ranger is striking topography that sweeps steeply down avalanche-prone gullies from the top of the ridge to the east through rocky ridges, dominated by open slopes dotted with stringers or small clumps of coniferous trees. Where the slope starts to lessen toward the east, the conifers become thicker and more dominant, interspersed with open meadows of various sizes. At the bottom of the foothills and along drainages that cut through the middle hills, deciduous vegetation becomes dominant as the slopes meet the flat land along the bottom of Bridger Canyon.
The project area is behind and uphill of the private land along Bridger Canyon Road, with the private land serving as the foreground. Conversely, skiers look down onto the project area with private land beyond, or, in the case of units #1 and #18, view them in their very immediate foreground.

In an aerial view of the general project area, it is apparent, from the visible roads and some residual straight edges separating harvested and non-harvested treed areas, that there has been a fair amount of timber harvest activity in the past. Over the past 60 or so years, tree harvesting has occurred in roughly similar amounts on adjacent forested private land and on forested NF land (the Silviculture section contains a more detailed description of past management activities). Treatments have ranged from removal of all trees ("clearcuts") to partial removal, with total removal being the major treatment type. Vegetation treatments have also occurred since the ski area was opened, as part of standard ski area management and to provide for skiers' safety and enjoyment.

To viewers looking toward the project area from along or near Highway 86, the private land in the foreground exhibits a wide visual diversity consisting of widely-spaced constructed features, such as houses, barns, roads, and more open features such as agricultural field and fences, and vegetation being forested slopes, open meadows, and a mosaic of tree patches intermixed with open land. Vegetation closer to the road is predominantly deciduous, with coniferous trees becoming more dominant on land that slopes uphill to the west. The visually striking steep open avalanche slopes form a continuously dominant background to the middle hills. Tree removal activities on private land are discernible but in general do not overwhelm or dominant any of the views from along the Highway, and even less so when covered by snow in the winter. The middle hilly slopes, upon which the proposed units are located, is very varied, with some slopes facing slightly away from viewers along Highway 86 or completely blocked by closer hills. Between the variety in vegetative patterns, topography, foreground elements, and the spectacular rock ribs and avalanche chutes behind the middle hills, the project area has a high degree of visual absorption capability.

The NF land, higher and behind the foreground private land is at times obscured by foreground hills that are private land. In other places topography allows expansive views of the NF land from Highway 86. On NF land south of the ski area, past harvest activities have left a few still-discernible unnatural-appearing patterns, such as a few straight edges of old clearcuts that abut denser forest and sections of road on slopes that face viewers. These are visible from a few sections along or near Highway 86, from residences and other locations on the western slopes of the Bangtail Mountains, such as the Jackson Creek Road and of course to recreationists traveling through the project area on foot, mountain bike or horseback. To most viewers, these patterns are not visually dominant and the scenic integrity, when viewed from the Highway is still fairly high.

ENVIRONMENTAL CONSEQUENCES

For the purpose of analyzing the Action and No Action alternatives to determine compliance with the Forest Plan standard for visual quality, the critical observation platforms for this project are the Bridger Canyon Road and the ski area. Winter and summer views from the Bridger Canyon Road and from the ski area were considered in the analysis, with the winter view being the more critical, since that is when snow-free dark-colored trees create patterns that contrast more with the snow-covered ground.

No Action Alternative: Direct, Indirect and Cumulative Effects

The No Action Alternative would not cause any short term direct effects to the scenery. The scenery from the Bridger Canyon Road and from within Bridger Bowl Ski Area to which viewers have become accustomed, would remain unchanged in the short term. However, if insect infestations continue trending as they have been, and as they are predicted by forest pathologists (see the Silviculture section of this document for specific information) more of the mature trees and understory trees may die and drop their needles. To casual viewers along the Bridger Canyon Road, the visual effects would be minimally discernible, whereas homeowners along the road corridor who are intimately familiar with their views would most likely notice an opening up of the mosaic pattern and a grey tinge where entire stands of trees have died , and more white ground visible in the winter. The patterns, in terms of line, form, color and texture, would still appear natural. However, the effects to viewers within Bridger Bowl Ski Area might be more noticeable even within the next five years in and around Units 1 and 18. Tree stringers that currently define the edges of runs or that provide gladed skiing may eventually die and need to be removed so as to not pose a safety risk to skiers, especially on windy days. While this eventual openness would be a discernible change to skiers familiar with the runs that are especially defined by trees, the ski area would still remain natural appearing if the hazard tree removal work were done carefully.

Considering all known past, present and reasonably foreseeable activities which could cumulatively affect the scenery of the project area, timber harvesting is most relevant to this project. However, as stated in the “Affected Environment” section, those past harvests, while still discernible, do not visually dominate. In the short term and long term, the No Action Alternative would not change the current condition of the project area directly, indirectly or when considered along with other past, present or reasonably foreseeable future activities, and would meet the Forest Plan visual quality standard of Partial Retention. In addition to past, present and reasonably foreseeable harvesting activities on National Forest and private land, other known activities include authorized activities within the Bridger Bowl permit area; insect control activities; the Bridger Ridge communication site; road maintenance in the project area; noxious weed control activities; on-going grazing activities; and on-going recreation activities such as informal trails developed and used by hikers, horseback and mountain bike riders.

Proposed Action Alternative: Direct, Indirect and Cumulative Effects

The Action Alternative proposes thinning up to 250 acres of mature and over-mature trees to increase the overall health, productivity and resiliency of trees to reduce long term losses due to insects and diseases. This would mean that up to 50%-65% of the existing dead and live trees would be removed. After the project work is completed, approximately 50 to 150 trees per acre would remain (depending upon basal area/size of remaining trees), with approximately 15-20 feet between the crowns of those remaining trees.

The eventual longer term anticipated result is that there would be more diversity in the age, size and spacing of the trees, and the condition and health of the forests would be more sustainable. In the short term, the increased openness would be most noticeable by viewers within the south part of the ski area, especially by skiers or other recreationists very familiar with the area who pass by or alongside units #1 and 18, or look down and into units #2 and 3.

However, because the ski area and surrounding areas are a mosaic of open (both natural and regenerating after being harvested) and forested areas, this openness will not appear as a visually dominant anomaly. Also, the edges of some of the proposed units would abut land that is already more open and so visual character of the proposed units would appear somewhat similar.

Viewers along the Bridger Canyon Road would be able to discern parts of some of the proposed units, but those units would not be visually dominant. From each of the four representative viewpoints, the following units would be visible:

- From the junction with Stone Creek Road: parts of units #14,15 (just the eastern portion and it would only be partially visible, flattened and foreshortened) and 16;
- From the junction with Olson Creek Road: parts of units #12 (would be visible above the logging road and juxtaposed in front of and somewhat blending into the steep open slopes); parts of unit #13 (would be visible below the logging road, and the north end would blend into an existing adjacent open area); unit #17 (would appear very flattened and only very slightly visible);
- From the junction with Flaming Arrow Ranch Road: unit #2 (only the very eastern portion, but would be very flattened and only partially visible); unit #5 (just the southeast portion); unit #6 (would be very flattened and thus only partially visible); unit #7 (only part of the uphill portion would be visible); only very small parts of units # 12,13, and 16;
- From the junction with the Bridger Bowl Ski Area Road: units #5 and 6 (only portions would be visible and would appear somewhat flattened and partly blocked by trees in front of them).

The visual magnitude of the proposed units, as viewed from along the Bridger Canyon Road in the viewshed context, would be fairly low. The units would appear as more open roughly-textured areas on the hills (more discernible in winter with snow on the ground) juxtaposed directly with the much more visually dominant and eye-attracting steep open, rocky slopes and tree bands of Bridger Ridge behind them. The somewhat continuous band of trees that currently exists in parts of the project area would appear a bit more broken up, but still fairly natural-appearing.

The proposed road work would not be discernible to viewers along the Bridger Canyon Road or to skiers in the ski area.

Mitigation

The proposed activities associated with the Action Alternative would meet the Forest Plan visual quality standard of Partial Retention, when viewed from the Bridger Canyon Road or Bridger Bowl Ski Area, by incorporating the following mitigations:

1. Units #1 and #18 would be cut-tree marked because they would be in the immediate foreground of skiers.
2. In units #1, 2, 3 and 18, exact on-center leave tree spacing would be avoided. Instead, leave trees would be selected based upon their desirability and spacing distance from other leave trees, aiming for 15-20 feet between crowns. This method for selection of leave trees would create a more natural-looking appearance when viewed by skiers.
3. Along the northern and eastern edges of unit #1 and the eastern edge of unit #3, care would be taken to avoid abrupt, straight, unnatural-appearing transitions. This is important because these edges abut non-thinned forest and when viewed by skiers from above and in their foreground, would be very discernible due to the thinning.

As explained in the "Affected Environment" section, past harvests on Forest Service and on private land are currently discernible, but not dominant when viewed from the Bridger Canyon Road or from within the ski area. The effects on the scenery of the proposed units, when considered cumulatively with the effects of past harvests, as well as other past, present and reasonably foreseeable activities would not cause the viewshed to be out of compliance with the Forest Plan visual quality standard of Partial Retention. Those activities include authorized activities within the Bridge Bowl permit area, including the thinning currently being implemented; the Bridger Ridge communication site; road maintenance on administrative routes in the project area; noxious weed control activities; on-going grazing activities; and on-going recreation activities such as informal trails developed and used by hikers, horseback and mountain bike riders.

Summary / Conclusion

In summary, this analysis concludes that both the No Action Alternative and the Action Alternative along with the above-listed mitigations would meet the Forest Plan scenery standard of Partial Retention considering all past, current, and reasonably foreseeable activities within the project area.

HERITAGE RESOURCES

HERITAGE RESOURCE ISSUE

Project related ground disturbing activities have the potential to affect heritage sites in the project area.

ANALYSIS AREA

Spatial and Temporal Boundary

The spatial scale for Heritage analysis includes the template of the old road to be up-graded for log haul, and the areas of potential ground disturbance associated with the logging activity. The high potential areas were few since the project area is predominantly steep slopes.

The timeframe for project analysis consists of the length of time that ground disturbing activities would likely occur in the project area. For this project, it is estimated that construction and reclamation activities could occur for up to three years followed by mechanical treatment or burning of activity fuels.

METHODOLOGY

Prior to any field work being conducted, the Forest archaeologist researched the Heritage Site and Inventory data base to see if there had been previously inventories and if there are any documented sites located in the area. A predictive model of where sites are generally located in the regional local and the Site Inventory Strategy (SIS) were also utilized to determine past use in the project area or similar areas.

After completing the database search and reconstructing possible past use in the area and what could be expected to be found, “field work” was conducted by the Forest archaeologist. This included an intensive on the ground survey of the high potential areas.

AFFECTED ENVIRONMENT

Upon completion of the project review process, the Forest archaeologist discovered that one pre-historic site is located outside the project area and one mile from the north boundary of the project. This was an indication that there is potential for other pre-historic sites in the area. An intensive on the ground, survey was conducted in the summer of 2012 and 2013. No artifacts, features, or sites were discovered within the project boundary.

ENVIRONMENTAL CONSEQUENCES

Direct and Indirect Effects for (No Action) Alternative

No action would be initiated within the project area. Therefore, there would be no ground disturbance that could impact heritage resources. Since there were no resources found within the project area, there are no concerns with the No Action Alternative.

Cumulative Effects for (No Action) Alternative

There would be no cumulative effects for Heritage Resources since there were none identified during field survey.

Direct and Indirect Effects for (Proposed Action) Alternative

Based upon a review of the Heritage Site and Inventory data base and intensive on the ground surveys, no heritage sites were identified in the project area. Therefore, the Proposed Action, which includes timber harvest and temporary road construction, would not impact any heritage resources. Mitigation is in place to protect any sites that may be found during project implementation.

Cumulative Effects for (Proposed Action) Alternative

There would be no cumulative effects for Heritage Resources as none were identified in the project area.

REGULATORY FRAMEWORK & CONSISTENCY

The National Historic Preservation Act (NHPA) is the major law that guides actions for Heritage Resources. NHPA states that when a Federal Agency decides to conduct a project or designates funds toward a project, if the project is on federal lands or if the project needs a federal permit, then the agency is responsible to survey, identify, and evaluate any impacts that the project may have on heritage resources. Heritage resources may include historic trails, roads, cabins, mining sites, ditches, homestead sites or may include pre-contact Native American sites, such as pictograph sites, rock features, occupation sites, quarry sites, traditional cultural properties or sacred sites etc.

The heritage database was consulted and field surveys were conducted in the summer of 2013 for the project. Consultation was conducted with the Confederated Salish and Kootenai Tribes and the Crow Nation Elders committee. In 2012 and 2013 each tribe was given a GIS map with all Gallatin National Forest Projects identified on the map. Each project had the name of the project and the Forest Service number for the project. The Forest Archaeologist went over each project and explained what action was planned. We asked the tribes to contact us if there were cultural concerns for any of these projects. We were not contacted by the tribes with any cultural concerns.

The State Historic Preservation Office will be sent the Forest Negative Report for this project and all negative surveys for 2013 projects. Project related mitigation has been designed and will be incorporated into project implementation to ensure that the project complies with the NHPA.

The Gallatin National Forest Plan (1987) was also reviewed to ensure that all necessary policy directives associated with project related activities are in compliance. All project related activities would be conducted in accordance with these directives.

DESIGN/MITIGATION

If, in connection with operations under this decision, any historic or prehistoric resources are encountered, activities must cease in the vicinity of the find and the District Ranger and Forest Archeologist notified. Plans designed to avoid or reduce further disturbance or to mitigate existing disturbance will be formulated in consultation with the MT SHPO, affected tribes, and the Forest Service. The discovery must be protected until notified in writing to proceed by the authorized officer (36 CFR 800.100,112:43 CFR 10.4).

WILDLIFE

WILDLIFE ISSUES

The proposed vegetation treatment would alter habitat structure, which could affect habitat suitability for species of concern. Because wildlife species utilize a wide variety of habitat conditions, such changes may have negative results for some species, while others may benefit from proposed treatment. Logging operations and associated administrative activities would likely have some disturbance impacts to wildlife due to noise from equipment and increased human presence in the project area.

Species of concern for this project include Canada lynx (threatened species), wolverine (proposed for listing as a threatened species), gray wolf, bald eagle, peregrine falcon and black-backed woodpecker (Forest Service sensitive species), pine marten, northern goshawk and elk (Management Indicator Species), moose and mule deer (MA 11 focal species), and migratory birds (protected under the Migratory Bird Treaty Act). Grizzly bears (threatened), bighorn sheep, western big-eared bat, flammulated owl, trumpeter swan, and harlequin duck (sensitive species) are not of concern for this project, since they either do not occur in the Bridger Range, or the project area does not contain suitable habitat for these species, or both.

METHODOLOGY

Effects to wildlife species of concern were evaluated for potential impacts related to habitat alteration, as well as disturbance impacts that could alter behavior patterns and/or displace species of concern or their prey from the proposed treatment units and surrounding vicinity. Literature was reviewed to obtain the best available science pertinent to the wildlife species and habitat conditions that could be affected by the proposed action. Field surveys were conducted within and adjacent to proposed treatment units in order to assess species presence, and evaluate existing site-specific habitat conditions and resulting habitat suitability for species of concern. In addition to site-specific field data collected for project analyses, species occurrence data were obtained from a variety of sources to determine which species have been, are, or may be present in the project area and surrounding vicinity, as well as to evaluate implied habitat suitability, quality and relative use levels.

GIS technology was used to model landscape scale habitat potential for species of concern, and to quantify potential habitat changes that could result from implementation of the proposed action. Many of the habitat models used for this analysis resulted from a recent collaborative process wherein The Eastside Forests (Lewis & Clark, Helena, Gallatin, and Custer National Forests in Montana) in concert with the Northern Regional Office developed a broad-scale assessment (hereafter called Eastside Assessment) to: (1) evaluate the existing habitat conditions for key species that includes updating and refining existing wildlife habitat relationships based on current data, corporate datasets, and habitat conditions specific to the Eastside Forests; (2) evaluate the impacts to key species' existing habitat due to the current mountain pine beetle epidemic and current fire probability; and (3) produce an estimate of suitable habitat for key species in the near future using a model that estimates the effects of disturbance across large landscapes. The key species are elk, northern goshawk, black-backed woodpeckers, and lynx.

Spatial Bounds

The term "project area" refers to the immediate vicinity that contains and surrounds proposed treatment units. This area encompasses approximately 1,850 acres including parts or all of Sections 30 and 36, T1N, R7E and Section 6, T1S, R7E (see Project Map). Unless stated otherwise for particular species or groups of species, the project area is the spatial boundary used for direct and indirect effects analyses. Many of the wildlife species of concern identified for this project are wide-ranging and capable of long-distance movements. The geographic area used by wildlife to meet life cycle needs varies by species and by individuals within species, but unless indicated otherwise in the analyses that follow, the spatial boundary used for cumulative effects assessment includes the entire Bridger Mountain Range, plus the smaller Bangtail Range to the east. This area provides the largest fairly contiguous block (separated by MT Hwy 86) of mountainous forest habitat in the project vicinity. It was selected because it includes the project area, plus surrounding habitat that could reasonably be accessed by most species of concern, without requiring extensive travel across private, agricultural, rural and/or highly developed areas. This cumulative effects analysis area is roughly 150,846 acres in size, and therefore provides adequate space to encompass the home range size of wide-ranging species of concern identified for this project.

Temporal bounds

Temporal bounds are established to facilitate evaluation of direct, indirect and cumulative effects of the proposed action and alternatives considered over time. Because life expectancy varies between species, and wild animals have a wide variety of life cycle components and related habitat needs, temporal bounds can vary considerably between species assessments. Effects assessments take into account the ongoing effects of past activities, which are often presented through discussion of the affected environment as reflected by existing conditions; e.g. forest structural stages, rural development, road densities, etc. Length of time considered for past activities can vary by species, but is longest in those species for which mature forest is an important habitat component. In this geographic area it takes about 70+ years to produce mature forest structure after a major disturbance. Seventy years past also represents a time period when land management actions were beginning to have a notable impact on the landscape in the project area and surrounding vicinity, as well as a timeframe for which we have reasonable data related to forest vegetation conditions.

Project-related activities are scheduled to begin in 2014 and would likely take three to five years to accomplish. Major activities; e.g. road construction/reconstruction, timber felling and tree hauling, are expected to take two to three years. In addition to the timeframe in which project implementation occurs, the analysis considers future effects of the proposed action; i.e. how long the effects of the action alternative will last. These temporal aspects are used to determine what, if any, reasonably foreseeable future activities might overlap with the effects of the proposed action in the relevant analysis area, causing cumulative effects to the species in question. Effects of the proposed action on wildlife habitat would last beyond project implementation, and again could vary by species depending on life history and habitat needs. In general, effects of the proposed action are estimated to last between 15 and 100+ years beyond project completion, with 15 years representing the time it would take forest vegetation to regenerate to a point where it provides some degree of screening cover for most wildlife species, and over a hundred years to provide the mature to over-mature forest structure favored by some species. While it is recognized that effects to wildlife habitat may last for decades after project completion, we rarely have good information regarding reasonably foreseeable future activities beyond 10-15 years out. Activities that were considered for wildlife cumulative effects analyses are identified on cumulative effects checklist forms maintained in the project file.

THREATENED SPECIES

GRIZZLY BEAR

There have been no verified sightings or other documented detections (e.g. tracks, DNA samples, photos with landmarks) of grizzly bears in the Bridger Mountain Range for several decades, and the US Fish and Wildlife Service (FWS) does not indicate that grizzly bears may be present north of Interstate 90 on the Gallatin National Forest. The proposed action is in an area that may prove suitable as a travel corridor for grizzly bears sometime in the future. Implementation of the project is not expected to result in any impediments or barriers to grizzly bear movement. Therefore, the proposed action would have ***no effect*** on grizzly bears.

CANADA LYNX

Canada lynx is the only species currently listed as threatened under the Endangered Species Act that the FWS has determined may be present in the Bridger Mountain Range where the project is located. The FWS considers lynx use north of Interstate 90 to be transient in nature (USDI 2013).

Affected Environment

Lynx inhabit moist coniferous forests that experience cold, snowy winters and provide a prey base of snowshoe hares. In the winter, lynx preferentially use mature forests with multistoried structure, dominated by subalpine fir and spruce in the mid- and over-story. These preferred winter use areas contain larger-diameter trees, higher horizontal cover, deeper snow, and more abundant snowshoe hares compared to habitat available at random. In the summer, lynx broaden their habitat selection to include younger forests, but still select for high horizontal cover including shrubs, small-diameter trees and dense saplings, particularly spruce and fir saplings.

The project is located in the Bridger Mountain Range north of Bozeman, MT. Along with the smaller Bangtail Range just to the east, the Bridger/Bangtail area presents a relatively small, isolated mountainous environment surrounded by agricultural and rural development. The Bridger Range and the Bangtail Range were combined to form a lynx analysis unit (LAU), for assessment of direct, indirect and cumulative effects for this project. The Bridger/Bangtail LAU is roughly 150,846 acres in total size, with about 89,138 acres of NFS lands. Boreal forest types preferred by lynx and snowshoe hares occur at lower proportions, with patchier distribution in this LAU compared to other geographic areas on the Gallatin Forest. The entire LAU contains a total of about 39,628 acres of lynx habitat, of which 27,766 occurs on NFS lands.

