PACTOLA PROJECT AREA

DRAFT

ENVIRONMENTAL IMPACT STATEMENT

USDA Forest Service
Black Hills National Forest
Mystic Ranger District
Rapid City, South Dakota

Commonly Used Acronyms and Abbreviations

ARC	At-Risk-Community
BA	Basal Area
BF	Board Foot
BHNF	Black Hills National Forest
BMP	Best Management Practices
CCF	Cubic Hundred Feet
CDA	Connected Disturbed Area
CEQ	Council on Environmental Quality
CF	Cubic Feet
CFR	Code of Federal Regulations
CMAI	Culmination of Mean Annual Increment
CPUA	Concentrated Public Use Area
CWD	Coarse Woody Debris
CWPP	Community Wildfire Protection Plan
DBH	Diameter Breast Height
DEIS	Draft Environmental Impact Statement
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
FEIS	Final Environmental Impact Statement
FRCC	Fire Regime Condition Class
FS	Forest Service
FSH	Forest Service Handbook
FSM	Forest Service Manual
GIS	Geographic Information System
GPS	Global Positioning System
HFRA	Healthy Forests Restoration Act
ID Team	Interdisciplinary Team
MA	Management Area
MBF	Thousand Board Feet
MIS	Management Indicator Species
MMBF	Million Board Feet
MPB	Mountain Pine Beetle
MVUM	Motorized Vehicle Use Map
NEPA	National Environmental Policy Act
NFMA	National Forest Management Act
NFS	National Forest System
NFSR	National Forest System Road
OHV	Off Highway Vehicle
ROD	Record of Decision
S&G	Standard(s) and Guideline(s)
SDGF&P	South Dakota Game, Fish and Parks
SHPO	State Historic Preservation Officer
SOLC	Species of Local Concern
T&E	Threatened and Endangered
TMP	Travel Management Plan
TSI	Timber Stand Improvement
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
WUI	Wildland-Urban Interface

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Pactola Project Area
Draft
Environmental Impact Statement
Pennington County, South Dakota

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Abstract: The Mystic Ranger District of the Black Hills National Forest has prepared a Draft Environmental Impact Statement (EIS) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. The Mystic Ranger District proposes to implement multiple resource management actions within the Pactola Project Area as guided by the Black Hills National Forest Land and Resource Management Plan (Forest Plan) as amended, by the Healthy Forests Restoration Act (HFRA) and supported by the National Fire Plan, the President's Healthy Forest Initiative, and by other National level policy. The focus of the actions proposed is to manage the vegetation to reduce the threat to ecosystem components, including forest resources, from the existing insect and disease (mountain pine beetle) epidemic and to reduce hazardous fuels in order to minimize the potential for large-scale severe wildfires. Three alternatives are considered in detail. Alternative A is the No Action Alternative. Alternative B is the proposed action. It uses landscape level thinning and pine harvest to break up the large area of continuous, dense forest and lower the mountain pine beetle (MPB) and wildfire hazard. Alternative C responds to comments received during scoping. It includes roadside and fuel break treatments, as well as cable and helicopter logging. This Draft EIS discloses the direct, indirect, and cumulative environmental impacts resulting from the proposed action and alternatives. At this time, the Forest Service has not identified a preferred alternative.

Reviewers should provide the Forest Service with their comments during the review period of the draft environmental impact statement. This will enable the Forest Service to analyze and respond to the comments at one time and to use information acquired in the preparation of the final environmental impact statement, thus avoiding undue delay in the decision making process. Reviewers have an obligation to structure their participation in the National Environmental Policy Act process so that it is meaningful and alerts the agency to the reviewers' position and contentions. Vermont Yankee Nuclear Power Corp. v. NRDC, 435 U.S. 519, 553 (1978).

Environmental objections that could have been raised at the draft stage may be waived if not raised until after completion of the final environmental impact statement. City of Angoon v. Hodel (9th Circuit, l986) and Wisconsin Heritages, Inc. v. Harris, 490 F. Supp. 1334, 1338 (E.D. Wis. 1980). Comments on the draft environmental impact statement should be specific and should address the adequacy of the statement and the merits of the alternatives discussed (40 CFR 1503.3).

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Summary

The Black Hills National Forest, Mystic Ranger District proposes to implement multiple resource management actions within the Pactola Project Area. This proposal is guided by the Black Hills National Forest Land and Resource Management Plan as amended by the Phase II Amendment; the statutory authority and direction provided by the Healthy Forests Restoration Act; and supported by the National Fire Plan; The 10 Year Comprehensive Strategy Implementation Plan agreed to by the Western Governor's Association; and The President's Healthy Forest Initiative.

The project area lies approximately 10 miles west of Rapid City, SD. The project area encompasses approximately 26,017 acres. The project area consists of 24,863 acres of National Forest System lands with 1,154 acres of interspersed private lands. The forest condition is representative of a ponderosa pine fire adaptive ecosystem that has been managed for multiple-use objectives for decades.

The focus of the actions proposed are designed to treat vegetation on a broad landscape scale to reduce the threat to ecosystem components, including forest resources, from the existing insect and disease (mountain pine beetle) epidemic and reduce the potential for severe large-scale wildfire. There is a need to slow or appreciably halt the ongoing development and spread of mountain pine beetle (MPB) in the project area. The implications of continued spread of this epidemic include: increased tree mortality across the landscape; further accumulation of hazardous fuels and increased potential for severe large-scale wildfires threatening the values of the Wildland-Urban Interface (WUI) within the area and beyond; major changes in the scenery; and alteration of wildlife habitat. According to Schmid et al (2007), the most important aspect of managing mature ponderosa pine stands in the Black Hills National Forest is minimizing the MPB-caused mortality. The only effective long-term strategy to minimize MPB-cause mortality is controlling stand conditions through silvicultural means over large landscapes and monitoring areas of beetle buildup (USDA Forest Service, 2010d).

The ongoing MPB epidemic is of foremost concern in the project area. This epidemic is killing mature pine trees, resulting in stand replacement on a landscape scale. Locally (and nationally), the public is demanding action to reduce the risk of MPB affecting their lands, as well as, reducing potential for large-scale wildfires on public lands. The Healthy Forests Restoration Act (HFRA) of 2003, represents the culmination of a number of National level policy documents and efforts developed to address this issue. Guided by the Forest Plan and the HFRA, the Pactola Project proposed action has been developed to treat vegetation on a broad landscape scale to reduce the threat to ecosystem components from the existing insect and disease (MPB) epidemic and reduce the potential for large-scale severe wildfires. Ultimately, the intent is to limit effects to the environment from MPB and reduce the potential for loss of property or life due to large-scale wildfire.

Through varied public involvement and collaboration efforts, comments on the proposed action, potential concerns, and opportunities for managing the Pactola Project Area were solicited from Forest Service resource specialists, tribal representatives, members of the public, other public agencies, adjacent property owners, and organizations. Methods used to request comments included: Publishing the Notice of Intent (NOI) to prepare and EIS in the *Federal Register* on

August 9, 2010; publication of news releases and articles in the Rapid City Journal; mailing a scoping letter that solicited comments to approximately 400 interested parties; conducted public meetings; and meeting with interested individuals and parties.

Comments received during the scoping process were used to help in defining issues, develop alternatives and mitigation measures, and analyze effects. Through review and analysis of the scoping comments and input, the Pactola Interdisciplinary Team (ID Team) identified three (3) prevailing or key issues related to the proposed activities. The three key issues include: mountain pine beetle, wildfire and fuels hazard, and vegetation and wildlife habitat diversity.

These issues led the ID Team to develop alternatives to the proposed action. The alternatives analyzed in detail in this EIS are briefly described as follows:

Alternative A (No Action) – The National Environmental Policy Act (NEPA) requires the study of the no action alternative, and to use it as a basis for comparing the effects of the proposed action and other alternatives. This alternative assumes no implementation of any elements of the proposed action or other action alternatives. However, such things as ongoing fire suppression efforts, noxious weed treatments, and recurring road maintenance on Forest roads would continue as directed by the Forest Plan.

The no action alternative represents no attempt to actively respond to the purpose and need for action or the issues raised during scoping for this project. For example, there would be no effort to modify existing vegetation or related fuels conditions in the project area. The effort to reduce the widespread MPB epidemic and associated fuel loads would not be undertaken.

Alternative B (Proposed Action) – Alternative B was developed in response to the purpose and need and represents the proposed action. Alternative B is designed to treat the vegetation to reduce the potential for Mountain Pine Beetle (MPB) infestations. It also provides for landscape level and some private property boundary fuel breaks, thereby lowering the potential for large-scale wildfires. Alternative B proposes to expand hardwoods and reduces pine encroachment in historic meadows, thereby expanding natural fuel breaks and increasing biodiversity within the Pactola Project Area.

Vegetative management in this alternative is characterized by a number of specific treatments. There would be commercial timber harvest and non-commercial thinning (estimated 13,000 acres), which opens up forest stands with the objective of reducing the potential for MPB infestations and large-scale wildfire. Sanitation harvest to remove infested trees may be conducted in areas near or adjacent to identified stands in order to limit the expansion of MPB populations. Most harvest would be conducted using whole tree logging methods in order to reduce after-harvest fuel loading. Natural fuel breaks such as meadows and hardwoods would be treated to expand and enhance their ability to moderate wildfire and provide for wildlife habitat. Prescribed burning (approximately 5,000 acres) to reduce fuels and enhance natural fuel breaks is planned in this alternative.

Alternative C – Alternative C was developed in response to comments received during the scoping period. Under this alternative, approximately 16,900 acres would be treated mechanically

(commercial and non-commercial). The treatments in this alternative are the same as those described in Alternative B with three additional treatments: 1) treating approximately 400 acres along designated roadways within the project area to improve access (ingress/egress); 2) approximately 1,270 acres of cable and/or helicopter logging; 3) and helicopter logging of an additional 500 acres outside of treatment areas to remove "green hits" of mountain pine beetle infestations in areas that are not accessible by other means within the Pactola Project Area.

Prescribed burning is the same as described in Alterative B. Mechanical fuel breaks, a minimum of 200 feet wide, would be constructed along some private land boundaries where commercial treatments overlap.

Table 0-1 Effects to Key Issues by Alternative on NFS lands using Measurement Indicators

1. Mountain Pine Beetle		**Existing Condition**	**Alt A**	**Alt B**	**Alt C**
MPB Risk Rating – Low (acres)		1,881	12,095	9,117	8,668
MPB Risk Rating – Moderate (acres)		6,256	6,354	10,112	10,730
MPB Risk Rating – High (acres)		14,181	3,867	2,625	2,249
2. Wildfire and Fuels Hazard			**Alt A**	**Alt B**	**Alt C**
Fire Hazard Rating (High)	Post Treatment		63%	28%	20%
	In 20 years		77%	59%	54%
Total Mechanical Treatments (acres)			0	13,141	17,412
Roadside Treatments (acres)			0	0	436
Shaded Fuel Breaks (acres)			0	0	71
Prescribed Broadcast Burning (acres)			0	5,000	5,000
3. Vegetation and Wildlife Habitat Diversity			**Alt A**	**Alt B**	**Alt C**
Hardwood Retention (acres)			0	1,219	1,219
Hardwood Restoration (acres)			0	477	681
Meadows/Grasslands Retention/Restoration (acres)			0	436	461

Projected Habitat Structural Stages for the Project MA 5.1 and 5.4 in acres:

Structural Stage	**Existing Condition**		**Alternative A**		**Alternative B**		**Alternative C**	
	MA 5.1	**MA 5.4**	**MA 5.1**	**MA 5.4**	**MA 5.1**	**MA 5.4**	**MA 5.1**	**MA 5.4**
1	0	106	0	106	0	106	0	106
2	0	221	951	2,095	688	1,745	280	1,506
3A	317	1,233	1,869	4,251	986	3,716	889	4,047
3B	645	1,201	323	601	59	248	63	171
3C	340	738	170	369	22	176	7	128
4A	1,101	2,641	1,282	2,621	3,234	4,264	3,668	4,321
4B	2,185	4,231	732	1,301	213	647	180	665
4C	739	973	0	0	0	96	0	0
5	0	0	0	0	22	31	0	16

The Pactola Project purpose and need (see Chapter 1) provides the focus and scope of the proposal as related to National and Forest level policy and direction, plus the statutory mandate provided by the Healthy Forests Restoration Act. Given this purpose and need, the Deciding Official (District Ranger) reviews the proposed action, the issues identified during scoping, the alternatives, and the environmental consequences of implementing the proposal and alternatives disclosed in this EIS. This forms the basis for the Deciding Official to make the following determinations:

- Whether or not the proposed activities and alternatives address the issues, are responsive to National policy/guidance/law and Forest Plan direction, and meet the purpose of and need for action in the Pactola Project Area.
- Whether or not the information in this analysis is sufficient to implement proposed activities.
- Which actions, if any, to approve (decide which alternative or mix of activities to implement).
- Whether there is a need for site-specific amendments to existing Forest Plan direction.

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CHAPTER 1 PROPOSED ACTION and PURPOSE AND NEED FOR ACTION

Document Structure

The Mystic Ranger District of the Black Hills National Forest has prepared this Environmental Impact Statement in compliance with the National Environmental Policy Act (NEPA), the Healthy Forests Restoration Act (HFRA), and other relevant Federal and State laws and regulations. This Environmental Impact Statement discloses the direct, indirect, and cumulative environmental impacts that would result from two action alternatives and No Action alternative. The document is organized into seven chapters followed by Appendices A – E.

Chapter 1. Proposed Action and Purpose of and Need for Action: The chapter includes information related to background of the project proposal, issues, the purpose of and need for the project, and a description of the agency's proposal for addressing that purpose and need. This section also details how the Forest Service involved the public, how the public responded and what issues were generated regarding the proposal.

Chapter 2. Alternatives, including the Proposed Action: This chapter provides a more detailed description of the proposed action as well as alternative methods for achieving the stated purpose. The proposed action (Alternative B) was developed based on addressing the purpose and need. Alternative C was developed based on comments raised by the public, other agencies, and internally. This chapter also provides a discussion of design criteria and monitoring required. Finally, this section includes summary tables of the environmental consequences and a comparison of effects associated with each alternative.

Chapter 3. Affected Environment and Environmental Consequences: This chapter describes the environmental effects of implementing the proposed action and other alternatives. This analysis documentation is organized by resource area, e.g., Fire and Fuels, Wildlife Habitat, Watershed, etc.

Chapter 4. Bibliography/References: The bibliography provides a list of references supporting the documentation in the EIS.

Chapter 5. Glossary: The glossary provides a list and explanation of key words, acronyms, and terminology used throughout the EIS.

Chapter 6. List of Preparers: This chapter provides a list of preparers involved during the development of the environmental impact statement.

Chapter 7. Index: The index references page numbers for many key document topics and words.

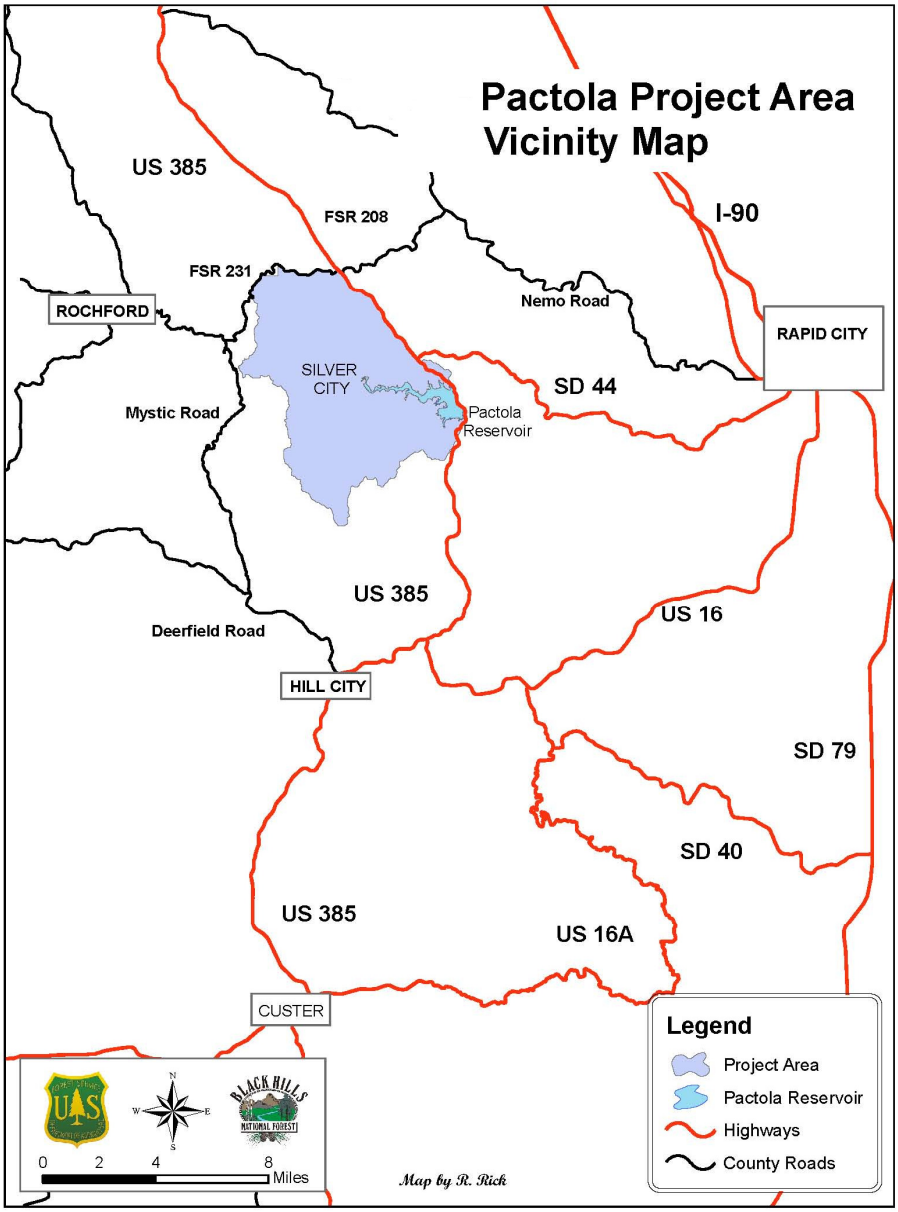
Appendices: The appendices provide more detailed information to support the documentation and analysis presented in the EIS.

Additional documentation, including more detailed analyses of project-area resources, may be found in the Project File located at Mystic Ranger District office in Rapid City, South Dakota.

Background

The Black Hills of South Dakota is a heavily settled area. There are numerous communities scattered throughout the Black Hills, along with a complex pattern of private land interspersed with National Forest System land. Many of these private lands have housing developments or isolated houses or structures. Others are rapidly becoming residential developments. This poses unique challenges to the management of National Forest System lands, as the effects of such management greatly affect our neighbors, and vice versa. Figure 1-1 displays the location of the Pactola Project Area.

Figure1-1-1 Pactola Project Area Vicinity Map



The composition of today's vegetation is more the result of a combination of aggressive fire suppression and past management activities than from natural events. Photographs and records from the late 1800's and early 1900's indicate that today's forest is more continuous, uniform and dense than what has historically occurred. There are more pine trees in this area than existed under natural conditions, and less meadows/grasslands and hardwoods due to pine tree encroachment.

A MPB epidemic is rapidly expanding within and adjacent to the Pactola Project Area. This epidemic is killing large numbers of mature pine trees. This epidemic is changing vegetation structure and wildlife habitat on a landscape scale. As trees are killed they fall to the ground adding dead, dry fuels within an area already rated as having high wildfire hazard. The rate of infestation is increasing and the epidemic is likely to spread over a large area over the next three to five years. MPB prefer stands of dense, mature pine trees, which is abundant and continuous throughout the area. Approximately 92 percent of the project area pine stands are at medium to high risk for MPB infestation. The primary management tool for reducing MPB-caused mortality is to remove the infested trees and to reduce the density of the remaining trees through mechanical thinning.

Historically, insects and fire were a major force in shaping and contributing to the structure and composition of the ponderosa pine forests of the western United States, including the Black Hills. Insect infestations, especially mountain pine beetle (*Dendroctonus ponderosae*), have played a role in thinning dense stands.

Since 1970, approximately 128 fires have been recorded within the Pactola Project Area totaling approximately 76 acres. The largest recorded fire during that time period was the Boardinghouse Fire (1980) which burned approximately five acres. In 1939, the McVey Fire, the worst recorded fire to that date in the Black Hills, burned approximately 22,000 acres. The southern end of the project area was affected by this fire, with approximately 3,000 acres within the project boundary. Several prescribed fires have taken place within the project area accounting for approximately 3,660 acres.

Large wildfires (fires greater than 300 acres) burned about 147,900 acres during the period from 1900 to 1980 in the Black Hills. Since 1980, a dramatic increase in acreage burned has occurred. Recent wildfires, including but not limited to the Jasper Fire, Roger's Shack, Elk Mountain II, Battle Creek, Grizzly Gulch, Red Point, Ricco, Cement, East Ridge, and Alabaugh Fires have burned over approximately 296,000 acres. These intense fires covered large areas, moving as far as eleven miles in one day and as fast as five miles in three hours.

Although wildland fires are natural occurrences, they can conflict with land management objectives by impacting soil productivity, increasing conditions for soil erosion, expanding noxious weeds, harming some plant and animal species, reducing visual quality and recreation values, and destroying valuable timber resources. In addition, large wildfires threaten the lives of residents and firefighters, destroy houses and other private property, and contribute to substantial impact to the local economy and private landowners.

The Pennington County Community Wildfire Protection Plan and Lawrence County Community Wildfire Protection Plan (CWPP) designate most of the project area as wildland-urban interface. The 'at-risk'-community of Silver City is located in the central portion of the Project Area. Edelweiss (and other) subdivisions are located on the south end of the project area. In total, there are 1,154 acres of private lands scattered throughout the project area, and many more acres of

private land, homes, and businesses in adjacent areas. Pactola Lake and US Highway 385 are located on the eastern portion of the project area. Pactola Lake is a major recreational complex within the Black Hills. It includes a Forest Visitor Center, campground complex, a developed trail system, boat launches, swim beach, and marina. The campground is managed by a private concessionaire; the marina is also privately operated. Several tourist businesses are operated on private land in the northeast portion of the project area. Pactola Lake and Rapid Creek are part of the Rapid City community water supply. The threat of wildfire is a major concern for those living, working, and recreating in this area, and for the large Rapid City community that depends on this watershed for a portion of their domestic water supply.

Approximately 63 percent of the Pactola Project Area is rated as having a high to very high wildfire hazard. This rating is based mainly on crown fire hazard. The ongoing MPB epidemic is making this situation worse by replacing live, green standing fuels with large amounts of dead and dry fuels. These dead fuels are slow to decompose in this dry area and would be a fire hazard for the next several decades. Fires burning in these heavy fuels would be difficult and dangerous to suppress. The primary management tools to reduce fuel loads and wildfire hazards are to mechanically thin dense stands with high wildfire hazard, remove MPB infested trees, remove activity fuels from the forest floor, retain and expand hardwoods and meadows/grasslands, and conduct prescribed burning to eliminate ground and surface fuels.

Management Direction

The following sections provide an overview of the management direction applicable to the Pactola Project.

Forest Plan Direction

The Black Hills National Forest programmatic management direction is the 1997 Revised Land and Resource Management Plan (LRMP or Forest Plan), as amended by the Phase II Amendment (October 2005), and supported by the Final Environmental Impact Statement (FEIS) for the Phase II Amendment to the 1997 LRMP. The Forest Plan is required by the rules implementing the Forest and Rangeland Renewable Resources Act of 1974 (RPA), as amended by the National Forest Management Act of 1976 (NFMA).

The Forest Plan as amended, provides revised and new goals, objectives, and standards and guidelines focused on protecting communities, property, and forest values by reducing severe insect infestations and fire hazards; conserving viable plant and animal species and habitats for the long term supported by the best available science; designating research natural areas; and providing for the continuing viability of the existing forest products industry and infrastructure essential to cost effectively managing vegetation on the Black Hills National Forest.

The purpose of the Forest Plan (FP) is to provide management direction for multiple use and sustained yield of goods and services from National Forest System lands in an environmentally sound manner. Moreover, the Forest Plan provides overall management allocations, goals and objectives (FP Chapter I), as well as associated standard and guidelines (FP Chapter II) for management.

Management Areas

The Forest Plan sets management allocations for specific uses of land (Management Areas) within the Forest to meet multiple use objectives (FP Chapter III). The Pactola Project Interdisciplinary (ID) Team reviewed Management Area (MA) direction and confirmed that no new information existed that would require reconsideration of Forest Plan resource allocations. The MAs designated in the Forest Plan for the Pactola Project Area are listed in Table 1-1.

Table 1-1 Management Area Designations and Acreage in the Project Area

MANAGEMENT AREA	ACRES	NFS %
2.2 - Research Natural Areas	548	2.2%
3.7 - Late Successional Forest Landscape	1,268	5.1%
5.1 - Resource Production Emphasis	5,766	23.2%
5.4 - Big Game Winter Range Emphasis	12,210	49.1%
8.2 - Developed Recreation Complexes	5,071	20.4%
Total NFS	24,863	100.00%
Private	1,154	
Total Gross	26,017	

Forest Plan Goals and Objectives

The Forest Plan establishes eleven multiple use goals and associated objectives for management of the Forest. Goals 1-4, 10 and 11 are directed toward natural resource objectives for multiple use management of the Forest. Goal 3 and 5-9 provide socio-economic emphasis for management of the Forest. The goals and objectives, applicable to specific resource management issues needing resolution, provide the basic direction for defining the purpose and need and subsequently developing the project proposal. The eleven Forest Plan goals are discussed in Chapter I of the Forest Plan. The Responsible Official for the Pactola Project has chosen to propose resource management actions that respond to Forest Plan Goals 2, 3, 7, and 10.

> **Goal 2. Provide for a variety of life through management of biologically diverse ecosystems.**
> **Goal 3. Provide for sustained commodity uses in an environmentally acceptable manner.**
> **Goal 7. Emphasize cooperation with individuals, organizations and other agencies while coordinating planning and project implementation.**
> **Goal 10. Establish and maintain a mosaic of vegetation conditions to reduce occurrences of catastrophic fire, insect, and disease events, and facilitate insect and disease management and firefighting capability.**

Associated with these goals are specific resource objectives. Comparing objectives to current conditions is integral to defining the purpose and need and developing the proposed action. Objectives providing management emphasis for this project are summarized below. Note that other Forest Plan goals and numerous objectives not mentioned in detail also provide guidance and are achieved to varying degrees as a function of project implementation and effect.

Goal 2 - Provide for a variety of life through management of biologically diverse ecosystems.

Objective 201. "Manage for a minimum of 92,000 acres of aspen (double current aspen acres)… The highest priority for hardwood restoration is where conifers (e.g., spruce and pine) have out-competed aspen adjacent to riparian systems that once supported beaver…"

- *There is an opportunity to increase/maintain hardwood communities by reducing pine competition within these stands. In addition, opportunities exist to enhance and expand hardwood inclusions by opening canopies and removing conifers.*

Objective 205. "Manage for 122,000 acres of prairie grassland and 3,600 acres of meadow during the life of the Plan. Restored acres will not be considered suitable for timber production."

- *There is an opportunity to increase the acres of interior grassland communities by removing pine encroachment, and also to enhance isolated grasslands by opening canopies through mechanical thinning and prescribed burning.*

Objective 221. "Conserve or enhance habitat for R2 sensitive species and species of local concern (SOLC)…"

- *There is an opportunity to conserve R2 sensitive species and SOLC habitat by removing MPB infested trees and thinning stands to reduce insect damage and wildfire hazard.*

Objective 234. "Create or maintain a moderate-to-low crown-fire hazard adjacent to occurrences of R2 sensitive and species of local concern…where long-term persistence is at risk from a single high-intensity fire."

- *There is an opportunity to reduce wildfire hazard on NFS lands in the project area currently estimated at 63% high to very high.*

Objective 238. **"**...objectives for management indicator species (MIS) …"

- *There is an opportunity to increase Aspen communities and increase the number of acres of stands with a very large tree size rating.*

Goal 3 - Provide for sustained commodity uses in an environmentally acceptable manner.

Objective 302. "Maintain rangelands in satisfactory range condition."

- *There is an opportunity to utilize prescribed broadcast burning to increase grasses and forbs.*

Objective 304. "On lands not identified as suitable and available for timber harvest, timber volume may be offered as a by-product of other vegetation management objectives. This volume would be offered in addition to the ASQ."

- *There is an opportunity to do noncommercial thinning (less than 9 inch diameter trees) to reduce MPB hazard.*

Goal 7 - Emphasize cooperation with individuals, organizations and other agencies while coordinating planning and project implementation.

Objective 701. "Continue to cooperate with interested parties and organizations in the development of plans and projects."

- *There is an opportunity to work with the Counties, State, and private landowners to generate a broad base of support and/or a well informed public regarding project plan/design and project actions proposed and taken.*

Objective 702. "Encourage cost sharing as part of cooperative efforts."

- *There is an opportunity to work with the Counties, State, and private landowners on cost sharing in an "All Lands" approach to MPB in the Project Area.*

Objective 703. "Seek partnerships with other service providers – federal, state, county, local and private sector – to define complementary roles that best meet customer needs."

- *There is an opportunity to coordinate with the Counties, State, and private landowners to partner and possibly cost-share in vegetation treatment and fuel reduction actions adjacent to and/or across mutual boundaries.*

Objective 704. "Consult with tribal governments, traditional practitioners, and other knowledgeable individuals to identify important areas of American Indian religious significance."

- *There is an opportunity to utilize the ongoing BHNF process and project-specific consultation to provide mutually beneficial information exchange, cooperative and open relations, and maintains trust and credibility between the agency and tribal representatives.*

Goal 10 - Establish and maintain a mosaic of vegetative conditions to reduce the occurrences of catastrophic fire, insect, and disease events, and facilitate insect and disease management and firefighting capability.

Objective 10-01. "Manage for 50 to 75 percent moderate-to-low fire hazard in the wildland-urban interface and reduce fire hazard within proximity of structures… Manage the remainder of the Forest for 50 percent moderate-to-low fire hazard…"

- *There is an opportunity to reduce existing fire hazard that currently exceeds objectives on NFS lands in the project area.*

Objective 10-04. "Reduce or otherwise treat fuels commensurate with risks (fire occurrence), hazard (fuel flammability), and land and resource values common to the area, using the criteria in Forest-wide Guideline 4110."

- *There is an opportunity to treat fuels and reduce hazards in the area.*

Objective 10-05. "Manage wildfires using the appropriate response based management area emphasis, existing values, risk of ignition, and fuel hazards within a given area."

- *There is an opportunity to reduce existing and activity fuels to a manageable level thereby facilitating a proactive and effective response to wildfire.*

Objective 10-06. "Develop fuel management and protection strategies for intermixed land ownerships in partnership with private, state, and other federal agencies."

- *There is an opportunity to coordinate with the State and Counties based on goals established in the Pennington County CWPP and Lawrence County CWPP to reduce fuels on both public and private lands in order to reduce the potential for large wildfires that could affect homes, infrastructure, visual quality, timber and forest ecosystem values, and wildlife (including sensitive species) habitat in the area..*

Objective 10-07. "Where outbreaks of mountain pine beetle could present risks to management objectives for ponderosa pine, reduce acreage of ponderosa-pine stands that are in medium or high risk for infestation."

- *There is an opportunity to respond to MPB infestations by removing infested trees and thinning pine trees to reduce the amount of medium and high risk stands.*

Management Area Specific Goals and Objectives

Management Area 2.2 - Research Natural Areas

The Pactola Project Area contains 548 acres in MA 2.2. Actions proposed in Alternative B and C would not occur in this management area.

Management 3.7 - Late Successional Forest Landscape

Objective 3.7-201. "Manage each contiguous unit within this management area as late-successional landscape, so that late-successional structure is always present within some portion of each unit."

- *An opportunity exists to enhance the late-successional character by thinning and treating stands infested with MPB.*

Guideline 3.7-2103. "Timber harvest may be used if necessary to move stands toward late-successional conditions."

- *The opportunity exists in the Project Area to promote MA 3.7 characteristics by removing trees infested with MPB and promoting growth through silvicultural treatments.*

Management Area 5.1 - Resource Production Emphasis.

Goal 5.1-201. "Manage tree stands to emphasize timber products, forage production, and water yield."

- *There is an opportunity to manage vegetation for insect, fuels and fire hazard reduction while concurrently providing timber products, forage production, and contributing to increased water yield.*

Objective 5.1-202. "While meeting other objectives for this management area, provide variety in stand sizes, shape, crown closure, age structure and interspersion."

- *There is an opportunity to manage vegetation focused on reducing insect, fire and fuels hazards designed to be fully compatible with the objective of providing variety in the forested setting.*

Objective 5.1-203. "Maintain or enhance hardwood shrub communities where biologically feasible, and within management objectives."

- *There is an opportunity to manage vegetation geared to improve hardwoods and also contribute to the fuel break benefits that hardwoods naturally provide.*

Objective 5.1-204. "Manage for the following percentages of structural stages in ponderosa pine across the management area in a variety of sizes and shapes." (Reference structural stage table, LRMP, Phase II Amendment, Page III-67)

- *See opportunity statement (italics) under Objective 5.1-202 above.*

Guideline 5.1-4101. "Utilize appropriate fuel treatment practices, including prescribed fire, to meet management objectives."

- *There is an opportunity to utilize a full complement of fuel treatment tools (including prescribed fire) in accomplishing insect, fuels and fire hazard reduction objectives.*

Management Area 5.4 - Big Game Winter Range Emphasis.

Goal 5.4-201. "Manage tree stands for wildlife habitat and vegetative diversity."

- *There is an opportunity to manage vegetation for insect, fuels and fire hazard reduction while concurrently benefiting wildlife habitat and vegetative diversity.*

Objective 5.4-206. "Manage for the following percentages of structural stages in ponderosa pine across the management area in a variety of sizes and shapes." (Reference structural stage table, LRMP, Phase II Amendment, Page III-92)

- *There is an opportunity to manage vegetation focused on reducing insect, fire and fuels hazard to be compatible with structural stage objectives.*

Guideline 5.4-4101. "Utilize appropriate fuel treatment practices, including prescribed fire, to achieve resource management objectives."

- *There is an opportunity to utilize a full complement of fuel treatment tools (including prescribed fire) in accomplishing wildlife habitat improvement objectives while concurrently contributing to fuel and fire hazard reduction objectives.*

Management 8.2 - Developed Recreation Complexes.

Goal 8.2-201. "Manage vegetation in high-use recreation areas to provide for public safety, to improve forest condition…"

- *There is an opportunity to reduce existing and activity fuels to a reasonable and manageable level for effective response to visuals and public safety concerns.*

Goal 8.2-204. "Manage fuels to retain a natural forest appearance and to reduce the threat of wildfire damage to forest resources."

- *There is an opportunity to reduce the threat of wildfire damage to the infrastructure and natural setting of the Pactola Developed Recreation Complex.*

Goal 8.2-206. "Control insect-and-disease pest populations in and adjacent to the area through active monitoring while reducing pest-population potential through vegetative management…"

- *There is an opportunity to manage vegetation by reducing mountain pine beetle infestations and lower the risk/hazard in the project area.*

Other Direction

While fires have always helped shape the landscape, today's fires are not simply those of the past; they are often hotter, more destructive, and more dangerous to suppress. The increase in catastrophic wildfire nation-wide has led to considerable new and/or revised National level initiatives, policy, and law regarding fire and fuels management. These initiatives, policy, and law also apply to insects and disease.

The Healthy Forests Restoration Act (HFRA) of 2003 (H.R. 1904) provides improved statutory processes for hazardous fuel (including insect/disease) reduction projects and healthy forest restoration on National Forest System lands. Other supporting policy includes the Healthy Forest Initiative, intended to reduce administrative process delays related to implementation of fuels (and insect/disease) reduction projects; National Fire Plan, and The Federal Wildland Fire Management Policy. The main focus of this National guidance is an emphasis on reducing the probability and occurrence of large-scale wildfire in fire adapted ecosystems, especially near at-risk communities and the wildland-urban interface (WUI); and to reduce the levels of insect infestations and disease.

HFRA contains a variety of provisions to expedite hazardous fuel reductions on specific types of National Forest land. The Pactola Project is an authorized hazardous fuel reduction project under Section 102(a)(4) of the Healthy Forests Restoration Act of 2003. The area qualifies under section 102(a)(4) because there is an existing mountain pine beetle epidemic occurring within and adjacent to the project area which poses a significant risk to resource values on National Forest and private lands (see Determination of Insect Epidemic letter held in the Project File).

The HFRA provides expedited procedures for complying with National Environmental Policy Act (NEPA) requirements. Section 104 of HFRA provides guidance on the range of alternatives studied and disclosed in the NEPA document. All authorized hazardous fuel reduction projects must be consistent with applicable Forest Plan direction or, if not, it includes an amendment to the Forest Plan.

Another provision of the HFRA regards the encouragement of communities to prepare a Community Wildfire Protection Plan (CWPP), which identifies areas of wildland-urban interface (WUI) and recommends the types and methods of treatments on Federal and non-Federal land. Pennington and Lawrence Counties have completed a CWPP. The plans designate most of the Pactola Project Area as WUI for the purposes covered by HFRA. The 'at-risk'-community of Silver City lies within the Project Area. Edelweiss (and other) subdivisions are located on the south end of the project area. In total, there are 1,154 acres of private lands scattered throughout the project area, and many more acres of private land, homes, and businesses in adjacent areas. Pactola Lake and US Highway 385 are located on the eastern portion of the project area. Pactola Lake is a major recreational complex within the Black Hills. It includes a Forest Visitor Center, campground complex, a developed trail system, boat launches, swim beach, and marina. The campground is managed by a private concessionaire; the marina is also privately operated. Several tourist businesses are operated on private land in the northeast portion of the project area. Pactola Lake and Rapid Creek are part of the Rapid City community water supply. The threat of wildfire is a major concern for those living, working, and recreating in this area, and for the large Rapid City community that depends on this watershed for a portion of their domestic water supply.

Purpose Of and Need for Action

The Purpose and Need provides the basis for development of the Proposed Action and any alternatives generated. The Purpose and Need is based on direction provided by the Black Hills National Forest, Land and Resource Management Plan (Forest Plan) and National level policy and law. The Purpose and Need provides fundamental rationale for the project and it provides guidance to the Pactola Interdisciplinary Team during environmental analysis for the Pactola Project Area.

Purpose and Need. The primary management emphasis in the Pactola Project Area is to:

- Reduce the threat to ecosystem components, including forest resources, from the existing insect and disease (mountain pine beetle) epidemic.
- Move toward achieving desired land and resource conditions, as provided by the Forest Plan, within the project area.
- Restore resource conditions, to a healthy, resilient fire-adapted ecosystem.
- Help protect local communities and resources from large-scale wildfire by reducing hazardous fuels.

There is a need to maintain or improve forest health and vigor on a landscape scale with the objective of maintaining a healthy forest that is less susceptible to forest insects and diseases, and can better withstand events such as wildfire, wind, snow, drought, or other weather related impacts.

There is a need to appreciably slow or halt the ongoing development and spread of mountain pine beetle (MPB) in the project area. The implications of continued spread of this epidemic include: increased tree mortality across the landscape; further accumulation of hazardous fuels and increased potential for severe large-scale wildfires threatening forest resources and values of the WUI within the area and beyond; major changes in the scenery; alteration of wildlife habitat; and impacts to soil and water resources.

Associated with the need to address the MPB epidemic is the need to reduce the potential for severe large-scale wildfire. This can be accomplished by breaking up the continuity and implementing a variety of vegetation management treatments to thin and reinvigorate pine stands, reduce forest fuels, and to facilitate effective wildfire suppression/protection in the area – much of which is WUI.

In association with the focus on improving forest health in the project area, stemming the advance of MPB, and reducing fuels/fire hazard, there is an opportunity to address other Forest Plan objectives. These include maintaining or improving wildlife/plant habitat, providing forest products to local industry, and providing for other resource amenities and uses. The current Forest Plan management area emphasis for the Pactola Project is MA 2.2 Research Natural Areas (548 acres), MA 3.7 Late Successional Forest Landscape (1,268 acres), MA 5.1 Resource Production Emphasis (5,766 acres), MA 5.4 Big Game Winter Range Emphasis (12,210 acres), and MA 8.2 Developed Recreation Complexes (5,071 acres).

Proposed Action

The proposed action was introduced to the public during the scoping period (see Public Involvement and Collaboration section discussed later in Chapter 1). This proposal was based on addressing the purpose and need described in the previous section.

The proposed action is presented in detail in Chapter 2 of this EIS. It includes removal of MPB infested trees, thinning and harvesting pine across the landscape, as well as in right-of-ways. It also includes removal of encroaching conifers within and adjacent to hardwood stands and historic meadows/grasslands, and overstory removals. In total, approximately 13,000 acres of the Pactola

Project Area would receive mechanical treatments of one kind or another. This would be followed by prescribed burning on up to approximately 5,000 acres.

The removal of MPB infested trees and thinning of dense stands is designed to reduce the levels of MPB mortality and resultant high fuel loads and wildfire hazard. Removal of encroaching conifers in and surrounding hardwood stands and within historic meadows/grasslands is intended to increase habitat diversity and to act as natural fuel breaks. Overstory removals would increase early seral habitat as directed by the Forest Plan and prescribed burning is intended to remove ground and surface fuels and increase habitat diversity.

Decision Framework

The Pactola Project purpose and need provides the focus and scope for the proposal as related to the programmatic goals of the Forest Plan and the Phase II Amendment. Given the purpose and need, the Deciding Official (District Ranger) reviews the proposed action, the issues identified during scoping, the alternatives, the environmental consequences of implementing the proposal and alternatives, and public comments on the Draft EIS. This forms the basis for the Deciding Official to make the following determinations:

- Whether or not the proposed activities and alternatives address the issues, are responsive to Forest Plan direction, and meet the purpose of and need for action in the Pactola Project Area.
- Whether or not the information in this analysis is sufficient to make a reasoned decision.
- Which action, if any, to approve (decide which alternative or combination of alternatives to implement).

If any action alternative is selected, project implementation could begin in the Fall 2011. The initial focus would be to remove MPB infested trees and thin stands in the areas of highest infestation. Certain actions (such as fuel break maintenance) could last for a longer term.

Public Involvement and Collaboration

During project development and analysis period, collaborative efforts were made to involve, interact, and cooperate with individuals and groups interested in the Pactola Project. Part of this effort included public scoping as discussed below (see Appendix A).

Scoping is the process of obtaining public comments about proposed federal actions to determine the breadth of issues to be addressed. Comments on the proposed action, potential concerns, and opportunities for managing the Pactola Project Area were solicited from members of the public, American Indian Tribes, other public agencies, adjacent property owners, organizations, and Forest Service specialists.

A scoping letter was mailed to approximately 400 interested parties, including adjacent landowners on July 28, 2010. This letter included a description of the project area, and overview of the NEPA process, a general explanation of the actions proposed, and an invitation to comment.

During the public scoping period and throughout the project development and analysis period, a collaborative effort was made to involve and interact with individuals and groups interested in the Pactola Project. A public meeting was held at the Silver City Community Hall in Silver City, SD on Tuesday August 24, 2010. At the meeting, key members of the ID Team presented the project

proposal to the public, questions were answered, concerns and issues were solicited and documented for consideration.

Some key interest groups consulted with and/or involved in the planning process were the South Dakota Department of Agriculture – Division of Resource Conservation and Forestry and Division of Wildlife Fire Suppression, and Rapid City Chamber of Commerce (Agriculture and Natural Resource Committee). A concerted effort was made to engage in consultation regarding the project with Tribal contacts known to have interest in management of the National Forest. Specialists also met with individuals, as well as the Silver City Volunteer Fire Department to discuss additional treatments surrounding the community of Silver City and other private lands.

The project was entered into the Schedule of Proposed Actions (SOPA) in June 2010. SOPA contains a list of Forest Service proposed actions that will soon begin or are undergoing environmental analysis and documentation. It provides information so the public can become aware of and indicate interest on specific proposals (located on-line at www.fs.fed.us/sopa).

The Notice of Intent (NOI) to prepare an EIS was published in the *Federal Register* on Monday, August 9, 2010. This provided official notification that the public comment period for the Pactola Project Area would last for 30-days concluding September 8, 2010. During the scoping period, the Forest Service received considerable public response supporting the proposal and rationale for action.

Issues

This section provides a summary of issues identified during the public and internal scoping period for the Pactola Project. Comments received during scoping were used to help in defining issues, develop alternatives and mitigation measures, and analyze effects. A total of 195 comments were received via letters, faxes, public meeting transcripts, personal-delivery, or email during the formal scoping process. The majority of responses were supportive of the overall project, a few were not. Through review and analysis of scoping comments and input, the Pactola Project Core ID Team identified three prevailing or key issues related to the proposed activities. Comments received and the agency 'response to comments' are summarized in the Pactola Project File located at the Mystic Ranger District, Rapid City office.

The ID Team reviewed input submitted during the scoping period and separated the issues into significant [as directed by the Council on Environmental Quality (CEQ) regulations (40 CFR 1500.4(g) and 1501.7)] and non-significant issues. Significant issues are defined as those directly or indirectly caused by implementing the proposed action. Non-significant issues were identified as those: 1) outside the scope of the proposed action; 2) already decided by law, regulation, Forest Plan, or other higher level decision; 3) irrelevant to the decision to be made; or 4) conjectural and not supported by scientific or factual evidence. The Council on Environmental Quality (CEQ) NEPA regulations explain this delineation in Sec. 1501.7, "…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)…." Non-significant issues and rationale regarding their categorization as non-significant may be found in the project record. A brief description of the three key issues and measurement indicators follows below:

1. Mountain Pine Beetle

The ongoing MPB epidemic is of foremost concern in the project area. The epidemic is killing mature pine trees, resulting in stand replacement on a landscape scale. The majority of the project area includes relatively dense stands of mature pine trees, consisting mostly of even size and age trees. This is the preferred food source of MPB. Approximately 92 percent of the project area pine stands are rated at medium to high risk for MPB infestation. A high level of mortality is expected throughout the area as a result of the ongoing epidemic. This would increase fuel loads and wildfire hazard, and poses a significant threat to ecosystem components and forest resources.

According to Schmid et al (2007), the most important aspect of managing mature ponderosa pine stands in the Black Hills National Forest is minimizing MPB-caused mortality. The only effective long-term strategy to minimize beetle-cause mortality is controlling stand conditions through silvicultural means over large landscape and monitoring areas of beetle buildup (USDA Forest Service 2010d). The proposed action includes immediate removal of infested pine trees to limit MPB spread locally, and thinning of denser pine stands throughout the landscape to reduce their susceptibility to attack both now and into the future.

Comments and feedback during scoping indicates strong support for management action and a sense of urgency in getting these actions completed. This is especially true of those who live in or near the area. Some have experienced MPB infestations on their own private property and are taking actions to treat these stands. The dilemma they face is that large expanse of infested and high hazard National Forest System lands adjacent to or surrounding their property. One comment recommended that the MPB epidemic should take its natural course and create natural disturbance regimes and questioned whether conventional thinning and removing infested trees to reduce stand density would actually reduce MPB susceptibility and tree mortality.

The parameters presented below are the measurement indicators for the mountain pine beetle issue. The focuses on the MPB hazard levels for pine stands within the project area – the larger number of acres at high hazard, the greater the potential for infestation. A comparison between alternatives is displayed in table format at the end of Chapter 2. Also, a narrative description of the comparative differences in effects is presented briefly in the Comparison of Alternatives section in Chapter 2 and in more detail under the Vegetation section in Chapter 3 of this EIS.

Measurement Indicator for Mountain Pine Beetle:

- **MPB Hazard Rating – Low (acres)**
- **MPB Hazard Rating – Moderate (acres)**
- **MPB Hazard Rating – High (acres)**

2. Wildfire and Fuels Hazard

The Forest Service, State of South Dakota, local governments, and area residents take the need to reduce fuels and the potential for large-scale wildfires very seriously. Large wildfires (fires greater than 300 acres) burned about 147,900 acres during the period from 1900 to 1980 in the Black Hills. Since 1980, a dramatic increase in acreage burned has occurred. Recent wildfires, including but not limited to the Jasper Fire, Roger's Shack, Elk Mountain II, Battle Creek, Grizzly Gulch, Red Point,

Ricco, Cement, East Ridge and Alabaugh Fires have burned over 296,000 acres. These intense fires covered large areas, moving as far as eleven miles in one day and as fast as five miles in three hours. Area fires have significantly impacted natural resources, public and private lands, threatened the safety of and injured firefighters, and resulted in civilian death.

The Pennington County Community Wildfire Protection Plan and the Lawrence County Community Wildlife Protection Plan (CWPP) designates most of the project area as wildland-urban interface. It includes the 'at-risk'-community of Silver City, 1,154 acres of private lands, subdivisions, businesses, and a major recreational complex within the project area. The project area is rated as a fire regime condition class of 3 (FRCC3). This means it has been significantly altered from the historical range and there is a high risk of significantly altering or losing key components of the forest ecosystem. Currently, 63 percent of the project has a high fire hazard rating. This hazard is associated with the potential for large-scale wildfires. The ongoing MPB epidemic is increasing the wildfire hazard by adding large amounts of dead fuels to the mix.

The proposed action includes removing MPB infested trees, thinning stands with moderate and high wildfire hazard, constructing fuel breaks, removing activity fuels from the forest floor, retaining and restoring hardwoods and meadows/grasslands, and prescribed burning. Many of the stands with moderate/high wildfire hazard also have high risk for MPB. The proposed action recognizes that wildfire in this setting cannot be eliminated. But by deliberately managing vegetation and fuels, reduced potential for large and severe wildfires can be realized.

Comments and feedback during scoping indicate that there is broad public support for fuel hazard reduction using mechanical means. One comment recommended focusing fuels treatments close to private lands (within one-half mile of inhabited structures) and not treating in the backcountry (the larger landscape). There was also support for using prescribed fire as a tool for reducing fuels and slash. Concerns regarding prescribed fire include the threat of escaped fire, visuals, and smoke.

The parameters listed below are measurement indicators for the multiple aspects of the wildfire and fuel hazard reduction issue in the Pactola Project Area. These indicators represent a number of variables associated with the threat of wildfire and fuels hazard reduction. Public concern about risk, health, and safety relative to large-scale wildfire are of paramount importance and implicitly considered and represented in these measurement indicators. A comparison between alternatives is displayed in table format at the end of Chapter 2. Also, a narrative description of the comparative differences in effects is presented briefly in the Comparison of Alternatives section in Chapter 2 and in more detail under the Fire and Fuels section in Chapter 3 of this EIS.

Measurement Indicators of Wildfire and Fuel Hazard Issue:

- **Fire Hazard Rating (acres now/post treatment)**
- **Mechanical Treatments (acres)**
- **Fuel Break Corridors (acres)**
- **Natural Fuel Break Enhancement – Hardwood and Meadows/Grasslands (acres)**
- **Prescribed Burning (acres)**

3. Vegetation and Wildlife Habitat Diversity

The Forest Plan provides desired future conditions for the five management areas involved – MA 2.2, MA 3.7, MA 5.1, MA 5.4, and MA 8.2. Included in the desired future conditions for all MA's is to have a mosaic of vegetation, with openings and diverse sizes and ages of tree stands, and a diversity of plant and animal species. Both large-scale MPB and wildfire are major threats to achieving these desired conditions within the Pactola Project Area.

The proposed action seeks to achieve vegetation and wildlife diversity for this area. Removal of MPB infested trees and thinning dense stands would reduce the amount of MPB-caused mortality and maintain mature pine trees within the stands; mechanical thinning, activity fuel removal, and prescribed burning would limit the potential for wildfire that could impact large areas of the forested ecosystem. Removal of encroaching conifers within and adjacent to hardwoods and meadows/grasslands would contribute to maintaining these habitats. Removing overstory trees in areas with advanced regeneration provides for younger structural stages that are important for many species.

Most respondents commented on their support to limit the spread of MPB and reduce wildfire hazard. A few respondents commented directly on vegetation and wildlife habitat diversity. Generally, the emphasis of these comments was to leave the maximum amount of mature pine on the landscape and ensure that the needs of all animal species be addressed. Comments also suggested no new road construction or reconstructed miles of road work in the Project Area.

Measurement indicators are listed below for the varied aspects of the vegetation and wildlife habitat diversity issue. These indicators are represented by habitat components applicable to the Black Hills NF as specified in the Forest Plan or other direction. A comparison between alternatives is displayed in table format at the end of Chapter 2. Also, a written description of the comparative differences in effects is presented in the Comparison of Alternatives section in Chapter 2 and in the Vegetation and Wildlife section in Chapter 3 of this EIS.

Measurement Indicators for Vegetative and Wildlife Habitat Diversity:

- **Structural Stages for the Project Area (acres)**
- **Retention and Restoration of Hardwoods and Meadows/Grasslands (acres)**

CHAPTER 2 ALTERNATIVES, INCLUDING THE PROPOSED ACTION

INTRODUCTION

This Chapter provides a detailed description of the proposed action (Alternative B), Alternative C, as well as a No Action alternative (Alternative A) for the Pactola Project Area. Maps of the proposed action and alternatives are located in Appendix E of this EIS. The Agency has not identified a preferred alternative at this time.

This chapter presents the alternatives comparatively by both describing and displaying the quantitative and qualitative differences between each alternative. The intent is to provide the public and decision maker a basis for choice among management options when considering the environmental consequences (effects) of implementing each alternative as disclosed in Chapter 3 of this EIS.

A brief overview is presented toward the end of this chapter regarding those alternatives that were considered by the Core ID Team but eliminated from detailed development and study. The last section of the chapter contains two comparative tabular summaries that describe each alternative and display the quantitative and/or qualitative effects of implementing each alternative relative to the three key issues presented in Chapter 1.

ALTERNATIVES CONSIDERED IN DETAIL

This section provides a summary of activities that are planned to occur during implementation of any of the alternatives. *It is important to note that the amount (e.g. acres, miles, etc.) of a certain activity in any alternative is approximate (based on inventory and survey estimates).* Actual figures may increase or decrease somewhat during "on-the-ground" preparation of the project actions based on such things as non-uniform fuels regime or stand structure, small inclusions of inoperable terrain, refinement of length or standard of road needed or eliminated, etc.

The Pactola Project qualifies as an "authorized fuel hazard reduction project" pursuant to HFRA Sec. 102(a)(4). This determination is set forth in a project memo entitled "Authorized Hazardous Fuel Reduction Projects per HFRA" held in the Pactola Project file.

Pursuant to HFRA, authorized projects cannot take place in wilderness areas, wilderness study areas or areas where removal of vegetation is prohibited by an act of Congress or Presidential proclamation. None of these restrictions apply to the Pactola Project (Sec. 102 (d)). Also, HFRA requires that projects, such as the Pactola Project, be consistent with the LRMP (Sec. 102 (b)).

The Pactola Project Core ID Team recommended (with Deciding Official concurrence) that the No Action, Proposed Action, and one additional action alternative would be considered in detail. Section 104 of HFRA provides guidance on the range of alternatives studied in detail and disclosed in the NEPA document.

Alternative A would take no action to address the purpose and need. Alternatives B and C are action alternatives that focus to varying degrees on meeting the purpose and need. Alternative B is the proposed action and includes commercial and non-commercial thinning, overstory pine removals, conifer removal within and surrounding hardwoods and meadows, and prescribed broadcast burning. Alternative C was developed in response to public comments received during the scoping period. Specifically, it responds to concerns about safety and access on roadways (ingress/egress) and the use of alternative logging techniques (helicopter/cable).

The HFRA (Sec. 101(3)) also encourages the development of Community Wildfire Protection Plans (CWPP), which identify areas of WUI and recommends the types and methods of treatments on Federal and non-Federal land. Pennington County and Lawrence County have both completed a CWPP. The plan designates most of the Pactola Project Area as WUI for the purposes "covered" by HFRA (Sec. 102(a)(1)).

Alternative A – No Action

The National Environmental Policy Act (NEPA) requires the study of the No Action Alternative and to use it as a basis for comparing the effects of the Proposed Action and other alternatives.

The No Action Alternative assumes that no implementation of any elements of the Proposed Action or other action alternatives would take place within the Pactola Project Area within the next 10 to 15 years. This alternative represents no attempt to actively respond to the purpose and need for action or the issues, concerns or comments identified during scoping for this project. There would be no effort to modify existing vegetation and related fuels conditions in the project area. However, ongoing fire suppression efforts, noxious weed treatment, and recurring road maintenance on system roads would continue as directed by the Forest Plan, as amended.

It is important to note that the absence of management actions does not mean that conditions in the area would remain static over time. In fact, there would likely be dramatic changes. This is related to the actions of nature and to the actions of people. Natural processes are likely to result in the large-scale mortality of mature pine trees due to the ongoing mountain pine beetle epidemic, and the continuing encroachment of conifers into hardwoods and meadows. Dead pine trees would add to the accumulation of ground and ladder fuels and increase the potential for large-scale wildfires with associated negative effects on the land, values, wildlife, and people. Human caused changes include a further increase in development on private land, expanded dispersed recreation use, and increased traffic on the newly designated road and trail system in the project area.

This alternative:

- Postpones management actions intended to move resource conditions toward achieving certain Goals and Objectives of the Forest Plan (i.e., related to insect/disease and fire/fuels hazard reduction); and

- Delays or does not respond to the Forest Plan and guidance provided by HFRA to deal with an epidemic of insects and fuel and fire hazard reduction needs.
- Continues routine maintenance of roads and road improvements
- Continues other National Forest management as directed by the Forest Plan and other project related decisions.

Alternative B – Proposed Action

Alternative B is designed to treat vegetation on a broad landscape scale to reduce the threat to ecosystem components, including forest resources, from the existing insect and disease (mountain pine beetle) epidemic and reduce the potential for large-scale wildfire. The alternative was developed as a proactive response to the purpose and need for action and it represents the Forest Service proposed action (see description of the purpose and need plus the proposed action in Chapter 1 of this EIS).

Alternative B proposes approximately 13,000 acres of commercial and non-commercial thinning to open up forest stands by removing MPB infested trees and reduce stand densities to lower mountain pine beetle and wildfire hazard. Most non-commercial thinning overlaps commercial thinning acres. This broad forest thinning serves to reduce MPB habitat, reduce fuel loads, increase tree growth, and create landscape-scale fuel breaks to reduce the potential for large-scale high intensity wildfire. Most forest thinning would be conducted using whole tree harvest methods or methods achieving a similar result in order to reduce fuel loading. Sanitation harvest to remove infested pine trees may be conducted in areas near or adjacent to identified stands in order to limit the expansion of MPB population. Commercial thinning activities would emphasize thinning from below and retaining the larger diameter trees while meeting the insect and fire hazard reduction objectives. Alternative B also includes treatments of fuel break adjacent to some private property boundaries, along primary roads, and utility corridors where commercial/non-commercial units overlap.

Scattered overstory removals are also planned in this alternative. They provide a break in the continuous overstory canopy that can further reduce potential for fire spread, create early seral stage habitat and a mosaic landscape, and help meet Forest Plan structural stage objectives. Alternative B proposes conifer removal (retention and restoration) from within and surrounding typed hardwood stands, and reduces pine encroachment into historic meadows. Removing pine from these areas improves their capability to function as a natural fuel breaks and provides habitat diversity over the long term.

Alternative B proposes prescribed burning on approximately 5,000 acres to reduce fuels and enhance natural fuel breaks. This prescribed burning is intended to provide multiple benefits: limit fuel loads and lessen wildfire hazards; re-establish fire and its natural role in the environment; and provide for habitat diversity.

See Table 2-1 and Table 2-2 at the end of this chapter for a comparison of alternatives. Appendix E contains maps that display vegetation treatments, fuel reduction and prescribed

fire activity. Design criteria, mitigation, and monitoring specific to this alternative are described in Appendix B.

Specific action planned and treatment activities in Alternative B include:

Commercial and Non-Commercial Treatments*

- Thinning – 6,411 acres
- Removal Cuts – 828 acres
- Hardwood Retention – 1,219 acres
- Hardwood Restoration – 477 acres
- Meadows/Grasslands (conifer removal) – 436 acres
- Cable Logging – 0 acres
- Fuel Break Thinning (along primary roads) – 0 acres
- Helicopter Logging – 0 acres

*Non-commercial treatments may overlap in commercial units

Non-Commercial Treatments

- Thinning – 3,770 acres
- Shaded Fuel Breaks – 0 acres

Total Estimated Area of Mechanical Treatments 13,142 acres

Other Treatments

- Prescribed Broadcast Burning – 5,000 acres

Total Estimated Volume of Timber and Other Products Removed

- Volume of Saw Timber Removed – 24,800 MBF (49,600 CCF)
- Volume of Products (pole timber) Removed – 3,215 CCF

Road Work

- New Road Construction – 3 miles
- Road Reconstruction – 27 miles
- Maintenance – 69 miles

Alternative C

Alternative C was developed in response to public comments received during the scoping period. Specifically, it responds to concerns about safety and access on roadways (ingress/egress) and the use of alternative logging techniques (e.g. helicopter/cable).

Under this alternative, approximately 16,900 acres would be treated mechanically (commercial and non-commercial thinning). The treatments in this alternative are the same as those described in Alternative B with three additional treatments:

- Treating approximately 400 acres along designated roadways within the project area to improve access (ingress/egress).
- Approximately 1,270 acres of cable and/or helicopter logging.
- Helicopter logging of an additional 500 acres outside of treatment areas to remove "green hits" of mountain pine beetle infestations in areas that are not accessible by other means within the Pactola Project Area.

Prescribed broadcast burning is the same as described in Alterative B.

See Table 2-1 and Table 2-2 at the end of this chapter for a comparison of alternatives. Appendix E contains maps that display the location of vegetation treatments, fuel reduction, and prescribed fire activity. Design criteria, mitigation, and monitoring specific to this alternative are described in Appendix B. Specific actions planned and treatment activities in Alternative C include:

Commercial and Non-Commercial Treatments*

- Thinning – 7,194 acres
- Removal Cuts – 1,041 acres
- Hardwood Retention – 1,219 acres
- Hardwood Restoration – 681 acres
- Meadows/Grasslands (conifer removal) – 461acres
- Cable Logging – 1,269 acres
- Fuel Break Thinning (along primary roads) – 436 acres
- Helicopter Logging – 500 acres

*Non-commercial treatments may overlap in commercial units

Non-Commercial Treatments

- Thinning – 4,540 acres
- Shaded Fuel Breaks – 71 acres

Total Estimated Area of Mechanical Treatments 17,412 acres

Other Treatments

- Prescribed Broadcast Burning – 5,000 acres

Total Estimated Volume of Timber and Other Products Removed

- Volume of Saw Timber Removed – 35,700 MBF (71,600 CCF)
- Volume of Products (pole timber) Removed – 3,650 CCF

Road Work

- New Road Construction – 19 miles
- Road Reconstruction – 29 miles
- Maintenance – 72 miles

ACTIVITIES COMMON TO ALL ACTION ALTERNATIVES

The following is a description of specific actions planned that are common to both action alternatives (with some exceptions as noted) both in terms of type of action, amount, or size.

Fuels Management Collaboration and Cooperation
Under all Action Alternatives strong emphasis would be given to further current efforts at working collaboratively with the State Wildland Fire and Forestry Divisions, Volunteer Fire Departments, Pennington County, Lawrence County, landowners, and others regarding insect and fuels hazard reduction and management concerns including:

- Implementing the management recommendations and guidance set forth in the Pennington County and Lawrence County Community Wildfire Protection Plans;
- Working collaboratively with State, local jurisdictions, and private landowners to treat hazardous fuels in a coordinated effort along adjoining NFS/private land boundaries;
- Advocating the use of appropriate building materials, landscaping techniques, appropriate fuel break construction methods like those recommended by the "*Firewise*" program on adjoining lands; and
- Coordinating access needs for ingress/egress and fire suppression with local VFDs, the appropriate State and County authorities and private landowners.

DESIGN CRITERIA

Design criteria include standard practices such as Forest Plan Standards and Guidelines (S&Gs), Best Management Practices, and others. They are actions that are applicable and expected to be implemented as a matter of standard operating procedures consistent with the theme of a given alternative. Design criteria are applied in order to protect resources and forest users, as well as minimize impacts resulting from implementing action alternatives (see Appendix B).

MONITORING

The Mystic Ranger District is responsible for monitoring results and effects of the selected actions. The District would ensure that EIS and Record of Decision (ROD) direction including design criteria and any necessary mitigation measures are applied and carried out appropriately.

Project and contract administrators would perform much of the project monitoring during project implementation. Other resource specialists would monitor specific progress including application of design criteria and mitigation measures related to their resource of

concern. There would be a negligible difference in costs associated with monitoring across all Action Alternatives (See Appendix B).

ALTERNATIVES CONSIDERED but ELIMINATED FROM DETAILED STUDY

Additional alternatives to the Proposed Action were considered based on issues and concerns expressed during the scoping period. Most scoping comments were supportive of the Proposed Action, but some had recommendations to consider alternative actions as part of the NEPA analysis. The HFRA Section 104(c)(1)(C)(i)(ii) specifies consideration of additional alternative(s) meets the purpose and need of the project. Some of the comments recommended actions that were outside the scope of the purpose and need, some were actions that could be incorporated into design and mitigation measures included in the proposed action, and some were incorporated into an additional alternative (Alternative C) for detailed study. The following provides an overview of alternatives that were considered, but eliminated from detailed study.

An alternative was proposed that would not allow any new or reconstructed miles of road work or convert any 'non-system' roads or user-created routes into system roads. Alternative A (No Action) addresses a portion of this proposed alternative – no new road construction. The Forest-wide Travel Management EIS/ROD designates motorized routes/areas within and surrounding the project area.

The Transportation System for the Proposed Action (Alterative B) proposes to convert one-half mile of existing non-system road and construct approximately three miles of new road. This represents only a small fraction (1-2%) of the total system and non-system roads that currently exist on the landscape. The HFRA, under which the project is proposed, is intended to streamline the NEPA process, limit the number of alternatives analyzed (see HFRA Section 104(c)(1) and (2)), and focus on meeting the purpose and need for the project (HFRA Section 104(c)(1)(C)(i)(ii)). Analyzing a separate alternative that constructs no new roads or converts no existing non-system roads is already well within the range of alternatives considered in detail in this EIS.

Alternatives B and C propose to reconstruct approximately 27 to 28 miles of system road to improve drainage, protect roadbeds from damage, and ensure safe passage of needed equipment. An alternative that does not treat MPB infested stands by precluding reconstruction would not meet the purpose and need for the project. If these stands were treated without reconstructing the roads, then unacceptable environmental damage and safety issues would occur, and would not be in compliance with the Forest Plan, as amended.

An alternative that does not allow any new construction, conversion of existing non-system roads, or reconstruction of existing system roads was considered but eliminated from detailed study for the reasons cited above.

An alternative that addresses fragmentation concerns on the BHNF. Fragmentation and related issues were considered in the 1996 Final EIS for the Revised Forest Plan (p. III-247 through III-275). The Forest Plan addresses both fragmentation and wildlife habitat

diversity in part through a desired mix of structural stages (see Objectives 5.1-204 and 5.4-206). Action alternatives considered in detail for the Pactola Project are consistent with Forest Plan structural stage objectives.

This area was naturally fragmented prior to Euro-American settlement, and many species benefit or depend on vegetation patterns that some refer to as fragmentation. This natural fragmentation resulted in a mix of hardwoods, meadows, spruce, and various size and classes of ponderosa pine. Today's forest is more continuous, uniform, and dense than what naturally occurred, and there are less hardwoods and meadows now than in the past. The concern expressed about fragmentation includes the desire to maintain areas of mature pine trees across the landscape. Existing mature pine stands in the project area are being significantly altered by the ongoing MPB epidemic. The action alternatives considered in this EIS are expected to maintain larger areas of mature pine trees over the next decade than the No Action alternative. Therefore, the action alternatives, by design, address fragmentation to varying degrees. For the reasons cited above, a separate alternative designed to address fragmentation was considered but dismissed from detail study.

An alternative was proposed that would retain large diameter yellow bark trees, large diameter future snags, retain older dense pine stands, and minimally treating mature pine stands (Structural Stages 4B, 4C and 5). No alternative would treat SS 5 stands. Structural Stage 4B and 4C stands are rated high hazard for mountain pine beetle infestation and are a high to very high wildfire hazard (Phase II EIS, II-4, Table2-1; see also the Vegetation, and Fire and Fuels sections of Chapter 3; and Forest Health Evaluation Report R2-10-02 - USDA Forest Service, 2010d). Many of these stands are currently infested with MPB and a large-scale epidemic is killing trees and increasing fuel loads within and surrounding the Pactola Project Area. An alternative that that does not remove any large trees or thin dense pine stands was considered but eliminated from detailed study because it would not address the purpose and need as presented in Chapter 1 of this EIS, nor would it meet Forest Plan direction. Specifically, it would not move toward achieving desired land and resource conditions, would not reduce the threat to forest resources from the existing MPB epidemic, would not restore resource conditions to a healthy, resilient fire-adapted ecosystem, and would not help protect local communities and resources from large-scale wildfire.

An alternative was proposed that would limit commercial treatments to within one-half mile of structures. This proposal is intended to provide defensible space from wildfires around private property. The Healthy Forests Restoration Act encourages the development of Community Wildfire Protection Plans. Pennington and Lawrence Counties have Community Wildfire Protection Plans and defines WUI buffers and treatments within one-half mile, one and one-half mile, and three mile buffer zones. An alternative that only treats within one-half mile of structures was considered but eliminated from detailed study for several reasons. First, wildfires in the Black Hills have been observed lofting embers and starting spot fires up to one-half mile in front of a fast moving fire front. Second, limiting mechanical treatments to one-half mile does not address the need to treat stands that are infested with MPB or other high hazard stands. Third, over the entire project area, 63% of NFS lands receive a high or very high fire hazard rating. Combined with steep and broken terrain, the potential for a fast moving stand replacing fire is relatively high.

Furthermore, it does not address the threat to ecosystem components from a large-scale wildfire over the larger project area.

COMPARISON OF ALTERNATIVES

This section presents a brief comparative discussion of the three alternatives given detailed study in this EIS. The alternatives are described and compared in terms of the effects each alternative has on the key issues described in Chapter 1. A comparative overview of vegetation treatment activities is also provided. Table 2-1 and 2-2, display comparative summaries of the effects of each alternative and their respective treatment activities. The environmental consequences of the alternatives to the resources affected in the Pactola Project Area are more completely described in Chapter 3 of this EIS and information contained in the Project File.

1. Mountain Pine Beetle Issue

The ongoing MPB epidemic is of foremost concern in the project area. This epidemic is killing mature pine trees, resulting in stand replacement on a landscape scale. According to Schmid et al (2007), the most important aspect of managing mature ponderosa pine stands in the Black Hills National Forest is minimizing MPB-caused mortality. The only effective long-term strategy to minimize beetle-cause mortality is controlling stand conditions through silvicultural means over large landscape and monitoring areas of beetle buildup (USDA Forest Service, 2010d).

Stand conditions in large parts of this area remain conductive to sustaining high levels of beetle-caused mortality allowing the outbreak to expand further – 92% of the project area is rated at medium to high MPB hazard. Alternative A would allow the epidemic to expand. The western end of the project area has the most beetle activity, the central part is starting to pick up groups of infested trees, and the eastern edge has low levels of tree mortality (USDA Forest Service 2010d). In the hardest hit areas, near complete mortality of the larger trees would occur on up to 75% of structural stages 4B, 4C, and 5 (dense stands with larger trees). Significant but lesser amounts of mortality would be expected in structural stage 3B, 3C, and 4A – 3B and 3C because of the tree density and in SS 4A because of the larger tree size.

Thinning stands to achieve lower basal areas and removal of infested pine trees under Alternatives B and C would reduce the MPB hazard. The protection provided for the area would extend into the next decade and remain low/medium in areas treated for much of that time. Alternative B would reduce the existing MPB hazard within the project area from 66% high hazard rating to 33%. Alternative C would reduce the MPB high hazard rating from 55% to 26%. Alternative C would have a slightly lower MPB hazard rating and somewhat lower expected MPB-caused tree mortality as compared to Alternative B.

2. Wildfire and Fuel Hazard Issue

Most of the Pactola Project Area is outside of its historical range of variability and can be classified as Fire Regime I, Condition Class 3 (FRCC). As discussed in other parts of this EIS, FRCC is a classification system for the amount of departure from the natural

(historical) fire regime of vegetation and fuels conditions in a given area (see Chapter 6 Glossary for full definition of FRCC). The Pennington County and Lawrence County Community Wildfire Protection Plan designates most of the project area as wildland-urban interface (WUI). The project area includes the 'at-risk' community of Silver City, 1,154 acres of private lands, subdivisions, businesses, and a major recreational complex.

Within the project area, slopes are typically less than 40%, but increase sharply in areas around Rapid Creek and Pactola Reservoir, in which many hill slopes are 40% or steeper. The Pactola Project Area has 231 identified address points and an additional 114 within one half mile of its boundaries. Private property accounts 1,154 acres of the total project area. Though there are two directions for a potential evacuation from Silver City, egress could be a dangerous activity. Both directions require climbing out steep terrain with tight windy roads. There are also several other concentrations of homes within the area including Edelweiss Mountain and Pactola Estates. Edelweiss Mountain, in particular, is located in a somewhat precarious position. Located in the upper third of a substantial drainage, structure protection and firefighting would be a dangerous proposition under high fire danger weather conditions.

It is not possible to eliminate fire from a short interval fire regime based on past history of fire events in the Black Hills. Wildfires would continue to occur within or adjacent to the project area. Most of these fires are of low intensity and are too small to have a significant effect upon the environment. It is the large, severe wildfires that have the most impact upon the ecosystem, the public, and private lands conditions and values. The alternatives for the Pactola Project have been evaluated on their effectiveness in reducing the potential for large, severe wildfires.

Forest vegetation and fuels conditions in the Pactola Project area would continue to deviate from its historical range under Alternative A (No Action). With the expanding MPB epidemic, large amounts of dead, dry fuels would be added to an already serious wildfire hazard. Currently, 63% of the project area is rated at a high to very high wildfire hazard and this hazard would continue to increase if no action is taken to modify or treat the fuels. The end result could be high intensity wildfire over much of the project area that would remove much of the existing forest cover. This would cause significant negative effects to the ecosystem, area infrastructure, public and private lands, and threaten the lives of residents and firefighters.

Treatments planned in Alternatives B and C would help reduce the potential for a severe wildfire by moving the forest closer to a Condition Class 1 or 2 - i.e., conditions more closely approaching the natural (historical) range of variability of vegetation characteristics; fuel composition; wildfire frequency, severity and pattern; and other associated disturbances. This would be accomplished by thinning the ponderosa pine forest, removing or treating some of the surface fuels and by use of prescriptive fire.

Both Alternatives B and C would have an effect on reducing fire hazards. Both alternatives would treat the forest and manage the forest to a lower stand density. Treatments would be implemented on a landscape basis and designed so that it would complement existing or natural fuel break features such as hardwood stands, meadows, private land pastures, and moister habitats.

Fire Hazard is expected to be reduced with Alternatives B and C, but conditions change quickly in a Fire Regime I forest, and fire hazard would eventually escalate post-treatment as the vegetation grows and the detritus once again accumulates. However, the fire hazard in twenty years is expected to be much lower with Alternative B or C than the No Action Alternative.

3. Vegetation and Wildlife Habitat Diversity Issue

Vegetation and wildlife habitat are not static properties. Changes in vegetation and associated wildlife habitat would occur in the Pactola Project Area regardless of which alternative is selected, including the No Action Alternative. The ongoing MPB epidemic would continue to greatly affect the vegetation and wildlife habitats in the project area. In the hardest hit areas, near complete mortality of the larger trees would occur on up to 75% of the structural stages 4B, 4C, and 5 (dense stands with larger trees). Significant but lesser amounts of mortality would be expected in structural stage 3B, 3C and 4A – 3B and 3C because of the tree density and 4A because of the larger tree size. Increased fuel loading caused by dead and dying pine trees would increase the potential for even more dramatic changes from wildfire, up to the complete removal of the existing forest over large portions of area.

In the short term, Alternative A would favor wildlife species that prefer dense mature pine stands with large amounts of standing dead trees (snags). Many of these habitats would change with the ongoing MPB epidemic and greater potential for large-scale wildfire, so Alternative A might not provide for these habitats on a long term basis.

Action Alternatives B and C would directly reduce, but not eliminate the amount of dense pine habitat, and would tend to favor wildlife species that thrive in more open and varied stands. Lower basal areas would improve growth and vigor and increase the size of the remaining trees. These alternatives also would have a lower but sufficient amount of snags as compared to Alternative A. Alternatives B and C would reduce mountain pine beetle hazard and tree mortality. Fuel loading would be managed and overall wildfire hazard reduced.

The removal of the pine overstory in Alternatives B and C would release the established understory from competition for light, water, and nutrients. The effect would be an increase in early successional, younger structural stage pine directed at meeting Forest structural stage objectives. Species associated with early seral pine habitats would benefit from treatments proposed in Alternatives B and C. Non-commercial treatments and prescribed broadcast burning included in Alternatives B and C would remove the smaller diameter pine understory. That component of stand structure would be reduced, in individual stands and across the landscape, but such treatments would have little effect on the overall structural and seral stage of the pine community.

Both Alternatives B and C would restore hardwoods (aspen and birch) by removing conifers from around the edges of the typed hardwood stands. This would give the hardwoods an opportunity to expand in size and limit the amount of pine encroachment in these areas. Alternatives B and C would also retain existing hardwoods by removing conifers that are growing within the within the hardwood stands. Alternatives B and C would remove pine from meadows/grasslands where trees have encroached. Both alternatives would benefit

wildlife species associated with important hardwood and meadow/grasslands communities. Both Alternatives B and C would do the most benefit hardwood dependent species. Alternative A would do nothing to slow the loss of these communities.

Table 2-1 Effects to Key Issues by Alternative

1. Mountain Pine Beetle		**Existing Condition**	**Alt A**	**Alt B**	**Alt C**
MPB Risk Rating – Low (acres)		1,881	12,095	9,117	8,668
MPB Risk Rating – Moderate (acres)		6,256	6,354	10,112	10,730
MPB Risk Rating – High (acres)		14,181	3,867	2,625	2,249
2. Wildfire and Fuels Hazard			**Alt A**	**Alt B**	**Alt C**
Fire Hazard Rating (High)	Post Treatment		63%	28%	20%
	In 20 years		77%	59%	54%
Total Mechanical Treatments (acres)			0	13,141	17,412
Roadside Treatments (acres)			0	0	436
Shaded Fuel Breaks (acres)			0	0	71
Prescribed Broadcast Burning (acres)			0	5,000	5,000
3. Vegetation and Wildlife Habitat Diversity			**Alt A**	**Alt B**	**Alt C**
Hardwood Retention (acres)			0	1,219	1,219
Hardwood Restoration (acres)			0	477	681
Meadows/Grasslands Retention/Restoration (acres)			0	436	461

Projected Habitat Structural Stages for the Project MA 5.1 and 5.4 in acres:

Structural Stage	**Existing Condition**		**Alternative A**		**Alternative B**		**Alternative C**	
	MA 5.1	**MA 5.4**	**MA 5.1**	**MA 5.4**	**MA 5.1**	**MA 5.4**	**MA 5.1**	**MA 5.4**
1	0	106	0	106	0	106	0	106
2	0	221	951	2,095	688	1,745	280	1,506
3A	317	1,233	1,869	4,251	986	3,716	889	4,047
3B	645	1,201	323	601	59	248	63	171
3C	340	738	170	369	22	176	7	128
4A	1,101	2,641	1,282	2,621	3,234	4,264	3,668	4,321
4B	2,185	4,231	732	1,301	213	647	180	665
4C	739	973	0	0	0	96	0	0
5	0	0	0	0	22	31	0	16

Table 2-2 Treatment Outputs by Alternative

Commercial/Non-Commercial Treatments*	**Alternative A**	**Alternative B**	**Alternative C**
Thinning	0	6,411	7,194
Removal Cuts	0	828	1,041
Hardwood Retention	0	1,219	1,219
Hardwood Restoration	0	477	681
Meadows	0	436	461
Roadside Treatments	0	0	436
Cable Logging	0	0	1,269
Helicopter Logging	0	0	500
Total Commercial/Non-Commercial Treatment Acres	0	9,371	12,872
Non-Commercial Treatments			
Thinning	0	3,770	4,540
Shaded Fuel Breaks	0	0	71
Total Mechanical Treatments	**0**	**13,142**	**17,412**
Other Treatments			
Prescribed Fire	0	5,000	5,000
Volume Removal			
Sawtimber MBF	0	24,800	35,700
Sawtimber CCF	0	49,900	71,,600
Products CCF	0	3,215	3,650
*May include both commercial and non-commercial treatment			

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CHAPTER 3 AFFECTED ENVIRONMENT and ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter describes the affected environment for each resource analyzed. Subsequently, the environmental consequences of the alternatives on the resource components of the physical, biological, and social environment in the Pactola Project Area are disclosed. Environmental consequences are described in terms of the beneficial/adverse, short and long-term direct/indirect and cumulative effects. Effects are quantified where possible, although qualitative discussion is often necessary. Elements that are not affected or minimally affected by the alternatives such as climate, noise, and topography are not discussed. This chapter provides the scientific and analytical basis for the comparison of alternatives presented in Chapter 2.

Direct and indirect effects of the proposed action and its alternatives were analyzed over the planning period (10-15 years). Cumulative effects take into account past, present, and reasonably foreseeable activities from actions other than the Pactola Project, in addition to direct and indirect effects of the Pactola Project. The area analyzed for cumulative effects is the project area for all resources unless otherwise noted. Cumulative effects are disclosed under each resource topic.

In order to understand the contribution of past actions to the cumulative effects of the proposed action and alternatives, this analysis relies on current environmental conditions as a proxy for the impacts of the past action. This is because existing conditions reflect the aggregate impact of all prior human actions and natural events that have affected the environment and might contribute to cumulative effects.

This cumulative effects analysis does not attempt to quantify the effects of past human actions by adding up all prior actions on an action-by-action basis. There are several reasons for taking this approach. First, a catalog and analysis of all past actions would be impractical to compile and unduly costly to obtain. Current conditions have been impacted by innumerable actions over the last century (and beyond), and trying to isolate the individual actions that continue to have residual impacts would be nearly impossible. Second, providing the details of past actions on an individual basis would not be useful to predict the cumulative effects of the proposed action or alternatives. In fact, focusing on individual actions would be less accurate than looking at existing conditions, because there is limited information on the environmental impacts of individual past actions, and one cannot reasonably identify each and every action over the last century that has contributed to current conditions. Additionally, focusing on the impacts of past human actions risks ignoring the important residual effects of past natural events, which may contribute to cumulative effects just as much as human actions. By looking at current conditions, we are sure to capture all the residual effects of past human actions and natural events, regardless of which particular action or event contributed to those effects. Finally, the Council of Environmental Quality issued an interpretive memorandum on June 24, 2005, regarding analysis of past actions. The memorandum states, “agencies can conduct an adequate

cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions."

The cumulative effects analysis in this EIS is also consistent with Forest Service National Environmental Policy Act (NEPA) Regulations (36 CFR 220.4 (f)) (July 24, 2008), which state, in part:

> CEQ regulations do not require the consideration of the individual effects of all past actions to determine the present effects of past actions. Once the agency has identified those present effects of past actions that warrant consideration, the agency assesses the extent that the effects of the proposal for agency action or its alternatives would add to, modify, or mitigate those effects. The final analysis documents an agency assessment of the cumulative effects of the actions considered (including past, present, and reasonably foreseeable future actions) on the affected environment. With respect to past actions, during the scoping process and subsequent preparation of the analysis, the agency must determine what information regarding past actions is useful and relevant to the required analysis of cumulative effects. Cataloging past actions and specific information about the direct and indirect effects of their design and implementation could in some contexts be useful to predict the cumulative effects of the proposal. The CEQ regulations, however, do not require agencies to catalogue or exhaustively list and analyze all individual past actions. Simply because information about past actions may be available or obtained with reasonable effort does not mean that it is relevant and necessary to inform decision making (40 CFR 1508.7).

For these reasons, the analysis of past actions in this section is based on current environmental conditions.

The resource components described in this chapter are arranged in three sections:

- Physical Environment
- Biological Environment
- Social Environment

PHYSICAL ENVIRONMENT

This section will describe the affected environment and environmental consequences for each resource of the Physical Environment (Watershed, Geology, and Soils; Transportation; and Minerals).

WATERSHED, GEOLOGY, and SOILS

Affected Environment

Geographic Setting

The Pactola Project Area is situated in the central portion of the Black Hills National Forest, on the Mystic Ranger District. The project area lies west of Rapid City, north of Hill City, and contains the Pactola Reservoir on the eastern boundary. The area is

characterized by the undulating, densely-forested terrain, typical of the Black Hills region. The landscape is dominated by broad ridge tops, narrow valleys, and the steep-walled canyon associated with Rapid Creek. This canyon is oriented generally west to east.

Elevation generally increases as one travels west, ranging from approximately 4,600 feet at the Pactola Reservoir spillway on the eastern boundary, to just over 6,100 feet in the vicinity of Old Bald Peak on the southwestern boundary. Slopes are typically less than 40% for most of the Project Area (82%), but increase sharply in areas around Rapid Creek and Pactola Reservoir, in which many hill slopes are 40% or even steeper. Local relief ranges from less than 400 feet from drainage to ridge-top in the northern and southern portions of the Project Area, up to 800 feet in the vicinity of Rapid Creek and Pactola Reservoir.

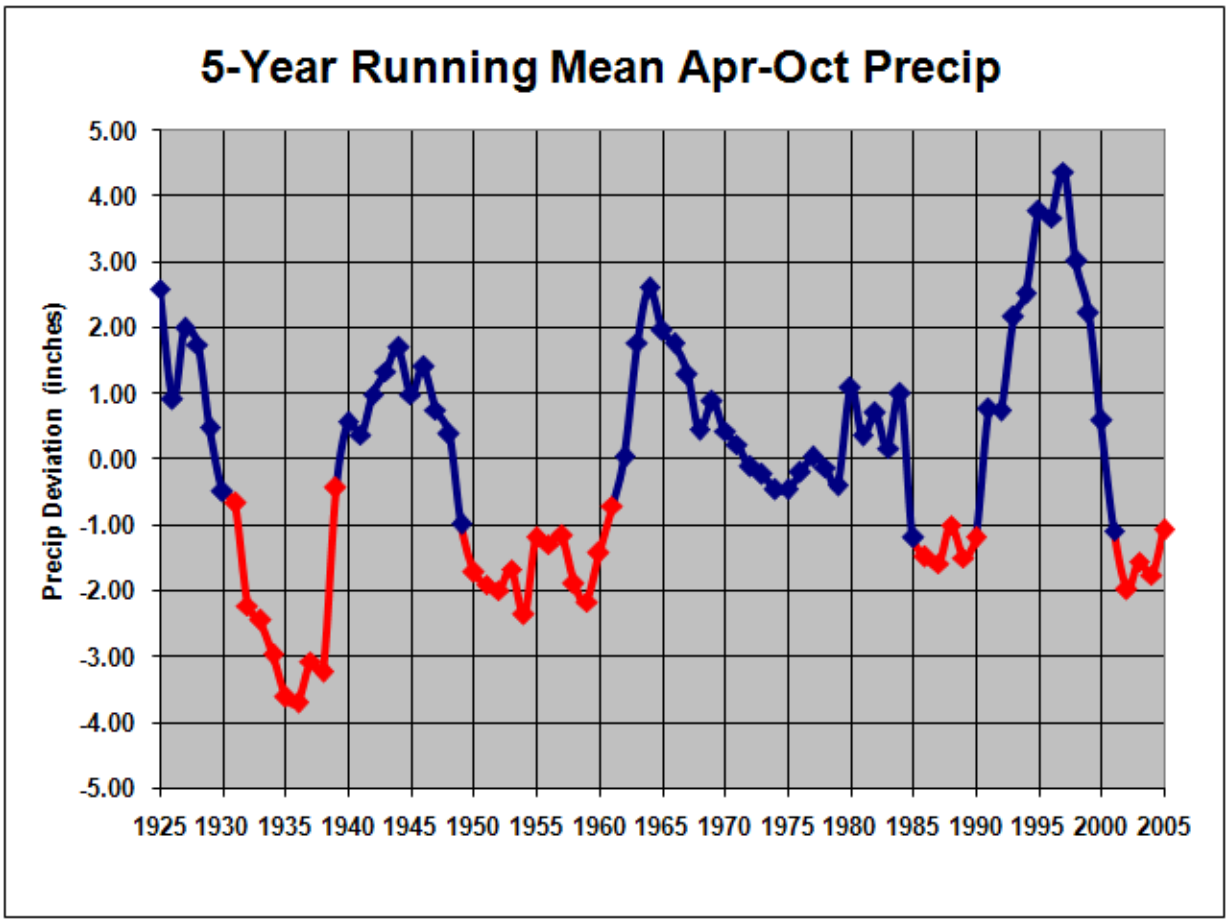
Weather and Climatic Patterns

The weather and climate of the Pactola Project Area mimics that of the overall Black Hills region. It is considered a continental climate, with hot summers, cold winters, and extreme variability in both precipitation and temperature. Precipitation and temperature are greatly influenced by topography and elevation, with more precipitation and cooler temperatures in the higher elevation areas associated with the Limestone Plateau and Crystalline Core. Temperatures range from near 100ºF during the summer months to well below 0ºF in winter. Summer days are usually quite warm, but nights are typically cool. This summertime temperature pattern and the predominant regional updraft often cause convective storms to form, starting in late spring and continuing throughout the summer.

The Pactola Project Area has two weather stations monitored through the High Plains Regional Climate Center (HPRCC) within or nearby the area. These stations include Pactola Ranger Station and Hill City (HPRCC, 2011). The average annual snowfall for Pactola Ranger Station is 48 inches and 59 inches for Hill City (HPRCC, 2011). Average annual precipitation ranges from 21 to 23 inches for the project area, increasing from south to north (Driscoll et al, 2000; Driscoll et al, 2002). Approximately 50% of the annual precipitation occurs during May, June, and July, and almost 75% during the five month period between April and August, in the form of rain associated with high-intensity, short-duration thunderstorms. The smallest amounts of precipitation typically occur during the winter months, November through February, as snow. Most of the total annual snow fall occurs in the late spring months of April and March, in which heavy and wet snowfall often causes tree damage. Over 92% of the total annual precipitation is lost to evapo-transpiration associated with the vast forests of the area (Driscoll et al, 2002).

Extremely wet climatic conditions were experienced throughout the Black Hills region during the 1990s, which is the wettest period since 1931 (Carter et al, 2002; Bunkers, 2007). Extended drought conditions occurred earlier in the century, during the 1930s and 1950s, whereas relatively short term drought conditions occurred of late in the 1980s and since 2000 (Carter et al, 2002; Bunkers, 2007). Figure 3-1 depicts both wet and drought periods as well as the cyclical nature of these events for the Black Hills region. Although it is difficult to predict what climate changes may result from global warming, researchers expect much of the western U.S. to experience earlier melting of mountain snowpacks in the spring with extended, warmer, and drier summer months (Westerling et al, 2006; Running, 2006; USDA Forest Service, 2004), much like what was experienced during 2000 through 2007 in the region.

Figure 3-1 Five-Year Running Average of Precipitation in the Black Hills Region



Geologic Analysis Area and Time Period

The analysis area for geologic resources coincides with the Pactola Project Area boundary because any impacts would not accumulate outside of the activity area due to the inherent nature of the geology found in the area. Geologic characteristics were considered for the entire Pactola Project Area, regardless of ownership, to assess existing resource conditions and analyze potential effects associated with each of the three alternatives.

Effects to geologic resources were analyzed for the time period beginning in the fall of 2011 and extending through 2036. Fall 2011 was chosen as a starting point for analysis because it is the soonest that activities related to the Pactola Project would be implemented. The year 2036 was chosen as an ending point in time because project activities would not begin to be implemented until 2011, with proposed prescribed burning and harvest activities taking place over the course of the next 20 years through the year 2031. Scientific research has found that most burned areas tend to recover within three to five years following a fire (Neary et al, 2005), so a buffer of 5 additional years was added to allow for recovery of the landscape following any prescribed burning activities that would be implemented as late as the year 2031.

Hydrogeologic Analysis Area and Time Period
The analysis area for hydrogeologic (groundwater) resources also coincides with the Pactola Project Area boundary because any impacts would not accumulate outside of the activity area due to the inherent nature of the geology found in the area. Hydrogeologic characteristics were considered for the entire Pactola Project Area, regardless of ownership, to assess existing groundwater aquifer conditions and analyze potential effects associated with each of the three alternatives. Effects to hydrogeologic resources were analyzed for the same time period as geologic resources, for the same reasons previously discussed.

Soil Analysis Area and Time Period
The analysis area for soils includes only the proposed activity units because impacts to soils occur on the site and do not accumulate outside of the activity area (USDA Forest Service, 1992). The USFS Region 2 Soil Management Handbook (FSH 2509.18) defines an activity area as "An area of land impacted by a management activity ranging from a few acres to an entire watershed depending on the type of monitoring being conducted; it is commonly a timber sale cutting unit, a prescribed fire burn unit or an allotment pasture" (USDA Forest Service, 1992). This area represents the area which was analyzed for direct, indirect, and cumulative effects to soil resources because impacts to soils occur on the site and do not accumulate outside of the activity area. Therefore, effects to soil resources in units outside of the proposed Pactola Project Area are outside the scope of this project and as such, these areas will not be further analyzed or discussed in this document. Tree harvest, grazing, and other various activities on non-Federal lands are also outside of the soil analysis area. Effects to soils were analyzed for the same time period as geologic and hydrogeologic resources for the same reasons stated previously. Effects to soil resources are summarized in the context of short term effects (five years or less) as well as long term effects (longer than five years).

Effects from known past actions were included in the analysis of existing resource conditions. Generally this includes activities that have occurred since the 1874 Custer Expedition to the Black Hills region. Proposed activities associated with each alternative were considered in the Analysis of Direct and Indirect Effects section. Past and present land use and activities within the Pactola Project boundary include timber harvest, wild and prescribed fire, livestock grazing, private land ownership, roads and off road vehicles, mines and quarries, various types of recreation, and forest product gathering. All of these activities or events individually have some level of impact on the landscape which results in cumulative effects to soil conditions and processes.

Water Resources Analysis Area and Time Period
Since the project area does not coincide exactly with watershed boundaries, the water resources analysis area differs from the project area boundary, as well as the boundary created by the four watersheds that contain portions of the project as shown in Appendix E, Map 2. The watershed analysis area encompasses the entire Pactola Reservoir-Rapid Creek 6th-level watershed, the upper 7th-level sub-watersheds within the Jim Creek-Box Elder Creek and Victoria Creek-Rapid Creek watersheds, and the entire contributing drainage area of the Silver Creek-Rapid Creek 6th-level watershed (Table 3-4).

This analysis area was used in determining direct and indirect effects to larger streams and river systems, such as Rapid Creek, that flow through a project area yet have multiple segments outside a project area – both upstream and downstream. This is done because watershed conditions upstream and downstream of a project area can cause adjustments to larger streams and rivers that propagate throughout the stream network - both upstream and downstream. Isolated water resources that are not interconnected are analyzed within the Project Boundary. These typically include springs, wetlands, and ponds.

A second, smaller scale was used to evaluate direct and indirect effects at the 8th level watershed scale. This scale was chosen in order to assess points adjacent to and directly downstream from contributing activities because any impacts that may occur can be readily observed and quantified and linked to activities associated with the project. Effects that are observable at this scale are referred to as localized in their extent.

A subset of the Upper Rapid Creek watershed was selected for the cumulative effects analysis area because activities are proposed within portions of each watershed; only a small portion of the Jim Creek and Victoria Creek watersheds include project activities; the majority of proposed project activities would take a place in the Silver Creek and Pactola Reservoir watersheds which all drain to Pactola Reservoir; Pactola Reservoir serves as a "storage and assimilation" point for any upstream effects that may occurs; downstream of which, any effects in the upper watershed should not be detectable; any resource impacts occurring in the upper headwaters of the Castle Creek watershed, which is tributary to Rapid Creek upstream of the project area, would be absorbed by Deerfield Reservoir; and beyond this level, it is difficult to link any cumulative impacts to water resources to activities associated with the Pactola Project.

Effects to water resources were analyzed for the same time period as geologic, hydrogeologic, and soil resources for the same reasons stated previously. Effects to water resources are also summarized in the context of short term effects (five years or less) as well as long term effects (longer than five years).

Current and reasonably foreseeable actions listed in Appendix C of the Pactola EIS were considered for cumulative effects to water resources. Effects from known past actions were included in the analysis of existing resource conditions. Generally this includes activities that have occurred since the 1874 Custer Expedition to the Black Hills region. Proposed activities associated with each alternative were considered in the Analysis of Direct and Indirect Effects section. Past and present land use and activities within the analysis watersheds, which encompasses both the soil analysis area and Pactola Project boundary, include timber harvest, wild and prescribed fire, livestock grazing, private land ownership, roads and off road vehicles, mines and quarries, various types of recreation, and forest product gathering. All of these activities or events individually have some level of impact on the watershed, which results in cumulative effects to watershed and water resources conditions and processes.

Geological Resources

Geologic Setting
The Pactola Project Area contains geologic units consisting of Precambrian-aged igneous and metamorphic rocks. Major rock forms include greywacke, slate, schist, scattered pegmatites, and quartzite. A more detailed geology map for the Pactola Project Area is located in the project file. Map data correlates with the "Geologic Map of South Dakota" published by Martin et al (2004). There are no known caves in the project area due to the lack of limestone.

Alternative A – No Action

Direct and Indirect Effects for Geologic Resources
Alternative A does not have any proposed activities and thus would have no direct or indirect effects on geologic resources. Natural geologic weathering and adjustment would continue at current rates until a significant natural geologic disturbance occurs (e.g. landslide, earthquake, etc).

Alternative B – Proposed Action

Direct and Indirect Effects for Geologic Resources
No direct or indirect effects to geologic resources are expected to result from the implementation of Alternative B. Geologic resources are not being extracted (e.g. mining activities) and no major road construction or land re-shaping is proposed with Alternative B. Natural geologic weathering and adjustment would continue at current rates until a significant natural geologic disturbance occurs.

Alternative C

Direct and Indirect Effects for Geologic Resources
Direct and indirect effects to geologic resources may result from the implementation of Alternative C. Although like Alternative B, no geologic resources would be extracted, cable road construction and associated alteration of hill slopes is proposed with Alternative C. Forest Service Manual 2880 – Geologic Resources, Hazards, and Services (USDA Forest Service, 2008) requires facilities (such as roads, trails, bridges, etc.) and other management activities be located, designed, and maintained to avoid or minimize effects on geologic hazards. It also directs the USFS to manage existing geologic hazards on NFS lands to ensure the protection of public safety, health, property, and the environment. Refer to the Slope Stability and Unstable Soils discussion for an analysis of effects related to cable road construction and slope stability. Natural geologic weathering and adjustment would continue at current rates for all other un-altered areas until a significant natural geologic disturbance occurs.

Cumulative Effects for Geologic Resources
There would be no cumulative impacts associated with Alternative A or B because there are no overlapping direct or indirect effects. However, there may be cumulative impacts to geologic resources associated with Alternative C due to cable road construction and the associated alteration of the landscape and geology. Refer to the Slope Stability and Unstable Soils discussion for an analysis of cumulative effects related to cable road construction and slope stability.

Hydrogeology (Groundwater)
Ground water is the Nation's principal reserve of fresh water and represents much of the potential future water supply. Forest Service lands contains substantial groundwater resources, for which stewardship and protection are mandated by several Congressional Acts including but not limited to the Safe Drinking Water Act of 1974, Resource Conservation and Recovery Act of 1976, and the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, also known as CERCLA or "Superfund" (USDA Forest Service, 2007c).

"Many other natural resources on National Forest System (NFS) land rely, directly or indirectly, on ground water and would be damaged or destroyed if groundwater were depleted or contaminated. Ground water on the NFS is a major contributor to flow in many streams and rivers and has a strong influence on the health and diversity of plant and animal species in forests, grasslands, riparian areas, wetlands, and cave systems. Ground water and surface water are interconnected and interdependent in almost all ecosystems. Ground water plays significant roles in sustaining the flow, chemistry, and temperature of streams, lakes, springs, and cave systems. Ground water has a major influence on rock weathering, stream bank erosion, and the head-ward progression of stream channels. In steep terrain, it governs slope stability; in flat terrain, it limits soil compaction and land subsidence" (USDA Forest Service, 2007c).

Concerns about groundwater resources on or adjacent to public land involve questions about depletion of groundwater storage and the associated effects on other water resources and associated animal or human uses. Pumping of groundwater can reduce river and stream flows, lower lake levels, and reduce discharges to wetlands, springs, and groundwater dependent ecosystems. Pumping of groundwater can also lower local water tables and impact vegetation in meadows, grasslands, and forest stands. Increased drawdown can impact ecological resources by depleting groundwater that supports riparian vegetation, wetlands, or sensitive flora and fauna.

Livestock and wildlife water holes may have reduced overall volumes of water, shorter duration when available, or may dry up entirely. Over pumping of groundwater can cause well water levels or pressures to drop or shallow wells to go dry entirely, requiring deepening of the well or replacement. Excessive well withdrawals can also affect water quality in the aquifer. Poor-quality or contaminated water may migrate from adjoining water-bearing units or from surface soil and water bodies.

Hydrogeologic Setting
The underlying geology of the Black Hills largely influences the hydrogeology (groundwater) and surface water characteristics of the area, both in quantity and quality. For example, the Limestone Plateau is known for its general lack of surface water, but abundant number of springs, many of which are the headwaters for major streams in the Black Hills. Spring waters have been in contact with calcium carbonate and thus tend to precipitate out these minerals on the stream bottoms. In contrast, the Crystalline Core is much less permeable than the limestone, and thus has abundant surface flow with minimal stream losses to aquifer recharge. Rainfall runoff is higher in the Crystalline Core as well. A detailed hydrogeologic map of the Pactola Project Area is included in the project file. This map is produced from data published for the Black Hills Hydrology Study (Williamson et al, 2000).

The Pactola Project Area is situated in the center of the Black Hills uplift, on the Precambrian Crystalline Core. Thus, groundwater in the project area is present in unconfined, non-artesian aquifers, also known as water-table aquifers. Topography can be a major influence on the direction of groundwater flow in water-table aquifers (Carter et al, 2003). Major groundwater aquifers like the Madison and Minnelusa aquifers are not present in this area. The Precambrian core is generally considered a confining layer below all other aquifers, but can yield water when wells are drilled into localized, fractured zones. Despite the lack of a major groundwater source, groundwater-dependant ecosystems such as springs and fens are common in the project area due to geologic faulting and alluvial groundwater sources. Groundwater Dependent Ecosystems are discussed in more detail in the Water Resources, Wetlands, Riparian Areas, and Groundwater Dependent Ecosystems section of this report.

Unconsolidated units such as alluvium and colluvium can also be aquifers where saturated. Alluvial deposits along streams are commonly used as local aquifers. Silver City residents obtain their water from wells constructed in the stream alluvium associated with Rapid Creek (SD DENR, 2011a). The Pactola Recreation Complex also obtains its water from two groundwater wells (Slepnikoff, 2009). Additionally, many private landowners and recreation residences have drilled shallow groundwater wells into other alluvial valleys, as well as deeper wells into the fractured Precambrian rocks. Groundwater quality is discussed in more detail in the Water Resources, Water Quality section of this report.

Alternative A – No Action

Direct and Indirect Effects for Hydrogeologic (Groundwater) Resources
Alternative A does not have any proposed activities and thus would have no direct effects on groundwater aquifer yields. The continued expansion of MPB and a potential wildfire resulting from it also are not expected to indirectly affect groundwater aquifers because of the nature of the geology in the project area. The metamorphic and igneous rocks associated with the "Crystalline Core" are not as permeable as the limestone and sandstone units that surround the Black Hills and therefore produce surface runoff versus deeper percolation into groundwater aquifers. Pumping from existing wells would continue and new wells may be completed according to South Dakota state permitting regulations. Refer to the Water Quality and Wetlands, Riparian Areas, and Groundwater-Dependant Ecosystems sections for more discussion pertaining to groundwater quality and groundwater dependent wetlands, springs, and fens and Alternative A.

Alternatives B and C

Direct and Indirect Effects for Hydrogeologic (Groundwater) Resources
No direct or indirect effects to groundwater aquifer yields are expected to result from the implementation of either Action Alternative for the same reasons described under Alternative A. Furthermore, groundwater would not be extracted and aquifers would generally not be affected by activities occurring on the land surface. Pumping from existing wells would continue and new wells may be completed according to South Dakota state permitting regulations. Forest Service Manual 2880 – Geologic Resources, Hazards, and Services (USDA Forest Service, 2008) requires inclusion of measures to manage and protect ground-water

quality and quantity, as well as ground-water dependent ecosystems. Refer to the Water Quality and Wetlands, Riparian Areas, and Groundwater-Dependant Ecosystems sections for more discussion pertaining to groundwater quality and groundwater dependent wetlands, springs, and fens and the Action Alternatives (B and C).

Cumulative Effects for Hydrogeologic (Groundwater) Resources
There would be no cumulative impacts to groundwater aquifer yields associated with any of the project alternatives because there are no overlapping direct or indirect effects. Pumping from existing wells would continue and new wells may be completed according to South Dakota state permitting regulations. Refer to the Water Quality and Wetlands, Riparian Areas, and Groundwater-Dependant Ecosystems sections for more discussion on cumulative impacts pertaining to groundwater quality and groundwater dependent wetlands, springs, and fens.

Soils Resources

Soil Descriptions
Soils in the Project Area are relatively young and weakly developed, having formed from material weathered from underlying bedrock, alluvial and colluvial deposits, or various combinations of these materials. Parent materials are primarily metamorphic and igneous rocks such as slates, phyllites, schists, and graywackes (an impure sandstone) from the bedrock formations exposed in the immediate vicinity. Soil textures throughout the project area are dominated by channery loams and unweathered bedrock. Channery soils contain thin, flat rock fragments of sandstone, shale, slate, limestone, or schist up to six inches in length. Stringers of cobbley loam and loam-textured soils are found along drainage bottoms associated with major streams and tributaries. Soils are thin to absent on rock outcroppings; generally shallow on steep hills lopes; and relatively deep on the gentler hill slopes and in alluvial valleys.

Eleven different soil map units are present within the Pactola Project Area (Table 3-1). Soil map units are a grouping of different soil types that may be individually too small to map separately or differentiate from other surrounding soils. Soils in the Pactola Project area are dominated by the Pactola and Virkula soils, and rock outcrop. Two soil maps units (RlG or 149G and PaE or 104E) comprise 93% of the project area. The remaining ten soil map units individually occupy 5% or less of the overall project area. Table 3-1 displays a summary of these dominant soil map units and the individual percentage of the overall project area that each unit comprises.

Table 3-1 Dominant Soil Map Units in the Pactola Project and their respective percentage of the Project Area

Map Unit Symbol(s)	Map Unit Name	Acres in Project	Percent of Project
RlG, 149G	Rock outcrop-Pactola complex, 40 to 80 percent slopes	12,977	50%
PaE, 104E	Pactola-Virkula-Rock outcrop complex, 10 to 40 percent slopes	11,171	43%
W	Water	747	3%
CvB	Cordeston loam, 2 to 10 percent slopes	390	2%
MhA, 88B	Marshbrook loam, 0 to 4 percent slopes	221	1%
VpC	Virkula-Pactola complex, 2 to 15 percent slopes	160	0.6%
CwB, 40B	Cordeston-Marshbrook loams, 0 to 6 percent slopes	120	0.5%
HeE	Heely channery loam, 9 to 30 percent slopes	94	0.4%
HoD	Hilger-Virkula complex, 2 to 30 percent slopes	74	0.3%
WtB	Winetti cobbly loam, 2 to 10 percent slopes	34	0.1%
BsB	Bullflat-Cordeston silt loams, 2 to 9 percent slopes	25	0.1%
HfC, 58D	Heely-Cordeston complex, 2 to 15 percent slopes	3	0.01%

Most soils in the project area developed under a ponderosa-pine forest. However, soils within meadows are unique and different from soils that support timber stands. Soil Map Units that developed in grassland conditions cover approximately 890 acres (3%) and include Bullflat-Cordeston silt loams (BsB), Cordeston loam (CvB), Cordeston-Marshbrook loams (CwB or 40B), Heeley channery loams (HeE), Heeley-Cordeston loams (HfC or 58D), Marshbrook loam (MhA or 88B), and Winettie Cobbly loam (WtB) soil units. These soil map units are found in stringer meadows, stream floodplains, and drainage bottoms. These soil units generally represent historic or currently existing meadows within the project area and can be used to evaluate conifer encroachment into meadows. The remainder of the project area (97%) contains soils that developed under forested environments. A map delineating soils formed under historic grassland conditions versus forested environments is located in the project file.

Slope Stability and Unstable Soils

Slope stability is a product of natural physical characteristics such as geologic, topographic, and hydrologic conditions, as well as modifications to these conditions caused by natural geologic processes, vegetation, land use practices, and human activities (Turner and Schuster, 1996). Unstable slopes can have several causes but only one trigger (Turner and Schuster, 1996). Triggers are external events such as intense rainfall, rapid snowmelt, water level changes, earthquake shaking, volcanic eruption, storm waves, rapid stream erosion, and human modifications that cause an almost immediate response in the form of a landslide (Turner and Schuster, 1996).

The generic term “landslide” is used to describe “the movement of a mass of rock, debris, or earth down a slope” (Turner and Schuster, 1996). Landslides are classified based on the type of material (rock, debris or earth) and the type of movement which include falls, topples,

slides, spreads, or flows (Turner and Schuster, 1996). These mass movements of material include the more familiar terms of rock falls and slides, soil creep, slumps, debris avalanches and flows, debris torrents, earth flows, and others (Chatwin et al, 1994). Mass movement can occur on unstable slopes if roads overload or undercut them, vegetation is removed from them, or additional runoff is emptied onto them. The overall hazard depends on the type of disturbance, slope steepness, the nature of earth material (parent rock, bedding planes, soil, etc.), and water content. The hazard can be natural, human-caused, or a combination of both.

Unstable soils can cause landslides as well. According to FSH 2509.25, unstable soils are those soils that have properties that make them susceptible to dislodgement and downslope transport of soil and rock material under direct gravitational stress; the process includes slow displacement such as creep and rapid movements such as landslides (USDA Forest Service 2006c). Soil failures also include land subsidence, shrinking and swelling soils, and collapsing soils. Removal of subsurface fluids or materials, or changes to hydrology on certain soil types, can induce soil failures (USDA Forest Service, 1996c).

Once a failure has occurred, the landscape will continue to adjust (e.g. fail) without warning in response to more runoff, gravitational shearing, minor earth tremors and even minor hill slope disturbances. This will continue until a stable slope angle is reached or intensive geotechnical engineering methods are employed. Rehabilitation and restoration of slope failures can be extremely challenging, problematic, and costly. Small slope failures generally have the greatest chance of successful stabilization but would remain a "weak spot" on the landscape in the long term. Larger slope failures present more difficulty of successful stabilization and can remain a permanent "scar" on the landscape.

The major concern with these areas is associated with road or trail construction, and ground-based harvest equipment operations on steep slopes. For the Black Hills, an increased risk of road failure exists where roads are located on soils with mass movement potential and slopes are steeper than 40%, especially if road drainage problems are present or roads cuts through bedrock layers that parallel the hill slope. Similarly, an increased risk of mass movement exists when ground-based equipment operates on these same slopes.

Most of the Pactola Project Area has slopes that are less than 40%. However, approximately 4,800 acres or 18% of the project area has slopes steeper than 40%. Hill slopes in the northern and southern thirds of project area are moderately rolling, ranging from 0 to 40%, with scattered isolated areas where slopes exceed 40%. These areas are generally well suited for ground-based, mechanical operations.

The middle third of the project area corresponds to the crystalline canyon lands associated with Rapid Creek, and thus is dominated by slopes exceeding 40%. These steeper areas are not well suited for ground-based, mechanical operations. This area is considered to be moderately stable, although road cuts in the micaceous-schists tend to slump when roads cut bedrock layers that parallel hill slopes. Rock talus slopes within the crystalline canyons can also move en-masse if significantly disturbed (e.g. earthquake or removal of slope toe by road cuts or rock mining). Both of the dominant soil map units in the project area are rated as having an elevated risk of mass-movement (USDA SCS, 1990). These soil map units occupy

approximately 24,000 acres (93%) within the Pactola Project Area boundary. No major slope failures were identified during field reviews, with the exception of talus rock slopes in the Rapid Creek drainage on canyon walls.

A total of approximately seven miles of existing roads and trails are located on hill slopes with slope or soil stability concerns within the Pactola Project Area, regardless of ownership. Of this total, approximately six miles are existing Forest Service road and trail segments. The majority (5.2 miles) of these USFS roads are closed year long. However, approximately 0.5 miles associated with multiple road segments are open year long. Another 0.3 miles are open seasonally but closed during winter months. The remaining one mile of roads and trails on hill slopes with slope or soil stability concerns are non-USFS roads – roughly one-third mile each between state, county, and private road segments.

Alternative A – No Action

Direct and Indirect Effects for Slope Stability and Unstable Soils
Alternative A would not involve implementation of any proposed actions on or near steep slopes or soils with mass movement potential. Therefore, there would be no direct effects to slope stability or unstable soils associated with the implementation of Alternative A.

Hill slopes would continue to adjust in response to natural weathering processes such as freezing and thawing. These hill slope adjustments are expected to be isolated individually and small (less than 1000 sq. feet) unless a significant natural disturbance occurs (i.e. excessive rainfall causing flash flooding or a wildfire). The risk of severely burned soils is greatest with this alternative should a wildfire occur, particularly in the steep and not very accessible Rapid Creek canyon (refer to Silviculture and Fire/Fuels report for more information on fire hazard in the project area). Thus, the risk of post-fire slope instability is also greatest with this alternative.

A wildfire under Alternative A has the greatest potential of exposing and altering soils and thus the greatest risk of indirectly contributing to conditions that may result in an increase in slope failure. Ponderosa pine killed by the continued expansion of MPB infestations would fall, accumulating on the forest floor, thereby potentially increasing the amount of dead and downed wood levels above current levels. With increased amounts of downed wood, there is likely a greater risk of longer fire residence times and potential for higher temperatures should a wildfire occur. This in turn can result in moderate to high soil burn severity, which is exhibited by more exposed mineral soil and changes in physical, chemical, biological, and/or hydrologic soil properties. Hill slope adjustments would continue to occur until vegetation is sufficiently dense enough to stabilize slopes and slopes have reached equilibrium. This generally occurs within 3-5 years following a wildfire for areas that experience low to moderate soil burn severity, but can take 15 years or more for areas that experience high soil burn severity (Neary et al, 2005).

Existing open road segments on slopes with stability concerns pose a greater risk of failure due to increased soil and slope disturbances from vehicle use, road maintenance, and storm related runoff and erosion. Although closed road segments receive only administrative use traffic, they can pose a high risk of slope failures due to the increased length of time between scheduled road

maintenance. Seasonally open road segments located on slopes with stability concerns pose the same risks associated with both open and closed roads as discussed previously due to the seasonal accessibility as well as closure. Stability problems and CDAs related to road segments would be corrected through maintenance or reconstruction over time, as appropriated funds are available. Without road maintenance and improvement work, existing road-related instabilities would continue to worsen, thereby increasing the risk of failure.

Alternative B – Proposed Action

Direct and Indirect Effects for Slope Stability and Unstable Soils

Vegetation Management Activities: Alternative B proposes thinning ponderosa pine forest stands through various commercial and non-commercial methods. These methods would utilize ground-based equipment and thus have the potential to disturb slopes and soils directly. Approximately 1,200 acres out of the total vegetation management activities proposed under this alternative have areas where slopes are greater than 40% and soils have the potential for mass movement. However, these are isolated areas within larger treatment units and are often associated with steep, rocky outcrops and canyon walls. A map of these locations can be found in the project file.

Outside of the areas mentioned above, the remainder of the project contains slopes that are gentle to moderate and thus the proposed activities are not expected to produce ground disturbance that would cause future slope instabilities. Commercial and non-commercial removal of trees is not anticipated to de-stabilize hill slopes or initiate future slope instabilities because forest stands are not being clear cut. Therefore the root systems of remaining live trees would continue to stabilize soils on steep hill slopes in the long term. Additionally, the root systems of harvested trees generally remain on site after thinning, providing some level of soil and slope stabilization for the next 10 to 20 years until natural decay processes have broken down the stump and root structures.

The project has been designed so that all proposed ground-based mechanical treatments under Alternative B would generally avoid slopes exceeding 40%. Therefore, any soils prone to movement on these slopes would therefore also be avoided. Ground-based equipment operations are excluded from these areas, except to cross short, isolated segments, as part of project Design Criteria that includes Watershed Conservation Practices (WCPs) and Best Management Practices (BMPs) in order to minimize the risk of initiating a slope failure during or following harvest activities in these areas. The applicable Watershed Conservation Practices (USDA Forest Service, 2006a) and Best Management Practices (SDSU et al, 2003) for this project are listed in Appendix B. Isolated sections of high-risk slopes within commercial activity areas are typically avoided during project implementation. Larger contiguous areas of steep slopes would be removed from ground-based mechanical treatment units during field layout in accordance with required Design Criteria and WCP/BMP measures.

Non-commercial thinning and stand improvement activities would also adhere to project Design Criteria and thus avoid ground-based equipment operations on unstable slopes. Hand crews would be used to accomplish thinning work in non-commercial units where large contiguous blocks of steep slopes exist.

No new road construction is proposed to take place on areas with potentially unstable slopes. Although a very small amount of new road construction (approximately 250 feet) crosses potentially unstable slopes or soils, this is likely due to GIS mapping tolerances. Road maintenance and reconstruction activities would take place on 3.7 miles of road that are currently located on potentially unstable slopes. This road work would correct existing road issues and minimize the risk of road or slope failure due to excess road runoff. However, the increased soil and slope disturbances from vehicle use and road work also poses a slight risk of indirectly causing increased road runoff, erosion, and minor slope failures. Approximately 1.5 miles of existing roads on potentially unstable slopes would not be part of the transportation plan for commercial harvest activities but may be used for other project-related or Forest activities. These roads segments have a moderate risk of slope failure due traffic use without the accompanying means to perform road work. Without maintenance, existing and new road or slope problems can go uncorrected for longer periods of time. Another 0.8 miles are associated with unauthorized roads – of which a total of 0.5 miles is proposed for use as temporary roads during commercial harvest activities.

Existing open road segments on slopes with stability concerns pose a greater risk of failure due to increased soil and slope disturbances from vehicle use, road maintenance, and storm related runoff and erosion. Although closed road segments receive only administrative use traffic, they can pose a high risk of slope failures due to the increased length of time between scheduled road maintenance. Seasonally open road segments located on slopes with stability concerns pose the same risks associated with both open and closed roads as discussed previously due to the seasonal accessibility as well as closure. Stability problems would be corrected through maintenance or reconstruction over time, as appropriated funds are available. Without road maintenance and improvement work, existing road-related instabilities would continue to worsen, thereby increasing the risk of slope failure.

The Pactola Project has been designed such that all new road construction under Alternative B would generally avoid slopes exceeding 40%. Any soils prone to movement on these slopes would therefore also be avoided. All ground-based equipment operations, including road building, are excluded from these areas, except to cross short, isolated segments, as part of project Design Criteria and WCP/BMP measures in order to minimize the risk of initiating a slope failure during or following harvest activities in these areas (Appendix B). Road maintenance and reconstruction activities would correct existing problems and reinforce road segments existing on potentially unstable slopes, thereby minimizing the risk of road-related slope failure.

Alternative C

Direct and Indirect Effects for Slope Stability and Unstable Soils

Vegetation Management Activities: Alternative C proposes thinning ponderosa pine forest stands through various commercial and non-commercial methods and thus has the potential to disturb soils directly. Both ground-based equipment and aerial methods, such as cable logging and/or helicopter logging, would be used. Approximately 2,025 acres out of the total vegetation management activities proposed under this alternative have areas where slopes are greater than 40% and potentially unstable soils. A map of these locations can be found in the project file. Most of the larger, contiguous areas are located in the Rapid Creek drainage and

Pactola Reservoir area and are included in units proposed for aerial logging methods. Small, isolated areas are also scattered throughout the project area.

Effects of ground-based logging activities under Alternative C are similar to those discussed previously under Alternative B.

The large, contiguous areas of steep slopes found in the central portion of the project area are well suited for the aerial logging methods proposed by this alternative. Proposed cable logging units would take place on steep slopes in the Rapid Creek drainage and in the vicinity of Pactola Reservoir. Commercial removal of trees through aerial logging methods is not anticipated to de-stabilize hill slopes or initiate future slope instabilities because mechanized ground-operations will not occur on these slopes and forest stands in these treatment units would not be clear cut. Therefore, the root systems of remaining live trees would continue to stabilize soils on steep hill slopes in the long term. Additionally, the root systems of harvested trees generally remain on site after thinning, providing some level of soil and slope stabilization for the next 10 to 20 years until natural decay processes have broken down the stump and root structures. However, due to the inherently steep, rocky nature and limited soil depth in these areas, tree root systems do not have the same depth as other more gently sloped areas with deeper soils.

Pine regeneration can be hindered on steep, rocky slopes due to thinner soils, so water uptake by existing saplings and establishing seedlings may not exceed the available moisture stores following harvest in the short term. If this is the case, excess moisture would be present causing saturated soils and "loading" of steep hill slopes with excess weight. Although local soil moisture levels usually increase following even partial removal of forest cover, no studies have been documented for the Black Hills as to what threshold might exist related to excess moisture levels and initiation of slope failure.

Non-commercial thinning, fuel breaks, and roadside treatments are also not expected to have any measureable effects on slope stability, directly or indirectly. These activities are not anticipated to de-stabilize hill slopes or initiate future slope instabilities because most non-commercial treatments would be accomplished with hand crews and forest stands would not be clear cut. Therefore the root systems of remaining live trees would continue to stabilize soils on steep hill slopes in the long term. Non-commercial thinning and stand improvement activities would also adhere to project Design Criteria and thus avoid ground-based equipment operations on unstable slopes. Hand crews would be used to accomplish thinning work in non-commercial units where large contiguous blocks of steep slopes exist.

Approximately 22 acres of fuel break treatments around private parcels and 51 acres of roadside treatments are also proposed along primary roads in the Pactola Project Area. All of these treatment areas contain small, isolated slopes with mass movement potential and slopes exceeding 40%. Ground-based equipment operations are excluded from these areas as part of project Design Criteria and WCPs/BMPs (Appendix B), so conventional logging (e.g. hand crews) would be required in these areas. Furthermore, fuel breaks would be thinned only, leaving live trees and their root systems to provide for soil and slope stabilization.

Overall, Alternative C proposes more road-related soil disturbance on areas prone to slope instability than Alternative B. Alternative C proposes an additional four miles of new road that would be located on hill slopes with slope stability concerns. Therefore the risk of both short and long-term stability problems is also greater with Alternative C. A map of these road locations can be found in the project file.

The Pactola Project has been designed such that road construction under Alternative C would avoid slopes exceeding 40%. Road maintenance and reconstruction activities would take place on 3.7 miles of road that are currently located on potentially unstable slopes. Road maintenance and reconstruction activities would correct existing problems and reinforce road segments existing on potentially unstable slopes, thereby minimizing the risk of road-related slope failure. However, the increased soil and slope disturbances from vehicle use and road work also poses a slight risk of indirectly causing minor slope failures.

Approximately 1.5 miles of existing roads on potentially unstable slopes would not be part of the transportation plan for commercial harvest activities but may be used for other project or Forest activities. These roads segments have a moderate risk of slope failure due traffic use without the accompanying means to perform road work. Without maintenance, existing or new road or slope problems can go uncorrected for longer periods of time. Another 0.8 miles are associated with unauthorized roads – of which a total of 0.5 miles is proposed for use as temporary roads during commercial harvest activities. These temporary road segments are short, isolated segments and thus do not pose a great risk of slope failure.

The risk of potential slope failure is highest with this alternative due to cable road construction and presence on the landscape. In order to complete cable logging operations, approximately 15 miles of newly constructed cable roads would also be required. Cable road construction would disturb both soils and slopes and thus poses the greatest risk of initiating a slope failure directly or indirectly following initial construction. Cable roads would require full bench design and construction methods, as well as blasting in steep, rocky terrain. Blasting would disturb soils and slopes and may initiate localized slope failures during actual road construction. Refer to the Transportation Section for more information on cable road construction.

Approximately four miles of this total would cross areas with slope stability concerns. However, only one mile out of these four miles would involve cable road construction in mid-slope locations. Mid-slope road locations tend to cause more slope adjustments than roads on ridge tops or valley bottoms. All other cable road locations avoid mid-slope positions and paths that traverse back and forth across steep hill slopes. Therefore these routes would not cut into already steep slopes, expose soils, and intercept and collect water. The longer the cable roads remain on the landscape, the higher the probability of failure, especially in response to higher than average precipitation events. However, if such an event occurred, actions would be implemented to stabilize road and resource problems and reduce impacts to soil. Overall, if such an event occurred, stabilization and rehabilitation measures would trend toward returning the detrimental soil disturbance levels below this threshold.

Road-related Design Criteria and engineering controls have been included to minimize negative impacts to soil and water resources and to mitigate the risk of slope failure from all

road activities as much as possible (see Appendix B). All cable roads would be closed to traffic following harvest activities as part of project Design Criteria. Depending upon site-specific conditions and post-activity stabilization needs, these roads would generally be out-sloped to disperse road runoff and mimic natural hill slope runoff process. Structures and fill material installed at stream and drainage crossings would also be removed to prevent plugging and failure.

Common to Both Alternatives B and C

Direct and Indirect Effects for Slope Stability and Unstable Soils
Alternatives B and C both propose the implementation of approximately 5,037 acres of prescribed broadcast burning that would take place in the southeastern portion of the Pactola Project Area. Approximately 560 acres of prescribed burning would occur on areas with slope stability concerns. A map of these soil locations for each action alternative can be found in the project file.

Prescribed burning activities associated with either of the action alternatives are not expected to have any measureable effects on slope stability, directly or indirectly. Although prescribed burning is to take place across the landscape, including areas where slopes exceed 40% (e.g. canyon areas), this type of activity does not normally disturb soils to a degree that triggers slope failures or increase the risk of mass failure for several reasons. First, the project has been designed to use existing roads and trails as fire containment lines where possible. Using existing roads and trails limits the need for constructing both dozer and hand-dug fire lines. Secondly, project Design Criteria generally prevents fire containment lines from being constructed across these soils with the potential for movement on slopes exceeding 40%. These in turn minimize the amount of ground disturbance and the risk of initiating any localized slope failures. Additionally, while surface vegetation and downed wood may be consumed in prescribed fire, the below-ground root systems are generally left intact. Although some mortality may occur, most root systems are expected to remain intact and provide for both short and long-term stabilization. This has been directly observed in low-intensity areas of past wildfires including the Jasper, Grizzly, Battle Creek, Rogers Shack, and Elk Mountain II Fires; in prescribed fires conducted locally on the Black Hills National Forest; and has been quantified during research in the Jasper Fire area (Gould, 2003).

Both action alternatives are generally expected to indirectly reduce the risk of slope failures associated with wildfire and post-fire rain events through the treatment of hazardous fuels. In contrast to Alternative A, both action alternatives would directly decrease existing levels of dead, downed wood through fuels treatment and prescribed burning. This in turn influences how a wildfire might behave in the project area (see Fire and Fuels section). If a wildfire were to occur in the area following implementation of either action alternative, fire residence times are expected to be shorter and fire temperatures would be cooler because less dead, downed wood is present to burn. Therefore, while effects from a future wildfire are unknown, effects on soils would likely be less severe and better mimic the historic burning characteristics associated with more frequent, but less intense wildfires. Although hill slopes can be expected to continue to adjust in response to natural weathering processes such as freezing and thawing, a wildfire under either action alternative would generally be expected to result in less exposed mineral soil and fewer changes to soil characteristics as compared to the Alternative A.

Cumulative Effects for Slope Stability and Unstable Soils
Any failures that may occur are expected to be isolated, localized, and minor in both severity and extent. Therefore, there is little risk that material from slope failures would be transported to the stream network or other water resources, unless the failure occurred immediately adjacent to these water resources. Design Criteria and appropriate WCP/BMP measures apply to all forest management activities and uses. These measures are designed to control runoff and erosion for a 10 year storm event (USDA Forest Service, 2006c). Therefore, the risk of slope failure is mitigated for typical storm events observed in the Black Hills.

Grazing management throughout the project area is not expected to cause slope stability issues because cows generally avoid steep slopes to begin with. Dispersed recreation activities also do not cause slope stability issues due to the lack of concentrated use or avoidance of steep areas. Concentrated recreation sites are purposely located in flatter terrain and therefore avoid steep slopes as well. Mining activities can take place on steep slopes but Design Criteria apply to these activities as well to mitigate risk of slope failures associated with mining-related activities. Public use of roads and trails is managed under the Forest Travel Management Plan and road maintenance work on these roads and trails occurs as necessary and appropriated funds are available.

Soil Erosion and Displacement
Soil erosion is defined as the movement of individual soil particles by a force, and is initiated by the planar removal of material from the soil surface (sheet erosion) or by concentrated removal of material in a downslope direction (rill erosion). Surface erosion is a function of four factors: 1) susceptibility of the soil to detachment; 2) magnitude of external forces (raindrop impact or overland flow); 3) the amount of protection available by material that reduces the magnitude of the external force (soil cover); and 4) the management of the soil that makes it less susceptible to erosion (Foster, 1982; Megahan, 1986).

Although erosion is a natural process occurring on the landscape, management activities can increase the amount of material transported offsite, as well as accelerate the rate at which it is removed. Severe erosion can impair long-term soil productivity if soils are heavily disturbed on shallow or highly erodible soils. Erosion potential is the relative susceptibility to sheet and rill erosion when surface cover is completely removed from the site. Ground vegetation, downed debris, root masses, and duff help stabilize soil. When soil is disturbed by management practices, it can be exposed to runoff. When this happens, sheet and rill erosion occur. Erosion hazard is therefore an indication of the risk of soil loss associated with disturbance.

Concentration of runoff, accelerated erosion, sediment delivery to surface waters, and damage to roads and trails can result from soil rutting. Soil displacement and puddling (soil deformation and compaction) may occur simultaneously with rutting. The ratings in this interpretation indicate the hazard of surface rut formation through the operation of forestland equipment (USDA NRCS, 2009). Soils within the Pactola Project Area are split nearly equally between the two ends of this rating spectrum. Soils associated with the Crystalline Canyonlands within the Rapid Creek drainage are rated as “slight” rutting hazard due to the large amount of rock fragments in these soils that prevent rutting. However, the northern and southern areas on either side of Rapid Creek are rated as “severe” and thus are easily rutted.

These latter areas coincide with areas that are suited for ground-based operations based on the gentler slopes. A map of the soil rutting hazard for the landscape assessment area is included in the project file.

Displacement can occur when the productive, upper layer of soil is removed or mixed with underlying, less productive layers during harvest or site preparation. The most common causes of displacement are side-casting of soils during road or fire-line construction, skidding logs, and landing construction and rehabilitation. Soil erosion is discussed in terms of the erosion hazard for activities occurring off roads and trails, as well as the soil suitability for native surface roads and trails.

Soils within the Pactola Project Area have slow to very slow infiltration rates due to fine textures such as clay, and restrictive soil or rock layers that prevent the downward movement of water within the soil profile. This equates to a high runoff potential during wet periods and correlates to a higher potential for soil erosion. A map displaying hydrologic soil group classifications within the project area is included in the project file.

The ratings in this interpretation indicate the hazard of soil loss from off-road and off-trail areas after disturbance activities that expose the soil surface (USDA NRCS, 2009). Nearly all of the soils in the Pactola Project Area are rated as "moderate" (44%) or "severe" (50%), with the exception of a few soils associated with stringer drainage bottoms, which are rated as "slight". A map of soil erosion potential for off-road and off-trail operations is located in the project file.

Soil Suitability for Roads (Natural Surface) and Erosion Hazard (Roads and Trails): The soil suitability for natural surface road rating indicates the suitability for using the natural surface of the soil for roads (USDA NRCS, 2009). The erosion hazard rating for roads and trails is an indicator of the hazard of soil loss from un-surfaced roads and trails (USDA NRCS, 2009). Soils across the entire Pactola Project Area are rated as "poorly suited" for natural surface roads, with the exception of a few, scattered stringers rated as "moderately suited". Furthermore, the project area is dominated (94% of the project area) by soils rated as having a "severe erosion hazard", indicating that significant erosion can be expected from natural surface roads without adequate erosion control measures. A map of soil suitability for natural surface roads is included in the project file. Both of these ratings indicate that the area is largely not well suited for natural surface roads. Water-road interaction surveys completed during the summer and fall of 2010 also indicated that existing roads required more drainage structures to control runoff and erosion. Examples of these improvements include more closely-spaced drainage features and more frequent maintenance.

Alternative A – No Action

Direct and Indirect Effects for Soil Erosion and Displacement

Alternative A would not involve any additional management activities. Thus, this alternative would not have any proposed actions on or near soils with high erosion risk. Therefore, there would be no direct effects to soil erosion rates with the implementation of the Alternative A.

Soil disturbances and erosion would be expected to continue at current rates until a natural disturbance occurs. A wildfire that may be experienced under Alternative A is expected to have the greatest potential of exposing and altering soil conditions and thus the greatest risk of indirectly contributing to increases in soil erosion for the same reasons discussed previously under the Slope Stability and Unstable Soils section. Since hill slopes in the project area are gently undulating, with the exception of rocky canyon walls, any soil erosion that may be generated is likely to travel only short distances. However, if an intense rainfall event occurs, soil erosion may increase greatly and mimic conditions observed during post-fire precipitation events in the Jasper Fire area, in which eroded sediment was carried in flood waters all the way to Angostura Reservoir. In the case of the Pactola Project, sediments, ash and debris could be carried through the stream network into Pactola Reservoir.

Wildfire effects to soils have been well documented and are thoroughly presented in "Wildland Fire in Ecosystems: Effects of Fire on Soil and Water" (Neary et al, 2005). Fires increase the potential for both wind and water erosion of soil. Fire consumes most of the shielding plant and litter cover, which provides protection from wind and raindrop splash, as well as soil stability (Neary et al, 2005). Ultimately, erosion rates would depend on the timing, duration, and intensity of rainfall following the fire, as well as the recovery of plant communities.

Past monitoring and field investigations within the project area found that most existing erosion problems are related to roads and their effects on streams (USDA Forest Service, 2010c). Without road maintenance and improvement work, as well as stream restoration efforts, these sites would continue to degrade, eroding soil and transporting the resulting sediment through the stream network. Correcting problem areas would occur more slowly compared to both action alternatives, depending on when and how much appropriated funding is made available.

Alternative B – Proposed Action

Direct and Indirect Effects for Soil Erosion and Displacement

Vegetation Management Activities: Alternative B proposes thinning ponderosa pine forest stands through various commercial and non-commercial methods. These methods would utilize ground-based equipment and thus have the potential to expose bare soil to rainfall and snowmelt and create conditions with a greater likelihood of soil erosion and subsequent sediment transport to water bodies (Refer to the Water Quality section of the effects analysis for more discussion on this topic). Approximately 5,100 acres out of the total vegetation management activities proposed by Alternative B have soils with elevated erosion risk. This equates to 20% of the project area. A map of these locations can be found in the project file.

Ground-based logging activities are not expected to result in detrimental levels of soil erosion, directly or indirectly based on the inclusion of project Design Criteria and WCPs/BMPs that prevent or minimize erosion. Examples of such practices include use of existing and designated trails; operating season and moisture limitations; operating on a slash mat where possible; installation and maintenance of drainage structures; seeding of disturbed areas; and rehabilitating skid roads and trails. The proven effectiveness of WCPs and BMPs used on the BHNF as well as ground cover following harvest treatments has been monitored and meets or exceeds recommended levels found in the Forest Plan (Thomas, 2008; USDA

Forest Service, 2010c). Full implementation of the practices is expected to meet compliance with Forest Plan Standards and Guidelines 1103, 1104, 1105, 1106, 1108, 1109, 1110, and 1111 to minimize detrimental soil disturbance, take steps to protect soils from runoff and erosion, and rehabilitate disturbed sites (USDA Forest Service, 2006c).

Non-commercial thinning activities are not expected to result in detrimental levels of soil erosion, directly or indirectly. Erosion is expected to be minimal in these areas due to the required implementation of project Design Criteria, WCPs/BMPs, and the fact that these activities would primarily be accomplished with hand crews.

New road construction poses the greatest risk of elevated erosion, particularly in the above-mentioned areas, because these new roads would primarily be native surface roads. Approximately three miles of new construction would take place on soils with elevated erosion risk under this alternative. However all new roads are required to implement standard WCP/BMP measures to control runoff and erosion as part of project Design Criteria (Appendix B). WCPs are designed to control runoff and erosion from a 10 year storm event (USDA Forest Service, 2006c). New roads on areas with the potential for severe erosion may also be closed to traffic following harvest activities to protect soil and water resources as part of project Design Criteria.

Road work would correct existing road runoff and erosion issues and reduce sediment transport to streams and water bodies resulting from known road problems. However, on-going use of native surface roads in areas where soils are especially prone to erosion would continue to result in rutting, collection and concentration of road runoff, and associated soil erosion from these road templates. Project Design Criteria to address this issue includes seasonal or year-long road closure to protect soil and water resources; seeding the road template to establish stabilizing vegetation; installation of additional road surface drainage structures; or placement of aggregate.

Approximately 1.5 miles of existing roads on highly erodible soils would not be part of the transportation plan for commercial harvest activities but may be used for other project or Forest activities. These roads segments have a high risk of road damage and soil erosion due to traffic use without the accompanying means to perform road work. Without maintenance, existing or new road problems can go uncorrected for longer periods of time.

Alternative C

Direct and Indirect Effects for Soil Erosion and Displacement

Vegetation Management Activities: Alternative C proposes approximately 7,400 acres of vegetation management activities that overlap soils with erosion concerns. This equates to nearly one-third (28%) of the total project area. These activities would include various commercial and non-commercial methods utilizing both ground-based equipment and aerial methods, such as cable logging and/or helicopter logging. These methods both have the potential to expose bare soil to runoff caused by rainfall and snowmelt and create conditions with a greater likelihood of soil erosion and subsequent sediment transport to water bodies (refer to the Water Quality section of the effects analysis for more discussion on this topic). A map of these locations can be found in the project file.

Effects of ground-based logging activities under Alternative C are similar to those under Alternative B. Refer to effects discussion presented previously.

Aerial logging systems would minimize soil erosion due to the fact that logs are suspended off the ground by cables and ground equipment is not needed to fell or yard trees to landings.

Non-commercial thinning, fuel breaks, and roadside treatments are not expected to result in detrimental levels of soil erosion, directly or indirectly. Erosion is expected to be minimal in these areas due to the required implementation of project Design Criteria and WCPs/BMPs, and the fact that these activities would primarily be accomplished with hand crews.

Overall, Alternative C proposes more road-related activities than Alternative B, particularly new road construction and cable logging road construction. Therefore, Alternative C poses the greatest risk of both short and long term road erosion problems, as well as increased soil erosion rates and volumes from roads. Alternative C also proposes 19 miles of new road that would be located on soils highly susceptible to erosion. A map of these road locations can be found in the project file. New road construction poses the greatest risk of elevated erosion, particularly in the above-mentioned areas, because these new roads would be native surface roads. New roads are required to implement standard BMPs to control runoff and erosion as part of project Design Criteria (Appendix B). New roads on areas with the potential for severe erosion may be closed to traffic following harvest activities to protect soil and water resources as part of project Design Criteria. Road maintenance and reconstruction activities would correct existing road issues and minimize soil erosion.

Erosion rates and volumes would be highest with this alternative due to the inclusion of proposed cable access roads that would be required to complete cable operations. In order to complete cable logging operations, approximately 15 miles of newly constructed cable roads would also be required. Approximately four miles of this total would be on soils with severe erosion concerns. As discussed previously, only one mile out of these four miles would involve cable road construction in mid-slope locations. Therefore most routes would not cut into already steep slopes, expose soils, and intercept and collect water that would increase soil erosion rates and volumes. Cable road segments on mid-slope locations may cause some localized increases in soil erosion. Increased soil erosion can lead to slope stability issues and vice versa.

However, road-related Design Criteria and engineering controls have been included to prevent negative impacts to soil and water resources and to mitigate the risk of increased soil erosion from all road activities as much as possible (see Appendix B). All cable roads would be closed to traffic following harvest activities as part of project Design Criteria. Depending upon site-specific conditions and post-activity stabilization needs, these roads would generally be out-sloped to disperse road runoff and mimic natural hill slope runoff process; and structures and fill material installed at stream and drainage crossings would be removed to prevent plugging and failure.

The risk of observing measureable soil erosion is greatest for cable roads that would remain on the landscape long-term for reasons discussed previously under slope stability. Depending on the severity and size of the slope failure, soil erosion could be localized and short term or chronic and long-lasting. Most slope failures in the Black Hills are localized in extent and do

not deliver material to streams and water bodies, unless the slope failure occurs immediately adjacent to these areas (e.g. stream channel undercuts a slope causing it to fail). If such an event occurred, immediate actions would be implemented to stabilize road and resource problems and reduce impacts to soils. Furthermore, WCPs are designed to control runoff damage from at least a 10-year storm of any duration (USDA Forest Service, 2006c). Therefore, for typical precipitation events observed in the Black Hills area, soil erosion is not expected to approach levels that would be deemed as detrimental.

Common to Both Alternatives B and C

Direct and Indirect Effects for Soil Erosion and Displacement

The removal of trees through harvest activities under both action alternatives may make it easier for public users to access hill slopes and trails associated with activities in the project area. However, the Forest Travel Management Plan allows OHV use in designated areas only. Refer to the Travel Section for more discussion pertaining to Travel Management on the Black Hills. Therefore, increased erosion as a result of off-road use of trails and hill slopes should be minimized. The potential for damage caused by off-road vehicles can be further reduced by retaining slash and tree tops on site to function as a natural obstacle to deter unauthorized off-road travel. Additionally, roads and trails would be rehabilitated where needed to discourage unauthorized use. Road rehabilitation techniques may include surface ripping to alleviate compaction, partial or full restoration of original slope contour, slash placement, and entrance barricades.

Both action alternatives propose the implementation of approximately 5,037 acres of prescribed broadcast burning in the southeastern portion of the Pactola Project area. Approximately 560 acres of soils with erosion concerns are contained within these prescribed broadcast burn units. A map of these soil locations for each action alternative can be found in the project file.

Prescribed burning activities associated with either of the action alternatives are not expected to result in detrimental levels of soil erosion, directly or indirectly. This type of activity does not normally disturb soils to a degree that results in detrimental levels of soil erosion based on past observations of prescribed burn areas. Prescribed burning is intended to decrease the risk of exactly that, should a wildfire occur. Furthermore, prescribed burning is not proposed in the steep portions associated with the Rapid Creek drainage, where soils are more susceptible to erosion. Prescribed burning associated with the Pactola project was designed to use existing roads and trails as fire containment lines when possible, thus limiting the need for both dozer and hand-dug fire lines. This in turn minimizes the amount of ground disturbance and exposed bare soil.

Additionally, while surface vegetation and downed wood may be consumed in prescribed fire, the below-ground root systems are generally left intact. Although some mortality may occur, most root systems remain intact and provide for adequate ground cover to limit erosion. Some areas may have higher intensity burning and thus may result in moderate to high soil burn severity. Examples include dead tree stumps and roots that tend to burn completely and where downed wood has accumulated naturally or been purposely piled. Since these areas are isolated, small in size (less than 1,000 sq. feet), and located within a mosaic of lower intensity burn, soil erosion is expected to remain below detrimental levels.

It is reasonable to expect that low to moderate severity fire resulting from prescribed fire would not increase soil erosion to those levels identified as detrimental by the Region 2 Soil Management Handbook (FSH 2509.18). Gould (2003) found that runoff and erosion were generated in the Jasper Fire area during summer thunderstorms when less than 60% effective ground cover was on-site. Prescribed fires are generally conducted during conditions which result in shorter flame lengths, shorter fire residence times, and when soil heating is expected to be lower as compared to when wildfires occur. Thus, the effects to soils are generally limited in severity and spatial extent. Gould (2003) also found the percentage of exposed mineral soil following low severity fire in the Jasper Fire area ranged between 0 and 30%.

Both Action Alternatives are generally expected to indirectly reduce the risk of detrimental soil erosion associated with wildfire and post-fire rain events through the treatment of hazardous fuels. In contrast to Alternative A, a wildfire under either action alternative would generally be expected to result in less exposed mineral soil and thus less soil erosion would occur for the reasons discussed previously.

Cumulative Effects for Soil Erosion and Displacement

Any soil erosion that may occur related to implementation of the Pactola Project is expected to be localized, minor in both severity and extent, and thus well below levels that would be considered detrimental. This expectation also applies to other forest management activities and uses. Design Criteria and appropriate WCP/BMP measures apply to all forest management activities and uses. These measures are designed to control runoff and erosion for a 10 year storm event (USDA Forest Service, 2006c). Therefore the risk of cumulative detrimental soil erosion is mitigated for typical storm events observed in the Black Hills for all forest management activities.

Grazing management throughout the project area is not expected to extensive soil erosion. Dispersed recreation activities generally do not cause excessive soil erosion issues due to the lack of concentrated use. Concentrated recreation sites are purposely located in flatter terrain which minimizes the potential for soil erosion and employs management strategies to guide concentrated uses where measures are in place (e.g. WCPs/BMPs) to minimize soil erosion. Mining activities can take place on but Design Criteria apply to these activities as well to mitigate risk of soil erosion associated with mining-related activities. Public use of roads and trails is managed under the Forest Travel Management Plan and road maintenance work on these roads and trails would occur as necessary and appropriated funds are available to correct any soil erosion issues.

Soil Compaction

Compaction can occur on all soils, particularly if soil moisture conditions are too wet; if excessive equipment passes are made; or exceptionally heavy equipment is used (e.g. pressure applied per unit area). Soil compaction results from a packing together of soil particles due to increased pressure on the soil surface, as by equipment or large animals. Compaction is predominantly influenced by moisture content; depth to saturation; percent of sand, silt, and clay; soil structure; organic matter content; and content of coarse fragments. Susceptibility to compaction is generally increased during wetter periods. Compaction associated with equipment and vehicles is often accompanied by the formation of ruts as discussed previously.

Compaction impairs water infiltration, root growth, and soil biota, all of which contribute to increased runoff and erosion. Compaction also affects plant production and composition and affects organisms living within the soil, which contributes to overall site productivity.

Three soil map units within the Pactola Project Area are rated as being especially susceptible to compaction, but can usually be operated on by controlling the season, location, or intensity of equipment operations. These include the HoD, PaE/104E, and VpC soil map units. Altogether, these three soil map units equate to approximately 11,400 acres or 44% of the Pactola Project Area. Both the Pactola and Virkula soils found in these three soil map units are susceptible to developing compacted soil layers where soils have lower rock content. The PaE/104E soil map unit is one of two that dominates the Pactola Project Area and corresponds to the northern and southern areas that have slopes conducive to ground-based operations. A map of the soil compaction risk is included in the project file.

Alternative A – No Action

Direct and Indirect Effects for Soil Compaction
Alternative A does not have any proposed activities and thus no direct effect on soils that are highly susceptible to compaction. This alternative would not have any new activities occur within the project area so soil compaction would generally not be affected and remain unchanged from existing conditions.

However, this alternative does not address the increasing level of hazardous fuels already downed or continuing to accumulate on the ground surface due to MPB activity. Thus the wildfire hazard and potential severity of effects would continue to increase. Soils can be made more susceptible to compaction if fire conditions are severe enough to alter soil structure, thus breaking down soil aggregates (Neary et al, 2005). Although fire does not directly cause compaction, by consuming organic material on top of and within the mineral soil, soils in burned areas are made more susceptible to compaction from other management activities, as well as natural processes (Neary et al, 2005). Organic material is no longer present in the top layers or interstitial spaces between soil particles to help absorb applied pressure

Alternatives B and C

Direct and Indirect Effects for Soil Compaction
Vegetation Management Activities: Alternative B contains approximately 7,600 acres of ground-based logging activities that would take place on soils highly susceptible to compaction. This equates to 29% of the total project area. Alternative C contains approximately 9,000 acres of proposed ground-based logging activities that would take place on soils highly susceptible to compaction. This equates to roughly one-third (34%) of the total project area. Maps of these soil locations for each Action Alternative can be found in the project file.

Thinning, mechanical fuels treatment, and prescribed burning activities associated with either of the Action Alternatives are not expected to directly or indirectly result in detrimental levels of soil compaction. Much of the project area contains rock outcroppings and extensive surface rock within the soil which protect soils in these areas from compaction. By controlling the season, location, and intensity of equipment operations, harvest activities can take place on

soils with a higher susceptibility to compaction, without causing significant detrimental disturbance. Management activities associated with both action alternatives are designed to minimize soil compaction through the use of Design Criteria, including designated and existing skid trails in sensitive areas, soil moisture limitations, and seasonal restrictions.

Skid trails, and temporary roads utilized during harvest activities are to be rehabilitated post-activity as necessary, as part of Design Criteria measures to stabilize soils following management activities. Full implementation of Design Criteria measures is expected to comply with Forest Plan Standards and Guidelines 1103, 1104, 1105, 1106, 1109, 1110, and 1111 to minimize or rehabilitate soil compaction (USDA Forest Service, 2006). According to research conducted by Luce and Black (1997), it is reasonable to expect that skid trail rehabilitation treatments would decrease soil compaction and improve water infiltration on roads and trails.

Both action alternatives propose both treatment within and immediately surrounding aspen stands. By their very nature these soils tend to be moist year round, making it difficult to operate equipment without damaging soils. Ground-based treatment, particularly within the aspen stands, has the potential to damage the moist soils found there through compaction and rutting. Treatment methods that avoid ground-based equipment operations within aspen stands such as hand felling, yarding from outside the aspen clone, or leaving felled pine in place, would protect these moist soils and conserve soil characteristics. Equipment operations over snow and/or frozen soil conditions in these areas surrounding the aspen should provide adequate soil protection as well as meet operational needs.

Any prescribed broadcast burning would not directly or indirectly cause soil compaction because burning is conducted under controlled conditions which minimize the fire intensity and thus the consumption of organic layers and level of soil heating.

Cumulative Effects for Soil Compaction

Any soil compaction that may occur related to implementation of the Pactola Project is expected to be localized and well below levels that would be considered detrimental. This expectation also applies to other forest management activities and uses. Design Criteria and appropriate WCP/BMP measures apply to all forest management activities and uses. Therefore the risk of cumulative detrimental soil compaction is mitigated for typical storm events observed in the Black Hills for all forest management activities.

Grazing management throughout the project area is not expected to cause detrimental levels of soil compaction due to where livestock naturally tend to roam and the presence of rock fragments in most of the soils within the project area. Compaction from grazing is generally more prevalent in wet soils associated with wetlands and riparian areas (refer to the Wetlands, Riparian Areas, and Groundwater Dependent Ecosystems section for more discussion). Dispersed recreation activities also do not tend to cause detrimental soil compaction due to the lack of concentrated use for this type of recreation. Concentrated recreation sites are purposely located in flatter terrain and therefore avoid steep slopes as well. Mining activities can cause compaction if ground-based equipment is used, but Design Criteria apply to these activities as well to mitigate this risk.

Soil Heating and Damage by Fire

Damage to soils caused by burning is often discussed in terms of "severely burned" soils. The National Soil Management Handbook (FSH 2509.18) defines "severely burned" soil as: "…a condition where most woody debris and the entire forest floor is consumed down to bare mineral soil. Soil may have turned red due to extreme heat. Also, fine roots and organic matter are charred in the upper one-half inch of mineral soil." In general, for a soil to be considered severely burned the heat needs to be so intense and the residence time of the fire long enough such that the soil structure and color may be visibly changed. A circumstance where this is most likely to occur is under a burning slash pile, where the fire sits on the top of the soil for a sufficient time to literally cook the soil. In the case of a wind driven wildfire, the heat and residence time of the fire, though enough to severely burn the vegetation and perhaps the litter and duff layers, are not likely to cook the soil to the extent where soil structure and color are visibly changed over broad areas. There may be small isolated locations in the burned area where the fire persisted long enough to severely burn the soil, such as around stump holes or downed logs.

Severely burned soils are considered to have experienced physical, chemical, and biological changes resulting from high-intensity burns of long duration. Areas classified as high soil burn severity according to Burned Area Emergency Response (BAER) techniques (USDA Forest Service, 1995; Parsons et al, 2010) are considered a detrimental disturbance (USDA Forest Service, 1992) Areas of high soil burn severity retain very little, if any, duff and litter due to the complete consumption of the forest floor during a wildfire event. Soils often exhibit some level of water repellency caused by the intense heating of wildfires. Therefore, these sites are more susceptible to soil erosion and compaction because they no longer have the protection of the litter and duff layer to absorb water and reduce runoff, or to support equipment pressure (Neary et al, 2005).

Frequent fires are a natural disturbance process and ponderosa pine and grasslands have developed over time in response to these processes. However, most of the project area has not experienced fire for nearly 70 years. The south-western portion of the Pactola Project Area overlaps part of the area burned by the 1939 McVey Fire. A map of past wildfires is included in the project file. Soils in this area have a relatively low degree of natural water repellency prior to fire disturbance, based on the loamy soil textures. Current fire research points to the fact that soils tend to begin the recovery process within three to five years following wildfires as vegetation is established (Neary et al, 2005). This is the only large fire recorded in the project area and since it has had over 70 years to recover, no severely soils currently exist within the project area and any fire-induced water repellency has long-since dissipated with the annual freeze-thaw cycles.

The NRCS has developed management interpretations which indicate the potential for damage to soil nutrients, as well as physical and biotic characteristics caused by fire. All soils within the Pactola Project area are rated low for potential for damage by fire with the exception of the organic (peat) soils in the Jim Creek valley along Rochford Road (FSR 237), which are rated moderate. A map of the potential for fire damage to soils is included in the project file.

Alternative A – No Action

Direct and Indirect Effects for Soil Heating and Damage by Fire
Alternative A does not have any proposed activities and thus has no direct effect on severely burned soils resulting from past wildfires, nor would this alternative directly create conditions where adverse soil heating and associated effects would occur.

However, this alternative has the greatest potential for resulting in severely burned soils as a result of a wildfire because the biomass and fuels would not be treated and are expected to continue to accumulate. Ponderosa pine trees killed by the continued expansion of MPB infestations would fall, accumulating on the forest floor, thereby increasing the existing levels of dead and downed wood. High levels of downed wood is associated with longer fire residence times and high temperatures should a wildfire occur. Large accumulations of dead material on the forest floor supports more intense (hotter) and longer duration fires, which can substantially heat the soil profile and alter physical, chemical, biological, and hydrologic functions (Neary et al, 2005). This in turn can result in moderate to high soil burn severity conditions, which is indicated by more exposed mineral soil and changes to physical, chemical, biological, and/or hydrological soil properties.

Alternatives B and C

Direct and Indirect Effects for Soil Heating and Damage by Fire
Proposed prescribed burning associated with Alternative B and C is not expected to result in severely burned soils within proposed activity areas. Both action alternatives have more potential to directly impact soils through soil heating than Alterative A because of the proposed prescribed fire. However, prescribed broadcast-burn prescriptions are designed to provide only the fire intensity needed to achieve vegetation and fuel management objectives. Design Criteria based on research conducted by Busse (2006) for optimum soil and duff/litter moisture is included for both Action Alternatives to minimize fire damage to soils and thus minimize severely burned soils. Soil heating and associated effects to physical, chemical, biological, and hydrologic soil functions are expected to be minimal because fire intensities are expected to be primarily low to moderate. Both the degree and extent of soil heating resulting from prescribed burning are expected to be much less than that associated with wildfire burn intensities. While uncertainties exist on timeframes for the Black Hills, research conducted throughout the western United States on fires varying in size, intensity, vegetation, and climate, has shown that soil conditions tend to recover three to five years post-fire (Neary et al, 2005).

Cumulative Effects for Soil Heating and Damage by Fire
Current and reasonably foreseeable actions listed in Appendix C of the Pactola EIS were considered for cumulative effects to soils from fire. No negative cumulative effects to soils are anticipated to occur with the implementation of any of the project alternatives because no activity units associated with either Action Alternative are currently located on severely burned soil, resulting from past wildfires or prescribed broadcast-burning. Additionally, none of the activities proposed by the Pactola Project or those listed in Appendix C would result in severely burned soils.

Organic Soils
Organic soils are also present within the Pactola Project Area. These soils are located within the Jim Creek valley, along the Rochford Road (FSR 237) on the northern boundary of the project. These soils have been specifically mapped by the NRCS during the Lawrence County Soil Survey update. Organic soils, known as histosols, are defined as an accumulation of un-decomposed and partially decomposed plant material. Organic soils differ from mineral soils with organic layers due to the type of parent material that forms the soil. Mineral soils develop overtime as parent rock is weathered, off-site material is deposited, and water moves through the soil profile. Overtime, organic matter accumulates in the upper portions of the mineral soil profile but it is altered by decomposition such that the original source of the organic material cannot be identified. In organic soils, the decomposition of plant materials is slowed due to anaerobic conditions associated with wetlands. Saturated conditions result from extended periods of standing water and/or poorly drained soils, limiting the amount of oxygen present to aid the decomposition process. Organic soils are further classified as types of peat, mucky peat, or muck depending on the plant life present and the degree of decay of the material (Mitsch and Gosselink, 2007; Evans and Warburton, 2007). The origin and type of organic material can often be easily identified – for example peat formed from sedges or peat formed from mosses, also known as "peat moss".

Organic soils are extremely fragile and difficult to rehabilitate or restore following disturbances. These soils are highly susceptible to compaction and deep rutting because they have no or very little mineral soil and rock fragments to provide structural support. They are also more susceptible to erosion by water flows if a disturbance reduces stabilizing surface vegetation or channelizes water through these areas. In these events, large chunks of organic peat are washed from the site. Hungerford et al (1992) found that organic soils can be extremely combustible despite the presence of water, igniting with moisture levels as high as 90%.