The lynx recovery plan categorizes lynx habitat as core areas, secondary areas and peripheral areas. The Bridger/Bangtail LAU has been identified as secondary habitat for lynx. Secondary areas are those that may have historical records of lynx, but no documentation of lynx reproduction (USDA 2007:4). There are no verified historical records of Canada lynx in the Bridger Mountain Range (McKelvey et al. 2000:224, map), and there are no verified occurrences of more recent lynx presence in the Bridger/Bangtail LAU in databases maintained by Montana Fish, Wildlife and Parks (FWP) or the Montana Natural Heritage Program (MNHP) (pers. comm. B. Giddings, S. Blum 2013). Forest Service sponsored surveys using snow-tracking, hair-snagging and remote camera stations, have been conducted in the Bridger Range over multiple years since the lynx was listed as threatened in 2000; no lynx detections have resulted from these surveys.

Given the lack of evidence for regular use by lynx, and no recent or historic documentation of lynx reproduction in the area, the Bridger/Bangtail LAU is considered secondary, unoccupied lynx habitat (USDA 2007:Figure 1-1). Although the FWS acknowledges that lynx may be present in the Bridger Mountain Range due to transitory movement (USDI 2013), lynx habitat is considered unoccupied unless: 1) there are at least two verified lynx observations or records since 1999– not including transient individuals, or 2) there is evidence of lynx reproduction (USDA 2007:3). Although the LAU does not likely have sufficient lynx habitat to support resident lynx, or provide habitat suitable for successful rearing of lynx kittens, it does provide a potential travel corridor for lynx to move through when dispersing between core areas; i.e. linkage habitat.

Lynx habitat in the Bridger/Bangtail LAU contains a broad spectrum of structural conditions ranging from stand-initiation stage where trees have not yet grown tall enough to protrude above the snow during winter (i.e. currently in an unsuitable condition for lynx and snowshoe hare); early succession seedling sapling stage that provide snowshoe hare habitat where trees are dense enough to produce high horizontal cover; mid-succession stem exclusion structural stage that typically does not provide snowshoe hare habitat due to lack of horizontal cover, but does provide lynx with cover suitable for resting and travel; and mature to old-growth forest that provides suitable cover for resting and travel, often produces abundant coarse woody material associated with suitable denning habitat, and in multi-storied stands, can provide snowshoe hare habitat where understory regeneration is dense enough to produce high horizontal cover. Due to natural succession and disturbance processes (e.g. aging forests, fire, wind, insects and disease), the large, down woody debris component that provides cover and potential denning habitat for lynx is not limited in this LAU.

As noted above, lynx habitat is patchily distributed with only 26% (39,628 out of 150,846 acres) meeting the criteria for boreal forest conditions. The remainder of the LAU is made up of warmer, drier, montane forest types, non-forest vegetation and rocky areas devoid of vegetation. Of the approximately 250 acres of proposed treatment, about 119 acres fall in mapped lynx habitat (boreal forest); the remainder are located on warmer, drier or harsher sites that do not meet the criteria for lynx habitat.

The proposed treatment is located on the lower slopes of the east side of the Bridger Range. Moist, coniferous habitat types are present within the project area, which is generally between about 6,000 – 7,000 feet elevation. Dominant forest cover types include Douglas fir and lodgepole pine, with lesser amounts of spruce and subalpine fir. Douglas fir stands are experiencing epidemic levels of mortality from Douglas fir beetle and western spruce budworm, whereas mountain pine beetle has killed about half of the lodgepole pine in mixed stands. Without treatment, there is a high probability that many more trees will be severely impacted by insect infestation. The project area has been influenced by human development with Bridger Bowl ski area to the north and west, private land development (residential housing) to the north, south and east, and Montana Highway 86 just east of the project area.

Using a canvas ‘cover board’ as described by Squires and others (2010:1652), all proposed treatment units were measured for horizontal cover to assess potential for snowshoe hare habitat in August 2013. Although there are multi-storied stands present in the project area, none of the proposed treatment units currently provide adequate horizontal cover to function as high quality winter snowshoe hare habitat. A winter snow tracking survey conducted in March 2013 revealed that snowshoe hares were present, though not common, within the project area, but snowshoe hare tracks were not found in proposed treatment units. Snowshoe hares occur at low density in the Bridger Range compared with higher quality lynx and snowshoe hare habitat found south of I-90 on the Gallatin Forest. Red squirrels, which can be an important alternate prey species for lynx, were common within and between proposed treatment units.

Applicable Direction

As a federally listed species, the Canada lynx is subject to the rules and regulations of the Endangered Species Act, including the requirement for consultation on projects that may affect lynx or designated critical habitat. The FWS published a Final Rule with a revised designation of critical habitat for Canada lynx (USDI 2009). The Bridger/Bangtail LAU (and hence, the proposed action) is not within designated critical habitat unit for lynx.

The Canada Lynx Conservation Assessment and Strategy (LCAS – Ruediger et al. 2000) established early conservation measures for lynx. In 2007, the Northern Rockies Lynx Management Direction (NRLMD) FEIS (USDA 2007) was published, which both drew and expanded upon the guidance found in the LCAS. Publication of the NRLMD Record of Decision (ROD) amended the Gallatin Forest Plan (Amendment No. 46) to formally incorporate management direction for the conservation of lynx. Where there is overlap between the LCAS and the NRLMD, the NRLMD provides agency direction, whereas the LCAS may provide additional references and relevant science. Lynx management direction applies to National Forest System lands that are known to be **occupied** by Canada lynx. Isolated mountain ranges (including the Bridger/Bangtail LAU) on the Gallatin Forest are **unoccupied.** Until such time as these areas become occupied, they should consider lynx management direction, but are not required to follow it (USDA 2007 – ROD, Attachment 1, p. 1). The Gallatin Forest Plan (USDA 1987) contains a Forest-wide standard that a biological evaluation will be completed prior to implementation of activities that have potential to affect threatened species. The NRLMD contains the only management direction specific to lynx in the Gallatin Forest Plan (A46).

The SBI project is a forest health treatment project and not designed as a fuels reduction project, although it is located in a wildland urban interface (WUI) identified in the Gallatin County Community Wildfire Protection Plan. NRLMD requirements that were considered for the South Bridger Interface project focused on issues related to habitat connectivity, coniferous forest regeneration through vegetation management, effects to foraging habitat – particularly snowshoe hare habitat but considering other prey species as well, availability of denning habitat, and management of project roads. Specific standards and guidelines considered from the NRLMD are listed in the *Consistency* section below.

Direct and Indirect Effects

No Action Alternative

Under the No Action alternative, the project would not be implemented. Areas within Bridger Bowl Ski Area special use permit boundary would continue to be managed under the ski area Master Development Plan, which could involve commercial timber harvest in some cases. Personal use firewood gathering could continue as allowed under the Forest Plan, but with limited public vehicle access, firewood gathering is not expected to occur at high levels, even though there is ample dead standing wood available. Therefore, under this alternative, there would be only minor changes in forest structure in proposed treatment units due to human activities. However, insects have already had a very notable effect on the project area, and would be expected to continue at high levels in most cases if left untreated (see vegetation analysis for more detailed discussion of insect and disease mortality under the No Action alternative).

Indirect effects of no action would result in increased tree mortality over time. Without removal through logging, dead trees will eventually fall, resulting in a greater abundance of coarse woody material that could eventually provide denning structure for lynx. However, with the overall patchy distribution of boreal forest conditions throughout the LAU, it does not seem likely that the area would support residential use by lynx, and therefore reproductive habitat is not a limiting factor. If left untreated,

continued insect related tree mortality would continue to produce high fuel loads that if ignited, could result in stand-replacing burns that would more drastically affect habitat suitability for lynx and snowshoe hare than would the proposed treatment. However, insect mortality followed by stand-replacing fire is a natural ecological process in this ecosystem, and one to which lynx and their prey species have adapted over time. Short-term impacts of no action could result in large areas of habitat that would be unsuitable for use by lynx and their prey species for 15 to 30 years.

Proposed Action Alternative

The proposed action is located in secondary, unoccupied habitat, where lynx presence is not expected, but if it does occur, would most likely be transient in nature. About half of the proposed treatment units contain the cool, moist (i.e. boreal forest) conditions that produce lynx habitat, while some units contain warmer, drier types not favored by lynx or snowshoe hares. None of the proposed treatment would affect snowshoe hare habitat. Effects to lynx could result from habitat alteration and/or disturbance. Habitat impacts would be due to reductions in cover, but limited to the approximately 250 acres of treatment proposed. Treatment prescriptions would leave live trees and shrubs, dead standing trees (snags) and coarse woody debris on the ground, all of which would continue to provide some degree of screening cover to facilitate lynx movement through treated stands.

Approximately 2,500 feet (total) of temporary project road would be needed to provide access to proposed treatment units. Construction of project roads could have temporary impacts on lynx habitat by removing cover. The temporary road accessing treatment unit 3 (approx. 1,500 feet total length) would be located in lynx habitat, but roughly half (~ 800 ft) would be through early stand initiation stage habitat that is currently providing minimal (or no) cover, and the other half (~700 ft.) would be in the proposed treatment unit. Therefore, construction of this segment of temp road would have minimal impacts on lynx habitat beyond that which would occur with proposed treatment. Habitat impacts from project roads would be temporary; i.e. cover is expected to regenerate naturally on the road surface once the road is closed after project completion. The project road accessing treatment unit 16 would be located in non-lynx habitat; i.e. dry, open forest and meadow, so it would not affect lynx habitat per se, but could result in removal of a very small number of trees (since it is planned in relatively open habitat to begin with). Construction of this temporary project road would not impact lynx habitat, and would have negligible impacts on cover between patches of lynx habitat.

Public motorized use would not be allowed on temporary roads built specifically for this project. Administrative use of project roads could create disturbance factors that may affect lynx traveling through the project area. However, available information suggests lynx do not avoid roads, except at high traffic volumes (USDA 2007:95). Roads may create access routes that facilitate human use during winter, and snow compaction on roads is thought to give competing carnivores winter access into lynx habitat (Ibid). Temporary project roads may be used by skiers or other non-motorized recreation during winter, but the area is not open for snowmobile use by the public, so mechanical compaction on temporary project roads is unlikely. Winter logging is not likely to occur since the main access road (FSR #538) would not be plowed during Bridger Bowl's operating period (typically November – April). The project area already has high levels of road and trail access. Temporary project roads would result in a very minor increase in road access relative to existing conditions.

Proposed treatment would reduce cover availability for lynx, and reduce both food and cover for lynx prey species. Such habitat alteration would occur as a result of tree harvest, as well as mechanical operations that create skid trails and damage understory vegetation. However, since prescribed treatment does not include regeneration harvest methods or broadcast burning, the post treatment stands would not be considered unsuitable for lynx to travel through. Proposed treatment units are relatively small, and although some are connected, there would still be some cover left within treatment units and existing

cover would still be available between treatment units. Much of the vegetative structure (e.g. boles and lower branches of larger trees, small trees, shrubs, tall grasses and forbs) that provides food and horizontal cover for snowshoe hares would be removed in treatment units, potentially reducing the availability of this important prey species within treated areas. Removal of large trees could also affect the habitat of red squirrels, an important alternate prey species, within treated areas. However, ongoing insect activity is already affecting red squirrel habitat, and this would continue without treatment. Finally, snowshoe hares and red squirrels could still find and occupy suitable habitat in untreated areas within (streamside management zones would not be treated), between and surrounding treated areas.

Over time, vegetation in treated areas would regenerate. It is estimated to take 15 to 30 years following forest treatment for regenerating trees and shrubs to reach heights sufficient to extend above winter snow depths where they may again be used by snowshoe hares (Ruediger et al. 2000:2-3). It would take much longer for treated stands to again achieve the mature, closed canopy forest structure preferred by red squirrels. While mechanical treatment may speed up this process slightly through ground scarification, we would expect similar regeneration from canopy breaks created by natural tree mortality due to insect infestations.

Habitat alteration resulting from the proposed action could affect habitat connectivity in the LAU. Removing vegetative cover reduces the suitability of the project area for lynx movement. As noted previously, lynx habitat is naturally more fragmented and patchily distributed in the Bridger/Bangtail LAU due to the higher proportions of drier, more open montane forest types and naturally non-forested vegetation types in these mountain ranges. However, dispersing lynx will travel through drier, more open areas to reach suitable habitat. Reducing the amount of security cover in the proposed treatment units would affect, but would not preclude, the ability of lynx to travel through the area. Overall habitat connectivity would be retained within the project area and would not be affected by the proposed action in the vast majority of the LAU.

Since the proposed treatment involves thinning rather than regeneration harvest, treated areas would continue to provide some screening cover for lynx. Therefore, the proposed action would not change the category of lynx habitat within proposed treatment units or change the proportions of lynx habitat components within the LAU from the existing condition. Indirect effects of the proposed action are expected to result in improved overall forest health and a subsequent reduction in fuel build-up. Through pre-emptive treatment designed to reduce tree mortality impacts from insects, the proposed action could extend the period of utility within proposed treatment units to provide travel and resting sites for dispersing lynx.

The proposed action could also affect lynx through disturbance impacts resulting from noise associated with equipment and increased human presence in the project area. Lynx behavioral responses to human activities are poorly understood. Some research has described lynx as being generally tolerant of humans, and anecdotal observations also suggest that lynx are not easily displaced by human activity (Ruediger et al. 2000:1-13). High levels of noise and human presence associated with project implementation could cause a lynx traveling through the project area to alter its course, but there are alternate travel routes available in the project vicinity. Given the isolated nature of the Bridger Mountain Range, a lynx would have to travel through far more disruptive conditions (e.g. cross inter-state and state highways; through residential, commercial, recreational and agricultural areas, etc.) to even reach the Bridger Range. An animal that could persevere through the human development in areas surrounding the Bridger Range would likely demonstrate an equally high tolerance for the level of human activity associated with the proposed action.

Cumulative Effects

No Action Alternative

Cumulative effects to lynx habitat within the Bridger/Bangtail LAU have occurred due to natural and managed processes, which have shaped the environment over time to produce the existing condition described above in the affected environment section. Under the no action alternative, the anticipated effect on lynx habitat would be continued tree mortality due to unchecked insect activity. Over time, dead trees would contribute coarse woody debris, which is an important component of lynx denning habitat. No action would reduce foraging habitat and security cover by facilitating continued defoliation and mortality of live trees. This alternative would also continue to contribute to heavy fuel buildup, which would eventually promote wildfire spread if an ignition occurs within or near the project area. Stand-replacing burns result in early stand-initiation stage vegetation, which does not provide foraging habitat or screening cover for travel or resting for a period of approximately 15-30 years. However, insects, disease and wild fire are all natural ecological processes to which lynx and their prey species have adapted over time.

Proposed Action

Cumulative effects to lynx habitat within the Bridger/Bangtail LAU have occurred over time due to land management actions such as timber harvest, prescribed burning, wild fire suppression, livestock grazing, recreational and residential development and associated roading, as well as natural ecological processes such as wild fire, wind events, avalanches, floods, insects, disease, and natural forest succession. These natural and managed processes have shaped the environment over time to produce the existing condition described above in the affected environment section. Ongoing activities affecting lynx habitat include continued management and use within the Bridger Bowl Ski Area boundary as dictated by Special Use Permit, livestock grazing on public and private lands, ongoing recreational uses including motorized and non-motorized transportation, and ongoing human uses in developed residential areas. Most of these ongoing activities are expected to continue at current or slightly increased levels into the foreseeable future. Future proposals being considered on federal lands include a trail re-location project in the North Cottonwood Creek area (west Bridgers) and a fish habitat enhancement project in the 16-mile area (north Bridgers), both of which would have very minor impacts on lynx habitat. Activities that are reasonably expected to occur on private land include additional residential development, timber harvest (including corporate timber lands in the Bangtail Range), and vegetation management for fuel reduction purposes around residences.

Summary/Conclusion

Given the naturally fragmented distribution of boreal forest types within the Bridger/Bangtail LAU, coupled with the lack of verified historic or recent lynx occurrence within the LAU, it is a logical conclusion that the Bridger/Bangtail area contains marginal lynx habitat at best, and past events (natural or man-caused) have not likely changed the overall nature of this area for lynx use. The primary utility of this LAU appears to be as connective habitat to facilitate lynx dispersal between core areas. The proposed action would have minor impacts on lynx habitat, but would not notably change the utility of the area for connectivity.

Consistency with Applicable Direction

The project is consistent with all applicable direction. The proposed action will go through a consultation process with the US Fish and Wildlife Service. This specialist report meets the Forest Plan requirement

for a biological evaluation. The project complies with Forest Plan Amendment No. 46 by considering lynx management direction in the NRLMD as follows:

Standard ALL S1: Vegetation management projects must maintain habitat connectivity in an LAU and/or linkage area.

While habitat quality would be reduced in the short term due to project implementation, it would not be to a degree that would preclude lynx dispersal movement. Overall habitat connectivity would be retained within the project area and would not be affected by the proposed action in the vast majority of the LAU.

Standard VEG S1: If more than 30 percent of the lynx habitat in an LAU is currently in a stand initiation structural stage that does not yet provide winter snowshoe hare habitat, no additional habitat may be regenerated by vegetation management projects.

Currently, only 9% of the lynx habitat in the LAU is in the early stand initiation structural stage. The proposed action does not include any regeneration harvest methods.

Standard VEG S2: Timber management projects shall not regenerate more than 15% of lynx habitat on NFS lands within an LAU in a ten-year period.

See response to Standard VEG S1.

Standard VEG S5: Precommercial thinning projects may occur from the stand initiation structural stage until the stands no longer provide winter snowshoe hare habitat only for exceptions listed in the NRLMD.

No precommercial thinning is proposed.

Standard VEG S6: Vegetation management projects that reduce snowshoe hare habitat in multi-story mature or late successional forests may occur only: within 200 feet of admin sites (including infrastructure within permitted ski area boundaries), for research studies, or for incidental removal during salvage harvest.

The proposed action would not reduce snowshoe hare habitat. Although there are multi-storied stands present in the project area, none of the proposed treatment units currently provide adequate horizontal cover to function as winter snowshoe hare habitat.

Guideline VEG G1: Vegetation management projects should be planned to recruit a high density of conifers, hardwoods, and shrubs where such habitat is scarce or not available.

Over time, vegetation in treated areas would regenerate. Opening the forest canopy allows more light to penetrate to the ground, which stimulates regeneration of conifer, shrub, forb and grass species that eventually provide cover and food for lynx and prey species.

Guideline VEG G5: Habitat for alternate prey species, primarily red squirrel, should be provided in each LAU.

Removal of large trees could affect the habitat of red squirrels within treated areas. However, ongoing insect activity is already affecting squirrel habitat, and this would continue without treatment. Red squirrels could still find and occupy suitable habitat in untreated areas within treatment units (streamside management zones would not be treated), as well as between and surrounding treated areas. Red squirrel habitat is readily available in this LAU.

Guideline VEG G11: Denning habitat should be distributed in each LAU in the form of pockets of large amounts of large woody debris. If denning habitat appears to be lacking in the LAU, then projects should be designed to retain some coarse woody debris.

Due to natural succession and disturbance processes (e.g. aging forests, fire, wind, insects and disease), the large, down woody debris component that provides cover and potential denning habitat for lynx is not limited in this LAU.

Guideline HU G9: On new roads built for projects, public motorized use should be restricted. Effective closures should be provided in road designs. When the project is over, these roads should be reclaimed or decommissioned, if not needed for other management objectives.

Per the Gallatin Forest Travel Management Plan (USDA 2007), roads constructed for project activity are to be designed with minimum standards necessary to accomplish the task, temporary in nature, and effectively gated to restrict public motorized use. Once the activity is complete, project roads are to be permanently and effectively closed and re-vegetated.

SPECIES PROPOSED FOR FEDERAL LISTING

WOLVERINE

In February 2013, the wolverine was proposed for listing as a threatened species under the Endangered Species Act (ESA). Wolverines have demonstrated a sporadic presence in the Bridger Mountain Range over time. They have been detected in winter surveys and harvested by fur trappers in the Bridger Range in recent years; however, their presence has not been documented within the project area.

Affected Environment

Wolverine use high elevation, alpine habitats (Copeland and Whitman 2003:676). In a study that includes parts of the Gallatin Forest, Inman and others (2003:29) reported wolverine use ranging from 4,900 to 10,800 feet in winter and 6,900 to 11,800 feet in summer and fall. This study concluded that wolverines use higher elevations (>6,900 feet), steeper slopes (>16°) and northerly aspects disproportionately to their availability. In later work (Ibid 2008:2) these authors noted that because wolverines utilize high-elevation, alpine habitats that exist in island-like distribution, they persist in small, local populations (demes) and require successful dispersal between island habitats to maintain a viable metapopulation. This information led to a concept that identified a "Central Linkage Ecosystem" (CLE) composed of smaller, isolated patches of primary wolverine habitat (i.e. high-elevation alpine and subalpine areas) located between the core (or regional) population centers found in the Yellowstone, Northern Continental Divide, Bitterroot and Salmon Ecosystems of Montana, Idaho and Wyoming. The CLE is noted for its ecological importance in that it contains substantial primary wolverine habitat in public ownership, supports reproductive female wolverines and facilitates dispersal among the core population centers (Ibid:4-5). The Bridger Range is within this CLE for wolverines.

Areas occupied by wolverines have a common theme of remoteness from humans and human development (Banci 1994:100), suggesting that wolverines are sensitive to human disturbance. However, human presence is not always a deterrent to wolverine use, as evidenced by wolverines feeding in garbage dumps, their presence in logged areas (Ibid:101), their notoriety for robbing trap lines, wilderness caches and cabins (Copeland and Whitman, 2003:680), and their ability to cross through human developments and high human use areas during long-range movements (Hash 1987). Rowland and others (2003) found

an inverse correlation between road densities and wolverine occurrence, and concluded that road densities provide a reasonable proxy for human disturbance relative to wolverine occurrence on the landscape. However, these authors did not explain how "road densities" were calculated for the models they examined. "Road densities" may include various combinations of public roads, administrative roads, and private roads. For the Interior Columbia River Basin, Rowland and associates (2003) found wolverine occurrences to be distinguishable at road densities greater than 0.44 km/km^2 (> 0.7 mi/mi^2) while Carroll and others (2001) found that predicted wolverine occurrences in the Rocky Mountain Region declined when road densities exceeded 1.7 km/km^2 (> 2.7 mi/mi^2).