Alternative A – No Action

Direct and Indirect Effects for Organic Soils
Alternative A does not have any proposed activities and thus has no direct or indirect effects on organic soils.

Alternatives B and C

Direct and Indirect Effects for Organic Soils
No direct or indirect effects to organic soils are expected to result from the implementation of either action alternative. The organic soils present in the Jim Creek valley along the Rochford Road (FSR 237) are associated with fen and wetland sites. Much of this valley is privately owned lands. For organic soils on Federal lands, project Design Criteria and WCPs require buffers around these areas and thus restrict ground-based operations within these buffers. All organic soils will also be protected from damage by prescribed fire through the inclusion of project Design Criteria (Appendix B). These measures do not allow prescribed burning within the buffers associated with fens or other areas with organic soils in order to protect these highly-combustible soils from burning.

Cumulative Effects for Organic Soils
Even though there are no effects to organic soils associated with any of the alternatives under the Pactola Project due to the lack of proposed activities and/or exclusion of ground-disturbing activities in these areas, there would continue to be cumulative impacts to these delicate areas from livestock concentration in these areas. These grazing-related impacts are outside the scope and authority of the Pactola Project, but can be addressed through adjustments in grazing management. Impacts to organic soils would continue until livestock are excluded from these areas. Additional cumulative impacts to these soils may also occur from activities occurring on adjacent non-federal lands that would cause negative effects to migrate upstream and downstream through organic soils on federally managed lands. These impacts could be addressed through watershed partnerships with adjacent landowners.

Soil Organic Matter and Nutrient Cycling
None of the soils within the Pactola Project Area are limited by topsoil organic matter (less than 2% per BHNF Forest Plan, Standard 1102). Therefore, this Standard does not apply and no special design measures are required for management activities occurring in the Pactola Project Area.

Forest ecosystems have evolved with a continual flux of both fine and coarse woody debris (CWD). Fine woody debris or "fines" consist of leaves, needles, branches, and limbs less than three inches in diameter. Fines can be especially important in soils with limited organic matter present in the topsoil because they decompose faster than CWD to create soil organic matter. Fines also provide surface stability and protection of raindrop splash and erosion.

Coarse woody debris, the larger component of forest nutrient cycling, is defined as woody material greater than three inches in diameter, excluding stumps, and is derived from tree limbs, boles, and roots in various stages of decay (Graham et al, 1994). CWD performs many physical, chemical, and biological functions in forest ecosystems. Physically, it protects the forest floor and mineral soil from erosion and mechanical disturbances. CWD disrupts airflow and provides shade, which insulates and protects new forest growth. In moist forest types, it can be a seedbed and nursery area for new conifer seedlings. CWD also has significant water holding capacity, making it an important source of moisture for vegetation during dry periods. This decaying woody debris provides nutrients, especially sulfur, phosphorous, and nitrogen, necessary for new plant growth. CWD also hosts ectomycorrhizae, micro-organisms which play an important role in the uptake of nutrients and water by woody plants (Graham et al, 1994).

Too much CWD can also be a problem. An overabundance of CWD can result in an overloading of organics above the soil surface, causing migration of biological decomposition processes from within the upper soil horizons to the litter and CWD layer. If decomposition rates are substantially higher above the soil surface than within the upper soil horizons, critical nutrients can be volatilized to the atmosphere, reducing soil productivity. An overabundance of CWD also poses a greater risk of severely burned areas resulting from fire.

Graham (1994) recommends 7-13 tons/acre of CWD for ponderosa pine-fescue stands. Recommendations for CWD in spruce stands have yet to be examined. However, Forest Plan Objective 212 prescribes 5-10 tons/acre of CWD for conifer stands, providing there isn't a conflict with fire or pest management objectives (USDA Forest Service, 2006). A range of

diameters, lengths, and decay states is preferred. Distribution of CWD throughout a treated area is also more desirable than isolated concentrations.

CWD levels were estimated using the "Photo Series for Quantifying Forest Residues in the Black Hills" for Ponderosa Pine and Spruce Types (USDA Forest Service, 1982). Current CWD levels of sites surveyed during field investigations appear to meet or exceed the minimum recommended levels. Areas impacted by mountain pine beetle greatly exceed recommended CWD levels currently and would continue to accumulate as dead trees fall to the ground. The excess CWD poses a higher risk of severely burned soils and associated effects should a ground fire sweep through this area. Areas that have continuous grass cover in addition to dead and downed trees pose an even greater risk of soil damage resulting from sustained burning associated with a ground fire. Refer to the Fire and Fuels section for more discussion on fire hazard as it relates to current fuel load conditions.

Alternative A – No Action

Direct and Indirect Effects for Soil Organic Matter and Nutrient Cycling
Alternative A does not have any proposed activities and thus has no direct effect on soil organic matter or nutrient cycling. However, the potential for more severe fire effects to soils is generally highest with this alternative, which can directly affect the amount of organic material and nutrient cycling in an area.

Fire can alter nutrient availability and cycling processes dramatically, depending on the severity of the fire. Whether nutrient concentrations increase, decrease, or remain the same is highly dependent on fire behavior, severity, nutrient response to fire, post-fire recovery and erosion processes, and even post-fire management activities. Fire volatilizes nutrients present in both vegetation and soil organic matter. Although some volatized nutrients are lost during the fire, through gases and particulates carried by smoke, other nutrients are mobilized and made more readily available. For example, fire acts as a rapid mobilizing agent that instantaneously releases phosphorus bound in organic matter, as compared to the much slower, natural decomposition processes (DeBano et al, 1998). Nutrients can be re-deposited or remain on site in ash on the soil surface. These highly available nutrients can then be leached out of the ash and into the soil. In contrast, these same highly available forms can be transformed from organic to inorganic compounds during combustion or when immobilized by other chemical compounds. Additionally, nutrients present in ash can be lost from the system through wind and water erosion. In contrast, some nutrients would remain available in partially combusted and unburned vegetation and soil organic matter.

Alternatives B and C

Direct and Indirect Effects for Soil Organic Matter and Nutrient Cycling
Long term soil productivity associated with organic matter and nutrient cycling is not expected to be negatively affected directly or indirectly by management activities proposed under either action alternative, but rather to trend towards a net improvement following project implementation. Proposed thinning and fuel treatment activities associated with both action alternatives have been designed to reduce hazardous fuel levels, while maintaining desired CWD levels necessary for both short and long-term nutrient recycling. Current CWD levels

greatly exceed desired levels suggested by Graham (1994) and the Black Hills National Forest Plan (USDA Forest Service, 2006).

Both action alternatives also propose prescribed broadcast-burning. Overall, prescribed burning associated with both action alternatives is not expected to detrimentally affect soil productivity within the activity areas. The proposed prescribed burning is designed to result in low-to-moderate fire intensity. This fire intensity is expected to result in light-to-moderate soil heating, and therefore is not expected to reach the temperatures necessary to cause large nutrient losses through volatilization. Nutrients locked up in the surface duff layer would be expected to be released into the soil and likely become available for uptake by regenerating vegetation. An increase in short-term nutrient availability may occur and contribute to maintaining long-term soil productivity. Some portion of the mobilized nutrients may be lost through leaching, but most nutrients would remain in the soil profile or utilized by vegetation. No change in soil structure or infiltration is expected. Temperatures are not expected to reach those necessary to alter physical characteristics of the soil.

Cumulative Effects for Soil Organic Matter and Nutrient Cycling
No negative cumulative impacts to soil organic matter or nutrient recycling are anticipated for any of the project alternatives. Rather a net benefit is expected due to the combined efforts to treat the expanding MPB epidemic and reduce levels of CWD across the project area. These activities would move current CWD levels towards more natural and desired levels.

Soil Productivity and Detrimental Soil Disturbance
Soil productivity is the inherent capacity of a soil to support the growth of vegetation. The most productive part of the soil occurs near the surface, at the contact between the forest litter and the mineral soil. Here the litter has been decomposed into an organic rich layer containing most of the soil nitrogen, potassium, and mycorrhizae that must be present for a site to be productive. However, this is also the part of the soil that is easiest to disturb by management activities. Soil quality refers to the capacity of a soil to function within ecosystem and land use boundaries, to sustain biological productivity, maintain environmental quality, and promote plant and animal health (Doran and Parkin, 1994). According to FSH 2509.25, "Soil quality depends on soil structure, organic matter, nutrient pools, and biotic processes; soil quality is impaired when these qualities are markedly degraded for a period of years; severe disturbances can impair soil quality by heating, displacing, compacting, or eroding the soil" (USDA Forest Service, 2006c). Various factors influence soil quality. Although management activities do not affect factors such as climate and soil parent material, they can affect physical, chemical, biologic, and hydrologic soil properties. Soil erosion, soil compaction, nutrient removal, soil heating and regeneration hazards can limit the long-term productivity of forested sites.

Detrimental Soil Disturbance is defined by FSH 2509.18 as the condition where established thresholds for soil properties are exceeded and result in a significant change in overall productivity of the land due to impairment to long-term soil functions. The Region 2 supplement to FSH 2509.18 provides thresholds for soil properties as well as criteria for determining detrimental soil disturbance for each property. Detrimental soil disturbance can result from management activities including road construction, timber harvest, mechanical fuels treatment, prescribed burning, grazing, and fire suppression, as well as

natural causes, such as mass movement or wildfire. Detrimental soil disturbance includes compaction, rutting (in wet soils), displacement, severely burned soil, and erosion, including mass movement (USDA Forest Service, 1992; USDA Forest Service, 2006c). Soil quality is maintained when erosion, compaction, displacement, rutting, burning, and loss of organic matter are maintained within defined soil quality standards. Thresholds and definitions for detrimental disturbance related to each of these categories can be found in the Region 2 supplement to FSH 2509.18 – Soils Handbook (USDA Forest Service, 1992).

The NRCS (2009) provides management interpretations based on soil properties pertaining to the overall susceptibility to soil degradation, as well as the recovery potential following disturbances. The resistance to degradation of a rangeland or woodland site is a measure of its ability to function without change throughout a disturbance (USDA NRCS, 2009). Resistance to degradation can also be described as an area's buffering capacity. This depends upon soil type, vegetation, climate, land use, disturbance regime, temporal and spatial scales (USDA NRCS, 2009). Soils within the Pactola Project Area are predominantly rated as "slightly susceptible to degradation", with the exception of three isolated areas on slopes surrounding Pactola Reservoir which are rated moderately susceptible; areas of rock outcrop for which this rating does not apply; and the organic soils associated with the Jim Creek valley along the Rochford Road (FSR 237) which are rated as highly susceptible to degradation if disturbed. For the remainder of the Pactola Project, the area is either rock outcrop or soils that are fairly resistant to degradation. A map depicting the potential for soil degradation is included in the project file.

Even though some soils are rated with a moderate potential for site degradation based on inherent soil properties, all soils within the Pactola Project Area are rated as having a "high Potential for favorable soil recovery" should unforeseen degradation occur. Soil restoration potential is a rating based on the inherent ability of a soil to recover from degradation, which is often referred to as soil resilience (USDA NRCS, 2009). Soil resilience is dependent upon adequate stores of organic matter, good soil structure, low salt and sodium levels, adequate nutrient levels, microbial biomass and diversity, adequate precipitation for recovery, and other soil properties (USDA NRCS, 2009).

No previously disturbed sites within the Pactola Project Area were found to be degraded and existing soil conditions indicate overall soil health, productivity, and function. Results from WCP/BMP monitoring of previously logged areas associated with the Bullock Timber Sale within the project area (see Appendix C) also indicate that although there are some residual impacts from past logging activities, site degradation is not present in these areas (Thomas, 2008). Existing soil disturbances include soil mixing and heating in burned pile locations; compression tracks associated with skid trails; and some compaction in highly-traveled areas such as skid trails and landing areas. Displacement and mixing of soil layers is limited to landing areas that have been scarified following burning, livestock concentration areas, and connected disturbed areas. These were generally associated with more recent management activities, while sites with management that occurred some time ago exhibited few if any residual impacts. Over 90% effective ground cover was observed throughout the area, with the exception of recovering log landings; areas where livestock tend to concentrate; and areas where thin soils overlay rock outcrops. Overall soil disturbance is well below the 15% detrimental disturbance threshold.

A summary of the acres of potentially ground disturbing activities taking place on sensitive soils is presented for each alternative in Table 3-2 below. The term "sensitive soil" as used in this analysis includes soils with mass movement potential and slopes exceeding 40%; high erosion potential; elevated compaction potential; severely burned soils; soils with low levels of topsoil organic matter; meadow soils; and organic (peat) soils. These areas represent soils that are more prone to detrimental disturbance as defined in the Region 2 supplement to FSH 2509.18 – Soil Management Handbook. However this does not mean that detrimental soil disturbance would result from project activities on these soils. It is provided as a means of comparing Alternatives and evaluating the risk to soil resources associated with each. Design Criteria has been included to minimize overall soil disturbance, as well as any detrimental soil disturbance, as part of the project proposal, regardless of which Alternative is chosen. Design Criteria includes applicable measures from both Forest Service WCPs (USDA Forest Service, 2006) and SD State Forestry BMPs (SDSU et al, 2003). For both action alternatives, non-commercial thinning could be accomplished with mechanized equipment or manual labor. If manual labor is used, the acres of harvest activities on sensitive soils shown in the table, particularly soils susceptible to compaction, would decrease.

Table 3-2 Proposed Activity Acres on Sensitive Soils for each Alternative

Soil Characteristic	Alternative A	Alternative B		Alternative C	
		Silviculture (Acres)	Burning (Acres)	Silviculture (Acres)	Burning (Acres)
Mass movement risk and slope exceeding 40%	0	1,200	560	2,100	560
Elevated Erosion risk	0	5,100	2,250	7,400	2,250
Elevated Compaction risk	0	7,600	N/A	9,000	N/A
Severely burned soils	0	0	0	0	0
Low topsoil organic matter with Shelterwood Harvest System	0	0	0	0	0
Meadow Soils	0	445	90	545	90
Organic Soils (Peat)	0	0	0	0	0

A summary of the road related activities that would take place on soils with mass movement potential and slopes exceeding 40%; high erosion potential; meadow soils; and organic (peat) soils is also presented for each alternative in Table 3-3. Design Criteria pertaining to roads are also included for both action alternatives to minimize impacts to the soil resource (Appendix B).

Table 3-3 Miles of New Construction (New), Temporary Road Construction (Temp), and Reconstruction and Maintenance (Recon/Mntc) affecting various soil properties for each Alternative

Soil Characteristic	Alternative A (miles)	Alternative B (miles)	Alternative C (miles)
Mass movement risk and slope exceeding 40%	0	New = < 0.1 mile Temp = 0.3 mile Recon/Mntc = 4 miles	New = 4 miles Temp = 0.3 mile Recon/Mntc = 4 miles
Elevated Erosion risk	0	New = 3 miles Temp = 13 miles Recon/Mntc = 97 miles	New = 19 miles Temp = 13 miles Recon/Mntc = 100 miles
Meadow soils	0	New = < 0.1 mile Temp = 0.5 mile Recon/Mntc = 7 miles	New = < 0.1 mile Temp = 0.5 mile Recon/Mntc = 7 miles
Organic Soils (Peat)	0	0	0

Alternative A – No Action

Direct and Indirect Effects for Soil Productivity and Detrimental Soil Disturbance
Alternative A does not propose any management activities. Therefore there would be no direct detrimental soil disturbance of any type associated with the implementation alternative. No new roads would be built under this alternative. Thus, no additional acreage would be removed from the productive soil/timber base. However, unneeded and user-created trails would also remain on the landscape, thus preventing these areas from being part of the productive soil base. The risk of experiencing severe wildfire effects is expected to be greatest with this alternative for the reasons discussed previously. Therefore, Alternative A may indirectly lead to detrimental soil disturbance in the short term.

However, long term soil productivity is expected to be maintained for two reasons. First, fire effects research conducted by Neary et al (2005) has shown that forest soil conditions typically recover within 3-5 years following wildfire. While uncertainties exist on the actual timeframes for Black Hills soils, it is reasonable to expect that timeframes would be similar based on the cross-section of forest ecosystems studied. Secondly, the ponderosa pine ecosystem of the Black Hills region historically evolved under more frequent fires of varying intensities. The soils have continued to maintain support of vegetative communities to the present time, and can be expected to continue to do so despite exposure to wildfires.

Cumulative Effects for Soil Productivity and Detrimental Soil Disturbance
Soil disturbance associated with livestock grazing, OHV activity, recreation, mining, and other forest activities authorized under other planning documents or authorities in the project area (refer to Current and Reasonably Foreseeable Activities) also have the potential to disturb soils. However, Design Criteria and WCP/BMP measures also apply to these other activities and thus minimize their impacts to soils as well. Monitoring of soil disturbance has also been included as part of the project proposal and would take place regardless of which action alternative is chosen (Appendix C). If the Alternative A is chosen, soil monitoring

would take place at the Forest level and soils within the Pactola project area may or may not be randomly chosen as part of this sampling.

Alternatives B and C

Direct and Indirect Effects for Soil Productivity and Detrimental Soil Disturbance
Management activities associated with both action alternatives are not expected to result in detrimental soil disturbance that would exceed the 15% threshold defined in the Region 2 Watershed Conservation Practices Handbook (2509.25) and the Region 2 Soil Management Handbook (FSH 2509.18).

Much of the project area has had ground based logging activity in the past, so existing landing locations, roads, and trails would be utilized as much as possible, thereby minimizing the need for disturbed new areas. Potential timber sale purchasers would have the option to use tractor or forwarder operations, except where designated otherwise. Whole tree yarding with tractors has the potential for more ground disturbance of the two methods. If a cut-to-length system is used, soil disturbance is generally minimized due to equipment operating on slash, and since organic matter is left on site, nutrient cycling is ensured and large, burned landings are avoided. Non-commercial thinning and post-and-pole treatments would be accomplished with either mechanized equipment, manual labor, or a combination of both. Generally, if manual labor is used, less mechanized logging equipment is needed and thus less overall ground disturbance can be expected.

Both action alternatives propose thinning, fuels treatments, and prescribed burning activities that have the potential to directly and indirectly disturb soils and disrupt soil productivity. However, through careful design of project activities and adherence to project Design Criteria (which include WCPs and BMPs), the actual likelihood of directly or indirectly disturbing soils to the extent that detrimental disturbance is caused and soil productivity is affected is low.

To minimize or eliminate potential negative effects from harvest activities and prescribed burning on sensitive soils, Design Criteria include one or more of the following measures: use of designated skid trails; winter harvest; partial or full suspension (i.e. forwarder) yarding; equipment exclusion; suspension cable yarding; processing at the stump; and/or higher coarse woody debris requirements. These Design Criteria are fully expected to minimize soil disturbance and maintain site productivity in and around those sensitive areas, and to meet the 15 percent standard for detrimental soil disturbance. Therefore, no short or long term effects to overall soil productivity are expected with either action alternative. Furthermore, this project would comply with Forest Plan Standards and Guidelines 1101, 1102, 1103, 1104, 1105, 1106, 1108, 1109, 1110, and 1111 pertaining to protection of soil resources and overall soil productivity (USDA Forest Service, 2006).

Cable roads in Alternative C pose a high risk of exceeding detrimental soil disturbance thresholds should the right environmental conditions occur (e.g. saturated soil conditions, excess precipitation, etc) as described previously. The longer the cable roads remained on the landscape, the higher the probability of failure and the higher the probability of impacts

to soil resources. Depending on the severity and size of the slope failure, impacts would be localized and short term or chronic and long-lasting. However, if such an event occurred, immediate actions would be implemented to stabilize failures and trend toward returning detrimental disturbance levels back below the 15% threshold.

Cumulative Effects for Soil Productivity and Detrimental Soil Disturbance
Cumulative detrimental soil disturbance related to the Federal actions under both action alternatives is expected to remain well below the 15% detrimental disturbance threshold due to the inclusion of project Design Criteria and WCPs/BMPs, which apply regardless of which alternative is chosen (Appendix B). Design Criteria were developed specifically for the Pactola Project to minimize potential cumulative, negative effects from vegetation management, prescribed broadcast-burning, and road related activities occurring on sensitive soils. Design Criteria may include one or more of the following measures: use of designated skid trails; winter harvest; partial or full suspension (i.e. forwarder) yarding; equipment exclusion; suspension cable yarding; processing at the stump; and other proven measures. These Design Criteria are expected to minimize soil disturbance in general, prevent detrimental disturbance, and maintain long term soil productivity.

Soil disturbance associated with livestock grazing, wildlife high-use areas, OHV activity, recreation, mining, and other forest activities authorized under other planning documents or authorities in the project area (refer to Current and Reasonably Foreseeable Activities) all have the potential to disturb soils. However, Design Criteria and WCP/BMP measures also apply to these other activities and thus minimize their impacts to soils as well. Both action alternatives would have areas that overlap these other activities and thus would have a greater potential for additive soil disturbance. However, strict adherence to WCP/BMP measures, including proper implementation and maintenance of runoff and erosion control structures would ensure compliance with this soil standard. Therefore, long term soil productivity in the project area is expected to be maintained or improved.

Monitoring of soil disturbance has also been included as part of the project proposal and would take place regardless of which alternative is chosen (see Appendix C). If the Alternative A is chosen, soil monitoring would take place at the Forest level and soils within the Pactola Project Area may or may not be randomly chosen as part of this sampling.

If monitoring identifies detrimental soil disturbance levels have exceeded 15%, rehabilitation actions would be taken to improve soil conditions with a net improvement in soil quality, as directed in the Region 2 Supplement to FSM 2550. Such rehabilitation actions may include, but are not limited to: scarifying skid trails and/or landings to de-compact soils, adding slash to inhibit and slow runoff, and seeding and fertilizing the site to aid in establishment of vegetation. According to research conducted by Luce and Black (1997), it is reasonable to expect that skid trail rehabilitation treatments would decrease soil compaction and improve water infiltration. Trail rehabilitation activities would meet R2 soil quality standards by trending toward a net soil improvement, and would further protect soils within the project area through the elimination of potential OHV access and travel routes. Overall, soil conditions after project implementation and trail rehabilitation are expected to remain below the 15% detrimental disturbance threshold.

Water Resources

Watersheds

A watershed is defined as an area of land where all of the water that drains from it goes into a common waterway, such as a stream, lake, estuary, wetland, groundwater aquifer, or even the ocean (US EPA, 2009; US EPA, 2011a). The water moves through a network of drainage pathways, both underground and on the land surface. Watershed boundaries are also known as drainage divides, the boundary between one drainage area and another (USGS, 1995).

The Pactola Project Area is located within four 6th-level watersheds within the Rapid Creek watershed (Appendix E, Map 2 and Table 3-4). All four watersheds are within the Cheyenne River Basin. Watershed boundaries and HUC codes were obtained from the National Hydrography Dataset developed and maintained by the USDA Service Center and USGS (USGS, 2008).

Table 3-4 6th Level Watersheds (HUC12) within the Pactola Watershed Analysis Area

6th Level (HUC 12) Watershed	6th Level (HUC 12) Watershed Name	Total Watershed Acres	Acres of Watershed in Project	Percent of Watershed in Project
101201100110	Silver Creek - Rapid Creek	22,348	1,957	9%
101201100201	Pactola Reservoir - Rapid Creek	21,324	21,161	99%
101201100202	Victoria Creek - Rapid Creek	30,805	1,370	4%
101201110305	Jim Creek – Box Elder Creek	17,687	1,491	8%

"A healthy watershed operates in dynamic equilibrium. Soil and water quality, flow regimes, and aquatic and riparian habitats vary within a certain range of conditions. Large natural disturbance events shift a watershed out of equilibrium. Recovery then begins. Poor land management practices can also shift a watershed out of equilibrium. Laws and common sense direct us to maintain equilibrium conditions between large natural disturbance events, avoid actions that may shift a watershed out of equilibrium or worsen major events, and assist watershed recovery. The natural resilience of the system must be conserved in order to sustain ecosystem health. Some disturbance can occur and still sustain watershed health. If runoff and sediment regimes, soil and channel conditions, water quality, and aquatic and riparian habitats are maintained between large natural disturbance events, watershed health is conserved" (USDA Forest Service, 2006c).

Water Rights

Management activities would not alter the status of water rights claims or uses, directly or indirectly. Thus, water rights will not be analyzed further in this document. Potential impacts to water quantity and quality are discussed for each alternative and considered in cumulative watershed effects within the respectively titled sections.

Annual Water Yield

Forested landscapes intercept rain and snow, evapo-transpiring the moisture back to the atmosphere. As a result, forests can lower the quantity of water that reaches the ground surface to then trickle through soil and groundwater systems, and eventually emerge in streams. However, forests also help conserve moisture by providing shade and cooler temperatures

which provide for less overall evaporation. The transpiration of moisture back to the atmosphere contributes to rain and snow development in the area. Thus, the annual water yield depends upon the density or coverage of the forest, the type of forest vegetation, as well as many other factors including climate, weather patterns, geology, slope, soils, stream channel conditions, and riparian area conditions.

Water yield is a concern for communities in and around the Black Hills (USDA Forest Service 1996). The water provided by streams that flow from the Black Hills is an important resource utilized for drinking water supplies, irrigation, stock watering, fisheries, and recreation in the surrounding area. The influence of forested landscapes on water yield has been investigated in the Black Hills in several studies (Anderson, 1980; Orr 1968, 1972, 1975; Orr and VanderHeide 1973; Smith 1983). In general, water discharge increases after timber harvest or wildfire due to the decreased interception by the vegetation and a decrease in the evapotranspiration rate (Gary, 1975; Leaf, 1975; Shepperd et al, 1992). Anderson (1980) reported an average increase in the annual water yield of 2.24 inches (5.7 cm) after 25% of the timber volume was cut. However, as regeneration occurs after timber harvest or wildfire, water yield declines. The rate of this decline, or recovery, depends on habitat type and the rate and density of vegetative growth.

Since the creation of the Black Hills National Forest and implementation of fire suppression in the early 1900s, annual water yields throughout the Black Hills region have decreased, primarily due to aggressive fire suppression tactics that have encouraged the growth and expansion of dense forest stands (Parrish et al, 1996; Grafe and Horsted, 2002; Horsted, 2006). As forests become denser, more precipitation (both rain and snow) is intercepted or trapped in the canopy; evapo-transpiration of precipitation is increased. Water budget calculations performed by the USGS for the Black Hills Hydrology Study (BHHS) concluded that 92% of the annual precipitation is evapo-transpired by these dense forest stands (Driscoll et al, 2002).

The overall result is less water infiltrating through soils and deeper into groundwater aquifers, reduced water tables in wetlands, and reduced volume of base flow in springs and stream channels, as well as shorter durations of flow throughout summer months. When persistent drought conditions are added to the over-growth of woody biomass, some seeps and springs, as well as perennial and intermittent streams, may “dry up” completely due to the lack of enough base flow to saturate the alluvium and appear as surface water. Once precipitation returns to near normal for a period of years and recharges groundwater aquifers, seeps, springs, and stream channels sustain surface water for a longer period throughout the summer months. In fact this has recently been observed in 2010 following four successive years of normal or above normal precipitation in the overall Black Hills Region.

Alternative A – No Action

Direct and Indirect Effects for Water Yield

Alternative A reflects the existing watershed conditions. This alternative would not directly contribute to changes in water yield in the short term. Indirectly, the existing MPB infestation will continue to expand and kill forest stands. With less live, healthy trees to take up soil moisture and intercept and evapo-transpire precipitation, more water

would be available for runoff and groundwater aquifer recharge in the short term. However, over the long-term the available water would decrease again as new trees establish themselves in these areas. Areas not affected by MPB currently would continue to increase in biomass and water consumption until a natural disturbance such as a wildfire or MPB outbreak occurs.

Alternatives B and C

Direct and Indirect Effects for Water Yield

Any silvicultural activity or natural disturbance that removes ponderosa pine trees from a forest has the potential to increase water yield. However, the growth of new seedlings and remaining trees would potentially offset this and decrease water yield. The overall increase or decrease in water yield depends on the amount of forest removed. Studies conducted on the Black Hills and in similar ecosystems in Colorado indicate that 25 to 30 percent of the growing stock in a forested watershed must be removed before there is a measurable increase in water yield from that watershed (Shepperd and Battaglia, 2002).

None of the proposed treatment methods, individually or combined, are expected to significantly affect water yields. Both action alternatives propose prescribed burning, which does not involve enough crown removal to have a measurable effect on water yield. However, the annual water yield may increase with the removal of trees associated with both action alternatives, especially in the Precambrian Crystalline geologies. Whether the increase in water yield is measurable depends on how much forest canopy is removed on a watershed basis, as well as when harvest occurs within the watershed over the life of the project.

Cumulative Effects for Water Yield

Livestock grazing, routine maintenance of trails, developed recreation facilities, and dispersed campsites, public use, and the operations of outfitters/guides would not involve activities which could remove trees to an extent that would affect annual water yield. These activities are generally dispersed across the landscape and the amount of vegetation removal, if any, as a result of these activities, is inconsequential in relation to the amount of yearly vegetative recovery within the analysis watersheds. Timber harvest and road construction activities are expected to continue to occur on private lands, but occur less often and scattered across the landscape, such that water yield increases would not be discernable in comparison with harvest on the surrounding Federal lands.

Under Alternative A, current water yield will likely persist until the mountain pine beetles kill enough trees across watersheds, or a wildfire occurs. Timber management activities associated with Alternative B and C would cumulatively make more soil moisture available throughout the watersheds especially in the Precambrian Crystalline geologies. This would cumulative provide slightly more annual water yield from the project watersheds which would supply Pactola Reservoir.

Stream Flow Regime

The Pactola Project Area contains approximately 33 miles of perennial streams, 43 miles of intermittent streams, and 28 miles of ephemeral streams (Table 3-5). A map of streams and the

field-determined flow regime is included in the project file. Due the highly dissected nature of the Black Hills, numerous ephemeral drainages are also present. These channels generally do not have a defined channel and are often swales, and carry water only in response to larger storm events or snowmelt. Ephemeral drainages and swales carry water in dispersed, shallow, sheet-like flows versus a concentrated streamflow path. Ephemeral drainages/swales are not specifically mapped.

Table 3-5 Miles of Perennial, Intermittent, and Ephemeral Streams in the Pactola Project Area

Stream Flow Regime	Stream Miles	Acres Associated with Protected Streams (WIZ)
Perennial – defined channel and generally flows year-round.	33 miles	800 acres
Intermittent – defined channel but flows for only part of the year; includes loss zones where streamflow goes underground into aquifers.	43 miles	1,040 acres
Ephemeral – defined channel or flow path, but carries water only in response to larger storm events or snowmelt.	28 miles	N/A

Stream flow in the Black Hills is influenced by the amount and timing of precipitation. Snow thaw is common from the middle to the end of March. By the end of March, flows start to increase in the streams. In April, a sharp increase in flow is attributed to the combination of precipitation and melting of accumulated snow. Flows reach their maximum during May or June. Although precipitation is highest in June, streamflow does not increase proportionally due to the increased evapotranspiration of the forested stands.

The drainages in the Pactola watershed analysis area are in a stream flow regime dominated by runoff resulting from both snowmelt and intense summer thunderstorms (Sando, 1998). Runoff from rapid snowmelt or rain-on-snowmelt can occasionally occur in the late spring months. Peak flows result from both rainfall and snowmelt but no studies have been conducted to determine the proportion or relative magnitude of peak flows resulting from snowmelt (Sando, 1998). Peak stream flows resulting from rainfall runoff account for roughly 90% of the annual peaks observed in the Black Hills (Sando, 1998). Peak flows generally occur during the months of April, May, or June, but can occur any month from March to September if significant thunderstorm activity occurs (Carter et al, 2002). Since these thunderstorms generally occur between May and September, flash floods can and do often occur during these months as well.

In fact, two such events have been known to occur in the project area within the past twenty years. The most recent occurred in the spring of 2008 and the previous was in 1998 (USGS, 2011). Both flooding events caused significant damage to reaches of Rapid Creek, as well as other streams in the general area. It is important to note that these floods only caused damages where streams were already impacted and unstable due to problem road crossings, roads encroaching or isolating floodplains, past in-stream mining, stream channelization, and other anthropogenic causes.

Stream flow within the crystalline core is also highly variable due to the relative impermeable igneous and metamorphic rocks that shed runoff rather than infiltrate it into aquifers (Carter et

al, 2002). Within this hydrogeologic setting, ground-water discharge contributes to the base flow of many streams; however, base flow can diminish rather quickly during periods of minimal precipitation (Driscoll et al, 2002).

Stream flows have been altered from historic conditions by various human-related disturbances. Historic accounts by the Custer and Dodge Expeditions in 1874 and 1875 noted more perennially-flowing streams, more abundant and lush riparian zones, and more wetlands in low-gradient valley bottoms than conditions today (Grafe and Horsted, 2002; Horsted, 2006; Shepperd and Battaglia, 2002). Subsequent post-settlement timber harvesting, mining, livestock grazing, and beaver trapping changed the water yield as described previously and thus also affected streamflow (Shepperd and Battaglia, 2002). These changes damaged the riparian zones and led to an increase in peak flows and the intensity of flash floods, and a decrease in the perennial flow of some streams (Parrish et al, 1996). More recently, the construction of the Pactola Reservoir in the 1950's significantly altered the flow regime of Rapid Creek, both upstream and downstream of the dam. Pactola Reservoir now stores and dampens the natural effect of pulse-type runoff events (i.e. floods) that occur in the Rapid Creek headwaters. Thus, Rapid Creek downstream of the reservoir now receives regulated flow releases. However, the Bureau of Reclamation (BOR) has taken steps in recent years to mimic pulse-type flood events during the spring runoff season to benefit stream habitat by providing "flushing flows" without causing significant flood damage to the stream and the multitude of commercial and residential properties along Rapid Creek (USDI Bureau of Reclamation, 2011; USGS 2011).

The primary watershed concern with vegetation removal is the potential for increased stream flows, which can degrade unstable stream channels. Streams in watersheds of the same size can have different levels of response, due to natural factors such as soils, topography, and geology. Changes in stream flow can be described in terms of changes in runoff magnitudes (increases or decreases). Annual water yield is also fundamental in stream channel formation, maintenance, and/or destabilization. Stream flow regimes can be altered by major changes in cover type or ground cover, dense road networks, or engineering projects such as reservoir storage and releases. If vegetation and/or organic ground cover in a watershed is reduced enough to markedly increase the magnitude or duration of peak stream flows, stream channels may erode their banks, causing channel instability and damage to aquatic habitat.

Alternative A – No Action

Direct and Indirect Effects for Stream Flow Regime

Alternative A reflects the existing watershed conditions. This alternative would not directly contribute to changes in stream flow in the short term. Indirectly, as more forest stands are affected by the spread of MPB, more water would be made available for streamflow in the short term for the reasons discussed previously under Annual Water Yield. However, over the long-term the stream flows would decrease again, returning to current levels as new trees grow and the forest stand regenerates. These flow conditions would continue until a large disturbance occurred, such as a wildfire.

If wildfire were to occur, fire residence times would be longer and fire temperatures higher due to the amount of large tree boles on the soil surface. This would result in more complete consumption of vegetation, litter, and duff and soil alterations. This in turn would lead to another short (less than 5 years) post-fire period of accelerated runoff in response to summer thunderstorms and rapid snowmelt. Many residences located adjacent to streams within floodplains would be threatened by post-fire flooding. Thus, the threat to downstream life and property following a fire is greatest with this alternative.

If a large enough wildfire were to occur, snowmelt and runoff characteristics may be altered in the long term due to the loss of a large amount of forest canopy. An increased amount of runoff (more volume of water) as well as a decreased time to peak (runoff is concentrated in less time) often leads to hill slope erosion, channel scouring, channel instability, and increased sediment loads. Similar post-fire watershed responses have been observed and documented for large fires throughout the Black Hills, including the 1988 Galena Fire (Driscoll et al, 2004), the 2000 Jasper Fire (Gould, 2003), the 2001 Elk Mountain Fire (USDI Interagency BAER Team, 2001) and the 2002 Grizzly Gulch Fire (USDI Interagency BAER Team, 2002). However, unlike the Jasper Fire area, a large fire in the Pactola Project area may affect snowmelt and runoff characteristics in the long term (15 years or longer) due to the less permeable, metamorphic geology present. Once forest stands began to re-establish, this response would diminish and return to background levels.

Indirectly, in the long-term wildfire and runoff responses would mimic natural cycles in which a disturbance would cause a "pulse" of water and sediment to be flushed through the stream network followed by a period of recovery. This cycle would repeat based on natural disturbance cycles (e.g. fire frequency intervals).

Alternatives B and C

Direct and Indirect Effects for Stream Flow Regime

Stream flow is not anticipated to be negatively affected by implementation of project activities associated with either Alternative B or C. Stream base flows may be sustained for a longer period in the late summer and early fall due to the reduction in overall forest canopy throughout the project area. A slight increase in flow magnitude may be seen but may not be measurable for the reasons discussed previously under Annual Water Yield. Ephemeral streams and drainages occasionally flow in response to very intense summer thunderstorms currently and would continue to do so. In these events, the amount and rate of rainfall is the driving force behind streamflow being produced and carried throughout the drainage network. Therefore, proposed treatments are not expected to measurably alter this current response. Furthermore, WCPs are included in the project design. These measures are designed to control runoff damage from at least a 10-year storm of any duration (USDA Forest Service, 2006c). Therefore, for typical precipitation events observed in the Black Hills area, storm runoff is not expected to cause damages to soil or water resources, so long as WCP/BMP measures are implemented properly.

A wildfire may still occur within the Project Area under both Action Alternatives. However, vegetative and fuel treatments are expected to reduce the intensity and the size of a fire (see the

Vegetation and Fire/Fuels sections for further discussion). Watershed effects as described for Alternative A may also still occur following a wildfire, although it is expected to a lesser degree and in localized areas.

Cumulative Effects for Stream Flow Regime
Livestock grazing, routine maintenance of trails, developed recreation facilities, and dispersed campsites, public use, and the operations of outfitters/guides would not involve activities which could alter stream flow regimes. These activities are generally dispersed across the landscape and do not involve alterations to stream flows through major diversions, storage, or releases of water from or back into streams.

Under Alternative A, current stream flow conditions will likely persist until the mountain pine beetles kill enough trees across watersheds, or a wildfire occurs, both of which could cumulatively result in increased stream flows in the short term. Timber management activities associated with Alternative B and C would cumulatively make more soil moisture available throughout the watersheds to sustain higher stream base flows, especially in the Precambrian Crystalline geologies. This would cumulative provide slightly more streamflow within the project watersheds.

Stream Channel Stability and Floodplains
Stream channel conditions are a function of the upland watershed's natural characteristics, changes related to land management activities, the inherent stream channel sensitivity, and the recent stream channel disturbance history. Alterations in the watershed's hydrologic processes can change the duration, magnitude, and timing of stream flows as compared to natural flow regimes. Increases (flooding) or decreases (drought) in magnitude or duration of peak stream flows can change stream channel conditions. Typical adjustments to increased peak flows are increased channel scour in the steeper reaches and increased deposition of the scoured sediment in the flatter reaches. Typical adjustments to decreased stream flows include deposition of sediment and bedload, filling of pools and stream habitat features, shifts in vegetation type, and loss of channel definition. Adjustments in stream channels can in turn result in decreased water quality due to the additional sediments and any other pollutants present in the eroded soils.

The ability of increased stream flow to cause channel erosion depends on the stream channel type and condition. The relative sensitivity of a channel to disturbance depends on a number of factors including stream gradient, size and shape of substrate, bank stability, and access to floodplain and overflow channels. Sensitivity to erosion varies naturally among stream reaches. Stable channel segments can withstand sizable flood events without a major departure from its dimension, pattern, and profile, whereas channels that are in an unstable condition may be measurably degraded by relatively small runoff events.

The greatest risk of stream channel degradation in the Black Hills occurs during periods of high-flow, usually resulting from intense summer thunderstorms and particularly thunderstorms occurring in burned watersheds (Gould, 2003) and direct bank damage associated with forest use and management. Effects to stream channels from an increase in runoff magnitude can include accelerated streambed erosion and stream channel

destabilization. However, silvicultural prescriptions used on the Black Hills and specifically in the project area, do not remove most or all of the forest canopy in one cutting (i.e. clear cutting) and thus do not result in significant increases in flood magnitudes. Direct bank damage can occur from forest use and management activities such as road construction, stream crossings, livestock concentration along streams, and other activities that take place along streams. Damage to stream banks through either natural or human causes may add large amounts of sediment directly into streams.

Streams within the watershed analysis area have not yet been rigorously surveyed and evaluated for stream stability. However, general stream health assessments have been completed for the perennial streams and many of the intermittent streams as well in accordance with Region 2 and Forest Plan guidance. Most of these are rated "At-risk" for moderate departures in geomorphic, hydrologic and/or biotic integrity relative to their natural, potential condition, due largely in part to past mining activities, road-related problems, and livestock concentration and associated damages.

Jim Creek, Kelley Gulch, and Nugget Gulch are rated as "Diminished" according to Region 2 protocols, because these streams exhibits low geomorphic, hydrologic and/or biotic integrity relative to their natural, potential condition and are experiencing major departures from the stable dimension, pattern, and profile appropriate for its stream type. These streams are rated as such due to extensive alteration due to roads encroaching on the floodplain, re-routing or channelizing the stream, and multiple stream crossings; and heavy livestock concentration and trampling of stream banks and adjacent riparian and wetlands, including two fens. A rating of "Diminished" stream conditions is an indicator that State assigned beneficial uses and water quality criteria may not be adequately supported. In these cases, more detailed field investigations should be completed, in addition to some basic water quality monitoring in order to determine if beneficial uses and water quality criteria are truly threatened.

Executive Order 11988 on Floodplain Management gives responsibility to all federal agencies to provide leadership and take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by floodplains (Carter, 1977a). Floodplains provide for flood moderation, water quality protection, ground water recharge, wildlife habitat, among other benefits. This order is directly tied to the National Flood Insurance Act and Flood Disaster Protection Act. To meet the requirements of these acts, the Federal Emergency Management Agency (FEMA) has mapped 100-year floodplains across the nation, including Pennington and Lawrence Counties (FEMA, 1998). A floodplain is the flat area on either side of a stream or river that is susceptible to inundation by floodwaters. There are approximately 1,600 acres of 100-year floodplains within the project area. The 100-year flood is a flood having a 1% chance of being equaled or exceeded in magnitude in any given year. It is not a flood occurring once every 100 years. Floodplains slow flood velocities and decrease erosion because they are by nature wide and flat, thus allowing for shallower and slower water. Mapped floodplains are located along the following major streams: Rapid Creek, Deer Creek, and Jim Creek. A map depicting the mapped 100-year floodplains is included in the project file.

Alternative A – No Action

Direct and Indirect Effects for Stream Channel Stability and Floodplains
Alternative A does not propose any management actions and thus would not directly contribute to changes in stream channel stability or floodplains in the short term or long term. However, indirectly, if the spread of MPB continues and a wildfire should occur, post-fire flooding can be expected to cause significant changes to stream channels and banks through excess channel scour, bank erosion, channel abandonment, and excess deposition in low gradient reaches. However, as stated previously, recovery would be expected to occur in three to five years, so stream flow would also return to background levels. Stream channels and floodplains would stabilize naturally until the next "pulse" disturbance and response cycle.

However, stream channel stability is dependent on "channel maintenance" flows occurring periodically. As biomass continues to increase, less water would be available for maintaining stream beds and banks and natural transport processes of nutrient, sediment, and woody debris. The extended drought conditions and dense forest in the project area are currently affecting streams in this way. On the other extreme, if a wildfire should occur, post-fire flooding can be expected to cause significant changes to stream channels and banks through excess channel scour, bank erosion, channel abandonment, and excess deposition in low gradient reaches. Recovery of already unstable streams would be very slow, so the accelerated timing of runoff, increased water volume, accelerated erosion and sediment delivery may persist for several years. Furthermore, road improvements would occur as appropriated funding is available, thus current impacts to streams and floodplains at road crossings, CDAs, and areas where roads closely parallel streams would persist.

Alternatives B and C

Direct and Indirect Effects for Stream Channel Stability and Floodplains
No measureable, negative direct or indirect effects to stream channels and floodplains in the Project Area are expected as a result of changes in annual water yield or runoff magnitudes resulting from either Action Alternative, due to the reasons mentioned previously.

Short-term impacts may occur to stream channels and floodplains under both action alternatives in areas where vegetative treatment and road work is proposed within riparian corridors and adjacent to streams. However, Design Criteria and WCPs/BMPs (Appendix B) are included to protect stream courses and minimize floodplain and riparian impacts during management activities. All perennial and intermittent streams and other water bodies have 100-foot vegetative buffers, as required by the agreement between the USFS and the State of South Dakota (USDA Forest Service, 2009) stipulating that USFS Region 2 WCPs would be used above and beyond South Dakota BMPs to comply with State and Federal water quality regulations related to the Clean Water Act (US EPA, 2011b). Forest Plan Standards 1301, 1302, 1306 and Guideline 1115 also stipulate the use of buffers for streams and riparian areas (USDA Forest Service, 2006b).

This 100-foot buffer is referred to as the Watershed Influence Zone (WIZ) buffer and applies to both sides of each perennial and intermittent stream, as well as other water bodies (lakes,

wetlands, etc). The WIZ buffer is more protective than the 50-foot buffers, known as Streamside Management Zones or SMZ buffers, required by the South Dakota State Forestry BMPs (SDSU et al, 2003). Vegetation within streamside buffers provides physical stream bank stability and serves to slow water velocities during flood events. For most stream sections, this 100-foot buffer also includes the 100-year floodplain. For stream sections located in wide valley bottoms that also have a floodplain zone that is wider than the 100-ft buffer, Design Criteria has been included specifying the types of activities that may occur in these areas.

Forest management activities such as tree harvest and prescribed fire can take place within the 100-ft WIZ buffer if desired for silvicultural reasons and done so cautiously, with a "tread lightly" approach. In general, WIZ buffers would be avoided by ground-based equipment except at designated crossing points, to perform road work, to end-yard any cut trees out of the WIZ, or where site-specifically approved. Design Criteria has been included to protect streamside vegetation within the WIZ, including willows, aspen, spruce, or other trees or shrubs providing physical bank stabilization, and thus would not be removed unless site specifically approved otherwise by the hydrologist and the appropriate resource professional for any other resource concerns that may exist within that stream-side buffer. This could include the wildlife biologist, fisheries biologist, botanist, or other disciplines based on the inter-relation of resources associated with each stream segment.

Implementing project Design Criteria and WCPs/BMPs also ensures compliance with Forest Plan Standards and Guidelines 1115, 1301, 1302, and 1306 through the use of buffers for streams and riparian areas (USDA Forest Service, 2006). In addition, road improvements associated with timber sales would provide for improvements to stream channels and floodplains that are currently problematic.

The risk of negative impacts to stream channel stability and floodplains resulting from a slope failure is greatest with Alternative C for the reasons described previously throughout the soils discussion. Impacts to streams and floodplains may be localized and short term, or chronic and extensive, depending on the severity and size of the slope failure and its location relative to stream channels. This could be accompanied by a loss of streamside wetlands and riparian ecosystems; floodplain deposition, scouring, and/or blockage; a decrease in channel stability; and increased scouring of stream channels should slope failures and debris transport to streams and floodplains occur.

Cumulative Effects for Stream Channel Stability and Floodplains

Past mining, livestock grazing, and road construction are the primary contributors to stream instability. Roads are also the primarily source of impact on floodplains. The environmental impacts of roads have been described previously. Grazing impacts on stream bank stability has not been specifically analyzed since changes in grazing management are beyond the scope of this project. However, changes in grazing management will be pursued to achieve more stable stream banks. Design Criteria and WCPs/BMPs have been included in both action alternatives to protect streams and floodplains during harvest activities. Road improvements associated with both action alternatives would lead to improved floodplain access and channel stability at some stream crossings.

Cumulatively, stable stream channels throughout the area are expected to remain in their current conditions until a natural disturbance such as wildfire occurs, which would likely cause instability as discussed previously, or improvements are brought about through changes in grazing management and road alignment. Conversely, already unstable stream channels would continue to degrade, causing impacts to ripple throughout their tributary networks as well. This would continue until management activities are implemented to arrest head-cutting and channel incision, and restore the necessary stream channel dimensions, pattern, and profile to achieve system stability again. Detailed stream stability surveys and assessments are recommended to design a solution for road alignment that improves stream stability in streams identified as unstable.

Water Quality

Black Hills groundwater and surface water are highly interconnected, and thus the quality of groundwater can affect the quality of surface water, and vice versa. The quality of water can change as it flows over the land surface into streams and lakes, as wells as through underground aquifers. Water quality standards for both groundwater and surface water have been established by the U.S. Environmental Protection Agency (EPA) and the State of South Dakota, Department of Environment and Natural Resources (SD DENR) depending on the identified beneficial uses (SD DENR, 1999; US EPA, 2011b).

The quality of groundwater is important for the Black Hills region because of the aquifers present and recent increase in development of the aquifers to provide water for uses such as residential and municipal water supplies, commercial and industrial uses, livestock water, and irrigation. As ground water comes in contact with soil and rock materials, some of the minerals, chemicals, and nutrients dissolve and become part of the groundwater chemistry. Chemicals and nutrients in groundwater can result from both natural and human influences. The potential for groundwater contamination in the Black Hills can be high, especially where aquifer recharge zones (outcrops) occur.

Naturally high concentrations of iron and manganese are associated with groundwater originating in the Precambrian aquifers present in the project area (Carter et al, 2003). Hardness is determined by the amount of dissolved calcium and magnesium in the water. Precambrian rocks have few carbonate rocks and thus water from this aquifer is much lower in hardness. Throughout the Black Hills, water from the major aquifers is generally fresh and low in dissolved solids within and near outcrop areas (Carter et al, 2003).

Many activities have the potential to contribute contamination to soils and ground water simply through the presence of fuels, oils, solvents, paints and detergents, and by the generation of solid or liquid wastes. Typical contamination sources on the NFS include mines, oil and gas wells, landfills, and septic systems (USDA Forest Service, 2007c). Contamination of soils and ground water can be difficult, time-consuming, and expensive to clean up. Since the release of even small amounts of stored chemicals or fuels may substantially damage ground-water resources, efforts must be made to ensure that all Forest Service activities and facilities comply with regulations for preventing ground-water contamination (USDA Forest Service, 2007c). Forest Service lands also contain the headwaters for many streams that flow off-forest and recharge zones for groundwater aquifers from which water is used for human consumption.

Therefore, the protection of groundwater from contamination is also covered by the Safe Drinking Water Act of 1974.

Groundwater pollution is most often associated with sanitary sewer systems and chemical spills. The USFS has several vault toilet installations within the Pactola Project Area. These include 13 vault toilets associated with the Pactola Recreation Complex, including the Pactola Visitor Center; Pactola North Overlook; Veterans Point, Pactola Point, and Jenny Gulch Picnic Areas; North and South boat ramps; and Bear Gulch and Pactola Campgrounds (Slepnikoff, 2009). One additional vault toilet is located at the Rapid Creek Trailhead on the Centennial Trail just below the Pactola Dam (Slepnikoff, 2009). All USFS vault toilets are regularly maintained and inspected and are not currently known to be leaking. Numerous residential septic systems also exist on privately owned lands throughout the project and watershed analysis areas. No sewer system problems have been reported to the SD DENR in this area, although some small petroleum product spills have occurred along Highway 385 (SD DENR, 2011b).

According to the SD DENR (2010), "The Black Hills region traditionally has some of the best surface water quality in the state. This is due in a large part to a cooler climate and higher rainfall than the surrounding plains as a result of greater elevation and forest cover. Also contributing to the water quality in this region is the nature of local bedrock formations which are much less erodible than the highly erodible and leachable marine shales and badlands on the surrounding plains. However, the Black Hills streams are vulnerable to losses of flow exacerbated by periodic droughts. Grazing of streamside vegetation, which increases stream bank erosion, water temperature and nutrient loading, also continues to be a problem in some streams in this area" (SD DENR, 2010). Establishing consistent long-term trends in water quality for Black Hills streams can be difficult, especially for smaller streams, due to water quality fluctuations that naturally result from climatic and hydrologic factors in the region (SD DENR, 2004).

The SD DENR assigns water quality standards based on the beneficial uses of each water body. All streams in South Dakota are assigned the beneficial uses of irrigation, fish and wildlife propagation, recreation, and stock watering (SD DENR, 1999). Most streams and water bodies in the project area are also classified as supporting coldwater fisheries and limited-contact recreation waters. In addition to all these beneficial uses, Rapid Creek and Pactola Reservoir are also both considered public drinking water supplies and classified as immersion-contact recreation waters. Detailed information pertaining to the State assigned beneficial uses for each stream and waterbody with the Pactola Project Area, along with water Quality criteria for each beneficial use is included in the project file.

No formally identified Municipal Watersheds are located in the Pactola Project Area. However, the Pactola Reservoir is a municipal water supply for the City of Rapid City. Residents of Silver City obtain water from their individual, residential wells and thus this community does not meet the definition of a Public Water Supply. A public water supply is defined as having at least 15 service connections or regularly serving at least 25 individuals daily for at least 60 days out of the year. However, the Pactola Recreation Complex is considered a Public Water Supply and has two wells, one at the Visitor Center and another for the campground, that are used to supply domestic water (Slepnikoff, 2009). A few private

groundwater wells, both shallow alluvial wells and deeper aquifer wells, are located throughout the area on privately-owned land parcels (SD DENR, 2011a).

None of the waterbodies within the Pactola Project Area are currently listed as impaired (SD DENR, 2010). However some stream segments within the project area have been listed on previous years' reports and there are impaired stream segments within the watershed analysis area that are not meeting one or more beneficial uses currently or have not in previous years (SD DENR, 1998; 2002; 2004; 2006; 2008; 2010).

Rapid Creek (R34), from its headwaters to Pactola Reservoir, was listed in 1996 for Total Suspended Solids (TSS), pH, and ammonia (SD DENR, 1998). Subsequent monitoring data showed it to be meeting the criteria for each and thus fully supporting its beneficial uses (SD DENR, 1998; 2004; 2006; 2008; 2010). Pactola Reservoir was listed in previous reporting years as a Category 2 waterbody, meaning that some uses were met and others had insufficient data to make a determination. It was identified as a high quality waterbody but vulnerable to nutrient enrichment and sedimentation from natural soil erosion, recreational activities, and various silvicultural activities (SD DENR, 2004). Water quality monitoring of the reservoir currently confirms that is indeed meeting all its assigned beneficial uses (SD DENR, 2008; 2010).

Non-point sources of pollution are the primary potential causes of degraded water quality within the Project Area. Non-point source pollution is water pollution that has sources that cannot be isolated to a single source, but can best be controlled by proper soil, water, and land management practices, such as WCPs (USDA Forest Service, 2006c) and SD BMPs (SDSU et al, 2003). Fine sediment is perhaps the most important potential non-point pollutant. Although a natural level of sediment exists in all streams, a substantial change in sediment delivery to the streams can lead to adverse geomorphic channel adjustments and impacts to aquatic species. Depending on the composition of sediment, nutrients and other contaminants may be adsorbed to particles and carried throughout a stream network and into water bodies (Waters, 1995). Road use, road construction, and road maintenance are considered the principle sources of sediment from many upland watersheds (Brooks et al, 1997; Waters, 1995; Meehan, 1994). A number of studies indicate that as much as 90 percent of the sediment associated from timber harvesting operations in the United States originates from roads (Brooks et al, 1997).

Considerable sediment can be generated during and immediately following new road construction. Sediment delivery usually declines substantially over time as vegetation re-establishes on cut and fill slopes and ditches and channels adjust to culverts. Road/stream crossings can continue to be a chronic source of sediment to streams because sediment from the road surface or ditch water is delivered directly to the stream at these sites. Sediment usually originates from erosion on the cutslopes, scour in the ditch line, or washing of surface fines from the road surface. Unnatural channel widths, gradient, and streambed form occur upstream and downstream of stream crossings. Often scour occurs at the outlet of culverts causing channel instability downstream. The frequency and amount of sediment delivery to the streams is highly variable, and is largely influenced by road segment length, slope, and location within the watershed, as well as precipitation type, amount, and timing (Luce and Black, 1999; King and Tennyson, 1984). Excess sediment deposits in stream beds can harm

insect populations and fish reproduction (Waters, 1995). Refer to the Wildlife and Fisheries sections for more discussion.

Changes in water temperature and dissolved oxygen can also affect overall water quality and stream health. Water temperatures can be increased through the removal of streamside vegetation that provides shade and thus cooler stream temperatures. Water temperatures can also increase when streams are widened, and thus get shallower, or during periods of reduced stream flow. The temperature of the water controls how much dissolved oxygen is present. As water temperatures get warmer, less dissolved oxygen is available for use by aquatic organisms such as fish.

The Pactola Project does not propose stream stabilization or restoration activities and thus potential effects associated with advancing stream channel incision or "head cutting" apply under both action alternatives. However, both action alternatives include Design Criteria and WCPs/BMPs to prevent further effects to these already impaired and unstable systems. Some existing stream problems may be fixed through road maintenance and improvement work associated with timber haul routes. Other restoration activities would be pursued through separate NEPA authorities.

Alternative A – No Action

Direct and Indirect Effects for Water Quality

Alternative A would not involve any additional management activities or road improvements. Rates and volumes of sediment delivered to streams and other water bodies are expected to continue at current rates for most of the project area. However, rates and volumes may possibly increase in problem areas and as faulty stream crossings continue to degrade, or in response to a natural disturbance, such as a wildfire, occurs. Rates and volumes of sediment delivered to streams and other water may increase if problem road crossings and unstable streams are not fixed. Stream temperatures and dissolved oxygen would generally remain unchanged from current conditions. Alternative A would not involve road improvements, so sediment delivery to streams would continue to occur.

A wildfire that may be experienced under Alternative A is expected to have the greatest potential of exposing and altering soil conditions and thus the greatest risk of indirectly contributing to increases in soil erosion and off-site sediment transport to water bodies. If a wildfire occurs, and intense rainfall events follow it, soil erosion and the resulting sediment transport would likely mimic conditions previously observed during post-fire precipitation events in the Jasper Fire area, in which sediment was carried in flood waters all the way to Angostura Reservoir. Post-fire flooding may impact water quality in a significant and negative way for several years following the fire, leading to impairment of beneficial uses within and downstream of the project during and immediately following any post-fire flooding events. This would continue until watershed conditions have recovered. Flash floods have and would still occur in the project area in response to intense summer thunderstorms. Should a wildfire occur, these flash floods may be intensified in both magnitude and frequency.

Recovery of the watershed following a wildfire could be very slow based inherent characteristics such as slope, soils, geology, vegetation, etc. So the accelerated timing of

runoff, increased water volume, accelerated erosion and sediment delivery may persist for several years. If an intense rainfall event occurs, soil erosion and the resulting sediment transport to Pactola Reservoir would likely mimic conditions previously observed during post-fire precipitation events in the Jasper Fire area, in which sediment was carried in flood waters all the way to Angostura Reservoir in 2001 (Gould, 2003). Post-fire flooding may lead to degraded water quality and impairment of beneficial uses within and downstream of the project area. Similar post-fire watershed responses have been observed and documented for large fires throughout the Black Hills, including the 1988 Galena Fire (Driscoll et al, 2004), the 2001 Elk Mountain Fire (USDI Interagency BAER Team, 2001) and the 2002 Grizzly Gulch Fire (USDI Interagency BAER Team, 2002).

In addition, the town of Silver City and many residences located adjacent to streams, would be threatened by post-fire flooding. Furthermore, large ponds would pose an additional threat to life and property if post-fire flooding exceeded the storage capacity of the impoundments, causing dams to be breached and send a large "pulse-type" flood wave. Thus the threat to downstream life and property following a fire is greatest with this alternative.

Alternatives B and C

Direct and Indirect Effects for Water Quality

Vegetation Management and Prescribed Broadcast Burning: Proposed timber and fuels management, and prescribed burning activities associated with both action alternatives is not expected to degrade water quality or exceed State specified thresholds for the various water quality parameters associated with each beneficial use. Commercial and non-commercial thinning and prescribed burning activities associated with Alternative B and C are not expected to result in detrimental levels of soil erosion as explained previously in the soil erosion discussion, and therefore no substantial increase in sediment transport to streams and water bodies is anticipated. Measures have been included in the project to protect the quality of ground water as required by Forest Service Manual 2880 – Geologic Resources, Hazards, and Services (USDA Forest Service, 2008b). Applicable WCPs found in FSH 2509.25 (USDA Forest Service, 2006c), along with SD BMPs (SDSU et al, 2003), are used to prevent degradation of both surface and ground water quality. These measures apply to all proposed activities and are listed in Appendix B. These measures include stream and riparian buffers, avoidance of sensitive areas, seasonal operations, drainage features, and restrictions on harvest, road activities, and fire ignition in and immediately adjacent to water resources. Measures are also included to prevent the use and storage of concentrated pollutant sources near water bodies or applying harmful chemicals near water bodies, including fuels, oils, and lubricants used in equipment operations as required by the WCP Handbook (USDA Forest Service, 2006c) and Forest Plan Standard 1107 (USDA Forest Service, 2006).

These practices have been proven effective in preventing runoff, erosion, sediment delivery, and chemical pollution of water resources when implemented properly (Lee, 2001; Lee and Everett, 2001; Everett, 2004; Thomas, 2008; Hoxie and Engelskirger, 2009; USDA Forest Service, 2003, 2006c, 2010c). All management activities have been designed to meet Forest Plan Standards and Guidelines through the inclusion of project Design Criteria and specified WCP/BMP measures. These measures also help to ensure compliance with the Clean Water

Act (US EPA, 2011b) and all State and National water quality regulations. So long as project Design Criteria are properly implemented and adhered to, no substantial or long-lasting effects to surface or ground water quality are expected.

Furthermore, vegetative buffers would remain in place to filter any incoming sediment or chemical pollutants, provide stream bank stability and minimize bank erosion, and provide necessary shading to maintain cooler water temperatures necessary for coldwater fisheries. All water bodies including but not limited to lakes, ponds, wetlands, springs, and perennial and intermittent streams, have 100-foot WIZ vegetative buffers as required by agreement with the SD DENR (USDA Forest Service, 2006c; 2009g) and Forest Plan Standards 1301, 1302, 1306 and Guideline 1115 (USDA Forest Service, 2006). These buffers protect streams and other water resources from increased sediment delivery or chemical pollutants by filtering runoff prior to entry into streams and wetlands. Vegetation within streamside buffers provides physical stream bank stability and thus minimizes bank erosion and associated suspended sediment transport in streams. Streamside vegetation also provides necessary shade to maintain cooler stream temperatures essential for coldwater fisheries.

Forest management activities such as tree harvest and prescribed fire can take place within the 100-ft WIZ buffer if desired for silvicultural reasons and done so cautiously, with a "tread lightly" approach. In general, WIZ buffers would be avoided by ground-based equipment except at designated crossing points, to perform road work, to end-yard any cut trees out of the WIZ, or where site-specifically approved. Design Criteria has been included to protect vegetation within the WIZ associated with streams, lakes, ponds, wetlands, and other water bodies. Within this buffer, willows, aspen, spruce, or other trees and shrubs providing physical bank stabilization or shade to the stream or water body would not be removed unless site specifically approved otherwise by the hydrologist and the appropriate resource professional for any other resource concerns that may exist within that buffer. This could include the wildlife biologist, fisheries biologist, botanist, or other disciplines based on the inter-relation of resources at each stream or water body.

The Pactola Project is being proposed under the HFRA authority, which limits road improvements to only those roads used during vegetation treatments. The HFRA authority cannot authorize project-wide road management. With this in mind, the project was designed to reduce the impacts of existing roads on watersheds to the extent possible under the HFRA authority. Other problem areas can still be addressed through existing authorities (i.e. road maintenance) or brought forth for analysis under other NEPA projects.

Approximately 69 miles of road maintenance activities are proposed under Alternative B and 72 miles under Alternative C. Road maintenance activities under both alternatives would focus on reducing the distance water flows in ditches, reducing road surface erosion, filtering ditch water before entering streams, and reducing the probability of stream-crossing failures. Research has demonstrated that improved road design, construction, and maintenance can reduce road-related erosion (Gucinski et al, 2000). In addition, adding aggregate to road surfaces can greatly reduce erosion and sediment delivery (Kennedy, 1997).

Road construction, reconstruction, maintenance, and temporary use of roads within riparian areas and at stream crossings have the greatest potential to increase sediment. However, through the use of Design Criteria and BMPs, sediment delivery to water resources should be minimized. Furthermore, road problems and CDAs would be corrected as part of the commercial timber harvest and road package, thus reducing sediment to the streams. Reducing stand density in upland areas, and thus potentially increasing stream base flows would have a positive effect on stream temperature. Streamside vegetation would be protected through required buffers and thus would not be removed. Design Criteria and BMPs are included to prevent use and storage of concentrated pollutant sources near water bodies or applying harmful chemicals near water bodies, including fuels, oils, and lubricants used in road-related equipment operations.

Both Alternative B and C could result in localized, short term sediment delivery to water resources from road-related activities adjacent to streams or at stream crossings. Although very minor, this would add to sediment from existing road conditions and on-going road maintenance activities. However, these road-related activities are designed to improve existing stream channel conditions or water quality issues at individual sites (e.g. culverts, low water crossings, etc.). In the long term, roads would produce less sediment as a result of the implementation of the committed road work in these alternatives (road work associated with timber sale areas). Other road improvement work is planned, but not guaranteed. The committed road work would trend toward improvement in sediment delivery and overall water quality.

Implementation of project Design Criteria including WCP/BMP measures is expected to protect soil and water resources, and thus minimize any adverse impacts to the downstream water quality that may result from road work. The various impoundments within and downstream of the project would trap sediment and nutrients if an extreme event were to occur. Such an event might be severe thunderstorms, similar to those that occurred in 1998 and 2008 that caused major flooding of Rapid Creek, or rain events following a large wildfire. If a significant amount of precipitation occurred with such an event, some sediment and nutrients could be carried through the stream network all the way to Pactola Reservoir. However, this type of event cannot be predicted and is independent of proposed actions associated with the project.

The risk of observing negative impacts to water quality associated with cable road construction and potential failure is highest with Alternative C for the reasons described throughout the soil and water discussion. A measurable, negative change in water quality may result from cable road construction and long-term presence on the landscape if environmental conditions (saturated soils, excess precipitation, etc.) were to occur. The longer the cable roads remained on the landscape, the higher the probability of failure and the higher the probability of impacts to water quality. Depending on the severity and size of the slope failure, impacts to water quality may be localized and short term or chronic and long-lasting. However, if such an event occurred, immediate actions would be implemented to stabilize road and resource problems and reduce impacts to soil and water resources. Therefore long-lasting water quality effects to Rapid Creek or Pactola Reservoir – both classified as public drinking water supplies – are not anticipated.

Cumulative Effects for Water Quality

Cumulatively, all activities are expected to maintain current water quality levels with the implementation of Design Criteria and WCPs/BMPs (see Appendix B). No measurable change

in overall water quality is expected in any of the streams from activities associated with the project other than decreased sediment delivery where problem road crossings and other road-related CDAs are corrected, as discussed above. Other federal ongoing and foreseeable activities would also adhere to applicable Forest Service policy and Federal and State regulations regarding water resources.

Grazing management strategies are employed to prevent water quality impairment associated with livestock concentration in or near water bodies. Routine maintenance of trails, developed recreation facilities, and dispersed campsites or the operations of outfitters and guides would not involve activities which would increase sedimentation or affect water quality. Public Recreational uses would have no measurable effect on sediment yields in the Project Area, due to the fact that disturbance created by these activities would be small, if any and dispersed across the landscape. Routine road maintenance is likely to occur as needed on existing roads in the Project Area. The roads most likely to receive maintenance are those open to vehicle traffic. Roads with restricted vehicle access would receive maintenance as needed to correct problems as they occur. Although minor sediment inputs into streams are possible, the long-term benefit of road maintenance is a reduction in routed sediment and water. Short-term sediment input to streams is expected to be minimized or eliminated by using WCP/BMP measures.

Connected Disturbed Areas

Connected Disturbed Areas (CDAs) are disturbed sites that have a continuous surface flow path into streams and other water bodies (USDA Forest Service, 1999). Hydrologic connection exists where overland flow, sediment, or pollutants have a direct route to the stream network, lake, pond, wetland, etc (USDA Forest Service, 2006c). Sediment delivery to and transport in streams is a natural process, but roads and other disturbed sites can act as channels that multiply sediment loads to the stream network during runoff events. Most material that enters streams comes from an adjacent source zone and will eventually reach an aquatic ecosystem (USDA Forest Service, 2006c). Such "connected disturbed areas" can be a major source of damage to aquatic ecosystems. CDAs can lead to decreased physical habitat, impaired water quality, and increased risk of flood damage. CDAs include roads, ditches, compacted soils, bare soils, mine spoils, and areas of severely burned soils that are directly connected to the stream network. Ground disturbing activities located within the water influence zone are also considered connected unless site-specific actions are taken to disconnect them from streams (USDA Forest Service, 2006c). CDAs in the Pactola Project Area are primarily associated with roads, past mining activities, and livestock concentration in wet areas.

Alternative A – No Action

Direct and Indirect Effects for Connected Disturbed Areas

Alternative A would not involve any additional management activities or resource improvements. Therefore, existing CDAs would remain as problem areas until road maintenance, grazing allotment improvements, or wetland and stream restoration projects occurred. These activities would take place as funding and current project authorities allowed. Refer to the Water Quality discussion for Alternative A for impacts to water quality related to CDAs.

Alternatives B and C

Direct and Indirect Effects for Connected Disturbed Areas
CDAs associated with roads that would be used to complete commercial vegetation management activities (e.g. timber sales) can be corrected under the HFRA authority. Road related CDAs are listed in the project file as well as the Engineering/Transportation Report. Fixing other CDAs is generally beyond the scope of the Pactola project, but can be accomplished under other projects as funding allows.

Cumulative Effects for Connected Disturbed Areas
Current and reasonably foreseeable actions listed in Appendix C of the Pactola EIS were considered for cumulative effects to Connected Disturbed Areas. Cumulative impacts associated with Connected Disturbed Areas would be similar to those discussed under the Water Quality section.

Wetlands, Riparian Areas, and Groundwater-Dependant Ecosystems
Wetlands, riparian areas, and groundwater dependent ecosystems are susceptible to degradation from land use activities such as livestock grazing, roads, land development, and recreation activities that inherently tend to be concentrated along streams and other water bodies. Livestock concentration and road-related problems are the primary impact sources to these resources within the Pactola Project Area. Nearly all wetlands, riparian areas, and particularly spring areas in the Pactola Project Area exhibit signs of livestock concentration including trampled and hoof-sheared banks; hummocky ground; over-utilization of willows, as well as grasses and forbs; excess sediment deposition; and extensive manure within and immediately adjacent to stream channels, seeps, springs, and other wet areas. A map depicting known wetlands, springs, and riparian areas is included in the project file.

Executive Order 11990 on Protection of Wetlands gives responsibility to all federal agencies to provide leadership and take action to prevent the destruction, loss or degradation of wetlands, and to preserve and enhance natural and beneficial values of wetlands (Carter, 1997a). Wetlands and the activities that occur in wetlands are regulated by the EPA and the US Army Corps of Engineers under Section 404 of the Clean Water Act. "Wetlands control runoff and water quality; recharge ground water; and provide special habitats. Actions that may alter their ground cover, soil structure, water budgets, drainage patterns, and long-term plant composition can impair these values" (USDA Forest Service, 1996c). Wetlands have been mapped for the Black Hills region as part of the National Wetland Inventory (NWI) program. Wetlands are classified as Lacustrine, Palustrine and Riverine according to the NWI classification system (USDI Fish and Wildlife Service, 1995). Field investigations are used to verify the NWI mapping. A map depicting known wetlands is included in the project file.

There are approximately 866 acres of wetlands mapped by the NWI within the Pactola Project Area (Table 3-6). Pactola Reservoir comprises most of this acreage, totaling approximately 824 acres. The remaining wetlands range from 0.1 acre to over 14 acres in size, but most are less than half an acre. With the exception of Pactola Reservoir and the associated wetlands where Rapid Creek enters the reservoir, all of the remaining wetlands are classified as Palustrine, many of which are impounded by beavers or man-made dams.

Additionally, there are 20 miles of mapped linear wetlands within the project boundary, about half of which are classified as Riverine and the remainder classified as palustrine (Table 3-6). Riverine linear wetlands are associated with Rapid Creek. Palustrine linear wetlands can be found along streams and drainage ways associated with Gimlet Creek, Jim Creek, Deer Creek, Jenny Gulch, West and Middle Nugget Gulches, and Empress Gulch. All lakes and ponds in the Black Hills are man-made and thus have impoundment structures. Many of these are included in the NWI wetland mapping with codes indicating the presence of man-made impoundments. The largest of these is Pactola Reservoir, which has nearly 18 miles of shoreline associated with the 824 acres of surface water (at full pool).

Table 3-6 Mapped Wetlands in the Pactola Project Area

Wetland Classification	Wetland Type(s)	Wetland Areas (acres)	Linear Wetlands (miles)
Lacustrine	Lakes	838	None
Palustrine	Marshes, swamps, floodplains, fens, bogs, wet meadows, etc.	28	12
Riverine	Adjacent to rivers, streams and includes ox bows, freshwater marshes, etc.	None	8
Total		866 acres	20 miles

A determination has not been made as to whether the NWI-mapped areas within the project area are "jurisdictional wetlands" according to U.S. Army Corp of Engineers wetland definitions and classifications (US Army Corps of Engineers, 1987). However, all areas with wetland characteristics would be treated as if they were jurisdictional until proven otherwise in order to protect and preserve the unique characteristics and functions associated with these areas.

Riparian areas are a transition zone between permanently saturated wetlands and drier upland areas. These areas exhibit vegetation or physical characteristics reflective of permanent surface or subsurface water influence (USDI Bureau of Land Management, 1998). Riparian ecosystems provide shade; root strength for bank stability; organic matter and woody debris for fish habitat and cover; sediment storage and release; pollutant filtering; flood and moisture storage; and interaction between surface and ground water supplies (USDA Forest Service, 1996c).

The health of riparian systems is largely dependent on the condition of the vegetative community. Healthy riparian vegetation provides overhead cover and thus temperature moderation; habitat for aquatic and terrestrial insects, two critical components for fish habitat and fisheries condition; as wells as sediment filters, water storage, and floodwater dissipation. Riparian areas can also provide critical habitat for many unique plant species and many wildlife species. Refer to the Botany, Fisheries, and Wildlife Reports for more discussion on plants, fish, and wildlife with respect to riparian areas. Depending on the stream channel type and volume or rate of flow, the relative magnitude of these functions can vary widely. Where disturbance occurs in riparian areas there is an increased risk of erosion and reduced productivity thereby reducing the buffering effect that the riparian area has on streams and the protection of beneficial uses.

Riparian areas within the Black Hills generally coincide with perennial and intermittent streams. There are approximately 29 miles of perennially flowing streams and 42 miles of intermittently flowing streams in the project area, for a total of 71 miles of riparian areas. Nearly all riparian areas in the project area exhibit signs of livestock concentration including trampled and hoof-sheared banks; hummocky ground; over-utilization of willows and grasses and forbs; excess sediment deposition; and extensive manure within and immediately adjacent to stream channels. Past mining activities and road building have further impacted and impaired many of these same areas.

Groundwater dependant ecosystems (GDEs) are communities of plants, animals, and other organisms whose extent and life processes depend on groundwater (USDA Forest Service, 2007c). Some examples of GDEs include springs, aquifer systems, caves and karst systems, streams and lakes fed by groundwater, and many types of wetlands, including the rare peat-forming wetlands such as fens and bogs. These special ecosystems rely on the nearly constant supply of groundwater to sustain their unique hydrologic and ecologic characteristics. GDEs vary dramatically in how much they depend on ground water, from being entirely dependent to having occasional or partial dependence. GDE wetlands also fall under the authority of Executive Order 11990 (Carter, 1977b) and regulating agencies such as the EPA, US Fish and Wildlife Service, and Army Corps of Engineers. Forest Service land managers are directed by the USFS national groundwater policy to "protect the ecological processes and biodiversity of ground-water-dependent ecosystems; and minimize adverse impacts on ground-water-dependent ecosystems by: 1) maintaining natural patterns of recharge and discharge, and minimizing disruption to ground-water levels that are critical for ecosystems; 2) not polluting or causing changes in ground-water quality; and 3) rehabilitating degraded ground-water systems where possible" (USDA Forest Service, 2007c). This national policy also stipulates that preferential consideration be given to ground-water-dependent resources when conflicts among land use activities occur (USDA Forest Service, 2007c).

A spring is defined as "any natural discharge of water from rock or soil onto the land surface or into a surface waterbody" (Carter et al, 2002). Major springs are those that discharge greater than one cfs, whereas seeps are small springs, with generally less than one cfs average discharge (Rahn & Gries, 1973). There are 6 spring headworks recorded in the water development database maintained by Range Resources within the Pactola Project Area. However, over 30 additional seeps and springs were found in the project area during field surveys conducted in 2009 and 2010. Many of these springs also have fens associated with them. Other fens are scattered across the Project Area and are small sites, generally less than one acre each. A map depicting known springs and fen areas is included in the project file.

Fens are defined in the Region 2 WCP Handbook as "Geographically restricted wetlands where perennial groundwater discharge occurs on the time scale of millennia and where little erosion or mineral sediment deposition occurs. Fens are generally characterized by their stable presence on the landscape for thousands of years and associated plant and animal communities that may be relics from historic glaciation periods (USDA Forest Service, 2006c)." Fens differ from bogs in that they are sustained by primarily by ground water, where as bogs are primarily maintained by surface and atmospheric waters. Fens are peat-forming wetlands usually vegetated with mosses and sedges. Black Hills fens are relatively rare and unique from other fens worldwide. Fens are

typically formed in basins with impeded drainage or where springs have been present on the landscape for millennia. Peat develops due to the incomplete decomposition of dead plant material in saturated soils. Because of their water-holding capability, fens provide very stable habitats for plants and wildlife species in the long term. For example, many of the fens of Colorado are over 10,000 years old, with organic soil accumulation rates ranging from about 4 to 16 inches per thousand years (USDA Forest Service, 2002). It can take up to 10,000 years to form a fen naturally (USDA Forest Service, 2007c). Fens in the Black Hills are undergoing research so little is currently known regarding ages and peat accumulation rates. However preliminary carbon dating of samples in the Rochford area indicate that Black Hills fens are at least 3,000 years old (Grimm, 2000). Because the rate of peat accumulation is so slow in fens, these ecosystems are essentially irreplaceable.

Peat-forming wetlands, including fens and bogs, are recognized by wetland regulating agencies (EPA and Army Corps of Engineers) as rare wetlands that cannot be replaced in-kind (U.S. Army Corps of Engineers and EPA, 2008). Mitigation for loss of fens is problematic, as there are no known methods to create new functional fens. Thus avoidance and preservation of these rare wetlands is emphasized by these regulatory authorities as documented in 33 CFR Parts 325 and 332 and 40 CFR Part 230 (U.S. Army Corps of Engineers and EPA, 2008). The U.S. Fish and Wildlife Service (USDI FWS), Mountain-Prairie Region, has made conservation and protection of fens one of their wetland priorities (USDA Forest Service, 2002; USDI FWS, 1999a and 1999b). Furthermore, the Mountain-Prairie Region has determined that all functioning fens fall within their Resource Category 1. This means that the goal is no loss of existing habitat value, and that every reasonable effort should be made to avoid impacting these habitats. The Forest Service also recognizes the rarity and importance of such peat-forming wetlands and the unique plant and animal habitats they support and requires that land managers "avoid any loss of rare wetlands such as fens and springs" (USDA Forest Service, 2002; 2006c; 2007c).

Roads have impacted many of the wetland, riparian, and GDEs present in the Pactola Project Area. Road-related problems exist where roads are located immediately adjacent to these streams and wetlands and in the vicinity of stream crossings. Stream channel adjustments continue to occur both upstream and downstream of problem road crossing, some migrating through wetland features, including fens (i.e. channel incision or "head cutting" and draining of GDE features). All fens in the project area exhibit signs of livestock concentration including trampled and hoof-sheared banks; hummocky ground; over-utilization of willows and grasses and forbs; excess sediment deposition; and extensive manure within and immediately adjacent to seeps, springs, and fens. Livestock impacts to wetland and riparian areas is outside the scope and authority of the Pactola HFRA Project, but can be addressed through allotment management and/or water resource improvement projects. More detailed site information and maps are included in the Watershed section of the Project File. A map depicting known wetlands, riparian areas, springs, fens, floodplains, lakes and ponds, and other water bodies is also included in the project file.

Alternative A – No Action

Direct and Indirect Effects for Wetland, Riparian, and Groundwater Dependant Ecosystems
This alternative would not have any new activities within the project area so there would be no direct impact or affect on wetland and riparian ecosystems. Existing problems at wetlands, riparian areas, seeps, springs, and fens are associated primarily with livestock grazing and roads. Protective and restorative measures would occur primarily through grazing allotment management and road improvements, both of which are beyond the scope and authority of this project, depending on when and how much appropriated funds are available.

As described previously, the risk of negative impacts to both soil and water resources is greatest with this alternative. Therefore, the risk of degradation of wetlands, riparian areas, seeps, springs, and fens is also greatest with this alternative. These ecosystems can be filled with sediment, ash, and debris entirely or they can be scoured by high-energy flood waters. These processes were also observed following post-fire flood events within and downstream of the Jasper Fire.

Alternatives B and C

Direct and Indirect Effects for Wetland, Riparian, and Groundwater Dependant Ecosystems
Wetlands, riparian areas, and groundwater dependent ecosystems (springs and fens) have been identified in or adjacent to proposed treatment units throughout the Pactola Project area. Design Criteria have been included to protect these areas during management activities and are found in Appendix B. Since buffers provide protection for these areas, no effects to wetland and riparian areas are anticipated for proposed activities so long as WCP/BMP measures are properly implemented and adhered to. Therefore this project would comply with all water-quality related Forest Plan Standards and Guidelines and all State and National water quality regulations.

Forest Service Manual 2880 – Geologic Resources, Hazards, and Services (USDA Forest Service, 2008) requires inclusion of measures to manage and protect ground-water quality and quantity, as well as ground-water dependent ecosystems. Measures used to do this come from WCPs and SD BMPs. Although springs and fens require special Design Criteria to prevent any loss of these rare groundwater dependent ecosystems from occurring, it would not be necessary to eliminate entire stand polygons from treatment due to the presence of a spring or fen within an individual stand. Rather, avoidance of spring and fen areas, as well as the small contributing areas to these ecosystems, along with Design Criteria addressing harvest and hauling operations, should be sufficient to preserve these fragile ecosystems.

Wetlands, riparian areas, seeps and springs, and fens are all buffered in a “bulls-eye” manner, in which ground based activities can take place within the 100-foot buffer in order to accomplish project objectives so long as resources are protected, but no equipment is allowed within the 50-foot buffer. The hydrologist would be consulted prior to initiating management activities within these buffers in order to make a site specific determination of what kinds of activities are acceptable and the specific locations they can be implemented while protecting wetland and riparian resources. The botanist and wildlife biologist may also be involved depending on the resource concerns associated with each individual wetland, riparian area, or GDE. A typical example of this situation is the need for a short segment of skid trail within the outer buffer due to restrictive topography. Site specific needs of this type arise as thinning

units are laid out, marked, and logging plans developed, as well as during timber sale administration. Any additional wetlands and riparian areas discovered during project layout and implementation would also be protected.

Timber harvest, road construction, construction of fire line (hand or dozer), operation of heavy equipment, or ignition of prescribed fire is generally not allowed within these buffers due to project Design Criteria and WCP/BMP requirements. However, it is possible that prescribed fire may enter wetlands and riparian ecosystems, but due to the naturally moist conditions of these areas only low intensity fire is anticipated. This should closely mimic natural fire conditions, and no long-term adverse effects are expected. However, prescribed fire is not allowed in fens and springs because of the presence of organic soils that are highly combustible as discussed previously in the Organic Soils section. Roads that cross wetland and riparian areas have Design Criteria and WCPs/BMPs associated with them and will be improved or relocated out of these areas where feasible. The net result is expected to be an overall improvement in wetland and riparian conditions once protective measures around these areas are installed (i.e. fencing or natural barriers) and road improvements are made.

The Pactola Project does not propose wetland stabilization or restoration activities and thus potential effects associated with advancing headcuts through iron-rich fens and wetlands apply under both action alternatives. However, both action alternatives include Design Criteria and BMPs to prevent further effects to these already impaired and unstable systems. Some impacts may be addressed through road maintenance and improvements associated with timber haul routes. Other restoration activities would be pursued through separate NEPA authorities.

The risk of negative impacts to wetlands, riparian areas, and groundwater dependent ecosystems resulting from a cable road slope failure is greatest with Alternative C for the reasons described previously throughout the soil and water discussion. Impacts may be localized and short term, or chronic and extensive, depending on the severity and size of the slope failure and its location relative to these water resources. If such an event were to occur, these areas would be very difficult to stabilize and rehabilitate and thus the risk of losing wetlands, especially the irreplaceable springs and fens, is greatest with this alternative.

Cumulative Effects for Wetlands, Riparian Areas, and Groundwater Dependent Ecosystems
Current and reasonably foreseeable actions listed in Appendix C of the Pactola EIS were considered for cumulative effects to wetlands, riparian areas, and groundwater dependent ecosystems such as springs and fens. These areas are expected to remain in their current condition until grazing management changes are implemented to repair fences and prevent concentrated use in these areas and road problems are addressed. Although grazing management is beyond the scope and authorization of the Pactola project, protective and restoration measures for problem areas identified during field investigations would be pursued through adaptive management under the grazing allotment management plans and grazing permits.

The creation of new openings resulting from timber harvest may lead to increased livestock use over a larger area, which could reduce grazing pressure on existing high-use areas, which tend to be wetlands, springs, fens, streams, and other riparian areas. However, opening up areas around already existing problem areas could make those areas even more accessible to livestock, thus exacerbating existing problems. Livestock grazing can disturb soils in localized

areas of concentrated use such as watering areas, salt block locations, and easily accessible stream banks or meadows. Bank shearing and compaction are the two most common soil disturbances resulting from grazing. Stream bank shearing occurs when livestock cross a stream or wetland and collapse the bank. This can lead to an increase in bank scour during high flows. Compaction by livestock occurs in areas of concentrated use, usually when soils are moist and more prone to compaction. Impacts to soil and water resources as a result of livestock management are beyond the scope of this project. Although grazing management is beyond the scope and authorization of the project, protective and restoration measures for problem areas identified during field investigations will be pursued through adaptive management under the grazing allotment management plans and grazing permits.

Overall Watershed Condition and Processes

Alternative A – No Action

Cumulative Effects Overall Watershed Condition and Processes
No cumulative, measurable change in water yield, flow regime, stream channel stability, floodplains, water quality, or wetland and riparian conditions is expected, unless a wildfire occurs, followed by intense summer thunderstorms. As discussed throughout the soil and water resources sections, Alternative A poses the greatest risk of severe fire effects resulting from a wildfire and multiple degraded resources resulting from post-fire runoff and flooding. If this happens, then adverse impacts to water quality would be expected to mimic those observed following the Jasper Fire and Grizzly Fire, as well as other large wildfires in the Black Hills. These post-fire floods would transport ash, sediment, and debris through the stream networks and into lakes, clogging culverts, washing out roadways, eroding stream banks, scouring channels, filling ponds and reservoirs, and clogging or damaging irrigation points. Wetlands would be scoured or filled with ash and debris depending on their position in relation to flood waters. Infrastructure located within streams and floodplains would be at risk of damage, clogging, or complete removal (e.g. washout) by these debris-laden floodwaters. Thus, downstream water uses, water rights, and water quality would be at risk. The risk of downstream impairment of water quality in Pactola Reservoir following a post-fire flood is greatest with this alternative.

Disturbances associated with livestock grazing, wildlife high-use areas, OHV activity, recreation, mining, and other forest activities authorized under other planning documents or authorities in the project area (see Appendix C) have the potential to disturb watershed processes as discussed throughout the soil and water resources section, and thus can also affect overall watershed condition. However, Design Criteria and WCP/BMP measures also apply to these other activities and thus minimize their impacts as well. Strict adherence to WCP/BMP measures, including proper implementation and maintenance of runoff and erosion control structures would ensure protection of water resources.

Alternatives B and C

Cumulative Effects for Overall Watershed Condition and Processes
No measurable, negative change in water yield, flow regime, stream channel stability, floodplains, water quality, or wetland and riparian conditions is expected to result from the implementation of either action alternative, when cumulatively combined with other activities.

This project and all other Forest Service activities use applicable WCP and BMP measures to prevent or minimize effects to water resources. Additionally, private lands are limited within the watershed analysis area and activities occurring on them must still comply with State water quality laws and standards, SD State Forestry BMPs (SDSU et al, 2003) for harvest and road building, and permitting for construction sites or alteration of wetlands.

Overall, the risk of severe post-fire watershed conditions would be reduced and the future health and function of the watershed improved. Vegetation management and fuels treatment associated with both action alternatives provides an opportunity to cumulative improve watershed conditions, as well as prevent adverse effects should a wildfire occur for the reasons discussed previously. With improved watershed conditions, it would take a much larger storm event to produce runoff and erosion and thus flood damage is limited and localized. This means that the risk of cumulative impairments to downstream water quality and beneficial uses (i.e. Pactola Reservoir) would also be minimized. If drought conditions persist, the risk of watershed impairment caused by high-severity wildfire would be decreased. If climatic conditions return to normal or cycle towards colder and wetter conditions, the risk of watershed impairment caused by high-severity wildfire would be lower, and thus management activities associated with the Action Alternatives would have less effect. Over the long term climate cycling between hot and dry, and cool and wet periods, the action alternatives would decrease the long term risk of watershed impairment resulting from a high-severity wildfire.

Disturbances associated with livestock grazing, wildlife high-use areas, OHV activity, recreation, mining, and other forest activities authorized under other planning documents or authorities in the project area (see Appendix C) have the potential to disturb watershed processes as discussed throughout the soil and water resources section, and thus can also affect overall watershed condition. However, Design Criteria and WCP/BMP measures also apply to these other activities and thus minimize their impacts as well. Strict adherence to WCP/BMP measures, including proper implementation and maintenance of runoff and erosion control structures would ensure protection of water resources.

TRANSPORTATION

Primary access into the Pactola Project Area, from the city of Rapid City, is provided by SD Highway 44. US Highway 385 (Forest Highway-1) provides access to the area from the communities of Lead and Deadwood and US Highway 16/385 provides access to the area from the cities of Custer and Hill City.

Unique characteristics and transportation challenges of the Pactola Project Area are the presence of Rapid Creek, Castle Creek, Slate Creek and other stream courses; Pactola Lake and associated recreational facilities; steep, rugged terrain; the Centennial, Deerfield, Michelson, Osprey, and Veterans Point Trails; and the implementation of the Black Hills National Forest Travel Management Decision (USDA Forest Service, 2010).

Affected Environment

The existing transportation system in the Pactola Project Area was inventoried in 2008 and 2009 and reviewed in 2010. Road condition surveys were conducted during the 2010 review.

Road conditions vary throughout the area. In areas of active or recent timber sales, the roads meet maintenance standards due to the ongoing or recent maintenance activities by the timber purchaser (Placer Timber Sale is active and Bullock Timber Sale recently closed). Other maintenance level 1 and 2 roads, which have not had grid maintenance recently, do not meet maintenance standards. Segments of roads are located in or cross drainage bottoms, meadows or other wet areas. These road segments do not drain properly and are contributing to sediment movement. Some road sections that cross drainages do not have a hardened surface or a proper design through the crossing and portions have steep grades, which show evidence of road rutting and surface material loss.

During the road inventories, "unauthorized" routes were identified in the project area. Many of these routes are "user defined," poorly located and have no drainage structures resulting in sediment movement, rutting and vegetation compaction or loss.

Road access is limited by private property and/or steep terrain. The Silver City area in Township 2 North, Range 5 East, Section 31 is one example of restricted access. The landscape is too steep for road access on forest land and would require access (easement) through private property and a recreational summer home. Similar situations exist in the Edelweiss Estates (T1N, R5E, Sections 17 and 20), the Nugget Gulch area (T1N, R5E, Sections 18 and 19), and the Sunnyside Gulch area (T2N, R5E, Sections 30 and 31). Road access is also limited by steep terrain and Pactola Lake north of the lake.

Newly designated motorized trail system routes are located in the north section of the project area. Some of these trails would be utilized as log haul routes and would create mixed use traffic.

Road condition surveys identified some existing closures that are not effective. There is evidence of motorized traffic gaining access behind gate and closure barriers.

The Record of Decision (ROD) for the Black Hills National Forest Travel Management Plan was signed on May 7, 2010 and implementation began with publication of the Motorized Vehicle Use Map effective December 1, 2010. The ROD designates certain roads and trails as open to motorized vehicle traffic on lands administered by the Forest and also assigns a class of vehicle and season of use to these designated roads or trails. Trail designations in the ROD were the result of either changing an existing National Forest System Road (NFSR) to a Forest System Trail, or converting an unauthorized route to a system trail. Some NFSR's were also changed from the status of "highway legal only" to "mixed use" (also referred to as roads open to all motorized uses).

Most but not all of the designated roads and trails included in the Travel Management ROD have been implemented on the ground. Implementation of the full Travel Management ROD is ongoing and expected to be completed within the next two to three years. Full implementation of the Travel Management ROD is used as the baseline or existing condition for the Pactola Project transportation analysis. This baseline is presented in Table 3-7.

Table 3-7 TMP Designated Routes/Trails Open

Designation	Length in Miles		
	Open Yearlong	Seasonal	Total
Highway Legal Only	22	7	29
Roads Open to All	12	2	14
Trails Open to All	5	8	13
Trails Open to Vehicles <62”	13	16	29
Trails Open to Motorcycles	10	2	12
Totals	62	35	97
Closed Forest System Roads are approximately 60 miles.			

The following table displays road and trail densities within the Pactola Project Area. This does not include State, County, or private roads, nor does it include private land.

Table 3-8 Road Density

Road/Trail Density	Length (Miles)	Miles/Square Mile
Seasonal Open (May 15 to Dec 15)	97	2.5
Yearlong Open (Dec 15 to May 15)	62	1.6

Within the Pactola Project Area, eight miles of road are maintained by the South Dakota Department of Transportation, 10 miles are maintained by Pennington County, and 19 miles are maintained annually by the Forest Service (Maintenance Level 3, 4, and 5). The remaining system roads are reviewed for maintenance needs every five years or sooner if identified for other management needs or if they are causing resource damage (Maintenance Level 1 and 2).

The following table shows National Forest System Roads within the Pactola Project Area that are maintained annually by the Forest Service. These roads are Maintenance Level 3, 4, or 5.

Table 3-9 Annually Maintained Routes

Road No. (Trail No.)	Road Name	Length in Miles	Maintenance Level	Surface
251	Cross Over	3.8	3	Aggregate
253	Bear Creek	1.5	3	Aggregate
258	Custer Gulch	2.7	5	Asphalt
258.1D	Pactola Point PG	0.1	4	Asphalt
261	Jenny Gulch	4.1	3	Aggregate
269	Pactola Boat Dock	0.8	5	Asphalt
450	Jenny Gulch PG	0.7	3	Aggregate
545	Pactola CG	1.1	4	Asphalt
545.1A	Pactola CG Loop 1A	0.9	4	Asphalt
545.1B	Pactola CG Loop 1B	0.5	4	Asphalt
545.1C	Pactola CG Loop 1C	0.4	4	Asphalt
657	Pactola Overlook	0.1	4	Asphalt
657.1A	Blue Star Memorial	0.1	4	Asphalt
657.1B	Veterans Point	0.1	4	Asphalt
672 (TR6232)	Broad Gulch	2.3	3	Aggregate

Environmental Consequences

Alternative A – No Action

Direct and Indirect Effects
Under Alternative A there would be no direct effects to the existing transportation system. Scheduled annual and grid maintenance would continue as it has in the past. Implementation of the Travel Management ROD would continue. Road densities would not change under this alternative.

The beneficial effects of taking no action are that there would be no ground disturbing activities, no increased dust and noise, no tree removal, etc. as which would occur with Alternatives B and C (see direct effects under Alternative B and C).

The adverse indirect effects of taking no action include foregoing the opportunity to provide additional maintenance, reconstruction, reclassification of unauthorized roads, and road closings associated with and funded by timber harvesting. Annual maintenance would continue on approximately 19 miles and grid maintenance would continue on a five-year rotation on the remaining forest system roads. With budgets continuing to decline, fewer miles of roads within the area may be maintained to the current standard in the future. Since the system roads within the Pactola Project Area are on different grid maintenance schedules, some of the roads would not receive grid maintenance for up to five years.

Roads located through meadows and in flatter terrains could create changes to the road bed. These roads are difficult to maintain. The location of these roads do not provide for surface water relief or drainage structure effectiveness. Continued use, especially during wet periods, result in the roadbed being lower than the surrounding ground elevation. This would increase maintenance costs and effectiveness.

Roads located on steeper grades and roads without an adequate number of drainage structures would continue to lose roadbed surface material. Ruts would deepen as material washes off the road. More substantial maintenance would be required as road conditions deteriorate. Positive driving experiences for some users would be affected as these roads become more difficult to navigate.

Unauthorized roads would remain on the landscape until future projects and funding is secured. Unauthorized roads, in most cases, have no drainage structures, have poor alignment and are located in drainage bottoms, on steep slopes or in meadows, resulting in compaction and vegetation loss.

Current road closures in the project area range from effective to ineffective. The ineffective closures would not be secured to prevent motor vehicle travel. Additional funding would be needed to reinforce these existing closures. This would have the effect of continued use in areas that are meant to be closed to motorized travel to protect the roads and other resources.

Forest lands that are not easily accessed due to steep terrain or land-locked by surrounding private property would continue to be difficult to access for future management activities and would slow wildfire suppression activities.

Cumulative Effects
Although Alternative A proposes no action, there are cumulative effects in the area that would result from past, present, and reasonably foreseeable activities. Additional roads and easements may be needed to access private land, and new roads could be needed for transmission line construction. The exact location of these roads is unknown at this time. Increased recreation use of system trails and mixed use roads might require additional maintenance over time. Tree mortality due to mountain pine beetles and the consequent increase in wildfire hazard could result in increased water runoff onto the roads and increased erosion.

Alternatives B and C

Direct and Indirect Effects
The action alternatives propose additional maintenance, reconstruction, new construction and road closure activities. Direct adverse effects from these proposed activities are short term vegetation loss, vegetation removal, soil disturbance and compaction, an increase of mixed traffic and traffic delays during project implementation. Short term increases of noise and dust would occur.

The action alternatives would utilize existing National Forest System Roads (NFSR), reconstruct existing NFSRs, reclassify unauthorized routes, utilize/reconstruct trails, and construct additional system roads. Road reconstruction could include improvements, restoration or realignment. S elect system roads would be closed to protect and prevent damage to resources. Some existing unauthorized routes would be reconstructed and converted to NFSRs, and some trails would be temporarily changed to roads and then returned to trails after vegetation management activities are completed. Some existing unauthorized routes would be used as temporary roads and then reclaimed and closed when vegetation management activities are completed.

Direct and indirect beneficial effects include improvements to existing roads and trails. All road work would comply with Best Management Practices and road design criteria. Safety issues would be addressed in the road design. Existing roads located in meadows would be relocated and/or armored with aggregate material to prevent road indentation, rutting and sediment movement. Existing roads would be realigned and relocated to reduce grades if needed.

Once road improvements are completed, long term maintenance and deferred maintenance costs would decrease. As vegetation is reestablished, the effects on soil erosion would be reduced. The vegetation would aid in stabilizing the roadway and the cut and fill slopes. Positive driving experiences would improve from proper road design and repair of the travel way. The road use pattern in the area would change as unauthorized roads, used as temporary roads, are closed and closure devices are secured.

Crushed aggregate needed to stabilize the roadbed or to plate drainage dips would come from a commercial source unless the quantity needed is large enough to justify the cost of crushing in a Forest Service quarry. Benchmark Quarry is the closest Forest Service rock source.

The average road density for the Black Hills National Forest, including system and unauthorized road miles, is 4.4 miles per square mile as shown in the Forest Plan (Phase II Amendment). The current open road density for the Pactola Project Area is 2.5 miles/square mile from May 15 through December 15 and 1.6 miles/square mile from December 15 through May 15. Total road densities would increase under both Alternatives B and C because of new road construction and converting unauthorized roads to system roads. These roads would be closed following harvest operations, therefore open road densities would not change.

Maintenance on system roads used for timber harvest is the responsibility of the Purchaser/Contractor for the life of the Timber Sale Contract. Maintenance includes cleaning out silt from sediment collecting ponds and depositing it in upland locations, keeping silt fence upright and functioning by cleaning out any sediment collected in front of the silt fence and depositing it in upland locations, keeping all drainage structures and ditches clear and functional, eliminating erosion of cut and fill slope and roadway soils, removing roadway vegetation and blading road surfaces.

Maintenance of the roads after the proposed activity would be the responsibility of the Forest Service and would be performed when needed or with grid maintenance every five years, whichever comes first.

Recreational road and trail use associated with the Travel Management ROD could be negatively affected by transportation needs associated with timber hauling, equipment access, and harvesting activities. Recreational users might not be able to use some of the roads and trails at times during implementation of either action alternative (see Travel Management section).

Fourteen miles of "Roads Open to All Vehicles" would be utilized as haul routes under both action alternatives. Twenty-three miles of designated trails under Alternative B and twenty-five miles of trails under Alternative C would be temporarily changed to roads and utilized as haul routes. Eight miles of these trails would be reconstructed under both alternatives to support commercial haul and to protect soil and water resources.

Alternative B would maintain 69 miles of road, reconstruct 27 miles, temporarily change 23 miles of trails to NFSRs, and add 3.5 miles to the forest road system by converting 0.5 miles of existing unauthorized routes to NFSRs, and constructing three miles of new system roads. Alternative B would close all newly constructed roads, NFSR conversion, and approximately 13 miles of unauthorized routes used for temporary access after use as part of timber operations.

Alternative C would maintain 72 miles of road, reconstruct 28 miles, temporarily change 25 miles of trails to NFSRs, and add 20.5 miles to the forest road system by converting 1.5 miles of unauthorized roads to NFSR and constructing 19 miles of new system roads. Alternative C would close all new road construction, NFSR conversion, and approximately 12 miles of unauthorized roads used for temporary access after use as part of the logging operations.

The proposed transportation plan for Alternative B would maintain, reconstruct, and construct fewer miles than Alternative C. Direct effects in terms of cost and ground disturbance are lower under this alternative. Alternative B would improve and repair slightly fewer miles of road than Alternative C, but would still reduce adverse indirect effects, such as soil erosion and sedimentation. Future maintenance cost would likely be reduced.

The following table summarizes mileages and costs contained within the action alternatives.

Table 3-10 Action Alternatives – Activity in Miles and Estimated Cost

Activity	Alternative B	Alternative C
Maintenance	69	72
Reconstruction	27	28
Reconstruct/Convert Unauthorized Road to NFSR	0.5	1.5
Temporary Change from Trail to NFSR	23	25
New Construction	3	19
Estimated Cost***	$281,700	$1,0630,600

Designated trails temporarily used as roads are included under the road mile figures in Table 3-10, and would be returned to trails when operations have been completed. New Construction miles are based on the success of obtaining road rights-of-ways (ROW) through private property. The miles of new construction needed could increase if ROWs are not obtained or decrease if ROWs are obtained. New construction miles under Alternative C would decrease if helicopter logging is implemented in place of cable logging units.

Cost estimates are based on the following average cost per mile: Maintenance = $300/mi, Reconstruction = $8000/mi, Reconstruct/Convert = $8000/mi, New Construction = $15,000/mi, and New Construction (Cable Logging) = $50,000/mi.

Miles of road work shown Table 4 are approximate lengths. A significant storm event or the extent of time between project planning and project implementation could trigger changes in road conditions. If road conditions worsen before project implementation, additional reconstruction may be necessary

Cumulative Effects

There are cumulative effects in the area that would result from past, present and reasonably foreseeable activities. Additional roads and easements may be needed to access private land, and new roads could be needed for transmission line construction. The exact location of or need for these roads is unknown at this time. Increased recreation use of system trails and mixed use roads might require additional maintenance over time. Tree mortality due to mountain pine beetles and the consequent increase in wildfire hazard could result in increased water runoff onto the roads and increased erosion. Since wildfire hazard would be reduced compared to Alternative A, there would be less potential for large scale wildfire and subsequent road erosion under the action alternatives.

MINERALS

Affected Environment

Mining has played a big part in the development of this area as evidenced by the numerous prospect pits, adits, shafts and abandoned mine workings. Bureau of Land Management (BLM) index to mining claims LR 2000 lists numerous claims within the project area. While not active, there is always the possibility that they may become so during the life of the project. This could affect travel management as the owners of these claims need access to their area of operation.

Minerals can be divided into three categories on National Forest System lands. This includes locatable, leasable, and saleable minerals.

Locatable Minerals

Locatable minerals are minerals such as gold, copper, silver, and other metals subject to claim and development under the General Mining Law of 1872, as amended. As set forth in this law, all locatable minerals on public domain lands such as the Pactola Project Area are open to location, discovery, and mining, except in areas that have been withdrawn from mining entry. The Forest Service has only limited authority to restrict and regulate locatable mineral activities on public domain lands (USDA Forest Service Mineral Program Handbook, 1991). A person or company can file a mining claim with the BLM when they have something of value, and must get approval from the Forest Service before conducting any surface disturbing activities. Based on the January 5, 2010 search of BLM's Geographic Claim Index (LR2000), there are six active mining claims located within the Pactola Project Area. There are also seven additional active claims that lie just outside of the project area.

Leasable Minerals

Oil, gas, and coal are leasable minerals under the Mineral Leasing Act of 1920. This act provides authority to the BLM to lease oil and gas deposits on public domain National Forest system lands. Oil and gas production is occurring along the western and southwestern margins of the Black Hills. Leases are awarded at the discretion of the government for these types of minerals. There are no mineral leases within the project area. Based on the geology in the project area the potential for these types of minerals is low.

Salable minerals

Salable minerals are a group of mineral commodities such as common variety sand, gravel, slate, and building stone that are salable under the Materials Act of 1947. The Forest Service has discretionary authority over production of these commodities from National Forest system lands (USDA Forest Service Mineral Program Handbook, 1991). The project area contains deposits of saleable type minerals such as sand, gravel, and slate. Sand and gravel is present in alluvium along a small portion of Rapid Creek just above Pactola Reservoir. The limited size of this alluvial deposit would make its development unlikely. Slate is also present in the project area and has been quarried in several locations just outside the project area. However, there are currently no projects of this type within the project area.

Environmental Consequences

All Alternatives

Direct, Indirect, and Cumulative Effects
Effects to travel management would occur as the owners of the active claims, discussed above, need access to their areas of operation. Future road access needs are unknown. However, once an operating plan is submitted to develop a mining claim, reasonable access must be provided. This possible requirement for road access is stipulated under 36 CFR 228.1 subpart A and United States Mining Laws 30 U.S.C. 21-54, which confers a statutory right to enter upon public lands to search for minerals. If road access becomes a necessity, then the category of road use and maintenance level of the road will be determined. Roads currently in place may be suitable for access thus reducing the need to open decommissioned or construct additional new roads.

Roads used and maintained to support any of the action alternatives could potentially provide improved travel access to mining claims. There could be positive direct, indirect, or cumulative effects to the mineral resource or to mining claimants from any of the alternatives that would reconstruct or construct roads available for miners to access their claims.

BIOLOGICAL ENVIRONMENT

This section will describe the affected environment and environmental consequences for each alternative to the Biological Environment (Vegetation, Fire and Fuels, Range, Noxious and Invasive Weeds, Wildlife Habitat, Fisheries, and Botany).

VEGETATION

The overall goal of silviculture is to manage the forest environment to achieve desired management goals and objectives. This involves not only the timber resource, but also all of the resources that can be found in a forested ecosystem, as well as the needs of the forest users. This input is designed to only address the timber resource however, and does so realizing that all of the resources in the entire forested ecosystem are interrelated and interactive. It is the intent of this input to add only information, issues and concerns with regards to the timber resource using the Black Hills National Forest Land and Resource Management Plan standards, guidelines and Phase II Amendment as a desired future condition. In addition, this report is intended to supplement the analysis in the Black Hills LRMP and Phase II Amendment and not duplicate it. This is tiered to the aforementioned documents and applicable silviculture sections. Each site was analyzed to determine if it met forest plan condition and/or the purpose and need both on a site specific basis and its contribution to the landscape. Treatments were formulated to move the project area towards the desired condition.

Affected Environment

Records indicate that harvesting within the project area has occurred as far back as the turn of the century. Since that time, additional harvesting has occurred on a periodic basis. Much of the area has had vegetative treatments within the past 30 years. District records show commercial harvests and non-commercial thinnings from the early 1980's to the present have

taken place on approximately 50% of the project area. Many treatments were designed to lower the basal area to promote increased growth and vigor and regenerate the stands of timber. Much of the activity that has occurred within the project area has been timber sales and related activities, which include the sales listed in Appendix C, Table 1.

The following discussion summarizes existing conditions in terms of topography, roads, fuel loading, plant species composition, age class distribution, stocking levels, regeneration, insects and disease, and structural stage distribution.

Topography: The topography is dominated by Rapid Creek and its tributaries with many small drainages leading into the larger and more developed drainages and into Pactola Reservoir. Elevations run from a low of 4,580 feet in valleys to almost 6,000 feet on some of the ridge tops. Slopes are moderate over most of the area with an average slope of 20%. There are steep rocky outcroppings above Rapid Creek and steep rimrock running below some ridges scattered throughout the project area. There are approximately 6,000 acres or 25% of the forested stands within the project area that have average slopes in excess of 40%. Pactola Reservoir covers 868 acres within the project area.

Insects and Disease: Mountain pine beetle (*Dendroctonus ponderosae*) is the number one killer of pines throughout the western United States. The beetle is a native species to the West and attacks most pine species including ponderosa pine in the Black Hills. Mountain pine beetles (MPB) have always been a part of the Black Hills Forest ecosystem, with outbreaks occurring periodically. The largest recorded outbreak occurred from the late 1890's through the early 1900's, and killed an estimated 1-2 billion board feet of timber (USDA Forest Service, 2010d).

Mountain pine beetles prefer dense stands of mature pine trees greater than seven inches in diameter. Adult flight typically occurs in July and August, with the peak flight around the first week of August. During this flight, adult beetles leave previously infested trees and attack and kill new host trees. The adults attack green trees, chew through the bark and construct galleries along which eggs are laid. Larvae hatch from the eggs and begin feeding on the phloem of the tree in late summer to early fall. Larvae, pupae or callow adults over-winter under the bark of the infested tree.

Currently, in the Pactola Project Area, beetle activity is characterized as an incipient or growing epidemic (USDA Forest Service, 2010e). At this time, parts of the Pactola Project Area and the Nautilus Project Area just to the north have some of the most actively expanding beetle spots in the entire Forest (USDA Forest Service, 2010d). Generally speaking, the western part of the project area is where the most intense beetle activity is occurring (in and around West Nugget Gulch to Canyon City and north to the Experimental Forest) , with the central part (around Silver City) being more moderately infested, and the eastern portion along US Highway 385 having the lowest infestations at this time. Across the project area, 80% of the dead trees encountered in the fall of 2009 were infested but still green, compared to 20% killed in the previous two years. The combination of the high percentage of green infested trees compared to those killed the past few years and the widespread movement of new infestations over the entire landscape, indicate a rapidly growing mountain pine beetle infestation. Although beetle activity and mortality is currently light to moderate in the eastern

part of the project area, stand conditions in much of that area are conducive to sustaining high levels of beetle-caused mortality and allowing the outbreak to expand.

Stands were rated for mountain pine beetle hazard using the Insect Rating Guide based on structural stage from the Forest Plan Amendment (FEIS Phase II Amendment, III-385). The hazard rating is summarized in Table 3-11 as follows:

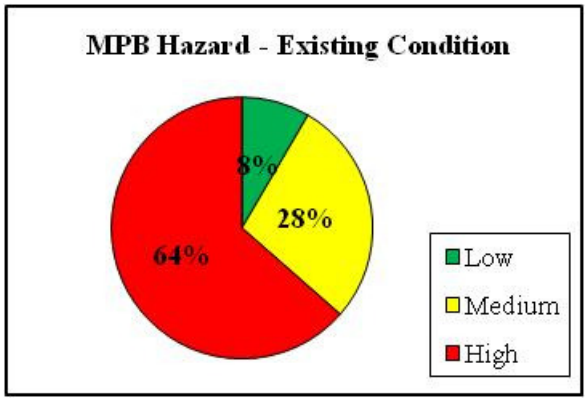
Table 3-11 Pactola Project Mountain Pine Beetle Hazard Rating – Ponderosa Pine

Rating	Sum Area	Percent \1
Low	1,881	8%
Medium	6,256	28%
High	14,181	64%

\1 Percent based on National Forest System lands

The overall hazard of MPB infestation can be considered high in the project area. The hazard rating refers to the potential for losses within a stand if an infestation occurs and not the probability of an infestation. If an infestation occurs within stands with a high hazard rating, then one can expect higher overall losses than those stands with lower hazard ratings. Approximately 64% of the area is rated at high hazard for MPB, with an overall infestation hazard rating of high for the project area. The probability—or risk—of infestation is also high due to the ongoing epidemic in the area.

Figure 3-2 Existing Mountain Pine Beetle Hazard Rating in Pactola Project Area



Western gall rust (*Peridermium harknessii*) has been observed in the area. Most of the galls have been observed to be occurring on the limbs and not on the boles of the ponderosa pine. This would reduce growth of the pine stands to a certain extent but should not be considered a major threat to the merchantability of the stands in the area. Other diseases that occur in the tree species are either occurring infrequently or have not been observed.

Roads: Roads are abundant in the project area from past mining, harvesting and recreation. Many of the roads are Forest Development Roads and are maintained by the Forest Service. Other roads and trails are not maintained and provide access for recreational users and hunters.

Fuel-loading: Most of the slash from past harvesting and non-commercial thinning has been treated to a point where existing fuels are at levels below existing forest plan standards.

Approximately 27% of the area has had treatments that, at the time of treatment may have reduced the crown cover to a level that would reduce the hazard of a crown fire. Residual densities however were designed for timber vigor and growth and not fire hazard reduction and many stands have grown into high fire hazard conditions.

Stand Structure: The Black Hills Land and Management Plan Phase II Amendment specifies that certain management areas (MAs) should be managed to provide a distribution of structural stages in a variety of sizes and shapes. It further specifies the structural stage objectives (percentage) for each MA. Within the Pactola Project Area there are two such MAs: MA 5.1, Resource Production Emphasis; and MA 5.4, Big Game Winter Range Emphasis. Both of the MAs have the same structural stage objectives. Table 3-12 displays the distribution of structural stages within each management area across the Black Hills National Forest. (USDA Forest Service, 2010c)

Table 3-12 Forest-wide Conditions by Management Area. Ponderosa Pine Stands – Structural Stage Distribution

Objective		MA 5.1 Existing		MA 5.4 Existing	
SS	%	Acres	%	Acres	%
1	5%	26,760	6%	45,616	13%
2	5%	16,673	4%	10,152	3%
3A	10%	24,236	5%	17,454	5%
3B	15%	17,047	4%	22,227	7%
3C	5%	10,269	2%	15,763	5%
4A	25%	185,062	39%	86,487	25%
4B	25%	142,228	30%	87,864	26%
4C	5%	50,437	11%	52,865	16%
5	5%	1,227	0%	1,066	0%
Total	100%	473,939	100%	339,494	100%

Additional Forest-wide objectives in Phase II include providing 10% of the 4 structural stage with an average tree size of "very large" where the average size pine is greater than 16 inches DBH; seek opportunities to increase understory shrubs in open-canopy structural stages; and actively manage stands to provide 5% in desired late successional characteristics. Table 3-13 displays the acres of Structural Stage 4 (SS4) with a tree size of very large within each management area across the Black Hills National Forest. (USDA Forest Service, 2010c).

Table 3-13 Forest-wide Conditions by Management Area. Ponderosa Pine Stands – Structural Stage 4 with Very Large Tree Size

Objective	MA 5.1 – Existing		MA 5.4 – Existing	
% of SS4	Acres	% of SS4	Acres	% of SS4
10.0%	48,756	12.9%	19,761	8.7%

Plant Species Composition: Within the project area the vast majority of the cover type on NFS lands are ponderosa pine (22,317 acres). Other cover types include 253 acres of white spruce and 938 acres of aspen. There are numerous small inclusions (10 acres or less in size) of aspen located in non-aspen sites. These are usually very productive sites where conifers would eventually take over the site if no treatment is done. In addition, there are 394 acres of grasslands which may have conifers encroaching on them.

Table 3-14 Existing Condition Cover Types of National Forest Lands within the Pactola Project Area

Cover Type	Acres	Percent
Grass	394	1.6%
Shrubs	28	0.1%
Aspen	938	3.8%
Ponderosa Pine	22,317	89.8%
White Spruce	253	1.0%
Water	868	3.5%
Non-Vegetated	64	0.3%
TOTALS	24,863	100.0%

Age Class Distribution: Approximately 7,605 acres (54%) of the suitable pine acres inventoried within the project area are greater than 105 years of age. 5,571 acres (40%) of the suitable pine acres are between 66 and 105 years old, with 855 acres (6%) being 65 years or less.

The distribution of age classes ranges from 20 to 280 years with the majority of stands (66%) in the 90 to 140 year age classes. The age class curve is a bell shaped curve with the greatest acreage in the 100-year class (see Figure 3-2). The majority of the stands were regenerated post-European settlement and are indicative of intensive harvest activities and fire protection occurring within the last 130 years. The width of the bell curve where the majority of acres occur is between 90 and 140 years which indicate that many of the stands were regenerated over a 50 year period from the 1870s through the 1920s which corresponds to historical accounts of heavy logging activity. There is a period from the 1950s to the 1980s where the amount of new stand regeneration declines rapidly indicating that harvesting activities to regenerate stands and natural stand level disturbances were not as prevalent. Within the past 20 years, an increase in the amount of regeneration harvesting has occurred as can be seen by the slight upward trend in acres in the 20 year age class. Not unexpectedly, a much larger percentage of pine stands are in the 160 year age class or older (28%) in unsuitable stands than the more actively managed suitable stands (6%). Topography and management direction in these areas limit our management options. To develop an even distribution of age classes across the landscape over a 120-year period, approximately 1,400 acres of stands would have to be regenerated each decade. While in theory this could occur, management objectives, accessibility and natural stand replacement events make the probability of this unlikely.

Stocking Levels: The majority of suitable ponderosa pine acres in the project area are within the timber management zone as identified in Appendix H-3 of the LMRP. Although they are within the zone, many of these stands are at a high hazard rating for MPB infestation. Considering the existing ongoing epidemic within the project area, and that Forest Plan Goal

10, Objective 10-07 states "where outbreaks of MPB could present risks to management objectives, reduce acreage of ponderosa pine stands that are in medium or high risk for infestation," management activities would move many of these stands to the lower range within the management zone. Although basal areas are generally a good indication of stocking in most sawtimber and pole timber stands, it does not represent smaller diameter stands (<6" dbh) nor large diameter stands (>16" dbh) well.

Late Successional Stands: There are currently no stands within the project area classified as late successional, Structural Stage 5 (SS5). We have identified 24 sites totaling over 900 acres within the project area that have the age and stand structure characteristics for SS5. These stands would be designated as SS5 for this analysis. There are currently approximately 9,700 acres of SS4B stands within the project area that would be available to grow into older, denser late successional stands. These stands would be needed to increase the amount of old growth and replace existing old growth as they deteriorate or are lost through fire, insects or other natural events. An additional 2,100 acres of 3B structural stage stands would also be available to grow into SS5 stands in the future as additional replacement stands.

Regeneration: Pine regeneration is occurring in the project area where the crown canopy is open and where competition from grasses and forbs is low. In areas where grasses have invaded the site, regeneration is at moderate to low levels. Where pine regeneration is desired such as in regeneration harvests, activities within the project area should be designed to reduce ground cover competition and expose mineral soil, increasing natural regeneration potential. Past regeneration harvests in adjacent areas have resulted in fully stocked stands of pine when the soil was disturbed or in conjunction with site preparation. In stands that are scheduled for regeneration harvests, prescribed burning should generally be excluded unless needed to retard regeneration for other resource needs (e.g. fire, range, or wildlife) since burning would encourage grass establishment and discourage pine regeneration. Experience shows that even with competition from grass, pine sites in the project area generally regenerate to full stocking levels without site preparation within five to ten years.

Desired Future Condition (DFC)

Insect and Disease: The Forest Plan direction is to "consider preventive vegetation management practices, including silvicultural treatments, to protect forest stands from insect and disease epidemics" (Phase II Amendment, Page II-47). Also, Phase II Goal 10, Objective 10-07 states "Where outbreaks of mountain pine beetle could present risks to management objectives for ponderosa pine, reduce acreage of ponderosa pine stands that are in medium or high risk for infestation" (Phase II, I-36).

Silvicultural Prescriptions: Silvicultural systems used would be dependent on the structure desired to meet the purpose and need of this project. Even-aged systems would result in even-aged stands and would include the Shelterwood method in both the pine and white spruce forest type. Uneven-aged systems that would result in uneven-aged stands would include group selection and single tree selection methods. Hardwoods would be managed using either coppice for even-aged stands or group selection for uneven-aged stands.

Guidelines for commercial and non-commercial thinning would be followed as specified in Chapter II of the Phase II Amendment to the Forest Plan and stocking charts in Appendix H of the Forest Plan. Generally, stands would be treated to achieve lower stocking levels for a reduction of crown fire hazard and mountain pine beetle hazard. For further detailed discussion of these methods refer to Chapter II-24 of the Phase II Amendment and Appendix H of the Forest Plan.

Stand Structure: The desired stand structure for the ponderosa pine type would be even-aged with the majority of the trees in a stand having an age within a range of 20 years of one another. Most of the pine would be either dominant or co-dominant. The exception to this would be stands regenerating after shelterwood treatments and uneven-aged stands managed for wildlife, recreation and visual objectives.

Very Large Tree Size: Objectives 4.1-203, 5.1-204, and 5.4-206 in the Phase II Amendment call for 10% of the 4 ponderosa pine structural stage (sawtimber nine inches and larger) have an average tree size of "very large," where the average size pine is greater than 16 inches DBH.

Age Class Distribution: Ideally, there should be a mosaic of pine stands with varying ages, well distributed across the landscape with approximately 8% of the acreage in each ten-year class based on a 120 year rotation. This would provide horizontal diversity for wildlife, an opportunity to create an even flow of products over time, and reduces the area's hazard to fire and insects.

Stocking Levels: The Forest Plan direction (page II-31) is to "use thinning practices which consider genetic diversity and competition among trees for water, nutrients and light." This direction specifies "use the stocking charts contained in Appendix H to implement intermediate cuttings in even-aged, suitable timberland stands..."

Within Management Area 5.4 - Big Game Winter Range, commercial thinning should be heavy, leaving stands with lighter stocking yet still within management zone limits. This would provide healthy plant communities with a variety of species for forage as specified in the Forest Plan (page III-98).

Most stands scheduled for treatments would have basal areas reduced to 60 BA or less in pine stands to minimize susceptibility to mountain pine beetle and reduce the hazard of high intensity fires. Exceptions may occur for other resource management objectives.

Plant Species Composition: Forest Plan direction is to manage for "double current aspen acres" (Phase II, Page I-7).

Wildfire: Phase II Goal 10: Establish and maintain a mosaic of vegetation conditions to reduce occurrences of high intensity fire, insect, and disease events, and facilitate insect and disease management and firefighting capability. Objective 10-01 states that stands will be managed for 50% to 75% moderate-to-low fire hazard in the wildland-urban interface and reduce fire hazard within proximity of structures to current NFPA standards. Additional

guidance has also been provided from the Healthy Forest Restoration Act of 2003 and other National level policy and directives.

Environmental Consequences

Most of the treatments and cutting methods discussed below are described and illustrated in section II-31 "Methods to Achieve or Influence Vegetative Diversity" of the Black Hills National Forest Final Environmental Impact Statement (EIS) for the Revised Forest Plan for the Black Hills National Forest (1996).

Alternative A – No Action

Direct and Indirect Effects
Under this alternative, no timber management activities would occur, other than on-going activities such as firewood gathering, right-of-way clearing, Christmas tree cutting, and some minor vegetation treatments for other resource purposes. There are state and county rights-of-way throughout the planning area. Many of these rights-of-way have both commercial and non-commercial timber in them. Hazard trees and timber within these rights-of-way would be removed to reduce the risk to motorists and "daylight" the roads to reduce icing. Timber may be removed with small sales, or in the case of very small quantities or unmerchantable timber, the timber may be removed as administrative free use. The effects of removing this timber would be minimal. Public safety would be increased by the removal of hazard trees that could fall on the roads; removing shade in some areas would reduce winter icing or allow quicker melting of ice and snow pack; and visibility around curves would be improved. The amount of volume removed would be insignificant and the impacts to the timber resource almost non-measurable when compared to the project area.

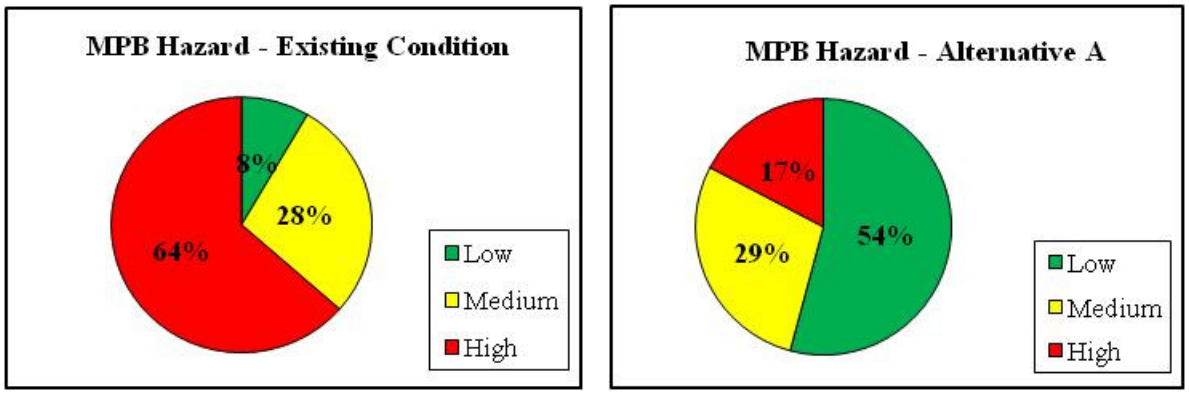
Insects and Disease: The overstocked stands of pine pose a high hazard to attack by mountain pine beetle. This hazard would increase over time, with growth, due to increasing stocking levels, until natural disturbances act to reduce stand densities. There are 20,437 acres (92%) of National Forest conifer stands in the project area that currently have a high or moderate hazard rating. When this fact is added to the fact of high beetle populations in the area, the likelihood of a continuing widespread epidemic-level infestation of mountain pine beetle is high. There are considerable changes in the landscape taking place within the Pactola Project Area due to MPB mortality. If no action is taken, many currently forested areas could lose most or all of their mature pine overstory. This loss of mature pine trees would add greatly to fuel loads and wildfire hazard on a long-term basis (see Fire and Fuels Section), and cause substantial changes to wildlife habitat (see Wildlife Section).

If not treated, the hazard should remain high until stocking levels decrease due to mortality from MPB activity or wildfire. It is not possible to determine exactly which stands would become infested and the precise level of MPB-caused mortality, but reasonable estimates can be made based on the current extent of the epidemic, the expanding MPB brood populations available to infest new trees, and the large volume and wide distribution of medium to high hazard stands in the project area. What is apparent is that there would be considerable changes in the landscape in the Pactola Project Area.

Stands in high mortality areas would revert to younger age structural stages over time. The highest levels of pine tree mortality are expected in the western portion of the project area, with significant mortality moving to the east over the next three to five years. Projections by Kurt Allen, Forest Service Entomologist for this project, estimate that most of the closed canopy stands, structural stages 3B, 3C, 4B, and 4C would be converted to more open structural stages 2, 3A, and 4A. (USDA Forest Service, 2010e) In the hardest hit areas, near complete mortality of the larger trees would occur on up to 75% of structural stages 4B, 4C, and 5 (dense stands with larger trees). Approximately one half of the dense sawtimber stands would be converted to seedling, sapling and pole stands, SS2, 3A, and 3B, while another 25% would become SS4A open sawtimber stands. The remaining 25% would be moderately dense sawtimber stands, 4B. Significant but lesser amounts of mortality would be expected in structural stage 3B, 3C, and 4A stands; 3B and 3C because of the tree density and 4A because of the larger tree size. One half of the 4A stands would be converted to SS2 and 3A stands, while the other half would retain enough live large trees to remain as open sawtimber stands. It is estimated that one half of the 3B and 3C stands have average diameters large enough to be susceptible to MPB infestation. These would be converted to a SS2. Adding younger structural stage stands helps to increase vegetation diversity in the area, which is dominated by mature pines. However, the large volume of dead and down trees significantly increases fuel loads and wildfire hazard in this wildland-urban interface (see Fire and Fuels Section). This increases the probability for large, intense wildfires resistant to control that threaten natural resources, private property, and human life.

The charts below displaying current conditions and conditions projected several years into the future show the effects of the current MPB epidemic continuing and spreading throughout the project area. The hazard ratings for the future condition were based on projections from RCSC-2-11, Consequences of the "No Action" Alternative in the Pactola Project Area. The MPB hazard decreases due to the beetle-caused mortality reducing stocking levels in stands currently rated as high and medium hazard stands. Even though the MPB hazard would decrease, the fire hazard would increase due to the number of dead trees that would be present. The amount of heavy continuous fuels on the ground as the dead trees fall would create especially dangerous conditions.

Figure 3-3 No Action MPB Hazard Rating



The pine engraver beetles (*Ips pini*) are non-aggressive and breed in damaged ponderosa pine trees and slash greater than 2 inches in diameter. Unless severe drought, weather damage or fire damage occurs, the probability of a major buildup of these insects is very unlikely.

Plant Species Composition: Plant species composition and diversity would decrease. Pine is encroaching into hardwood and meadow areas and filling in small openings in the forest canopy. As the canopy closes, aspen and other hardwoods would diminish in numbers until natural disturbances once again open up the canopy. Within many sites, forbs and grasses in the under story would be shaded out reducing benefits to other resources such as wildlife, range, recreation, and scenic quality. It is expected that hardwoods and meadows would benefit as a result of continued pine mortality caused by the mountain pine beetle, although the amount of that increase is unknown.

Other Effects: The effects of deferring treatment in the project area would be increased mortality and the resulting decrease in growth and yield due to the continuation of the MPB epidemic; reduction of diameter growth due to age and overstocking in stands not impacted by MPB activity; and an increase in the hazard for high intensity wildfire. With no treatments, the 9,955 acres of pine type that have a basal area greater than 100 square feet per acre would experience reduced growth due to overcrowding and competition for nutrients, water, and light. Age class distribution would not change except for changes created through unpredictable natural processes, such as insect infestations and wildfire. Structural stage imbalances would persist and be exacerbated by the lack of regenerated stands. Long-term effects in stands not heavily impacted by MPB infestation would be an increase in mortality due to competition between pine and an increase in merchantable defect due to disease. Long-term sustainability of the timber resource would be in jeopardy since much of the mature forest would be killed by the MPB and relatively few acres are currently young and available to grow into the next generation of mature forest.

Periodic annual increment is declining in some of the stands and is less than desired due to overstocking and age. Deferment would cause a further drop in the periodic annual increment. The NFMA law requires that even-aged stands scheduled to be harvested during the planning period will generally have reached the culmination of mean annual increment (CMAI) of growth. During the diagnosis phase of the analysis, stands were identified totaling more than 8,000 acres that had reached CMAI. Net growth would remain positive, but it would be below its potential. Overall, quality of the pine would decline due to MPB activity, and remain below its potential due to suppression, mortality, damage, disease, and poorly formed trees. As the stands of pine become dense, they would become susceptible to snow damage. Dense stands of pine with interlocking crowns cannot shed snow, as well as open stands. During times of heavy snowfall and wind, snow can build up on the crowns of dense stands and cause heavy breakage. Stands with open canopies shed their snow as wind shakes them and are less susceptible to snow buildup. Under this alternative, more snow damage would most likely occur.

The hazard of a stand replacing wildfire would be higher without treatment. Crown fires, such as the Battle Creek fire of 2002 would cause many of the stands to be completely killed. The effect of such a high intensity fire to the timber resource would be a loss of timber value, a large reduction of age class distribution, a disruption of an even flow of timber to local mills,

an increase in insects, and a disruption of the natural regeneration process. Solarization would reduce the success of both natural and artificial regeneration. Soil sterilization would reduce productivity for many years, as the process of rebuilding soil horizons in this relatively dry climate is slow.

Cumulative Effects

Much of the area has had vegetative treatments within the past 30 years. Commercial harvests and non-commercial thinning from the late 1970's through the early 2000's have taken place on approximately 70% of the project area. Many treatments were designed to lower the basal area to promote increased growth and vigor as well as regenerate the stands.

The effect of past treatments has been an increase of merchantable volume growth; increase in the quality of timber and until recently, a minimal amount of insect and disease infestations. The commercial thinning has reduced the stocking levels in overstocked stands. The effect has been an increase in the quality of the timber through the removal of damaged, diseased, and poorly formed trees. There has been increase in individual tree growth by releasing the remaining trees from competition for light, water, and nutrients. Trees have developed larger diameters due to a reduction of competition. A reduction of the MPB hazard to the pine stands due to the reduction of basal area to lower the level of susceptibility to pine beetle attack has also occurred for stands which have recently been treated.

Some timber harvesting is occurring on private land within the project area, mostly in conjunction with mountain pine beetles, fuels reduction and development. Since private land comprises approximately 4% of the project area (1,154 acres) and approximately half of that is timberland, the effects of timber harvesting practices could affect the project area. The amount of timber harvesting during any one decade however has been small and its effects on National Forest timberland should be minimal.

Anticipated future silviculture activities, not connected to this analysis, that would occur within the area are as follows: Fuel breaks adjacent to developed private land may be created for protection of those improvements. Firewood gathering and Christmas tree cutting by permit would continue to occur within the area. Other silvicultural treatments such as small salvage sales for the removal of storm damaged or beetle infested timber, road right-of-way clearing, pine encroachment removal, hardwood regeneration, and release may occur within the project area. The size of these projects would generally be small (less than ten acres) and the cumulative effects of these projects should not be of any measurable significance

With an increasing interest from landowners to manage their forested land, protect their property from fire and mountain pine beetle infestation, and clear land for home sites, an additional 400 acres may be treated within the next decade. Since the amount of silvicultural activities not connected to this analysis would be minimal, the cumulative effects of these activities under any of the alternatives would also be minimal. Treatments on private land for fire hazard reduction or mountain pine beetles would contribute to both a reduction of hazard from high intensity wildfire and mountain pine beetle.

Alternative B – Proposed Action

Direct and Indirect Effects
Under this alternative, approximately 13,000 acres of forestland would be mechanically treated. Treatments specified generally apply to 80% or more of the stand. Many of the stands in the project area have inclusions of less than ten acres in size that may have basal areas, age classes, size classes, and tree species that differ from the majority of the stand. As these stands are laid out and marked these inclusions may not be prescribed and marked as specified in the stand treatment table, but rather prescribed using criteria developed for other stands with similar characteristics, e.g. an inclusion of pole size pine may be thinned if located within a stand scheduled for a removal cut.

The law generally prohibits the harvest of stands before they reach their maximum growth rate (National Forest Management Act (NFMA), 16 U.S.C. 1604(m)). Exceptions in the law allow the harvest of individual trees, or even parts or whole stands of trees, before this time to thin and improve timber stands, and salvage damaged stands of trees (part m1 of the law). Further exceptions are allowed in order to achieve multiple-use objectives other than timber harvest (part m2). This alternative would harvest some trees before the maximum potential growth rate of some stands in the project area has been reached. These harvest treatments are consistent with the exceptions provided in part m2 of the law, and include the following: Commercial Thinning, Non-Commercial Thinning, Meadow Retention and Restoration Treatments, and Hardwood Restoration and Retention Harvests which are designed to meet other than timber objectives. These treatments are proposed to move towards meeting Forest Plan direction and respond to HFRA guidance. Illustrations of many of these treatments can be found in Appendix E.

Rights-of-Way: There are state and county rights-of -way throughout the planning area. Many of these have both commercial and non-commercial timber in them. Hazard trees and timber within these rights-of-way would be removed to reduce the risk to motorists and "daylight" the roads to reduce icing. Where timber harvest units are adjacent to these areas the rights-of-way would be included in the timber sale. The effects of removing this timber would be minimal to the timber resource. Public safety would be increased by the removal of hazard trees that could fall on the roads. Removing trees in some areas would increase melting of ice and snowpack and speed the drying of roads. Visibility around curves would be improved.

Commercial Thinning: Commercial thinning would occur on approximately 6,400 acres of the area with many of those acres also having non-commercial thinning after completion of harvest activities. Commercial thinning would generally consist of thinning from below, removing suppressed and intermediate pine from the stand, and the overmature pine from the overstory, leaving the larger mature pine of good form. Some areas have been identified to thin from above, removing the older, larger trees to create a younger stand of smaller trees. Generally, the range of BA's for commercial thinning would be from 20 to 80 BA. Residual stocking would generally be 50 square feet of basal area (BA) per acre with some stands treated to lower or higher BA's based on proximity to structures on private land, communities, and the need to achieve the structural stage goals for the management emphasis areas. Generally, the range of BA's for commercial thinning would be from 20 to 80 BA. This alternative calls for a lower basal area than is normally

prescribed for under the Forest Plan, but still within management parameters. In areas where there are ongoing beetle outbreaks, lowering stand densities even further, such as to 40 BA would be advised. (USDA, Forest Service (2010d) Forest Health Evaluation R2-10-02) Fire managers have determined a lower basal area and associated reduced bulk density of crown fuels reduce the potential for high severity wildfires. Leave trees in commercial harvest units would generally not be uniformly spaced to create a more natural appearing stand. Treatments adjacent to developed private property would serve as fuel breaks and may be treated differently. Whole tree skidding would be the preferred logging method to remove as much slash as possible during harvest activities. Sanitation harvest to remove mountain pine beetle infested pine trees may be conducted in areas near or adjacent to stands identified for treatment in order to limit the expansion of MPB populations. Large trees would generally be retained and removed only where infested with MPB or necessary to meet density objectives, other resource needs, and for landings and other clearings to facilitate timber harvesting activities.

The thinning would reduce the stocking levels in overstocked stands. The effect would be an increase in the quality of the timber through the removal of damaged, diseased, and poorly formed trees and an increase in individual tree growth by releasing the remaining trees from competition for light, water, and nutrients. Trees would develop larger diameters due to a reduction of competition which concentrates the stand growth on fewer stems and a reduction of MPB rating would occur due to the reduction of basal area to lessen the level of susceptibility to MPB attack. Total yield would not be maximized because the trees would not fully occupy the stand.

Non-Commercial Thinning: Non-commercial thinning would occur on 3,770 acres within the project area outside of commercial timber sale cutting units. Non-commercial thinning would occur in pine stands and consists of the removal of pine one foot in height up to 8.9 inches in diameter leaving the largest pine of good form at a rate of approximately 130 - 200 trees per acre depending on size of trees and management objectives. Spacing of leave trees may vary from 12 to 24 feet to create a more natural appearing stand. A reduction of MPB hazard would occur due to the reduction of stocking to lower the level of susceptibility to pine beetle attack. Slash buildup from non-commercial thinning, if not treated properly, could encourage Ips Beetle (*Ips pini*) buildup and mortality in residual stands of pine. Past practices of lopping, scattering, and burning of slash piles within a year of treatment has reduced Ips infestation to less than a few trees per acre. Additional fuel treatments for fire hazard reduction would also reduce the probability of insect infestations. Scattering slash facilitates the rapid drying of fuels, which reduces conditions favorable for Ips buildup. No major adverse effects are anticipated to the timber resource.

Shelterwood Removal Cuts: Removal cuts would occur on approximately 800 acres and would generally be followed with non-commercial thinning. Most of these overstory stands have reached CMAI and are no longer needed for seed production and shade. The removal of the pine overstory would release the established understory from competition for light, water, and nutrients. Generally, all overstory pine eight inch dbh and greater would be removed, retaining only pine necessary for other resource needs. The stands identified for liberation cuts would also have the overstory removed to create needed younger, earlier successional stands. The effect would be an increase of approximately 800 acres of early successional, younger structural stage pine towards meeting Forest structural stage

objectives; an increase in growth of the remaining pine; the establishment and production of forage for both cattle and wildlife; and a reduction of aerial fuels, reducing potential for fire spread from individual tree torching and associated spotting.

Hardwood Release and Restoration: The retention and restoration of approximately 2,000 acres of hardwoods (aspen) from conifer competition would occur in this alternative. Commercial treatments and non-commercial treatments removing all of the pine from hardwoods would occur. Hardwood stands would be enlarged to include adjacent pine stands that have encroached upon them. Treating a 33 foot buffer around existing aspen sites would increase the aspen component by 220 acres. Pine would be removed from the area within 33 feet of the edge of the inclusion or, in the case of draws where there are remnants of past hardwood occupation, the pine would be removed to the boundary of the original stand which would normally be 33 feet to 100 feet. Small inclusions of established hardwoods that are scattered throughout the stands scheduled for treatment in the project area would be restored by removing pine from within and adjacent to these hardwood inclusions. Most of these areas would be small, less than five acres in size or narrow linear bands adjacent to existing hardwood stands. Currently there are 938 acres of the hardwood cover type and approximately 2,600 acres of mixed pine-hardwood stands typed as ponderosa pine on NFS lands within the project area. Adding 120 acres of type conversion of large aspen inclusions in pine stands to aspen stands and 220 acres of type conversion in buffers around existing hardwood stands, there would be a 340 acre increase in hardwood communities. We have also identified mixed conifer-aspen sites totaling 477 acres in Alternative B to be converted to hardwoods through conifer removal. This would result in a total increase of the aspen component in Alternative B of 817 acres (87%). Since these acres are within sites identified for other commercial treatments listed above, and would be identified during the sale preparation process, these inclusions have already been accounted for in the total area treated in Table 3-17. Upon completion of these treatments, hardwood acreage would be increased to approximately 1,756 acre in this alternative, almost doubling the aspen component to 7.3% of vegetated NFS lands within the project area. Additionally, 260 acres (10%) of mixed pine-hardwood stands would become pure aspen inclusions through conifer removal. Although they would not be typed as aspen stands and are not included in the acres of aspen above, these treatments would contribute to the Forest Plan goal of conserving existing hardwood communities and restoring historic hardwood communities (LRMP I-10 - 201). The effects of these treatments would be an increase in vegetative diversity and increased vigor of hardwood communities by release from the competition of conifer, increasing and improving the habitat of the hardwood dependent wildlife species. An additional indirect benefit would be the value of hardwood stands as natural fuel breaks. It is also expected that aspen would benefit as a result of continued pine mortality caused by the mountain pine beetle, although the amount of that increase is unknown.

Meadow Retention and Restoration: Pine encroaching in meadows and draw bottoms would be removed on approximately 500 acres. Currently, there are 394 acres of the grass cover type in the project area and an additional 106 acres of grassland with a ponderosa pine cover type. Commercial treatments and non-commercial treatments removing all of the pine from meadows would occur. Most of these grass sites have only scattered individuals or small groups of conifers so the commercial volume removed from these sites would be low. These grass sites would be enlarged to include adjacent pine stands that have encroached upon them.

Assuming a 33 foot treatment buffer around these grass sites would increase the grass sites by approximately 120 acres. Since these acres are within sites identified for other commercial treatments listed above, and would be identified during the sale layout process, the treatment of these inclusions have already been accounted for in the total area treated in Table 3-17. One small, three acre pine site would be converted to a grass site. Small openings that are within some of the stands in the project area would be enlarged by removing pine from within and adjacent to the openings. Pine would be removed from the area within up to 66 feet of the edge of the opening or, in the case of historic meadows, especially in draw bottoms, the pine would be removed to its original boundary as defined by soil type, slope, and moisture regime, which usually is less than 100 feet. The amount of increase in acreage is estimated to be 1% of the treated acres or approximately 130 acres in Alternative B, but since most of these inclusions would be small (less than five acres in size), they would likely not be converted to a grass cover type site so are not included in the statistics below. Upon completion of these treatments, the grass cover type would increase by 123 acres (31%) to approximately 520 acres in this alternative, which is approximately 2% of the NFS lands within the project area. This increase would move the area toward the Forest Plan goal of conserving existing meadow acreage and restoration of some historic meadows. The effects of this treatment would be an increase in vegetative diversity and an increase in grass and forb production in the meadow communities by release from the competition of pine, improving and increasing the habitat of meadow dependent wildlife species. An additional indirect benefit would be the value of meadows as fuel breaks. It is also expected that openings would increase within forested sites as a result of continued pine mortality caused by the mountain pine beetle, although the amount of that increase is unknown.

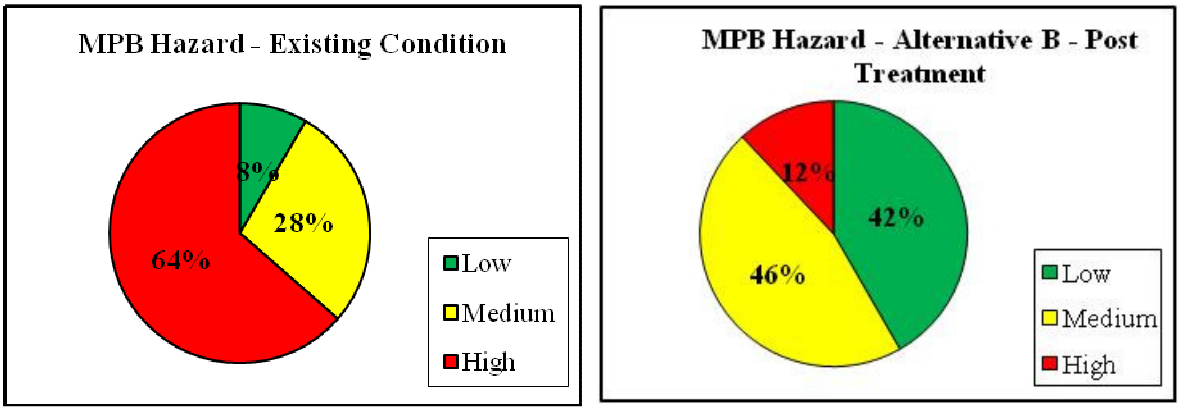
Prescribed Burning: Moderate intensity broadcast prescribed burning would occur on up to 5,037 acres in the project area, reducing ground fuels and increasing vegetative diversity in the understory. Approximately 3,100 acres would be burned in conjunction with mechanical treatments, while 1,900 acres would be burned outside of commercial or non-commercial treatment areas. In some of the stands, the understory vegetation is lacking due to needle cast and a closed canopy cover. A moderate intensity prescribed fire would reduce inhibiting duff and stimulate residual grasses and forbs. Broadcast prescribed burning should be designed to limit mortality in the polesize and sawtimber size pine stands within the suitable land base to 10% or less with seedling/sapling mortality less than 75%. Burning in stands to be regenerated would favor grass establishment and reduce regeneration. The effects of prescribed burning on the timber resource would be a short-term increase in growth from the nutrients released into the soil. Total yield in the project area would be reduced by the burn-related mortality. The reduction in yield should be minimal for the project area using the low levels of mortality which have occurred on recent prescribed burns.

Insects and Disease: Current losses from insect and disease are at an epidemic level in the western part of the project area. According to Schmid et al, 2007, the most important aspect of managing mature ponderosa pine stands in the Black Hills is minimizing MPB-caused mortality. The only effective long-range strategy to minimize beetle-caused mortality is controlling stand conditions through silvicultrual means over large landscapes and monitoring for areas of beetle buildup (USDA Forest Service, 2007a). These are forest management actions that increase tree vigor and reduce stand susceptibility to beetle attack through reducing

stocking levels. They are preventive treatments that should be completed prior to stands experiencing beetle outbreaks. Sanitation harvest (removal of infested trees) can also provide protection to surrounding uninfested trees and stands by removing a large source of attacking beetles. Creating diverse stand conditions across the landscape would result in an overall forest that is less susceptible long term to beetles.

Alternative B would substantially reduce the existing MPB hazard within the Pactola Project Area. To achieve a MPB hazard rating of low, most of the project area would have to consist of grass/forb, seedling or open sapling/pole stands. All pine stands identified with a Structural Stage 4, mature, have a MPB hazard rating of medium or high. Only stands with a structural stage of 1, 2, or 3A are categorized as a MPB hazard rating of low according to Forest Plan Amendment guidance. There are currently 14,181 acres (64%) of the ponderosa pine stands in the high hazard rating. There would be a reduction of 11,556 acres of stands from a hazard rating of high to a lower rating. The lower mountain pine beetle hazard is a result of reducing stocking levels below the levels most susceptible to MPB. The protection provided for the area would extend into the next two decades and would remain moderate for much of that time. Upon completion of the treatments, there would be 2,625 acres (12%) of the area with the high hazard rating. Forty-six percent (10,112 acres) of conifer stands would have a medium hazard rating while 42% (9,117 acres) would have a low hazard rating. Not included in Figure 3-4 below are the 123 acres of pine converted to grass and the 818 acres of pine converted to aspen. These acres have no mountain pine beetle rating since they are no longer typed as conifer stands.

Figure 3-4 Alternative B MPB Hazard Rating



Slash buildup from treatments, if not treated properly, could encourage Ips Beetle (*Ips pini*) buildup and mortality in residual stands of pine. Past practices of lopping, scattering, and burning of slash piles within a year of treatment has reduced Ips infestation to less than a few trees per acre. Whole tree skidding, which would significantly reduce the amount of slash and need for additional fuel treatments for fire hazard reduction, would also reduce the probability of insect infestations. Scattering slash facilitates the rapid drying of fuels, which reduces conditions favorable for Ips buildup. Other insects and diseases affecting both pine and other species of trees in the project area that are present are having minimal impact on the area and would probably continue to have a low impact under this alternative.

Stand Structure: Stand structure within the project area generally would be even-aged with the majority of the trees within a stand having an age within a range of 20 years of one another. Most of the pine would be either dominant or co-dominant. Most of the intermediate and suppressed pine would be removed in treatment areas to raise crown heights and reduce ladder fuels for crown fire hazard reduction.

Within the project area, stand structure generally would change from a more closed canopy structure to an open canopy structure. More than 13,000 acres would move from the more closed 3B, 3C, 4B, and 4C structures to the open structure of Structural Stages 2, 3A, and 4A. This change results from the combination of treatments and the application of MPB mortality estimates for the untreated stands. Of this total, approximately 70% of the 3,857 untreated pine acres (2,546 acres) are a consequence of MPB activity and would still have high or very high fire hazard ratings. Treatments are designed to reduce mountain pine beetle hazard, increase acres of younger structural stages, and to accomplish the fire hazard reduction over the landscape within the wildland-urban interface (WUI). This was done also to achieve the forest plan objective 10-01 to manage for 50% to 75% moderate-to-low fire hazard in the WUI and reduce fire hazard within proximity of structures (Phase II amendment I-35).

Forest-wide management area stand structure changes occur in the structural stages as displayed in the table below (USDA Forest Service, 2010c). Generally, structural stages change only slightly, less than 1%, except as follows. For Management Area 5.1 there is a 586 acre (0.1%) decrease in Structural Stage 3B that changes the Forest percentage from 4% (3.6%) to 3% (3.47%) of the total, an increase in 4A from 39% to 40% which exceeds Forest Plan (FP) objectives, and a decrease of 1% in 4C towards FP objectives. In Management Area 5.4 there is a 1% increase towards the FP objective of 10% in 3A with a corresponding 1% decrease in 3B and 3C away from FP objectives. Both Structural Stages 4B and 4C decreased in Management Area 5.4 by 1% towards FP objectives, while Structural Stage 4A increased 1%, away from FP objectives. These changes from denser stands to more open stand conditions were necessary to lower the MPB hazard and to accomplish fire hazard reduction over the landscape within the WUI.

Table 3-15 Forest-Wide Ponderosa Pine Structural Stage Distribution: Existing vs. Post Treatment

Objective		**Management Area 5.1**			**Management Area 5.4**		
SS	%	Existing	Alternative B	%	Existing	Alternative B	%
1	5%	26,760	26,760	6%	45,616	45,616	13%
2	5%	16,673	17,361	4%	10,152	11,676	3%
3A	10%	24,236	24,905	5%	17,454	19,937	6%
3B	15%	17,047	16,461	3%	22,227	21,274	6%
3C	5%	10,269	9,951	2%	15,763	15,201	4%
4A	25%	185,062	187,195	40%	86,487	88,110	26%
4B	25%	142,228	140,256	30%	87,864	84,280	25%
4C	5%	50,437	49,698	10%	52,865	51,988	15%
5	5%	1,227	1,249	0%	1,066	1,097	0%
Total	100%	473,939	473,836	100%	339,494	339,179	100%

Very Large Tree Size: Objective 204 in the Phase II Amendment calls for 10% of the 4 ponderosa pine structural stage have an average tree size of "very large," where the average size pine is greater than 16 inches DBH. There would be an increase in the number of acres of stands with a very large size class rating in Alternative B for both management areas with a tree size objective. In Management Area 5.1, the increase exceeds the Phase II objective of 10% while in Management Area 5.4 the acreage moves towards the goal of 10%. There is a total increase of 69 acres in these two management areas. In order to reduce the acreage of stands in the very large size class more of the area could be thinned from above removing the larger pine. However, to meet the objective of reducing fire hazard, it was necessary to thin the intermediate and suppressed pine to raise the crown base height. This retains the larger pine and thus moves some stands into the very large size class. The table below displays the existing acreage of stands with a tree size of "very large" and the acreage of "very large" upon completion of planned activities.

Table 3-16 Forest-wide Conditions by Management Area and Alternative. Ponderosa Pine Structural Stage 4 with Tree Size Class of Very Large

Management Area 5.1				**Management Area 5.4**			
Existing		Alternative B		Existing		Alternative B	
Acres	%	Acres	%	Acres	%	Acres	%
48,756	13%	48,862	13%	19,761	9%	19,896	9%

Age Class Distribution: Age class distribution would improve in this alternative, with an increase in the younger, early seral stages towards Forest Plan objectives. There would also be an increase in the older age classes due to removal of smaller and younger pine and retention of large, older trees where thinning from below occurs. However, in the 6"+ diameter classes in many even-aged stands, age would change little due to the removal of pine spread out over a range age classes within the stand.

Stocking Levels: This alternative was designed to reduce mountain pine beetle hazard and also fire hazard within large portions of the project area by increasing the spacing between trees. The only long-range strategy to minimize beetle-caused mortality is controlling stand conditions through silvicultural means over large landscapes and monitoring for areas of beetle buildup (USDA Forest Service, 2007a). Fire managers have determined lower basal areas and associated reduced bulk density of crown fuels reduce the potential for high intensity wildfires. The effect would be an increase in the quality of the timber through the removal of damaged, diseased, and poorly formed trees and an increase in individual tree growth by releasing the remaining trees from competition for light, water and nutrients. Trees would develop larger diameters due to a reduction of competition, which concentrates the stand growth on the fewer stems. This alternative would contribute to the Forest Plan goal of providing for sustained commodity uses while using acceptable silvicultural systems. This alternative would also provide adequately stocked pine stands for future management. Basal area distribution for Alternative B after treatment is illustrated below:

Plant Species Composition: The amount of hardwood and meadow acreage would increase in this alternative. The extent and effects are described in the meadow and hardwood restoration sections previously discussed above. Opening of the stands would allow other

grasses and forbs to become established in the understory. Pine regeneration in the understory after harvest would become abundant and may be a limiting factor in their establishment. Understory species establishment and diversity would be much greater than the No Action Alternative because mechanical treatments and prescribed burning would limit pine regeneration and encourage grass, shrub and forbs establishment. It is also expected that hardwoods and meadows would benefit as a result of continued pine mortality caused by the mountain pine beetle, although the amount of that increase is unknown.

Table 3-17 Pactola Project Area Cover Type Composition

	Existing		Alternative B Post Treatment	
Cover	**Acres**	**Percent**	**Acres**	**Percent**
Grass	394	1.6%	517	2.1%
Shrubs	28	0.1%	28	0.1%
Aspen	938	3.8%	1,756	7.1%
Ponderosa Pine	22,317	89.8%	21,394	86.0%
White Spruce	253	1.0%	235	0.9%
Water	868	3.5%	868	3.5%
Non-Vegetated	64	0.3%	64	0.3%

Late Successional Stands: There are currently no stands within the project area classified as late successional, Structural Stage 5 (SS5). Twenty one sites totaling almost 900 acres have been identified within the project area that have the age and stand structure characteristics to be classified as SS5. These stands would be designated as SS5 stands in this alternative. The designation of these stands would be due to analysis of current condition, not through treatment. An additional 700 acres of 4B and 4C stands would be treated from below in this alternative to remain in a closed canopy structural stage. The treatment would make them less susceptible to high intensity fires and MPB infestation. It is estimated that approximately 70% of the untreated closed canopy stands would be converted to open canopy stands by MPB activity. Due to commercial thinning, Alternative B leaves over 3,600 acres more of sawtimber stands than the no action alternative. These larger and older stands would grow into late successional stands much earlier than the younger stands created by MPB activity in Alternative A. These stands would be needed to increase the amount of late successional stands and replace existing old growth as they deteriorate or are lost through fire, insects or other natural events.

Regeneration: The natural regeneration of pine and other native species of trees within the project should be good with the treatments in this alternative. Whole tree skidding would have the effect of site preparation by scarification of the forest floor, which favors regeneration establishment and has a positive effect in discouraging competition from grasses and forbs during seed germination and early seedling establishment. This abundance of regeneration would, however, create dense sapling size pine within the next 20 to 40 years, posing an increased fire hazard as these pine become ladder fuels which would necessitate the need for non-commercial thinning in the future. Where prescribed burning occurs, regeneration would be reduced due to the rapid establishment of competitive grasses and forbs.