Including all roads open to the public, administrative, and private use combined, average road density for the Bridger/Bangtail area is1.6 mi/mi^2. However, counting only those roads open to motorized use by the general public, average road density declines to only 0.3 mi/mi^2 for the analysis area. In addition to road access, motorized use occurs on trails, which could also disturb wolverines. When motorized trails are added, total motorized access route density for the Bridger/Bangtail area averages approximately 2.0 mi/mi^2 – including all known motorized use on roads and trails of all land ownerships. Generally speaking, motorized access route densities are highest in the Bridger Canyon area, (which includes the proposed treatment units) and the Bangtail Range. All proposed treatment units and associated access roads would be in areas that currently have at least 1 mi/mi^2 total motorized access route density, with the majority in areas with 2 mi/mi^2 or greater. Moderate access route densities occur on the east side of the Bridger Range north of the project, with lower densities on the west side of the Bridgers. The Bridger/Bangtail area contains relatively high motorized access route densities compared with other areas on the Gallatin Forest. While this is partly due to a higher proportion of private land and associated private roads, it also reflects a degree of travel management emphasis on motorized use, particularly in the Bangtail Range. Yet even with the relatively high levels of motorized access, wolverines still persist in the Bridger/Bangtail area. Perhaps this is because most of the motorized access routes (roads and trails) are generally located at lower elevations rather than in the alpine and subalpine areas favored by wolverines.

Wolverine reproductive habitat is associated with areas of deep snow accumulation that persist into spring, with den sites located several feet under an insulating layer of snow that include an extensive system of subnivean tunnels (Copeland and Whitman 2003:675-676). The Bridger Mountain Range provides suitable wolverine reproductive habitat at higher elevations (7,500+ feet). The Bangtail Range has very limited habitat that provides optimal conditions for reproductive den sites.

Wolverines are considered habitat generalists in the summer, using a foraging strategy typical of opportunistic omnivores (Banci 1994:113). Wolverines remain active year-round, and in winter adapt their foraging strategy to that of a scavenger. Winter food sources may be be somewhat dictated by the distribution of big game species (Hash 1987), with winter-killed carcasses of elk, moose and deer as the primary food item consumed in winter. Newborn ungulates (elk, deer and mountain goat) were present in late spring and early summer diet. Marmots were well-represented in the spring diet and the most common food item in summer. Other small mammals and birds (e.g. pika, snowshoe hare and grouse) apparently supplement the diet throughout the year.

The SBI project area is primarily between 6,000 – 7,000 feet, with most proposed treatment units at or below the lower elevation cutoff for summer-fall wolverine use. The project site contains security cover that would facilitate wolverine movement, and likely provides a suitable travel corridor for wolverine dispersal. While the project area typically receives substantial snow in winter and can hold snow into the spring months, it is not considered high quality reproductive denning habitat due to temperature fluctuations that result in freeze-thaw events that affect the snow's insulating qualities needed for thermoregulation and adequate protection of wolverine kits. Suitable reproductive denning habitat is available at higher elevations in the Bridger Range. The project area does not contain large, open talus

slopes that are the preferred habitat for the wolverine's primary summer prey species, the marmot, and is below the elevation level typically occupied by pikas. The project area does not provide high quality winter range for elk or mule deer (FWP distribution maps), although a few individual mule deer may be present in winter (J. Cunningham, pers. comm. 2013). The area does provide winter range for moose (FWP maps), but only a few individuals would be expected within this relatively small area. Overall, the project area contains a range of vegetation and structural characteristics that provide a variety of habitats with an assortment of potential food sources that could be used by an opportunistic omnivore such as the wolverine.

The project area receives moderate levels of recreation use, mostly hiking, biking and horse-back riding on system roads and trails in the summer months, with a slight increase in use during the fall hunting season. Public use in the project area is limited to non-motorized forms of recreation, but administrative use occurs on roads and trails by Forest Service personnel and Bridger Bowl Ski Area employees. Within the ski area permit boundary, routine maintenance and administration occurs year-round. This activity has increased over the past ten years as Bridger Bowl has been implementing their Master Development Plan. In winter, the portion of the project area inside the ski area permit boundary receives high use on a daily basis, including recreational skiing and administration during the day, as well as ski area maintenance (e.g. grooming, avalanche control) during the night and early morning hours. Public use in the remainder of the project area is relatively low in winter; basically limited to just a few cross-country skiers.

Applicable Direction

The wolverine was identified as a Forest Service sensitive species on the Gallatin Forest in recent years; however, once a species is proposed for listing or listed, it is no longer considered a Forest Service sensitive species. On February 4, 2013 the USFWS published a proposed rule to list the wolverine in the contiguous US as a threatened species under the ESA. There is no proposed critical habitat for wolverine at this time. With the proposed listing, the Forest Service must now determine whether any action carried out or authorized by the agency requires conferencing with the USFWS. Consultation with the USFWS is not required for a species proposed for listing, and conferencing with the USFWS is not required for anything less than a "*likely to jeopardize*" determination. The proposed rule to list the wolverine contains "Special rules" (p. 7890) for management of wolverine, including the following:

- *"Any activity where wolverines are attempted to be, or are intended to be, trapped, hunted, shot, captured, or collected… will be prohibited."*
- *"Incidental take of wolverines will not be a violation of section 9 of the Act, if it occurs from any otherwise legal activities involving wolverines and their habitat that are conducted in accordance with applicable State, Federal, tribal and local laws and regulations. Such activities occurring in wolverine habitat include:"*
    - *Management activities by Federal agencies such as timber harvest*

Direct and Indirect Effects

No Action Alternative

Under the No Action alternative, the project would not be implemented. Bridger Bowl Ski Area would continue to be managed under the ski area Master Development Plan, which could involve commercial timber harvest in some cases. Personal use firewood gathering could continue as allowed under the Forest Plan, but with limited public vehicle access, firewood gathering is not expected to occur at high

levels, even though there is ample dead standing wood available. Therefore, under this alternative, there would be only minor changes in forest structure in proposed treatment units due to human activities. However, insects have already had a very notable effect on the project area, and this would be expected to continue at high levels in most cases if left untreated.

Indirect effects of no action would result in increased tree mortality over time. Without removal through logging, many dead trees will eventually fall, resulting in a greater abundance of coarse woody material (standing snags and downfall) that would still provide some degree of screening cover for wolverines. If left untreated, insect-related tree mortality would continue, adding to already high fuel loads, that if ignited, could result in large-scale stand replacement fire that could have a much greater impact on security cover for wolverines than would the proposed treatment. However, insect mortality followed by stand-replacing fire is a natural ecological process in this ecosystem, and one to which wolverines and their prey species have adapted over time. Indirect effects of no action could result in large areas of habitat with limited security cover for dispersing wolverine. Once insects and disease have run their course, or if a fire results from fuel buildup associated with high levels of tree mortality, it would take approximately 15 years for natural regeneration to replenish vegetative structure that would once again provide high quality security cover for wolverines.

Proposed Action Alternative

The proposed action has the potential to affect wolverines directly or indirectly through habitat alteration and/or disturbance impacts. Habitat alterations would impact wolverines by removing vegetation that would otherwise provide security cover for wolverine movement through the project area. Some cover would remain within treated units, and vegetation between and surrounding treatment units would continue to provide cover for wolverines as well. Habitat alteration resulting from project implementation would not create a barrier to wolverine movement.

Habitat modification associated with proposed treatment could also affect food availability in the project area. Proposed treatment is expected to alter the types of spring/summer/fall food items available for wolverines, but is not expected to reduce the overall variety of food sources. While forest thinning would reduce habitat quality for prey species associated with mature, dense forest (e.g. red squirrel, spruce grouse), it would improve habitat suitability for other potential prey species (e.g. ruffed and dusky grouse, and eventually snowshoe hare) that select for more open, and/or early succession forest structure. Opening the forest canopy would stimulate growth of vegetative food items such as berries and forbs, and increase forage availability for big game species that could serve as prey or carrion.

Riparian areas preferred by moose would not be treated. While reducing the forest canopy through timber harvest would decrease habitat suitability for wintering moose, continued insect mortality (naturally occurring) would have a similar effect. The only big game tracks noted within or near proposed treatment units during a snow track survey conducted in March 2013 was a single set of deer tracks. Given the limited utility of the project area as big game winter range, habitat alterations resulting from project implementation are not expected to have a notable impact on winter foraging habitat for wolverines. Newborn ungulates that provide a spring food source for wolverines are typically born in close proximity to high-quality winter range. The project area could provide suitable calving habitat for moose, but neonatal moose were not reported in GYE wolverine diet. Therefore, no discernible impact on spring food availability is expected to occur as a result of the proposed treatment.

In addition to habitat alterations, noise from logging operations and added human presence associated with project activities may also contribute disturbance effects to wolverines. Since the project is generally below the summer elevation range used by resident wolverines, there would be limited disturbance effect resulting from the proposed treatment. Although winter logging would not be

prohibited for the project, there is minimal likelihood of logging activity in winter, since the primary access road would not be plowed during Bridger Bowl's operating season. Therefore, the project is not expected to affect reproductive wolverines. The project area most likely serves as a movement corridor for dispersing individuals, and possibly as an occasional winter foraging area for resident wolverine. Juvenile dispersal movements appear to be correlated with the female reproductive season; i.e. subadults are most likely to leave their natal ranges in early spring when their mothers produce new litters, and while snow conditions are suitable for travel (Inman et al. 2007:10, 12). Spring logging could occur, but this is also unlikely due to the limited operating period between Bridger Bowl closing and spring break-up, when project activities would again be restricted to protect soils and facilities. Since the project area is most likely to be used by wolverines during winter or spring when logging operations are least likely, the project would have little or no direct or indirect disturbance impact on wolverines.

Approximately 2,500 feet (< ½ mile) of temporary road construction may be required to reduce long skid routes. Project roads would come off existing administrative roads in the project area, involving two short (<= 1,500 ft) segments at opposite ends of the project area (see project map for temp road locations). Project temporary roads are proposed in an area that already has relatively high motorized access route density, although most of the motorized use in the project vicinity involves administrative use or use on private roads. Addition of less than ½ mile of temporary project road would not notably affect road density in the project area. Once the activity is complete, project roads are to be permanently and effectively closed and re-vegetated. Temporary roads built for project implementation would not appreciably alter wolverine habitat, and activity would be limited in duration and restricted to administrative use for motorized vehicles. Road use would peak in summer/fall, when wolverine use is not expected to occur in the project area.

Cumulative Effects

No Action Alternative

Cumulative effects to wolverine habitat within the Bridger/Bangtail analysis area have occurred due to natural and managed processes, which have shaped the environment over time to produce the existing condition described above in the affected environment section. Under the no action alternative, the anticipated effect on wolverine habitat would be continued tree mortality due to unchecked insect activity. No action would reduce security cover by facilitating continued defoliation and mortality of live trees. This alternative would also continue to contribute to heavy fuel buildup, which would eventually promote wild fire spread if an ignition occurs within or near the project area. Dying trees, standing snags and fallen logs can still provide some degree of screening cover for wolverines, but provide less security cover for movement than live trees. Ongoing tree mortality due to insect activity would contribute to heavy fuel buildup, which could facilitate fire spread if a wild fire starts in the project vicinity. Stand-replacing burns of high intensity can reduce security cover even more than insect mortality. However, insects, disease and wild fire are all natural ecological processes to which wolverines and their prey species have adapted over time.

Proposed Action

Cumulative effects to wolverine habitat within the Bridger/Bangtail effects analysis area have occurred over time due to land management actions such as timber harvest, prescribed fire, livestock grazing, recreational and residential development and associated roading, as well as natural ecological processes such as wild fire, wind events, avalanches, floods, insects, disease, and natural forest succession. These natural and managed processes have shaped the environment over time to produce the existing condition described above in the affected environment section. The Bridger and Bangtail Mountain Ranges are considered important linkage habitat for wolverines, and dispersal of animals through such linkage areas

may be crucial to maintaining the wolverine metapopulation present in the Rocky Mountains of Montana, Idaho and Wyoming (Inman, et al. 2008). Factors that can affect wolverine dispersal are those that pose a physical barrier to movement, and those that impact a wolverine's ability to find adequate food, water and shelter.

The Bridger/Bangtail area is relatively small compared to other mountainous areas on the Gallatin Forest, and isolated from more contiguous habitat by urban, rural and agricultural development, as well as state and federal highways. The area's close proximity to the human population center of Bozeman makes it attractive for resource management as well as recreation. The Bridger and Bangtail Ranges both have a history of fairly intensive timber production and livestock grazing on both public and private lands. Timber harvest activity was at its peak during the 1960s through the 1980s, and clear-cutting was a primary technique used during this period. Most of the areas harvested during this time period have since regenerated to a point where they now provide adequate screening cover for wolverines. Recent (since 1990) timber harvest on NFS land in the Bridger Range occurred as part of a "timber for land" component of the congressionally mandated Gallatin Forest Land Consolidation Act. This harvest occurred several miles north of the SBI project area, in the South Fork of Carrol Cr., Frazier Cr., and So Fk of Flathead Cr. Drainages, and involved primarily clear-cut harvest methods. Timber harvest has also occurred on private land in the Bridgers since 1990, but has been more limited in scale, and often involved individual tree selection. Recent timber harvest in the Bangtail Range has occurred only on private (corporate timber) lands, and has involved clear-cutting and commercial thinning. While clear-cutting basically removes security cover for wolverines, intermediate prescriptions like thinning and individual tree selection generally retain some degree of cover for wolverines.

Livestock grazing is a traditional use in the Bridger/Bangtail area that is expected to continue in the foreseeable future. There are 19 range allotments (14 in the Bridgers and 5 in the Bangtails) grazed by cattle, with allowances for 2,142 cow/calf pairs in the Bridgers and 494 cow/calf pairs in the Bangtails. Wolverines may occasionally scavenge carcasses when livestock die on the range from various causes, but there have been no reported incidents of wolverine depredation on livestock in the Bridger/Bangtail area. Livestock can have limited impacts on forage availability for wolverine prey species, but range management utilization standards for livestock minimize this impact. The Pine Creek allotment in the Bridger Range overlaps proposed treatment units at the south end of the project area. Proposed forest thinning would likely produce a short-term flush of forage that could attract cattle, resulting in a possible increase in livestock use within treatment units. However, cattle already use the area to some degree to obtain forage in openings and shelter under the forest canopy. There are only 46 cow/calf pairs permitted in the Pine Creek allotment, and use occurs between July 1 and September 30, not during the winter/spring season when wolverine use of the project area is most likely.

As described in the affected environment section, road and motorized trail densities are relatively high in the Bridger/Bangtail Ranges compared with other areas of the Gallatin Forest, and much of the existing road system in the area resulted from the need to provide access for resource extraction and management on both public and private lands. Addition of less than ½ mile of temporary project road would have no effect on average road density in the Bridger/Bangtail analysis area for wolverines, and access levels would return to Travel Plan designation with project road closure upon project completion; i.e. temporary roads built for project implementation would be closed and re-vegetated.

The Bridger Bowl Ski Area is a destination winter resort that was established in the 1950s and has grown substantially over time. Bridger Bowl operates under Special Use Permit (SUP) on National Forest System (NFS) lands, as well as adjacent private land owned by Bridger Bowl. The ski area is slightly within and adjacent to the area proposed for treatment. On NFS lands, the ski area operates under a Master Development Plan (MDP) that was approved in 2005. The MDP serves as guidance for the life of the SUP, and includes plans for expansion and additional development, most of which has been

implemented since 2005. Much of the terrain within the ski area boundary is naturally lacking vegetative cover, but ski area management results in some level of permanent habitat alteration by maintaining ski runs in some areas that would otherwise provide a higher degree of vegetative screening cover for wolverines. Proposed treatment units 1, 2, 7 and 18 are either wholly or partially within the ski area SUP boundary. Snow compaction resulting from mechanical grooming and skier traffic also results in winter habitat alteration. Snow compaction can impact wolverines, because they are physiologically adapted to have a competitive advantage over some other predators in deep, soft snow conditions. The upper elevations within the ski area boundary have characteristics of wolverine reproductive denning habitat, but winter ski area operations greatly reduce the suitability of the area as reproductive denning habitat, both through snow compaction and disturbance factors. The ski area influence impacts habitat from the lower elevations in Bridger Canyon with skier traffic on Hwy 86 and Bridger Bowl access road, parking and base area facilities, plus area development, maintenance and use all the way up to the ridgeline. Yet, Bridger Bowl has been operating in this same location since the 1950s, and wolverines have persisted in the Bridger Range. Suitable habitat is available elsewhere in the Bridger and Bangtail ranges to accommodate wolverine habitat needs, including suitable reproductive denning habitat at higher elevations in the Bridgers and habitat connectivity for dispersal corridors in both the Bridgers and Bangtails.

Determination of Effect

The Gallatin National Forest wildlife biologist determined that the proposed action ***is not likely to jeopardize the continued existence*** of wolverines. This determination is based on the following rationale, consistent with findings of the USFWS proposed rule (USDI 2013) to list the species. The proposed rule (pp. 7879-7880) states:

- *"Wolverines are not thought to be dependent on specific vegetation or habitat features that might be manipulated by land management activities, nor is there evidence to suggest that land management activities are a threat to the conservation of the species."*
- "*The available scientific and commercial information do not indicate that potential stressors such as land management, recreation, infrastructure development and transportation corridors pose a threat to the species."*
- *"Little scientific or commercial information exists regarding effects to wolverines from development or human disturbances associated with them. What little information does exist suggests that wolverines can adjust to moderate habitat modification, infrastructure development and human disturbance."*
- *"Large amounts of wolverine habitat are protected from human disturbances and development, either legally through wilderness and National Park designation, or by being located at remote and high elevation sites. Therefore, wolverines are afforded a relatively high degree of protection from the effects of human activities by the nature of their habitat."*
- *"Wolverines are known to successfully disperse long distances between habitats through human-dominated landscapes and across transportation corridors. The current level of (human) development in the western United States does not appear to have precluded the long-distance dispersal movements that wolverines require for maintenance of genetic diversity."*

In addition to the findings presented in the proposed rule, the South Bridger Interface project is not likely to jeopardize the wolverine because:

- Proposed treatment would generally occur below the elevation zone typically used by resident wolverines

- Proposed treatment would not affect reproductive denning habitat
- Project activities are unlikely to occur during the wolverine reproductive season or when subadults are likely to disperse (winter/spring)
- Proposed treatment would not negatively affect wolverine foraging habitat or prey base at the landscape scale utilized by this wide-ranging species
- Proposed treatment and associated infrastructure would not pose a barrier to wolverine movement during or after project implementation

Consistency with Applicable Direction

With the proposed rule to list the wolverine as a threatened species, the wolverine is no longer considered a Forest Service sensitive species. The Forest Plan contains direction to maintain habitat that is essential for sensitive species, but there is no direction in the Forest Plan specific to species proposed for listing. However, it is notable that the proposed action would not affect reproductive habitat for wolverines, which is habitat that could be considered essential for the species. Further, although the project would result in some degree of habitat alteration, it would not present a barrier to wolverine movement within a dispersal corridor that could also be considered essential habitat. As a proposed species, the only applicable direction for wolverine at this time is that found in the "Special rules" contained in the proposed rule to list the species (see *Applicable Direction* above). Basically, these rules prohibit the attempted or intended 'take' (trapping, hunting, shooting, capture, or collection) of wolverines, but allow for 'incidental take' that occurs as a result of otherwise legal activities conducted in accordance with applicable laws, including management actions by Federal agencies. There is no attempt or intent to trap, hunt, shoot, capture or collect wolverines as part of the proposed action. The project involves legal activity (timber harvest) on federal land in accordance with applicable law and regulation. Therefore, the proposed action is consistent with applicable direction.

FOREST SERVICE SENSITIVE SPECIES

Forest Service Sensitive Species are those plant and animal species identified by the Regional Forester for which population viability is of concern. There are currently nine terrestrial wildlife sensitive species that are either known or suspected to occur on the Gallatin Forest. Of these, the gray wolf, bald eagle, peregrine falcon and black-backed woodpecker are either known or suspected to be present in the Bridger Mountain Range based on verified sightings or presence of suitable habitat and are therefore identified as species of concern for this project.

The remaining sensitive species have not been documented in the Bridgers for decades. Habitat is lacking in the project area for trumpeter swans and harlequin ducks, as there are no suitable water bodies for these species. Flammulated owl surveys conducted in the project area in 1992 resulted in no detections of this species, but the project area does not contain habitat; e.g, yellow pines or warm, dry, open forest, preferred by this species. Additional flammulated owl surveys conducted in 2005 on the west side of the Bridgers where habitat is more suitable due to south and west exposure, again resulted in no detections. There are no large caves or abandoned mines that would provide suitable roosting sites for western big-eared bats in the project area. Bighorn sheep do not occur in the Bridger Range, and there are no cliffs or steep, rocky slopes in the project area. Montana Fish, Wildlife and Parks personnel are currently evaluating the potential for bighorn sheep reintroduction into the Bridger Mountain Range. The proposed reintroduction site is on the west side of the mountain range, and the SBI project area is well outside of the expected, continuous habitat for bighorn sheep in the Bridger Range. Therefore, there is no potential for the SBI project to influence bighorn sheep reintroduction or success in the Bridger Range (J. Cunningham, pers. comm. 2013). Since these sensitive species are not currently known or suspected to

be present in the Bridger Range, and there is no essential habitat for any of these species in the project area, the proposed action would have ***no impact*** on trumpeter swan, harlequin duck, flammulated owl, western big-eared bat or bighorn sheep. Therefore, these species will not be addressed further.