Growth and Yield: The thinning would reduce the stocking levels in overstocked stands and bring those stands into forest plan condition. The effect would be an increase in the quality of the timber through the removal of damaged, diseased, and poorly formed trees and an increase in individual tree growth by releasing the remaining trees from competition for light, water and nutrients. Trees would develop larger diameters due to a reduction of competition which concentrates the stand growth on fewer stems and a reduction of hazard to the pine stands would occur due to the reduction of basal area to lower the level of susceptibility to pine beetle attack. Total yield would be lower over time than if the stand were fully stocked because the trees would not fully occupy the stand. But higher density stands are much more susceptible to MPB infestations and high intensity fires, and with the proximity of large populations of MPB, this decrease in yield should be weighed against the benefits of reductions in MPB and fire hazard.

Snags: Currently for the Pactola Project Area, there is an average of approximately 4.7 hard snags per acre on forested NFS lands. We would not be cutting snags in either action alternative except for safety reasons. For additional information on snags, refer to the Black Hills National Forest Monitoring Plan.

Alternative C

Direct and Indirect Effects
Under this alternative approximately 17,000 acres of forestland would be treated mechanically. The treatments in this alternative are the same as those in Alternative B with four exceptions:

- Propose treating approximately 400 acres along designated roadways within the project area to improve safe access. Primary ingress/egress roads associated with the Wildland Urban Interface (WUI) access in Pennington County have been identified in the Pennington County Community Wildfire Protection Plan (PCCWPP) and should be treated to provide for safe access during a fire event.
- We have also identified approximately 1,270 acres of cable logging to treat over-stocked pine stands that are not treatable using conventional ground-based systems.
- Propose helicopter logging of up to 500 acres of mountain pine beetle infestations in areas that are not accessible by other means. These are areas that would be identified in response to MPB activity outside of other treatment areas identified in the Pactola Project Area.
- We would treat an additional 71 acres of fuel breaks adjacent to private property that are not being treated in Alternative B.

Treatments specified generally apply to 80% or more of the stand. Many of the stands in the project area have inclusions of less than ten acres in size that may have basal areas, age classes, size classes, and tree species that differ from the majority of the stand. As these stands are laid out and marked these inclusions may not be prescribed and marked as specified in the stand treatment table, but rather prescribed using criteria developed for other stands with similar characteristics, e.g. an inclusion of pole size pine may be thinned if located within a stand scheduled for a removal cut.

The law generally prohibits the harvest of stands before they reach their maximum growth rate (National Forest Management Act (NFMA), 16 U.S.C. 1604(m)). Exceptions in the law allow the harvest of individual trees, or even parts or whole stands of trees, before this time to thin and improve timber stands, and salvage damaged stands of trees (part m1 of the law). Further exceptions are allowed in order to achieve multiple-use objectives other than timber harvest (part m2). This alternative would harvest some trees before the maximum potential growth rate of some stands in the project area has been reached. These harvest treatments are consistent with the exceptions provided in part m2 of the law, and include the following: Commercial Thinning, Non-Commercial Thinning, Meadow Retention and Restoration Treatments, and Hardwood Restoration Harvests which are designed to meet other than timber objectives. These treatments are proposed to move towards meeting Forest Plan direction and respond to HFRA guidance. Illustrations of many of these treatments can be found in Appendix E.

Rights-of-way: Right-of-way clearing would occur as described in Alternative B above.

Commercial Thinning: Commercial thinning would occur as described in Alternative B above, but would include an additional 783 acres of thinning. Sanitation harvest to remove mountain pine beetle infested pine trees may be conducted in areas near or adjacent to stands identified for treatment in order to limit the expansion of MPB populations.

Non-Commercial Thinning: Non-commercial thinning treatments would occur as described in Alternative B above, but would include an additional 770 acres of treatment.

Shelterwood Removal Cuts: Shelterwood seed cut treatments would occur as described in Alternative B above, but would include an additional 213 acres of treatment.

Hardwood Release and Restoration: Hardwood treatments would occur as described in Alternative B above, but would include an additional 204 acres of treatment.

Meadow Retention and Restoration: Meadow treatments would occur as described in Alternative B above, but would include an additional 25 acres of treatment to be converted to grass cover type.

Roadside Treatments: Primary ingress/egress roads associated with the Wildland Urban Interface (WUI) access in Pennington County have been identified in the Pennington County Community Wildfire Protection Plan (PCCWPP) and would be treated to provide for safe access during a fire event. The Pennington County CWPP has recommended a 180 foot buffer on either side of these roads be managed to minimize a high intensity crown fire from threatening the use of these travel routes. Specific treatments would include thinning from below to approximately 60 square feet of basal area to raise crown base height and increase crown separation of the overstory, and thinning the understory and treating the slash to reduce ladder fuels. Leaving small groups of two to three trees and variable spacing may be desirable to create a more diverse appearance to these treatments. Whole tree harvesting would be used in these areas where possible, and all slash would be removed or piled and burned. Also, conifers would be removed from hardwood stands and inclusions along these routes to reduce the fire hazard. The area of these roadside treatments would be

approximately 1,600 acres. 1,200 of these acres are already identified for treatments in this alternative, leaving approximately 400 acres to be treated as a special roadside treatment.

Cable Logging: The harvest of approximately 1,270 acres of ground not conducive to harvest by ground-based systems would be accomplished by cable logging. This treatment would generally thin from above, removing the larger overstory trees and leaving an understory of seedlings, saplings, and pole timber. Following the commercial harvest the understory may be thinned non-commercially to reduce stocking levels for improved growth, vigor and to reduce the fire hazard. Additional new road construction would be necessary to access the cable units. See the Transportation Section for specific information.

Helicopter Logging: In areas where mountain pine beetle infestations are occurring in inaccessible areas outside of stands scheduled for treatment, helicopter logging may be used to treat a maximum of 500 acres. Treatment would generally include hand fallers cutting green, infested trees, removing the non-merchantable parts of the trees, and then attaching the logs to a cable suspended from a hovering helicopter. The helicopter would then fly the logs down to a landing located adjacent to a road. Logs would be loaded on a truck at the landing and transported to a mill. Since ground based equipment would not be used, the impact to the resources would be less than ground-based logging. All logging slash left at the site of the cut trees would be treated to a maximum of 18 inches in depth.

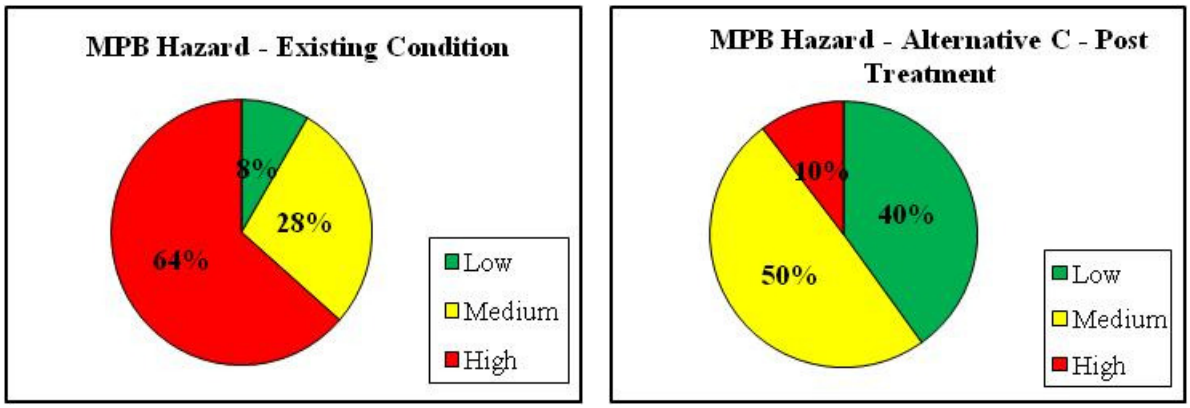
Fuel Breaks: Fuel breaks would be constructed adjacent to private property in areas where other treatments are not already planned. A 200 foot buffer would be thinned from below along the property boundary to remove ladder fuels increase the spacing between trees. Commercial sized materials may be removed where equipment is not limited. Whole tree logging is preferred where possible, but piling and burning of slash may be necessary where access is limited. Seventy-one acres of fuel breaks are planned in this alternative. Areas adjacent to developed private property identified for other treatments in both action alternatives would be treated similarly.

Prescribed Burning: Prescribed burning treatments would occur on 5,037 acres as described in Alternative B above, with approximately 1,600 acres of burning outside of units identified for other treatments.

Insects and Disease: Current losses from insect and disease are at an epidemic level in the western part of the project area. According to Schmid et al, 2007, the most important aspect of managing mature ponderosa pine stands in the Black Hills is minimizing MPB-caused mortality. The only effective long-range strategy to minimize beetle-caused mortality is controlling stand conditions through silvicultural means over large landscapes and monitoring for areas of beetle buildup (USDA Forest Service, 2007a). These are forest management actions that increase tree vigor and reduce stand susceptibility to beetle attack through reducing stocking levels or controlling other stand conditions. They are preventive treatments that should be completed prior to stands experiencing beetle outbreaks. Creating diverse stand conditions across the landscape would result in an overall forest that is less susceptible long term to beetles.

Alternative C would substantially reduce the existing MPB hazard within the Pactola Project Area. To achieve a MPB hazard rating of low, most of the project area would have to consist of grass/forb, seedling, or open sapling/pole stands. All pine stands identified with a Structural Stage 4, mature, have a MPB hazard rating of medium or high. Only stands with a structural stage of 1, 2, or 3A are categorized as a MPB hazard rating of low according to Forest Plan Amendment guidance. There are currently 14,181 acres (64%) of the ponderosa pine stands in the high hazard rating. There would be a reduction of 11,932 acres of stands from a hazard rating of high to a lower rating. The lower mountain pine beetle hazard is a result of reducing stocking levels below the levels most susceptible to pine beetles. The protection provided for the area would extend into the next two decades and would remain moderate for much of that time. Upon completion of the treatments, there would be 2,249 acres (10%) of the area with the high hazard rating. Fifty percent (10,730 ac) of conifer stands would have a medium hazard rating while 40% (8,668 acres) would have a low hazard rating. Not included in the figure below are the 123 acres of pine converted to grass and the 1,021 acres of pine converted to aspen. These acres have no mountain pine beetle rating since they are no longer typed as conifer stands.

Figure 3-5 Alternative C MPB Hazard Rating



Slash buildup from treatments, if not treated properly, could encourage Ips Beetle (*Ips pini*) buildup and mortality in residual stands of pine. Past practices of lopping, scattering, and burning of slash piles within a year of treatment has reduced Ips infestation to less than a few trees per acre. Whole tree skidding, which would significantly reduce the amount of slash and need for additional fuel treatments for fire hazard reduction, would also reduce the probability of insect infestations. Scattering slash facilitates the rapid drying of fuels, which reduces conditions favorable for Ips buildup. Other insects and diseases affecting both pine and other species of trees in the project area that are present are having minimal impact on the area and would probably continue to have a low impact under this alternative.

Stand Structure: Stand structure within the project area generally would be even-aged with the majority of the trees in the stands having an age within a range of 20 years of one another. Most of the pine would be either dominant or co-dominant. Much of the intermediate and suppressed pine would be removed in treatment areas to raise crown heights and reduce ladder fuels for crown fire hazard reduction.

Within the project area, stand structure generally would change from a more closed canopy structure to an open canopy structure. More than 13,700 acres would move from the more

closed 3B, 3C, 4B, and 4C structures to the open structures of 2, 3A, and 4A. This change results from the combination of treatments and the application of MPB mortality estimates for the untreated stands. Of this total, approximately 70% of the 2,579 untreated pine acres, (1,800 acres) are a consequence of MPB activity and would still have high or very high fire hazard ratings. Treatments are designed to reduce mountain pine beetle hazard, increase acres of younger structural stages, and to accomplish the fire hazard reduction over the landscape within the wildland-urban interface (WUI). This was done also to achieve the forest plan objective 10-01 to manage for 50% to 75" moderate-to-low fire hazard in the WUI and reduce fire hazard within proximity of structures (Phase II amendment I-35).

Forest-wide management area stand structure changes occur in the structural stages as displayed in the table below. Generally, structural stages change only slightly, less than 1%, except as follows, and mostly towards Forest Plan objectives. In Management Area 5.4, there is a 1% change towards Forest Plan objectives in Structural Stage 3A. There is a 1% change towards the Forest Plan objective of 25% in the 4B structural stage in each of the management areas and a 1% change exceeding the 25% objective in the 4A structural stage in all management areas.

Table 3-18 Forest-Wide Structural Stage Distribution: Existing vs. Post Treatment

Objective		**Management Area 5.1**			**Management Area 5.4**		
SS	%	Existing	Alternative C	%	Existing	Alternative C	%
1	5%	26,760	26,760	6%	45,616	45,616	13%
2	5%	16,673	16,953	4%	10,152	11,437	3%
3A	10%	24,236	24,808	5%	17,454	20,268	6%
3B	15%	17,047	16,465	3%	22,227	21,197	6%
3C	5%	10,269	9,936	2%	15,763	15,153	4%
4A	25%	185,062	187,629	40%	86,487	88,167	26%
4B	25%	142,228	140,223	30%	87,864	84,298	25%
4C	5%	50,437	49,698	10%	52,865	51,892	15%
5	5%	1,227	1,227	0%	1,066	1,082	0%
Total	100%	473,939	473,699	100%	339,494	339,112	100%

Very Large Tree Size: Objective 204 in the Phase II Amendment calls for 10% of the 4 ponderosa pine structural stage have an average tree size of "very large," where the average size pine is greater than 16 inches DBH. There would be an increase in the number of acres of stands with a very large size class rating in Alternative C across all management areas. In Management Areas 4.1 and 5.1, the increase exceeds the Phase II objective of 10% while in Management Area 5.4 the acreage moves towards the goal of 10%. This retains the larger pine and thus moves some stands into the very large size class. The table below displays the existing acreage of stands with a tree size of "very large" and the acreage of "very large" upon completion of planned activities.

Table 3-19 Forest-Wide Conditions by Management Area and Alternative. Ponderosa Pine Tree Size Class of Very Large

Objective	MA 5.1 - Alternative C		MA 5.4 - Alternative C	
% of SS4	Acres	% of SS4	Acres	% of SS4
10%	48,862	13%	19,896	9%

Age Class Distribution: Age class distribution would improve in this alternative, with an increase in the younger, early seral stages to meet Forest Plan objectives. Alternative C would create more of the younger seral stages than Alternative B since there are more removal cuts and the cable logging would generally be thinning from above. There would also be an increase in the older age classes due to removal of smaller and younger pine and retention of large, older trees where thinning from below occurs. However, in the 6"+ diameter classes in many even-aged stands, age would change little due to the removal of pine spread out over a range age classes within the stand.

Stocking Levels: In this alternative, stocking levels would be decreased considerably compared to Alternative A. The alternative was designed to reduce mountain pine beetle hazard and crown fire hazard within large portions of the project area by increasing the spacing between trees. The only long-range strategy to minimize beetle-caused mortality is controlling stand conditions through silvicultural means over large landscapes and monitoring for areas of beetle buildup (USDA Forest Service, 2007a). Fire managers have determined lower basal areas and associated reduced bulk density of crown fuels reduce the potential for high intensity wildfires. The effect would be an increase in the quality of the timber through the removal of damaged, diseased, and poorly formed trees and an increase in individual tree growth by releasing the remaining trees from competition for light, water and nutrients. Trees would develop larger diameters due to a reduction of competition, which concentrates the stand growth on the fewer stems. This alternative would contribute to the Forest Plan goal of providing for sustained commodity uses while using acceptable silvicultural systems. This alternative would also provide adequately stocked pine stands for future management. Basal area distribution after treatment is illustrated below:

Plant Species Composition: The amount of hardwood and meadow acreage would increase in this alternative. The extent and effects are described in the meadow and hardwood restoration sections previously discussed above. Opening of the stands would allow other grasses and forbs to become established in the understory. Pine regeneration in the understory after harvest would become abundant and may be a limiting factor in their establishment. Understory species establishment and diversity would be much greater in this alternative because mechanical treatments and prescribed burning would limit pine regeneration and encourage grass, shrub, and forbs establishment. It is also expected that hardwoods and meadows would benefit as a result of continued pine mortality caused by the mountain pine beetle, although the amount of that increase is unknown.

Table 3-20 Alternative C Project Area Species Composition

	Existing		Alternative C Post Treatment	
Cover	**Acres**	**Percent**	**Acres**	**Percent**
Grass	394	1.6%	517	2.1%
Shrubs	28	0.1%	28	0.1%
Aspen	938	3.8%	1,959	7.9%
Ponderosa Pine	22,317	89.8%	21,191	85.2%
White Spruce	253	1.0%	235	0.9%
Water	868	3.5%	868	3.5%
Non-Vegetated	64	0.3%	64	0.3%

Late Successional Stands: There are currently no stands within the project area classified as late successional, Structural Stage 5 (SS5). Eighteen sites totaling over 700 acres have been identified within the project area that have the age and stand structure characteristics to be classified as SS5 and would be designated in this alternative. The designation of these stands would be due to analysis of current condition, not through treatment. Almost 900 acres of 4B and 4C stands would be treated from below in this alternative to remain in a closed canopy structural stage. The treatment would make them less susceptible to high intensity fires and MPB infestation. It is estimated that approximately 70% of the untreated closed canopy stands would be converted to open canopy stands by MPB activity. Due to commercial thinning, Alternative C leaves over 4,000 acres more of sawtimber stands than the no action alternative. These larger and older stands would grow into late successional stands much earlier than the younger stands created by MPB activity in Alternative A. These stands would be needed to increase the amount of late successional stands and replace existing old growth as they deteriorate or are lost through fire, insects or other natural events.

Regeneration: The natural regeneration of pine and other native species of trees within the project area should be good with the treatments in this alternative. Whole tree skidding would have the effect of site preparation by scarification of the forest floor, which favors regeneration establishment and has a positive effect in discouraging competition from grasses and forbs during seed germination and early regeneration establishment. This abundance of regeneration would, however, create dense sapling size pine within the next 20 to 40 years, which would necessitate non-commercial thinning in the future and pose an increased fire hazard as these pine become ladder fuels. Where prescribed burning occurs, regeneration would be reduced due to the rapid establishment of competitive grasses and forbs.

Snags: Currently for the Pactola Project Area, there is an average of approximately 4.7 hard snags per acre on forested NFS lands. We would not be cutting snags in either action alternative except for safety reasons. For additional information on snags, refer to the Black Hills National Forest Monitoring Plan.

Growth and Yield: The thinning would reduce the stocking levels in overstocked stands and bring those stands into forest plan condition. The effect would be an increase in the quality of the timber through the removal of damaged, diseased, and poorly formed trees and an increase in individual tree growth by releasing the remaining trees from competition for light, water and

nutrients. Where mechanical thinning occurs, trees would develop larger diameters due to a reduction of competition which concentrates the stand growth on the fewer stems. MPB hazard would be reduced in these areas due to the reduction of basal area to levels less susceptible to pine beetle attack. Alternative C would have higher growth and yield than Alternative A and slightly more than Alternative B. This is due to the substantially higher amount of beetle-caused mortality in Alternative A and slightly higher levels in Alternative B as compared to Alternative C. Total yield would be lower over time than if the stand was fully stocked, because the trees would not fully occupy the stand. But higher density stands are much more susceptible to MPB infestations, and with the proximity of large populations of MPB, this decrease in yield should be weighed against the benefits of reductions in MPB and fire hazard.

Cumulative Effects

Past activities are listed under in Alternative A above. Cumulative effects of past treatments and treatments proposed in this alternative generally would be positive. Thinning of stands created with regeneration harvests would bring those stands into desired condition. Fire hazard reduction and MPB hazard that was lowered with past treatments would be improved or maintained where treatment occurs in these alternatives. Plant species diversity was increased with past treatments and would be increased in these alternatives where treatment occurs.

Present activities are minimal and their effects are listed in Alternative A above. Alternatives B and C treatments would have a minimal effect over those discussed under direct and indirect effects for these alternatives.

Anticipated future silviculture activities, not connected to this analysis, that would occur within the area are as follows: Future silvicultural activities would be minimal and their effects are listed in Alternative A above. Alternatives B and C treatments would have a minimal cumulative effect over those discussed under direct and indirect effects for these alternatives.

Silvicultural activities on other than National Forest System lands would be minimal and their effects are listed under in Alternative A above. Alternatives B and C treatments would have a minimal cumulative effect over those discussed under direct and indirect effects for this alternative. Treatments on private land for fire hazard reduction or mountain pine beetle would contribute to both a reduction of hazard from high intensity wildfire and mountain pine beetle.

FIRE and FUELS

Affected Environment

Historically, fire return intervals in the Black Hills were relatively frequent (0-35 years) and fire intensities were low (surface fires most common) to mixed severity (partial overstory mortality)(Brown and Seig 1999, Brown et al. 2008). Fire return intervals combined with fire severity defines a Fire Regime. Much of the Black Hills, including the Pactola Project Area is classified as a Fire Regime I. Burn severity is the degree fire affects vegetation and soils over the landscape; the fire return interval is the amount of time between consecutive fires to burn in a given area. In a mixed severity forest, like the Black Hills, a mosaic pattern of vegetation across the landscape caused by the differing fire conditions should be the norm. Fuel loadings, both live and dead, topographic influences, and weather are all directly related

to fire severity. Fast moving crown fire is often associated with severe fire effects, though surface fire can often cause severe effects as well (Lentile et al. 2006).

Condition Class defines a landscape's departure from its historic fire regime. Every fire regime has three condition classes (FRCC1, 2, and 3). They describe the extent that a landscape has departed from its historic vegetative cover and fire cycle: low (FRCC1), moderate (FRCC2), and high (FRCC3). Fire has in effect been removed from much of the Black Hills ecosystem, including the Pactola Project Area, for more than 100 years. Using a coarse scale, the Black Hills National Forest is in the high category or FRCC3 (Schmidt et al 2002). Elements of FRCC3 that apply to the Pactola Project Area include:

- The fire regime has been significantly altered from its historical range.
- The risk of losing key ecosystem components is high.
- Vegetation attributes have been significantly altered from the historical range.
- Fire frequencies have departed from the historical frequencies by multiple return intervals resulting in dramatic changes in fire size, intensity, severity, and landscape patterns.

Fire History: Since 1970, 128 fires (3.2 fires per year average) have been recorded within the Pactola Project Area, totaling 76.3 acres. The largest recorded fire during that time period was the Boardinghouse Fire (1980) which burned five acres. In 1939, the McVey Fire, the worst recorded fire to that date in the Black Hills, burned approximately 22,000 acres. The southern end of the project area was affected with 3,034 acres falling within the McVey Burn. Several prescribed fires have take place within the Pactola Project Area accounting for 3,660 acres, starting with Nugget prescribed burn in 1980 and most recently with Horse Nugget prescribed burn in 2007. These prescribed burns have largely covered the footprint of the McVey Fire. The balance of acres within the project area, 22,281 acres, has not been significantly affected by fire within the past 100+ years.

Topography: The project area is as rough and broken country as the Mystic District has to offer. Elevation ranges from 4,600 feet to 5,800 feet. Thirty percent of the project area is over 40% slope. Consequently, access for firefighting is difficult resulting in slower response times. This can allow time for a wildland fire to establish itself making control more difficult and expensive.

Vegetation: Ponderosa pine is the dominant species in the Pactola Project Area. The area is interspersed with pockets of Aspen and Birch. Some smaller meadow openings exist within the area as well. Vegetation distribution in the project area is shown in Table 3-21.

Table 3-21 Forest cover types within the Pactola Project Area (NFS lands)

Forest Type	Acres	Percent of Project Area
Ponderosa	22,914	88%
Grass	632	2%
Aspen/Birch	946	4%
White Spruce	253	1%
Non-Vegetative (Pactola Lake, roads, etc.)	1,241	5%

Mountain Pine Beetle: The ongoing Mountain Pine Beetle (MPB) epidemic has established itself within the Pactola Project Area. Approximately 500 acres of infested trees were identified during the 2010 MPB aerial surveys performed by R2 Forest Health Management. Approximately 58% of the area is in stands that will provide favorable habitat for the beetles (Allen, 2010). Black Hills Land and Resource Management (LRMP) Goal 10-07 addresses the issue of MPB, "Where outbreaks of mountain pine beetle could present risks to management objectives for ponderosa pine, reduce acreage of ponderosa-pine stands that are in medium or high risk for infestation." Though this report only speaks specifically to the Pactola Planning Area, adjacent stands and planning areas are also susceptible to MPB outbreaks. An expanding outbreak within the Pactola Project Area would surely have an impact on those adjacent areas.

Fire Hazard: Fire Hazard can be defined as a combination of fire risk, fuel condition, weather, and topography. Fire risk is based on the potential for a fire to start in a given area. With an average of 3.2 fires a year within the project area, the risk is real. Fuel conditions are based on quantity, arrangement, and sometimes live to dead ratios.

The Forest Plan, as amended, speaks directly to the fire and insect hazard in the forest. Fire hazard ratings for the Black Hills are based on ponderosa pine forest structural stages. The structural stage provides a description of the continuity of aerial fuels within a given stand. The denser the stand, the more likely a crown fire could be sustained. The Forest Plan, as amendment, correlates crown fire hazard with structural stages. As shown in Table 3-22.

Table 3-22 Structural Stages and Fire Hazard Ratings

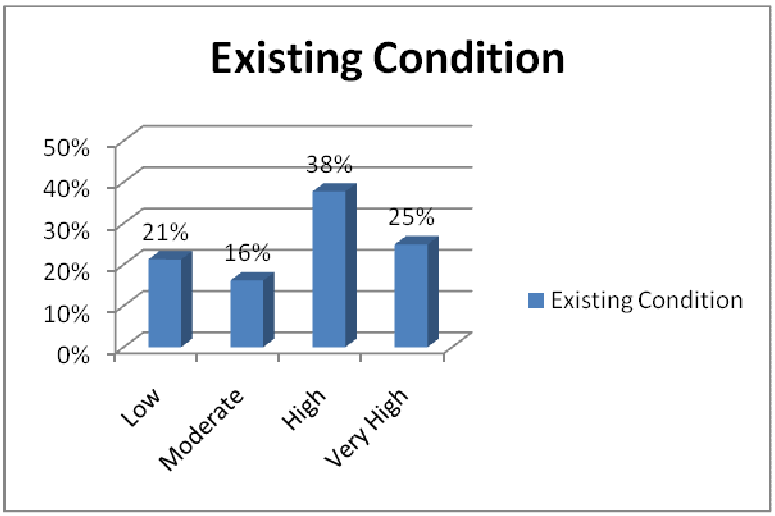
Structural Stage	Fire Hazard Rating
1 – Grass/Forb	Low
2 – Shrub/Seedling	Moderate
3A – Sapling-pole, <40% crown cover	Moderate
3B – Sapling-pole, 40-70% crown cover	High
3C – Sapling-pole, >70% crown cover	Very High
4A – Mature, >40% crown cover, >9" avg. diameter	Moderate
4A – Mature, >40% crown cover, <9" avg. diameter	Very High
4B – Mature, 40-70% crown cover, >9" avg. diameter	High
4B – Mature, 40-70% crown cover, <9" avg. diameter	Very High
4C – Mature, >70% crown cover, all diameters	Very High
5 – Late Successional	Very High

Using structural stage data from individual stands within the Pactola Project Area (NFS lands) fire hazard ratings correlate as follows:

Table 3-23 Fire Hazard Rating for Pactola Project Area

Fire Hazard Rating	Acres
Low	5,284
Moderate	4,021
High	9,376
Very High	6,183

Figure 3-6 Fire Hazard Ratings for the Pactola Project Area



Wildland Urban Interface

The Pactola Planning Area has 231 identified address points and an additional 114 within one half mile of the project boundary. Private property accounts for 1,455 acres of the total project area. The community of Silver City, centrally located in the Pactola Project Area and at the confluence of several drainages on Rapid Creek, is listed on the National Registry of At Risk Communities (ARC)(Federal Register, 2001). Though there are two directions for a potential evacuation, egress from the settlement could be a dangerous activity. Both directions require climbing out steep terrain with tight, windy roads. There are also several other concentrations of homes within the area including Edelweiss Mountain and Pactola Estates. Edelweiss Mountain, in particular, is located in a somewhat precarious position. Located in the upper third of a substantial drainage, structure protection and firefighting would be a dangerous proposition under high fire danger weather conditions.

The Pennington and Lawrence County Wildfire Protection Plans (CWPP) (Pennington County, 2006, Lawrence County, 2009) identifies three buffer distances: one half, one and one half, and three miles around private property. The three mile buffer guideline places the entire project area within the WUI. Both the CWPP's state, "The goal of fuels reduction projects will be to reduce the risk from fire by lowering fire intensities and reducing crowning and torching activities that threaten values in the WUI." In essence, the CWPPs call for lowering the fire hazard in and around the WUI allowing for a safer firefighting effort.

Pactola concentrated public use area (CPUA) is within the project boundary and is an epicenter for summer time recreation. Up to 50,000 visitors use the Pactola CPUA during an average 110 day season (Ballard, 2011). Two campgrounds, two picnic areas, boat ramps, and numerous trailheads exist. US Highway 385, the major north/south corridor through the Black Hills, provides the eastern boundary to the project area.

Forest Plan direction pertaining to WUI include the following:

- Goal 10 of the Forest Plan provides direction for management of vegetation in and around the wildland urban interface (WUI).

- Objective 10-01: "Manage for 50 to 75 percent moderate-to-low fire hazard in the wildland-urban interface and reduce fire hazard within proximity of structures to current NFPA (National Fire Protection Association) standards…"
- Objective 10-04: "Reduce or otherwise treat fuels commensurate with risks (fire occurrence), hazard (fuel flammability), and land and resource values common to the area, using the criteria in Forest-wide Guideline 4110"

Research Natural Areas
The 589 acre Canyon City Research Natural Area (RNA) lies within the Pactola Project Area. The purpose of the RNA is to have a designated area for "non-manipulative research" and to maintain biological diversity.

The Canyon City RNA is approximately three quarters of a mile from Silver City, a registered ARC. Forest Plan direction pertaining to RNA and ARC include the following:

- Goal 10-03: "Within 5 years of a formal research natural area (RNA) designation, manage for a moderate-to-low fire hazard between RNAs and at-risk communities (ARCs) and other resources as needed where the topography, wind conditions, and fuels could create the potential for high-intensity crown-fire spread to the ARCs or resources."

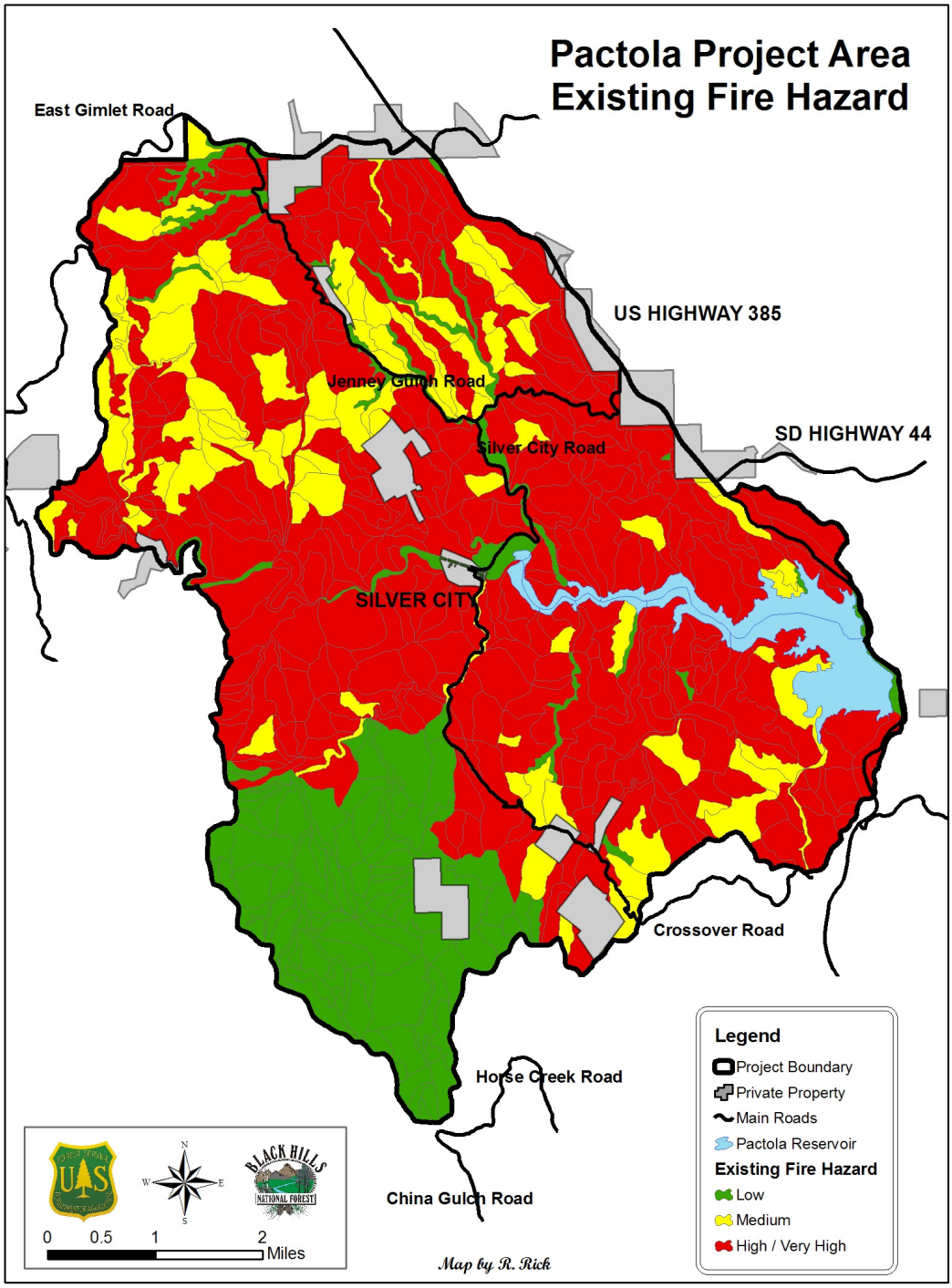
Air Quality
The project area is within the vicinity of South Dakota's Class I Airsheds: Wind Cave National Park (approximately 35 air miles south) and Badlands National Park (approximately 55 air miles east southeast). Class I Airsheds are considered pristine. Air quality in most parts of the country has to be at or slightly above National Ambient Air Quality Standards; Class I areas can tolerate little if any degradation in air quality – primarily from a visual standpoint. In 1997, The Environmental Protection Agency (EPA) issued PM 2.5 standards to protect health and the environment. PM 2.5 standards are levels allowed in the outdoor air for particulate matter 2.5 microns in diameter or smaller—a better measure of air quality degradation from forest fire emissions than the previous standard of PM 10 (10 microns in diameter or smaller). EPA has issued two standards for PM 2.5: and annual standard, at 15 micrograms per cubic meter; and a 24 hour standard at 35 micrograms per cubic meter.

The Clean Air Act requires state and local governments to take steps to reduce fine particle pollution in nonattainment areas. The term "nonattainment" means that an area violates the fine particle standard or that it contributes to violations of the standard in a nearby area. The entire state of South Dakota is in attainment status; so far, there is no history of air quality violations from prescribed broadcast burning in the Black Hills or surrounding areas. "Smoke management" is an essential element of the prescribed broadcast burn planning process, and a legal requirement during the implementation phase. Prior to ignition, the "Burn Boss" must demonstrate through weather forecasts and test fire observations that the smoke emissions would be in full compliance of National Ambient Air Quality Standards.

A Dangerous Trend
Over the entire project area, 63% of the NFS lands receive a high or very high fire hazard rating (see Figure 3-7). Continuous aerial fuels, combined with steep and broken terrain,

create the environment for a potential fast moving stand replacing fire. Direct experience has shown that continuous stands of ponderosa pine can easily support sustained runs of crown fire, either day or night, given the correct weather conditions. High fire severity is a real danger to the existing forest resources but the real danger is to life safety. Rapidly moving fire can easily cut off escape routes for the public and emergency services.

Figure 3-7 Fire Hazard Rating Map for the Pactola Project Area



Few studies have been done on MPB, ponderosa pine, tree mortality, and fire. Consequently, we do not have a firm research basis on which to draw conclusions, anecdotal evidence and field experience is currently the best way to draw conclusions.

Insect Hazard closely correlates with Fire Hazard Ratings and structural stages previously mentioned. One year post infestation, a ponderosa pine's needles will begin to fade and ultimately turn rust red by season's end, (Hopkins, 1905). A fading (dying) or "red top" (dead) ponderosa pine might more easily support the transition from a surface fire to the crowns due to the lack of foliar moisture present within the needles (given the correct weather conditions). The potential for crown fire may increase for this relatively short time while the needles are still attached to the tree. Needles fall from the dead tree in as little as six months or as long as two years depending on weather factors. The fire hazard, as defined by structural stage, would lower dramatically due to the lack of crowns. With less vegetative cover, sites would become dryer due to increased solar insulation and surface winds. Within five years, 70-95% of the dead trees would fall to the ground (Schmid et al. 2009). The fuel profile has now changed dramatically. The potential for crown fire would disappear in areas severely affected by the MPB. However, fuel continuity would remain albeit different. Surface fuel loadings would go from a typical fuel model 9 (needle cast) at approximately four tons per acre to fuel model 10 (heavy surface fuels) at approximately 15 tons per acre (GTR INT-122, 1982). A fire passing through this fuel model would be slower moving than a crown fire, but would be resistant to control due to higher fireline intensities, flame lengths exceeding four feet (flame lengths greater than four feet require mechanized equipment) and spotting from fire brands. Resulting damage to residual trees, regeneration, and soils would most likely be severe. Direct experience with prescribed fire in Fuel Model 10 has shown that even under moderate conditions, care must be taken to prevent tree torching (fire transitioning from the surface to the crowns of individual or small groups of trees) and crown scorch (crowns being damaged from convective heat release), both of which can result in mortality of young and mature trees.

Environmental Consequences

Alternative A – No Action

Direct and Indirect Effects

Under the No Action alternative, no vegetative management would take place. Change towards desired conditions as outlined in the Forest Plan would not occur. Direction given in the Healthy Forests Restoration Act, National Fire Plan, and the Pennington County and Lawrence County Wildfire Protection Plans would not be met.

Fire exclusion would continue, furthering the departure from historic fire return intervals. Currently, 15,559 acres or 63% of the total acreage within the Pactola Project Area are rated as high or very high. Fire risk would also increase with more people and resulting infrastructure moving in the WUI. As fire hazard and risk increase, the potential for a large stand replacing fire event would become more likely. Continuous stands of ponderosa pine would become denser and opportunity for human caused wildfires would

increase. Damage to forest resources would correspond with fire size, intensity, and severity. Values-at-Risk in the WUI would also be threatened to a higher degree. The threat to life safety of the public and emergency services would also become more of an issue. The ability to safely engage a fire during high fire danger would become more difficult as time passes.

The continuing Mountain Pine Beetle epidemic would expand in the project area. Crown fire potential could increase in the short term with dry red needles versus green. A more likely scenario would be large areas of living trees transitioning to areas of significant down woody debris over a three to five year period. Though the fuel profile and composition would change, the condition class of FRCC3 would not. This material would add to an already existing available fuel bed. Severity from a fire in this type of fuel model can be very high. Residual trees, regeneration, and soils could be greatly impacted. Regenerating ponderosa pine would most likely be prolific. Areas with thick growth of pine regeneration would undergo yet another fuel type change. The areas of down woody debris, Fuel Model 10, could transition to areas that would burn more a like a shrub fuel model. When ponderosa pine regenerates itself in the Black Hills, it often grow like "dog hair" (overstocked with saplings) and can burn like a shrub (see Silviculturalist's report). Fire intensity and rate of spread in this model are potentially very high and resistant to control.

Air quality would not be directly affected by Alternative A. The potential for a large stand replacing fire is greater with this alternative. A large wildfire within the project area would likely create unhealthy levels of smoke into the surrounding communities, but natural events are exempt from National Air Quality Standards.

The No Action Alternative would not be consistent with Forest Plan Goal 10, Objectives 10-1, 10-4, and 10-7.

Alternative B – Proposed Action

Direct and Indirect Effects

Under Alternative B, proposed activities would mechanically modify the fuel profile of 13,141 acres across the project area. This would include commercial and non-commercial treatments breaking up the continuity of the stands. Approximately 71 acres of non-commercial fuel breaks along private property would also occur. Many primary ingress/egress routes would be treated, but only where they correspond with planned logging activities. Primarily, treatments are to be "whole tree skidded" as opposed to "lop and scatter." Whole tree skidding reduces overall fuel loads by removing the entire tree versus just the bole of the tree and leaving the remaining slash on the ground.

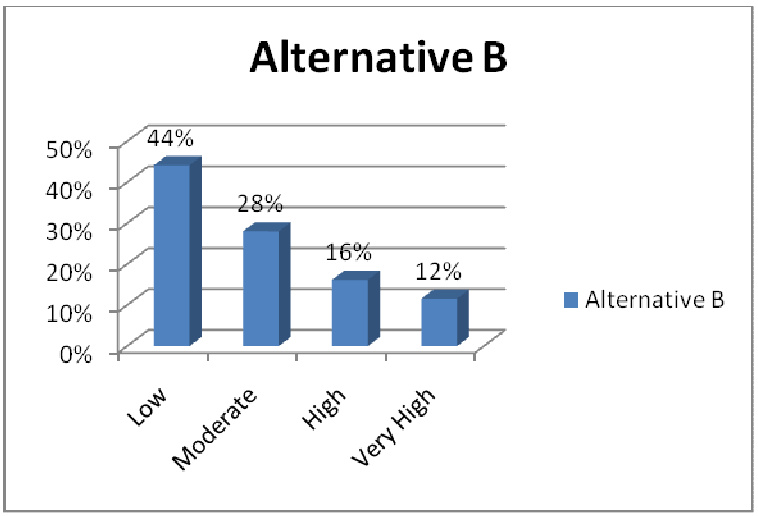
In addition to mechanical treatments, up to 5,037 acres would be treated with prescribed broadcast burning. Combining mechanical and prescribed fire treatments would reduce fuel loading and continuity across the landscape, therefore reducing the overall fire hazard. Treatments would also help bring the area back towards its historic fire regime reducing the threat of losing key ecosystem components and values.

Alternative B treatments would have the following effect on fire hazard as defined by structural stage within the Pactola Project Area:

Table 3-24 Alternative B Fire Hazard Rating for Pactola Project Area Using Structural Stage Data

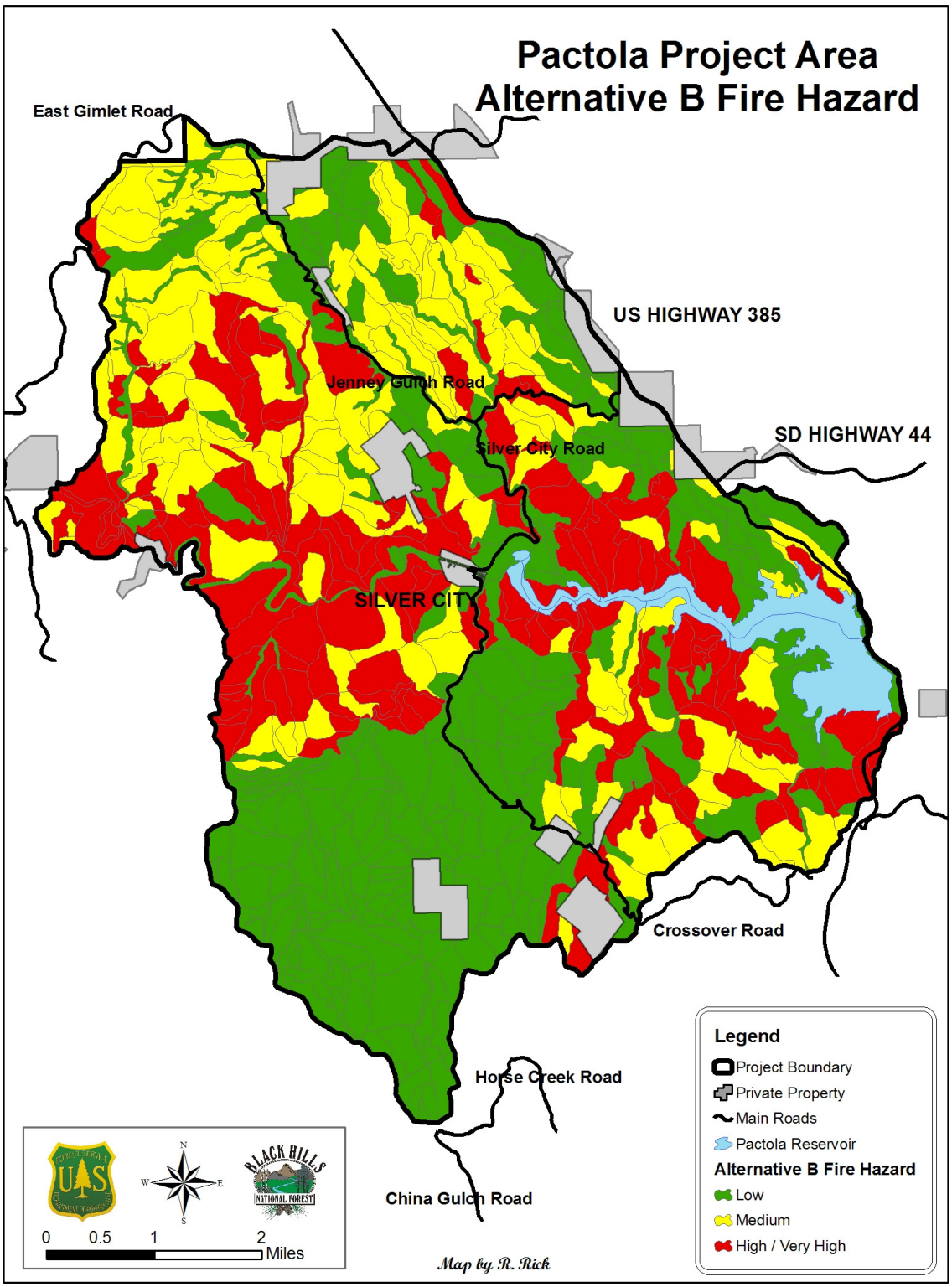
Fire Hazard Rating	Acres
Low	10,986
Moderate	6,969
High	4,028
Very High	2,880

Figure 3-8 Alternative B Fire Hazard Rating for Pactola Project Area Using Structural Stage Data



Alternative B would be consistent with Forest Plan Goal 10, Objectives 10-01, 10-04, 10-06, 10-07, and Guideline 4110. Alternative B would also meet the recommendations of the Pennington and Lawrence CWPPs. Alternative B would reduce the high/very high fire hazard rating from 63% to 28% in the project area (see Figure 3-9). In addition to reducing fire hazard, Alternative B would lower risk from the MPB. By reducing the acreage at high risk to the MPB, potentially large areas of Fuel Model 10 would be avoided reducing fire severity and intensity, therefore fire fighting safety and effectiveness would increase. Areas not directly treated by mechanical thinning or prescribed broadcast burning would indirectly benefit as well. By breaking up continuity of ponderosa pine stands, the potential for a running crown fire is reduced.

Figure 3-9 Alternative B Fire Hazard Rating Map for Pactola Project Area



Alternative B would also meet the intent of Standard 4103 and Guideline 4105 by allowing up to 5,037 acres of prescribed broad cast burning. A reduction of surface fuels would be the most noticeable effect of broadcast burning. There is a direct relationship between surface fuel loading and high severity fire. Crown fire is initiated, and generally sustained, by energy released by fuels on the surface burning under extreme conditions. Another direct effect would be raising the canopy base height. Fire "prunes" ponderosa pine by scorching the lower branches, thus raising the height of the crowns or canopy. Reducing ponderosa pine seedling and sapling densities is also an expected outcome. All of these effects have a positive impact on potential fire severity. Less noticeable effects would include returned nutrients to the soil and improved wildlife habitat by stimulating herbaceous plants and browse for large game animals.

Figure 3-10 Horse Nugget Prescribed Fire

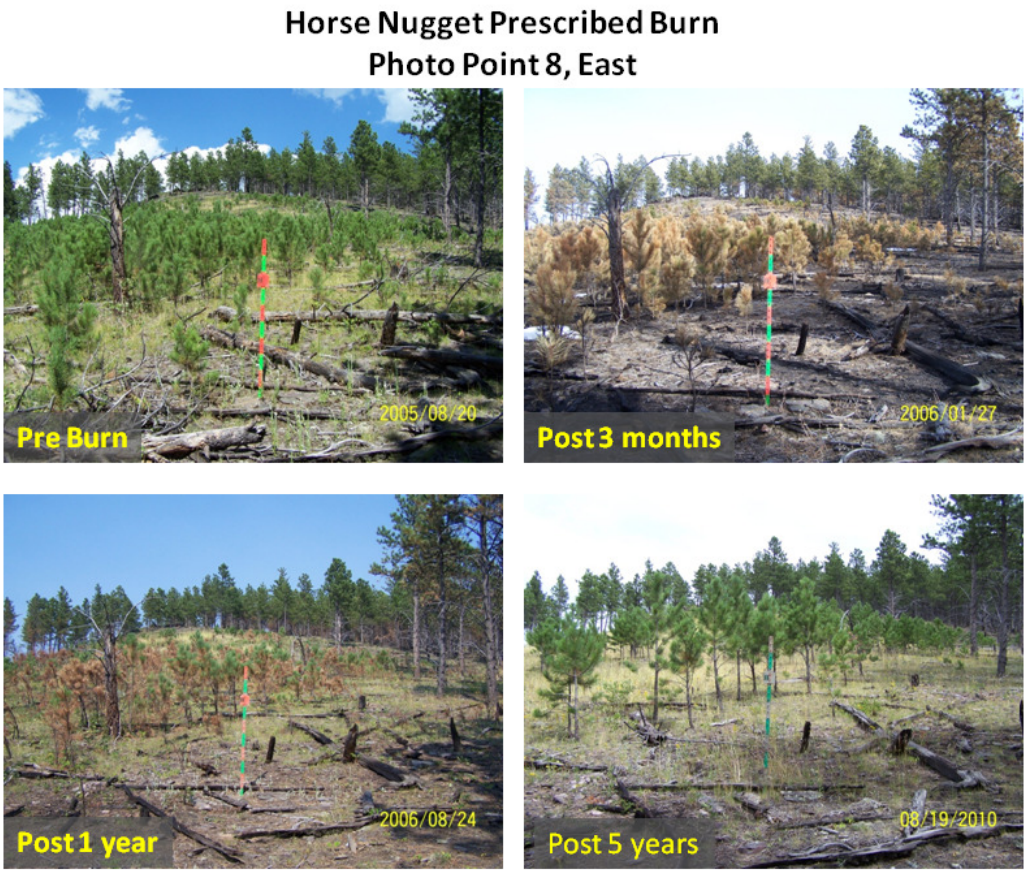


Photo monitoring from the Horse Nugget prescribed fire. Notice the reduction in fuels and thinning of pine regeneration.

Alternative B would also allow for maintenance burning in the Horse Nugget, Snugget, and McVey prescribed burns. Approximately 3,600 acres of the total prescribed burning has previously been burned since 1988. Within these past burn projects, tree mortality occurred and by returning fire to these areas, the down trees would be consumed. With each repeated burn fewer trees would be expected to succumb to the fire. As many as seven treatments might be necessary to return an area to its' historical range (Reinhardt et al. 2008). Prior to ignition, a "Burn Plan" would be written that state objectives, environmental conditions,

operational considerations, etc. Tree mortality parameters (part of the objectives) are written into individual Burn Plans by the District Silviculturalist. As the tree size class increases, the corresponding allowance for mortality decreases. A good example of a Silviculturalist's prescription is from the Horse Nugget Prescribed Fire:

Table 3-25 Example of Silviculturalist's Prescription for Horse Nugget Prescribed Fire

Mature Pine 16"+ dbh	Large Pine 9"-16" dbh	Pole Size Pine 5"- 9" dbh	Sapling Pine 3"-5"	Seedling Pine 0-3"
<2%	<5%	<20%	<30%	<60%

Percent of allowable tree mortality by size class in the Horse Nugget prescribed broadcast burn ("dbh" equals diameter at breast height, four feet off the ground).

Recent studies have concluded that following mechanical treatments with prescribed broadcast burning is the best way to ultimately reduce fire hazard and severity well into the future (Omi et al. 2007, Stephens et al. 2009). Allowing thinning without follow-up broadcast burning can actually increase wildfire severity. Experience on numerous broadcast burns on the Mystic District has shown that it is difficult to burn residual slash, even under moderate conditions, without resulting group tree torching or a high degree of crown scorch. The balance of acres not treated with prescribed fire should be whole tree skidded versus allowing lop and scatter. This would be critical in lowering surface fire hazard and severity.

All prescribed fire acres for the Pactola Project are within Management Area 5.4, Big Game Winter Range Emphasis. Management is to emphasize a vegetative mosaic with natural and created openings. Stand diversity of age, density, and species with ample browse for large game are all aspects of the desired future condition (USDA Forest Service 2005a).

Combining these mechanical and prescribed fire treatments would reduce fuel loading and continuity across the landscape, therefore reducing the overall fire hazard. Treatments would also steer the area back towards its historic fire regime, reducing the threat of losing key ecosystem components and values.

Air Quality during prescribed burning would be affected. Prescribed burning emits concentrations of gases, water vapor, and particulate matter that may impair human health, welfare, and visibility. During prescribed fire operations gases are quickly diluted and are generally low in concentration, and therefore public health hazards are negligible. Smoke dispersion forecasts produced by the National Weather Service are taken into account prior to ignition. These dispersion forecasts are one of the primary factors included in the decision making process to proceed with ignition. Notification of the general public living in the area should be given a reasonable time prior to the day of ignition. Night time hours are generally when smoke would have the greatest negative impacts. Residual smoke generally settles to the ground with cooler temperatures and often flows down drainages potentially affecting "sensitive receptors." The Mystic Ranger District generally tries to complete ignition operations as early in the day as possible to allow for more combustion time before night time temperature inversions set up. Prescribed fire generally occurs in the fall and spring in the Black Hills and surrounding areas. Certain weather conditions allow for prescribed broadcast burning to occur and only a limited number of days are considered to be a "good weather window." Coordination between Forest Districts and

other Agencies helps mitigate negative impacts on air quality by preventing all units from burning simultaneously. No air quality violations have been recorded to date by the South Dakota Department of Environment and Natural Resources, however, a growing concern about particulate concentrations have been noted. (Schultz, 2011)

Alternative C

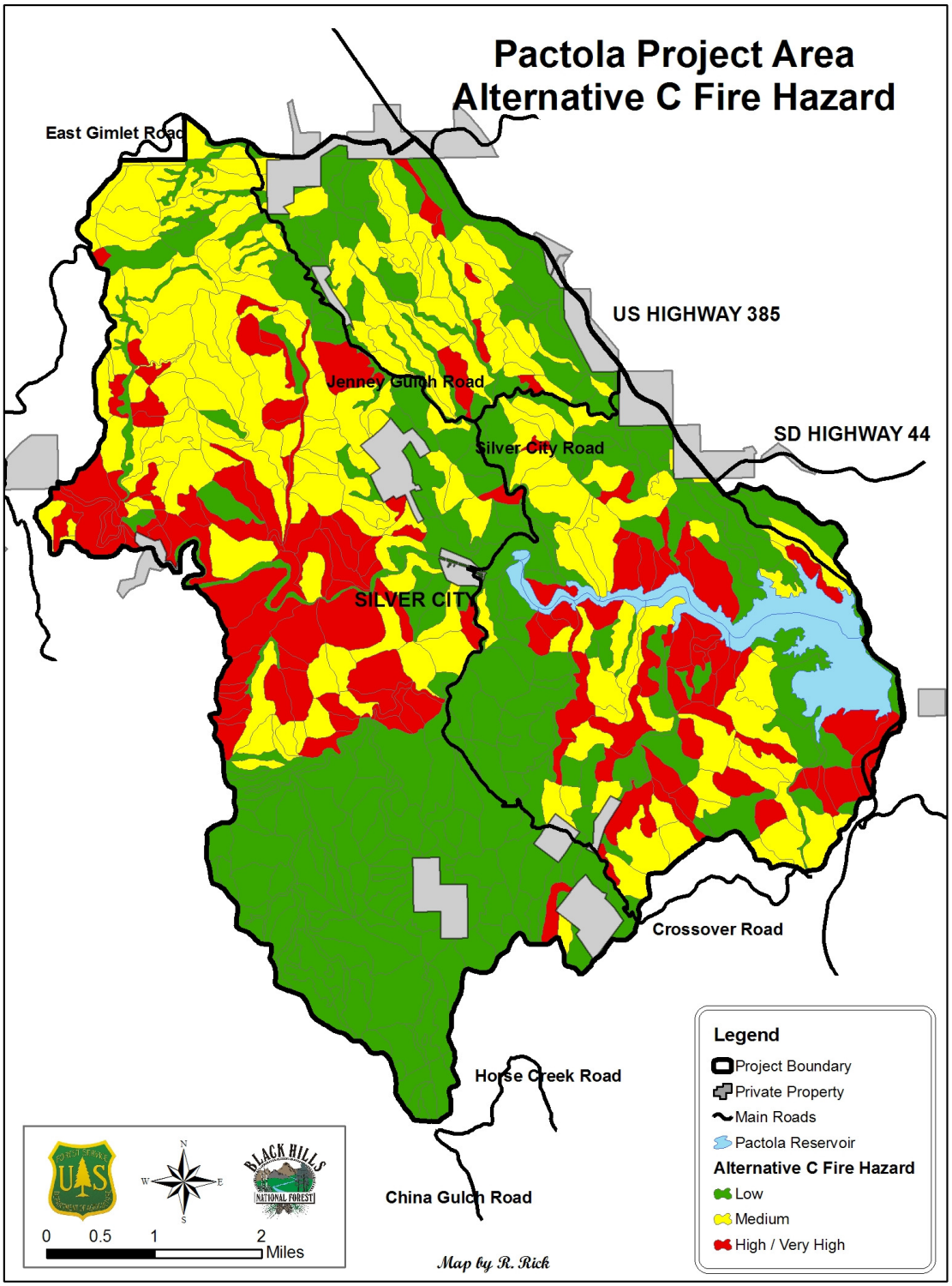
Direct and Indirect Effects

Under Alternative C, proposed activities would mechanically modify the fuel profile of 17,412 acres across the Pactola Project Area. Nominal acreage has been added to treatments as outlined in Alternative B. Prescribed fire on the same 5,037 acres are included as well. There are two primary additions to Alternative C: 1,269 acres of cable logging, 436 acres of roadside treatments, and the option of helicopter logging up to 500 acres as a sanitation tool.

Cable logging allows for steeper terrain to be treated as compared to traditional ground based logging methods used in the Black Hills. Slope can be a key factor in initiating and sustaining crown fire. Large fire events spread, to a great extent, by spotting; firebrands can be lofted into the air and land downwind often times from ridge top to ridge top. By treating steeper terrain, the ability for surface fire to transition to crown fire can be reduced, lowering the fire hazard as determined by structural stage. Residual slash from cable logging can be problematic for fire suppression under normal situations. Without this treatment, though, most of the mature trees on the steep slopes are likely to succumb to the MPB. The result would be steeper hillsides transitioning from the existing Fuel Model 9 to Fuel Model 10 with greater fire line intensities and flame lengths. Mechanically treating this steeper country would, over the long term, lower surface fire hazard by removing the boles of the trees, therefore reducing the potential tons per acre.

Alternative C includes 436 acres of additional roadside treatments. These treatments are primarily commercial in nature, though non-commercial thinning would also be taking place within these ingress/egress routes. By treating additional roadway corridors, safety would increase for vehicles either leaving or entering the area in the event of a wildfire. These acres would more fully help meet guidelines set in the Pennington and Lawrence County CWPPs. Alternative C would reduce the high/very high fire hazard rating from 63% to 20% in the project area (see Figure 3-12).

Figure 3-11 Alternative C Fire Hazard Rating Map for Pactola Project Area



Helicopter logging would be an additional option allowed in Alternative C for sanitation removal of MPB infested trees. Only the boles of the trees would be removed leaving the residual slash on the surface. These concentrations of slash would be nominal due to the selective use of the helicopter and would be less than if the entire tree were to fall to the ground.

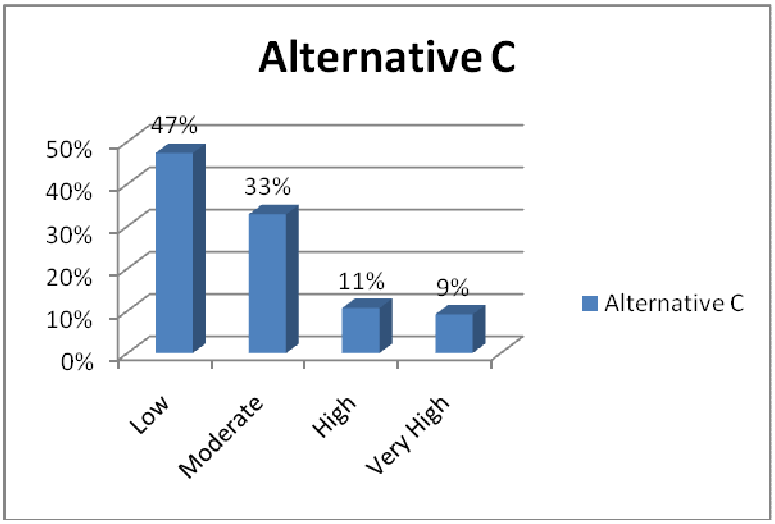
Alternative C would be consistent with Forest Plan Goal 10, Objectives 10-04, 10-06, 10-07, and Guideline 4110. This alternative would exceed Objective 10-1 in the short-term.

Using structural stand stage data from the Silviculturalist's Report, Alternative C treatments would have the following effect on fire hazard within the Pactola Project Area:

Table 3-26 Alternative C Fire Hazard Rating for Pactola Project Area Using Structural Stage Data

Fire Hazard Rating	Acres
Low	11,776
Moderate	8,167
High	2,650
Very High	2,280

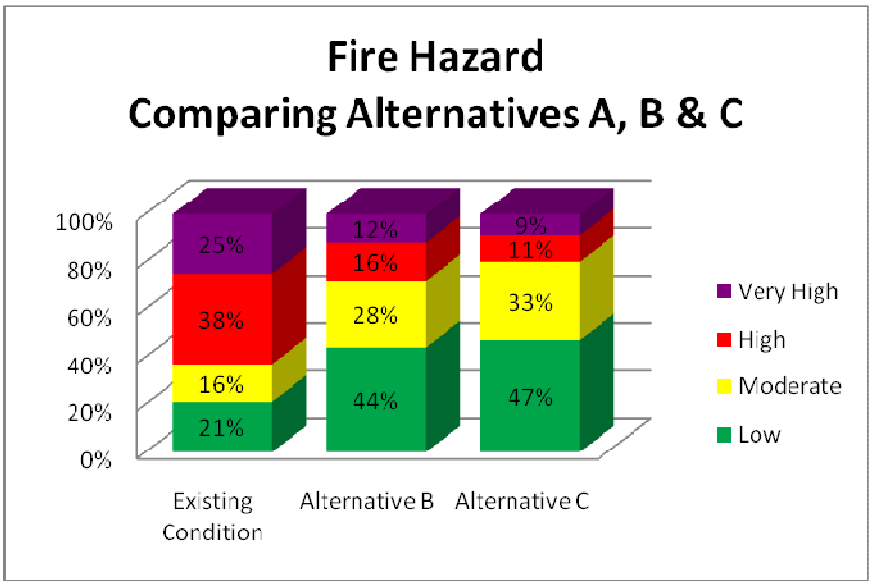
Figure 3-12 Alternative C Fire Hazard Rating for Pactola Project Area Using Structural Stage Data



Cumulative Effects

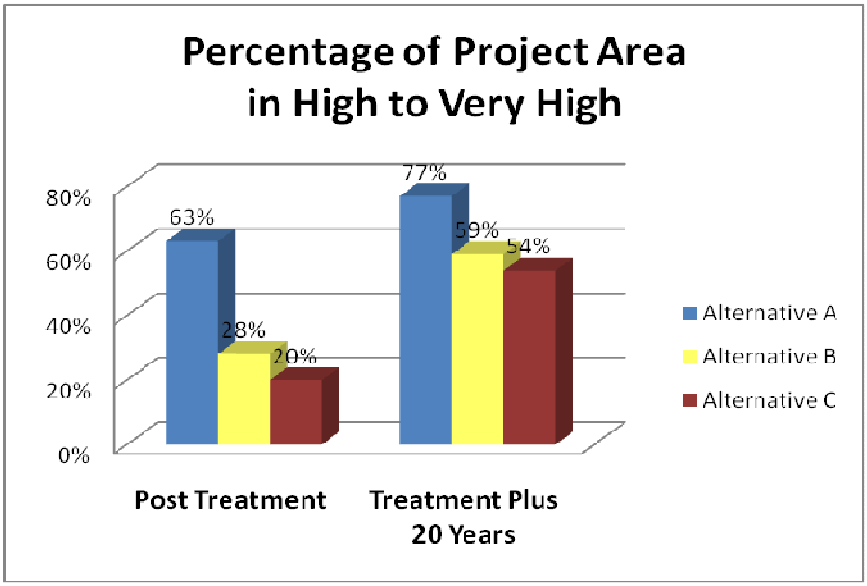
Fire Hazard would be expected to be reduced significantly with both Alternative B and C. A comparison of the Alternatives shows the potential positive results of timber management in the Pactola Project Area.

Figure 3-13 Fire Hazard Comparison of Alternatives



However, conditions change rapidly in a Fire Regime I forest. Pine regeneration can be prolific, often exceeding 1,000 stems per acre in the Black Hills, favoring disturbed soils resulting from timber sales or fire (Battaglia et al 2008). With this regeneration, Fire Hazard would begin to again increase (at a significantly lower level) than if no management were to take place. However, the fire hazard in 20 years would be expected to be lower in Alternatives B and C if no management were to take place.

Figure 3-14 Fire Hazard Comparison of Alternatives Post Treatment and Treatment Plus 20 Years



The caveat in using structural stage to describe fire hazard during this period of MPB epidemic is explained as follows: Fire hazard as defined by structural stage (crown density/closure), whether we manage or not, will go down. The resulting tree mortality due to the MPB will break up the continuity of the stands reducing the "fire hazard." The difference would be the

shift from a dense, high fire hazard stand, potentially supporting a crown fire to a high fire hazard surface fuel load. Either option has potentially negative effects on public and firefighter safety. Fire suppression efforts would also be negatively impacted. The unknown is the potential magnitude and impact of the MPB on the Pactola Project Area. Without treatment, large areas would likely be affected by the MPB (see Silviculturalist's Report).

Fire risk (in terms of human-caused fire) would most likely increase within the Pactola Project Area in the next 20 years as more people move into the WUI. As more people move into the WUI, a corresponding amount of values-at-risk would appear, as well. Consequently, the cost and complexity of suppressing wildland fires would increase. Reducing Fire and MPB Hazard in the Pactola Project Area should have a positive impact on fire size, severity, and magnitude of inevitable wildland fire incidents. This should help offset increased complexity in the WUI. The potential impact to forest resources and private property should be reduced, as well.

A substantial reduction in Fire Hazard from Alternatives B and C should have a positive effect on reducing fire severity and magnitude of subsequent wildfires. The possibility of losing key ecosystem components would be minimized and would provide for a safer environment for emergency services to engage wildland fires. A substantial reduction in fire hazard should also mitigate the potential for a large fire event to release massive amounts smoke into the air. Reducing possible fire severity should also protect forest resources by reducing tree mortality. However, it is critical to understand that a continuing commitment to fuels management within this project area is required to realize the benefits of this project into the future.

RANGE

Affected Environment

The Pactola Project Area overlaps three cattle grazing allotments on the Mystic (MY) Ranger District and one on the Northern Hills (NH) Ranger District. The Silver City Allotment is essentially entirely within the area, while only portions of the other three allotments are affected. Permitted livestock grazing has been a recurring use in the project area since the time the U.S. Forest Service was created in 1905. Annual grazing use is authorized by a Bill for Collection for grazing fees. Livestock may not be placed on the allotment until grazing fees payment is accepted.

Suitable rangelands are appropriate for grazing with consideration of environmental and economic consequences, and alternative uses. The majority of NFS lands within the project boundary are currently under management for cattle grazing; an area around Pactola Reservoir is managed for recreational uses. Forest Plan standards and guidelines for all resources affected by grazing are followed.

There are 731 cow/calf pairs permitted to graze these allotments. Livestock numbers may vary if a permittee elects to take non-use or substitutes some yearlings for the cow/calf pairs. At any given time during the grazing season, there may be cattle within and confined by range improvements (fencing, cattleguards) to pastures in the project area. Pasture rotation

schedules and instructions (including rest of some pastures) are revised on an annual basis during winter meetings with the term grazing permit holders.

The fences on these allotments have been constructed to create pasture and allotment division boundaries, and thus control the movement of cattle from pasture to pasture. Often these boundaries are linked to topographic features such as steep forested slopes or rocky ridgelines. Fencing is also used along road right of ways and for exclosures to protect spring sources.

Range improvements are designed to manage grazing in a manner that sustains the vegetative and watershed resources, provides for a variety of biologically diverse ecosystems, moves range conditions towards or maintain at a desired status, and provides for sustained commodity uses in an environmentally acceptable manner. Improvements within the Pactola Project Area include structures such as exterior and interior pasture barbed wire fences, water developments (stock tanks, ponds, and dugouts), spring exclosures, corrals, and cattleguards. Range improvements such as fences and water developments are used with salting to control and gain distribution of cattle. Permittees are responsible for maintenance of designated improvements, cost share in construction or new or rebuilt structures.

The timing of grazing use such as moving on to the forest, or to and from a pasture may vary from season to season. Additionally, livestock numbers and length of grazing season can be adjusted on an annual basis to adapt to availability of forage and drinking water.

Forage utilization monitoring is done periodically throughout the permitted grazing season to ensure Forest Plan standards and guidelines are met. Permittees are responsible for moving livestock when allowable proper use standards or riparian stubble heights will be exceeded. Additionally, some permittees have submitted monitoring data in written or verbal form on occasion. Study transects exist for some upland and riparian areas to improve monitoring efforts and track trends, and more are planned.

Allotment Management Plans (AMPs) with environmental assessment work that fulfill direction from the 1995 Range Rescission Act are completed for three of the five allotments. The Bald Horse and Redfern Allotments are covered by the Mystic Range Project's Final Environmental Impact Statement (FEIS) and Record of Decision (ROD) signed October 22, 2010. New AMPs are planned for these two allotments.

The affected pastures within the Pactola Project boundary provide forage opportunities for cattle and use by a variety of wildlife including big game such as elk and whitetail deer. There are many meadows of varying sizes and shapes found in both uplands and valley bottoms. Most meadows are being invaded by small pine. In this project area, most meadows are confined to narrow drainages surrounded by ponderosa pine or in some instances spruce. Other woody vegetation such as aspen, birch, bur oak, and willows are generally linear-shaped stands and also show active pine or spruce encroachment. The hardwood stands also provide some forage for cattle; livestock interest this understory vegetation may vary depending on the time of use.

These meadow areas are designated as primary range because they are accessible to cattle, produce good quality grass forage, and often have dependable water – either spring fed water tanks, flowing seeps in drainages, or catchment basins for run-off. In dry years, there are

inconsistent water sources in some pastures within all allotments which can limit cattle grazing use and distribution. From the late 1990s through the mid 2000s, seven years of drought depleted forage plant root reserves and ground water storage. Abundant moisture in 2009 and 2010 has restored much of the depleted ground water storage as evidenced by visible surface water flows.

Water developments aid by increasing cattle distribution and providing more dependable watering sources for livestock and wildlife. These structures are constructed to maximize water use while reducing resource effects from excessive trailing, trampling of spring sources, and congregating actions by cattle. The goal is to provide cattle and wildlife with suitable drinking water in addition to and away from riparian areas such as creek channels and protected spring sources. Supplemental dispersed watering locations help to conserve riparian habitat from excessive cattle and wildlife use.

Often existing water developments need renovation and new ones need to be constructed when natural vegetation barriers are altered thru vegetative management. The cattle respond by changing grazing patterns, and often travel into new places previously inaccessible prior to tree removal.

During the drought, a lack of widespread, dependable watering sources in some pastures has increased cattle trailing to remaining water sources, and increased congregation of cattle in some upland and riparian areas. Length of use adjustments and resting of pastures has helped alleviate these effects, but continued vigilance is necessary to deal with drought. Term grazing permittees, in coordination with the Forest Service, responded to these effects with a variety of tactics including annual reductions of herd size, adjusting on/off dates, and developing or renovating existing water sources.

Overall, upland rangelands within this project area are generally in stable, satisfactory condition with some locations appearing to show increasing numbers of plant species after previous vegetative treatments (Ursek and Severson, 1998). There are some primary range areas where forage and soil conditions show heavier use; causal factors may include periods of drought, ineffective cattle distribution efforts by a permittee, pine encroachment reducing available grazing acreage, and the duration of permitted use. Moderate to heavy use of some riparian areas has occurred during the drought, and stream channels show the effects of such cattle use.

In recent years portions of range allotments within the Pactola Project area have been subject to timber sales. Generally these sales reduced mature pine stands down to a basal area (BA) of around 80 square feet/acre using commercial thins and overstory removals. These sales have reduced the density of ponderosa pine, creating some transitional (secondary) range grazing opportunities for cattle and use by big game (Sieg, 1996) (Ursek and Severson, 1989). This level of timber harvest does create additional short-duration forage opportunities but growth from residual trees rapidly shades out understory vegetation. These opportunities seem to last no more than ten to fifteen years based on local range personnel observations.

Noxious weed and invasive species control is an on-going cooperative effort (see Noxious and Invasive Weeds report). Treatments after past timber harvests have been completed; these include chemical and biological tactics designed to control, reduce, or eliminate infestations.

Light cattle use of these secondary areas has been observed by district staff and some permittees. Some forage within opened up forested areas tends to be less preferred by cattle. It has been observed and suggested that these grasses are less palatable to cattle when found in close proximity to residual pine trees and needle cast (Beckner, 2007). Ursek and Severson (1988) found that total nutrients can be altered by reducing the forest overstory, but this result is from increased plant production, not from changes in forage quality. They reasoned that increased opportunities for ungulates to exercise selective feeding resulted from increased forage diversity and total plant production.

Even with past timber harvests to 80 BA, there still are progressive, increasing reductions in forage production occurring from the development and encroachment of woody vegetation into primary rangelands. As the pine moves into the meadows, the net result is reduced forage available, and further confinement of cattle and big game competition into smaller areas.

Natural vegetation barriers can be altered thru vegetative treatments, and additional fencing may be needed to keep cattle in the correct pasture. Treatments may include timber sales, POL (Products other than Logs) sales, thinning, and prescribed burning. These vegetative actions can be beneficial by creating new grazing opportunities, or detrimental if cattle move into the wrong pasture or allotment, or onto private property or roadways.

Some exterior boundaries of pastures or allotments adjoin private lands. Construction, installation, and maintenance of private land line fences and cattleguards are the responsibility of the private landowner under existing federal laws. In the past, many of these private properties were owned by ranchers or private individuals with livestock, and they generally kept their fences maintained. The trend has been for these lands to be sold off, sometimes subdivided, and the new landowner(s) often have no interest in fence maintenance or cattleguards.

Often private landowners do not understand the Forest Service's position on boundary fences between private and NFS lands, and refuse to cooperate with the permittees, despite the District's attempts to explain the U.S. Government's long-standing position and U.S. Supreme Court support for such laws. While permittees are encouraged to work with the private landowners on fence maintenance, they are under no legal obligation to do so.

One positive aspect of the transition from adjacent private ranches to home sites is there are fewer incidents of privately owned livestock (not permitted and authorized) intruding onto the National Forest Lands.

Currently, the lack of private land boundary fences or maintenance of said fences often hinders cattle management in some pastures of the Silver City Allotments. Cattle retention on NFS lands may be more difficult for permittees to achieve when private landline fencing is not properly maintained. One result is incomplete cattle grazing next to interface locations. This can result in increases in fine fuel accumulation and subsequent elevated fire hazard in these areas.

Development of the transportation system for these past timber sales has improved the access of permittees to manage their cattle and maintain or construct range improvements such as fences or water developments. Where pasture fences cross roads or trails and no cattleguard exists, wire gates are used. These gates are used to move cattle from one pasture to another or perhaps on or off the NFS lands. Where heavy traffic exists from motorized vehicles, there is a

tendency for wire gates to be left open. Open gates usually result in cattle entry into the wrong pasture, or an area previously grazed or not yet intended for use. Cattleguards are used in these locations to allow traffic to pass unimpeded, including logging equipment and haul trucks, while restricting cattle movement to specified pastures.

Slight increases in water yield from reducing numbers of pine trees may occur with sale activity, but these gains are gradually reduced as remaining trees grow and regeneration of pine seedlings occurs. Changes in water yield are discussed in the hydrologist's specialist report.

Whole tree skid is much preferred by the permittees and Forest Service range managers as lop/scatter of slash residues impede cattle and wildlife access to range, forage, and browse.

Environmental Consequences

Alternative A – No Action

Direct and Indirect Effects

Term permitted grazing use would continue as authorized. No new vegetative or prescribed fire treatments are planned except for those projects derived from previously approved environmental analysis. There would be no change in carrying capacity (Animal Unit Months (AUMs)) as from Alternative A's implementation. Permittees would continue to be provided administrative access to conduct range management activities within closed areas per District Ranger approval. Range structures would be maintained and improved as necessary to continue cattle management at its current scope and intensity, subject to forest-wide standards and guidelines. Fence lines would need encroaching pine and brush cut back with chainsaws to remain open and accessible for repairs and maintenance. Current levels of fine fuel removal (grass) accomplished by cattle grazing will continue to reduce ground fire hazards.

The current transportation system in Alternative A remains unchanged. Open and seasonally open motorized road miles remain unchanged. No roads are identified for decommissioning, and unauthorized routes remain in place. Permittees would continue to be provided administrative access to conduct range management activities within closed areas per District Ranger direction and approval. Past development of the transportation system for these old timber sales has improved the access of permittees to manage their cattle and maintain or construct range improvements such as fences or water developments.

New AMPs with approved Mystic Range FEIS/ROD (USDA Forest Service, 2010b) work that fulfill requirements from the 1995 Range Rescission Act would be completed for the Bald Horse and Redfern Allotments. When completed, these two allotments would join in with the already approved analysis and AMPs for the other three allotments with updated range management direction for forage, browse vegetation, and watershed resources.

Water yields for stock ponds and springs may decline as developing and encroaching woody vegetation draws ever-increasing amounts of surface and ground water for plant processes (see Watershed, Geology, and Soils section). Meadows and hardwood stands would continue to be subject to conifer encroachment, and their individual size and landscape spread reduced in acreage and location. These reductions would continue unless some type of mechanical treatment action or wildfire of sufficient magnitude occurred.

Ponderosa pine trees would continue to be infected and die from the mountain pine beetle infestation. Most of these dead trees eventually break up or fall over the next five to ten years, often at accelerated rates with high winds (reference the Battle Creek Fire area 2002-2010). Such tree breakage and windthrow has historically been shown to impede cattle access to primary and secondary rangelands. Large areas are opened up to sunlight, and a variety of plants appear including forbs, grasses, and shrubs. Tree downfall has blocked cattle access and the increased amounts of fine fuel growth are not grazed by domestic livestock.