Of note with regard to sensitive species, two *Myotis* (bat) species were added as sensitive species for the Region in 2011. These species, the long-earred and long-legged myotis were detected in bat surveys on the Gallatin Forest. However, after adding these two species to the sensitive species list, a clarification was sent from the Regional Office (email: K. Swisher, 6/27/11) that stated these species should be analyzed as sensitive *if the species is known to occur on the unit AND is recognized as sensitive in the state*. Both statements must be true for the species to be carried forward into analysis as sensitive. Since the two myotis species are not recognized as sensitive by the state of Montana, they are not considered sensitive species for the Gallatin Forest and will not be addressed further.

Affected Environment

Gray wolves are habitat generalists, and make use of a variety of habitat types throughout the course of their lives. Big game winter range is a key component of wolf habitat. The Brackett Creek Pack, whose home range/territory is established in the Bangtail Range make occasional forays into the Bridger Range. There are no known den or rendezvous sites in the Bridger Range (A. Nelson, pers. comm. 2013).

The **bald eagle** is typically associated with large lakes (> 80 acres) and major river courses. They feed primarily on fish and carrion, but are capable of taking small to medium size avian and mammalian prey species as well. No bald eagle nests have been documented within or near the Bridger Mountain Range, and there is no high quality nesting habitat (no large water bodies) for bald eagles in the vicinity. Bald eagle presence has been noted in winter/spring, generally associated with presence of winter-killed ungulates on the west side of the Bridger Range, or scavenging along state and county routes for road-killed ungulates. Bald eagles are regularly recorded along the Bridger Mountain raptor flyway during fall migration.

Peregrine falcons nest in cliff and rock formations, typically associated with lakes and streams. Riparian habitat and open meadows are favored hunting habitat for peregrines. Suitable nesting habitat in the Bridgers is not known to have been occupied by breeding peregrine falcons; however, the project area provides foraging habitat within a reasonable distance from potential nesting cliffs. Although there are no known occupied peregrine falcon eyries in the Bridgers.

Black-backed woodpeckers occupy forested habitats that contain high densities of recently dead or dying trees, which provide an insect prey base. They are typically found in post fire areas that have burned within 1 to 6 years, or areas with extensive insect outbreaks causing widespread tree mortality, or a natural range of smaller disturbances such as wind throw and ice damage that produce small patches of dead trees (USDA 2007:5). Nesting habitat for black-backed woodpeckers is characterized by high densities of medium-sized snags (USDA 2007:7). Black-backed woodpeckers were not detected on the Gallatin Forest in bird surveys in the 1990s (USDA 1994), and the Natural Heritage database has no observation data for black-backed woodpeckers in the Bridgers. However, the black-backed woodpecker is a nomadic species, following insect outbreaks as they occur, keying in on recently burned forest. Recent and ongoing insect infestations throughout the Bridger Range, including the project area, provide a prey base for black-backed woodpeckers. Black-backed woodpeckers were not detected in proposed treatment units in a 2013 survey. In 2009, the Flaming Arrow fire burned roughly 200 acres almost entirely on private land adjacent to the project area. This fire burned mostly non-forest and open forest types, and some of the burned trees have since been salvaged. Consequently, this burn area is not optimum habitat for black-backed woodpeckers, as it does not contain high densities of burned snags.

Applicable Direction

The gray wolf, bald eagle and peregrine falcon were formerly protected under the Endangered Species Act. The gray wolf was officially removed from the endangered species list (delisted) in 2011, the bald eagle was delisted in 2007, and the peregrine falcon was delisted in 1999. The bald eagle remains protected under the Bald and Golden Eagle Protection Act (16 USC 668) and both the bald eagle and peregrine falcon remain protected under the Migratory Bird Treaty Act (16 USC 703-712). Executive Order 13186 requires agencies to ensure that environmental analyses evaluate the effects of federal actions on migratory birds. Federal protection for the bald eagle and peregrine falcon prohibits the "taking" of these species. The Gallatin Forest Plan (USDA 1987: II-19) contains a forest-wide standard that general management direction for bald eagles is provided by the Greater Yellowstone Bald Eagle Management Plan (GYBEMP 1995). National management guidelines for bald eagle (USDI 2007) and the Greater Yellowstone Bald Eagle Management Plan focus on protecting bald eagle nests and surrounding breeding habitat. Upon removal from the endangered species list, the gray wolf, bald eagle and peregrine falcon were designated Forest Service sensitive species in the Northern Region. The black-backed woodpecker is also on the Northern Region sensitive species list, and like the bald eagle and peregrine falcon, is managed under the Migratory Bird Treaty Act and Executive Order 13186. The Gallatin Forest Plan (USDA 1987:II-18) contains a forest-wide standard to manage essential habitat to maintain sensitive species.

Direct and Indirect Effects

No Action Alternative

Under the No Action alternative, the project would not be implemented. Bridger Bowl Ski Area would continue to be managed under the ski area Master Development Plan, which could involve commercial timber harvest in some cases. Personal use firewood gathering could continue as allowed under the Forest Plan, but with limited public vehicle access, firewood gathering is not expected to occur at high levels, even though there is ample dead standing wood available. Therefore, under this alternative, there would be only minor changes in forest structure in proposed treatment units due to human activities. However, insects have already had a very notable effect on the project area, and this would be expected to continue at high levels in most cases if left untreated.

Indirect effects of no action would result in increased tree mortality over time. Without removal through logging, many dead trees will eventually fall, resulting in a greater abundance of coarse woody material (standing snags and downfall) and potentially, few if any live trees remaining. If left untreated, insect-related tree mortality would continue, adding to already high fuel loads, that if ignited, could result in large-scale stand replacement fire. The no action alternative could potentially improve habitat conditions for black-backed woodpeckers, since they feed on insects, and are highly selective for recently burned areas. However, fire is not a guaranteed result of no action. Currently, spruce budworm is the most abundant tree-feeding insect in the project area, and it is not a wood-boring species preferred by black-backed woodpeckers. No action would have no obvious benefits for other sensitive species known to occur in the project vicinity.

Proposed Action Alternative

Proposed treatment would alter habitat in the project area, reducing tree density and forest canopy. The project would not affect known reproductive sites for any of the sensitive species (gray wolf, bald eagle, peregrine falcon or black-backed woodpecker). The project area provides habitat for big game species, which would be the primary attraction for wolves and eagles. However, it is not ideal winter range for deer or elk, which are the most abundant wild ungulates in the Bridger Range. The project area may

support a few wintering moose and/or mule deer, but not in numbers that would likely attract wolves or eagles. Wolf use in the Bridger Range has been most notable on the west slopes, where there is high quality big game winter range and wild ungulates are present year-round. In the project vicinity, eagles are mainly attracted to winter killed ungulates, typically found on the west slopes of the Bridgers, or road-killed big game, most notably found along Montana Highway 86, located roughly 1- 1.5 miles east of the project area. Reducing the forest canopy could stimulate forage production in treatment units, which could attract big game species in summer/fall, but is not expected to notably change the character of the project area for big game use, or associated use by wolves or bald eagles. Reductions in forest canopy due to proposed treatment could decrease the area suitability as winter range for moose and the few deer that use the area, but would not notably affect wolf or bald eagle use, since these species would key in on big game winter range elsewhere, or find road-killed ungulates associated with highway vehicle use. The project area contains suitable foraging habitat for peregrine falcons. Riparian areas favored by falcons for hunting would be protected by stream and wetland buffers. Tree removal would provide openings more favorable to peregrines for hunting than closed canopy dense forest conditions.

Insect infestations in the project area provide a prey base for black-backed woodpeckers. Recently burned forest habitat, with which black-backed woodpeckers are strongly associated, is not available in the project area. The stated purpose and need for the project is to implement insect control measures to reduce tree mortality from insect infestations. If successful, the proposed treatment would reduce potential nesting and foraging habitat for black-backed woodpeckers. Proposed treatment would have an indirect effect of reducing fuel loads in the project area, decreasing the potential for future stand-replacing fire in the project area. Given the extent of recent insect outbreaks in forested habitats across the Gallatin Forest, coupled with numerous large fires in recent years, high-quality black-backed habitat is not limited, and the relatively small scale of proposed treatment would have a very minor impact on black-backed habitat availability.

Noise from equipment and added human presence could have disturbance impacts on sensitive species and/or their prey. However, none of the sensitive species (gray wolves, bald eagles, peregrine falcons and black-backed woodpeckers) are known to be particularly sensitive to human disturbance, except when such disturbance occurs near reproductive areas. There are no known wolf dens or rendezvous sites, and no known nest sites for bald eagles, peregrine falcons or black-backed woodpeckers within or near any of the proposed treatment units. The proposed action calls for approximately 2,500 feet total of temporary road to access treatment units. New roads would add to disturbance impacts and could potentially affect prey distribution within the project area. However, given the low densities of big game use in the project area, and existing condition of relatively high road density, this impact would be extremely minor for wolves and eagles, and would have little or no effect on bird or insect prey availability for falcons and woodpeckers. Roads built to access treatment units would be low standard, temporary in nature, closed to public motorized use, and permanently closed upon project completion, further minimizing any potential impact. Therefore, project-related disturbance impacts to these sensitive species would be insignificant.

Cumulative Effects

No Action Alternative

Cumulative effects to habitat within the Bridger Range have occurred due to natural and managed processes, which have shaped the environment over time to produce the existing condition described above in the affected environment section. Under the no action alternative, the anticipated effect on sensitive species habitat would be continued tree mortality due to unchecked insect activity. This alternative would also continue to contribute to heavy fuel buildup, which would eventually promote wild fire spread if an ignition occurs within or near the project area. Increased insect activity or resulting wild fire would provide additional habitat for black-backed woodpeckers. However, no action would reduce

security cover for big game and thus impact potential foraging habitat for gray wolves and bald eagles. No action would likely have neutral effects on foraging habitat for falcons, as bird (prey) species composition may change, but overall prey abundance would not notably change. Ultimately, insects, disease and wild fire are all natural ecological processes to which sensitive species and their prey species have adapted over time.

Proposed Action

Cumulative effects to sensitive species (gray wolves, bald eagles, peregrine falcons and black-backed woodpeckers) may occur as a result of project impacts adding to effects from past, ongoing and reasonably foreseeable future activities in the project area and surrounding vicinity. The proposed action could have minor impacts on distribution of prey species, such as big game animals (for wolves and eagles), and insects (for woodpeckers), but is not expected to have notable impacts on prey (birds) availability for peregrine falcon. Past activities on public and private land in the Bridger Range, including timber harvest, livestock grazing, recreational and residential development, and fire suppression, have altered vegetative patterns over time, which could influence prey availability and distribution. However, wolves, bald eagles and peregrine falcons were generally absent from the Bridger Range when populations were low, and their relatively recent return to the area is indicative that habitat conditions in the area are at least acceptable as foraging habitat. Past vegetation management activities, particularly timber harvest, insect/disease control, and fire suppression have influenced the availability of suitable habitat for black-backed woodpeckers. There have been regular small- and large-scale insect infestations and stand-replacing burns across the Gallatin Forest over time that have provided adequate habitat for the species. Therefore, while cumulative effects of natural processes and human activities have influenced habitat for sensitive species that utilize the Bridger Range, the recent re-occupation of the area by previously threatened and endangered species is indicative that such events have not rendered habitat unsuitable.

Summary Conclusion

The proposed treatment would alter habitat conditions in the project area, and added human presence associated with project activities would contribute disturbance impacts to sensitive species. However, given the relatively small scale (<= 250 acres of treatment), and limited duration (<= 5 consecutive years of activity), coupled with ongoing insect activity that would continue to alter habitat in the absence of treatment, project impacts would be minor and may impact individuals, but would be limited enough in scope and scale so as to have no notable impacts on any sensitive wildlife species at the population level.

Consistency with Applicable Direction

The Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act prohibit the “taking” of bird species, including bald eagles, peregrine falcons and black-backed woodpeckers, except as regulated by authorized programs. Incidental take of migratory birds exempted so long as it occurs as a result of otherwise legal activities that are conducted in accordance with applicable State, Federal, tribal and local laws and regulations. Vegetation management on National Forest System lands is an authorized program and mitigations are used to minimize potential take of migratory birds. Executive Order 13186 requires agencies to ensure that environmental analyses evaluate the effects of federal actions on migratory birds. This specialist report meets the requirement to evaluate the effects of this proposed federal action. Management direction for bald eagles provided by the 1995 Greater Yellowstone Bald Eagle Management Plan and the 2007 national management guidelines for bald eagles focus on protecting bald eagle nests and surrounding breeding habitat. Since there are no known bald eagle nests, and no high quality nesting habitat in the project area, the proposed action is consistent with this direction. The Forest Plan contains a forest-wide standard to manage essential habitat to maintain sensitive species. Since there

is no essential habitat for sensitive species within the project area, the proposed action is consistent with this standard.

Determination of Effects

The proposed treatment would not affect reproductive habitat for any terrestrial wildlife sensitive species, but it could have minor impacts on potential foraging habitat and/or travel/resting areas for gray wolves, bald eagles, peregrine falcons and black-backed woodpeckers. Therefore, the proposed action ***may impact individuals or habitat, but would not lead to a trend toward federal listing*** for any of these species. Table 3.40 provides a summary of effects determinations for terrestrial wildlife sensitive species.

Table 3.40. Sensitive Species Biological Evaluation – Summary of Effects Determinations

Species - Wildlife	Determination	Rationale
Gray Wolf	MIIH	Wolves occasionally present in Bridger Range. Prey present at low densities in project area
Bald Eagle	MIIH	Project is within 1.5 mile of winter/spring foraging habitat along MT Hwy 86
Peregrine Falcon	MIIH	Project area contains foraging habitat in proximity to suitable nesting cliffs
Black-backed Woodpecker	MIIH	Potential nesting and foraging habitat; minor impact: <=250 ac. treated
Flammulated Owl	NI	Lack of suitable habitat
Harlequin Duck	NI	Lack of suitable habitat
Trumpeter Swan	NI	Lack of suitable habitat
Bighorn Sheep	NI	Lack of suitable habitat
Townsend's big-eared bat	NI	Lack of suitable habitat

NI = No Impact
MIIH = May Impact Individuals or Habitat, but would not lead to a trend towards federal listing

MANAGEMENT INDICATOR SPECIES

Management Indicator Species (MIS) are those species identified in the forest planning process that are used to monitor the effects of planned management activities on populations of wildlife, including those that are socially or economically important (USDA 1987:VI-14). MIS are the species or groups whose habitat is thought to be affected by forest management activities. Terrestrial wildlife species identified in the Gallatin Forest Plan include: grizzly bear, bald eagle, elk, northern goshawk and American (or pine) marten (Ibid: II-18, II-19). With the exception of the grizzly bear, all terrestrial wildlife MIS are at least occasionally present within or near the Bridger Mountain Range.

LANDSCAPE SCALE ASSESSMENT

Evaluating land management effects relative to MIS population trends is a mechanism used to assess whether we are meeting our Forest Plan goal to provide for viable populations of wildlife. As an evaluation tool, the Forest Plan contains a forest-wide standard to monitor population trends of management indicator species and relationships to habitat change. This requirement is accomplished by

observing the consequences of multiple management actions across the landscape over time. As a result, a forest-wide assessment of terrestrial wildlife MIS population and habitat trends was completed in 2011 (Canfield, 2011). Previously, the Gallatin Forest Monitoring Report summarized information for the period 2004-2006, indicating stable to increasing population trends for Gallatin wildlife MIS. The 2011 MIS assessment also concluded that, at the planning unit scale; i.e. within the boundaries of the Gallatin Forest, population trends of terrestrial wildlife MIS were generally stable to increasing, unless noted otherwise in this report. Of note for this project, elk herds using habitat in the Bridger Range are currently at or above state population objectives (Canfield, 2011:7; J. Cunningham, pers. comm. 2013).

The 2011 MIS assessment noted that it is difficult to determine population trends for goshawks at the Forest level, but that globally, northern goshawks are well distributed and stable. A Regional assessment in 2005 concluded that breeding goshawks and associated habitats are widely distributed and relatively abundant on NFS lands within the Northern Region of the US Forest Service, including the Gallatin Forest. Based on detection surveys, goshawks are present and distributed across the Gallatin Forest. Project-level surveys are conducted to ensure that if found, goshawk nests will be protected through mitigation measures. The 2011 MIS assessment also noted a relatively stable to slightly declining population trend for pine marten from records across the state of Montana, with similar trends indicated for the Gallatin Forest. However, pine marten detections and harvest levels upon which these trends are based, can be influenced by a number of factors other than habitat change, such as snow conditions and fur markets. No information has been presented since the 2011 assessment that would lead us to believe MIS population trends are significantly changing on the Gallatin Forest, or that current land management practices are having notable impacts on MIS populations through habitat changes. Ongoing monitoring efforts are in place to continue to track MIS population trends and habitat conditions at the planning unit (i.e. forest) level.

Population trends of indicator species reflect baseline habitat conditions that have resulted from past management actions and natural ecological processes over time. Habitat management practices have varied in scale and intensity over the years, with a history of large scale, intensive vegetation management (e.g. clear-cut timber harvest) and high density livestock grazing in the past, trending toward smaller scale, lower impact (e.g. thinning and prescribed burning) vegetation management practices and lower levels of livestock use in recent years. In light of these trends, (i.e. MIS population trends generally stable to increasing over time in response to changing management paradigms) we are confident that the forest thinning proposed in the South Bridger Interface project, coupled with site-specific mitigation measures, will not affect MIS population trends on the Gallatin National Forest.

GRIZZLY BEARS AND BALD EAGLES

Grizzly bears and bald eagles are identified in the Forest Plan as indicators of threatened and endangered species respectively (USDA 1987:II-19), although the bald eagle has since been removed from the list of threatened and endangered species. Grizzly bears are currently listed as a threatened species, although they are not present in the Bridger Range, and have not been found in that area for decades. The Bridger Range could provide a travel corridor that would serve to connect grizzly bear populations in the Northern Continental Divide Ecosystem to the north with the Greater Yellowstone Ecosystem to the south; however travel through this area by grizzly bears has not been verified in recent years. Bald eagles are not known to occupy the Bridgers for breeding purposes, but are occasionally seen foraging for winter/road kills during winter/spring, and are commonly seen along the Bridger Migratory Flyway in fall. Grizzly bears and bald eagles were addressed above under Threatened and Sensitive Species respectively, so effects analyses for these species will not be repeated here.

ELK & BIG GAME

Affected Environment

The proposed action is located in the Bridger Mountain Range, which is a relatively small mountain range that is isolated from larger mountains and the more contiguous forested environments in surrounding areas. As such, the Bridger Range provides an array of habitat conditions for a variety of wildlife species, as well as connecting habitat between larger blocks of more contiguous habitat. Elk are the MIS identified in the Gallatin Forest Plan to represent big game species (USDA 1987:II-19). However, there is limited evidence of elk use in the project area. Since mule deer and moose are more prominent in the project area, they will be addressed here as featured species for MA 11, but they are not designated as management indicators in the Forest Plan. Elk are basically habitat generalists. They feed primarily on grasses in spring, with forbs becoming more important in summer. They switch back to grasses and start to include browse species by fall and into winter (Peek 2003:881). Elk typically forage in open meadows and forest openings, and utilize forested areas for hiding and thermal cover. Elk winter range is characterized by warmer, drier slopes, typically with a southerly or westerly aspect, that remain relatively free of snow. Winter ranges contain open areas of grass and shrub cover, with coniferous forest nearby to provide thermal cover for temperature regulation and hiding cover to escape predation. Spring range for elk typically occurs in the transition zone between winter and summer range. Calving areas, which are part of spring range, occur at the upper elevation limits of winter range where shrubs and conifers provide hiding cover to help protect calves from predation. Elk show a preference for moist sites during summer months. These sites are selected based on juxtaposition with other habitat components such as forest cover, and are generally associated with habitat types in the subalpine fir and spruce series (Lyon et al. 1985:12).

Mule deer have somewhat similar habitat needs to those of elk for summer, fall and winter range. Reproductive (spring/summer) habitat for mule deer is that used by does during fawning and lactation. Mackie et al (1998:25-26) described reproductive (fawning) habitat for mule deer as mesic montane forest, with a wide range of topographic and vegetative diversity to provide a dependable source of succulent, high-quality forage, as well as escape terrain to avoid predators. Moderately steep slopes with northerly exposures provide good quality reproductive habitat for mule deer. Winter range for elk and mule deer is generally found at lower elevations on the west side of the Bridger Range, continuing out onto the flat lands associated with privately owned agricultural and residential property to the south and west of the project area.

Moose occur at low densities throughout the Bridger Range year round. They are typically found in association with willow-riparian and upland shrub habitat, although they will use coniferous forest for temperature regulation and security cover. Moose tend to show a strong degree of sexual segregation outside the breeding season, with males typically selecting habitats relative to forage availability and females selecting habitat for security cover. Browse is the primary foraging technique, with twigs and stems of woody plants making up the bulk of their winter diet, while leaves and tender young shoots of trees and shrubs are used the rest of the year. Calving areas for moose are isolated areas selected based on microsite characteristics such as food availability and view for detecting potential predators (Bowyer et al. 2003:940-944).

The project area is relatively small, dominated by forested habitat, yet largely influenced by human activities from adjacent developed recreation facilities (Bridger Bowl Ski Area), private land, and State Highway 86. The only recent MIS detection within the project area is occasional use by elk. Elk are an important big game species in the Bridger Range, with notable herd use in the north Bridgers and the Springhill area on the west side of the range. There is considerably less elk use in the southeast portion of

the range where the project is located. Elk that use the project area are associated with herds that spend most of their time on private lands south of the project area (J. Cunningham, pers. comm. 2013). The geographic area used by these elk contains large proportions of natural meadows and agricultural fields, with forested cover being a relatively minor component. The project area does not provide winter range or calving areas for elk. Elk that may occasionally use habitat within the project area typically winter to the south, with the majority of winter use occurring on private land. There is limited evidence of elk use within the project area (i.e. no collared elk locations, few aerial survey locations and few sightings of animals or sign). Elk occasionally travel through the project area during migratory movements between seasonal ranges. However, there are no definitive migration routes or staging areas for elk or other big game species within the project area. Rather, travel by wild ungulates occurs in a dispersed pattern throughout the area (Ibid).

Mule deer are the most abundant big game species that utilize the project area, mainly in summer and fall. A few individuals, primarily mature bucks, may be found wintering within the project area. Most mule deer that use the project area winter over in the Shields River Valley to the east, with some moving up and over to the west slopes of the Bridger Range. The project area provides year-round habitat for moose, but given the relatively small area identified for treatment, only a very few moose are expected to be present within the project area at any particular time. Moose winter use in the project area would be concentrated in willow/riparian areas and dense, spruce/fir forest cover types (J. Cunningham, pers. comm. 2013).

Analysis Parameters

Spatial Boundaries

Elk are the MIS identified for big game species, so the effects analysis areas used for elk were used for deer and moose as well. Montana Fish Wildlife and Parks and the US Forest Service recently engaged in a collaborative overview of elk habitat management practices on NFS lands, including the Gallatin National Forest (MDFWP and USFS 2013). This effort resulted in a recommendation to use elk analysis units (EAU) as the appropriate analysis scale for examination of direct, indirect and cumulative effects of land management actions (e.g. projects) on elk habitat. EAUs were then developed in a collaborative effort between Forest Service wildlife biologists and Montana Fish Wildlife and Parks biologists. To serve for both landscape scale and project level analyses over time, EAUs were delineated as discrete polygons; i.e. they do not overlap. Discrete EAU polygons facilitate effects analyses by eliminating sliver effects, as well as avoiding the double counting of land use impacts where elk herd use areas overlap.

EAUs identified on the west zone of the Gallatin Forest, including the Kelly Canyon EAU which covers the project area, were based on radio relocation data from collared elk, aerial observation of elk herd locations, local wildlife biologist observations and knowledge of elk habitat use, and topographic and hydrologic features. While EAUs may reflect elk herd unit home ranges, they are not considered literal representations of elk herd unit home ranges, since home ranges are dynamic, changing in response to environmental conditions. Further, individuals within a herd unit often utilize habitat differently. While some individuals may travel beyond EAU boundaries and overlap spatially with elk from other herds, other individuals may stay entirely within, and utilize only a small portion of an EAU. The Kelly Canyon EAU combines four 6th code drainages (HUCs) that encompass an area of concentrated elk location data. This EAU is approximately 72,757 acres in size, of which only 28,462 acres (39%) is within the forest boundary. The small proportion of this EAU inside the forest boundary is indicative of habitat use by elk herds, or groups of animals associated with this EAU; i.e. the majority of elk use as indicated by available data, occurs on private land outside the forest boundary. Even within the forest boundary, NFS lands account for only a minor proportion (15%) of the EAU, and include areas that are not highly suitable

(steep, rocky slopes) as well as areas that have been heavily managed for timber production and recreation (e.g. Bridger Bowl ski area). Finally, NFS lands within this EAU are patchily distributed and interspersed with private land.

The majority of the proposed treatment is located in MA 11, which is identified as forested big game habitat. The Forest Plan contains a standard for MA 11 lands that timber management re-entry should not occur unless 40% or more of the drainage can be maintained in cover (p. III-34). Since this standard specifies the drainage as the area for which conditions are to be met, we looked to the individual 6th code HUC (Bridger Creek drainage) that contains the project area as the appropriate scale to assess compliance with this standard. Using the 6th code HUC for finer scale analysis (relative to the EAU) is consistent with the Northern Region Eastside Forests framework for project level effects analysis on elk (USDA 2013:5).

Direct and Indirect Effects

No Action Alternative

Under the No Action alternative, the project would not be implemented. There would be no commercial removal of timber product, (live or dead trees) from proposed treatment units in MA 11; however, areas within MA 2, Bridger Bowl Ski Area special use permit boundary, would continue to be managed under the ski area Master Development Plan, which could involve commercial timber harvest in some cases. No temporary project roads would be constructed under this alternative. Personal use firewood gathering could continue as allowed under the Forest Plan, but with limited public vehicle access, firewood gathering is not expected to occur at high levels, even though there is ample dead standing wood available. Therefore, under this alternative, there would be only minor changes in forest structure in proposed treatment units due to human activities. However, insects have already had a very notable effect on the project area, and this would be expected to continue at high levels in most cases if left untreated.

Indirect effects of no action would result in increased tree mortality over time. Without removal through logging, many dead trees will eventually fall, resulting in a greater abundance of coarse woody material (standing snags and downfall) and potentially, few if any live trees remaining. Standing dead trees provide some degree of screening cover for big game, but generally less so than live trees with needles. Dead trees have little or no value as thermal cover for big game. Over time, dead trees lose needles, branches, and eventually fall, all resulting in a reduction in functional hiding cover. Natural regeneration is expected to provide some degree of replacement cover over time, but left unchecked, insect infestations can negatively affect natural regeneration processes, because some insects (e.g. spruce budworm, which is at epidemic levels in proposed treatment units) feed on the seed and cones of Douglas fir in the early larval stages, and can also feed on and kill young replacement trees in the understory (see Vegetation Analysis for more details). Excessive tree mortality would significantly reduce hiding and thermal cover for big game. If left untreated, insect-related tree mortality would continue, adding to already high fuel loads, that if ignited, could result in large-scale stand replacement fire, which would have even more severe impacts on the mature forest structure that provides hiding and thermal cover for big game. However, insects, disease and wildfire are all natural ecological processes to which big game species have adapted in this ecosystem.

Proposed Action Alternative

Vegetation management and associated road construction have the potential to impact habitat security for big game species. Secure habitat results from a combination of factors that allow elk to remain in a specific area while under stress from hunting. Security area components can include geography, topography, vegetation, or a combination of these features. Security areas are intended to reduce elk and

other big game vulnerability during the hunting season and to provide animals the opportunity to meet biological needs free from displacement and other physiological stresses associated with hunting pressure (USDA 2013). Hillis and others (1991) defined security areas as blocks of habitat at least 250 acres in size and at least ½ mile from an open road. In the Northern Region, eastside forests (including the Gallatin) have developed a security assessment model that applies GIS technology to calculate the proportion of 'secure' habitat within an Elk Analysis Unit (EAU). While the "Hillis paradigm' (Hillis et al. 1991) speaks only to open roads, developers of the eastside security model acknowledged impacts to big game security from motorized use on trails as well. Therefore, the security model identifies all routes open to motorized use by the public during hunting season, and buffers them by ½ mile on each side of the route. In addition, private routes, plus temporary (e.g. project) and permanent administrative routes that receive consistent and/or frequent use during the hunting season are also buffered and detracted from security areas. Once these motorized routes are identified and buffered, the model calculates the percentage of the EAU comprised of 'secure' blocks at least 250 acres in size.

Hillis and associates (1991) suggest that to optimize elk habitat and related hunting opportunities, security areas should comprise at least 30% of an elk analysis unit. However, Christensen and others (1993) acknowledged that local land management objectives would influence habitat conditions for big game, and that as a consequence, some areas would only provide minor contributions to big game habitat management goals. The interagency (FS and FWP) collaborative overview and recommendations for elk habitat management (2013) stated that one of the driving factors for security area management is to reduce or eliminate elk displacement from public land prior to normal migration events, with the objective of maintaining or enhancing elk presence on NFS lands so that elk are available to the hunting public on public lands. The Kelly Canyon EAU is primarily located on private land. Sixty-one percent of the EAU acreage is completely on private land located beyond the national forest boundary. An additional 24% of the acreage in this EAU is on private land inside the forest boundary, leaving just 15% of the EAU on NFS lands. Much of the land within this EAU (public and private) has been developed for residential, agricultural, recreational or business purposes, all of which require access, generally in the form of roads. Therefore, secure habitat, which the eastside model only calculates within the forest boundary, is currently 3,033 acres. With 28,462 acres of the EAU inside the forest boundary, this equates to only 11% secure habitat within the portion of the EAU inside the forest boundary.

Hillis and associates (1991) define security areas as "non-linear blocks of hiding cover". However, the studies upon which the 'Hillis paradigm' was based were located west of the Continental Divide in Montana, where forest cover is more continuous than in big game habitat located on the eastside forests (including the Gallatin). Recent analyses of elk habitat selection during the hunting season in Montana (K. Proffitt, pers. comm. 2013) did not show a significant selection for security areas comprised of total conifer cover relative to security areas just defined by size and distance from a road. These analyses showed that security areas as a variable in habitat selection during the hunting season are strongly related to the motorized route variable (USDA, MDFWP 2013:15). Therefore, the Northern Region eastside assessment model for security habitat only considers motorized routes and patch size in the calculation of secure habitat. Cover is indeed an important factor in big game habitat, but is important year-round; i.e. is not limited to the hunting season, and is therefore calculated differently.

Under the proposed action, approximately 2,500 feet (two segments, <=1,500 feet in length) of temporary road would be needed to access treatment units. However, due to the existing configuration of open motorized routes within and adjacent to the proposed treatment, there is currently no secure habitat in the immediate project area. Effects from temporary roads required for project implementation would fall within the buffers of existing routes. Therefore, the proposed action would have no effect on existing secure habitat, and would not change the proportion of secure habitat within the Kelly Canyon EAU.

In MA 11, the Forest Plan requires that "security areas" be provided adjacent to timber harvest project areas. For this requirement, security areas typically should be 5,000 acres or larger, contain a similar complement of vegetative habitat components that exist in the project influence zone, and be in areas that are either roadless or where road density is one mile per square mile or less (USDA 1987:III-34, 35). Note that the definition of "security areas" for this MA 11 standard is different (i.e. allows up to 1 mi/mi^2 road density) than the definition of "secure habitat" used in the eastside assessment model (i.e. at least ½ mile from an open motorized route, and at least 250 acres). To evaluate the proposed action for this requirement, the analysis looked at motorized route density categories within the Kelly Canyon EAU and adjacent to the project area, and identified over 7,000 acres adjacent to the project influence zone with similar vegetation characteristics, and motorized route densities from 0.0 mi/mi^2 to 1.0 mi/mi^2. Additional security areas meeting the road density criteria are available in the project vicinity, and are contiguous with those security areas identified immediately adjacent to the project influence zone, increasing the size of security areas available to over 11,000 acres. However, these additional areas occur outside the EAU, are typically at or above timber line, or on the west side of the Bridger Range, and thus, although they provide alternate refuge for big game animals that may be displaced by the proposed action, they generally do not contain similar vegetative habitat components to those available in the proposed treatment units.

Habitat effectiveness is a term that varies in definition throughout scientific literature. For this analysis, the term is described in the Eastside Forest Framework for Project Level Effects Analysis on Elk (USDA 2013). Habitat effectiveness relates to the effect of motorized access on elk summer range, which has been shown to significantly affect elk use during the highly productive summer months. Generally speaking habitat effectiveness can be expected to decline by at least 25% with a density of one mile of open motorized route per square mile of habitat, and by at least 50% with two miles of open motorized route per square mile (Ibid). The South Bridger Interface project area is already dominated by moderate to low habitat effectiveness for big game, since the majority of the area is in the category at or above 1 mi/mi^2 open motorized route density, and much of the project area, including nearly all proposed treatment units, are in the category at or above 2 mi/mi^2 open motorized route density. Consequently, the project is located in an area where habitat effectiveness is already reduced by 25-50%.

All Forest Service system routes (roads and trails) that receive motorized use by the public, as well as those routes that receive frequent, consistent administrative or private use, were included in the analysis for this project. The proposed action includes two segments of temporary road, each estimated to be 1,500 feet or less, for a total of approximately 2,500 feet of temporary road needed to access proposed treatment units. These temporary project roads would be located in areas where current habitat effectiveness is reduced between 25-50% due to existing motorized route densities at or above 1 mi/mi^2. Adding the relatively short segments of proposed temporary project road would not change the proportion of area from 1.0-2.0 mi/mi^2, or the proportion of area > 2.0 mi/mi^2 road density. Therefore, the proposed action would have no effect on habitat effectiveness in the project area or within the Kelly Canyon EAU. Per the Forest Travel Management Plan, temporary project roads would be built to minimum standards required to safely implement the project, would be closed to motorized use by the public, and would be permanently closed and re-vegetated upon project completion.

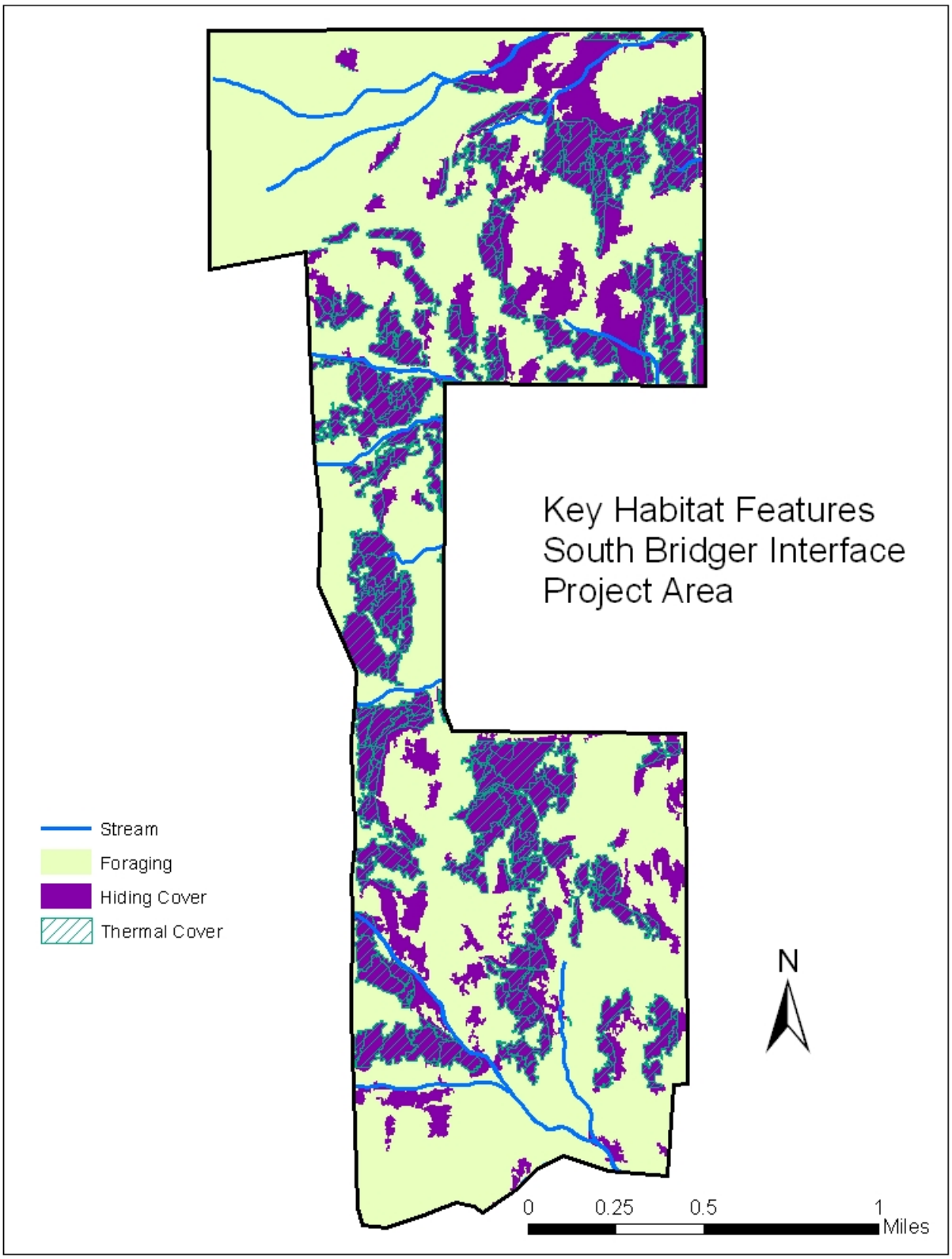
Forest cover provides a measure of security for reducing vulnerability to predation (including hunting), temperature extremes and other environmental factors. Cover is a term with broad interpretation and which includes a variety of habitat components for big game, such as hiding cover, thermal cover, escape cover and overall security. In the Gallatin Forest Plan (Amendment No. 14, Big Game Cover Definitions), hiding cover is defined as vegetation capable of concealing 90% of a standing adult big game animal from the view of a human at a distance equal to or less than 200 feet. Thermal cover is a habitat security component that provides structure necessary to ameliorate effects of ambient temperature on big game species, thus reducing the amount of energy expenditure required for thermoregulation.

Thermal cover requirements vary by season, with warmer, drier aspects typically selected for winter thermal needs, and cooler, moister types serving as summer thermal cover. The Forest Plan (A-14) defines thermal cover as mature conifer stands (tree height of at least 40 feet) with average crown closure of at least 70%, and for deer, thermal cover may also include saplings, shrubs, or trees at least 5 ft. tall with 75% or greater canopy closure (USDA 1993). The project area generally contains the cooler, moister types associated with summer thermal cover. There is no recognized elk winter range in the project area, and little documented spring, summer or fall use by elk in proposed treatment units. Moose and mule deer are the primary big game species that use the project area in spring, summer and fall, and the project area currently serves as winter range for very low numbers of moose and deer.

A spring-summer-fall big game cover assessment model was developed for R1 eastside forests. This model calculates existing hiding cover as well as the acres that have the potential to provide cover, but have been impacted by either timber harvest or natural processes such as wildfire or insects and disease. Existing hiding cover is determined by tree canopy cover as presented in R1VMap data as having at least 40% canopy cover. Field surveys on the Gallatin Forest, including within the project area, have verified that forested habitats with at least 40% canopy cover are indeed capable of hiding 90% of a standing adult elk from human view at a distance of 200 feet or less (USDA 2013:12).

The Forest Plan contains a forest-wide standard to maintain at least two thirds of the hiding cover associated with key habitat components over time. Key habitat components include moist areas (wallows, etc), foraging areas (meadows and parks), hiding cover, thermal cover, migration routes and staging areas (see Figure 3.15). This standard applies to vegetation management projects, including timber harvest. Under the proposed action, mechanical thinning of mainly mature trees would immediately reduce the amount of functional hiding and thermal cover in the project area. However, as noted above, to do nothing could eventually have similar, or more impactive results. Field surveys conducted in summer 2012 and 2013 using a horizontal cover board and a standing adult elk decoy verified that all proposed treatment units currently contain hiding cover as defined by the Forest Plan. Of the proposed treatment units, only two (units 3 and 8) are predicted to maintain a canopy cover of at least 40% post treatment; i.e. would still provide hiding cover. We applied the eastside spring-summer-fall cover assessment model to the Kelly Canyon EAU to assess existing and “affected” hiding cover in the EAU. “Affected” hiding cover represents naturally forested habitats deemed capable of producing at least 40% canopy cover, but which have been recently altered through natural or managed processes that removed live trees and resulted in less than 40% canopy cover.

Figure 3.15: Key Habitat Features



The Kelly Canyon EAU was delineated based on known elk location data. Since the vast majority of elk use occurs on private land, the hiding cover model application was limited by a number of factors. First, since the majority (61%) of the EAU falls outside the forest boundary, and VMap data are only available for a 1-mile buffer outside the forest boundary, the hiding cover model only contains data for approximately 58% of the EAU. Second, the model has limited data regarding fire, timber harvest or other events that have affected potential hiding cover on private land. Third, a considerable proportion of the private land within the EAU but outside the forest boundary has been permanently converted from natural historic conditions to agricultural and or residential developments. Given these limits, the hiding cover model could not be used to provide complete or accurate values for existing and 'potential' hiding cover in the entire EAU. With these model limits in mind, results in the portion of the EAU for which VMap data are available (including both public and private land), show approximately 23% of the area to be forested habitat capable of producing hiding cover. Currently, only 19% of the area (but 80% of the forested capable area) has existing hiding cover. In other words, hiding cover is a minor habitat component in this EAU due to both natural processes and land management actions.

The forest wide standard to maintain two thirds of the hiding cover associated with key habitat components over time applies to NFS lands that are administered by the Gallatin National Forest (USDA 1987:II-14). Hiding cover model results for NFS lands are more reliable than for lands outside the forest boundary because of more complete and accurate data. In the Kelly Canyon EAU, there are approximately 11,253 acres of NFS land, of which only 3,980 acres have the potential to produce a forest canopy cover of at least 40%; i.e. to provide hiding cover for big game. The remainder includes natural openings such as naturally open forest (generally well below 40% canopy cover), meadows, bedrock, cliffs and scree, as well as permanently maintained openings including a number of the ski runs at the Bridger Bowl Ski Area. Of the capable NFS lands, approximately 926 acres have been recently affected by timber harvest, fire or other ecological processes such that they currently have less than 40% canopy cover. This leaves 3,054 acres, or about 77% of the NFS capable habitat in a condition that currently provides hiding cover. The proposed action calls for commercial timber harvest to improve forest health. Approximately 206 acres of proposed thinning are predicted to result in canopy cover of less than 40% post treatment. Project implementation would leave a total of 2,848 acres, or about 72% of the capable forest habitat in a condition where it would provide hiding cover. Seventy-two percent meets the requirement to maintain at least two thirds of the hiding cover on NFS lands administered by the Gallatin Forest within the EAU. In addition, treatment prescriptions include measures to maintain at least two thirds of the existing hiding cover associated with other key habitat components such as meadows, wet microsites and riparian areas within or adjacent to proposed treatment units (see Vegetation Analysis).