Where opportunities exist to improve existing range management, they will be identified and subject to scoping, a new environmental analysis and decision document may be necessary, and subsequent updates or changes to existing approved AMPs may be required.

Cumulative Effects

There are no anticipated cumulative effects that would impair or unduly influence short-term range management of the allotments within the Pactola Project Area if Alternative A was selected. Both existing and future AMPs will indicate direction to be followed to improve or sustain desired range conditions and capacity. However, there are several emerging threats to sustainable cattle grazing: 1) diminished water yields may result from expanding and growing woody vegetation and may reduce watering supplies (this may be offset by the forecasted large scale die-off of ponderosa pine from the mountain pine beetle); 2) encroachment of woody vegetation on grazeable areas reduces available forage and potentially cuts back carrying capacity over time; 3) the risk of large-scale wildfire is increased with this alternative, and any ignition may disrupt grazing use for a period of time to allow for resource recovery; and 4) experience with large scale wildfires on the Black Hills have demonstrated that remaining black stems of trees that are not harvested will decay, fall over, and block access to vegetation by cattle and wildlife.

Alternative B – Proposed Action

Direct and Indirect Effects

Under this alternative, term permitted grazing use would continue as authorized. There would be no change in carrying capacity (Animal Unit Months (AUMs)) as currently allocated since vegetative openings from treatments would increase available forage for livestock. Range structures would be maintained and improved as necessary to continue cattle management at its current scope and intensity, subject to forest-wide standards and guidelines. Fences would still need brushing to remain open and accessible for repairs and maintenance, but not to the level as in Alternative A since commercial and non-commercial treatments are planned with Alternative B which would clear fence lines to varying degrees.

Additional construction of more barbed wire fences may be needed as natural barriers to cattle distribution are opened by new roads, mechanical treatments and/or prescribed burning. Fencing and water developments do exist throughout the Pactola Project Area that would need protection from commercial and non-commercial treatment activities such as road construction, road closure, harvest machinery, and skidding. The same improvements will need protection from prescribed fire implementation.

There are 13,141 acres of vegetative commercial and non-commercial treatments planned with this alternative as well as 5,037 acres of prescribed fire use. Alternative B's treatments would effect and increase herbaceous and shrub production over Alternative A since they create canopy openings. Vegetation is either mechanically removed or in some cases consumed with prescribed fires, or in some cases both actions proposed sequentially. These treatments would allow more sunlight to reach the ground underneath the remaining ponderosa pine trees, and increase production of grasses and browse for cattle and wildlife use. The initial quantity of this vegetation usually increases distribution of cattle throughout the project area (Ursek and Severson, 1988), into primary and secondary rangelands.

Proposed vegetative treatments may congregate cattle near private land line fences in need of maintenance or reconstruction, aggravating working relationships with nearby neighbors. In contrast, there would be ample adjacent areas with enhanced forage (after thinning and tree removal) to draw cattle away from private property.

There would be substantial reductions in conifer encroachment into meadows and hardwood stands (retention and restoration) as approximately 2,132 acres of these vegetative types are planned for treatment, in addition to about 3,770 acres of POL thinning and non-commercial work. These treatments would initially increase the amount of available forage and browse found within these vegetative types, based on past range personnel local observations.

Current levels of fine fuel removal (grass) accomplished by cattle grazing would continue to reduce ground fuel hazards. The initial response of existing grass plants to a more open growing environment may produce higher levels of grass production than current permitted numbers of cattle can harvest each season. Follow-up prescribed fire after vegetative treatments have been demonstrated on the Black Hills NF to produce even higher levels of forage and browse production. This is also true with applied fire in areas where no vegetative treatment has occurred, although plant response is generally not as great compared to commercial and non-commercial treated areas with follow-up fire application.

By temporarily increasing the number of cattle or the number of days the permitted livestock are kept in a pasture where vegetative treatments, prescribed fire treatments, or both have occurred and stimulated higher levels of grass production, the increase in fine fuels (biomass) can be annually removed by grazing. This process may be annually repeated to effect an immediate change in fire behavior by reducing the rate of spread and fire intensity. The result would be to annually crop the new grass growth (fine fuels) to maintain conditions that support desirable fire behavior. This temporarily permitted activity has been accomplished on another allotment by following standards and guidelines to protect other resource values. Such permitted action may be useful in wildland/urban interface settings within the Pactola Project Area.

Given the proposed size and scope of prescribed burning, it may be difficult to not displace some permittees from their respective allotments for a period of time. Prescribed burning may have positive or negative effects on livestock operations, hence coordination is critical between the fuels management specialist and the range management specialist to: 1) plan the projected dates of the burn; 2) to relocate cattle within the allotment and allocate forage in advance to assist in prescribed fire execution and accomplishment of objectives; 3) adjust grazing seasons;

and 4) relocate permittee's cattle or administer non-use for resource protection during the planned ignition, if necessary. This may include construction of additional range improvements to defer or rest pastures after treatment in accordance with forest plan standards and guidelines. Advance warning needs to be given to term grazing permittee(s) to minimize, where possible, disruptions to their operation.

A slight increase in water yield may occur with Alternative B, perhaps more so than experienced with Alternative A due to the landscape nature of MPB mortality acres, and all vegetative commercial, non-commercial, prescribed fire treatments. See Watershed, Geology, and Soils section for more information.

The road system is adjusted in this alternative to meet existing and anticipated future transportation needs. Total forest road miles are minimally increased in this alternative compared to Alternative A. Permittees would continue to be provided administrative access to conduct range management activities within closed areas per District Ranger approval, but methods of access may vary from past approaches due to the new Travel Management Plan (USDA Forest Service, 2010). Any new miles added to the transportation system from Alternative B would further enhance the access of permittees to manage their cattle, and maintain or construct range improvements such as fences or water developments.

The projected declines in water yields for stock ponds and springs from expanding woody vegetation's demand on surface and ground water are anticipated to be slowed or slightly reversed by implementing Alternative B. See Watershed, Geology, and Soils section for more information.

Tree breakage and windthrow has historically been shown to impede cattle access to primary and secondary rangelands. Under Alternative B, large areas are opened up to sunlight, and a variety of plants generally appear including forbs, grasses, and shrubs. Cattle are more likely in Alternative B to access more area, and therefore reduce more fine fuels than in Alternative A.

Where opportunities exist to improve existing range management, they would be identified and subject to scoping, a new environmental analysis and decision document may be necessary, and subsequent updates or changes to existing approved AMPs may be required.

Cumulative Effects

There are no anticipated cumulative effects that would impair or unduly influence short-term range management of the allotments within the Pactola Project Area if Alternative B was selected. Increased forage production would promote wider distribution of livestock and may improve riparian conditions. Eventually, temporary increases in forage production would subside as confer regeneration and growth shades out understory vegetation. Both existing and future AMPs would indicate direction to be followed to improve or sustain range condition and capacity. However, there are still the emerging threats to sustainable cattle grazing such as the risk of large-scale wildfire. Any large acreage ignition may disrupt grazing use and damage or destroy range improvements. A large scale wildfire can also cause dead trees which would decay, fall over, and restrict access to vegetation by cattle and wildlife.

Alternative C

Direct and Indirect Effects

Under this alternative, term permitted grazing use would continue as authorized. There would be no change in carrying capacity (Animal Unit Months (AUMs) as currently allocated. Range structures would be maintained and improved as necessary to continue cattle management at its current scope and intensity, subject to forest-wide standards and guidelines. Fences would still need brushing to remain open and accessible for repairs and maintenance, but not to the level as in Alternative A. When compared to Alternative B, commercial and non-commercial treated acreages with Alternative C are slightly larger and may clear more fence lines to varying degrees. This means there may be slightly lower levels of repairs and maintenance needs with Alternative C when compared to Alternative B.

Additional construction of more barbed wire fences may be needed as natural barriers to cattle distribution are opened by new roads, mechanical treatments and/or prescribed burning. Fencing and water developments do exist throughout the Pactola Project Area that would need protection from commercial and non-commercial treatment activities such as road construction, road closure, harvest machinery, and skidding. The same improvements would need protection from prescribed fire implementation.

There are 16,908 acres of vegetative commercial and non-commercial treatments planned with this alternative, as well as 5,037 acres of prescribed fire use. Alternative C proposes treating more acres by commercial and non-commercial methods than Alternative B – primarily through helicopter and cable logging efforts. It is anticipated that slightly more fence construction may be needed since less natural barriers to cattle spread would be intact after harvest.

Fencing and water developments do exist throughout the Pactola Project Area that would need protection from commercial and non-commercial treatment activities such as road construction, road closure, harvest machinery, and skidding. The same improvements would need protection from prescribed fire implementation.

Alternative C's treatments would have more affect on total herbaceous and shrub production than Alternative B since more acres are treated, and when also compared to Alternative A. Vegetation is again either mechanically removed or consumed with planned fire use, or in some cases both actions proposed sequentially. These treatments would increase production of grasses and browse for cattle and wildlife use. The initial quantity of this vegetation should increase distribution of cattle throughout the project area.

There would be substantial reductions in conifer encroachment into meadows and around hardwood stands (restoration) as approximately 2,428 acres of these vegetative types are planned for treatment, in addition to about 4,540 acres of POL thinning and non-commercial thinning work. Alternative C's increases in forage and browse would be larger than experienced with Alternative B since more acres are treated.

Any improvements in water yield are anticipated with Alternative C are expected to be similar to those with Alternative B. See Watershed, Geology, and Soils section for more information.

Current levels of fine fuel removal (grass) accomplished by cattle grazing would continue to reduce ground fuel hazards. Like Alternative B, the initial response of existing grass plants to a more open growing environment may produce higher levels of grass production than current permitted numbers of cattle can harvest each season. But this increased production would be more with Alternative C since more acres are treated than Alternative B. Vegetative responses (similar to Alternative B) are expected following prescribed fire use after vegetative treatments. Grazing (term or temporary permits) crops new grass growth and may maintain fine fuel conditions that support desirable fire behavior.

As discussed in Alternative B, prescribed burning may have a positive and negative effect on cattle grazing based on the timing and location of the burning. Coordination between the fuels management specialist and the range management specialist is crucial, and needs are the same as expressed in Alternative B.

The road system is adjusted in this alternative to meet existing and anticipated future transportation needs. Total forest road miles are increased in this alternative compared to Alternative B to accomplish cable logging. Four miles of new road construction is proposed, as well as another fifteen miles of road for cable logging. Roads constructed for cable logging are proposed for closure to the public after use. Permittees would continue to be provided administrative access to conduct range management activities within closed areas per District Ranger approval, but methods of access may vary from past approaches due to the new Travel Management Plan. Any new miles added to the transportation system from Alternative B would further enhance the access of permittees to manage their cattle, and maintain or construct range improvements such as fences or water developments.

The projected declines in water yields for stock ponds and springs from expanding woody vegetation's demand on surface and ground water are anticipated to be slowed or slightly reversed by implementing Alternative C. This would be similar to Alternative B's anticipated results. See Watershed, Geology, and Soils section for more information.

Under Alternative C, large areas are opened up to sunlight, and a variety of plants appear including forbs, grasses, and shrubs. Cattle are more likely in Alternative C to reduce more fine fuels than in Alternative B since more acres are treated with Alternative C.

Where opportunities exist to improve existing range management, they would be identified and subject to scoping, a new environmental analysis and decision document may be necessary, and subsequent updates or changes to existing approved AMPs may be required.

Cumulative Effects

The anticipated cumulative effects are the same as shown in Alternative B's narrative.

NOXIOUS and INVASIVE WEEDS

Affected Environment

Known noxious weed and invasive plant sites (known collectively as "noxious weeds" for this section) within the perimeter of the Pactola Project Area are found over approximately 472 acres. National Forest System lands (NFS) and private property within and adjacent to the project area have established noxious weed populations including, but not limited to: Canada thistle, Leafy spurge, Houndstongue, Yellow toadflax, Musk Thistle, Bull thistle, Scotch thistle, Whitetop, Chicory, St. Johnswort, Common tansy, Burdock, Common mullein, Spotted knapweed, and Perennial Sow thistle. Past treatments within this area have been done on a yearly basis in some locations due to the Canada thistle and Leafy spurge infestations.

Noxious weeds may be spread by a variety of agents. Tires on mechanized vehicles may trap weed seed or plant parts within treads. Logging equipment and service vehicles may contain viable seed within their machinery, only to have the material loosen and fall out in a new location. Forest visitors may entrap weed seed within their clothing, gear, or shoes and similarly loose the seeds in other locations. Use of uncertified noxious weed free hay and feed may also bring in new seed stock. Livestock, big game, and birds may disperse seed after ingestion. The list of agents is vast and only limited by lack of weed seed within an area and its availability for dispersal.

In the past five years, about 600 acres of noxious and invasive weeds have been treated in the project area. These treatments were completed using a variety of chemical and biological methods. Actions taken were approved integrated weed management practices (BHNF EA, 2003).

Biological control sites were established on five new sites in 2009 within the project area with Aphthona Flea beetles for Leafy spurge control and Canada thistle Urophora gall flies. Aggressive biological control methods help establish insect colonies to control the spread of Leafy spurge and Canada thistle. Monitoring of sites occurs and depleted insect colonies may be re-stocked.

Field evaluations are conducted in the project area to assess effectiveness of chemical and biological control measures, determine and document losses of productive vegetation, and locate areas of new infestations of noxious and invasive weeds. Established noxious weed populations within the project area have been mapped using GPS units. County and private lands within and adjacent of the project area have established noxious weed populations that have been identified through mapping and coordination with the Pennington County Weed and Pest Supervisor. Almost all efforts are being recorded with GPS units to monitor for new weed invasions. NFS roads and trails, and county roads within the project perimeter have been GPS'd to facilitate monitoring of noxious weed spread into and within the project area. Projected rate of spread per year for noxious weeds could be as high as 10 to 20 percent of the known acres with any ground disturbance. New weed areas are likely to be established with any additional ground disturbance because of the viability and distribution of weed seed in the project area.

Environmental Consequences

Alternative A – No Action

Direct and Indirect Effects

Under existing conditions, continued designated motorized route travel may increase the spread of noxious weeds and invasive plants. Even with normal road/trail use and maintenance of NFS and county roads within the project area, the projected rate of the spread of noxious weeds under no action may be as high as 10 percent per year, with the 472 acres of known noxious weed sites potentially serving as seed sources. Any activity off designated routes may also increase the percentage of noxious weed infestations and the possibility of new exotics being introduced into previously un-infested locations. The noxious weed infestations generally increase with the event of a wildfire, based on experience from Jasper (2000) and Battle Creek (2002) fires. It is believed this occurs due to the abundance of weed seed throughout the Black Hills area. The new Travel Management Plan would continue recreation activities in the project area because of the routes designated open for road and trail use by the public, and the Black Hills in general being a destination area for Forest visitors with motorized vehicles (USDA Forest Service, 2010). Additionally, the project area would still need to be monitored for new species and new infestations in areas of previous soil disturbance from past timber sales (e.g., Bullock Timber Sale). Noxious weeds may have a high spread rate even when left alone without any treatment. For example, noxious weeds such as Leafy spurge can increase in area by typical seed spread methods and by rhizomes; seeds may be expelled up to 15 feet in any direction. A wildfire area generally shows increases in noxious weeds if left alone without an integrated weed management treatment approach. Known noxious weed sites and new infestations would be managed as funds become available.

Cumulative Effects

Since weed seed appears to be present in many areas throughout the Black Hills, any ground disturbance may create a favorable seedbed for noxious weed establishment, especially around areas of high use. Such areas may include NFS roads, county roads, NFS trails, locations where livestock or big game congregate, large events on the Forest under special use permit, plus wildfire impacts and prescribed fire activities. Up to an estimated 10-20 percent of each ground disturbance may be added to the known 472 acres of noxious weeds and would need prompt treatment to avoid yearly increases in infested acres. Past experience with wildfires and prescribed fires indicates noxious weed infestations from these two disturbances have the potential to increase at similar rates found with logging activities.

Alternative B – Proposed Action

Direct and Indirect Effects

With the addition of 13,141 acres of commercial and non-commercial treatment, the associated ground disturbance would potentially increase the presence of noxious weeds to a greater degree than Alternative A. This is because there are more acres of ground disturbance from logging activities. Mitigation efforts generally reduce the amount and rate of increase of noxious weeds. In addition, 27 miles of road reconstruction (655 acres), 69 miles of pre-use maintenance (1,673 acres) and three miles of new construction (73 acres) would have to be monitored and possibly

treated for noxious weeds. Additionally, roads going into and out of the project area would have to be monitoring and probably treated for noxious weeds dispersed by hauling traffic.

Noxious weed seed stock is in all areas of the Forest, and most weeds have a seed viability rate much more than a native plant. For example, Canada thistle seeds may be viable as long as 30 years. Most other noxious weeds are viable from seven to ten years. Any ground disturbance creates a favorable seedbed to establish noxious weed populations, especially in and around skidder areas. Noxious weeds would establish quickly in these areas since they are geared to rapid growth in vacant sites. Native vegetation may take longer to re-establish in comparison to noxious weeds. Weeds take rapid advantage of the available local resources (soil nutrients and soil moisture), since little vegetative competition is present or newly established.

During the timber harvest efforts, vehicles and heavy equipment would move throughout the sale area(s) and through the weed infested lands. Many vehicles and heavy equipment used in and around the sale area have the potential to carry noxious weed seeds and increase the potential for noxious weed infestations. This potential is estimated at 10-20 percent of the known 472 acres with ground disturbance.

Logging trucks are hauling the logs out using existing or newly built roads. Some of these roads are to be closed after the sale has ended. These roads would also need to be treated for noxious weeds due to disturbed ground and debris coming off the equipment and logs. Avoidance of noxious weed areas is almost impossible during a timber sale since almost all areas in the Forest have an established noxious weed seed stock. Ground disturbance from skidder trails and operations on landings created during the timber harvesting efforts are expected to further increase noxious and invasive weed infestations.

Use of NFS roads, county roads and the NFS trails are expected to continue to contribute to the spread of noxious weeds.

Wildfires would also increase the spread of noxious weeds. Potential for large wildfires would be less than No Action since fuels are treated by harvest activity (see Fire and Fuels Section). Wildfire areas may need to be managed for noxious weed infestation since disturbed soils from fire line activities and/or high intensity burn areas may create suitable seedbeds.

The 5,037 acres of prescribed fire may also increase the chances of noxious weed spread on up to 20 percent of burned acres. This estimate is based on past experiences with prescribed burning on the Mystic Ranger District. These prescribed fire acres need to be monitored, and treated if necessary as soon as the weather permits and funding becomes available.

Cumulative Effects

The addition of 13,141 acres of commercial and non-commercial treatment with ground disturbance would potentially increase the presence of noxious weeds. In addition 27 miles of road reconstruction (655 acres), 69 miles of pre-use maintenance (1,673 acres), and three miles of new construction (73 acres) would have to be added for treatment of noxious weed control. Since weed seed appears to be present in many areas throughout the Black Hills, any ground disturbance would create a favorable seedbed for noxious weed establishment, especially in

and around skidder areas. Up to an estimated 10-20 percent of ground disturbance would be added to the known 472 acres of noxious weeds and would need prompt treatment to avoid yearly increases in infested acres. Past experience with wildfires and prescribed fires indicates noxious weed infestations from these two disturbances have the potential to increase at similar rates found with logging activities.

Alternative C

Direct and Indirect Effects
With the addition of 16,908 acres of commercial and non-commercial treatment, the ground disturbance would potentially increase the presence of noxious weeds to a greater degree than Alternative B. In addition 29 miles of road reconstruction (696 acres), 72 miles of pre-use maintenance (1,745 acres), and 19 miles of new road construction (461 acres) would have to would have to be monitored and possibly treated for noxious weeds. Additionally, roads going into and out of the project area would have to be monitoring and probably treated for noxious weeds dispersed by hauling traffic.

All other direct and indirect impacts are similar to Alternative B.

Cumulative Effects
The addition of 16,908 acres of commercial and non-commercial treatment with ground disturbance would potentially increase the presence of noxious weeds. In addition 29 miles of road reconstruction (696 acres) and 72 miles of pre-use maintenance (1,745 acres), and 19 miles of new road construction (461 acres) would have to be added for treatment of noxious weed control. Since weed seed appears to be present in many areas throughout the Black Hills, any ground disturbance would create a favorable seedbed for noxious weed establishment, especially in and around skidder areas. Up to an estimated 10-20 percent of ground disturbance would be added to the known 472 acres of noxious weeds and would need prompt treatment to avoid yearly increases in infested acres. Past experience with wildfires and prescribed fires indicates noxious weed infestations from these two disturbances have the potential to increase at similar rates found with logging activities. These cumulative effects are similar to Alternative B, and perhaps slightly more extensive due to additional acres proposed for treatment with this alternative.

WILDLIFE

This section documents what is currently known regarding wildlife and habitat resources in the Pactola Project Area on Mystic Ranger District and analyzes the potential effects of three alternatives to Management Indicator Species (MIS) and Species of Local Concern (SOLC). Data were collected and compiled from field surveys (2009-2010), District wildlife observation data, South Dakota Natural Heritage Program (South Dakota Game, Fish and Parks Department 2011a), literature reviews, communication with District personnel, and the Wildlife Report completed for the Phase II Amendment to the Black Hills National Forest Land and Resource Management Plan Revision (USDA Forest Service 2005a, Appendix C).

The goals and objectives for the Pactola Project Area for the wildlife resource are to protect basic soil, air, water, and cave resources and provide flora variety of life through the management of a biologically diverse landscape. These goals and objectives, along with the Black Hills National Forest Land and Resource Management Plan (hereafter Forest Plan) and Standards and Guidelines as amended by Phase II, would provide and maintain an appropriate mix and balance of habitats over the long term. This diversity would provide habitats to maintain populations of all vertebrate and invertebrate wildlife and plant species in the area, and would not result in any individual species trending toward or becoming listed as threatened or endangered. The area would provide for a variety of wildlife recreational opportunities, ranging from consumptive to non-consumptive activities (e.g. hunting to wildlife viewing).

This section tiers directly to the revised Forest Plan and the Phase II Forest Plan Amendment EIS and the associated Biological Assessment/ Biological Evaluations (BA/BE) (USDA Forest Service 1996, 2005a, Appendices H and C respectively). The Forest Plan, as amended, provides direction on how the area should be managed to comply with laws, regulations, and policy. The actions proposed would ensure that vegetative management and associated activities are in compliance with Forest Plan goals, objectives, standards, and guidelines, and any other applicable laws, regulations and policies.

Existing Condition

Area Description

The Pactola Project Area supports a diversity of plant community types because of the range of elevation in the project area and variations in geology. The Ponderosa Pine/Bearberry Woodland, Ponderosa Pine/Sedge Woodland, and Ponderosa Pine/Common Juniper Woodland communities comprise the majority of the area. Smaller communities such as Spruce/Twinflower Forest, Aspen/Shiny-leaf Spiraea Forest, and Ponderosa Pine/Little Bluestem Woodland, can also be found in the uplands. Riparian communities are mostly White Spruce Alluvial Black Hills Forest, Water Birch/Red-osier Dogwood Shrubland, Western Herbaceous Vegetation, and Beaked Willow Scrubland. Refer to the Black Hills Community Inventory (Marriott et al. 1999) for a more detailed discussion of plant communities. Ponderosa pine and white spruce are encroaching into many of the hardwood and meadow community types because of suppression of the natural fire regime. Riparian community types occur along perennial streams such as Rapid, Jenny, Kelly, Jim, Nugget, Bear, and Empress Creeks. There are also numerous intermittent streams with varying amounts of available water and associated riparian vegetation. A majority of the streams flow into Pactola Reservoir. Due to the steepness of slopes in the area, many of the roads are in drainages with some close to stream courses. Developed recreation facilities are predominately adjacent to Pactola Reservoir, but several trails are found in the area (e.g., Deerfield, Centennial) and a walk-in fishery is west of Silver City.

Historical Perspective Resulting In Current Existing Condition

A majority of the land within the Pactola Project Area has been altered to some extent, some areas more than others. Primary land uses include timber production, mining, livestock grazing, human habitation, and recreation. Additionally, fire suppression has greatly altered the forest ecosystem.

Wildfire and Reforestation
Wildfires have affected portions of the Pactola Project Area. In 1939, the McVey Wildfire (3,034 acres) was a high intensity, high severity fire. This type of fire not only consumes vegetation but also creates hydrophilic soil conditions. A couple of large rainfall events following the fire occurred. The results were narrow soil profiles with very little duff/litter on intensively burn areas, that limit forage production. After the McVey Wildfire, pine seedlings were planted in an effort to reforest the area. Most of these pine seedlings were of inferior stock, resulting in short, branchy trees that are infected with gall rust. These trees for the most part are considered low commercial value, therefore limited vegetation treatments have occurred in the McVey Wildfire area. Due to their growth patterns, forested areas in the McVey Wildfire area have become closed canopied, limiting forage production. On dryer sites, pine was not planted, leaving scattered grass dominated openings, especially on south-facing slopes. However, through time, these openings are slowly becoming smaller and more isolated due to pine encroachment. Following the McVey Fire, the amount of forage and aspen increased. Coupled with low snow accumulation, the area became a big game winter range. Several prescribed burns have been completed in the past 20 years in the McVey area to reduce pine regeneration, increase aspen suckering, and improve forage for wintering big game. Smaller wildfires have occurred but are not considered stand-replacing events.

Fire Suppression and Insect/Disease Processes
The ponderosa pine ecosystem in the Black Hills evolved in dynamic equilibrium with recurrent disturbances, especially fire, insects, and short-term and long-term climatic cycles (Parrish et al. 1996). A century of fire suppression has caused widespread alteration and degradation of wildlife habitat in the Black Hills (Brown and Cook 2006, SAIC 2003). Frequent recurring disturbances like fire and forest insect epidemics maintained a generally open, mature pine forest with a productive and diverse understory by thinning pine stands and creating open stands with abundant grasses, forbs, and shrubs in the understory (Sieg and Severson 1996). In the absence of frequent low-intensity fires, the increase in the density and canopy cover of pine stands has resulted in large, contiguous expanses of higher density trees with abundant pine regeneration with sparse understory (Parrish et al. 1996). Such stands are more susceptible to large-scale insect epidemics and wildfires. These shifts have increased habitat for species that prefer dense, mid-aged forest while decreasing habitat for wildlife species associated with more open forest conditions. Historically, frequent fires created many different age classes of ponderosa pine and provided forage in the understory, thus enhancing diversity across the landscape (Uresk and Severson 1998). Fire suppression has also resulted in the conversion of hardwood stands such as aspen and bur oak to pine or spruce, which has reduced diversity (Uresk and Severson 1998). Encroachment of pine into meadows and riparian areas has reduced grass, forb, and shrub abundance. The increased biomass of pine has altered hydrologic conditions by decreasing available water within the watersheds. Fire suppression, for the most part, has had negative effects on wildlife habitats for some species in the Black Hills, including the Pactola Project Area (Parrish et al. 1996).

Mountain pine beetle outbreaks are a natural disturbance process in the Black Hills, attributed to being an important mortality agent in unmanaged and managed stands. Mountain pine beetle epidemics have periodically occurred every 20 years in the Black Hills (Negron et al. 2008, Schmid et al. 2007, Parrish et al. 1996). Since 1997, there has been an ongoing out-break of mountain pine beetle on the Forest that is predicted to continue for the next 3-5 years.

MPB can cause extensive tree mortality on ponderosa pine (USDA Forest Service 2010d). In the Black Hills, stands with higher ponderosa pine basal area in stands with >9"DBH and stand density index are more likely to be attacked by MPB (Negron et al. 2008, Fettig et al. 2007, Schmid et al. 2007). Currently, there are some very large and active pockets of current beetle caused mortality in the Pactola Project Area (USDA Forest Service 2010e). Beetle activity is found to some degree across almost the entire project area. This mortality has created continuous areas of heavy fuel hazards increasing the potential for creating large stand-replacing wildfires. Population levels of MPB have not yet peaked Forest-wide, where pine mortality would continue to increase in the next five years (USDA Forest Service 2010d).

Vegetative Treatment

Most of the Pactola Project Area has undergone vegetative treatment activities, mostly commercial and non-commercial treatments for wood production and fuel reduction, over the last 130 years. More recently, a portion of the project area was treated under the Lakes EA with some fuel hazard reduction projects ongoing. Some vegetative treatments that improve and maintain hardwoods, maintain meadows and grasslands have also occurred. Even-aged silviculture treatment of pine stands have resulted in single story and two-story stands ranging from seedling/saplings to mature trees of various canopy closure. The number and size of multi-level pine stands have been reduced and are scattered across the landscape. For the most part, slopes greater than 40% have not been treated, although portions of the Rapid Creek watershed have been treated using cable logging systems (Snugget and Banner Timber Sales). For cable logging to occur, most roads parallel the ridge-tops and are numerous. Some of the past cable logging roads in the Pactola Project Area has been closed to motorized vehicles (e.g., closure gates) until recently. The Forest Travel Management Plan decision would now allow motorized recreation in a portion of the old Banner TS area.

Meadows, grasslands, and ephemeral drainages have shown disturbance due to placement of landings and mechanical harvesting equipment. Reduction in pine overstory increases forage for both livestock and wildlife and may increase water availability in treated areas. However, these benefits decrease as pine overstory increases in size and canopy closure. Conifer removal from hardwood stands and pine removal from grasslands maintain these seral plant communities. Mixed pine-hardwood stands have also developed as bur oak and aspen have proliferated after the mature pine canopy is removed. To facilitate vegetative treatments, road densities have increased. Road locations and the number of roads create barriers to water flow, increase sediments into stream channels, increase invasive species spread that reduces habitat. Roads and their use have been identified as barriers to dispersal and corridors for predators which can be detrimental for some wildlife species (Smith and Keinath 2007, Smith and Stephens 2003). Roads create corridors for livestock to access areas that normally would not be available to livestock, especially on steep terrain and dense conifer understory. Noxious weeds have also proliferated in treated areas as a result of ground disturbance and increased access.

Grazing, Mining, and Residential Development

Historically, grazing by native mammals occurred in most of the northern Great Plains and the Black Hills. Prior to European settlement elk, deer, bighorn sheep (Audubon), and bison were the dominate grazers. Bison with population estimates ranging from 40-60 million, influenced plant communities (diversity) and their distribution in North American grassland ecosystems. Most native grasslands evolved under the influence of grazing. Large herds of bison and elk

created intensive disturbance for shorter periods of time in areas, then moved on to higher quality forage areas, thus creating a mosaic of heavily grazed areas and un-grazed areas across the landscape. In the late 1800's and during European settlement, many wildlife species were slaughtered for food by settlers, miners, and loggers. When game became scarce, livestock was introduced to the Black Hills. Grazing by domestic livestock has continued over the last 130 years in the Black Hills. Currently, livestock grazing occurs from approximately June to October on all allotments in or adjacent to the Pactola Project Area and often times yearlong on undeveloped private land. Allotment management has added fences, cattle guards, watering areas, and developed spring structures to the landscape to distribute livestock, reducing the effects of free-ranging livestock.

Wildlife grazing and browsing has periodically impacted vegetation as well. Around 1900 there were very few deer left and Manitoban elk had been extirpated in the Black Hills. From 1945-1955 deer numbers were at an all-time high, and numbers were believed to have exceeded those reported by the Custer Expedition of 1874. Rocky Mountain elk were reintroduced starting in 1912, and the population has slowly increased. These ungulate species have impacted vegetation and riparian conditions, particularly browse species (e.g. shrubs) when their populations are high. Current domestic livestock forage allocation and big game forage allocation are determined on the amount of forage available forest-wide, along with the South Dakota Department Game, Fish and Parks big game population objectives (USDA Forest Service 1996).

Mining towns, homesteads, and mining claims were established primarily in open valley bottoms and drainages adjacent to streams which provided a water source, thus altering riparian habitat within the Black Hills. Mining and homesteading began around 1875, with the first post-office in Pennington Co in the Pactola Valley. Along with tri-weekly stage service and the discovery of gold and silver, many that came to seek their fortunes settled the area, especially around Silver City, Canyon City, and the now underwater town of Pactola. The crouch line followed Rapid Creek from Rapid City to Mystic which required many bridges. Flooding caused tracks and bridges to be lost. In an effort to maintain the railway, Rapid Creek was re-directed to reduce the amount of bridges. Since 1907, numerous camps were located in the area including a CCC camp. In 1956, the Pactola Reservoir was built flooding the valley up to 4,621feet elevation (Silver City area). To facilitate mining operations, hay production and grazing opportunities for domestic livestock, homesteaders destroyed beaver dam complexes, drained wetlands, impounded water, removed riparian shrubs, and introduced exotic grasses and weeds. The results displaced wildlife and altered the hydrologic function of most streams, also affecting riparian habitat. The old mining towns (e.g., Canyon City, Pactola), lumber mills, and homesteads are mostly gone. However, a resurgence of residential development in the last 40 years on private land adjacent to or within the Pactola Project Area has occurred, with the most growth in the last 20 years. This growth and development of private lands has replaced native grassland, wet meadows, and riparian areas with houses and businesses that put more pressure on forest lands to provide habitat for resident wildlife species. Permanent private residences are abundant and scattered throughout the area, with concentrations of development along US Hwy 385 and Rochford Road, Jenny Gulch, Bear Gulch, and in the Silver City areas. Private land within the project area is mostly developed communities with some areas still used for agricultural purposes (e.g., livestock pastures). Private land development is still occurring, and the trend is expected to continue into the future that would limit habitat for many wildlife species. Open road densities have also increased with development, to provide access to

residential communities and isolated tracts of private land. Arterial and collector roads are being improved to allow for higher speeds and low clearance vehicles.

Hunting, Trapping, and Recreation

Hunting and trapping have affected wildlife species in the Pactola Project Area and the entire Black Hills over time. Some species, such as black bear, wolves, Manitoban elk, and Audubon's bighorn sheep have disappeared. Other species, such as beaver and their influence on the environment, have been greatly reduced in numbers. Species such as white-tailed deer and mule deer have gone through wide population fluctuations, from being nearly extinct at the beginning of the 20th century, to being severely overpopulated in the 1950s. Other wildlife species have been introduced to the Black Hills, such as Rocky Mountain elk, Rocky Mountain bighorn sheep, mountain goat, American marten, Merriam's turkey, and several species of trout. Currently, hunting and trapping is regulated by the South Dakota Department of Game, Fish, and Parks (SD Game, Fish, and Parks Department 2010b).

Concentrated recreation areas and dispersed camping occurs throughout the Black Hills, primarily during the spring, summer, and fall seasons. Recreation use on the forest continues to increase yearly, which impacts wildlife directly through mortality (hunting, vehicle collisions) and changes wildlife use and distribution through disturbance. Recreation development (e.g., trails, picnic areas) are increasing, especially along major travel routes and near Pactola Reservoir. In the Pactola Reservoir area, developed recreation areas include campgrounds, day use areas, trails, and fishing/boating facilities. These concentrated use areas draw recreation uses to adjacent areas. Motorized vehicle use of forest roads and OHV use has increased significantly in the past 20 years. Increased vehicle use has negatively impacted the forest, especially those areas close to residential subdivisions and towns. Un-regulated OHV use has created numerous un-maintained trails, causing fence line destruction and resource damage to roads, vegetation, slopes, stream courses, and riparian areas. This use has affected wildlife use in key foraging areas (e.g. big game winter range) through increased disturbance, increased erosion, and sedimentation, especially in riparian areas. Negative effects increase when conditions are wet or in cases where streams are crossed. In addition, increased recreation use and disturbance has allowed noxious weeds and invasive species to spread, affecting native plant communities and the species these support. In 2010, a Forest-wide travel management plan was approved where limited motorized use is limited to designated trails/roads which would drastically reduce the effects to wildlife. However, those areas where designated travel routes are identified, the effects of motorized use would continue to affect wildlife and their habitats.

Environmental Consequences

The analysis of direct and indirect effects for wildlife species focuses on Management Indicator Species (MIS), Species of Local Concern (SOLC) and R2 Sensitive species (See Pactola Project Wildlife/Fish Biological Evaluation), their habitat needs and their prey species availability as it relates to mountain pine beetle activity, vegetative treatment (e.g. commercial/non-commercial harvest and prescribed burning) and associated activities (e.g., road construction and noxious weed treatment). Fragmentation and connectivity of habitat communities as it relates to MIS species were analyzed as part of the Forest Plan EIS (USDA Forest Service 1996), and analyzed in relation to SOLC species in the Phase II EIS (USDA

Forest Service 2005a). The best available science for each species was taken in to account, which may include additional information and referencing (e.g., conservation assessments).

The cumulative effects analysis includes past, present and reasonably foreseeable actions that have had or are expected to have impacts to the Pactola Project Area (See Cumulative Effects Section below). The cumulative effect section will also discuss how the project would affect Forest-wide conditions as they pertain to meeting Forest Plan direction for wildlife and their habitat. The cumulative effects analysis area for wildlife species is geographically bounded by 8th order watersheds within the project boundary and those immediately adjacent to the boundary including private land. This was chosen because it is significantly larger than the home ranges of most wildlife residing in the Pactola Project Area, excluding migrations that occur outside of the Black Hills. For deer, bighorn sheep, and elk, geographic bounding includes migratory routes and winter ranges that occur in the project area boundary. The temporal bounding of cumulative effects evaluated varies among activities, but for the purposes of this section the temporal bounding is from 1997 and up to 15-20 years future. This range accommodates the period from the planning period (1996) to a time in which actions are reasonably foreseeable. Past activities that have affected the project area is discussed in the historical perspectives as it relates to the existing condition section in this report. Present and reasonable future activities evaluated are those most relevant to the area and to the species, and include insect and disease processes, fire suppression, fire occurrence, vegetative treatment (e.g., timber harvest, thinning, and fuel treatments), livestock grazing, prescribed burning, land development, roads, and recreation use. With the notable exception of land development, all of the activities occur on both public and private lands. The wildlife analysis is dependent on and/or complimentary to other specialist reports (e.g., hydrology, silviculture) for the Pactola Project EIS. The 1997 Forest Plan FEIS (USDA Forest Service 1996) and the Phase II FEIS (USDA Forest Service 2005a) addresses cumulative effects of Forest management at the eco-regional (Black Hills) scale; please see these documents for effects appropriate to that scale. Determinations and conclusion discussions for MIS, R2 Sensitive, and SOLC species includes the direct, indirect, and cumulative effects analysis.

Habitat Communities and Habitat Features

Ponderosa Pine

Many wildlife species occur in ponderosa pine communities. Most emphasis species are primarily associated with conditions favoring a deciduous understory (e.g., broad-winged hawk, Lewis's woodpecker) or late-successional conditions (e.g., brown creeper, pygmy nuthatch). However, some species (e.g., northern goshawk, white-tailed deer) utilize various seral stages of pine (e.g., structural stages) throughout the year (USDA Forest Service 2005a).

The effects to wildlife species due to epidemic levels of MPB in ponderosa pine are not well understood. The major change arising from MPB infestation is death of most if not all mature pine in a stand and thus the loss of the dominant tree canopy cover. Because MPB is a natural element of pine forests, wildlife species have adapted to periodic outbreaks and epidemics. Outbreaks may affect mature pine trees in a stand but do not usually kill all of the pine. The death of pine promotes growth of other vegetation including shrubs, hardwoods, and ponderosa pine seedlings. Shrubs and forbs may flourish providing a benefit to wildlife that uses this component (Uresk and Severson 1998). Forest structural stage changes due to MPB epidemic

levels would likely affect species or functional groups of wildlife differently, effects having both short-term and long-term consequences.

Open forest conditions are more likely to benefit herbivores (e.g., bighorn sheep, elk, and deer) and species that are dependent on shrubs and hardwoods. Cavity nesting birds often increase in abundance following stand replacing events but decline to pre-disturbance levels rapidly as foraging resources diminish. However, Lewis's woodpecker appears to benefit from prolonged open condition created by insect attack where large snags are available (Bull and Wales 2001, Abele et al. 2004).

Negative impacts, both short-term and long-term, are to species that are heavily dependent on mature pine, especially those that depend on pine seed, large diameter pine and dense stand conditions for foraging, nesting and cover (Klenner and Arsenault 2009, Ritchie 2008). For these species, the loss of mature forest may take a half-century or more to replace (USDA Forest Service 2010e). The greatest impact would occur in mature, monotypic stands of ponderosa pine where high mortality leads to the loss of almost all mature trees. Once snags fall, very open early seral conditions would prevail until understory recruitment is obtained. The more wide-spread the insect caused mortality, the more likely that the affected area would lose heterogeneity (Schmid et al. 2007, Fettig et al. 2007, Klenner and Arsenault 2009), thus affecting wildlife habitat availability long-term. Therefore, a long-term management objective for extensive areas severely affected by bark beetles is to provide habitat for a wide range of species through the maintenance of heterogeneity within and between stands (Klenner and Arsenault 2009). Vegetative treatments and prescribed fire along with natural disturbances that facilitate the rapid replacement of habitat features have proven to be effective to reduce the effects of MPB infestations and increase heterogeneity (Klenner and Arsenault 2009, Negron et. al. 2008, Fettig et al. 2007, Schmid et al. 2007).

The Forest Plan sets objectives for various MAs within the Pactola Project Area (5.1-204, 5.4-206) to manage for percentage of structural stages in ponderosa pine across these management areas that provide for emphasis species habitat. Forest Plan objectives 10-01, 10-04, 10-06, and 10-07 would affect meeting these pine structural stages at the project scale. There is no Forest Plan objective for pine in MAs 2.2, 3.7, and 8.2 but, these MAs do contribute to emphasis species habitat (USDA Forest Service 2005a). However, analysis and discussion of meeting Forest Plan objectives for ponderosa pine structural stages as they relate to wildlife habitat is tied directly to the discussion on ponderosa pine structural stages more specifically discussed in the Silviculture Report for the Pactola Project Area. Table 3-27 displays the existing acres of pine structural stages by management area in the Pactola Project.

Table 3-27 Existing Ponderosa Pine Structural Stages in the Pactola Project Area by Management Area

Structural Stage	MA 2.2 (acres)	MA 3.7 (acres)	MA 5.1 (acres)	MA 5.4 (acres)	MA 8.2 (acres)
1	0	0	0	106	0
2	0	0	0	221	4
3A	0	0	317	1,233	0
3B	0	29	645	1,201	204
3C	0	156	340	738	53
4A	0	39	1,101	2,641	397
4B	114	613	2,185	4,231	2,565
4C	433	281	739	973	758
5	0	0	0	0	0
Total	547	1,118	5,327	11,344	3,981

Table 3-28 summarizes the expected changes by percent in pine structural stages in the Pactola Project Area (all MAs) by alternative.

Table 3-28 Percent of Ponderosa Pine Structural Stages of All Management Areas Combined

Pine Structural Stages	Existing (%)	Alt. A (%)	Alt. B (%)	Alt. C (%)
1	0	0	0	0
2	1	17	13	12
3A	7	37	28	28
3B	9	5	2	1
3C	6	3	1	1
4A	19	24	45	48
4B	44	14	10	9
4C	14	0	0	0
5	0	0	1	1

Numbers taken from Silviculture Report

According to the Forest Plan Monitoring and Evaluation Report (FPMER), forest-wide MA 5.1 structural stages (SS) 1 and 4 are abundant, whereas SS 2, 3, and 5 are deficient. Forest-wide MA 5.4 SS 1 and 4 are abundant, whereas SS 2, 3, 4A, and 5 are deficient. To move a timber stand from one structural stage category to another, and thus move toward Forest Plan objectives, may require growth or several vegetation treatments spanning decades (USDA Forest Service 2010c).

In the Pactola Project Area, approximately 22,317 acres (89.8%) is a ponderosa pine plant community, of which 16,671 acres are in MAs 5.1 and 5.4. Existing pine structural stages indicate SS 1, 4A, 4B, and 4C are abundant, whereas the remaining structural stages (SS 2, 3, and 5) are deficient when compared to Forest MA objectives. Approximately 64% of the area is currently rated at high MPB hazard and 28% in moderate MPB hazard. In the Pactola Project Area, there is a high level of hazard (stand conditions) and a high level of risk (current beetle activity). Stands that have a high MPB hazard would be the most susceptible followed by moderate MPB hazard rating (USDA Forest Service 2010d, 2010e). Therefore the more mature and/or dense structural stages are changing quickly to younger, more open pine stands due to mortality caused by mountain pine beetle (USDA Forest Service 2010d). Further analysis in this section will focus on MA 5.1 and 5.4 objectives for ponderosa pine that are affected by the Pactola Project Area.

Alternative A - No Action

Direct and Indirect Effects on Ponderosa Pine

Alternative A would have no direct effect to pine structural stages. Shifts in pine structural stages within the area would occur due to MPB mortality in the next three to five (USDA Forest Service 2010e), reducing structural stages that are currently in the moderate to high insect hazard condition. Based on mortality estimates, structural stages 3C, 4C, and 5 would no longer be available (3%). Structural stages 3B and 4B would be reduced by >60%. These stands would move toward early seral structural stages and open canopies (1, 2, 3A, and 4A). These changes could result in a landscape wide loss of structural diversity, juxtaposition of habitats, and habitat components typically associated with mature or late seral habitats. Effects from MPB may be more severe and long-term depending on the intensity and longevity of the infestation in the area. This alternative has a greater potential for stand-replacing wildfire, compared to the action alternatives due to subsequent fuel loadings. A stand replacing fire (depending on intensity and severity) would exacerbate the loss of mature pine recruitment for a longer period of time, moving the area affected to SS 1, 2, and 3A. Loss of mature age classes would favor species that prefer open grass forb dominated areas and young pine stands but would reduce habitat for species that require mature pine long-term.

Estimated MPB mortality in MAs 5.1 and 5.4 in Pactola Project Area would move the project area away from structural stage objectives for 3B, 3C, 4B, 4C, and 5, but would have little effect on Forest-wide conditions for these MAs (1% or less). Movement from mature and dense structural stages caused by the MPB epidemic conditions would further increase structural stages 2, 3A, 4A in the Pactola Project Area, but would have only slight changes (1% or less) in Forest-wide structural stage objectives. However, this alternative maintains more of a structural stage mix, especially in structural stages 3B, 3C, and 4B compared to the action alternatives.

Alternative B – Proposed Action

Direct and Indirect Effects on Ponderosa Pine

In addition to MPB mortality, Alternative B in general would shift structural stages in treated stands to early seral stages and open canopies. In an effort to contribute to Forest MA objectives, treatments are focused to reducing susceptibility of stands to MPB attack (decrease hazard), reduce fire hazard, and decrease the potential for MPB to spread to un-infested stands.

Stand structure generally would be even-aged with the majority of the stand having an age within a range of 20 years from another. Treatments would greatly reduce structural stages 3B, 3C, 4B, and 4C, but would maintain or increase structural stages 2, 3A, and 4A. Structural stage 5 (late-succession) stands would be designated with limited treatment (sanitation). However, based on mortality rates (USDA Forest Service 2010e), the persistence of SS 3C, 4C, and 5 would not occur (<2%). Stands that are not treated are likely to succumb to MPB effects, moving these stands to early seral pine stages in the next five to ten years. Prescribed burning and fuel treatments would reduce fire hazard in those treated areas, increasing sunlight to the forest floor. However, treatments would reduce the potential for decay processes normally associated with mature and dense structural stages.

Changes in structural stage distribution as a result of MPB mortality and treatments are more drastic than compared to Alternative A but less so compared to Alternative C. MPB mortality and subsequent treatment in MAs 5.1 and 5.4 would move away from structural stage objectives for 3B, 3C, 4B, 4C and 5, but would have little effect on Forest wide conditions for these MAs (1% or less). Increases in structural stages 2, 3A, and 4A in the Pactola Project Area would have slight changes (1% or less) in these Forest-wide structural stage objectives. Species that prefer more open pine canopies and younger pine stands would benefit at the expense of species that require more mature pine stands short-term. However, treatments would increase the potential for long-term maintenance of structural stages 4 in the area (52%) compared to Alternative A (35%) that would increase the potential to maintain older mature habitat in the area long-term.

Alternative C

Direct and Indirect Effects on Ponderosa Pine

Mountain pine beetle effects and treatments in this alternative are similar to Alternative B but this alternative would treat additional acres using cable and helicopter logging systems on stands that are not accessible using conventional ground-based systems. Stand structure generally would be even-aged with the majority of the stands having an age within a range of 20 years from another. Treatments would greatly reduce structural stages 3B, 3C, 4B, and 4C while increasing structural stages 2, 3A, and 4A more so than Alternative B. Structural stage 5 stands would be designated, with some treatment to reduce MPB infestation/hazard. Stands that are not treated are likely to succumb to MPB effects, moving these stands to early seral pine stages in the next five to ten years. Treatments would reduce fire hazard in those treated areas, increasing sunlight to the forest floor but reduce the potential for decay processes normally associated with mature and dense structural stages.

Changes in structural stage distribution as a result of MPB mortality and treatments are more drastic than compared to Alternative A and Alternative B. MPB mortality and subsequent treatment in MAs 5.1 and 5.4 in the area would move away from structural stage objectives for 3B, 3C, 4B, 4C, and 5, but would have little effect on Forest-wide conditions for these MAs (1% or less). Movement from mature and dense structural stages caused by MPB and treatment would further increase structural stages 2, 3A, and 4A in the Pactola Project Area, but would have only slight changes (1% or less) in Forest-wide structural stage objectives. Species that prefer more open pine canopies and younger pine stands would benefit at the expense of species that require more mature pine stands short-term. Alternative C would

maintain more structural stage 4 (55%) compared to 52% in Alternative B and 35% in Alternative A. Therefore, treatments would increase the potential for long-term maintenance of structural stages 4 increasing the potential to maintain older mature habitat long-term.

All alternatives would move away from denser stand conditions, especially mature stands at the project scale by varying degrees. The Pactola Project Silviculture Report (held in the project file) shows that, by-and-large, all alternatives would not change Forest-wide MA structural stages by more than 1%. Therefore, all alternatives would meet the intent of Objectives 5.1-204 and 5.4-206 in providing habitat for wildlife species.

Snags

Snag densities and occurrence may vary by structural stage, fire history, insect mortality, and several other factors. Dead trees are an important element for species-specific management for many emphasis species that depend on snags in ponderosa pine communities for foraging and nesting/roosting cavities.

The Forest objectives that most closely apply to snags in Pactola Project Area are 211, 2.2-401, 3.7-201, 5.1-204, 5.4-206, and 8.2-202, which relate to snags and snag recruitment provided by various stand structure and pine structural stages. An average of three snags per acre would be provided by following the MA pine structural stage objectives (USDA Forest Service 2005d). Forest Plan Standards and Guidelines 2301, 2304, and 2305, 8.2-3202 would maintain snag component on the Forest and in the Pactola Project Area. In addition, MA 2.2, 3.7, and 8.2 would provide for higher densities of dead trees. However, Forest Objectives 10-7 and 11-03 allow the Forest to reduce the spread of MPB and reduce fire hazard that may affect snag densities long-term.

Under normal conditions, the median age for snags in the Black Hills is 15 years (Lentile et al. 2000). Natural processes such as fire and insect outbreaks, especially where they create large snags (>14" DBH) at higher densities contribute to providing crucial habitat for many emphasis species (Saab et. al 2007, Negron et. al 2007). However, the benefits to cavity dependent species would be short-lived (three to five years) due to the rapid deterioration and high fall rates of snags created by MPB. Schmid and others (2009a) determined in structural stage 4C, an average 56% of the MPB killed trees broke below 25 ft height as required by Forest Plan Objective 211, where over 45% of the trees fell below 0-15 ft, with most of those being < 0-2 ft in height. In their study, hard snags vs. soft snags were not classified because the MPB created snags exhibited characteristics of both categories during the five years. Bark sloughing was not evident (hard snag) on nearly all of the MPB snags after five years but the bole breakage indicates some decay (soft snag). Based on these estimates, MPB could at best be classified as hard snags during the first two to three years and soft snags thereafter. Although their study area was on a small area of the Black Hills, their findings suggest that MPB created snags should not be used to meet Forest Plan Objective 211 of maintaining hard snags across the forest. Therefore it becomes important to maintain hard snag recruitment over a period of time that would provide habitat for primary cavity nesters long-term. Prescribed burning may reduce snag densities but may also increase snag densities, especially where MPB are present (Breece et al. 2008).

According to FPMER, Forest-wide the average number of hard snags >9" DBH is 3.5 snags per acre, 23% of these snags are >14" DBH per acre (0.8 snags/ac.). In addition, large areas affected by wildfire and insects it is estimated that snags >9" DBH is above 17.8 per acre forest wide. Therefore, the snag densities forest-wide are above Forest Objective 211 (USDA Forest Service 2010c). In all MAs in Pactola Project Area, the average hard snag density is 4.7 snags/acre (>9" DBH). In addition, MPB mortality is increasing, which would provide additional hard/soft snags short-term in the Pactola Project Area. Currently, snag densities in Pactola Project Area are well above Objective 211.

Alternative A - No Action

Direct and Indirect Effects on Snags
Harvesting and clearing of dead trees (snags) is not part of this alternative. However, snags may be cut because they pose a safety hazard to the public or to protect communities, all of which are consistent with Forest Plan direction. In Alternative A, short term snag densities would be the highest of any alternative in the next five to ten years due to high levels of MPB mortality (USDA Forest Service 2010e). However after ten years, the snag density would sharply decline. Long-term, snag densities would likely decline due a limited amount of large trees available post MPB infestation. In the short-term large areas of dead trees would attract irruptive species such as the black-backed woodpecker, Lewis's woodpecker, and redheaded woodpecker. Long-term, the loss of adequate size and density of snags may preclude the area in providing habitat for most cavity dependent species. Coincidently, this alternative would also amplify the wildfire hazard due to the increased fuel load when dead trees fall. Therefore, a stand replacing fire could exacerbate low snag densities long-term.

Alternative B – Proposed Action

Direct and Indirect Effects on Snags
Harvesting and clearing of dead trees (snags) is not part of the proposed action. However, in the action alternatives snags may be cut because they pose a safety hazard to the public or to protect communities which are consistent with Forest Plan direction. This could include dead trees being removed to provide safe public egress in the event of a wildfire, removal of dead trees within close proximity of a high use recreation sites and in fuel breaks, especially within 200 feet of private land. However, the removal of snags would not likely affect overall snag densities in the Pactola Project Area. Vegetative treatment operations and prescribed fire may reduce snag densities. MPB mortality would continue to affect both treated and untreated snags so snag densities would still be very high in the next five to ten years. Treatments would reduce the susceptibility of MPB attack in mature pine stands retaining large trees on the landscape. Therefore, there is a greater potential for hard snag densities to persist long term in the Pactola Project Area compared to Alternative A, but to a lesser extent compared to Alternative C. Fire hazard ratings are lower in this alternative reducing the potential for stand replacing fire, potentially maintaining hard snag densities long-term. Prescribed burning may create additional snags, depending on site specific conditions.

Alternative C

Direct and Indirect Effects on Snags
Harvesting and clearing of dead trees (snags) is not part of this alternative. Direct and indirect effects of this alternative are similar to those discussed in Alternative B. This alternative would treat more area, therefore there the effects would be greater. Additional road side treatments (436 acres) are proposed that would provide safe public egress in the event of a wildfire reducing snags in those areas. However, the removal of snags would not likely affect overall snag densities in the Pactola Project Area. Treatments would reduce the susceptibility of MPB attack in mature pine increasing the potential for large trees available for snag recruitment long-term. There is a greater potential for hard snag densities to persist long term in the Pactola Project Area compared to Alternative B and to a greater extent compared to Alternative A.

The potential decrease in snags short-term from the action alternatives are expected to be low and inconsequential to snag densities at both the project and Forest-wide scales. Long-term effects to snag size and density and future availability are tied to the extent and length of the current MPB outbreak forest-wide. However, the action alternatives are more likely to provide for large trees in the future, therefore potentially increasing snag availability long-term. All alternatives are consistent with Forest Plan Standards and Guidelines 2301, 2304, 2305, and 8.2-3202. Therefore, all alternatives contribute to meeting Forest Plan Objective 211.

Very Large Trees
Studies on the Forest suggest that density of large diameter snags (>16"DBH) were low (Spierling and Knight 2005, Lentile et al. 2000). Maintaining adequate numbers of large diameter snags are important especially when several snag dependent species require large snags for nesting and communal roosts (e.g., Lewis's woodpecker, northern flying squirrel, pygmy nuthatch, and bats).

Forest-wide, MA objectives specify that at least 10% of pine structural stage 4 (5.1-204 and 5.4-206) should be in the "very large" tree size category. This "very large" tree component is crucial for maintaining large diameter trees available for snag recruitment across the Forest (USDA Forest Service 2005a). This habitat feature is achieved when the average of a stand's basal area is >16" DBH. Objectives for SS 4 would maintain this component across the Forest long-term.

However, stand replacing events, such as wildfire and insect outbreaks, can severely limit the number of large diameter trees remaining on the landscape. Several studies examined the size of trees killed by MPB, indicating that as tree diameters increase the greater probability of attack especially in higher stand densities (Negron et al. 2008, Schmid et al. 2007, Klenner and Arsenault 2009). Under MPB epidemics, the loss of very large tree component is likely in SS 4. In addition, MPB caused mortality of pine structural stage classes between 7 inch and 16 inch DBH would severely restrict recruitment from smaller sized classes. Therefore, MPB effects may have long-term consequences on maintaining this habitat component. In addition, loss of very large trees could affect large diameter snag recruitment in the future. Negron and others (2008) suggest that retention of larger diameter trees in the face of MPB infestations can be achieved by regulating stocking levels with particular attention to the basal area in trees >9" DBH. Although this treatment may move stand structures to more open stands, the likelihood of maintaining large green trees improves substantially.

According to FPMER, the Forest-wide tree size objectives (e.g., >10%) are being met in MA 5.1 (13%), but are below objectives for MA 5.4 (9 %) (USDA Forest Service 2010c). According to the Pactola Project Silviculture Report, approximately 90 acres of "very large" category currently exists in the Pactola Project Area. These acres represent 2% of existing structural stage 4 in Pactola Project Area. Large diameter trees can also be found in MAs 2.2, 3.7, and 8.2 along with isolated trees in other structural stages that also contribute to providing this habitat for wildlife species.

Alternative A - No Action

Direct and Indirect Effects on Very Large Trees
Alternative A could have an indirect effect on the Pactola Project Area contributing to Forest-wide percentages. Based on estimated mortality rates, this alternative would maintain approximately 35% of these MAs in structural stage 4 (mature). Alternative A would increase the average percentages of very large tree to 3% in Pactola Project Area. However, due the amount of moderate to high insect hazard stands in the Pactola Project Area (92%), it is likely that most if not all of the large-diameter trees would succumb to MPB infestation, especially in 3B, 3C, 4B, 4C, and 5 structural stages. The loss of this habitat component is heavily tied to the extent and length of the current MPB outbreak. This alternative also has a higher risk of stand replacing fire to occur, which could further reduce this habitat component. This alternative could result in a loss of very large tree component and their availability in large portions of Pactola Project Area both short-term and long-term. In the absence of fire, wildlife species that rely on this habitat component would be most affected long-term by this alternative.

Alternative B – Proposed Action

Direct and Indirect Effects on Very Large Trees
Alternative B would reduce the number of very large trees short-term in an effort to reduce MPB hazard and reduce the risk of stand replacing fire. Long-term, treatments planned in Alternative B have a greater potential to maintain very large trees and mature pine stages compared to Alternative A, by reducing susceptibility of remaining mature pine to MPB attack and reducing the amount of fuel hazard in the area. Alternative B would maintain approximately 52% of these MAs in structural stage 4, increasing the average percentages of very large tree to 5% in area. This increase would only slightly increase Forest-wide levels in MAs 5.1 and 5.4. However, MPB mortality would continue to affect both treated and untreated stand that could further reduce this percentage. In the absence of fire, wildlife species that rely on this habitat component would be less affected long-term by this alternative but to a lesser degree compared to Alternative C.

Alternative C

Direct and Indirect Effects on Very Large Trees
The direct and indirect effects are similar to Alternative B but more acres would be treated in this alternative. Alternative C would maintain approximately 55% of MA 5.1 and 5.4 in structural stages 4, increasing average percentages of very large tree to 4 % in Pactola Project Area. This increase would only slightly increase Forest-wide levels in MAs 5.1 and 5.4. However, MPB mortality would continue to affect both treated and untreated stand that could further reduce this

percentage. In the absence of fire, wildlife species that rely on this habitat component would be less affected long-term by this alternative compared to Alternatives A and B.

All alternatives would increase this habitat component for wildlife species by varying degrees. Therefore all alternatives would move towards meeting Objectives 5.1-204, and 5.4-206 Forest-wide.

Spruce

White spruce is shade tolerant, enabling regeneration and growth under closed forest canopies and may be a climax species on cool mesic sites. These cool, moist environments provide habitat for several emphasis species such as American marten, golden-crowned kinglet, northern three-toed woodpecker, and brown creeper. Higher densities of birds were found in spruce habitat than any other habitats. In the absence of stand replacing events (e.g., fire, insects) and vegetative treatment, there is a potential for spruce communities to increase. However, due to its thin bark and low branches, it is susceptible to fire mortality (USDA Forest Service 2005a).

Spruce is not usually affected by MPB unless their population levels are high enough where the beetles attack indiscriminately (Pers. Comm. B. Schaupp 2011). Dense mixed conifer stands would likely lose the ponderosa pine component to MPB, where small openings appear then close with spruce regeneration. Loss of pine could affect the structure of spruce stands by increasing wind throw, coarse woody debris (CWD) and subsequent ladder fuels. Larger openings in mixed conifer stands that have a hardwood component stimulate hardwood growth short-term. This would create within stand heterogeneity that is optimum habitat for many wildlife species. An increase in CWD would provide prey species habitat, subnivean access, denning and resting sites until CWD would decay long-term (Klenner and Asenault 2009, Richie 2008, Buskirk and Ruggiero. 1994). However, loss of pine in mixed stands could reduce heterogeneity (move to pure spruce) long-term, especially in fire controlled systems. Large amounts of CWD could increase the probability of stand loss due to fire especially if adjacent have high fire hazard ratings and when conditions are dry.

The Forest Plan sets an objective (239-LVD) to provide 20,000 acres of spruce across the Forest. Spruce may be treated to achieve multiple-use objectives such as hardwood restoration, reduce fire hazard and for management for emphasis species. According to FPMER, there is approximately 25,749 acres of spruce cover type Forest-wide, which is above Forest objectives (USDA Forest Service 2010c). According to the Silviculture Report, approximately 253 acres of spruce cover type are classified in Pactola Project Area. Not reflected in the database, are spruce components found in other cover types (mixed conifer/hardwoods), which contribute to species habitat. Much of the spruce habitat in the project area is located along shaded drainages and north facing slopes west of Pactola Lake. Spruce communities are within the Wildland Urban Interface (WUI).

Alternative A - No Action

Direct and Indirect Effects on Spruce

Alternative A would have no direct effect on spruce communities in Pactola Project Area. Indirectly, spruce may increase in suitable habitat in the area in time due to dense canopy

conditions (stands not affected by MPB) and fire suppression. MPB would affect mixed conifer stands through pine mortality, which could reduce within stand heterogeneity long-term. CWD in spruce communities would likely increase, especially when falling pine causes a domino effect on adjacent spruce trees. Depending on the amount of pine mortality and spruce deadfall, openings could increase providing more sunlight that would stimulate early seral understory communities (hardwoods/shrubs/grasses) short-term. However, as this shade-tolerant species increases, the size, and amount of openings would decrease long-term.

Mortality estimates (USDA Forest Service 2010e) suggest that surrounding areas of mature pine would likely succumb to MPB infestation providing wildlife habitat but increase the potential for a large stand replacing fire. Depending on the intensity and severity of the fire, spruce habitat availability in the Pactola Project Area may be affected long-term. In the absence of fire, wildlife species that rely on this habitat component would not be affected long-term by this alternative.

Alternative B – Proposed Action

Direct and Indirect Effects on Spruce
Alternative B would treat 18 acres (<1%) of spruce to meet Forest-wide hardwood and fuel hazard reduction objectives. The majority of the spruce communities would remain untreated and the effects would be the same as described in Alternative A. There is less probability of a stand replacing fire that could negatively affect spruce communities. However, treatments, including meadow enhancement and prescribed fire would open pine crown densities, reducing the potential expansion of spruce communities. In addition treatments would reduce spruce components in other cover types and CWD, especially adjacent to egress routes which could impact some species, especially if used as a dispersal corridor. Although treatments in spruce cover types are limited, treatments in mixed stands would reduce habitat for spruce dependent wildlife species compared to Alternative A, but to a lesser degree compared to Alternative C. In the absence of fire, long-term effects to spruce communities are likely greater compared to Alternative A, but to lesser degree compared to Alternative C.

Alternative C

Direct and Indirect Effects on Spruce
The effects to spruce habitat would be slightly greater in Alternative C in that more acres are converted from spruce component (37 acres) to meet Forest objectives. The indirect effects to spruce communities are similar to those discussed in Alternative B. The majority of the spruce communities would remain untreated. Therefore, the indirect effects to untreated spruce communities would be the same as described in Alternative A. The additional acres for road side treatments, especially in mixed spruce stands would greatly reduce the habitat components that are usually provided by spruce communities (e.g. CWD, stand structure) that are important for many wildlife species. It would also reduce the effectiveness of this habitat to provide dispersal corridors for such species as American marten. Although treatments in spruce cover types are limited, treatments in mixed stands would reduce spruce component more when compared to Alternatives A and B. In the absence of fire, long-term effects to spruce communities are likely greater compared to Alternative B.

All alternatives would maintain spruce communities in the project area by varying degrees. Therefore, all alternatives maintain compliance of objectives LVD-239 Forest-wide.

Hardwoods

Hardwoods are considered early seral species that requires significant sunlight. Historically, natural stand replacing events, especially recurrent fire helped perpetuate hardwood communities. Fire stimulates new growth by reducing litter layers, opening the crown canopies and stimulates root/trunk suckering. Fire reduces the amount of conifers in these stands that eventually out-compete hardwoods for valuable sunlight. Forest management and fire suppression during the past century has affected hardwoods by limiting new growth and increasing conifer competition. Hardwood communities, with their diverse understory shrub components are an important source of forage, cover, and nesting habitat for many wildlife species such as ruffed grouse, beaver, and white-tailed deer. These communities have higher densities of bird species than pine habitats (USDA Forest Service 2005a).

Forest Plan Objective 201 encourages a Forest-wide increase in aspen to 92,000 acres and 16,000 acres of bur oak. Objective 204 conserves and manages for birch. According to FPMER, 45,805 acres of aspen, 13,556 acres of bur oak and 3,396 acres of birch currently exist Forest-wide. Currently, the Forest is below Objective 201 for aspen (50%), oak (21%), and slightly below objective 204 (USDA Forest Service 2010c). Forest land management treatments and natural disturbances would create more acres of hardwoods. Additional time is needed to meet Objective 201 and 204.

In Pactola Project Area, aspen is the only hardwood abundant enough to be recognized as a distinct cover type in the vegetation database. Birch is present in the area, but as a component of aspen communities. Oak and boxelder may be found but usually in the understory or along riparian areas. Currently, 938 acres (4%) are typed as aspen in the Pactola Project Area. Small inclusions of hardwoods (<10 acres in size) are present in other typed stands. Although these inclusions are not currently identified as hardwood in the database, they could be converted if enough conifers are removed. Forest Plan standards and guidelines 2202, 2204, 2205, and 3104 would provide hardwood habitat for wildlife species.

Alternative A - No Action

Direct and Indirect Effects on Hardwoods

Alternative A would have no direct effect on hardwood communities in Pactola Project Area. Indirectly, conifer encroachment would naturally continue in aspen stands and in hardwood inclusions, decreasing this community in the project area long-term. However, pine stands that succumb to MPB infestation would experience reduced canopy closure, allowing hardwood inclusions to thrive and expand until pine regeneration starts to outcompete hardwoods. In addition, there is a higher potential for stand replacing fire, which increases the expansion of aspen clones. Even in the absence of fire, Alternative A has the potential to contribute directly to meeting Objective 201 long-term. Wildlife that utilizes hardwoods, especially aspen would benefit most by this alternative.

Alternative B – Proposed Action

Direct and Indirect Effects on Hardwoods
Alternative B would result in conifer removal within and adjacent to aspen stands (1,150 acres) (hardwood retention/restoration) which would enhance aspen communities. In addition, 477 acres of mixed conifer/aspen stands that are currently classified as conifer cover type would be reclassified to aspen after treatment. Treatments in conifer stands would open up areas around approximately 120 acres of aspen inclusions. Total treatment to restore and maintain hardwoods would increase hardwood acres 1,756 acres (7%), which directly contributes to Forest Objective 201 (>1%). Although treatments would enhance hardwood communities, most treated areas would maintain pine overstory and reduce the potential for stand replacing fire. This could limit the expansion and growth of aspen understory long-term. Wildlife that utilizes hardwoods, especially aspen would benefit from this alternative but to a lesser degree compared to Alternatives A and C.

Alternative C

Direct and Indirect Effects on Hardwoods
Alternative C would result in conifer removal within and adjacent to aspen stands (1,150 acres) (hardwood retention/restoration) which would enhance aspen communities. In addition, 681 acres of mixed conifer/aspen stands that are currently classified as conifer cover type would be reclassified to aspen after treatment. Treatments in conifer stands would also open up areas around approximately 120 acres of aspen inclusions. Total treatment to restore and maintain aspen would increase hardwood to 1,959 acres (8%), which directly contributes to Forest Objective 201 (1%). Although treatments would enhance hardwood communities, they would maintain pine overstory and reduce the potential for stand replacing fire. This could limit the expansion and growth of aspen understory long-term. In the absence of fire, wildlife that utilizes hardwoods, especially aspen would benefit from this alternative to a greater degree compared to Alternative B but to a lesser degree compared to Alternative A.

All alternatives would maintain and enhance hardwood habitat for wildlife species by varying degrees. Therefore, all alternatives would move toward Forest Plan Objective 201 Forest-wide.

Grasslands and Meadow
Grasslands and meadows are defined as upland plant communities dominated by herbaceous vegetation with less than 10% tree cover. Prairie grasslands generally occur on the outer perimeter of the Black Hills, transitioning between true prairie ecosystems and forest ecosystems. Interior grasslands occur within the forest perimeter and can include large areas dominated by plant species typically associated with prairie ecosystems. After a century of fire suppression and forest management, acreage of interior prairies and meadows has been reduced from historic conditions (USDA Forest Service 2005a).

Forest Plan Objective 205 encourages the Forest to manage for 122,000 acres of grassland and 3,600 acres of meadows. Forest Plan standards and guidelines 2107, 3125, and 4111 maintain these habitats for wildlife such as the grasshopper sparrow, big game, and butterflies. According to FPMER, there are approximately 107,464 acres of grassland and 6,958 meadow communities Forest-wide. The Forest is approximately 14,536 acres short of the grassland objective. The

Forest has 3,358 acres more than the objective acres for meadow. However, there has been a 3% increase in grassland habitat since 1997 estimates. This increase may reflect projects across the Forest that has emphasized grassland restoration and/or a refinement of mapping and reporting methods where conditions have not changed on the ground (USDA Forest Service 2010c).

There is approximately 394 acres (1.6%) of grassland habitat in the project area. There are no large prairie grasslands in Pactola Project Area. Additional acres of grassland probably exist, especially on soils that have formed under grass. Smaller openings that exhibit grassland plant communities in other cover types, could provide species habitat if conifer is removed.

Alternative A - No Action

Direct and Indirect Effects on Grasslands and Meadows
Alternative A would not treat meadows to reduce conifer encroachment. In the absence of natural fire regime, conifer encroachment into grassland communities would likely decrease the productivity of these communities long-term. An increase in grassland habitat could occur as a result of pine mortality caused by MPB infestation. This increase is dependent upon soil types, community types and the length and duration of the insect infestation. Over time, conifer encroachment would decrease the productivity of this habitat. There would be no disturbance associated with treatment activities (e.g. skidding, landings, equipment use) that would increase invasive species. Alternative A has a greater potential for large stand replacing fire, greatly increasing the amount of grassland depending on the intensity and severity of that fire. A wildfire could change plant species composition of grasslands if duff layer and soils are severely affected, especially if invasive species spread. In the absence of fire, Alternative A has the potential to indirectly contribute to meeting Objective 205 long-term.

Alternative B – Proposed Action

Direct and Indirect Effects on Grasslands and Meadows
Meadow/grassland restoration treatments in this alternative would maintain and expand grassland communities in the project area. Conifer would be removed in small openings that occur within conifer-dominated forests, adjacent to existing grasslands (33 feet) and based on historic boundaries and soil type. Prescribed fire would likely reduce conifer encroachment and increase the size of grassland inclusions in those areas burned. Treatments would reduce the potential for stand replacing fire, reducing the potential for expansion of grassland habitat. Alternative B would slightly increase grassland habitat but would maintain pine overstory. Disturbance and increased vehicle use (vectors for dispersal) associated with treatment activities (e.g. skidding, landings, equipment use) would increase the potential for the spread of invasive species that may affect plant composition of native grassland. In the absence of fire, Alternative B would meet the intent of Objective 205 long-term by maintaining/enhancing grassland habitat in the area.

Alternative C

Direct and Indirect Effects on Grasslands and Meadows
Meadow/grassland restoration and prescribed fire treatments are the same as in Alternative B. Direct and indirect effects to grassland habitat are similar to those discussed in Alternative B. However, in this alternative more acres would be treated, which would increase the potential

negative effects to grassland communities associated with treatments (e.g. invasive species spread). In the absence of fire, Alternative C would meet the intent of Objective 205 long-term by maintaining/enhancing grassland habitat in the area.

None of the alternatives would take action to decrease the amount of grassland (meadows) habitat. Therefore, all alternatives would move toward achieving Objective 205 by varying degrees.

Riparian Habitat

Riparian communities are typically found along perennial and intermittent streams, springs, and seeps. These communities are some of the most productive and biologically diverse lands, providing water and habitat for aquatic and terrestrial wildlife. Riparian habitats are typically fire resistant due to their moist microclimate. Riparian dependent plant species include water birch, willows, sedges, and rushes, all of which provide forage, stream cover, and structural diversity. These communities provide water and habitat to many species such as beaver, song sparrow, American dipper, and the meadow jumping mouse (USDA Forest Service 2005a). Riparian areas also act as buffers and filters during high rainfall events by decreasing water velocity, reducing erosion, and sediment movement. Wildfire, along with vegetative treatments, fuel reductions, and prescribed burns can potentially affect riparian and wetland ecosystems through changes in sediment loads to creeks and introduction of spread of noxious weeds. Roads have been attributed to increasing sediment into streams. The larger the amount of ground disturbance and/or the closer proximity to wetland and riparian areas, the greater the indirect affect to these areas (USDA Forest Service 2005a).

The Forest Plan Objectives 104-107 and 213 apply to riparian habitats in Pactola Project Area, which encourages management to maintain riparian area diversity, physical structure, and size. Forest Plan standards 1301 thru 1306 and 3106 along with guidelines 3210 thru 3212 and 9107 and 9201 encourage maintenance and enhancement of riparian habitats for wildlife and fish species Forest-wide. According to FPMER, multiple resource programs influence riparian condition and trend. The implementation of Forest Plan standards and guidelines and Best Management Practices contribute to maintaining or enhancing riparian habitat Forest-wide. Watershed health (e.g., stream health, water quality) is an integral part of riparian condition (USDA Forest Service 2010c). An analysis of watershed health and alternative effects could be found in the Watershed, Geology, and Soils Section of this EIS and in the Pactola Project Hydrology Report (held in the project file).

In the Pactola Project Area, riparian habitats are typically very narrow, and are not well represented during the Forest's vegetation inventory process. These communities are commonly typed as conifer, hardwoods, shrub lands, or meadows. Consequently, the Forest and the Pactola Project Area vegetation database contain no acres typed as riparian. The project area encompasses the Rapid Creek watershed, which includes side tributaries such as Gimlet, Nugget, Jenny Gulch, Empress, Deer, and Kelly Gulch Creeks. In addition, there are numerous springs/seeps and several fen ecosystems occurring in the area. Due to the steep terrain, many travel routes are adjacent to stream and in some areas, the road crosses the stream numerous times (e.g., Kelly Gulch). Crossings may create barriers for dispersal for aquatic species, increase water temperature, and decrease water quality which is detrimental for

riparian dependent wildlife. Close proximity of the road and stream also increase potential conflicts with maintaining beaver colonies on those streams.

Very little is known regarding the effects of epidemic levels of MPB on riparian communities in the Black Hills. Loss of mature pine could increase water availability (short-term), increase water temperature (loss of shade), and provide higher levels of CWD within riparian corridors. Pine mortality caused by MPB could increase water temperature if overstory shading is removed. MPB infestations would not have much effect on riparian communities that lacked pine. Loss of overstory pine in surrounding areas would increase understory development of hardwoods, shrubs, grasses short-term followed by advanced pine regeneration that would help stabilize soils and prevent adverse effects of high rain fall events. Riparian areas and associated plant species are typically fire resistant. However, the effects of large scale mortality caused by MPB that increases the potential for stand replacing fire. A large wildfire could seriously impact watershed health, stream morphology and water quality mostly short term but could have long term effects. The magnitude of effects caused by a large stand replacing fire would depend on several factors such as fire severity and fire intensity, slope, and the percentage of the watershed affected. Loss of suitable aquatic habitat and riparian communities could affect wildlife presence, distribution patterns, and prey availability. High sediment loads into Pactola Reservoir that provides aquatic habitat for many wildlife species and their prey could have a negative effect on this lake habitat.

Alternative A - No Action

Direct and Indirect Effects on Riparian Habitat

Alternative A would have no direct effect on riparian communities. Indirectly, MPB effects would reduce the amount of trees on the landscape which would increase meadows adjacent to streams, stimulate growth in riparian shrub communities, and could increase available water to these communities short-term. Open canopies would stimulate pine regeneration, eventually out competing seral riparian communities, decreasing these beneficial effects long-term. Loss of mature pine along perennial and intermittent streams would increase water temperature if most of the stream shade is lost. MPB infestations would not have much effect on riparian communities that lacked pine. Increases in CWD from dead trees would offset loss of overstory by providing shade to stream channels but too much CWD could affect stream function (e.g., changes in stream channel). Existing roads and road crossings that do not meet Forest Plan direction repairs or improvements would not occur. These areas would continue to negatively impact stream habitat and may continue to be barriers to dispersal. No additional roads/trails would be added, nor disturbance caused by harvest activities. This alternative has a higher potential for stand replacing wildfire, which could negatively affect watershed function depending on the intensity, severity and amount of watershed impacted. Fires that reduce the capacity of the soils and upland vegetation to limit surface run-off could be detrimental to riparian communities and aquatic habitat short-term. In the absence of fire this alternative would be more beneficial to riparian habitat and the species that use them compared to the action alternatives.