MA 11 contains an additional standard that timber management re-entry should not occur unless 40% or more of the drainage can be maintained in hiding and/or thermal cover. The proposed action involves re-entry into MA 11 designated habitat that contains previously harvested areas. Just as the forest-wide standard to maintain hiding cover applies to NFS land within the analysis area (EAU), the MA 11 standard only applies to MA 11 designated lands, but this standard (i.e. whether re-entry should occur) stipulates a condition (at least 40% hiding/thermal cover) that applies to the entire drainage. Since the Forest Plan does not specify which order of drainage is to be considered, and the project area involves multiple named drainages (Pine Creek, Slushman Creek and Maynard Creek) plus associated tributaries, we looked to the 6th code HUC of Bridger Creek drainage, which is part of the Kelly Canyon EAU and includes all affected smaller drainages, to evaluate the proposed action relative to this standard. This analysis area is based on hydrologic features that are biologically meaningful to wildlife, and therefore does not stop at the administrative boundary that delineates the Gallatin National Forest.

The Bridger Creek drainage is roughly 30,599 acres in size and includes not only NFS lands, but also includes private land both within and outside of the forest boundary. As with the entire Kelly Canyon EAU, this smaller analysis area is not entirely covered by R1 VMap data. However, the vast majority of

land not covered by VMap data is obviously not forested habitat with canopy cover >= 40%. Therefore, with a total of 5,021 acres of existing forest habitat with canopy cover of at least 40%, only about 16% of the drainage is currently providing hiding and/or thermal cover, so the proposed action (i.e. re-entry) cannot occur without a site-specific Forest Plan amendment. The existing condition currently does not meet the cover requirement for re-entry in MA 11, and the abundance of naturally occurring and permanently maintained openings is not conducive to ever achieving at least 40% hiding/thermal cover in this drainage. The existing condition coupled with the fact that insect activity will continue to reduce hiding and thermal cover in the project area in the absence of prescriptive treatment, all lead to a logical conclusion that a site-specific amendment to allow re-entry for the purpose of limiting adverse impacts from continued insect activity would not have significant effects to big game species.

Thermal cover is important to big game in the project area. Under the proposed action, mechanical removal of live trees, and to some degree dead trees, would immediately reduce available thermal cover. Since the project area is not known to be frequented by elk in summer or winter, impacts to thermal cover would primarily affect moose and mule deer, which have been identified as focal species for MA 11 in this project area. Removal of live trees would reduce the snow intercept function in winter and increase radiant heat impacts in summer. The snow intercept function of a live tree canopy is important for moose and deer as it restricts snow depth on the ground, allowing for easier access to forage and less energy expenditure required for movement. A live tree canopy also provides shade and thus opportunities for animals to cool themselves in summer. Removal of live large and small trees would reduce the horizontal cover provided by live tree boughs near the ground. These live boughs reduce the chilling effects of wind in winter and the heating/drying effects of sun and wind in summer. Therefore, removal through mechanical harvest would reduce the thermoregulation properties of existing vegetation.

Cumulative Effects

No Action Alternative

Cumulative effects to big game habitat in the Kelly Canyon EAU have occurred due to natural and managed processes, which have shaped the environment over time to produce the existing condition described above in the affected environment section. Under the no action alternative, the anticipated effect on big game habitat would be continued tree mortality due to unchecked insect activity. Dead trees have little or no value as thermal cover for big game. Over time, dead trees lose needles, branches, and eventually fall, resulting in a reduction in functional hiding cover as well. Hiding and thermal cover combined currently represent only 23% of the EAU for which we have adequate vegetation data (VMap). Areas of this EAU not represented by VMap data are visibly dominated by natural meadows, open agricultural fields and residential development. In other words, forested cover is a relatively minor component in this EAU; yet elk herds using this area are currently at or above state population objectives (J. Cunningham pers. comm. 2013). Nevertheless, forested cover is an important habitat component in this EAU, and further loss due to insect activity is not a desired condition for habitat management. No action would continue to contribute to heavy fuel buildup, which would eventually promote wild fire spread if an ignition occurs within or near the project area. Stand-replacing burns could have even more severe impacts on big game hiding and thermal cover than ongoing insect activity. However, insects, disease and wild fire are all natural ecological processes to which big game species have adapted over time.

Proposed Action

Cumulative effects to big game habitat due to past management actions and natural ecological processes are reflected in the existing habitat conditions described for the Kelly Canyon EAU. Forested cover is a relatively minor component in this EAU, partly due to the presence of natural meadows and openings, but

largely due to past land management practices including timber harvest on both public and private lands. While the effects of timber harvest are usually temporary and change over time as forests naturally regenerate, big game habitat in this EAU has also been permanently altered by habitat conversion to agricultural lands, as well as recreational and residential development. Forested cover is an important habitat component for big game, and further reductions at the EAU level due to timber harvest in the project area is not a desired condition for big game habitat management at this time. However, the purpose for proposed treatment is to maintain and improve forest health in the project area, which is currently facing an epidemic insect infestation. While immediate impacts to forest cover would result from proposed treatment, in the long run, we believe the proposed action will do more to maintain forest cover for big game species than under no action.

Cumulative effects to big game habitat in this EAU have also resulted from the development of an extensive transportation system that has facilitated resource management and development on both public and private lands over the past several decades. The existing road and trail configuration has resulted in relatively low levels of secure habitat (areas at least ½ mile distant from an open motorized route) throughout the EAU. The proposed action would not directly impact secure habitat because temporary project roads would only be built in non-secure habitat, and would be permanently closed upon project completion. However, security for big game species is still an important management consideration for NFS lands within this EAU. The Gallatin Forest Travel Management Plan decision was signed in 2007. The travel planning process considered big game security and habitat effectiveness across the entire forest, and helped to inform the final decision that effectively increased big game habitat effectiveness in some areas, while maintaining or reducing habitat effectiveness in other areas of the forest. Access management change resulting from Travel Plan implementation in the Kelly Canyon EAU included a slight decrease in total motorized access route density (TMARD) in the Bridger Canyon Travel Planning Area (TPA), which is where the project is located, but allowed for a slight increase in TMARD in the Bangtail TPA, which is also within the EAU.

Other past, present and reasonably foreseeable actions that have affected and are expected to continue to influence big game habitat and use in the EAU include livestock grazing, fire suppression as well as prescribed burning, recreational and residential use and continued development. Livestock grazing has occurred in this EAU for decades and is expected to continue at current levels into the foreseeable future. NFS lands in the EAU are located mainly on the Bridger side, whereas the Bangtail side is primarily private ownership. On the Bridger side, livestock grazing involves the Pine Creek cattle allotment, which overlaps the project area and typically runs 46 cow/calf pairs from July 1 to September 30 in a 2 pasture deferred rotation system. Livestock management in the EAU has resulted in some notable impacts, mainly in riparian areas where animals tend to congregate. Mitigation measures such as fencing and changes to grazing rotation systems have been implemented in recent years to reduce such impacts. Cattle may compete with big game (mainly elk) for forage, but forage is not a limiting factor in this EAU and livestock utilization standards are managed to minimize impacts to big game foraging habitat.

Recreation and residential development has altered big game habitat, while associated use has contributed disturbance impacts to big game species in the EAU. Given the close proximity of this EAU to the population center in Bozeman, residential and recreational development and associated use is somewhat higher in the Bridger and Bangtail Ranges than elsewhere on the Forest. Along with disturbance impacts from such use, direct mortality of big game species occurs as a result of hunting as well as road kills from vehicle strikes, mainly on Highway 86. Reasonably foreseeable future recreational development includes some minor development within the Bridger Bowl Special Use Permit boundary, as approved in their Master Development Plan. Most of the scheduled improvements that involve habitat alteration have already been completed. There is a reasonable expectation that as the local economy continues to grow, there will be a commensurate increase in residential development on private land, as well as a slight increase in recreational use on both public and private lands in this EAU.

Summary/Conclusions

The proposed action would likely have some short-term negative impacts on big game in the project area resulting from habitat alteration due to reductions in cover, as well as short term disturbance impacts due to noise from equipment and added human presence. These impacts may affect individual animals, but are not expected to affect population levels for elk (MIS), moose or mule deer (MA 11 focal species) across the Forest. Elk populations have consistently been maintained at or above state population objectives in the project vicinity in light of relatively high levels of habitat management and human use. Moose and deer populations have experienced fluctuations at local and regional scales, due to a variety of complex ecological factors. The major impact to deer and moose under the proposed action would be a reduction in hiding and thermal cover. While reductions in cover are not desirable in the project area, they are occurring anyway due to epidemic levels of insect activity. Proposed treatment is designed to reduce tree mortality from insects and improve overall forest health in the project area. Therefore, we feel that the proposed action, while imparting short-term negative impacts, would benefit elk, moose and deer over time by maintaining habitat integrity and providing cover to a higher degree than is expected under the no action alternative.

NORTHERN GOSHAWK

Affected Environment

Goshawks are identified in the Forest Plan as indicators for old growth dependent species in dry Douglas fir dominated sites (USDA 1987:II-19). In a 1998 status review of the species, the US Fish and Wildlife Service concluded that while goshawks use stands of mature and older forests, they are not dependent on old growth, and use a variety of forest habitats in meeting life history requirements (USDI 1998 *cited in* USDA 2009:5). Goshawks use large landscapes, integrating a diversity of vegetation types over several spatial scales to meet their life-cycle needs. This species has shown a pattern of nest site selection in mature forests with closed canopy and open understory, but is considered a forest habitat generalist at larger spatial scales; e.g. post-fledging areas and foraging habitat (USDA 2009:8). Northern goshawks have been seen throughout the Bridger Range. Occupied goshawk nest territories have been documented in the north Bridgers, but are more abundant on the west side of the range. There are at least two known occupied goshawk nests located on the west side of the Bridger Range (in 2013) that are within three to four sections of the project area, a distance of roughly four to five air miles, up and over a ridge.

Analysis Parameters

Spatial Boundaries

Goshawks use large landscapes, integrating a diversity of vegetation types over several spatial scales to meet life cycle needs (Squires and Kennedy 2006:21). Goshawk home ranges during the nesting season vary depending on gender and habitat characteristics, and have been reported to range from 1,400 to 8,650 acres (USDA 2009:8). Home ranges consist of the nest area, post fledging area (PFA) and foraging area. PFAs are the areas surrounding the nest site, that are used by family groups from the time the young fledge until they become independent of adults (Ibid:10). Mature forest stands with particular structural characteristics are typically selected for nesting habitat, but goshawks are considered habitat generalists at larger spatial scales. Size increases, as does habitat diversity from the nest area to the PFA to the foraging area. With the exception of the nest area and possibly some or all of the PFA, home ranges are not likely defended from other goshawks and home ranges of adjacent pairs may overlap (Ibid:9). In the Northern Region, an average home range size of 5,000 acres is recommended for analysis purposes (Ibid:31). Given these factors, we considered the 6th code HUC Bridger Creek drainage as an analysis area to

conduct the effects assessment for goshawks. Since much of this HUC consists of non-forest (including natural, agricultural and residential) areas outside the forest boundary, we restricted the project analysis area to the portion of this 6th code HUC that is within the Forest boundary in the Bridger Mountain Range. The resulting analysis area contains all proposed treatment units, and at approximately 6,376 acres in size, is large enough to contain at least one average goshawk breeding home range.

There is potential nesting and foraging habitat for the northern goshawk in the analysis area, but goshawks have not recently (i.e. within 20 years) been documented within the project area. Goshawks were not identified in breeding bird surveys conducted in the project area from 1988-1991, and were not detected in goshawk surveys conducted within the Bridger Bowl Ski Area SUP boundary in 2000. Additional goshawk surveys were conducted in the project area during the breeding season (June-July) of 2013. Standardized acoustical broadcast surveys were conducted within proposed treatment units. Given the relatively small size of units (4-27 acres) and the distance at which the broadcast calls can be heard (> 750 feet), we are confident that the calls played in proposed units could be heard in adjacent habitat as well. No goshawks were detected during these recent surveys.

Nesting habitat was estimated using the eastside assessment model for goshawks (USDA 2012). This model incorporates nest stand data for known occupied goshawk nest sites on eastside forests, and predicts the presence of suitable nesting habitat based on tree species dominance types, canopy cover and tree size. For eastside forest in the Northern Region, occupied goshawk nest sites on average occur in forested habitat dominated by Douglas fir or Ponderosa pine with tree canopy of at least 25%, and dominant tree size of at least 10 inches dbh. Nest sites are also found in lodgepole pine forest, with tree canopy cover of at least 40% and average tree size of at least 5 inches dbh. Within the analysis area of 6,376 acres, which is slightly larger than the average home range size (5,000 acres) of goshawks in the Northern Region, the model estimated a total of 2,439 acres of existing goshawk nesting habitat; or roughly 38% of the analysis area.

Foraging habitat was also evaluated based on tree size and canopy cover, as recommended in the Northern Region Goshawk Overview (USDA 2009:32). Foraging habitat estimates for the SBI analysis area were compared with habitat structure figures reported in the literature for goshawk post fledging areas (PFA) and home ranges. Foraging areas are found throughout the home range, encompassing both the nest stand and the PFA. Compared with results presented in the literature, the SBI analysis area for goshawks contains lower a percentage of smaller trees (i.e. seed/sap and pole), but is within the range reported for larger trees (i.e. mature). Notably, the proportion of tree canopy cover at least 40% in the project analysis area is lower than the range reported in the literature. This may be due in part to the higher proportion of natural non-forest vegetation in the analysis area, but is at least partly due to past vegetation management. Table 3.41 shows foraging area structural characteristics of the analysis area compared to ranges reported in the Northern Region Goshawk Overview (Ibid:12).

Table 3.41. Goshawk Home Range / Foraging Area Diversity Matrix

Habitat Component	Average Range[1]	SBI Analysis Area
Seedling/Sapling[2]	4-17%	2%
Pole[3]	6-66%	3%
Mature[4]	11-66%	57%
Canopy Cover >= 40%[5]	37-69%	22%
Non-forest Vegetation[6]	7-11%	38%

[1]Average range of vegetative conditions as reported in the Northern Region Goshawk Overview (USDA 2009:12)
[2]Seedling/sapling stage young conifer trees 0.0 – 4.9 inches dbh
[3]Pole stage conifer trees 5.0 – 9.9 inches dbh
[4]Mature conifer forest dominated by trees >= 10 inches dbh

[5]Canopy cover at least 40% and tree size at least 5 inches dbh; literature typically presents canopy >= 50%, but VMap data breaks canopy cover class at 40% (USDA 2009:32)
[6]Non-forest vegetation including grass, forb and shrub habitats in natural meadows or in permanently converted areas such as ski runs, residential and agricultural sites.

Direct and Indirect Effects

No Action Alternative

Under the No Action alternative, the project would not be implemented. There would be no commercial removal of timber product, (live or dead trees) from proposed treatment units in MA 11; however, areas within MA 2, Bridger Bowl Ski Area special use permit boundary, would continue to be managed under the ski area Master Development Plan, which could involve commercial timber harvest in some cases. Personal use firewood gathering could continue as allowed under the Forest Plan, but with limited public vehicle access, firewood gathering is not expected to occur at high levels, even though there is ample dead standing wood available. Therefore, under this alternative, there would be only minor changes in forest structure in proposed treatment units due to human activities. However, insects have already had a very notable effect on the project area, and this would be expected to continue at high levels in most cases if left untreated.

Indirect effects of no action would result in increased tree mortality over time. Without prescriptive treatment, persistent insect activity would continue to reduce live tree canopy cover, which is an important component of goshawk habitat. Standing dead trees do not provide canopy cover associated with high quality goshawk nesting habitat, but could still provide foraging habitat if sufficient nesting habitat remains intact in the vicinity. If left untreated, insect-related tree mortality would continue, adding to already high fuel loads, that if ignited, could result in large-scale stand replacement fire, which could have severe impacts on the forest structure that provides nesting habitat for goshawks. However, insects, disease and wildfire are all natural ecological processes to which goshawks have adapted in this ecosystem, and burned areas could still provide potential foraging habitat.

Proposed Action Alternative

Commercial thinning can alter forest habitat and thus affect suitability as nesting, post fledging and foraging habitat for goshawks. Habitat modification resulting from proposed treatment would reduce suitability for nesting habitat by reducing canopy closure. Up to 202 acres of existing goshawk nesting habitat would be affected by proposed treatment. However, most (~182 acres) of that is predicted to still have sufficient canopy cover (>=25% in Douglas fir and >= 40% in lodgepole) to provide nesting habitat for goshawks after project completion. In other words, only 20 acres of proposed treatment (in units 9 and 14) would reduce canopy cover to a point where it would no longer be considered potential nesting habitat. Therefore, out of the 2,439 acres of existing nesting habitat in the analysis area, the project would reduce suitable nesting habitat by less than 1%. Insect activity and resulting tree mortality has already affected canopy closure in proposed treatment units, and if left untreated, could reduce canopy cover to a level below that which is used by goshawks for nesting. The proposed action is designed to reduce and/or slow insect mortality and improve stand health, which would prolong the utility of habitat within the project area for use as nesting habitat.

Proposed treatment would alter foraging habitat as well. Thinning would not change the overall size class of trees in treatment units, but would reduce canopy cover and horizontal structure in treatment units, which could affect prey species composition, distribution and abundance. Also, because the habitat of many prey species is linked to structural components such as snags and down wood, changes in these habitat components could affect goshawk prey species composition and availability. Snag management

direction would be followed to maintain a proportion of these components within proposed treatment units. Of the habitat components listed for goshawk foraging habitat within the analysis area (see Table 3.41 above), only the proportion of area with canopy cover >= 40% would be affected by the proposed action. The majority (approximately 220 acres or 88%) of treatment is predicted to reduce existing canopy cover below 40%. In other words, the project would reduce the proportion of forest with at least 40% canopy cover within the 6,376 acre analysis area from the current 1,387 acres (22%) to 1,167 acres, or 18%, which is well below the range of 37-69% for this component reported in the literature (see Table 3.38). Indirect impacts of proposed treatment are expected as a result of overall improved health of individual forest stands. Over time, remaining healthy trees will grow larger, increasing canopy cover in treatment units. Treated areas are expected to retain more live trees than if left untreated. It is predicted that treated areas could achieve 40% or greater canopy cover more quickly than if left untreated and subject to ongoing insect activity.

Additional noise and human presence due to project activities could have disturbance effects if goshawks are present in the project area. At the local level, human disturbance near occupied goshawk nests, particularly during incubation, can cause nest failure, as nest abandonment by adults can result in exposure, starvation and/or predation of young. On the other hand, at least one study noted repeated nesting attempts by goshawks despite extreme disturbance (USDA 2009:20). There are no known occupied goshawk nests in the project area. Since proposed treatment is at least 3 sections away and on the other side of the ridge from the closest known occupied nest, we do not expect disturbance from project activities to be a major impact on breeding goshawks. Goshawk surveys will be repeated during the breeding season before and during project implementation, and if an occupied nest is found in the project vicinity, mitigation measures will be implemented to minimize disturbance and habitat alteration impacts.

Cumulative Effects

No Action Alternative

Cumulative effects to goshawk habitat have occurred due to natural and managed processes, which have shaped the environment over time to produce the existing condition described above in the affected environment section. Under the no action alternative, the anticipated effect on goshawk habitat would be continued tree mortality due to unchecked insect activity. Loss of live trees would affect habitat suitability for nesting, and to a lesser degree foraging. No action would continue to contribute to heavy fuel buildup, which would eventually promote wild fire spread if an ignition occurs within or near the project area. Stand-replacing burns may provide some foraging opportunities for goshawks, but are not expected to retain suitable habitat for nesting and post-fledging areas. Insect infestations are widespread in the Bridger Range, with resulting tree mortality reducing habitat suitability for goshawk nesting at a larger scale. However, insects, disease and wild fire are all natural ecological processes to which goshawks and their prey species have adapted over time.

Proposed Action Alternative

Cumulative effects to goshawk habitat due to past management actions and natural ecological processes are reflected in the existing habitat condition, which is described in the affected environment section and displayed quantitatively in Table 3.41. Generally lower canopy cover within the analysis area is a result of past timber management practices combined with natural processes such as insects, disease, wind, etc. The proposed action would continue the decline in average forest canopy cover within the analysis area; however this condition is expected to occur under the no action alternative as well. Timber harvest for wood production generally has temporary effects on goshawk habitat as natural regeneration and forest succession replenish forest structure over time. Permanent habitat alteration has occurred within the

Bridger Bowl Ski Area special use permit boundary, with trees cleared and thinned for ski runs and resulting openings maintained in perpetuity. Additional permanent habitat alteration has occurred with recreational development on Bridger Bowl's private land, as well as some residential development in the analysis area.

Disturbance effects in the analysis area primarily occur as a result of administrative activity associated with Bridger Bowl operations, habitat management and livestock operations in the analysis area, as well as some minor recreation use. Except for within the Bridger Bowl special use permit boundary, recreation levels are not as high in the analysis area as elsewhere in the Bridger Range because access is restricted to non-motorized use. The area gets some use by hikers, horseback and mountain bike riders in summer, plus a fair amount of hunting use in fall. These use levels are not expected to notably increase in the foreseeable future, but have additive effects when combined with disturbance impacts associated with the proposed action.

AMERICAN MARTEN

Martens are identified in the Forest Plan as indicators for old growth dependent species in moist spruce sites (USDA 1987:II-19).