Alternative B – Proposed Action

Direct and Indirect Effects on Riparian Habitat
In Alternative B, treatments would occur in riparian communities to meet other Forest Plan objectives such as hardwood restoration and public safety (fuel reduction and improved public egress). Additional roads/trails are needed to treat areas that may influence riparian habitat. Beneficial effects from treatment in riparian communities would likely increase hardwood communities if competing conifer is removed. Negative effects from treatment may occur if stream shading is removed increasing water temperature and evapotranspiration rates. In addition, loss of CWD and horizontal structure could become barriers to dispersal for several species (e.g. American marten). Harvest activities (e.g. whole tree harvesting) on steep slopes (e.g., 30-40% slopes) adjacent to streams and within the Water Influence Zone (WIZ) has the potential to degrade stream bank stability and increase in-stream sediments, thus reducing water quality in aquatic habitats. Associated activities such as road placement, stream crossings, and noxious weed treatment could further impact the function of riparian communities to provide habitat for wildlife and aquatic species. Treatment activities would also increase invasive species due to disturbed soils. However, Forest Plan standards and guidelines, best management practices (BMPs) and Pactola Project design criteria would reduce the effects of treatment and associated activities (e.g., new road construction) on riparian communities and aquatic habitats (e.g., water quality) to within Forest Plan limits. In addition, access routes used for treatments that have been identified as not meeting Forest Plan standards and guidelines would be repaired and improved. This alternative reduces the potential for large stand replacing wildfire compared to Alternative A, but to a lesser extent compared to Alternative C. In the absence of fire, Alternative B would maintain and improve riparian and stream conditions, but would add more negative effects compared to Alternative A, but to a lesser extent compared to Alternative C.

Alternative C

Direct and Indirect Effects on Riparian Habitat
Direct and Indirect effects to riparian communities and aquatic habitat are similar to those discussed in Alternative B. Alternative C would treat more area, therefore effects would be greater. As part of this alternative an additional 436 acres of roadside treatments would increase the amount of disturbance/treatment in riparian communities compared to Alternative B. Roadside treatments that reduce fuel hazard and conifer overstory to <50 basal area (BA) that parallel perennial and intermittent stream courses would likely increase water temperatures in those streams. Additional road construction (19 miles) and reconstruction associated with proposed treatments (e.g., cable systems) have more potential to increase sediments, widen stream channels, increase water temperatures and create barriers to dispersal for aquatic species compared to Alternative B. Therefore the effects to riparian areas would be greater in this alternative compared to Alternatives A and B. Cable and helicopter logging systems usually have fewer effects on riparian areas compared to conventional logging systems but the roads associated with cable systems have the potential to increase sediment into streams. As in Alternative B, Forest Plan standards and guidelines, BMPs and Pactola Project design criteria would be followed reducing the effects of treatment and associated activities on riparian communities and aquatic habitats (e.g., water quality) within Forest Plan limits. Access routes used for treatments that have been identified as not meeting Forest Plan standards and guidelines would be repaired and improved. Treatments in this alternative would reduce the

potential for stand replacing fire more so compared to Alternatives A and B thus reducing its potential negative effects to riparian function and condition. In the absence of fire, Alternative C would maintain and improve riparian and stream conditions but would add more negative effects compared to Alternatives A and B. Therefore, this alternative would have the least beneficial effect on wildlife dependent on riparian communities.

All of the alternatives would affect the biodiversity, physical structure, and size of riparian communities in the area by varying degrees. It is anticipated that Forest Plan Standards and Guidelines would be equally met in both action alternatives and that any residual effects would be within Forest Plan limits. None of the alternatives would decrease the amount of riparian habitat in the area. Therefore, all alternatives would meet the intent of Objective 213.

Management Indicator Species

Management Indicator Species (MIS) are species that represent a suite of wildlife and fish species and their habitats. MIS are evaluated based on observations and/or presence of suitable habitat within the Pactola Project Area. The Phase II Amendment FEIS (USDA Forest Service 2005a; Sec 3-3.3.6 through Sec 3-3.3.8.2) provides in-depth information (e.g., range, distribution etc.) for each MIS selected for analysis. The Pactola Project analysis for MIS is tiered to that document and to the 1997 Forest Plan FEIS (USDA Forest Service 1996). Information from these documents is summarized for each MIS. Table 3-29 identifies MIS species selected for analysis for the Pactola Project, and reasons for their Forest Plan designation (USDA Forest Service 2005a).

Table 3-29 Summary of Forest Plan MIS, their status, and habitat these species represents

Forest Plan MIS	Status*	Habitat Represented
Black-backed Woodpecker	R2	Mature and late successional forest, burned forest, insects, and snag conditions.
Brown Creeper	MIS	Late successional conifer forest, large trees, and snag conditions.
Golden-crowned Kinglet	MIS	Spruce forest, mostly mature and late-successional.
Beaver	MIS	Riparian/aquatic habitat conditions (hardwood forests and shrub component).
Song Sparrow	MIS	Riparian habitats.
Grasshopper Sparrow	R2	Prairie grassland.
Ruffed Grouse	MIS	Aspen quality and vigor in pure and mixed stands.
White-tailed Deer	MIS	Variety of forest conditions, including occurrence of understory shrubs.
Mountain Sucker	R2	Aquatic habitat condition and connectivity.

* R2 = Region 2 Sensitive. MIS = Management Indicator Species

The MIS analysis focuses on how the alternatives would influence the Forest-wide population trend (if available), the Forest-wide habitat trend, and attainment of Forest Plan Objective 238. Trend data for all species was obtained from either the FY 2008 or FY 2009 Forest Plan Monitoring and Evaluation Reports (FPMER) (USDA Forest Service 2009c, 2010c) USDA unless otherwise indicated. Viability analysis has been completed at the Forest Plan level (USDA Forest Service 2005a), and therefore beyond the scope of this project level analysis. If the MIS species or suitable habitat does not occur in the project area, or if the species or its

habitat is not affected by the Pactola Project, then it is excluded from further evaluation. If a species is known or suspected to occur in the project area or if suitable but unoccupied habitat is present or adjacent to the area, then the species has been evaluated with respect to effects of the proposed project activities (Table 3-30).

Table 3-30 MIS Species and Rationale for Pactola Project Analysis

Species	Species/Habitat Present?	Analyzed	Habitat Description
Black-backed woodpecker (*Picoides arcticus*)	Y	Y	Burned areas with a high density of pre-burn snags, dense and/or mature forests with a high snag density (Anderson 2003, Rocky Mountain Bird Observatory 2001-2010).
Brown creeper (*Certhia americana*)	Y	Y	In the Black Hills, white spruce and late successional pine appears to be the most important habitat type for this species (Wiggins 2005c, Rocky Mountain Bird Observatory 2001-2010).
Golden-crowned kinglet (*Regulus satrapa*)	Y	Y	Found almost exclusively in white spruce habitat but occasionally present in other habitats with a spruce component (Rocky Mountain Bird Observatory 2001-2010).
Beaver (*Castor canadensis*)	Y	Y	Large rivers and lakes down to streams, marshes and small lakes with seepage/weak flow adequate for damming and suitable woody vegetation (Boyle and Owens 2007).
Song sparrow (*Melospiza melodia*)	Y	Y	Streamside thickets, particularly shrubby willows, are required. Occasionally found in adjacent spruce habitat (Rocky Mountain Bird Observatory 2001-2010).
Grasshopper sparrow (*Ammodramus savannarum*)	Y	Y	Found almost exclusively in native mixed-grass prairies (Slater 2004, Rocky Mountain Bird Observatory 2001-2010).
Ruffed grouse (*Bonasa umbellus*)	Y	Y	Variable aged aspen stands, other hardwoods, and pine forests provide habitat. Winter habitat is almost exclusively aspen (Tallman et al. 2002, Wiggins 2006a).
White-tailed deer (*Odocoileus virginianus*)	Y	Y	Very adaptable species that can live in almost any habitat. In South Dakota, this includes grasslands, wetlands, and woodlands (USDA Forest Service 2005a).
Mountain sucker (*Catostomus platyrhynchus*)	Y	Y	See Fisheries Report.

Tree Nesting MIS Species

The following species are dependent on trees for nesting, and are analyzed together in this section: black-backed woodpecker, brown creeper, and golden-crowned kinglet. For the most part, these three species are closely associated with mature pine (SS4C and SS5) and spruce communities that provide foraging and nesting habitat, although the black-backed woodpecker

is predominately found in ponderosa pine habitat. Specific habitat preferences are discussed for each species below.

According to FPMER, there are an estimated total of 152,897 acres of SS4C and SS5 ponderosa pine and 25,749 acres of spruce on the Forest. The Forest Plan structural stage objectives call for 5% of their respective MAs to be managed for SS 4C, and 5% in SS 5. These Forest MAs currently exceed the objective for SS 4C habitat Forest-wide (13%), and are moving toward the objective for SS 5 (0.5%) (USDA Forest Service 2010c). Other indicators of potential habitat for these species are the amount of area with spruce, high risk of beetle attack, insect mortality, "very large" pine trees, and snag density.

In Pactola Project Area, there is 253 acres (1%) of white spruce and approximately 1,712 acres (10%) of pine SS 4C and 5 in MAs 5.1 and 5.4. Inclusions of spruce do exist, but are typed as other cover types, having spruce component less than 50% of the stand. Many of these pine structural stages, due to their high beetle risk are heavily infested by MPB. Within the next five to ten years, it is likely the amount of 4C and 5 in the project area would decrease (<1%). Spruce habitat is not expected to change due to MPB effects. Approximately 172 acres of "very large" trees (<1%) are classified in the area. In Pactola Project Area, the average hard snag density is 4.7 snags/acre. See the Pactola Project Silviculture Report for more information about these objectives.

Black-backed Woodpecker (*Picoides arcticus*)

The black-backed woodpecker has dual management status, it is both an MIS and a R2 sensitive species. To reduce redundancy, most life history, current condition, and predicted effects information are provided in the Pactola Project BA/BE. Only MIS-specific documentation requirements are provided here (e.g., trend information and analysis of Objective 238). Forest Plan vegetation objectives that apply to the black-backed woodpecker in the Pactola Project are 11.03, 211, 218, 221, 238b, 2.2-401, 3.7-201, 5.1-204, and 5.4-206 which encourage maintenance of spruce, large snags, late succession characteristics, and pine structural diversity. Forest Plan Standards and Guidelines 2202, 2204, 2304, 2305, 4206, 2.2-1001, 2.2-3201, and 8.2-3201 would be applicable to maintaining habitat for this species.

Large trees are important habitat component for the black-backed woodpecker. Insect infested trees and large diameter snags provide foraging and nesting habitat. In the Black Hills, this woodpecker's distribution and abundance is closely associated with recent stand-replacing fires and insect outbreaks (Bonnot et al. 2009, Rocky Mountain Bird Observatory 2001 - 2010). These conditions provide increased numbers of their main prey: larvae of wood-boring beetles, engraver beetles, and bark beetles (Saab et al. 2007). However, once prey items become scarce, this species use of that area declines rapidly.

Forest monitoring indicates the black-backed woodpecker is distributed in low densities throughout most of the Black Hills. Where numerous wildfires and insect outbreaks have recently occurred, the species has been observed much more frequently and in higher densities.

Forest-wide relative density for this species is probably higher than "normal" given the current habitat conditions. Black-backed woodpecker populations are 'eruptive" as reflected

in their densities in burned habitat. This pattern of rapid colonization and subsequent decline is consistent with findings of other studies (Anderson 2003). This species' Forest-wide population trend is likely to decline in the future as vegetation management efforts to reduce the fire-hazard and insect-risk continue. Overall, habitat for this species is being provided consistent with Objective 238b, Objective 221 and Objective 11.03. The "aging" of large burned areas, such as the Jasper Fire, into habitat less suitable for black-backed woodpeckers is likely being offset by the increasing acreage of insect-infested timber stands and the stable acreage of large diameter, older pine trees. Though additional time is needed to grow more of structural stage 5 (USDA Forest Service 2010c).

This species has been documented in the Pactola Project Area mostly in mature pine stands and MPB infested areas.

Brown Creeper (*Certhia americana*)
The Forest vegetation objectives that most closely apply to the brown creeper in the Pactola Project are 211, 218, 238a, 239-LVD, 2.2-401, 3.7-201, 5.1-204, and 5.4-206 which encourage maintenance of large snags, late succession characteristics, and structural diversity, very large trees, and white spruce. Forest Plan Standards and Guidelines 2103, 2202, 2204, 2304, 2305, 4206, and 8.2-3201 would be applicable to maintaining habitat for this species.

In the Black Hills, the brown creeper is well distributed but low in abundance and is closely associated with dense mature and late successional ponderosa pine stands (structural stages 4C and 5) and white spruce forests (USDA Forest Service 2005a). Within that context, dead or decaying trees are particularly important because they provide nesting and foraging substrates. Large trees are important habitat component for brown creepers for foraging (Wiggins 2005c). Evidence suggests this species is area-sensitive (prefers blocks of habitat >30 acres in size), and may be susceptible to timber management and forest fragmentation (Wiggins 2005c).

According to FPMER, the short-term relative densities declined for this species in 2007 compared to previous years, but rebounded in 2009 in most habitats sampled (White et al. 2010). In 2009, for the first time the relative density in pine south was higher than white spruce. Blakesly et al. (2008) projected it would take 25 years to detect a 3% annual decline for this species in pine-north, late successional and white spruce habitats, and 30 years in pine-south habitat. The Forest-wide preferred habitat has been stable or slightly increasing over the past 5 years. Although preferred habitat defined by structural stages 4C and 5 decreased slightly, the acres of structural stage 4C with very large trees (>16" DBH) has increased. It appears that Objective 238a is being met. Continued effort and additional time is needed to increase the acres of structural stage 5 across the Forest (USDA Forest Service 2010c).

This species has been documented in the Pactola Project Area in mature ponderosa pine, spruce communities, and in MPB infested areas.

Golden-crowned Kinglet (*Regulus satrapa*)
The Forest objectives that are most relevant to the golden-crowned kinglet are 211, 218, 238c, 239-LVD, 2.2-401, and 3.7-201, which encourage maintenance of large snags, late succession characteristics, and management for 20,000 acres of spruce across the Forest. Forest Plan

Standards and Guidelines 2202, 2204, 2304, 2305, 4206, 2.2-1001, 2.2-3201, and 8.2-3201 would be applicable to maintaining habitat for this species.

The golden-crowned kinglet is found primarily in the northern Black Hills, with more localized occurrences in the southern hills and Bearlodge Mountains. This kinglet prefers spruce communities but it may be found in lower densities in other forest types. This species forages on bark beetle larvae and may be found in heavily infested MPB areas, especially with a spruce component. It is assumed that spruce is the preferred habitat of golden-crowned kinglet on the Forest, although it is possible that this entire habitat is not occupied and that this species may be found in other areas (USDA Forest Service 2005a).

Forest-wide monitoring data suggests in the short-term, the golden-crowned kinglet relative density in 2007 was the lowest since the forest bird monitoring program began in 2001. Blakesly et al. (2008) projected it would take 20 years to detect a 3% annual decline for this species in white spruce habitat. Relative densities rebounded considerably in 2009 in both late successional and white spruce habitats (White et al. 2010). Spruce habitat for the golden-crowned kinglet has increased over the long-term and is exceeding the Forest-wide target of 20,000 acres (Objective 239-LVD). The Forest is meeting Objective 238c based on the acres of preferred habitat.

The golden-crowned kinglet has been observed in Pactola Project Area, mostly in mixed conifer stands.

Alternative A - No Action

Direct and Indirect Effects on Tree Nesting MIS Species

There are no direct effects to the trees nesting species expected under this alternative. No treatment would likely continue widespread epidemic-level infestation of MPB. Therefore prey species availability (e.g., arthropods) would be higher in this alternative compared to Alternatives B and C short-term. Under this alternative, considerable changes in the seral stages of ponderosa pine communities would occur especially where most or all of the mature pine overstory would succumb to MPB infestation. The indirect effect to these species would decrease preferred SS4C and SS5 pine habitats (high hazard rating) short-term and long-term. Snag abundance would increase short-term (5-8 years) but quantity and quality of snags would decrease over the long term. Increased prey items along with increased snag densities would result in more black-backed woodpecker habitat than currently exists within the next five years but rapid changes in both components would decrease habitat and prey availability long-term in the area. Alternative A increases the risk of stand-replacing fire, where the effects would be similar to landscape level mortality caused by MPB. However, the potential for large fire would increase the potential for habitat loss needed for the brown creeper and golden-crowned kinglet long-term, especially if large tree component is removed. In the absence of treatment and fire, spruce may continue to grow and expand on suitable sites, increasing habitat for the golden-crowned kinglet long-term. The level of short-term and long-term effects would be dependent on the length and duration of MPB infestation and the intensity and severity of any stand-replacing fire. For these reasons, this alternative would be most favorable for the black-backed woodpecker and brown creeper short-term. However, the loss of all or most of the

mature trees in the project area could have long-term consequences for the area to provide habitat for these tree nesting species.

Alternative B – Proposed Action

Direct and Indirect Effects on Tree Nesting MIS Species
Inadvertent loss of some individuals and/or unknown nests is possible in Alternative B. Potential direct effects to these species may come from possible loss of nest (tree), nest disturbance and associated nesting failure (loss of eggs and hatchlings) resulting from activities related to vegetative treatments, fuel treatments, and prescribed burning. Proposed treatments and concurrent MPB infestation would decrease preferred pine structural stages (4B, 4C, and 5) to 6% but increase the amount of very large tree component (5%) in MAs 5.1 and 5.4 in the project area. Treatments would reduce the potential for MPB spread and reduce MPB numbers, therefore prey species availability (e.g., arthropods) would be lower in this alternative compared to Alternative A but more than in Alternative C. Effects for tree nesting species would be a loss of preferred pine habitat short-term. Vegetative treatments would reduce stand susceptibility to MPB attack, therefore providing mature trees and very large tree component to remain on the landscape long-term compared to Alternative A. Alternative B would decrease snag recruitment rates at the project scale short-term but may provide large diameter snags long-term by reducing the risk of MPB mortality. This could translate to reduced habitat quality and fewer tree nesting species within Pactola Project Area short-term but may provide habitat to these species long-term. In areas not treated, it is likely that this remaining habitat would succumb to MPB effects where habitat would be optimum short-term. The structural stage reductions within the Pactola Project Area would have minimal affect the Forest-wide habitat (< 1%) needed by these species.

Prescribed burning could decrease black-backed woodpecker preferred habitat (recently created snags) in those areas burned but may increase nesting/foraging habitat for these bark gleaning birds by creating new snags. It is unlikely that the proposed prescribed burn would impact the kinglet's habitat.

Alternative B would minimally reduce the amount of spruce habitat to 235 acres (<1%) to meet other Forest Plan objectives. In addition, spruce component in mixed stands may be reduced to meet hardwood and grassland objectives. Treatments would open forest canopies which are not conducive growth conditions for shade-tolerant spruce. Therefore expansion of golden-crowned kinglet habitat would not occur. However, these decreases in spruce component would have minimal effect on Forest objective 239-LVD.

Alternative C

Direct and Indirect Effects on Tree Nesting MIS Species
Direct and indirect effects of this alternative are similar to those discussed in Alternative B. However, this alternative would treat more area, therefore this alternative would have the greatest short-term effect on these species habitat compared to Alternatives A and B. Proposed treatments would decrease preferred pine structural stages (4B, 4C, and 5) to 5% and increase very large tree component to 4% in the project area. Vegetative treatments would reduce stand

susceptibility to MPB attack and the potential for stand replacing fire, therefore providing mature trees and very large tree component to remain on the landscape long-term compared to Alternative A and B. Even with more area treated, the structural stage reductions within the Pactola Project Area would have minimal affect the Forest-wide habitat (< 1%). Spruce habitats would be reduced more than in Alternative B which would slightly decrease habitat for the golden crowned kinglet. Prescribed burning would have the same effects as discussed in Alternative B. However, areas that have not been treated in the past would lose some of their late-succession components that would reduce this species habitat.

Conclusions for Tree Nesting MIS Species
All alternatives would slightly affect pine structural stage habitat, very large tree component, snag densities, and spruce habitat (1%) Forest-wide. Therefore, none of the alternatives would influence the Forest-wide population trend, Forest-wide habitat trend, or attainment of Objective 238 for the black-backed woodpecker, brown creeper, and golden-crowned kinglet, therefore these species are likely to persist.

Riparian/Aquatic MIS Species
The beaver and song sparrow are dependent on riparian habitat/vegetation, and are analyzed together in this section. See the Pactola Project Hydrology and Fishery Reports along with hardwoods and riparian habitat sections in this section for further discussion on effects to these species habitat.

Beaver (*Castor canadensis*)
The Forest Plan objectives that most closely apply to beaver in Pactola Project Area are 103 thru 105, 108, 201, 213, 214, 217, and 238a. Objectives 201 and 213 encourage maintenance of aspen and riparian area diversity, physical structure, and size. Such habitats are used by beaver for food, dams, and shelter. Forest Plan standards and guidelines 1105, 1106, 1113-1116, 1201, 1203, 1204, 1205, 1209, 1301-1302, 1306, 2202, 2205, and 3210 thru 3212, 4111, 4308, and 9107 would maintain or enhance habitat for this species.

Beaver occur throughout much of North America. They are semi-aquatic, and in the Black Hills and elsewhere, are widely distributed in streams, lakes, and marshes where permanent water is present. Beaver require aspen, willow, or cottonwood as a main food source. Beaver also use these and other woody plants to construct their dams and lodges. Beavers are considered a keystone species, because of their ability to restore degraded wetlands and provide habitat for many other species. Other than over harvest for fur, the most serious threats to beaver populations are habitat destruction and degradation due to human land uses such as water manipulations, livestock grazing in riparian areas, and urban and agricultural development in riparian/wetland areas. Human population growth and increasing demands on water resources have led to water storage, diversion, and channelization projects that affect water available in rivers, lakes, and wetlands (Boyle and Owens 2007). Restoring beaver populations to their maximum capability on the Forest would require restoring and maintaining healthy riparian ecosystems that would increase the potential for beaver re-establishment (Boyle and Owens 2007). In South Dakota, beaver are classified as furbearers, and as such are legally harvested during a three month period (South Dakota Game Fish and Parks 2010b).

According to FPMER, approximately 45,805 acres of aspen exist on the Forest, but none of this aspen is available to beaver. Baseline beaver surveys conducted on the Forest during 2004 indicated 259 - 392 beaver existed in nearly 80 known colonies. The long-term beaver population trend has increased in the Black Hills since heavy trapping was moderated by hunting regulations but it is less than its potential. The long-term habitat trend suggests decline, as evidenced by the decreasing quality of riparian habitats since European settlement, and a decrease in the amount of aspen over the past 30 years. In 2007, beaver abundance and distribution was monitored. Surveys were performed via helicopter to locate beaver food caches. Preliminary data resulted in a food cache density of approximately one cache for every 24 miles of perennial stream. Overall, 20 of the 52 sixth level watersheds (38%) surveyed had beaver food caches present. Additional time is needed to determine the trend in beaver abundance and distribution based on the food cache protocol (USDA Forest Service 2009c, 2010c).

Approximately 938 acres of aspen habitat occurs within the Pactola Project Area, but not necessarily in beaver habitat. No acres are typed as riparian in the project database, but suitable beaver habitat is found along the numerous perennial and intermittent stream courses in the Pactola Project Area. There are small amounts of both riparian and aspen habitats in stands dominated by pine or other species. Active beaver colonies are known to occur within the Pactola Project Area. Pactola Reservoir provides habitat for beaver dispersal and movement. These colonies are associated with streams and sometimes ponds where willows and aspen are present. Due to the steepness of terrain in the project area, most roads/trails are found within close proximity to beaver habitat. When conflicts arise, the beavers are moved or killed and the dams destroyed. With the increase in recreation demands, use patterns, increased road/trail access, and private land development in the Pactola Project Area, conflicts between beaver and humans would increase as beaver populations increase.

Song Sparrow (*Melospiza melodia*)

The Forest Plan objectives that most closely applies to the song sparrow is 103, 104, 105, 108, 201, 213, 214, 218, and 238a, which encourages management that promotes long-term stream health and riparian area diversity, physical structure, and size. Forest Plan standards and guidelines 1105, 1106, 1113-1116, 1201, 1203, 1204, 1205, 1209, 1301-1302, 1306, 2202, 2205, 3210- 3212, 4111, and 4308 would maintain or enhance habitat for this species.

This species is a summer resident of many Black Hills riparian areas, but it is most common in the northern hills. It occurs mainly in streamside thickets, especially willows, and is dependent upon these habitats throughout the breeding season. This sparrow has also been found in spruce areas adjacent to streams. The song sparrow forages on the ground in dense underbrush for invertebrates, seeds, and fruits. Nests are low to the ground in shrubs and understory vegetation. The greatest threats to this species are loss of deciduous riparian habitat to human development, conversion to agricultural land, and livestock grazing. Human population growth and increasing demands on water resources have led to water storage, diversion, and channelization projects that affect water available in rivers, lakes, and wetlands that would support riparian plant communities (Arcese et al. 2002, USDA Forest Service 2005a).

Forest-wide monitoring data suggests in the short-term, the relative density of song sparrows in 2008 had slightly declined since the forest bird monitoring program began in 2001.

Blakesly et al. (2008) projected it would take 20 years to detect a 3% annual decline for this species in the three riparian habitat types monitored (Rocky Mountain Bird Observatory 2001-2010). Riparian habitats have decreased in quantity and quality since the pre-European settlement era, indicating a long-term declining habitat trend (Parrish et al. 1996). Implementation of Forest Plan Standards and Guidelines and best management practices maintain riparian habitat, but at less than its full potential. Small riparian protection projects that have improved riparian conditions in some areas contribute to habitat enhancement and achievement of Objective 238a (USDA Forest Service 2009c). This species has been documented in suitable habitat in the Pactola Project Area.

Alternative A- No Action

Direct and Indirect Effects on Riparian/Aquatic MIS Species
Alternative A would have no direct effect on the beaver or song sparrow. Indirectly this alternative would improve riparian and hardwood communities. The loss of most pine overstory caused by MPB would likely benefit these species, increasing the potential for early seral communities, such as aspen, to expand and flourish short-term and could increase water availability necessary for riparian plant communities to thrive and expand. However, the loss of overstory that shade streams could affect evapotranspiration rate of streams reducing water availability and water quality. An increase in CWD could offset loss of shade, but could increase predation rates if near beaver colonies. In the absence of shade, young conifer encroachment would continue to out-compete hardwood communities in the absence of fire, therefore affecting beaver food availability and song sparrow habitat long-term. This alternative, compared to the action alternatives, has a higher potential for large stand-replacing fire which could affect watershed health. For the most part, riparian communities would be resilient to the direct effects of fire, but may affect beaver food availability and dam building materials short-term, but would increase these components long-term. Beaver populations would continue to increase in suitable habitat, increasing potential conflicts between humans and beaver. This alternative would benefit both the beaver and song sparrow by reducing pine competition that would expand hardwoods and riparian shrub communities.

Alternative B – Proposed Action

Direct and Indirect Effects on Riparian/Aquatic MIS Species
Direct effects to beaver are not anticipated by proposed treatments. Direct effects to song sparrows may include potential mortality from loss of nests, eggs, or chicks or nest abandonment associated with disturbance caused by harvest activities. Indirectly, active beaver dams could flood roads that are needed to access treatment areas where beaver are moved or killed. Treatments that enhance hardwoods and riparian communities would improve both species habitat and contribute to meeting Forest Plan Objective 201 and 238. Negative effects to beaver could potentially stem from placement of log landings and road-crossings that restrict movement and inhibit beaver complex expansion. Additional roads would increase conflict with beaver and road maintenance if constructed along suitable habitat. In addition, improved road conditions and access could increase fur harvest that would affect beaver expansion. Alternative B would

be the most favorable to beavers and song sparrows of the action alternatives in that less disturbance and treatments would occur within riparian habitat.

Alternative C

Direct and Indirect Effects on Riparian/Aquatic MIS Species
Direct and indirect effects to beaver and song sparrows and their habitats are similar to the effects discussed under Alternative B. However, in this alternative, more area would be treated therefore effects would be greater. This includes an additional 436 acres of roadside treatments to improve public safety, increasing the amount of disturbance/treatment in riparian communities compared to Alternatives A and B. Helicopter logging would not directly affect these species unless disturbance from operations would cause sparrow nesting to be interrupted or restricts beaver use. Additional road construction (19 miles) and reconstruction associated with proposed treatments (cable logging) would likely decrease water quality, increase water temperature, create barriers to dispersal and increase conflicts with beaver and road maintenance. Additional access would increase predation and trapping. Treatments in this alternative would reduce the potential for stand replacing fire more so compared to Alternatives A and B, thus reducing its subsequent negative effects to riparian function and condition. In the absence of fire, Alternative C would maintain and improve riparian and stream conditions but would add more negative effects to riparian communities compared to Alternatives A and B. Therefore, this alternative would have the least beneficial effect on the beaver and song sparrow species and their habitat.

Conclusions for Riparian/Aquatic MIS Species
Riparian dependent species would benefit most from Alternative A. Implementation of Alternatives B and C would follow Forest Plan standards and guidelines and contribute to riparian stability or improvement. All alternatives would meet the intent of MIS Objective 238a to maintain habitat for beaver and the song sparrow. Therefore, none of the alternatives would influence the Forest-wide population trend, Forest-wide habitat trend, or attainment of Objective 238, therefore these species are likely to persist.

Grasshopper Sparrow (*Ammodramus savannarum*)
The grasshopper sparrow has dual management status, it is both an MIS and a R2 sensitive species. To reduce redundancy, most life history, current condition, and predicted effects information are provided in the Pactola Project Wildlife BA/BE. Only MIS-specific documentation requirements are provided here (e.g., trend information, analysis of Objective 238). Forest Plan objectives that most closely apply to the grasshopper sparrow are 205, 218, 221, 230, 231, and 238. Objective 205 provides direction to manage for 122,000 acres of prairie grassland and 3,600 acres of meadow. Forest Plan standards 1110, 2107, 2412, 2417, 4111, 4301-4302, 3125, and 9204 would be applicable to this species.

In the Black Hills, this species is found mostly in native mixed-grass prairies but is documented in other types of grasslands (Rocky Mountain Bird Observatory 2001-2010, Vickery 1996). This species appears to be "area sensitive" (>30 ha), with a close association with grasslands of intermediate height. Threats to this species are habitat loss due to conifer encroachment, habitat fragmentation, and habitat degradation from grazing and fire regimes

that often fail to replicate the natural dynamics under which these species and their habitat evolved (Slater 2004, USDA Forest Service 2005a).

According to the FPMER, density estimates for the grasshopper sparrow have continued to increase since 2002. Grassland cover types are currently below management objectives. The general perception is that grassland habitats have been declining due to pine encroachment. However, for the ten-year monitoring period, grassland acreages have shown an increase then a decrease that is likely explained by inconsistencies in what cover types have been queried in the vegetation database not reflecting on the ground conditions which may have only changed slightly. The Forest is maintaining existing grassland habitat consistent with Objective 238a and additional time and effort is needed to achieve the grassland acreage identified in Objective 205 (USDA Forest Service 2010c).

In Pactola Project Area, there are approximately 394 acres of grassland communities. Additional acres of grassland probably exist, especially on soils that have formed under grass. The grasshopper sparrow has been documented adjacent to the area.

Alternative A- No Action

Direct and Indirect Effects to Grasshopper Sparrow
There are no direct effects to the grasshopper sparrow expected under this alternative. Indirect effects to grasshopper sparrow habitat could reduce the productivity and availability of native grassland habitat due to fire suppression and pine encroachment. However, due to anticipated MPB mortality, there is a greater potential for grassland habitat to expand. This alternative has a higher potential for stand replacing fire which would greatly add to the amount and size of grassland habitat. However, depending on the severity and intensity of the fire, native plant composition could change which could negatively affect grasshopper sparrow foraging and nesting habitat, especially if invasive species spread. In the absence of fire, this alternative would provide habitat for this grassland species to a greater degree compared to the action alternatives and indirectly contribute to meeting Objective 205 long-term.

Alternative B – Proposed Action

Direct and Indirect Effects to Grasshopper Sparrow
Direct effects to grasshopper sparrows may include potential mortality from nest destruction, loss of eggs or chicks or nest abandonment associated with disturbance caused by treatment activities. In the absence of fire, treatments that maintain grassland would increase grasshopper sparrow habitat slightly (see Grassland habitat discussion), but for the most part maintain a pine overstory. Additional pine mortality caused by MPB would have similar effects as Alternative A. Treatments and associated activities would increase the potential for invasive species to spread which could change plant community composition in grassland habitats, especially if large areas are disturbed in or adjacent to native grass communities. Alternative B reduces the potential for stand replacing fire, reducing the potential for grassland habitat expansion compared to Alternative A. This alternative would contribute directly to meeting Objective 205, thus increase habitat for the grasshopper sparrow.

Alternative C

Direct and Indirect Effects to Grasshopper Sparrow
Direct and indirect effects to the grasshopper sparrow and its habitat are similar to those discussed in Alternative B. An increase in treated areas, along with increase in disturbance associated with treatments and roads increase the potential for invasive species spread which would likely reduce productivity and availability of native grasslands. As with Alternative B, treatments would reduce the potential for stand replacing fire, reducing the potential for grassland habitat expansion from fire when compared to Alternative A. Alternative C would directly contribute to meeting Objective 205, thus increasing habitat for the grasshopper sparrow.

Conclusion for Grasshopper Sparrow
None of the alternatives would take action to decrease the amount of meadows. All alternatives, either directly or indirectly have the potential to contribute to meeting Forest Plan Objective 205. Grassland dependent species such as the grasshopper sparrow would benefit most from Alternative A. Implementation of Alternatives B and C would follow Forest Plan Standards and Guidelines to maintain the integrity of native grassland communities. All alternatives would meet the intent of MIS Objective 238a to maintain habitat for the grasshopper sparrow. Therefore, none of the alternatives would influence the Forest-wide population trend, Forest-wide habitat trend, or attainment of Objective 238, therefore this species is likely to persist

Ruffed Grouse (*Bonasa umbellus*)
The Forest Plan objectives that most closely apply to ruffed grouse are 201, 213, 217, and 238. Objective 201 encourages the Forest to provide at least 92,000 acres of aspen and 16,000 acres of bur oak. Forest Plan Standards and Guidelines 2107, 2202, and 2205 would be applicable to maintaining habitat for this species.

Ruffed grouse are widespread throughout the Black Hills, but occur in low abundance. This species is associated with hardwoods in a variety of age classes, including mature aspen stands used for drumming. Although found in conifers and hardwoods, this species is closely tied to aspen communities, relying on aspen buds and catkins in winter and spring, respectively. They typically nest at the base of a tree, bush, or stump. During the breeding season, drumming areas and broods are found in forests with a tall, dense understory of shrubs and abundant ground cover (Wiggins 2006a). Threats that affect grouse populations, lack of mixed-seral stage forest habitat, degradation of existing habitat due to fire suppression, and overgrazing by ungulates, and perturbations to local hydrology (Wiggins 2006a). The ruffed grouse is classified as an upland game bird with an annual hunting season between September and January (South Dakota Game Fish and Parks 2010b).

According to FPMER, the long-term habitat trend for ruffed grouse is one of decline given the reduction of aspen acreage compared to historic conditions. This has likely resulted in an associated population decline for ruffed grouse. Loss of aspen habitat is attributed to decadence of stands, to conifer encroachment and lack of periodic natural fire that would stimulate regeneration and suckering. Stands dominated by aspen currently occupy approximately 45,805 acres on the Forest. There has been a slight increase in aspen acres since 1997. The Forest continues to meet Objective 238a by maintaining aspen habitat. Additional

time and effort would be needed to increase aspen acreage. Monitoring protocol specific to ruffed grouse has been developed (Hansen et al. 2008). During this study, baseline estimates indicate probability of occupancy 0.111 in suitable habitat forest-wide. Implementation of ruffed grouse monitoring protocol should allow for the detection of long-term population trend (USDA Forest Service 2010c).

In the Pactola Project, there are approximately 938 acres dominated by aspen. Ruffed grouse has been documented in the Pactola Project Area mostly in hardwoods and mixed conifer communities.

Alternative A- No Action

Direct and Indirect Effects to Ruffed Grouse
There are no direct effects to ruffed grouse expected under this alternative. Alternative A would implement no hardwood retention/restoration treatments. Indirectly expected pine mortality caused by epidemic population levels of MPB would increase understory structure, hardwood communities and a mix of seral stages more so than the action alternatives (see Ponderosa Pine, Spruce, and Hardwood sections). This type of habitat would benefit rearing of broods, increase food items, and would provide more cover. Course woody debris would be higher, providing drumming logs but could also hide predators thus increasing predation rates. Due to the increased fuel hazard caused by the effects of MPB, there is higher potential for stand replacing fire. This type of fire usually increases expansion of aspen more so than silviculture treatments but could limit use of these areas due to a lack of cover and limited food items short-term. In the absence of fire, pine regeneration and encroachment would eventually out-compete hardwood communities and understory habitat components beneficial to ruffed grouse long-term. Spruce communities would increase in the absence of fire. This alternative would benefit this species more so than the action alternatives.

Alternative B – Proposed Action

Direct and Indirect Effects to Ruffed Grouse
Direct effects to ruffed grouse may include potential mortality from loss of nest, eggs, or chicks or nest abandonment caused by disturbance associated with treatment activities. A reduction in pine overstory and proposed hardwood retention and restoration treatments would increase aspen communities in the project area but to a lesser degree compared to Alternatives A and C. However, as pine canopy closes and regeneration occurs, competition between hardwood components and pine would reduce hardwood communities. Proposed treatments in addition to continued mortality caused by MPB would not provide a mix of seral stages in pine necessary for ruffed grouse short-term, but could provide habitat long-term if future treatments of the area focuses on increasing heterogeneity across the landscape. Prescribed burning would increase suckering and expansion of aspen in burned areas. However, CWD would be reduced by both prescribed fire and whole-tree harvest methods which could affect drumming areas. Increased access provided by roads could increase predation and hunting. Spruce would be slightly reduced by proposed treatments. Due to open canopies spruce would have limited expansion potential. There would be less potential for stand replacing fire, therefore expansion

of aspen would be less than compared to Alternative A. In the absence of fire, this alternative would be less beneficial to ruffed grouse compared to Alternative A.

Alternative C

Direct and Indirect Effects to Ruffed Grouse
Direct and indirect effects are similar to those discussed in Alternative B but effects would be greater due to more area being treated. Treatments that would enhance and expand hardwood communities would increase this species habitat more than Alternative B. In addition, loss of pine overstory through treatments and additional mortality caused by MPB would increase aspen understory component in the project area more so than Alternative B. However, proposed treatment and MPB effects would not provide a mix of seral stages in pine necessary for ruffed grouse short-term. As with Alternative B, this mix of seral stages could increase through future treatments that focus on creating heterogeneity across the landscape. Increased access provided by roads could increase predation and hunting far more than Alternative B. As with Alternative B, there would be less potential for stand replacing fire, therefore expansion of aspen would be less than compared to Alternative A. In the absence of fire, this alternative would less beneficial to ruffed grouse compared to Alternative A but more habitats would be provided compared to Alternative B.

Conclusion for Ruffed Grouse
Ruffed grouse species would benefit most from Alternative A. However, the Phase II Amendment FEIS determined that there would be adequate habitat to maintain a viable population of ruffed grouse if standards and guidelines are followed, and if conditions move towards hardwood restoration objectives. Implementation of Alternatives B and C would follow Forest Plan Standards and Guidelines to maintain the integrity of aspen and other hardwood communities (Objective 201). All alternatives would meet the intent of MIS Objective 238a to maintain habitat for ruffed grouse. Therefore, none of the alternatives would influence the Forest-wide population trend, Forest-wide habitat trend, or attainment of Objective 238, therefore this species is likely to persist

White-tailed Deer (*Odocoileus virginianus*)
The Forest Plan objectives that most closely applies to white-tailed deer are 201, 203, 204, 205, 213, 217, 238a, 5.1-202 through 5.1-204, 5.4-206, 5.4-207, and 8.2-203, which encourages the Forest to provide habitat species diversity, vegetative mosaic of natural and created openings, a variety of stand structures and to limit disturbance during critical months. However, Objectives 10-4 and 10-7 which reduces fire and insect hazard for areas with MPB would supersede MA objectives for pine at the project scale. Ponderosa pine structural stages provide a variety of habitat components for this species. Structural stages 1, 2, 3A, and 4A provide foraging habitat. Structural stages 3C, 4C, and 5 provide areas for cover habitat. Intermediate cover/forage habitat is provided by structural stages 3B and 4B. White-tailed deer utilize all of the pine structural stages, depending on summer and winter habitat needs. Forest Plan standards and guidelines 1301, 2101-2107, 2202, 2205, 2207, 3202, 3203, 3210-3212, 4111, 4107, 4201, 4206, 4301-4303, 4306, 9101, 9204 and 5.4-3201, 5.4-4101, 5.4-4102, 5.4-5101 and 5.4-9102 would maintain or enhance habitat for this species.

White-tailed deer are year-round residents in the Black Hills. Hardwood forests, meadows, and riparian areas are particularly important because these are the sites that produce the most forage (e.g., grasses, aspen, and various shrubs). This species may utilize different areas during the summer and winter months, especially if snow pack prevents access to an adequate food supply (USDA Forest Service 2005a). Hardwood stands of aspen and birch are prominent features in white-tailed deer's selection of home ranges and their use of sites within these ranges (SAIC 2003, Sieg and Seversen 1996). Kennedy (1992) suggested aspen stands are highly selected during fawning. Suitable deer habitat should have quality forage (tall forbs and shrubs) in adequate quantities in close proximity to cover (protection from weather and predators) and water within home ranges. These requirements become important on winter range and transitory range (SAIC 2003). However, there is no indication that these resources are limiting (USDA Forest Service 2005a). Effects to these habitat components have been discussed above (See Ponderosa Pine, Hardwoods, Grasslands, and Riparian sections in this document). This species is considered big game in South Dakota, with yearly harvest objectives set by the South Dakota Department of Game, Fish, and Parks (SDGFP 2010).

According to the FPMER, the most recent Black Hills South Dakota population estimate is approximately 43,000 deer (Huxoll 2010). Forest Plan Objective 217 supports habitat for management of 60,000 deer in the Black Hills, which matches state population objectives. The Forest-wide habitat trend is stable or increasing. Open habitat that provides forage is increasing and screening cover is stable. The Forest is meeting Objective 217 and Objective 238 based on white-tailed deer habitat and population trends (USDA Forest Service 2010c).

The current MPB epidemic would likely affect white-tailed deer habitat. While there is a great deal of information on the effects of the mountain pine beetle on forest health, little is known about the effects of this infestation on wild ungulate populations. It is assumed that as trees die, pine needles and trees begin to fall, this would lead to an increase in forest understory growth, and foraging habitat (Uresk and Seversen 1998, Sieg and Seversen 1996). As more trees die, the loss of thermal cover would occur. Depending on the length and duration of the current MPB outbreak, the effects could be similar to those caused by a stand replacing event such as fire. However, the difference between wildfire and MPB epidemic conditions is that hiding cover is not expected to change drastically, especially due to the prolific regeneration of pine that is likely to occur (Uresk and Severson 1998). The amount of CWD and slash could impede big game forage use temporarily. However, the loss of cover/forage juxtaposition may change big game behavior and use of habitats (Rumble et al. 2005, Millspaugh et al. 2000). A stand replacing fire could further change big game habitat availability and use.

Big game can be sensitive to disturbance such as road traffic and associated recreational use, which may restrict the use of some habitats (Stubblefield et al, 2006, Rumble et al. 2005, Wisdom et al. 2004, Millspaugh et al. 2000). The more extensive loss of cover especially in roaded areas increases the potential for human caused disturbance and predation which could affect winter survival and fawn recruitment. Therefore, reducing disturbance to big game during critical periods (winter) becomes more critical (Millspaugh et al. 2000). In areas where cover is lost, big game would likely use a combination of shrubs, topography, and areas of low human disturbance to meet their requirements for hiding and thermal cover (Stubblefield et al. 2006, Sawyer et al. 2006).

Very little is known on the effects of cable or helicopter logging on big game, especially deer. Some studies suggest that animals may respond differently to a human caused noise stimulus associated with perceived predation risk (Frid and Dill 2002, Stankowich 2008). Elk, bighorn sheep, and mountain goats appear to be more sensitive to disturbance. Factors that influence movement and avoidance may include predictability, frequency and magnitude, timing, and location of the disturbance (Knight and Cole1995). A sudden, fast approaching stimuli coming from above such as low flying aircraft may illicit a different response compared to a slow moving stimuli such as a hiker walking up a hill. Increased vigilance resulting from disturbance may reduce the physiological fitness of disturbed animals by increasing stress, increased movement costs and reducing time spent foraging (Hurley 2004).

Forest Plan Standards and Guidelines recognizes potential human disturbance by limiting access, provide cover/forage juxtaposition, and screening cover along at least 20% of arterial and collector roads. Roads/trail density open to motorized travel in the Pactola Project Area is 1.6 mi/mi2. During the winter road/trail density open to motorized travel is reduced to 0.9 mi/mi2. Objective 5.4-207 directs the forest to manage open road density of 1 mile/mile 2 or less for public travel from December 15 through May 15 to reduce human interaction during critical months. Standard 5.4-9101 and Guideline 5.4- 9102 provide additional direction pertaining to transportation and travel, restricting travel within certain areas of MA 5.4 between December 15 through May 15. Standard 5.4-9101 and Guideline 5.4- 9102 provide additional direction pertaining to transportation and travel, restricting travel within certain areas of MA 5.4 between December 15 through May 15. Although motorized use is outside the scope of the Pactola Project, access created or improved to meet treatment objectives would improve access for humans, livestock (forage competitors), and predators that would affect big game.

The Pactola Project is used year-round by white-tailed deer, although many deer migrate to traditional winter range in August. Management Area 5.4 is managed to provide winter range habitat for big game. Forested stands provide 22% of provide screening cover along arterial and collector roads in Pactola Project Area (see Appendix E-Maps). Topography along these roads (>30% slopes) would add additional screening cover (28%). The analysis determined that through vegetation and topography combined, screening cover is 48%. This demonstrates that Guideline 3203 is being exceeded.

Alternative A - No Action

Direct and Indirect Effects to White-tailed Deer

There are no direct effects to white-tailed deer expected under this alternative. Alternative A would implement no hardwood retention/restoration treatments or build additional roads. Indirectly expected pine mortality caused by epidemic population levels of MPB would increase understory structure, hardwood communities, and a mix of seral stages more so than the action alternatives (see Ponderosa Pine, Hardwood, and Riparian sections). This type of habitat would benefit rearing of fawns, increase forage availability and provide hiding cover. However, the loss of overstory would reduce thermal cover. Juxtaposition of cover/forage habitat would limit big game use in large portions of the area especially where there is a greater potential for human contact. Course woody debris would be higher, which could restrict access to forage and hide predators thus increasing predation rates. Due to the increased fuel hazard, there is higher

potential for stand replacing fire. This type of fire usually increases expansion of aspen more so than silviculture treatments. In the absence of fire, pine regeneration and encroachment would eventually out-compete hardwood communities and understory habitat components beneficial to white-tailed deer. Spruce communities would likely increase in the absence of fire and would provide cover. This alternative does not increase roads/trails but loss of cover in roaded areas could increase human disturbance and predation. In the absence of fire, this alternative would benefit white-tailed deer more so than the action alternatives.

Alternative B – Proposed Action

Direct and Indirect Effects to White-tailed Deer
Direct effects to white-tailed deer due vegetative treatment are not expected. Reduced pine overstory and proposed hardwood retention and restoration treatments would increase aspen communities in the project area but to a lesser degree compared to Alternatives A and C. To access treatment areas, additional roads would be needed. Proposed treatments in addition to mortality caused by MPB would not provide a mix of seral stages in pine necessary for white-tailed deer short-term. There is a potential to provide habitat long-term if future treatments in the area focuses on increasing stand heterogeneity and effectiveness of habitat across the project area. Road side treatments would reduce forested stand screening cover to 7% but maintain screening cover (31%) along arterial and collector roads. Loss of cover (hiding and thermal) would occur in an effort to reduce fire and MPB hazard that could decrease energy reserves. Prescribed burning would increase and improve palatability of browse species (e.g., aspen, chokecherry) and forage availability in portion of big game winter range. Course woody debris would be reduced by both prescribed fire and whole-tree harvest methods which could improve access to foraging areas. Spruce stands would be slightly reduced by proposed treatments but due to open stand conditions, spruce would not expand. There would be less potential for stand replacing fire, therefore expansion of aspen and grasslands would be less compared to Alternative A. Total road density would increase slightly but new roads would be closed to motorized travel once treatment activities are completed. New roads/trails would increase the potential for livestock use, predation, and human disturbance to areas previously not accessible. In the absence of fire, this alternative would be less beneficial to white-tailed deer compared to Alternative A but more beneficial compared to Alternative C.

Alternative C

Direct and Indirect Effects to White-tailed Deer
Direct effects to white-tailed deer due vegetative treatment are not expected, but could occur if flight response to helicopter activity causes death (e.g. loss of footing). Indirect effects to white-tailed deer would be similar to Alternative B. However, more area is treated therefore effects would be greater. Alternative C would have the greatest effect on ponderosa pine structural stages compared to the other alternatives which would affect white-tailed deer use in the area short-term but could provide habitat long-term. Prescribed burning would increase and improve palatability of browse species (e.g., aspen chokecherry) and forage availability in portions of big game winter range. Additional road side treatments would reduce forested stand screening cover to 5 %, but maintain screening cover (31%) along arterial and collector roads. More open stands with little escape cover increases susceptibility to predation and

hunting especially if access is improved. Cable logging could have a varied effect on big game populations. For the most part big game would likely become less affected by the disturbance as they adapt to a predicted disturbance stimuli. The amount of new roads constructed for cable logging in previously inaccessible areas would greatly increase the potential for livestock forage use, predation, and human disturbance that could affect big game especially if escape cover is not available. Helicopter logging effects to big game would be dependent on the area of disturbance, flight levels, approach patterns, and length of disturbance. However, helicopter logging would not have the long-term effects associated with new access. Total road density would increase appreciably, but new roads would be closed to motorized travel once treatment activities are completed. In the absence of fire, this alternative would be less beneficial to white-tailed deer compared to Alternatives A and B.

Conclusion for White-tailed Deer
All alternatives would slightly affect Forest-wide pine structural stage habitat (1%). All alternatives would reduce cover by varying degrees that would affect use patterns at the project scale. Implementation of Alternatives B and C would follow Forest Plan Standards and Guidelines to maintain the integrity of big game habitat communities and reduce the effect of human disturbance. Therefore, none of the alternatives would influence the Forest-wide population trend, Forest-wide habitat trend, or attainment of Objective 238, therefore this species is likely to persist.

Species of Local Concern

Species of Local Concern (SOLC) are defined as species that do not meet the criteria for sensitive species status but show a decline in only a portion of Region 2, or those that are important components of diversity in a local area. A list of SOLC for the Black Hills National Forest can be found in FSM 2620, Supplement r2_bh_2600-2005-1. The Phase II Amendment FEIS (USDA Forest Service 2005a; Sec 3-3.3.3 through Sec 3-3.3.5.8) provides in-depth information (e.g., range, distribution, etc.) on Forest SOLC analyzed for the Pactola Project. The Pactola Project analysis for SOLC is tiered to that document, which is summarized in each species section. The most relevant Forest Plan objective for SOLC is Objective 221 which directs the BHNF to “conserve or enhance habitat” for SOLC and to maintain long-term persistence forest-wide. There are no specific standards or guidelines to further direct attainment of the objective for the SOLC group as a whole. However, species-specific guidance would be addressed as appropriate below. If a species is known or suspected to occur in the project area or if suitable, but unoccupied habitat is present or adjacent to the area, then the species has been evaluated with respect to effects of the proposed project activities. Table 3-31 below the list of SOLC, whether they are present or if suitable habitat is found in the Pactola Project and a summary of their habitat requirements.

Table 3-31 Species of Local Concern of the Black Hills, South Dakota

Common Name (*Scientific Name*)	Species Present	Suitable Habitat Present	Habitat Requirements
Long eared Myotis (*Myotis evotis*)	Yes	Yes	Mostly coniferous montane habitats, uses large snags, caves, mines, abandoned buildings as maternity/hibernacula, also roosts in abandoned mines and buildings, rock crevices, and under bark. No known hibernacula in Black Hills (USDA Forest Service 2005a).
Long-legged Myotis (*Myotis volans*)	Yes	Yes	Primarily in montane coniferous forests, uses caves, mines, and snags as maternity/hibernacula, also roosts in abandoned buildings, rock crevices, and under bark (USDA Forest Service 2005a).
Northern Myotis (*Myotis septentrionalis*)	Yes	Yes	Dense ponderosa pine and mixed coniferous/deciduous forest. Hibernates in caves and mines. Maternity and day roosts in snags, buildings, caves and mines (USDA Forest Service 2005a).
Small Footed Myotis (*Myotis ciliolabrum*)	Yes	Yes	Variable habitats, but usually associated with rocky areas like bluffs, dissected breaks, ridges, cliffs and major rock outcrops. Roosts include mines, caves, rock features, and under bark (USDA Forest Service 2005a).
Meadow Jumping Mouse (*Zapus hudsonicus campestris*)	Yes	Yes	Strongly associated with riparian habitats along small streams in meadows (Cryan and Ellison 2005). Found throughout the Black Hills of Wyoming and South Dakota (USDA Forest Service 2005a).
Mountain Goat (*Oreamnos americanus*)	No	Yes	Rugged terrain with cliffs, rock faces, ledges and talus slopes, typically in higher elevations of the BHNF. Limited primarily to Black Elk Wilderness Area and Norbeck Wildlife Preserve (USDA Forest Service 2005a).
Northern Flying Squirrel (*Glaucomys sabrinus*)	Yes	Yes	Dense ponderosa pine and mixed coniferous/deciduous forest, roosts in cavities or builds nests. Most often associated with cool moist habitat with abundant snags. Large openings may inhibit gliding (USDA Forest Service 2005a).
American Dipper (*Cinclus mexicanus*)	Yes	Yes	Clear, fast-flowing streams, feeds on aquatic insects and insect larvae. Nests adjacent to streams on rocky ledges, cliffs, and under bridges. Limited primarily to Spearfish and Rapid Creeks in the BHNF (USDA Forest Service 2005a).

Common Name (*Scientific Name*)	Species Present	Suitable Habitat Present	Habitat Requirements
Black and White Warbler (*Mniotilta varia*)	No	No	Prefers mature and second growth deciduous and mixed deciduous coniferous forest with dense understory of shrubs/trees (USDA Forest Service 2005a). Limited primarily to the foothills in the BHNF (Tallman et al. 2002).
Broad-winged Hawk (*Buteo platypterus*)	No	Yes	Found primarily in mixed ponderosa pine and deciduous habitats. Nesting in SS4B, SS4C, and SS5 (USDA Forest Service 2005a).
Cooper's Hawk (*Accipiter cooperii*)	Yes	Yes	Found in ponderosa pine, spruce, shrublands and burned areas. Nests in mature riparian, conifer, and aspen forests with moderate to high canopy closure. Associated with SS3C, SS4B, SS4C, and SS5 (USDA Forest Service 2005a).
Northern Saw-whet Owl (*Aegolius acadicus*)	Yes	Yes	Prefers dense coniferous or mixed forest for nesting habitat. Dense sapling-pole sized stands are preferred for roosting, also associated with riparian habitats (USDA Forest Service 2005a).
Pygmy Nuthatch (*Sitta pygmaea*)	No	Yes	Prefers relatively open canopied, very mature undisturbed ponderosa pine forests with large trees and abundant large diameter snags (USDA Forest Service 2005a). Communal winter roosts in large diameter snags (Ghalambor and Dobbs 2006).
Sharp-shinned Hawk (*Accipiter striatus*)	Yes	Yes	Forages in a variety of dense forest habitats. Nesting habitat typically restricted to dense young conifer stands such as SS3B and SS3C (USDA Forest Service 2005a).
Atlantis Fritillary (*Speyeria atlantis pahasapa*)	Yes	Yes	Riparian areas adjacent to openings and moist meadows in boreal forests in Pennington, Custer, and Lawrence Co. Larvae of this genus feed exclusively on violets (USDA Forest Service 2005a).
Tawny Crescent (*Phycoides batesii*)	Yes	Yes	Open meadows, riparian wet meadows, and woodlands that provide diverse floral nectar species such as dogbane and composite flowers. Larvae feed mostly on asters (USDA Forest Service 2005a).
Callused Vertigo (*Vertigo arthuri*)	Yes	Yes	Moist shaded coniferous habitats mixed with hardwoods, exhibiting a deep litter layer and DWM. Most sites are associated with limestone substrates, but have been found in other soil types. Forages on decayed deciduous leaves and herbaceous plants (USDA Forest Service 2005a).

Common Name (*Scientific Name*)	Species Present	Suitable Habitat Present	Habitat Requirements
Cockrell's Striate Disc (*Discus shemekii*)	No	Yes	Moist shaded coniferous habitats mixed with hardwoods, exhibiting a deep litter layer and DWM. Often bordering or ranging slightly into stream floodplains. Most sites are associated with limestone substrates, but have been found in other soil types. Forages on decayed deciduous leaves and herbaceous plants (USDA Forest Service 2005a).
Frigid Ambersnail (*Catinella gelida*)	No	No	Duff specialist usually associated with limestone soils. Moist to dry coniferous forest with a deep litter layer, DWM, and deciduous tree/shrub understory. (USDA Forest Service 2005a).
Mystery Vertigo (*Vertigo paradoxa*)	No	Yes	Moist shaded coniferous forest mixed with hardwoods, exhibiting a deep litter layer and DWM. Most sites are associated with limestone substrates, but have been found in other soil types. Forages on decayed deciduous leaves and herbaceous plants (USDA Forest Service 2005a).

Predatory Species

The following species all prey upon small mammals or birds that are dependent on the lower vegetative strata and are analyzed together in this section: broad-winged hawk, Cooper's hawk, northern saw-whet owl and sharp-shinned hawk. Overstory vegetation is an important factor in these species foraging strategies in that it allows these species to remain unseen by prey. The more open the stand, the higher the potential to be observed. Predation may increase due to lack of cover. Since much of these species habitat is associated with pine structural stages, analysis is tiered to the Pactola Project Silviculture Report. A discussion of the effects of MPB to these communities can be found in the Habitat Communities and Habitat Component Sections of this section and the Vegetation Section for information on structural stages.

Broad-winged Hawk (*Buteo platypterus*)

The broad-winged hawk is the most common woodland hawk throughout its range, but is rare in the Black Hills. In the Black Hills, this bird is associated with ponderosa pine in mixed pine and deciduous habitats, occasionally with a white-spruce component. The Forest's bird monitoring program has recorded this species mostly in the Bearlodge Mountains and the northern Black Hills (USDA Forest Service 2010c). An active broad-winged hawk nest was found near Reno Gulch, making this pair the southernmost extent of this species' distribution in the Black Hills. This hawk hunts in a diversity of habitats, taking primarily a variety of small to mid-sized birds and mammals, but it is also an opportunistic raptor, and would feed on amphibians, reptiles, and insects. The primary risk factor for this species appears to be habitat alteration or loss that decreases nest site availability (Stephens and Anderson 2003).

According to FPMER, the highest number of broad-winged hawks occurred in 2004 in aspen habitat but this species has been documented in other habitats. Broad-winged hawk pine

habitat is quantified as structural stages 4B, 4C, and 5, especially with "very large" tree size. Forest MAs are moving towards objectives in pine structural stage 5, but meet or exceed Forest Plan objectives for 4B and 4C. The Forest is above large tree objectives for MA 5.1 (13%), but slightly below this objective in MA 5.4 (9%). Aspen habitat is currently below Forest Plan objective 201 (45,805 acres). Spruce habitat is above Forest Plan Objective (25,749 acres). Progress is being made towards meeting Forest Plan objectives for pine structural stages and aspen, though it may take some time to achieve the desired amounts of some structural stage habitat to meet this species needs (USDA Forest Service 2010c).

In the Pactola Project Area, in MAs 5.1 and 5.4, there are approximately 49% in pine structural stages 4B, 4C, and 5. In the project area, 1% is typed as spruce. Additional mature pine is available in the other MAs that would provide habitat for this species. Other habitats that pertain to the broad-winged hawk are addressed in the Very Large Tree, Snag, Aspen, and Riparian sections of this document. This species has not been documented in the Pactola Project Area.

Cooper's Hawk (*Accipiter cooperii*)

The Cooper's hawk is uncommon, but well-distributed in the Black Hills. This species is considered a habitat generalist, requiring mature forest with 60-90% canopy closure for nesting. This hawk usually nests in riparian, conifer, and aspen forests. Nest tree diameters are typically smaller than goshawk nest trees, although Cooper's hawks appear to select trees larger than what is randomly available. This hawk hunts in a diversity of habitats, taking a variety of small to mid-sized birds and mammals. In general, the species is more tolerant of human presence and habitat fragmentation than other accipiters. Habitat loss or alteration, predation, and prey availability appear to be the most threat to this species' persistence (Stephens and Anderson 2002, USDA Forest Service 2005a).

According to FPMER, Cooper's hawk was not detected during bird monitoring surveys in 2009. However, in the past this species has been detected in all major habitats, with no affinity to one particular habitat. Cooper's hawk pine habitat is quantified as structural stages 4B, 4C, and 5, especially with "very large" tree size. Forest MAs are moving towards objectives in pine structural stage 5, but meet or exceed Forest Plan objectives for 4B and 4C. The Forest is above large tree objectives for MA 5.1 (13%), but slightly below this objective in MA 5.4 (9%). Aspen habitat is currently below Forest Plan Objective 201 (45,805 acres). Spruce habitat is above Forest Plan Objective 239-LVD (25,749 acres). Progress is being made towards meeting Forest Plan objectives for pine structural stages and aspen, though it may take some time to achieve the desired amounts of some structural stage habitat to meet this species needs (USDA Forest Service 2010c).

In the Pactola Project Area, in MAs 5.1 and 5.4, there are approximately 49% in pine structural stages 4B, 4C, and 5. Additional mature pine is available in the other MAs that would provide habitat for this species. In the project area there is 4% typed as aspen and 1% typed as spruce. Other habitats that pertain to the Cooper's hawk are addressed in the Very Large Tree, Snag, Aspen, and Riparian sections of this document. This species has been documented foraging and nesting in the Pactola Project Area.

Northern Saw-whet Owl (*Aegolius acadicus*)
There are few documented observations of the northern saw-whet owl in the Black Hills, but this may be attributable more to its nocturnal habits than to actual demographics. The saw-whet is considered a habitat generalist usually found in coniferous and riparian forests. The species prefers mature forest, and selects large snag cavities excavated by primary cavity nesters (e.g., woodpeckers). Northern saw-whet owl pine habitat is quantified as structural stages 4A, 4B, 4C, and 5, especially with "very large" tree size, spruce, and aspen. The saw-whet owl often forages along forest edges, where it preys upon small mammals and birds. Limiting factors are availability of mature forests and nesting cavities (e.g., snags) within suitable breeding habitats (Johnson and Anderson 2003, USDA Forest Service 2005a).

According to FPMER, northern saw-whet owls were not recorded during forest bird monitoring surveys in 2009. However, Drilling (2010) found that saw-whet owls are the most common and widespread owl in the Black Hills. They were detected at 15% of all survey points and 93% of all routes and at all elevations and in all months. Forest MAs are moving towards objectives in pine structural stage 5, but meet or exceed Forest Plan objectives for 4A, 4B, and 4C. The Forest is above large tree objectives for MA 5.1 (13%), but slightly below this objective in MA 5.4 (9%). Aspen habitat is currently below Forest Plan objective 201 (45,805 acres). Spruce habitat is above Forest Plan Objective 239-LVD (25,749 acres). Progress is being made towards meeting Forest Plan objectives for pine structural stages and aspen, though it may take some time to achieve the desired amounts of some structural stage habitat to meet this species needs (USDA Forest Service 2010c).

In the Pactola Project Area in MAs 5.1 and 5.4, there is about 71% of mature pine. Additional mature pine is available in the other MAs that would provide habitat for this species. In the project area, there is 4% typed as aspen and 1% typed as spruce. Other habitats that pertain to the northern saw-whet owl are addressed in the Very Large Tree, Snag, Aspen, and Riparian sections of this document. This species has been documented along drainages the Pactola Project Area (Drilling 2010).

Sharp-shinned Hawk (*Accipiter striatus*)
This hawk occurs widely within the Black Hills, but it is also one of the rarest hawks here. Only a few nests have been documented on the Forest, primarily in conifer stands. Conifer stands of young age, with high tree density and high canopy closure have all been identified as potentially important breeding habitat parameters range-wide. This equates to white spruce and ponderosa pine in structural stages 3B and 3C. Furthermore, mature aspen may be particularly important foraging habitat due to the high wildlife diversity that it supports. The sharp-shinned hawk preys upon numerous species of small animals and birds. It is thought that foraging habitat for this hawk is represented by a variety of different vegetation conditions, especially those that provide a diverse prey base within their territories. Habitat loss or alteration, predation, and prey availability appear to be the most threat to this species' persistence (Stephens and Anderson 2002, Rocky Mountain Bird Observatory 2001-2010).

According to FPMER, sharp-shinned hawk was detected during bird monitoring surveys in 2009. However, this species is perhaps the rarest of the three forest accipiters and the Monitoring Breeding Bird Habitat (MBBH) program may not be adequate to effectively monitor this species. Forest MAs are moving towards objectives in pine structural stages 3B

and 3C, but are below Forest Plan objectives for these pine stages (4.65% and 3.13% respectively). Spruce habitat is above Forest Plan Objective 239-LVD (25,749 acres). Progress is being made towards meeting Forest Plan objectives for pine structural stages though it may take some time to achieve the desired amounts of some structural stage habitat to meet this species needs (USDA Forest Service 2010c).

In the Pactola Project Area, in MAs 5.1 and 5.4, there is 9% in pine structural stages 3B and 3C. Additional pine habitat is available in the other MAs that would provide habitat for this species. In the project area 1% is typed as spruce. Other habitats that pertain to the sharp-shinned hawk are addressed in the Ponderosa pine, Very Large Tree, Snag, Aspen, and Riparian sections of this document. This species has been documented foraging and nesting in the Pactola Project Area.

Alternative A- No Action

Direct and Indirect Effects to Predator Species
Alternative A would have no direct effect on these species or its habitat. Indirectly, the MPB mortality would decrease pine structural stages that 3B, 3C, 4B, and 4C habitats. Based on predicted mortality caused by MPB, existing MAs 5.1 and 5.4 pine structural stages 3B and 3C would change from 17% to 9% and structural stages 4B, 4C, and 5 would be reduced from 49% to 12%. Effects could be greater depending on the duration of the MPB infestation and stand densities. This decrease would only have a 1% affect on these structural stages forest-wide. Structural stage 4A would decrease from 32% to 23% as a result of MPB. MPB effects would improve stand heterogeneity that could be beneficial to these species long-term. Aspen component would increase due to lack of pine competition, improving prey abundance, but as pine regeneration becomes prolific, this component would start to decrease. In the absence of fire, spruce communities would increase providing stand heterogeneity. Indirect effects to the sharp-shinned hawk would be mostly short-term and would increase long-term (10-30 years) due to the high pine regeneration that occurs in the Black Hills and that MPB do not usually infest trees less than 6 inch diameter. Growth of younger pine would also be stimulated by the loss of mature overstory. However for the other predator species that require large diameter trees and dense mature stand conditions, the effects of large scale mortality caused by MPB could affect habitat availability long-term. Loss of overstory, increase in snag component, and CWD would improve most prey species (e.g. woodpeckers, small mammals) availability short-term. However long-term, a reduction of CWD, snags, and increased pine regeneration could affect prey availability. Short-term, large openings created by MPB limit the predator species foraging habitat to the edges due to the potential for predation. A stand replacing fire could also affect habitat and prey availability long-term. In the absence of fire, this alternative would be the least beneficial for predatory species long-term.

Alternative B – Proposed Action

Direct and Indirect Effects to Predator Species
Potential direct effects to predator species include nest loss during reproductive period, death of chicks and or fledglings and nest abandonment associated with treatment activities. Treatments to reduce susceptibility to MPB attack in addition to mortality caused by MPB would reduce preferred pine structural stages more that Alternative A, to a lesser degree compared to

Alternative C. Alternative B would reduce MAs 5.1 and 5.4 pine structural stages 3B and 3C from 9% to 3% and structural stages 4B, 4C, and 5 would be reduced from 12% to 6% compared to Alternative A. This decrease would only have a 1% affect on these structural stages forest-wide. The beneficial effects would be to reduce susceptibility of MPB attack in remaining mature pine and would leave 46% vs. 23% (Alternative A) in structural stage 4A to provide pine habitat for these species long-term. Effects could be greater depending on the duration of the MPB infestation and remaining stand densities. Untreated stands would be affected by MPB mortality and the effects to those stands would be similar to Alternative A. Aspen communities would increase benefiting broad-winged hawk and northern saw-whet owls, but as canopy closure and stand density increases, this benefit would start to decrease. Spruce stands would be slightly affected by treatment but open canopies would limit spruce expansion. Short-term, nesting habitat for predator species would be marginal. Open forest conditions would be beneficial to these species hunting strategies but also increases their susceptibility to predation. Treatments to reduce fuel hazard would reduce snag densities and CWD, reducing prey habitat. Even aged treatments would reduce stand heterogeneity, which could have long-term effects on these species habitat. Prescribed burning may increase stand heterogeneity but could reduce nesting habitat and prey habitat. The potential for stand replacing fire is less likely to occur which would be beneficial in maintaining mature pine stands long-term. In the absence of wildfire, this alternative would be less beneficial to these predator species short-term, but would be more beneficial to these predator species long-term compared to Alternative A.

Alternative C

Direct and Indirect Effects to Predator Species

Direct and indirect effects to predator species are similar to the effects discussed under Alternative B. However, more area would be treated so the loss of suitable habitat would be greater than compared to Alternatives A and B. Alternative C would reduce pine structural stages 3B and 3C from 9% to 2% and structural stages 4B, 4C, and 5 would be reduced from 12% to 5% in the project area compared to Alternative A. This decrease would only have a 1% affect on these species habitat forest-wide. The beneficial effects would be to reduce susceptibility of MPB attack in remaining mature pine leaving 50% vs. 23% (Alternative A) in structural stage 4A providing habitat long-term. Cable and helicopter logging systems could increase disturbance during nesting and cause abandonment. Roadside treatments would increase hardwoods, but a decrease in the conifer overstory could decrease effective foraging strategies (stealth) and increase owl predation. Treatments to reduce fuel hazard would reduce CWD, reducing prey abundance more so than Alternatives A and B. The potential for stand replacing fire is less likely to occur compared to Alternatives A and B. In the absence of wildfire, this alternative would be least beneficial for predator species compared to Alternatives A and B.

Conclusion for Predatory Species

All alternatives decrease pine structural stage habitat for these species short-term by varying degrees. Long-term, Alternatives B and C would provide pine habitat for these species more than Alternative A. None of the alternatives would notably decrease the amount of predatory species habitat at the Forest-wide scale. Therefore, it appears that all alternatives would be consistent with Objective 221; therefore these species are likely to persist.

Insectivore Species
The following species are dependent on insects as prey items. Nesting and roosting habitat are important factors but prey abundance and availability are important in maintaining persistence. Therefore, the pygmy nuthatch, long-eared myotis, long-legged myotis, northern myotis, and small-footed myotis are analyzed together in this section. Since much of these species habitat is associated with pine structural stages, analysis is tiered to the discussion on structural stages in the Vegetation Section and the Pactola Project Silviculture Report. A discussion of the effects of MPB to these communities can be found in the Habitat Communities and Habitat Component sections in this document.

Pygmy Nuthatch (*Sitta pygmaea*)
The pygmy nuthatch is an uncommon resident in the Black Hills and has been documented in a variety of ponderosa pine habitats, as well as in spruce forests and recently burned areas. This nuthatch has been observed in late successional pine but may not be limited to this habitat type in the Black Hills (Rocky Mountain Bird Observatory 2001-2010). This small bird is often associated with undisturbed old growth or mature pine stands. Large trees and snags (15-27" DBH) are preferred for nesting, foraging, and communal roosting. It is thought that mature pine forests with abundant big trees and snags provide good habitat in the Black Hills. This equates to pine stands having very large tree size (>16" DBH) in structural stages 4A, 4B, 4C, and 5. In addition, areas that have large snag densities such as burns and MPB affected areas could provide habitat for this nuthatch. Limiting factors appear to be loss of available large diameter snags for nesting and roosting habitat and availability of productive foraging habitat (Ghalambor and Dobbs 2006). The nuthatch feeds on ants, wasps, moths, beetles, grasshoppers, spiders, and pine seeds.

According to FPMER, the highest number of occurrences of pygmy nuthatch was recorded in 2007, but the number detected fluctuates from year to year. Forest MAs are moving towards objectives in pine structural stage 5 but meet or exceed Forest Plan objectives for 4B and 4C. The Forest is above large tree objectives for MA 5.1(13%), but slightly below this objective in MA 5.4 (9%). Structural stage objectives for ponderosa pine are moving toward Forest Plan objectives and along with stable to increasing snag availability forest-wide, indicates that the Forest is conserving and enhancing habitat for the pygmy nuthatch (USDA Forest Service 2009c, 2010c). The pygmy nuthatch has not been recorded in the Pactola Project Area.

SOLC Bats: Long-eared (*Myotis evotis*), Long-legged (*Myotis volans*), Northern (*Myotis septentrionalis*), and Small-footed (*Myotis ciliolabrum*)
Each of these bat species has similar limiting factors, response to management actions, and applicable Forest Plan direction. Because of this, they are summarized here as a group, with major similarities and differences discussed below.

All four SOLC bats appear to be widely distributed throughout the Black Hills region (Tigner and Stukel 2003). Abundance varies between the species, the long-legged myotis may be the most common in the Black Hills, and the long-eared myotis is probably the least common. All four bats utilize coniferous and mixed coniferous/deciduous forests in the Black Hills and in other parts of their ranges. Mature conifer forests with abundant big trees and snags provide good tree roosting habitat in the Black Hills. This equates to pine stands having very large tree size (>16" DBH) in structural stages 4A, 4B, 4C, and 5 and spruce communities. Roosts,

considered the primary limiting factor, include very large trees (live and dead), caves, mines, and rocks. Roosts provide relatively stable temperatures and moisture patterns compared to nearby external environments (Schmidt 2003a-2003d, Tigner and Stukel 2003, USDA Forest Service 2005a). Flying insects, especially moths and beetles, are important prey items for these species. Grasslands and hardwoods provide for diverse understory components that attract prey species. Water sources, especially ponds are important to bats in that they attract abundant numbers of prey species.

White-nose syndrome (WNS) is a disease responsible for unprecedented mortality in 45 species of hibernating bats in the northeastern United States. This previously unknown disease has spread very rapidly since its discovery in January 2007, and poses a considerable threat to hibernating bats throughout North America. To date, hibernating bat species that are considered "cave species" have mostly been affected by WNS. Northern Myotis bats have been documented as being affected WNS. The Fish and Wildlife Service has drafted a National Plan to aid in detection of WNS and conservation efforts (USDI Fish and Wildlife Service 2010a). In 2010, Forest Service temporarily closed to the public, all caves and abandoned mines on U.S Forest Service lands within the five-state Rocky Mountain Region to help slow the spread of WNS. Currently, little is known about WNS except that the fungus (*G. destructans*) is a common factor. It is unlikely that the proposed actions would have any impact on the spread of WNS.

According to FPMER, forest-wide monitoring suggests roost protection and snag availability are stable to increasing, therefore the Forest is conserving and enhancing habitat for the SOLC bats (USDA Forest Service 2010c). Forest MAs are moving towards objectives in pine structural stage 5 but meet or exceed Forest Plan objectives for 4B and 4C. The Forest is above large tree objectives for MA 5.1 (13%), but slightly below this objective in MA 5.4 (9%) (USDA Forest Service 2010c).

Caves and mines (collectively termed 'caverns' hereafter) are other important roost resources in the Black Hills. Although caverns are not as common as trees, they provide communal opportunities, meaning that any one suitable structure has the potential to host a greater number of bat species and individuals than any one tree typically does. Vegetation removal near cavern entrances could potentially change temperatures or air flow patterns within them (Tigner and Stukel 2003). Standards 3102 and 3207 mandates that microclimates be maintained in bat roosts. Implementing these standards would serve two purposes: ensuring that microclimates are maintained and preventing disturbance to roosting bats.

Currently, there many abandoned mines known to house SOLC bats in the Pactola Project Area. Surveys indicate that most of the mines are used for night roosts and a few indicated maternity or hibernation sites. Several of the mines have collapsed since original surveys were completed in 1992(e.g., Diana and Edelweiss). None of the sites have been gated to protect habitat. Due to high recreation activity, most mines have been entered by the public which may affect bat use and may pose a safety risk.

Alternative A- No Action

Direct and Indirect Effects to Insectivores
Alternative A would have no direct effect on these species or its habitat. Indirectly, MPB mortality would decrease pine structural stages that are currently in the moderate to high insect hazard, negatively affecting mature and late seral habitats. Based on predicted mortality caused by MPB, in MAs 5.1 and 5.4 existing pine structural stages 4B, 4C, and 5 in the project area would be reduced from 49% to 12% and structural stage 4A would decrease from 32% to 23%. This decrease would only have a 1% affect on these structural stages forest-wide. MPB effects to these species habitat could be greater depending on the duration of the infestation and stand densities. For these species, the loss of large diameter trees and dense mature stand conditions could affect habitat availability long-term. For the pygmy nuthatch, this loss of mature pine could also affect the availability of pine seeds as a food item. For SOLC bats, loss of vegetation adjacent to caverns could affect their microclimates making these caverns unsuitable for maternity and hibernation roosts. Grass/forb understory, aspen, and spruce communities would increase and improve prey availability. Snag densities would be greatest in this alternative compared to the action alternatives that would benefit these species short-term as snags created by MPB would fall within 5-10 years. Long-term, the lack of large mature pine, snag densities, and their availability would limit habitat needed by insectivore species. A stand replacing fire would provide prey habitat but could reduce the availability of water sources (ponds) that would affect foraging strategies of bats and further exacerbate the loss of large snags long-term. The loss of suitable habitat long-term makes this alternative the least favorable for the pygmy nuthatch and SOLC bats.

Alternative B – Proposed Action

Direct and Indirect Effects to Insectivores
Potential direct effects to SOLC insectivore species include loss of roost and nesting sites, death of pups and chicks and abandonment of nesting/roost sites associated with treatment activities. Treatments to reduce susceptibility to MPB attack in addition to mortality caused by MPB would reduce preferred pine structural stages more that Alternative A, to a lesser degree compared to Alternative C. Alternative B would reduce mature pine structural stages in the project area from 12% to 6% compared to Alternative A. The beneficial effects would be to reduce susceptibility of MPB attack in remaining mature pine and would leave 46% vs. 23% (Alternative A) in structural stage 4A providing mature habitat long-term for these species. MPB effects to treated and untreated mature pine stands could be greater depending on the duration of the infestation and remaining stand densities. This decrease in mature pine in the project would only have a 1% affect on these structural stages forest-wide. Very large tree component would increase from 3% in Alternative A to 5%. Snag densities would remain high short-term but are likely to decline after 5-10 years. Treatments to reduce fuel hazard would reduce CWD compared to Alternative A, affecting prey abundance. The potential for stand replacing fire would be reduced, avoiding its negative effects to these species habitat long-term. Grass and aspen communities would increase due to treatment but as canopy closure and stand density increases, abundance would decrease. Spruce stands would slightly be affected by treatment. Short-term, this alternative would provide a mix of pine habitat to a lesser degree compared to Alternative A, but to a greater

degree compared to Alternative C. Alternative B would be more beneficial for the pygmy nuthatch and SOLC bats long-term compared to Alternative A.