Affected Environment

A recent synthesis of scientific information on marten habitat selection concluded that American martens are not restricted to mature and older forest structure, but in western, montane habitats, they appear to prefer mature and older coniferous forest types (Thompson et al. *In: Aubry et al 2012*:209, 213). This same publication reported that pine marten occupancy declines when 25-30% of the landscape is regenerating from previous timber harvest (Ibid:217). Martens are found in a variety of successional stages in coniferous habitat throughout the Gallatin Forest, although they appear to be more abundant in cool, moist types. Martens select for late-successional forest types with complex structure and abundant coarse, woody debris on and near the ground (Coffin et al. 2002:viii). Their preferred prey species, red-backed voles, are most abundant in mature and old growth mesic forest habitat (USDA 1994:7). Marten kits are born in spring (Mar-April). Trees, snags, logs and rocks make up the majority of reproductive den structures, with all known marten den sites found in woody material occurring in large structures characteristic of mature and old-growth forest. Natal den site locations have consistently been reported in habitat with well-developed characteristics of old growth forest, such as mixed tree species, multi-layered canopy, large tree diameters, high snag densities and abundant coarse woody debris with large diameter logs present (Ibid:17).

Pine marten occur in the Bridger Range, but at much lower densities than elsewhere on the Gallatin Forest. There are only two trapping records for pine marten in the Bridgers between 1985 and 2006, and these occurred near the Bridger Bowl Ski Area in 1990 (N. Anderson, J.Cunningham, pers. comm. 2014). Marten presence has been sporadically detected in track surveys and at baited camera stations during winter carnivore surveys conducted in the Bridger Range between 2000 and 2011. The most recent detection occurred in 2003, in a drainage located approximately 2 miles north of the project area. Martens have not been documented within the project area, but general winter carnivore surveys in the Bridgers did not include the project area. A project-specific snow track survey was conducted within and between proposed treatment units in March 2013. Tracking conditions were good due to recent snowfall, but marten tracks were not detected in this one-time survey.

The project area contains some of the cool, moist, mature forest conditions preferred by pine marten, although these conditions are more prevalent at higher elevations within the analysis area. Natural

processes and past land management activities have influenced the existing forest structure pattern within and adjacent to the project area. Recent and ongoing insect infestations have resulted in significant tree mortality within the project area, resulting in a notable decline in the mature, closed canopy forest habitat component. The analysis area for marten is currently dominated by mature Douglas fir mixed forest (57%) and non-forest areas such as grass, forb and shrub meadows (36%). Spruce and subalpine fir are sometimes present in Douglas fir mix forests, but spruce/fir dominated stands preferred by marten are a minor habitat component in the analysis area at just over 1% combined. Lodgepole pine is common in Douglas fir mix cover types, but lodgepole dominant stands are also a relatively minor habitat component at about 6% of the analysis area. Mature age structure (average tree size >= 10 inches dbh), which is typically selected by martens, is prevalent in nearly 88% of the forested stands. Old growth forest (a subset of mature), which often contains the vegetative structure preferred by martens, is estimated to occur in about 7% of the forest habitat within the analysis area. Although forest age structure within the analysis area is heavily skewed toward mature and older age classes, tree canopy cover is lower compared to mature forest elsewhere on the Forest, with only about one third of the forested areas currently at >= 40% canopy cover.

Analysis Parameters

Spatial Boundaries

There is considerable variation in marten home range size across the species' distribution. Female home ranges are considerably smaller than males, and a relatively small home range size has been reported for male martens in northwest Montana at 198 acres (Buskirk and Ruggiero 1994:27). A number of studies have shown that marten home range size is larger in managed (i.e. logged) areas than in unmanaged forests (Thompson et al. pp. 217-218 *in:* Aubry et al. 2012). In a study from southwest Montana, Coffin et al. (2002) reported that male martens in heavily logged (primarily clearcut) areas near West Yellowstone, had much larger home range sizes (8,030 acres) than in less disturbed areas elsewhere in Montana. However, the West Yellowstone study area was also located in xeric lodgepole pine habitat, which is generally poorer quality habitat for marten (Ibid:30). Given that the project area has been heavily managed in the past, coupled with a lack of documented marten presence in the project area in recent years, we assumed a larger home range associated with martens for our project area, similar to that found in managed forests near West Yellowstone. With this in mind, we selected the timber compartment (TC 504) containing the project area for a cumulative effects analysis area for marten. Timber compartment boundaries are based on topographic and hydrologic features that are biologically meaningful to wildlife and the timber compartment is the spatial scale at which relevant Forest Plan vegetation management standards are applied (see the vegetation analysis for more details). TC 504 is approximately 7,750 acres in size, which could contain at least one male home range even at the larger scale reported for martens, and would encompass multiple female marten home ranges.

Direct and Indirect Effects

No Action Alternative

Under the No Action alternative, the project would not be implemented. There would be no commercial removal of timber product, (live or dead trees) from proposed treatment units in MA 11; however, areas within MA 2, Bridger Bowl Ski Area special use permit boundary, would continue to be managed under the ski area Master Development Plan, which could involve commercial timber harvest in some cases. Personal use firewood gathering could continue as allowed under the Forest Plan, but with limited public vehicle access, firewood gathering is not expected to occur at high levels, even though there is ample dead standing wood available. Therefore, under this alternative, there would be only minor changes in forest structure in proposed treatment units due to human activities. However, insects have already had a

very notable effect on the project area, and this would be expected to continue at high levels in most cases if left untreated. Persistent insect activity would continue to reduce live tree canopy cover, which is an important component of marten habitat (Coffin et al. 2002:30). Standing dead trees do not provide canopy cover associated with high quality marten habitat, but dead and down trees do provide coarse woody debris, which is a key component for reproductive denning habitat (USDA 1994:17) and also facilitates access through winter snow cover (Coffin et al. 2002:14).

Indirect effects of no action would result in increased tree mortality over time, with potential for complete stand replacement. Information specific to marten use of insect-killed forest has been presented only for one study in Newfoundland. In this case, martens were reported to have used old, open, insect-killed forest habitats, and also to utilize newly regenerating stands with dense trees at least ten feet tall (Thompson et al. *In: Aubry et al 2012*:217). However, this study occurred in an area where there are few predators and competitors of marten (Ibid:228). If left untreated, insect-related tree mortality would continue, adding to already high fuel loads that if ignited, could result in large-scale stand replacement fire, which could have severe impacts on the forest structure important to martens. Across North America, studies have shown that wildfire effects were similar to timber harvest regarding habitat alteration and marten occupancy (Ibid).

Proposed Action

A common theme in the literature is that commercial timber harvest is associated with declines in marten occupancy of affected areas (Thompson et al. *In: Aubry et al 2012*:217). Commercial timber harvest alters habitat structure by removing overhead cover and coarse woody debris. Overhead cover provides martens protection from predators and coarse woody debris is used for travel, resting and denning purposes (USDA 1994:24-25). Although clear cutting is the primary harvest method examined in marten habitat studies, partial harvest methods, such as the thinning proposed for the SBI project, can also impact marten use of habitat. One study in Maine found that martens continued to use treated stands with a residual basal area of 18 m^2/ha (roughly 78 ft^2/ac) and canopy cover of at least 30%. Another study in Quebec found continued marten use in partially harvested areas with at least 40% canopy cover. Although these studies occurred in the eastern part of North America where forest habitats conditions differ from western regions, the parameters (basal area and canopy cover) are similar to those predicted with proposed treatment in the SBI project (80-100 ft^2/ac basal area and 30-45% canopy cover). In the project area, overhead cover is currently declining due to insect activity and resulting live tree mortality. Prescriptive thinning is targeted to reduce tree mortality from insect activity and improve overall stand health. Therefore, the proposed action has greater potential to preserve suitability of treated stands than does the no action alternative. Under the proposed action, snag management direction would be implemented to retain a proportion of standing dead trees and down logs, which are important components of marten habitat.

An indirect effect of timber harvest can be creating easier access for fur trappers to marten habitat, particularly if roads used to access timber are open to motorized use by the public (Coffin et al. 2002). Roads in the project area are generally not open to motorized use by the public, and the entire area is closed to public snowmobile use in winter. These factors minimize the potential for increased trapping to be an indirect impact on marten in the project area.

Disturbance effects would most likely have impacts on martens during winter/spring, which is a critical time period since weather conditions are more extreme, food sources may be limited, and thermoregulatory demands are high. Reproductive females have the added energetic demands of developing fetuses, giving birth and nursing young during this time. Although winter logging would not be prohibited for the project, there is minimal likelihood of logging activity in winter, since the primary access road would not be plowed during Bridger Bowl's operating season. Spring logging could occur,

but this is also unlikely due to the limited operating period between Bridger Bowl closing and spring break-up, when project activities would again be restricted to protect soils and facilities.

Cumulative Effects

No Action Alternative

Cumulative effects to marten habitat have occurred due to natural and managed processes, which have shaped the environment over time to produce the existing condition described above in the affected environment section. Under the no action alternative, the anticipated effect on marten habitat would be continued tree mortality due to unchecked insect activity. Over time, dead trees would contribute coarse, woody debris, which is an important component of marten habitat for travel, resting and denning purposes. No action would continue to contribute to heavy fuel buildup, which would eventually promote wild fire spread if an ignition occurs within or near the project area. Stand-replacing burns result in early stand-initiation stage vegetation, which may not be suitable for use by marten for a period of approximately 40+ years (Thompson et al. *In: Aubry et al 2012*:228). Insect infestations are widespread in the Bridger Range, with resulting tree mortality reducing habitat suitability for marten at a larger scale. However, insects, disease and wild fire are all natural ecological processes to which marten and their prey species have adapted over time.

Proposed Action Alternative

Cumulative effects to marten habitat due to past management actions and natural ecological processes are reflected in the existing habitat conditions. Generally lower canopy cover within the analysis area is a result of past timber management practices combined with natural processes such as insects, disease, wind, etc. The proposed action would continue the decline in average forest canopy cover within the analysis area; however this condition is expected to occur under the no action alternative as well. Old growth is a relatively minor habitat component within the analysis area, and at an estimated 7%, is less than the forest-wide minimum standard of 10% within a timber compartment. The vegetation analysis addresses this condition in more detail. Bridger Bowl Ski Area development has had a notable impact on marten habitat, with trees cleared and thinned for ski runs and resulting openings maintained in perpetuity. Hazard tree removal associated with ski area operations has reduced the availability of the coarse woody debris habitat component for martens. Some limited firewood gathering in the analysis area has also potentially affected this habitat component, but restricted public vehicle access limits this impact within the analysis area. Fur trapping can have significant impacts on marten populations, and forest management such as timber harvest can improve access for trappers by opening travel ways. Trapper access to the analysis area is already limited by private land, as well as snowmobile area closures on public land. Also, the analysis area currently does not contain high quality marten habitat compared to other areas on the forest, so fur trappers are not likely to be attracted to this area for marten.

SUMMARY/CONCLUSION – MIS AND MA 11 FOCAL SPECIES

Forest level monitoring has indicated that MIS populations are generally stable to increasing on the Gallatin Forest. The proposed treatment is designed to improve stand health within treatment units by reducing tree mortality from insects. This project is intended to maintain healthy, resilient forest habitat over the short and longer term. Most of the MIS and MA 11 focal species depend upon intact forest structure for at least some part of their life cycle. Therefore, while this project may have short term negative effects through habitat alteration and/or disturbance, in the long run, it would maintain habitat suitability for MIS to a greater degree than would the no action alternative. In summary, while the proposed action may have short-term negative effects and long-term benefits for individual animals, these effects would be too minor to have impacts at the population level for MIS.

Applicable Direction

The National Forest Management Act (NFMA) requires the Forest Service to provide for a 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 Gallatin Forest Plan contains a forest-wide goal to provide habitat for viable populations of all indigenous wildlife species and for increasing populations of big game animals (USDA 1987:II-1) and a forest-wide standard that population trends of indicator species and relationships to habitat changes are to be monitored (Ibid:II-18, IV-6). The expected precision and reliability for this monitoring is "moderate" and the reporting interval is 5 years.

Aside from general direction for MIS, the Forest Plan does not contain specific direction for northern goshawk or pine marten. Elk is the MIS chosen to represent big game species. The Forest Plan contains forest-wide standards to manage big game winter range to meet the forage and cover needs of deer, elk, moose and other big game species in coordination with other uses, and to maintain at least two thirds of the hiding cover associated with key habitat components over time. Key habitat components are important features for wildlife that include moist areas (wallows, etc), foraging areas (meadows and parks), hiding cover, thermal cover, migration routes and staging areas; these features are to be mapped on a site-by-site basis for project analyses (USDA 1987:II-18).

Most of the proposed treatment (~195 ac, or 82%) is located in Forest Plan Management Area 11 (MA 11). MA 11 is described in the Forest Plan as forested big game habitat, with goals to: maintain habitat effectiveness following timber harvest, base vegetation management on vegetative characteristics needed for featured wildlife species, and allow a level of timber harvest consistent with these goals. Since MA 11 is identified as big game habitat, featured wildlife species include mule deer, moose, and to a lesser extent, elk. Mule deer are the most common big game species to use the area, and the project area provides year-round range for moose. Some elk use occurs in the project area, but at much lower levels than elsewhere in the Bridger Range, and across the Gallatin Forest in general. MA 11 (USDA 1987:III-34) contains standards for timber management to: design timber harvest on big game winter range to enhance winter range capability; design even-aged openings so no point is more than 600 feet from cover; and unless vegetative characteristics established for elk indicate otherwise, follow guidelines for scheduling timber sales as follows:

1. Duration of Activity
    a. Restrict sale activities to no longer than five (5) consecutive years
2. Re-entry
    a. A minimum of two (2) years inactivity following 1-3 years of consecutive activity, or a minimum of five (5) years following 4-5 years of consecutive activity
    b. Re-entry should not occur unless 40% or more of the drainage can be maintained in cover (20% hiding, 10% thermal, 10% hiding or thermal cover).
3. Security Areas
    a. Provide security areas immediately adjacent to the influence zone of the project area. Security areas typically should be 5,000 acres or larger, contain a similar complement of vegetative habitat components that existed in the influence zone, and be in areas that are roadless or where open road density is 1 mi/mi^2 or less.

The remaining treatment (units 1, 2, 18 and part of 7) are located within Management Area 2 (MA 2), which is the portion of the Bridger Bowl Ski Area under special use permit. These units amount to roughly 42 acres, or 18% of proposed treatment area. MA 2 is classified as unsuitable for timber production, but allows tree removal for reduction of safety hazards and to maintain a healthy and diverse vegetative pattern. There are no wildlife standards in MA 2 that apply to the proposed South Bridger Interface project.

In addition to direction prescribed by law and contained in the Forest Plan, the USFS Northern Region developed a Northern Goshawk Overview document (USDA 2009) which compiled the best available science and existing knowledge about the northern goshawk and its habitat needs, and provides a consistent approach to analyze available goshawk habitat and other management considerations for use during the environmental analysis process.

Consistency with Applicable Direction

The NFMA requires the Forest Service to provide for a diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet multiple use objectives. Monitoring population trends of MIS relative to changing habitat conditions across the entire Forest helps us to evaluate whether we are meeting the intent of NFMA to provide biodiversity at an appropriate landscape scale. The purpose and need for this project is to maintain healthy, resilient forest habitat in an area that has been hard-hit by recent and ongoing insect infestations. Tree mortality from insect damage is widespread in the Bridger Range. Large tree mortality has occurred in the project vicinity, primarily a result of defoliation by spruce budworm in Douglas fir stands, but mountain pine beetle has also had a considerable impact on lodgepole pine in the area (see vegetation analysis). The proposed action is designed to reduce the ongoing tree mortality due to insect activity. Insects and disease are a natural disturbance process in forest habitat. Wildlife have evolved with native forest insects, and these forest "pests" also have beneficial functions as a prey base for other species, nutrient cyclers, regulators of productivity, and a natural part of forest succession. However, with insect activity at epidemic levels in parts of the Bridger Range including the project area, dead and dying trees are not a limiting habitat component, and are in fact a major habitat component in many areas. By reducing susceptibility to insects and disease in proposed treatment units, the project would promote habitat diversity in an area that may otherwise soon be a monoculture of dead, dying, and eventually early stand-initiation stage forest. By retaining healthy mature trees in treatment units, the proposed action would help maintain a diversity of forest structure, which would in turn provide for a diversity of plant and animal communities.

The Forest Plan contains a forest-wide standard that population trends of indicator species and relationships to habitat changes are to be monitored (USDA 1987: II-18, IV-6). Since population trends for Gallatin NF MIS can only be detected over time and over a relatively large landscape scale, the project level analysis is neither the intended nor the appropriate level to assess management compliance with this standard. The appropriate geographic scale to evaluate this standard is across the entire Gallatin National Forest (i.e. the planning unit), and the Forest Plan dictates a reporting period of 5-year intervals for this standard. The Landscape Scale Assessment contained in this report shows the forest to be in compliance with this standard (having last assessed MIS population trends relative to habitat conditions on the forest in 2011). This forest-level assessment provides context for the project level analysis of direct, indirect and cumulative effects associated with the proposed action. Aside from general direction to monitor population trends for MIS, the Forest Plan does not contain specific direction for northern goshawk or pine marten.

The Forest Plan contains a forest-wide standard to manage big game winter range to meet the forage and cover needs of deer, elk, moose and other big game species in coordination with other uses. The project area provides moose winter range primarily in willow/riparian habitats, but also in dense spruce/fir cover types where available; however, it does not contain high quality winter range for deer or elk (J. Cunningham, pers. comm. 2013). Canopy cover is the limiting factor for moose winter range, as it provides a snow intercept that allows for easier movement and access to forage. Willow/riparian habitats would be protected through implementation of streamside management zone buffers. While the proposed action would initially reduce canopy cover in forested stands and have subsequent impacts on moose winter range, the long term benefit would be to maintain some degree of mature trees in the canopy, as

opposed to potentially losing the entire canopy to mortality from insects. The proposed action is more consistent with meeting this Forest Plan direction than are the potential results of no action.

The forest-wide standard to maintain at least two thirds of the hiding cover associated with key habitat components over time would be met with approximately 72% of the hiding cover maintained on NFS lands within the EAU after project implementation. Key habitat components are important features for wildlife that include moist areas (wallows, etc), foraging areas (meadows and parks), hiding cover, thermal cover, migration routes and staging areas; these features are to be mapped on a site-by-site basis for project analyses (USDA 1987:II-18). Figure 3.15 contains a map of key habitat features for the project areas. Hiding cover would be maintained around discrete features such as moist sites and foraging areas through streamside buffers and site-specific prescriptions that retain 40% canopy cover (100-120 foot basal area) within 50 feet of meadow edges in treatment units.

MA 11 standards to design timber harvest to enhance winter range capability would be met by prescriptions intended to maintain some degree of canopy cover to provide snow intercept for wintering moose and mule deer, as opposed to the no action alternative which could result in total loss of canopy cover. Thinning prescriptions would not leave large (600 foot) even-aged openings. Mitigation measures would restrict sale activities to no longer than five consecutive years. Re-entry timing would be met since there has been no timber harvest activity in the MA 11 portion of the project area in recent (at least 5) years. However, re-entry cover criteria for the drainage would not be met, and would require a site-specific Forest Plan Amendment. Security areas of over 5,000 acres in size have been identified adjacent to proposed treatment areas and within the analysis area (EAU). Additional contiguous security areas are available outside the EAU.

The Northern Region Goshawk Overview document (USDA 2009:39) provides recommendations for minimizing habitat alteration and disturbance effects within known occupied goshawk home ranges. The project analysis area does not contain any known goshawk nest sites, and is not within the estimated home range of any known goshawk nests in the vicinity. Surveys will be repeated before and during project implementation to discover any new or previously unknown nests in the project area. If any occupied goshawk nests are found within the project area, mitigation measures will be applied to minimize impacts to breeding goshawks and their young. Regardless of occupation within the analysis area, the Regional Overview recommends that vegetation management projects be designed to maintain at least 240 acres of nesting habitat per 5000-acre potential home range/foraging area for goshawks. Within the 6,376-acre analysis area, there are 2,439 acres of existing nesting habitat estimated with the eastside assessment model for goshawk nesting habitat. The proposed action would reduce nesting habitat by approximately 20 acres, leaving 2,419 acres available, or roughly ten times the recommended minimum.

MIGRATORY BIRD SPECIES

Migratory birds are a very diverse group, which includes raptors, waterfowl, shore birds, upland game birds and songbirds. Migratory bird species are protected under the Migratory Bird Treaty Act (MBTA). Executive Order 13186 requires agencies to ensure that environmental analyses evaluate the effects of federal actions and agency plans on migratory birds, with emphasis on species of concern (SOC). Montana Species of Concern (MFWP 2013, MNHP 2013) and Birds of Conservation Concern for the Northern Rockies (USDI 2008) were used to identify focal species for this project. Migratory bird SOC for this project include those that have been detected in the project vicinity, or for which the project area contains suitable habitat. A number of migratory bird SOC were previously addressed under separate headings, including: bald eagle, peregrine falcon and black-backed woodpecker (sensitive species) and northern goshawk (MIS). Other migratory birds SOC that could potentially be impacted by the proposed

treatment include: **Brown creeper, Cassin's finch, Clark's nutcracker, Evening grosbeak, Golden eagle, Great gray owl, Olive-sided flycatcher, Pileated woodpecker and Williamson's sapsucker**. This section will address those SOC not previously analyzed in other sections of this report.

Affected Environment

The Gallatin National Forest provides breeding habitat for dozens of migratory bird species. This extremely diverse group occupies all types of habitat in the project area including streams, wetlands, riparian areas, grass/forb meadows, shrub lands, deciduous forest, coniferous forest, mixed forest and rock outcrops. Within the project area, forested habitats provide trees, shrubs, snags, and surface vegetation for nesting birds. Open meadows provide habitat for ground nesters. Riparian areas support a high diversity of migratory bird species. Rock outcrops provide ledges, cracks and crevices as nesting areas for a number of species. Forage is abundant in the project area with birds, small mammals, and insects providing prey for a number of species. Seeds, berries and other vegetative food sources are also abundant. Recent insect infestations have produced an abundance of dead and dying trees, which provide snags and down logs for cavity nests and perches, as well as an insect prey base (see Vegetation Analysis for more detailed information on insect mortality and resulting snag and coarse woody debris availability in the project area and surrounding vicinity). The SOC identified for this project are all associated with forested environments, and utilize a variety of habitat structures as summarized below. Additional information is contained in the project record.

Table 3.42: Species of Concern in the Project Area

Species	Habitat Preference
Brown creeper	Dense, coniferous forest. Old growth, rarely logged.
Cassin's finch	Coniferous forest. Post-fire, partial cut forest
Clark's nutcracker	Coniferous forest. Areas of high conifer seed production.
Evening grosbeak	Coniferous forest, including harvested stands
Golden eagle	Cliff ledges, large trees with meadows and open forest for hunting
Great gray owl	Dry montane forest with broken top snags and tree stumps for nesting. Open areas for hunting.
Olive-sided flycatcher	Open forest with abundant snags. Post-fire, and previously harvested stands.
Pileated woodpeckers	Harvested and uncut mid-elevation coniferous forests with large trees. Rarely east of Continental Divide.
Williamson's sapsuckers	Heavily harvested coniferous forest that retains green trees.

Breeding bird surveys were conducted within the project area from 1988-1991. All of the migratory bird SOC described in this section were observed within the project area during these surveys. The Golden eagle and Pileated woodpecker observations were made during field activities incidental to the breeding bird survey counts, but all other SOC listed above were detected at breeding bird survey points within the project area. Brown creeper and Cassin's finch were commonly detected (> 30 times) and the rest; Clark's nutcracker, Williamson's sapsucker, Olive-sided flycatcher, Evening grosbeak and Great gray owl were not commonly detected (< = 30 times) at survey points (Moore 1991:24-25).

Applicable Direction

Management direction regarding conservation of migratory bird species primarily falls under the umbrella of the Migratory Bird Treaty Act (16 USC 703-712). The MBTA implements various treaties and

conventions for the protection of migratory birds, which makes it unlawful to take, kill or possess any migratory birds, except as regulated by authorized programs. Presidential Executive Order (EO) 13186 clarifies the responsibilities of federal agencies in providing for the conservation of migratory bird species under the MBTA. An interagency Memorandum of Understanding (MOU) between the Forest Service and the US Fish and Wildlife Service (2008) requires the Forest Service to evaluate the effects of agency actions on migratory birds, with emphasis on species of concern along with priority habitats and key risk factors. The Forest Service is required to evaluate and balance the long-term benefits of projects against any short- or long-term adverse effects of actions, and to consider approaches for identifying and minimizing take that is incidental to otherwise lawful activities.
With respect to migratory birds, the Gallatin Forest Plan (USDA 1987) contains forest-wide standards relevant to specific sensitive species, which were addressed as a separate topic above. Management Area (MA) 7 consists of riparian areas, much of which is not mapped because it is often a narrow zone, and therefore not practical to map. When riparian habitat conditions are found within any other MA, riparian standards will be applied. This includes a standard to maintain suitable habitat for those species of birds that are totally or partially dependent upon riparian areas for their existence (Ibid:III-19).

In 2000, the USDA Forest Service Northern Region developed the *Northern Region Snag Management Protocol* (NRSMP) as "an optional snag retention standard… to replace the Upper Columbia River Basin interim standard for National Forests that choose to use it" (USDA 2000:3). The Gallatin National Forest chose not to adopt the NRSMP because the analysis used to develop the protocol focused on forested habitats west of the Continental Divide, which contain substantially different habitat types than are found on the Gallatin and other national forests east of the divide. The Gallatin Forest Plan contains forest-wide standards for snag management (Amendment No. 15) to accommodate the needs of cavity nesting birds in conjunction with timber harvest activities.

Direct and Indirect Effects

No Action Alternative

Under the No Action alternative, the project would not be implemented. Bridger Bowl Ski Area would continue to be managed under the ski area Master Development Plan, which could involve commercial timber harvest in some cases. Personal use firewood gathering could continue as allowed under the Forest Plan, but with limited public vehicle access, firewood gathering is not expected to occur at high levels, even though there is ample dead standing wood available. Therefore, under this alternative, there would be only minor changes in forest structure in proposed treatment units due to human activities. However, insects have already had a very notable effect on the project area, and this would be expected to continue at high levels in most cases if left untreated. Insect activity is expected to continue without treatment, which would provide an important prey base for a variety of insectivorous migratory bird species.

Indirect effects of no action would result in increased tree mortality over time. Without removal through logging, some dead trees will eventually fall, resulting in a greater abundance of coarse woody material (standing snags and downfall) and potentially, few if any live trees remaining. Standing dead trees provide nesting and foraging habitat for snag-dependent migratory bird species, and also provide perch trees for habitat generalists. Tree mortality would also promote growth of grass, forbs and shrubs, which would favor some migratory bird species that prefer to nest and forage near the ground. However, other species, such as those that require forest interior for breeding habitat, or those with more generalist habitat associations, but require large, live trees for nesting or foraging, would be negatively impacted by continued tree mortality under the no action alternative.

Proposed Action Alternative

Habitat modification through logging can alter the quality and quantity of habitat available for migratory bird species by changing vegetative structure and composition. Consequently, silvicultural practices have the potential to influence migratory bird distribution and abundance. While habitat alteration can have negative impacts to some bird species, other species could benefit from habitat modifications associated with proposed treatment.

Bird surveys on the GNF were previously completed to compare overall bird abundance (number of individual birds) and species richness (number of different species) in harvested stands with uncut mature and old growth stands resulting from the Pine-Slushman timber harvest in 1985-1986. Survey results indicated:

- Total abundance of birds was significantly greater in old growth stands than in either mature uncut or harvested stands,
- There was little difference in bird abundance between mature uncut and shelterwood harvest units.
- No significant difference in bird abundance was found relative to canopy cover, but clear-cut units with < 10% canopy cover remaining had the lowest number of birds, while moderately open canopy stands (40-59% overstory canopy cover) had the largest number of birds.
- No significant difference in species richness (number of bird species) was detected based on canopy closure. (Moore 1991:5).
- Although old growth stands had the highest number of bird species per stand per year, the shelterwood cut had the highest number of species recorded over the four-year period (Ibid:24).

None of the stands identified for treatment outside the ski area boundary currently meet the criteria for old growth (see vegetation analysis for this project). All of the stands proposed for treatment are currently in a mature successional stage with varying levels of canopy cover. Proposed treatment would reduce the canopy cover to 30-45%, but would not change the overall stand age. Since breeding bird surveys in the project area did not identify significant differences in bird abundance or species richness between mature, uncut stands and mature, shelterwood cut stands, the proposed action would not likely result in significant changes in overall bird abundance or species richness in the project area, and therefore would not have negative effects on migratory bird populations or species diversity at the project level or landscape scale.

Snags (standing dead trees) are an important habitat component, used for nesting, roosting and foraging by a number of migratory bird species. Coarse woody debris (fallen snags and larger dead, down woody material) also provides foraging substrates, perches and cover for migratory birds. Due to recent insect infestations, these habitat components are currently abundant within the project area and surrounding vicinity. Proposed treatment would directly reduce the availability of snags and coarse woody debris within the treatment units by removing dead and dying trees on up to 250 acres. The proposed action would indirectly affect the future availability of snags and coarse woody debris in treatment units and perhaps adjacent forest by retarding the spread of insect infestation and consequently reducing snag/coarse woody debris recruitment in the project area. Proposed treatment would also reduce fuel loading in treatment units, which would decrease the potential for stand-replacing fire, another indirect effect that could impact future snag and coarse woody debris availability. Forest Plan Snag Management direction would be followed so that at least 30 snags (standing dead trees at least 10 inches dbh and 18 feet tall) would be retained per 10 acres of treatment.

Species of concern identified for the project have various habitat preferences, so that proposed treatment could have negative impacts on certain SOC, while having neutral or even beneficial effects for other SOC.

As many migratory birds are known to use a variety of habitat conditions, including cut and uncut forest, it is difficult to make definitive predictions about potential project impacts for bird SOC. However, while individual birds, breeding pairs or family groups might be affected, the effects summarized in Table 3.43 below would be too minor to have impacts to any species at the population level because the area treated is so small and there is an abundance of this habitat available. Further, under the no-action alternative, stand conditions are changing due to insect mortality. These naturally-occurring changes would likely have similar impacts as are expected to occur with proposed treatment.

Table 3.43: Effects to Migratory Birds

Species	Survey Results/Habitat Preferences	Effects of Proposed Action
Brown creeper	Surveys indicate brown creepers are more abundant in uncut old growth and mature stands.	Negative
Cassin's finch	Surveys indicate the Cassin's finch is significantly more abundant in harvested stands	Positive
Clark's nutcracker	Survey results varied. Detected in both harvested and uncut stands associated with old growth.	Neutral
Evening grosbeak	Habitat associations not specifically noted in surveys. Detected in both harvested and uncut stands. As this species feeds heavily on spruce budworm, there is potential for negative impacts to grosbeaks.	Neutral to negative
Golden eagle	Removal of dead, dying and live trees could reduce or eliminate potential nesting sites for golden eagles; however potential nest trees would be retained in treatment units, and outside treated areas.	Neutral
Great gray owl	Habitat associations not specifically noted in surveys. Detected in uncut stands and known to use harvested areas for hunting.	Neutral
Olive-sided flycatcher	Limited detections note olive-sided flycatchers were recorded in harvested and post-fire stands. Proposed thinning could benefit this species by creating post-treatment stand structure more attractive to this species.	Positive
Pileated woodpeckers	Uncommon on GNF. Feeds on insects and nests in cavities, so reducing insect infestations and snags could have negative impacts on pileated woodpeckers.	Negative
Williamson's sapsuckers	Survey results varied. Deteced in both harvested and uncut stands associated with old growth. Proposed thinning could benefit the Williamson's sapsucker by creating a post-treatment stand structure more attractive to this species.	Possibly positive

While habitat alteration could have beneficial, neutral or negative effects on migratory birds relative to the diverse range of habitat requirements, disturbance factors could have negative impacts on any migratory birds present during project operations. Spring is the critical breeding time for migratory birds. Pair formation, nest construction, egg-laying, brooding and nestling care, occurs for most species during the period from about the end of March through the end of June. Throughout most of the Forest Service Northern Region, young birds have fledged, and the breeding season is over by about mid-July (Hutto et al. 1998:8).

Project activities that occur during the migratory bird breeding season could result in the physical destruction of occupied nests, which would likely result in egg/nestling mortality. Disturbance associated with project activities during the nesting season could cause reduced parental care and/or nest abandonment, which could affect nestling survival rates, and possibly result in reproductive failure for some breeding pairs. Birds may change nest locations in response to human disturbance. Alternate nest sites may be less suitable in terms of security and thermal cover, availability of foraging habitat, perch sites, and other important habitat components. Disturbance outside the breeding season can influence a bird's energy balance, and consequently affect survival rates (Knight and Gutzwiller 1995:52, 55, 73). Project implementation could occur over up to five consecutive seasons. Since logging operations would generally occur after snowmelt when the area becomes accessible by vehicles, it is possible that some migratory birds may already be nesting in the project area, and could therefore be disturbed and/or displaced each year by project activities. Project activities that occur after July 15 would have the least impact on breeding birds, since most young birds have fledged and are independent of the nest by that time.

Cumulative Effects

No Action Alternative

Cumulative effects to migratory bird habitat have occurred due to natural and managed processes, which have shaped the environment over time to produce the existing condition described above in the affected environment section. Under the no action alternative, the anticipated effect would be continued tree mortality due to unchecked insect activity. Over time, dead trees would contribute snags and down logs, which are important habitat components for some bird species. No action would reduce the availability of live trees as nesting and foraging habitat through continued defoliation and mortality of live trees. Continued fuel buildup from insect-killed trees would contribute to heavy fuel loads, which would eventually promote wild fire spread if an ignition occurs within or near the project area. Some bird species show strong habitat preferences for recently burned habitat, while others, such as those associated with interior forest, would be displaced. Ultimately, insects, disease and wild fire are all natural ecological processes to which migratory birds and their prey species have adapted over time.

Proposed Action

The 1,850 acre project area was used for analysis of cumulative effects as well as direct and indirect effects for migratory birds. By definition, migratory bird species occupy habitat in different countries during different seasons, sometimes moving thousands of miles between breeding and wintering grounds. Because they are so wide-ranging, the geographic scope of evaluation for cumulative effects could conceivably be huge, including multiple continents. It is unreasonable to expect a thorough evaluation of all human activities that could affect migratory birds in all their potential habitats. Therefore, we limited the geographic scope of effects analysis to lands within the project area for various reasons. All proposed treatment units are fully contained within the project area boundary. Land within this area provides adequate habitat for potentially hundreds of individual pairs of birds to establish home range for the occupied season, which is generally the breeding season for most migratory bird species. Finally, we have no control over what might happen to birds or their habitat in other countries, which is primarily winter range.

Actions that could impact migratory bird species in the project area and have cumulative effects with the proposed action include past activities such as timber harvest, firewood gathering, road construction, recreational and residential development, fire suppression and livestock grazing, which collectively have shaped the existing landscape pattern and habitat structure present for migratory bird species today. Personal use firewood gathering can have additive effects on the availability of snags, but limited public

motorized vehicle access in the project area has kept this activity to very low levels over time. Livestock grazing is authorized at relatively low levels (46 cow-calf pairs) within the project area. Livestock use in the project area could be having minor habitat and disturbance impacts through grazing and trampling in grassland, shrub and riparian habitats, which can reduce available nesting cover and cause birds to make avoidance flights. Livestock come into the project area on July 1, but most young birds have fledged, and the breeding season is concluded by about mid-July in this area, so disturbance impacts would be limited in duration. Other ongoing activities such as recreational, residential and administrative uses contribute disturbance factors through noise and human presence.

Summary/Conclusion

Given the extreme variation in habitat needs across the spectrum of migratory bird species that may use the project area at some point, habitat modification resulting from the proposed action could have negative impacts on some individual birds while at the same time benefiting or having no effect on others. However, considering existing and predicted impacts from insect activity, habitat modification is occurring and expected to continue at a noticeable rate in the project area. Noise and disturbance from equipment and increased human presence associated with the proposed action would have negative impacts on birds of species likely to be present. Considering the limited geographic scale (maximum of 250 acres of treatment) and the limited temporal scale (major activities completed over three consecutive years with total project implementation completed within five consecutive years), neither habitat alteration nor disturbance impacts are expected to affect (positively or negatively) the numbers of birds that would have impacts at the population level for any of the migratory birds species that may be affected.

Consistency with Applicable Direction

Management direction for conservation of migratory bird species primarily falls under the umbrella of the Migratory Bird Treaty Act (MBTA). Under the MBTA it is unlawful to take, kill or possess any migratory birds, except as regulated by authorized programs. Vegetation management on NFS lands is an authorized program. Mitigation measures are recommended to minimize incidental take of migratory bird species. Executive Order 13186 requires agencies to evaluate the effects of federal actions on migratory birds with emphasis given to species of concern, and also to weigh the long-term benefits of projects against any short-term adverse effects. The analysis for this issue meets this requirement. The end results of the proposed action differ from those expected under no action, and either scenario would have negative impacts on some species and benefit others. However, widespread insect activity in the project vicinity has produced an abundance of beetle-killed forest and insect prey base. The proposed action would help preserve old and young live trees in treatment units, maintaining habitat diversity rather than promoting homogeneity associated with widespread mortality of older forest. Habitat diversity benefits migratory birds because of the wide range of habitat conditions required by this diverse group of species.

Management Area 7 consists of riparian areas, with a standard to maintain suitable habitat for birds. Riparian areas provide important habitat for a large proportion of migratory bird species. Habitat within riparian areas will be protected through the application of streamside management zone (SMZ) buffers.

Forest Plan Amendment No. 15 provides direction for management of snags and coarse woody debris to accommodate the needs of cavity nesting birds. The proposed action by design, contains measures to ensure compliance with snag and coarse woody debris management standards, including retention and replacement snag levels.

PROJECT DESIGN FEATURES

The following project design features will help to avoid or minimize adverse impacts to terrestrial wildlife species:

1. Limit proposed treatment to less than or equal to 250 acres total.
2. No public motorized use of temporary roads constructed for this project will be allowed. During project implementation, gates or other physical barriers will be maintained to prevent public motorized access.
3. All temporary roads constructed for the project will be built to the minimum standard necessary to accommodate project-related traffic. Temporary project roads will be closed and rehabilitated upon project completion.
4. Streamside management zones (SMZ) will be implemented to protect riparian habitat

MITIGATION MEASURES

The following mitigation measures are recommended to avoid or minimize adverse impacts to terrestrial wildlife species.

Migratory Bird Species

53. Trees and snags with broken tops, obvious large nest structures, or cavities would be targeted to meet snag retention standards.
54. If discovered, there would be no treatment within 250 yards of an known active black-backed woodpecker nest between May 1 and July 15.
55. If discovered, there would be no treatment within a minimum buffer of 40 acres around known occupied goshawk nest trees.
56. If discovered, there would be no ground-disturbing activities within known occupied post fledging area (PFA) between April 15 and August 15. The PFA is the area roughly 420 acres surrounding an active goshawk nest.

Big Game

1. Within treatment units, maintain at least two thirds of the existing hiding cover associated with key habitat features such as wet sites and foraging areas. This would be accomplished through implementation of SMZs in riparian areas, and maintaining at least 40% canopy cover in forested habitat within 50 feet of natural meadows for at least 2/3 of the meadow perimeter.
2. In MA 11, maintain a minimum of two years inactivity following 1-3 years of consecutive sale activity, or a minimum of five years inactivity following 4-5 years of consecutive sale activity.

Snag Dependent Species

1. Within harvest units, leave an average of 30 snags (at least 18 feet tall and 10 inches dbh) per 10 acres. If there are not sufficient dead trees meeting the size criteria, the largest available dead trees will be left as snags.
2. Within harvest units, require that a minimum of 15 tons per acres of three-inch diameter or larger woody debris be left scattered after project completion.

MONITORING

The following monitoring procedures are recommended to avoid or minimize adverse impacts to terrestrial wildlife species, as well as to evaluate effectiveness of mitigation measures.

1. Before and during project implementation, conduct surveys for black-backed woodpeckers and northern goshawks during the breeding season to identify needs for protective measures associated with potentially occupied nests.
2. Survey treatment units upon completion to evaluate effectiveness of snag and woody debris retention measures.
3. Monitor project road closures during implementation to ensure physical barricades are effective in precluding public motorized use on temporary roads. Monitor temporary project roads upon project completion to ensure permanent and effective closure.
4. Survey treatment units upon completion to evaluate effectiveness of measures to maintain hiding cover associated with key habitat features.

CHAPTER 4 – COORDINATION

LIST OF PREPARERS

Name	Resource Area
Anna Anderson	Fire-Fuels analysis
Bev Dixon	Wildlife analysis
Mary Erickson	Responsible Official
Tom Keck	Soils analysis
Keith Konen	Forest vegetation analysis
Susan Lamont	Range, Weeds, Sensitive Plants analysis
Nate Motzko	Economics analysis
Marcia Pablo	Cultural resources analysis
Bruce Roberts	Aquatic Species analysis
Jane Ruchman	Scenery analysis
Julie Shea	Fire-Fuels Analysis Update
Lisa Stoeffler	District Ranger
Wendy Uri	Recreation, Roadless analysis
Amy Waring	NEPA Interdisciplinary Team Leader
Dale White	Hydrology analysis

COORDINATION

USFS Region 1 Forest Health Protection

The GNF Silviculturalist coordinated the South Bridger Interface Project with Region 1 Forest Health Protection entomologists and pathologists regarding the purpose and need and development of the proposed action. Regional entomologists/pathologists visited the Bridger Bowl area in 2010 and the SBI project area on October 1st and 2nd, 2012 and prepared reports of their findings (Sturdevant et. al. 2010 and Sturdevant and Jackson 2012). This information is cited throughout the Forest Vegetation section of Chapter 3.

Bridger Bowl

The USFS coordinated proposed treatments in the Bridger Bowl ski area boundary with Randy Elliot from Bridger Bowl. Through these discussions, the size, boundaries, and prescriptions of Units 1 and 18 were adjusted to respond to concerns Bridger Bowl had about skiers going out of bounds.

MT Fish, Wildlife and Parks

The Forest Service Wildlife Biologist coordinated with the MT FWP Biologist throughout the project. Refer to the Response to Comments, Comment #7 under the NEPA/Cumulative Effects/Forest Plan Section. FWP submitted a comment letter noting that this coordination occurred, noted that the wildlife assessment was thorough, and agreed that the project will have long-term benefits for forest health and

wildlife habitat. Some of these coordination efforts involved the exchange of information regarding big game populations (see Response to comments, Comment #, 3, 4, 5, and 8 in the Big Game section.

US Fish and Wildlife Service

The Forest Service conducted informal, programmatic consultation with the US Fish and Wildlife Service, and has received concurrence for the determination of effect for listed species that may be present in the project area.

Trout Unlimited

On December 11, 2012, the USFS met with representatives from Trout Unlimited to discuss riparian management for the South Bridger Interface Project. This discussion led to the aquatic design/mitigation measures listed in Chapter 2 (page 2.2).

Public Meeting

On March 3, 2014, the USFS held an open house/meeting at the Bridger Canyon Fire Station, and provided the public with the opportunity to ask questions and comment on the South Bridger Interface Project. A number of local residents attended the meeting, as well as a representative from Bridger Bowl and Montana State University Extension Services.