Alternative C

Direct and Indirect Effects to Insectivores
Direct and indirect effects to these insectivore species are similar to the effects discussed under alternative B. However, more area would be affected by vegetative treatment, so the effects would be greater. Alternative C would reduce pine structural stages 4B, 4C, and 5 from 12% to 5% in the project area compared to Alternative A. This decrease would only have a 1% affect on these species habitat forest-wide. The beneficial effects would be to reduce susceptibility of MPB attack in remaining mature pine and would leave 50% vs. 23% (Alternative A) in structural stage 4A providing habitat long-term for these species. Roadside treatment would increase hardwood communities but may also increase evapotranspiration of water sources that could affect bat foraging. Cable and/or helicopter logging systems would have similar effects to insectivore species as conventional logging systems. Areas that have not been treated in the past would lose some of their late-succession components (decay processes) reducing preferred habitat long-term. Short-term this alternative would reduce preferred habitat compared to Alternatives A and B. This alternative would maintain mature overstory that would provide habitat for these species long-term.

Conclusion for Insectivore Species
None of the alternatives would notably decrease the amount of these species habitat at the Forest-wide scale. All of the alternatives would reduce preferred nesting/roosting habitat short term. Alternatives B and C would maintain mature trees in treated areas increasing the potential for these species' habitat to persist long-term. It appears that all alternatives would be consistent with Objective 221; therefore these species are likely to persist.

Riparian Dependent Species
The following species are dependent on riparian habitat/vegetation, and are analyzed together in this section: meadow jumping mouse, Atlantis fritillary butterfly, tawny crescent butterfly, and the American dipper. These species require various aspects of maintaining water quantity and quality, healthy riparian communities that provide structural diversity. For further discussion on the effects to these species habitat, see the Pactola Project Watershed, Geology, and Soils Section and the Hardwood and Riparian Habitat Sections in this document.

Meadow Jumping Mouse (*Zapus hudsonicus campestris*)
This subspecies occurs in the Black Hills and its range is thought to be limited to mountainous portions of eastern Wyoming and western South Dakota (Cryan 2004, Cryan and Ellison 2005, King et al. 2006). This species was found to be relatively common in riparian habitat sampled in the Black Hills (Cryan and Ellison 2005). The meadow jumping mouse is strongly associated with riparian and meadow habitats that occur along small streams. A dense understory of deciduous shrubs, grasses, forbs, and downed wood are often present. The mouse's diet varies, and includes seeds, berries, leaves, buds, fungi, and insects. This dense, diverse understory requirement in riparian areas may limit the species' distribution and abundance if these components are not available (Cryan 2004, Cryan and Ellison 2005, Duckwitz 2001).

According to FPMER, no Forest-wide monitoring data for the meadow jumping mouse or riparian resource condition (Objective 213) was collected in FY 2009. Implementation of Forest Plan standards and guidelines and best management practices maintain riparian habitat Forest-wide, but probably at a level less than its full capability. Progress is being made in achieving Objective 214 (USDA Forest Service 2010c). Projects to restore riparian and wetland habitat or to rehabilitate stream reaches have increased in the last five years, which could partially indicate trend of jumping mouse habitat. These projects have a small positive influence on the habitat trend for these mice to meet the intent of Objective 221. Limited data suggest that the Forest is conserving habitat for the meadow jumping mouse (USDA Forest Service 2009c, 2010c). This species likely occurs in the Pactola Project Area since it was commonly found in riparian zones sampled (Cryan and Ellison 2005).

SOLC Butterflies: Atlantis Fritillary (*Speyeria atlantis pahasapa*) and Tawny Crescent (*Phycoides batesii*)

These two species have similar limiting factors, response to management actions, and applicable Forest Plan direction. Because of this, they are summarized here as a group. In South Dakota, both species are found only in the Black Hills. Both of these butterflies are associated with riparian areas, particularly when found adjacent to meadows. Specific plant species are important to each butterfly for nectar supplies and/or larval hosts. The Pahasapa fritillary is most dependent on violets, and the tawny crescent is most closely associated with smooth aster, dogbane, and other composites. These butterflies have been documented feeding on noxious weed species such as leafy spurge and Canadian thistle. Limiting factors include the loss of nectar and larval host species through habitat loss, herbicide treatments, and invasive species (Marrone 2002, 2005, 2006, 2007). Stefanich (2001) hypothesized that the limiting factor in the Black Hills is the destruction of this butterfly's habitat or isolation of colonies to the extent that populations are unable to disperse. Both butterflies have been documented in the Pactola Project Area.

According to FPMER, no Forest-wide monitoring data regarding these butterflies or riparian resource condition (Objective 213) was collected in FY2009. Implementation of Forest Plan standards and guidelines and best management practices maintain riparian habitat Forest-wide, but probably at a level less than its full capability. Progress is being made in achieving Objective 214. Projects to restore riparian and wetland habitat or to rehabilitate stream reaches have increased in the last five years, which could partially indicate trend of riparian butterfly habitat. These projects have a small positive influence on the habitat trend for these butterflies to meet the intent of Objective 221 (USDA Forest Service 2009c, 2010c).

American Dipper (*Cinclus mexicanus*)

The American dipper is uncommon and isolated to clear, fast-flowing streams in the Black Hills. Dipper populations in South Dakota are declining, hence a status of state threatened in South Dakota. Until 2010, the South Dakota Department of Game, Fish, and Parks monitored dippers during the breeding and winter seasons (Backlund 2007, Lovett 2010). The Forest's bird monitoring program has recorded this species in Spearfish Creek and several of its tributaries but it has also been found in other streams (e.g., Bear Butte, Elk, Iron, Spearfish, Little Spearfish, East Spearfish, Whitewood, French, and Rapid Creeks). DNA analyses suggest that the Black Hills dipper population may be genetically distinct from other populations (USDA Forest Service 2010c, Backlund 2007). The USDI Fish and Wildlife

Service announced its 90-day finding on a petition to list the Black Hills population as a distinct population segment (DPS). Based on their review, the Fish and Wildlife Service concluded that this population is not a "listable" entity under the Endangered Species Act (USDI Fish and Wildlife Service 2009b).

This bird usually nests within 25 feet of streams on rocky ledges, cliffs, boulders, and bridges that overhang flowing water, preventing predation. It feeds primarily on aquatic insects and insect larvae caught while diving underwater. The dipper prefers cool, clear streams that flow for most of the breeding season. Loss of nests and young can be attributed to high flows, human disturbance, and predation (Lovett 2010). The primary risk factor for the dipper appears to be flow reductions, degraded water quality due to sedimentation, and other pollutants that reduce habitat and reproduction. Limiting factors include prey availability, suitable winter habitat, stream connectivity, and availability of nest sites (Anderson 2002). According to FPMER, nesting attempts in Spearfish Creek have remained fairly stable and then declined in 2009. Nesting attempts and success have declined in Whitewood Creek but remained stable in 2009. Additional monitoring is needed to determine long-term trends (USDA Forest Service 2010c).

There is one historical record of American dipper nesting along Rapid Creek above Silver City in the Pactola Project Area. No recent surveys for this species have been completed. Rapid Creek, a fast-flowing perennial stream may not provide suitable foraging habitat for the dipper due to poor water quality (iron), water temperature, and high sediment loads. However despite the water quality issues, Rapid Creek has been identified as providing good fish habitat, which indicates an adequate food supply. Additional habitat for this species could be available in smaller perennial streams in the project area, but most of these have water quality issues. Most likely the lack of nesting substrates that overhang perennial flowing water limits the area being used by dippers, since most streams in the area experience reduced flows in the middle to late summer.

Alternative A- No Action

Direct and Indirect Effects to Riparian Dependent Species

Alternative A would have no direct effect on the riparian dependent SOLC species. No treatments to enhance meadows and hardwoods would occur. No treatments adjacent to or within the WIZ would occur. No additional roads would be constructed or improved. Indirectly this alternative would improve riparian and hardwood communities. Loss of most pine overstory caused by MPB would likely benefit these species, increasing the potential for more openings adjacent to streams and stimulating hardwoods and shrub species. Loss of most overstory due to MPB effects could improve water availability. The loss of overstory that shade streams could affect evapotranspiration rate of streams reducing water availability and water temperatures which could affect dipper habitat. An increase in CWD could offset this loss of shade while providing cover for the meadow jumping mouse. Long-term, open conditions would stimulate pine regeneration which encroach into meadows and out-compete seral riparian communities, reducing habitat for these species. This alternative, compared to the action alternatives has a higher potential for large stand-replacing fire. For the most part, riparian communities would be resilient to the direct effects of fire but a stand replacing wildfire could increase water temperature and decrease water quality reducing aquatic prey abundance short-term. Wildfire would increase meadow habitat adjacent to streams that would be beneficial to SOLC butterflies

and the jumping mouse. In the absence of fire, Alternative A would provide the most beneficial effects to these species habitat compared to the action alternatives.

Alternative B – Proposed Action

Direct and Indirect Effects to Riparian Dependent Species
In Alternative B, treatments would occur in riparian communities to meet other Forest Plan objectives such as hardwood restoration and public safety (fuel reduction and improved public egress). Additional roads/trails are needed to treat areas that may influence riparian habitat. Potential direct effects to the meadow jumping mouse and SOLC butterflies include loss of nests with young, eggs, and mortality caused by machinery. Direct effects to American dipper are not expected. Beneficial effects would increase meadow habitat and hardwood habitat adjacent to streams and stimulate growth of deciduous riparian shrubs if competing conifer is removed. Negative effects from treatment may occur if stream shading is removed increasing water temperature and evapotranspiration rates. Treatments to reduce overstory and fuel hazard (e.g., CWD) along roads that parallel streams would reduce stream shading, increasing water temperatures. Harvest activities (e.g. whole tree harvesting) on steep slopes (e.g., 30-40% slopes) adjacent to streams and within the Water Influence Zone (WIZ) has the potential to degrade stream bank stability and increase in-stream sediments, thus reducing water quality in aquatic habitats. Associated activities such as log decks, road placement, stream crossings, and herbicide treatment increase the potential for loss of nectar and host species, increase disturbance where invasive species can spread, and increase in-stream sediment during high rainfall events. For the American dipper, sediments into Rapid Creek would negatively impact this species foraging abilities. However, Forest Plan standards and guidelines, best management practices (BMPs) and Pactola Project design criteria would reduce the effects of treatment and associated activities (e.g., new road construction) on riparian communities and aquatic habitats (e.g., water quality) to within Forest Plan limits. Existing access routes used for treatments that have been identified as not meeting Forest Plan standards and guidelines would be repaired and improved, increasing water quality, water temperature and maintain connectivity of streams in those areas. Treatments in this alternative would reduce the potential for stand replacing fire more so than Alternative A, but to a lesser extent compared to Alternative C. In the absence of fire, Alternative B would maintain and improve riparian and stream conditions within Forest Plan limits. However, the additional roads and treatments would cause disturbance to these species habitat short-term. Therefore, Alternative B would be less favorable to these riparian dependent SOLC species than Alternative A but more favorable than Alternative C.

Alternative C

Direct and Indirect Effects to Riparian Dependent Species
Direct and Indirect effects to riparian dependent SOLC species and their habitat are similar to those discussed in Alternative B. Alternative C would treat more area, therefore effects would be greater. As part of this alternative an additional 436 acres of roadside treatments would increase the amount of disturbance/treatment in riparian communities compared to Alternative B. Roadside treatments that reduce fuel hazard and conifer overstory to <50 BA that parallel perennial and intermittent stream courses would likely increase water temperatures and evapotranspiration rates in those streams which could affect aquatic prey abundance. However,

roadside treatments would remove conifer competition that would enhance riparian plant communities which would SOLC species habitat. Additional road construction (19 miles) and reconstruction associated with proposed treatments (e.g., cable systems) have more potential to increase sediments, widen stream channels, increase water temperatures and create barriers to dispersal for aquatic species compared to Alternative B. Increase in sediments to tributaries of Rapid Creek could negatively affect American Dipper use of Rapid Creek. Cable and helicopter logging systems usually have fewer effects on riparian areas compared to conventional logging systems but the roads associated with cable systems have the potential to increase sediment into streams. As in Alternative B, Forest Plan standards and guidelines, BMPs and Pactola Project design criteria would reduce the effects of treatment and associated activities on riparian communities and aquatic habitats (e.g., water quality) within Forest Plan limits. Existing access routes used for treatments that have been identified as not meeting Forest Plan standards and guidelines would be repaired and improved, increasing water quality, water temperature and maintain connectivity of streams in those areas. Treatments in this alternative would reduce the potential for stand replacing fire more so than Alternatives A and B. In the absence of fire, Alternative C would maintain and improve riparian and stream conditions but would add more negative effects compared to Alternatives A and B. Therefore, this alternative would have the least beneficial effect on SOLC species dependent on riparian communities.

Conclusion for Riparian Dependent SOLC Species

Alternative A would be the most beneficial to these SOLC species. Alternatives B and C through treatment activities would increase the potential to negatively affect riparian communities and aquatic habitats. None of the alternatives would notably decrease the amount of these species habitat at the Forest-wide scale. Forest Plan direction would maintain riparian diversity, condition, and trend, therefore Objective 213 would be met. It appears that all alternatives would be consistent with Objective 221; therefore these species are likely to persist.

SOLC Snails: Callused Vertigo (*Vertigo arthuri*), Mystery Vertigo (*Vertigo paradoxa*), and Striate Disc (*Discus shemekii*)

Gastropods are typically found in well-developed litter (but not thick or fungus matted) with very rich and comparatively wet, loose soil. Most sites have dense overstory and a deciduous component. Snail colonies in the Black Hills have patchy distribution (Frest and Johannes 1993, 2002, Anderson 2003b). This may be due to habitat preferences, foraging requirements, and/or hostile environmental conditions. Some snail species can tolerate somewhat dryer site conditions, where others may not. Most snail species prefer calcareous substrate materials but others (e.g., Vertigo spp.) have been found in other soil types (Frest and Johannes 1993, 2002, and Anderson 2004a, 2004b). Snails are generally susceptible to activities that change the temperature and moisture at the soil or litter level. Additional microhabitat conditions such as soil type, amount and type of plant ground cover, soil pH, depth and type of litter, and amount of cover from rocks or woody debris also play a role in where these snails can survive. Research indicates low snail diversity may be due to changes in the moist microclimate (lack of moss/lichen), increased environmental effects, and loss of overstory cover which creates drier site conditions that are detrimental to land snails (Anderson 2004a, 2004b). Threats to gastropods include loss of suitable habitat, predators, desiccation, soil compaction, trampling, and barriers to dispersal (Anderson 2004a, 2004b). Frest and Johannes (2002) identified that these snails are affected by roads (and their associated activities), livestock trampling, and timber harvesting.

According to FPMER, monitoring for these species was not funded in 2009. Forest Plan standard 3103 requires known SOLC snail colonies to be managed to retain favorable site conditions and to avoid/minimize the effects of land management activities to protect SOLC snails and their habitat. Subsequently, habitat is likely to be conserved for these species consistent with Objective 221 (USDA Forest Service 2010c). The Vertigo species have been documented in and/or adjacent to most of the Pactola Project Area, associated primarily with riparian areas and spring/seeps. Due to their small size, these species are often overlooked. All known Frest sites are immediately adjacent to existing roads, two of which (sites 95 and 306) are found in mesic conditions associated with conifer/hardwood mixed stands. Site 94 appears to have undergone previous treatment, where site conditions are open, dry with limited hardwood overstory.

Alternative A- No Action

Direct and Indirect Effects to SOLC Snails

No direct effects to SOLC snails are expected under this alternative. Indirectly loss of overstory caused by MPB infestation would increase sunlight and wind in suitable snail habitat. Open stands would increase mortality on drier areas. This would decrease the mesic conditions needed for snail movement and colony expansion. As trees die, pine needles, and CWD would increase along with understory vegetation that would maintain preferred microhabitat conditions and increase refugia habitat (e.g., large rotting logs). The potential for large stand replacing fire in this alternative is greater than compared to the action alternatives. This type of fire would cause mortality, loss of litter layers and vegetation that would provide suitable snail habitat. In addition, snail colonies may become more isolated or even be lost. In the absence of fire, this alternative would maintain suitable habitat for these snails.

Alternative B – Proposed Action

Direct and Indirect Effects to SOLC Snails

Potential direct effects to SOLC snail species include mortality caused by equipment associated with treatment activities and herbicide treatments. Indirectly, loss of overstory caused by MPB and treatments in suitable snail habitat would likely result in more open, drier site conditions that would affect snail colonies similar to effects discussed for Alternative A. Treatments and associated activities (e.g., road placement, skidding) that affect springs, seeps, and wet areas may cause soil compaction and habitat loss. Isolation of colonies could also occur if equipment use, roads, and skid trail compact soils and reduce litter layers that would create barriers to dispersal. Whole tree skidding and fuel treatments would reduce CWD that could provide habitat for snails during dry periods. Prescribed fire would not affect known snail colonies. In suitable habitat prescribed fire has the potential to lose colonies, isolate colonies, and/or reduce litter layers similar to the effects of more severe and intense wildfires. Forest Plan direction would protect known snail locations. In the absence of fire, this alternative would be less beneficial to SOLC snails compared to Alternative A.

Alternative C

Direct and Indirect Effects to SOLC Snails
Direct and indirect effects to SOLC snail species are similar to the effects discussed under Alternative B. In this Alternative, more area is treated to remove overstory and fuel hazards which would reduce habitat and the capability of these snails to disperse due to drier site conditions, therefore the effects would be greater than Alternative B. As in Alternative B, Forest Plan direction would protect known snail locations from loss due to treatments. Additional roadside treatments, especially along riparian areas and mesic sites would further isolate known colonies by opening up stands and reducing CWD.

Conclusion for SOLC Snail Species
All alternatives have the potential to reduce habitat either directly or indirectly that would affect the capability for snail species to disperse. Alternatives B and C through treatment activities would reduce the potential for stand replacing fire, which has the potential to decrease the number of snail colonies known to occur on the Forest. None of the alternatives would notably decrease the amount of these species habitat at the Forest-wide scale. Forest Plan direction would maintain riparian diversity, condition, and trend, therefore Objective 213 would be met. All alternatives would be consistent with Forest Plan Standard 3103 and Objective 221; therefore these species are likely to persist.

Northern Flying Squirrel (*Glaucomys sabrinus*)
The flying squirrel resides in a variety of forested habitats including pure ponderosa pine and pine mixed with aspen, birch, or spruce in the Black Hills (Krueger 2004). This species is well dispersed across the forest but is found primarily in the northern and central hills (Krueger 2004, Hough 2008). This species is nocturnal and utilizes mostly spruce and dense mature pine (SS 3C and 4) for foraging habitat, and snags for denning in the Black Hills (Hough 2008). Flying squirrels consume a varied diet, including fungi, lichens, seeds, insects, and bird eggs (Higgins et al. 2000). They nest and shelter in cavities of large trees, snags, and in small structures (dreys) that they build from twigs, bark, and roots. The flying squirrel tends to avoid large openings and early seral pine stages, which may prevent crossing small openings by gliding from one tree to the next (Hough 2008, Duckwitz 2001).

Turner (1974) noted that the highest densities of flying squirrels are likely found in white spruce forests in moist canyons and in the northern Black Hills. Hough (2008) found that the highest densities were found where habitat features such as snags, dead/down material, and a moist microclimate with fungi were most abundant. Aspen/birch stands were important denning habitat but were avoided for foraging habitat (Hough 2008).

According to FPMER, the Forest is conserving habitat for the northern flying squirrel in regards to spruce habitat, snag habitat, and very large tree components. Progress towards increasing the acres of structural stage 5 and structural stage 3C is still needed to enhance habitat. Hough (2008) determined that the population appeared to be stable.

In Pactola Project Area, suitable habitat for this squirrel is found in pine, spruce, and hardwood communities. See the Vegetation Section for discussion of pine structural stage habitat and

Habitat Community and Habitat Component sections. This species has been documented in the Pactola Project Area mostly in late successional conifer habitat and hardwood draws.

Alternative A- No Action

Direct and Indirect Effects to Northern Flying Squirrel
Alternative A would have no direct effect on this species or its habitat. Indirectly, MPB cause mortality would decrease pine structural stages that are currently in the moderate to high insect hazard, negatively affecting mature and late seral habitats. Based on predicted mortality caused by MPB, in MAs 5.1 and 5.4 existing pine structural stages 4B, 4C, and 5 in the project area would be reduced from 49% to 12%. Structural stage 4A would decrease from 32% to 23% as a result of MPB. This decrease would only have a 1% affect on these structural stages forest-wide. MPB effects to these species habitat could be greater depending on the duration of the infestation and stand densities. For this species, the loss of large diameter trees and dense mature stand conditions due to large scale mortality caused by MPB could affect habitat availability long-term. Loss of mature pine could also affect the availability of pine seeds as a food item. Although CWD would increase the potential for other food items such as fungi and insects, the large openings created by MPB infestation would affect movement and use of this habitat by flying squirrels. Snag densities would be greatest in this alternative compared to the action alternatives. Snag densities would remain high short-term but are likely to decline after 5-10 years and could become limiting long-term. Hardwoods would increase due to an increase in sunlight but without other habitat features the benefits would be minimal. A stand replacing fire would further exacerbate loss of nesting habitat and increase open conditions not conducive for flying squirrel. In the absence of fire, the loss of suitable habitat both short-term and long-term makes this alternative the least favorable for the northern flying squirrel.

Alternative B – Proposed Action

Direct and Indirect Effects to Northern Flying Squirrel
Potential direct effects to northern flying squirrels include loss of nest tree, death of young, and abandonment of nest sites associated with treatment activities. Treatments to reduce susceptibility to MPB attack in addition to mortality caused by MPB would reduce preferred pine structural stages more that Alternative A, but to a lesser degree compared to Alternative C. Alternative B would reduce mature, late successional pine structural stages in the project area from 12% to 6% compared to Alternative A. The beneficial effects would be to reduce susceptibility of MPB attack in remaining mature pine and would leave 46% vs. 23% (Alternative A) in structural stage 4A providing mature habitat long-term for these species. In addition, remaining pine would increase the potential for movement and use of treated areas. MPB effects to treated and untreated mature pine stands could be greater depending on the duration of the infestation that could create large openings avoided by this squirrel. This decrease in mature pine in the project would only have a 1% affect on these structural stages forest-wide. Snag densities would remain high short-term, but are likely to decline after five to ten years and could become limiting long-term. Treatments to reduce fire hazard may affect forage item availability that are associated with CWD. The potential for stand replacing fire would be reduced, increasing the potential for sustained food items long-term. Aspen communities would increase due to treatment but as canopy closure and stand density

increases, abundance would decrease. Spruce stands would only slightly affected by treatment. Alternative B would be more beneficial for the northern flying squirrel long-term compared to Alternative A, but to a lesser degree compared to Alternative C.

Alternative C

Direct and Indirect Effects to Northern Flying Squirrel
Direct and indirect effects to the flying squirrel are similar to the effects discussed under Alternative B. However, more area would be affected by vegetative treatment, so the effects would be greater. Alternative C would reduce pine structural stages 4B, 4C, and 5 from 12% to 5% in the project area compared to Alternative A. This decrease would only have a 1% affect on these species habitat forest-wide. The beneficial effects would be to reduce susceptibility of MPB attack in remaining mature pine leaving 50% vs. 23% (Alternative A) in structural stage 4A providing habitat long-term for these species. Roadside treatment would increase hardwood communities, but may also increase open areas that could prevent dispersal and increase predation. Cable and/or helicopter logging systems would have similar effects to this species as conventional logging systems. Areas that have not been treated in the past would lose some of their late-succession components (e.g., decay processes, mosses). Alternative C would be the most favorable for maintaining this species habitat long-term.

Conclusion for the Northern Flying Squirrel
None of the alternatives would notably decrease the amount of these species habitat at the Forest-wide scale. All of the alternatives would reduce preferred nesting and foraging habitat short term. Alternatives B and C would maintain mature trees in treated areas increasing the potential for northern squirrel habitat to persist long-term. It appears that all alternatives would be consistent with Objective 221; therefore these species are likely to persist.

Rocky Mountain Bighorn Sheep (*Ovis canadensis*)
The Rocky Mountain Bighorn Sheep was recently added to the R2 Sensitive species list. To reduce redundancy, most life history, current condition, and predicted effects information are provided in the Pactola Project Biological Evaluation document. Bighorn sheep are found in the Pactola Project Area and utilize some areas for lambing (J. Kanta, South Dakota Game, Fish, and Parks, Pers. Comm. 2009). All alternatives would be consistent with Forest Plan standards and guidelines, and Objective 221, therefore this species is likely to persist.

Mountain Goat (*Oreamnos americanus*)
The mountain goat is distributed from southeast Alaska through the Canadian Rockies to various mountain ranges in the northern United States. The goat was introduced to the Black Hills in 1924, and became established in only one area: the Black Elk Wilderness and Norbeck Wildlife Preserve region (Higgins et al. 2000).

The mountain goat is typically found in alpine and subalpine habitats, which straddle the natural tree line. Neither of these high elevation habitats (or a tree line) exists in the Black Hills. Here, the species occupies among the highest and rockiest habitats available to it, including pine and spruce covered slopes. The bulk of the mountain goat population in the Black Hills occurs largely within the Black Elk Wilderness and the Norbeck Wildlife Preserve

(Griebel et al. 2007) but they have moved to other suitable areas outside of the granitic core. Mountain goats utilize a variety of forage plants in the Black Hills, including chokecherry, buffaloberry, grasses and sedges, aspen, serviceberry, wild rose, willow, and hazel (USDA Forest Service 2005a). Mountain goats are sensitive to disturbance, depending on the perceived threat. Recreationists, especially rock climbers have been attributed to causing mortality by loss of footing during escape (See white-tailed deer Section).

Current mountain goat populations are smaller than estimates by Richardson (1971). The SDGFP administers a hunting season on this population but the harvest season has been closed since 2006. The original herd of six transplanted animals grew to an estimated 300-400 animal by 1971, but a 2007 survey suggests a current population of only 60 goats. The cause of this decline is unknown. Some possibilities include high predator (mountain lion) numbers, genetics, and/or possible habitat loss (USDA Forest Service 2010c). The Forest continues to coordinate with the South Dakota Department of Game, Fish, and Parks to determine if more specific habitat management actions are needed to conserve/enhance habitat for this species. Steep terrain in the Pactola Project Area could provide habitat for this species but would not be considered optimum habitat for this species. In 2009, a mountain goat was observed near Mystic (J. Kanta, South Dakota Game, Fish, and Parks, Pers. Comm. 2009).

Alternative A- No Action

Direct and Indirect Effects to Mountain Goat

There are no direct effects mountain goats expected under this alternative. Indirectly expected pine mortality caused by epidemic population levels of MPB would increase understory structure, hardwood communities, and a mix of seral stages more so than the action alternatives. This type of habitat would benefit this species habitat by increase forage availability, especially on or adjacent to steep rocky slopes where CWD would be higher, which could restrict access to forage and escape terrain and could hide predators thus raising predation rates. Due to the increased fuel hazard caused by the effects of MPB, there is higher potential for stand replacing fire. This type of fire usually increases expansion of grassland, shrubs, and aspen more so than silviculture treatments. In the absence of fire, pine regeneration and encroachment would eventually out-compete these seral communities and understory habitat components beneficial to mountain goats. This alternative does not increase roads/trails, but loss of cover in roaded areas could increase human disturbance and predation. This alternative would benefit mountain goat more so than the action alternatives.

Alternative B – Proposed Action

Direct and Indirect Effects to Mountain Goat

Direct effects to mountain goats due to vegetative treatments are not expected. Direct effects to this species may occur if a sudden and unexpected stimulus causes mountain goats or their kids to lose footing while escaping. Indirect effects of treatment would reduce pine overstory, increase hardwoods, and stimulate understory production that would benefit the mountain goat but to a lesser degree compared to Alternatives A and C. MPB caused mortality would continue in treated and untreated areas, therefore habitat conditions would improve (slopes >40%) similar as described in Alternative A. Long-term, pine regeneration would out-compete

these seral communities, eventually decreasing forage for this species. Prescribed burning would increase and improve palatability of browse species (e.g., aspen chokecherry) and forage availability treated areas. Course woody debris would be reduced by both prescribed fire and whole-tree harvest methods which could improve access to foraging and escape cover. There would be less potential for stand replacing fire, therefore expansion of aspen and grasslands would be less compared to Alternative A. Total road density would increase slightly but new roads would be closed to motorized travel once treatment activities are completed. New roads/trails would increase the potential for livestock competition, predation, and human disturbance in areas not previously accessible. Disturbance caused by recreation and logging operations could cause mountain goats to move to secure areas short-term. In the absence of fire, this alternative would less beneficial to mountain goats compared to Alternative A but more beneficial compared to Alternative C.

Alternative C

Direct and Indirect Effects to Mountain Goat
Direct effects to mountain goats due to vegetative treatment are not expected. Direct effects to this species may occur if a sudden and unexpected stimulus causes mountain goats or their kids to lose footing while escaping. Helicopter activity could cause this type of stimuli but would be dependent on several factors (See white-tailed deer section). Indirect effects to mountain goat would be similar to Alternative B. Alternative C treats more area therefore the effects would be greater. Alternative C would treat slopes >40% which would increase forage, but also affect use of these areas short-term. More open stands with little escape cover may increase susceptibility to predation and increase hunting opportunities, especially if access is improved. Cable logging could have a varied effect on mountain goats. For the most part, this species would likely become less affected by the disturbance as they adapt to a predicted disturbance stimuli. The amount of new roads constructed for cable logging in previously inaccessible areas would greatly increase the potential for livestock forage use, predation, and human disturbance that could affect mountain goats, especially if escape terrain is not accessible. However, helicopter logging would not have the long-term effects associated with new road access. Total road density would increase appreciably but new roads would be closed to motorized travel once treatment activities are completed. In the absence of fire, this alternative would the least beneficial to mountain goats compared to Alternatives A and B.

Conclusion for the Mountain Goat
None of the alternatives would notably decrease the amount of these species habitat at the Forest-wide scale. All of the alternatives would improve habitat short-term and long-term. It appears that all alternatives would be consistent with Objective 221; therefore these species are likely to persist.

Threatened, Endangered and Region 2 Sensitive Species

A Biological Assessment/Biological Evaluation (BA/BE) has been completed for the Pactola Project Area and can be found in the project file. The effects of the various alternatives and activities proposed were evaluated for all Endangered Threatened, Proposed, and R2 Sensitive species, and their habitat. A BA/BE is prepared in accordance with legal requirement set forth

under Section 7 of the Endangered Species Act of 1973 (19 U.S.C. 1536 (c)), and follows standards established in Forest Service Manual direction (2672.42) and the Code of Federal Regulations (50 CFR S401). The Regional Forester issued a Sensitive species list for the Rocky Mountain Region (FSM 2670), and a revised Sensitive species list (FSM Regional Supplement No. 2600-2009-1, dated June 9, 2009). The BA/BE tiers directly to the Final Environmental Impact Statement for the Phase II Amendment to the Forest Plan (USDA Forest Service 2005a). The BA/BE does not address species listed as threatened or endangered by the state of South Dakota, species tracked by the South Dakota Natural Heritage Program, or U. S. Fish and Wildlife Service candidate species (USDI Fish and Wildlife Service 2009c), unless they have been identified as Region 2 (R2) Sensitive species.

The USDA Fish and Wildlife Service website (http://www.fws.gov/southdakotafieldoffice/endsppbycounty.htm) was accessed on January 5, 2011 (USDI Fish and Wildlife Service 2011a) to determine the current list of Threatened, Endangered, or Proposed species that occur or potentially occur in Pennington, Lawrence, and Custer Counties. The bald eagle was removed from the list of Endangered and Threatened Wildlife effective August 8, 2007, therefore this species is now considered an R2 Sensitive species. No further analysis is needed for the whooping crane, least tern, and black-footed ferret because these species are not known or suspected to occur in the project area, and there is no suitable habitat is present (USDI Fish and Wildlife Service 2011e).

The determinations of effects for Region 2 Sensitive species were made based on the information gathered in the pre-field review, field reconnaissance and using information provided in the Pactola Project EIS draft document. The bases for the determinations are potential habitat, species distribution, and anticipated effects from proposed activities. The determination language is set forth in FSM Regional Supplement No. 2600-2009-1.

The Phase II Forest Plan Amendment FEIS (USDA Forest Service 2005a) evaluated population viability, and determined that all federally listed and R2 Sensitive species are likely to persist on the Forest over the next 50 years if standards and guidelines are followed, and if conditions move toward Forest Plan objectives. Project implementation would incorporate all Forest Plan Standards and Guidelines. Furthermore, all alternative are consistent with Objective 221, which is to conserve or enhance habitat for R2 Sensitive species. Therefore, persistence of all federally listed and sensitive species would not be affected by any alternative of the Pactola Project Area.

Migratory Birds

Many species of migratory birds are of international concern due to naturally small ranges, loss of habitat, observed population declines and other factors. The BHNF recognizes the ecological and economic importance of birds, and approaches bird conservation at several levels by implementing: 1) Forest Plan objectives, standards, and guidelines, 2) a Forest-wide bird monitoring program, and 3) site-specific mitigation and effects analyses for identified species of concern.

Bird monitoring is conducted at the Forest-level to determine species distribution, abundance, and trend (Rocky Mountain Bird Observatory 2001-2010). The monitoring is designed and

conducted by the Rocky Mountain Bird Observatory to provide statistically rigorous population trend data for at least 61 species that breed in the Black Hills. Trend data would assist the Forest in determining whether additional conservation measures are necessary.

Migratory birds of concern are identified by many sources, including the Endangered Species Act, the Regional Forester's Sensitive species list, the BHNF MIS and SOLC lists, the USFWS list of Birds of Conservation Concern (BCC, USDI Fish and Wildlife Service 2008), South Dakota Heritage Program (South Dakota Game, Fish and Parks Department 2011a) and the South Dakota All Bird Conservation Plan (South Dakota Department of Game, Fish, and Parks 2005b). All of these sources and their respective species of concern except for the BCC and South Dakota lists have been examined elsewhere in this section and/or the Pactola Project Biological Assessment/Biological Evaluation (BA/BE) report.

The BCC 2008 publication lists 24 species in the BRC 17 conservation region that includes the Black Hills. However, not all of these species are found in the Black Hills National Forest. The South Dakota All Bird Conservation Plan developed priority bird species list within specific habitats in the state. For the Black Hills, Level I and II priority species have not been identified. Nineteen Level III species may be affected by either of the Pactola Project action alternatives (South Dakota Department of Game, Fish, and Parks 2005b), especially if they are riparian dependent. The South Dakota Heritage Program has identified several bird species as being rare or threatened in the state that were not included in the Black Hills list in the All Bird Conservation Plan. Two of these species could be affected by the proposed treatments in the Pactola Project and would be discussed below. Most of the species do not need to be addressed here because: 1) specific species have another status designation that is already addressed in this section or the project BA/BE (e.g., MIS, SOLC, Sensitive), or 2) their habitat needs are addressed by Forest MIS species or 3) no habitat exists for them in the Pactola Project Area. Please see Appendix D for the full list and specific project disposition of each species.

Osprey (*Pandion haliaetus*)

The Osprey is a fish-eating bird of prey that is listed as a state threatened species in South Dakota (South Dakota Game, Fish, and Parks 2005b). A small breeding population occurs in the Black Hills, but they are very rare elsewhere in the state. Ospreys range throughout much of the world and are common in many parts of North America. This species responded well to the ban on DDT, which had caused eggshell thinning and led to population declines. Ospreys live in both freshwater and saltwater areas, including coastlines, inland lakes, and rivers. They prey on fish that they capture in shallow water or near the surface. Ospreys select nest sites that are higher than surrounding vegetation, safe from predators and allow easy access to nests (poor maneuver capabilities). Ospreys traditionally use large trees on or near water bodies as nest sites but have adapted to artificial sites such as power lines, channel markers and nesting platforms (Nature Serve 2011).

Ospreys tend to be poor nesting pioneers, and do not typically nest in new areas far from an existing population therefore their population has been slow to recover and expand. Ospreys were first documented in the Black Hills in the Pactola Basin. Currently, there are approximately nine known nest locations in the Black Hills, mostly increasing in the last five years. Most nest locations are close to ponds or lakes and some are on artificial structures.

Due to the presence of nesting ospreys and recent sightings near Pactola Reservoir, it is likely that unknown nest(s) are within one mile of the Lake. Natural nest sites could be lost to MPB mortality and or treatments. Proposed treatments could affect prey availability if sediments are deposited into the lake that affects water quality (see Riparian section). Forest Plan standard 3204 would be adequate to protect this species nesting habitat.

Great Blue Heron (*Ardea herodias*)

This species is found across North America and is the most abundant of heron species. The South Dakota All Bird Action plan lists this species as a bird of conservation concern (Priority Level II) because their population is suspected to be in decline (South Dakota Game Fish and Parks 2005b). Prey items are mostly small fish but have been known to eat amphibians, reptiles, small mammals, and birds. Foraging habitat is along streams and lake edges where water is calm or slow moving. This species usually nests in colonies (rookeries), but may have a single nest. Nesting habitat selection is predator driven, usually in trees located on islands or oxbows in close proximity to foraging sites. The heron is susceptible to human disturbance, especially in the early nesting season where adults would abandon eggs. Nest abandonment and colony abandonments increase as human visits increase. Road building and logging operations have been known to cause abandonment. However, this species would eventually habituate to non-threatening disturbance (Nature Serve 2011, Butler 1992).

In the Black Hills, the number of great blue heron rookeries has increased, mostly in the last five years. Several colonies are located adjacent to streams in high areas where predators can be observed. Currently, there are no known heron rookeries in or adjacent to Pactola Reservoir, but due to sightings and suitable habitat found in the project area, it is highly probably that a rookery may exist or appear in the future. Recreation use in the colony area could cause abandonment. The proposed activities in Alternatives B and C could also cause nest abandonment to unknown rookeries in the Pactola Project Area. This species does not have specific Forest Plan direction that would protect colonies from disturbance. Therefore design criteria have been added that would protect colonies during treatment activities (see Appendix B).

Climate Change

The USFS has embraced the management challenges posed by climate change. The agency's "Strategic Framework for Responding to Climate Change" (Hayward et al. 2009, USDA Forest Service 2008c) provides broad direction to guide future management and research to address climate change in all aspects of agency work. With this Framework, the agency has attempted to integrate climate change throughout its organizational structure. As a result, significant momentum is building from the individual Ranger District level up through the Washington Office to actively manage fish and wildlife habitat in a way that is mindful of climate change. It is assumed that climate change likely would lead to the loss of native species from extensive areas and result in increasingly scarce and fragmented populations in many others. Further changes within ecosystems would be triggered as invasive species, both plant and animal, fill the "holes" that are left as native species are lost. Increases in disturbance owing to fire, insects, and disease would accelerate the infiltration of invasive species. The loss of native ecosystems to invasive species affects many species as the effects of changing plant communities ripple through the ecosystems. As a result, many animal species likely would be lost as vegetation patterns change, associated changes in the food-web would cascade and

further destabilize ecosystems. Until these changes are better understood, it would be difficult to reliably predict the environmental outcomes of forest management activities (Ruggiero et al. 2008, Reid and Lisle 2008). The uncertainty associated with climate change and the potential risk associated with novel and untested management practices would require altogether new levels of institutional flexibility. The potential impacts to species in Pactola Project are speculative at best, especially at the scale of the project area.

Cumulative Effects

The Forest Plan Monitoring Implementation Guide (USDA Forest Service 2009h) provides guidance to implementing the monitoring and evaluation requirements to the Forest Plan. Forest-wide monitoring results can be found in the Black Hills National Forest Monitoring and Evaluation Reports (USDA Forest Service 2009c, 2010c). Projects, such as the Pactola Project, contribute to forest-wide cumulative effects on the landscape scale. The following cumulative effects analysis incorporates the 8th order watersheds within and adjacent to the Pactola Project. See the main discussion in the analysis of effects section.

There is no known evidence that the Black Hills was a stable ecosystem dominated by mature, dense conifer forests, especially in a ponderosa pine ecosystem. Evidence suggests that the Black Hills is ever changing from the effects of fire, insect outbreaks, drought, and human disturbances (Brown and Cook 2006, Sheppard and Battaglia 2002, USDA Forest Service 1996).

The Pactola Project Area has been largely unaffected by recent wildfires (within the last 30 years). Prescribed burning has occurred or may occur on 3,660 acres, mostly in the McVey winter range. Several prescribed burns may occur within the next five years that were identified in the Lakes EA, Prairie EIS, and the Slate Castle EIS. These burns are specifically designed to reduce ground fuels, pine regeneration, thin dense stands, and improve winter forage for big game. These burns have created an interspersion of openings and various tree densities while increasing the grass/forb understory. Pockets of snags are apparent in the burn area, along with insect and disease components that normally follows a fire. Proposed prescribed burns in the action alternatives would add to cumulative effects of these burns in reducing ground fuels, reduce pine regeneration, thinning dense stands, and improving winter forage habitat. These prescribed burns would increase the within stand heterogeneity across the landscape.

Fire suppression would continue to influence communities in the Pactola Project Area regardless of the alternative. As a result of fire suppression, the loss of seral plant communities due to pine growth, regeneration, and encroachment would likely reduce grassland/meadow communities, hardwood communities, and early seral pine structural stages over time. The loss of these seral habitats over-time would reduce available habitat for MIS species such as grasshopper sparrow, ruffed grouse, and white-tailed deer.

The MPB infestation is likely to increase due to the growing MPB population levels that are currently affecting the central portion of the Black Hills (USDA Forest Service 2010d), especially to the west/northwest of the analysis area (USDA Forest Service 2010e). All alternatives would reduce areas of continuous pine structural stages, especially mature and late succession pine, thus reducing patch size of these stands. The MPB population has already had an impact in these watersheds, increasing edge and changes to pine forest structure and size.

Alternative A, due to stand densities, could increase the intensity and lengthen the duration of the current MPB epidemic. Alternative A would not move toward Forest Goal 10. Alternative B and C would move toward Forest Goal 10 for managing insect outbreaks by reducing stand densities and reducing the susceptibility of those stands from MPB attack. However, in doing so these even-aged treatments along with continued MPB effects would create larger areas of structural stages 2, 3A, and 4A where stand and within stand heterogeneity is low. Because there is less competition with overstory, pine regeneration would flourish in the next 10-20 years. Combined with similar treatments in the analysis area, the treatments in Alternatives B and C could add to a loss of heterogeneity across the landscape, creating the same conditions (high fire hazard and high insect risk) in the next 20-30 years that could affect wildlife.

Limited use of pesticides (e.g., Carbaryl) to control the effects of maintains beetle in the Pactola Recreation campground area would occur for the next three – five years. These treatment would focused on maintaining mature pine overstory and provide public safety in high use recreation areas. No cumulative effects from the action alternatives would occur.

In areas not treated to reduce the susceptibility of MPB attack, increased fuel loading, and steep inaccessible slopes may create the conditions that increase the rate of spread, increase severity, and intensity of wildfires. A large stand-replacing wildfire, depending on the severity and intensity would be detrimental to soil, water, and ultimately loss of wildlife/aquatic habitat. Stand replacing wildfires may drastically alter or eliminate some species' habitat for long periods (e.g., >50 years). Alternative A due to the amount of standing dead and downed fuels created by MPB would add to the potential this type of wildfire. Alternatives B and C could reduce the rate of spread, severity, and intensity of wildfires by decreasing fuel loadings, increasing natural and planned fuel breaks and open crown densities allowing for effective fire suppression. Fuel reduction treatments in Pactola Project Area, along with areas adjacent to Pactola Project that reduce the potential for large-scale wildfire are expected to benefit most wildlife species, the exception would be the black-backed woodpecker and pygmy nuthatch that prefer standing dead/burned habitats.

During the last two decades, commercial and non-commercial treatments have occurred on 70% of the NFS lands in the project area. Post timber sale treatments such as thinning, noxious weed treatment, hardwood retention/restoration, and meadow restoration have been planned in the project area for the next five years as part of the Bullock Sale Area Improvement Plan (i.e., Knutson-Vandenberg Funds). In areas adjacent to the Pactola Project Area, several planning documents have been completed in the last 10 years, the more recent document was the Slate Castle EIS (signed July 9,2009) that include commercial and non-commercial vegetative treatments similar to the treatments proposed in the Pactola Project Area. The main emphases of these treatments are to protect communities, forest resources, and ecosystems from the on-going MPB epidemic and to reduce the potential for a large stand replacing wildfire. The result of these past and current vegetative management activities include moving much of the dense, mature pine forest toward more open stands structural stages. The Slate Castle Project Area (South and west of the Pactola Project Area) would reduce fuels, especially in the WUI, to reduce the potential risk of large-scale wildfire and the effects of the epidemic MPB activity. The Prairie Project Area (east of the Pactola Project) completed treatments to reduce wildfire hazard and insect/disease hazard and protect the communities of Johnson Siding and Rapid

City, SD. In addition, treatments to protect private land and communities from the effects of MPB and wildfire are planned and would likely continue as needed.

Alternative A would not contribute directly to cumulative effects of past and current vegetative treatments in reducing mature, dense pine structural stages on the landscape. However, indirectly forest maturation and predicted MPB mortality estimates would reduce mature, dense pine structural stages. The effects of this habitat loss would be dependent on the extent and duration of the beetle epidemic. Treatments associated with Alternatives B and C would contribute to meeting Forest-wide objectives for early seral and open canopied pine structural stages (1, 2, 3A, and 4A) but would contribute to a loss in denser stand conditions, especially in the older more mature structural stages (3B, 3C, 4B, 4C, and 5) on the landscape. Cumulatively, all Pactola Project alternatives would further reduce habitat for several wildlife species that require late-successional or dense mature stands in the analysis area, affecting their distribution on the landscape. All alternatives whether indirectly or directly contribute to the distribution and restoration of other plant communities by varying degrees in the analysis area, increasing structural diversity and maintaining seral communities on the landscape. Alternative A would maintain snag and CWD at the project scale and would contribute to meeting snag and downed wood objectives short-term. Alternative A, based on predicted MPB effects, may not contribute to snag objectives long-term. Alternatives B and C could further reduce snag distribution and CWD in treated areas, especially adjacent to roads and private land if deemed a safety hazard. In addition, silviculture treatments may affect snag densities (recruitment) by decreasing the number of low vigor trees available to become snags. However, the action alternatives would contribute to maintaining large snags on the landscape long-term.

Since 1997, cutting of snags on the forest has been limited to protecting the public and their communities, fuel breaks, and designated firewood gathering areas. Based on the amount of dead and downed wood from MPB and in close proximity to Rapid City and Hill City, it is likely that areas in the analysis area would be designated for firewood gathering. This would decrease snag abundance and availability mostly adjacent to accessible areas. However, firewood gathering is not expected to affect Forest-wide snag objectives.

The Canyon City RNA is surrounded on three sides by MA 3.7 (late-successional landscape), located along upper Rapid Creek. The Canyon City RNA would not be treated as part of the Pactola Project. A small portion of Pactola Project's MA 3.7 is proposed to be treated to meet Objective 10-03 through 10-06. Most of the areas adjacent to Rapid Creek and Slate Creek and have had not undergone vegetative treatments due to the steep slopes and lack of access. In those untreated areas, natural processes would continue to occur (fire, insects, and disease), providing habitat components associated with late succession habitat (decay process, fungi, CWD). MPB would likely reduce the amount of dense mature stands, changing the structural stage distribution in these areas. In addition, MPB effects would increase CWD, especially on steep slopes and inaccessible areas. These components would create conditions that increase the rate of spread, size, and complexity of a wildfire and compound effective fire suppression efforts. Alternative A would add to the potential of stand-replacing fire, therefore increasing the potential for these late successional MAs to move toward very open, less late-successional habitats. Treatments in Alternative B and C would reduce fire and insect risks adjacent to these areas providing some protection to these MAs from large stand replacing fire events. In

the event of this type of fire, the late-succession characteristics associated with the management objectives of MA 2.2 and 3.7 and untreated areas may be lost. The loss of late-succession habitat to MPB or wildfire could add to the reduction in many wildlife species habitat (pygmy nuthatch, brown creeper, and bats) forest-wide.

Livestock grazing on Forest and private land would continue in the Pactola Project Area and surrounding areas. Although grazing practices have improved from historic conditions, impacts may occur, especially during drought conditions. Some allotments in the project have recently undergone an analysis to improve grazing practices in the allotments (Mystic Range Project). Grazing allotment management plans incorporate wildlife habitat needs, protection of riparian habitats and moves toward meeting Forest Plan direction to maintain forage and cover for wildlife species. The Pactola Project would not add any cumulative impacts to livestock use long-term. However, livestock structures may be damaged by harvest activities, increase accessibility by adding roads and trails and/or create open stand conditions changing livestock grazing patterns and livestock distribution short-term.

Due to the project's location (close proximity to Rapid City), improved access (US Hwy 385), developed recreation facilities, and the Pactola Reservoir, the analysis area is greatly influenced by recreationists, both consumptive and non-consumptive. Roads and trails can remove habitat, increase predation, create barriers, or decrease habitat quality for some species (e.g., fish, amphibians, reptiles, and land snails). Use of roads by humans can also increase disturbance to wildlife, particularly to nesting raptors. High road densities increase accessibility, and can facilitate recreation use, wildlife hunting, poaching, and illegal removal of snags. Road/trail densities have increased in the analysis area as a result of past vegetation management activities (e.g., ground based and cable logging), private land development, and recreation.

In 2010, the Forest Travel Management Plan changed motorized travel use in the Pactola Project and surrounding areas. The northern portions of the Pactola Project Area have been designated as a Concentrated Motorized Use Area (CMUA) which may have more motorized use than in the past. In areas outside of the CMUA, the amount of road and trails currently utilized by the motorized public would be limited to designated routes. Off-road/trail motorized recreation is prohibited. However, road templates whether open to motorized travel or not could still provide access for recreationist (foot or horse travel), livestock, and predators. In addition, roads have been attributed to increasing sediments into streams. Alternative A would not add any additional road/trails to the area that could open up previously inaccessible areas, therefore would not add any cumulative effect to the analysis area. Alternative B would add additional road/trails (e.g., NFSR, temporary roads) to the landscape that would allow more access to previously inaccessible areas, but would repair poor roads/trail conditions to meet Forest Plan direction. Alternative C would greatly add additional roads/trails to the landscape allowing more access, especially to areas previously inaccessible but repair poor roads/trail condition to meet Forest Plan direction. All alternatives would maintain road/trail densities open to motorized vehicles, both year-round and seasonally. An increase in road prisms across the landscape may cause additional negative effects to stream health that could impact Pactola Reservoir and its downstream users. Since the Forest Travel Management Plan is a fluid plan, increases in motorized travel could occur if roads exist on the landscape (USDA

Forest Service 2010). The effects to wildlife distribution and habitat availability may be further affected by this increase in motorized use.

Private land development is still occurring, and the trend is expected to continue into the future. Habitat changes associated with increased development would likely decrease prime wildlife habitat (riparian areas and grasslands) and could influence wildlife distribution and their ability to move across the landscape. Providing secondary access roads (for evacuation during a fire) and clearing along these roads to maintain safe egress to private land would increase sight ability of wildlife and affect movement patterns. As development increases, water availability would be reduced, either from wells or water impoundments reducing flows in streams. Low water tables could drastically change riparian communities and aquatic habitats. Species most affected are those associated with riparian components (e.g., fish, song sparrows, beavers) and grassland communities (e.g., grasshopper sparrows, big game). In addition, increased noise, domestic animals, and introduction of invasive species would occur, changing wildlife distribution and use. Roads on private land are expected to increase, as land is sub-divided. Roads that access private land and communities would likely be improved to allow easier, safer access to arterial roads that would increase mortality and decrease use in adjacent suitable habitat. Some vegetative treatments are occurring on private land, mostly in conjunction with reducing MPB effects and increasing development opportunities. The amount of vegetative treatments on private land would slightly reduce wildlife habitat on the landscape. Alternatives B and C would contribute to these effects improving secondary access routes and by clearing roads and egress routes. Noise created by harvest activities would be short-term and cause a slight change in wildlife distribution and use. However, once equipment leaves an area, wildlife use would resume.

Although climate change may affect wildlife and fish species, it is speculative on the potential impacts to species in Pactola Project Area, especially at the scale of the project area. Effects of climate change are speculative and therefore cumulative effects to wildlife habitats at this scale cannot be determined.

FISHERIES

Affected Environment

The fish native to the Black Hills included a few species of suckers, chubs and daces. The mountain sucker is designated as a Rocky Mountain Region sensitive species and a Management Indicator Species (MIS) on the Black Hills National Forest. Other native fish species documented in the analysis area include the longnose dace and white sucker.

The primary recreational fishing opportunities in the project area are on Rapid Creek and Pactola Reservoir. Recreational fisheries are comprised of non-native gamefish species, primarily trout. Brook and brown trout fisheries are sustained almost entirely by natural reproduction, whereas rainbow trout are routinely hatchery stocked for high-use “put and take” fisheries. Brook and brown trout spawn in the fall with the fry emerging in the spring. A number of other gamefish species, such as bass, pike and perch, occur in Pactola Reservoir due to illegal stockings. Restricted motor vehicle access along Rapid

Creek provides for a walk-in fishing experience immediately upstream of Pactola Reservoir and also upstream of Silver City.

There are no natural lakes in the Black Hills (Stewart and Thilenius 1964). Pactola Reservoir is a 785-surface acre impoundment on Rapid Creek, constructed in the mid-1950s, and operated by the U.S. Bureau of Reclamation. Of the twelve fish species reported in Pactola Reservoir (SDGFP 2007), only the white sucker is a native species.

All streams and lakes in South Dakota are assigned the beneficial uses of irrigation and fish and wildlife propagation, recreation, and stock watering (South Dakota Administrative Rule 74:51:03:01). Rapid Creek, Jenny Gulch, Kelly Gulch and Pactola Reservoir are also assigned the beneficial use of coldwater permanent fish life propagation. This use is currently being attained (SD DENR 2010). West Nugget Gulch is assigned the beneficial use of coldwater marginal fish life propagation. Additional information on water resources can be found in the Watershed, Geology, and Soils section.

Environmental Consequences

Alternative A – No Action

Direct and Indirect Effects

Under this alternative there would be no effects from a proposed action. However, there are effects of continuing current management (no action) as discussed below.

Past, present, and other reasonably foreseeable actions would continue to affect fisheries. The most obvious direct effect results from anglers catching fish for recreation. Aquatic habitat would continue to be fragmented by Pactola Dam and other fish barriers, such as impassable culverts at road-stream crossings. Natural erosion processes, as well as road use and maintenance, livestock grazing, recreation activities and other uses would continue to add sediment into streams and Pactola Reservoir. This alternative has the highest fire/fuels hazard. There could be a pulse of sediment input into water bodies if a stand-replacing wildland fire occurs in the project area that is followed by a rainfall event prior to groundcover becoming reestablished to prevent soil erosion. All sediment transported through the stream network ultimately gets deposited in Pactola Reservoir. Sediment input into Pactola Reservoir post-wildfire may have a short-term negative impact on fish survival and reproduction. Bog iron deposits in the upper Rapid Creek watershed bind with phosphorus resulting in low productivity in Pactola Reservoir. A nutrient pulse into Pactola Reservoir post-wildfire may have short-term positive benefits to fish growth.

Site-specific fish habitat enhancement projects that improve fish passage, reduce sediment input, etc. may occur on a limited basis thru other program funding, such as wildlife/fish, watershed improvement, or Roads/Engineering. Recreational fishing opportunities, which exist primarily within Rapid Creek and Pactola Reservoir, would continue to be provided under the State's management jurisdiction. Fish harvest regulations and stocking rates may change to meet angler expectations.

Alternative B and C

Direct and Indirect Effects

Direct and indirect effects to fisheries resulting from land management activities were disclosed in the Forest Plan Phase II Amendment FEIS (USDA Forest Service 2005a). Direct effects to fisheries are defined as those inwater activities that have the potential to immediately injure or kill fish. These activities are typically associated with the installation or repair of structures, such as culverts at road-stream crossings. Reconstruction of National Forest System Roads 141.1D, 142, and 249 on Broad Gulch, Kelly Gulch, and Nugget Gulch, respectively, would require some inwater construction to harden stream crossings or to install culverts. The normal operating season for road work is June 1 to November 1, which minimizes the overlap with fall-spawning brook trout and brown trout, that are more susceptible to harm because their eggs are buried in the stream bottom in concentrated pockets (redds) and require a fairly long time to incubate, hatch and emerge as compared to native fishes. A design criteria specific to Kelly Gulch and Nugget Gulch to avoid inwater activities associated with road reconstruction and maintenance from October 15 to April 1 to avoid impacts to fall-spawning brook trout and brown trout their redds.

The indirect effects to fisheries are the changes in water quality, flow regimes, stream temperature, etc. that result from implementation of the action alternatives. These effects are disclosed in the Watershed, Geology and Soils section of the EIS. The input of fine sediments from roads have the potential to adversely affects fisheries by reducing forage and pool depth and degrading spawning habitat. Implementation of Forest Plan standards and guidelines, Rocky Mountain Region Watershed Conservation Practices (WCP's; Forest Service Handbook 2509.25), and design criteria specific to this Project would maintain water quality standards and protect assigned beneficial uses.

Subsequently, no long-term negative effects to fish spawning, rearing, foraging or sheltering are anticipated. No new barriers to fish movement would be created because all new instream structures would allow for the passage of fish consistent with Standard 1203. Effects specific to the mountain sucker are disclosed in the Biological Evaluation and summarized in Appendix D of this EIS.

Alternative C proposes cable and/or helicopter logging, roadside treatments and shaded fuel breaks that are not in Alternative B.

Only a small acreage of cable logging is proposed in close proximity to Pactola Reservoir, Jenny Gulch, Kelly Gulch, or Rapid Creek. Cable logging yards logs uphill concentrating the disturbance away from drainage bottoms and water bodies reducing the likelihood of sediment into streams and Pactola Reservoir. Design criteria to minimize ground disturbance in the water influence zone (a minimum of 100 feet adjacent to water bodies) should avoid adverse effects to fisheries due to loss of riparian vegetation or increased sediment input. Cable logging requires 19 miles of new road construction. New roads to access most of these units are on ridgelines, with the exception of about 0.3 mile of new road that spurs off of NFSR 141 upslope of Jenny Gulch, approximately 0.5 miles upstream of Pactola Reservoir. Road-related design criteria to minimize erosion and avoid sediment transport into Jenny Gulch and ultimately Pactola Reservoir would mitigate indirect impacts to fisheries.

Helicopter logging is expected to have minimal indirect effects to fisheries because ground disturbance at the site of tree removal would be negligible and the same road network would be used as haul routes. Logs would be flown to roads and landings used for ground based or cable logging.

Approximately 135 acres of roadside treatments are proposed within the water influence zone. The majority of these acres are along Kelly Gulch, Bear Gulch, and Broad Gulch, 58, 30, and 23 acres respectively. The implementation of resource conservation measures to avoid sediment input, maintain streambank stability, and maintain riparian shading to moderate water temperatures is predicted to mitigate indirect adverse effects to fisheries.

Four sites, totaling approximately 31 acres of fuel breaks adjacent to private lands, are proposed in proximity to perennial streams. A little over half of these acres occur near Rapid Creek and the remainder are near Bear Gulch. No roads are proposed to access these sites. Untreated private land provides a vegetation buffer between the fuel breaks and these perennial streams, reducing the likelihood of sediment input into streams. Overall, ground disturbance associated with these fuel breaks would be minimal and no adverse indirect effects to fish habitat are predicted.

Cumulative Effects

The cumulative effects analysis was bounded in space as the Pactola Project Area. Any potential indirect impacts to fisheries are not likely to be discernable in Rapid Creek downstream of Pactola Dam due to the dilution factor based on the volume of water stored in the reservoir and the regulated releases from the reservoir. The analysis was bounded in time as the next 10-15 years which is the likely duration of activities that may affect fisheries.

Overall, Alternatives B and C would have a positive incremental impact to fishery resources. Vegetation treatments that move ecological conditions (reduced fuel loads, increased hardwood acres) to a more desired fire regime condition class are likely to minimize the sediment "pulse" and water quality impacts that could result after a stand-replacing wildfire, should one occur. No substantial increase in sediment transport to water bodies is anticipated. Both Alternatives B and C are not expected to degrade water quality or exceed State-defined thresholds for the various water quality parameters associated with each beneficial use (see the Watershed, Geology, and Soils section for additional information). The maintenance and improvement of existing road-stream crossings in the Pactola Project Area provides an opportunity to reduce sediment input into streams in the long-term and maintain or improve fish passage and aquatic habitat consistent with Objectives 217, 219, and Standard 1203. Fisheries-related beneficial uses and water quality standards will be attained, thereby maintaining recreational fishing opportunities.

Management Indicator Species

Based on the mountain suckers historic occurrence in the analysis area, it was identified for project-level MIS analysis. Direct, indirect, and cumulative effects to the mountain sucker are disclosed in the Biological Evaluation (BE). The BE is summarized in Appendix D.

Long-term viability for this species was evaluated in the BE for the Forest Plan Phase II Amendment (USDA Forest Service 2005c). The Phase II BE determined that the mountain sucker was likely to persist for the next 50 years if land management activities are implemented consistent with the Forest Plan.

This MIS discussion focuses on this project's effects on the Forest-wide population and/or habitat trend and this project's consistency with the mountain sucker MIS objective in the Forest Plan (Objective 238d).

The Forest-wide population trend for mountain sucker is one of decline when comparing past to present abundance and distribution (USDA Forest Service 2010c). All alternatives would have a neutral effect on the Forest-wide population trend for the mountain sucker because of this species' limited occurrence and the small portion of habitat (Rapid Creek upstream of the Castle Creek confluence) that is in the Pactola Project Area. The implementation of design criteria, Forest Plan standards and guidelines, and regional watershed conservation practices under both Alternatives B and C would meet the intent of Objective 238d to maintain habitat quality and connectivity for this species. Reducing the fire/fuels hazard and the risk of mountain pine beetle infestation at the landscape level may have some positive benefits to this species, but the action alternatives are not focused on the threats, such as habitat degradation due to recurrent drought, negative interactions with non-native fish and stream fragmentation due to barriers, that are more likely causing the downward trend in the Forest-wide mountain sucker population.

Federally Threatened, Endangered, Proposed, or Region 2 Sensitive Species

There are no federally threatened, endangered or proposed fish species known to occur or likely to be affected by management activities in Pennington county nor any designated critical habitat (U.S. Fish and Wildlife Service 2010). Subsequently, no additional consultation is needed for fish species pursuant to the federal Endangered Species Act.

The finescale dace, lake chub, and mountain sucker are Region 2 sensitive species known to occur on the Black Hills National Forest. The action alternatives will have no impact on the finescale dace (*Phoxinus neogaeus)* or the lake chub (*Couesius plumbeous*). The finescale dace has not been documented in the Rapid Creek drainage (Isaak et al. 2003). The lake chub occurs in Deerfield Reservoir (Isaak et al. 2003), which is upstream of this analysis area.

The only documented occurrence of mountain sucker (*Catostomus platyrhynchus)* in the Pactola Project Area has been in Rapid Creek upstream of the Castle Creek confluence (Stewart and Thilenius 1964, Ford 1988). Direct, indirect, and cumulative effects to this species have been analyzed in the Biological Evaluation and summarized in Appendix D of this document. Alternatives B and C would have no impact on the mountain sucker because of its limited occurrence in the analysis area and the lack of proposed management activities that are likely to directly or indirectly affect this species in Rapid Creek upstream of the Castle Creek confluence.

BOTANY

Affected Environment

The Pactola Project Area supports a diversity of plant community types as a result of the range of elevation in the project area and major variations in geology and geomorphology. Ponderosa pine (*Pinus ponderosa*) dominates the majority of the project area. Most drainages and north facing slopes are characterized by white spruce (*Picea glauca*) stands with little vascular understory, mixed hardwood aspen (*Populus tremuloides*) and paper birch (*Betula papyrifera*), or willow/sedge (*Salix spp. /Carex spp.*) communities. Meadows within the project area are most commonly mixed grass/forb meadows or grass/sedge meadows.

Ponderosa pine is encroaching into many community types as a result of suppression of the natural fire regime. Riparian community types occur along perennial streams such as Rapid Creek, Slate Creek, and Jim Creek, as well as their tributaries. There are also numerous intermittent streams with varying amounts of associated riparian vegetation.

No Botanical Areas overlap with the Pactola Project Area, however the Canyon City Research Natural Area (RNA) lies within the project boundary. The Canyon City RNA is afforded protection from timber harvest to conserve and protect all natural ecosystem functions.

Species Considered and Evaluated

Federally Listed Plant Species

The U.S. Fish and Wildlife Service (USFWS) website list for Threatened and Endangered species was accessed on December 10, 2009 for the state of South Dakota. As of this date, there were no threatened or endangered plant species known to occur within the State of South Dakota (USDI Fish & Wildlife Service 2009a & 2009b), nor were there any proposed or candidate threatened or endangered plant species known to occur in South Dakota (USDI Fish & Wildlife Service 2009c & 2009d).

Threatened, endangered, and proposed plant species which could potentially occur on the Black Hills National Forest were identified and addressed through informal consultation with the South Dakota and Wyoming Field Offices of USFWS during the Phase II Amendment development (USDA Forest Service 2005a). Subsequently, these threatened, endangered, or proposed species do not need to be further analyzed and are not mentioned in subsequent sections.

Candidate species have sufficient information on their biological status and threats to warrant a proposal to list as endangered or threatened, but development of a listing regulation is precluded by other higher priority listing activities. Species that are candidates for listing under the Endangered Species Act (ESA) are automatically placed on the Region 2 Forester's sensitive species list. The analysis and determination of effects for candidate species are included as part of the Biological Evaluation for sensitive species. The only candidate plant species known to occur on the BHNF, narrowleaf grapefern (*Botrychium lineare*), was officially removed from the candidate list by the U.S. Fish and Wildlife Service (USDI Fish & Wildlife 2007). However,

narrowleaf grapefern remains on the Region 2 sensitive plant list and is discussed under the Biological Evaluation for Region 2 sensitive species found later in this document.

No further analysis is needed for species not known or suspected to occur in the project area.

It is my determination that implementation of any of the three alternatives as described will not affect any threatened or endangered plant species or designated critical habitat. Endangered Species Act Section 7 Consultation is not required for this project.

Region 2 Sensitive Plant Species

The Forest Service Manual defines sensitive species as those plant and animal species identified by a Regional Forester for which population viability is a concern, as evidence by:

- Significant current or predicted downward trends in population numbers or density.
- Significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution (Forest Service Manual 2670.5, 19).

All Region 2 sensitive plant species confirmed to occur in the Black Hills National Forest were considered in the evaluation. Habitat exists in the Pactola Project Area for several Region 2 sensitive plant species confirmed to occur within the Black Hills. Based on available information, species with habitat preferences differing from habitat types present within the Pactola Project Area were not analyzed. Prairie moonwort (*Botrychium campestre*) is the only Region 2 sensitive plant species confirmed to occur within the project area. Table 3-32 summarizes Region 2 sensitive plant species having suitable habitat within Pactola Project Area.

Table 3-32 Region 2 sensitive plant species having suitable habitat within the project area

Scientific Name	Common Name	Known to Occur in Project Area	Suitable Habitat	Habitat Category for Analysis
Botrychium campestre	Prairie moonwort	Y	+	+
Botrychium lineare	narrowleaf grapefern	N	+	+
Carex alopecoidea	fox-tail sedge	N	Y	white spruce/hardwood drainage
Cypripedium parviflorum	yellow lady's slipper	N	Y	white spruce/hardwood drainage
Lycopodium complanatum	trailing clubmoss	N	Y	white spruce/hardwood drainage
Platanthera orbiculata	large round-leaved orchid	N	Y	white spruce/hardwood drainage
Salix candida	sage willow	N	Y	wet meadow
Salix serissima	autumn willow	N	Y	wet meadow
Viburnum opulus var. americanum	highbush cranberry	N	Y	white spruce/hardwood drainage
Viola selkirkii	Selkirk's violet	N	Y	white spruce/hardwood drainage

+ Based on limited knowledge of habitat requirements for this species, presence/absence of suitable habitat in the project area and the habitat category for analysis were not determined.

Species of Local Concern (SOLC)
A Species of Local Concern is described in the Forest Service Manual as plant, fish or wildlife species (including subspecies or varieties) that do not meet the criteria for sensitive status. These could include species with declining trends in only a portion of Region 2, or those that are important components of diversity in a local area. The local area is defined as NFS lands within the Black Hills National Forest (USDA Forest Service 2005a). The list of SOLC appears in the Black Hills National Forest Land and Resource Management Plan Phase II Amendment Final EIS.

Two populations of pleated gentian (*Gentiana affinis*) were confirmed within the Pactola Project Area. Habitat may be present in the project area for seven additional plant Species of Local Concern. The primary habitat for the eight plant Species of Local Concern which occur or have suitable habitat within the project area can be categorized as white spruce and hardwood dominated drainages and wet meadows. Any potentially suitable habitat that may exist overlaps with suitable habitat for Region 2 sensitive plant species. Therefore, design criteria exist in the Botany Biological Evaluation that includes potential habitat for plant Species of Local Concern as well. Refer to the "Effects Analysis" section in the Botany Biological Evaluation (BE) for a discussion of possible direct, indirect, and cumulative effects to these habitats.

No further analysis is needed for species that are not known or suspected to occur in the project area, and for which no suitable habitat is present.

Analysis was conducted on the effects of the proposed action on Black Hills National Forest Species of Local Concern that may occur or for which potentially suitable habitat occurs in the Pactola Project Area. This analysis considers management activities of all action alternatives and associated design criteria and mitigation measures (see Appendix B).

Table 3-33 Plant Species of Local Concern with suitable habitat in Pactola Project Area

Scientific Name	Common Name	Known to Occur in Project Area	Suitable Habitat
Botrychium multifidum	Leathery grape-fern	N	Y
Carex bella	Southwestern showy sedge	N	Y
Gentiana affinis	Pleated gentian	Y	Y
Listera convallarioides	Broadlipped twayblade	N	Y
Lycopodium annotinum	Stiff clubmoss	N	Y
Oxyria digyna	Alpine mountainsorrel	N	Y
Petasites sagittatus	Arrowleaf sweet coltsfoot	N	Y
Salix lucida ssp. caudata	Shining willow	N	Y

Environmental Consequences

An effects analysis was completed for those species that could be impacted by the proposed project. This analysis addresses Region 2 sensitive plant species and plant Species of Local Concern (SOLC) with suitable habitat in the project area.

Two populations of pleated gentian were confirmed within the Pactola Project Area. Habitat may be present in the project area for seven additional plant Species of Local Concern. The primary habitat for the eight plant Species of Local Concern which occur or have suitable habitat within the project area can be categorized as white spruce and hardwood dominated drainages and wet meadows. Any potentially suitable habitat that may exist overlaps with suitable habitat for Region 2 sensitive plant species. Therefore, design criteria exist in the Botany Biological Evaluation that includes potential habitat for plant Species of Local Concern as well. Refer to the "Effects Analysis" section in the Botany Biological Evaluation (BE) for a discussion of possible direct, indirect, and cumulative effects to these habitats.

No further analysis is needed for species that are not known or suspected to occur in the project area, and for which no suitable habitat is present.

Analysis was conducted on the effects of the proposed action on Black Hills National Forest Species of Local Concern that may occur or for which potentially suitable habitat occurs in the Pactola Project Area. This analysis considers management activities of all action alternatives and associated design criteria and mitigation measures as set forth in the Pactola Project Area DEIS and can be found in the Pactola Project Area Botany Specialist Report.

In the Black Hills, the primary habitat for the R2 sensitive and plant SOLC with suitable habitat in the project area is moist forest and/or riparian communities often with a birch or spruce component. The Pactola Project Area has suitable habitat for the following species:

- R2 sensitive species: Prairie moonwort, narrowleaf grapefern, foxtail sedge, yellow lady's slipper, trailing clubmoss, large round-leaf orchid, sage willow, autumn willow, highbush cranberry, and great-spurred violet.
- SOLC: Leathery grapefern, southwestern showy sedge, pleated gentian, broadlipped twayblade, stiff clubmoss, alpine mountainsorrel, arrowleaf sweet coltsfoot, and shining willow.

Because suitable habitats for the analyzed Region 2 sensitive plant species can be grouped into like habitats, effects analysis were combined for species based on habitat type as divided in Table 3-34.

Table 3-34 Habitat Types Analyzed in Effects Analysis

Suitable Habitat Type	Species included in habitat
Drainages associated with white spruce and hardwoods	Foxtail sedge, yellow lady's slipper, trailing clubmoss, large round-leaf orchid, highbush cranberry, and great-spurred violet
Wet meadows	Sage willow, autumn willow
Unknown habitat classification	Prairie moonwort and narrowleaf grapefern

Alternative A – No Action

Direct and Indirect Effects Common to All Suitable Habitat Types
Under Alternative A there would be no negative and/or beneficial direct effects to any of the habitat groups because implementation of elements of the proposed action would not take place. Ongoing forest protection efforts and recurring road maintenance on system roads would continue as directed by the Forest Plan. Other management activities within the project area would also continue (see Cumulative Effects below).

Low intensity fires, commonly associated with light fuels (grass and small diameter woody debris) generally do not burn continuously or with great heat through moist, white spruce and hardwood dominated drainages or wet meadows and therefore do not have a catastrophic impact on these community types. If the project area remains untreated, over time there would be an increase in the amount of fuel in the area as trees are killed by mountain pine beetle and fall leading to an increased risk of high intensity wildfire. High intensity fires can change the characteristics of the soil making them unsuitable for certain sensitive plant species. When a fire burns in heavy fuels, the result is a smoldering fire. Although smoldering fires have lower temperatures than flaming fires, they move slowly through an area causing more profound soil impacts and greater vegetative mortality (Lentile et al. 2006).

Over time, if no action is taken within the Pactola Project Area, mountain pine beetles would most likely continue to cause ponderosa pine mortality. As the trees fall, more sunlight and precipitation would be allowed through the canopy to the understory changing the microclimate and ultimately the vegetation composition. Fallen trees could also crush sensitive species and cover up suitable habitat . Given the threats currently affecting the project area, the no action alternative, which may cause lesser impacts in the short-term, would result in greater impacts over time. These impacts affect hardwood and white spruce drainages, wet meadows, and unknown habitat classification suitable habitat types (Table 3-34).

Cumulative Effects
The cumulative effects are bound in space by an area half a mile outside the project area, because the influence of other management activities (particularly timber management) on botanical resources is primarily determined by impacts on hydrology and a half-mile buffer is sufficient to capture this influence. The cumulative effects are bound in time ten years prior to the decision and ten years after the decision because this is the average amount of time between vegetation treatments in any given area.

Activities outside the scope of this proposed action would continue regardless of which alternative is chosen and include firewood gathering, Christmas tree cutting, road and utility right-of-way clearing, range improvements, livestock grazing, and mining.

Firewood gathering occurs in designated areas, generally away from known occurrences of Region 2 sensitive species and their habitat, therefore the risk of firewood gathering to Region 2 sensitive plant species is low. This activity would most likely be less common in the project area if Alternative A is chosen because these areas are usually associated with slash piles and

former timber sales. This activity would primarily affect the unknown habitat classification suitable habitat types (Table 3-34).

Because Christmas tree cutting occurs Forest-wide, it can affect Region 2 sensitive plant species and their habitat. Because this activity occurs when the ground is frozen and the impact area is small, the risk to Region 2 sensitive plant species is low and generally limited to removing spruce trees which provide shade and microhabitat. This activity would remain at current levels if Alternative A is chosen. This activity would affect hardwood and white spruce drainages, wet meadows, and unknown habitat classification suitable habitat types (Table 3-34).

Road and utility right-of-way clearing affects areas already impacted by the presence of roads and utility corridors. Effects of these activities are similar to those of timber sales and include crushing, trampling, and uprooting of individual plants as well as changing the light and moisture regime within the project area. This activity would affect hardwood and white spruce drainages, wet meadows, and unknown habitat classification suitable habitat types (Table 3-34).

Range developments include fencing, dugouts, wells, and spring developments. These management activities are used to influence the distribution of livestock on the landscape. Range developments, particularly water developments, affect Region 2 sensitive plant habitat because they occur in drainages and wetlands (suitable habitat), however they tend to concentrate livestock use in these areas and exclude livestock from spring sources and other sensitive areas. This activity would continue at current levels if Alternative A is chosen. This activity would affect hardwood and white spruce drainages, wet meadows, and unknown habitat classification suitable habitat types (Table 3-34).

Livestock grazing affects most of the project area, with the greatest impacts on meadows, riparian, and wet areas. Impacts to Region 2 sensitive plant species includes trampling and grazing on individuals by livestock as well as soil disturbance and compaction. If Alternative A is chosen, livestock grazing may be further concentrated into meadows and riparian areas because as conifers encroach on meadows and convert from grassland to woodlands, less forage is available to livestock outside of the open grassy areas. This would result in livestock concentrating in smaller areas, particularly meadows and drainages, for longer periods of time, thus increasing their impact on these habitats. This activity would affect hardwood and white spruce drainages, wet meadows, and unknown habitat classification suitable habitat types (Table 3-34).

Any future projects would require separate environmental review and analysis of effects on resources to comply with the National Environmental Policy Act. This analysis addresses the direct and indirect effects the alternatives have on botanical resources in the Pactola Project Area.

Alternative B – Proposed Action

Direct and Indirect Effects

Prairie moonwort (*Botrychium campestre*) was the only Region 2 sensitive plant species confirmed within the project area and is restricted to one population. This population has design criteria associated with it that would limit the potential effects (see Appendix B). The

population is buffered with an area that would not be vegetatively treated, not have landings or log decks constructed, not have equipment parked during any management activities, not have broadcast prescribed burn control lines constructed through, and would only be burned if a low intensity burn can be achieved.

Direct and Indirect Effects Common to All Suitable Habitat Types

Direct negative effects of the proposed action to undetected individuals include destruction of individuals during tree felling and skidding operations, burial, crushing, and burning of individuals by slash piles, trampling by equipment and/or personnel, and burning of at least above ground parts as part of broadcast prescribed burning. Application of fire (either pile burning or broadcast prescribed burning) may result in the burning of undetected individuals, however most species recover quickly after low- to moderate-intensity prescribed burns (Knapp et al. 2007) and the areas exposed to high intensity pile burning are relatively small. Equipment used during construction and maintenance of roads and/or prescribed broadcast burn control lines could crush, burry, or uproot undetected individuals. Prairie moonwort and narrowleaf grapefern are particularly susceptible to these impacts because they frequently occur along road corridors and other disturbed areas. This potential effect is mitigated by limiting the grading of roads in areas of highest potential habitat.

Application of fire, particularly broadcast prescribed burning, removes the understory and litter layer from the forest floor. This loss of organic matter can decrease the moisture content of the soil. The heat generated by combustion of organic matter can also damage the ectomycorrhizal fungi community upon which some Region 2 sensitive species are dependent (narrowleaf grapefern, prairie moonwort, and yellow lady's slipper), however this effect is usually slight if fire intensity is kept low (Bastias et al. 2006). In addition, burning removes existing understory vegetation, reducing competition, and opening up habitat for invasion by other species. These effects are magnified in areas experiencing intense burns, such as slash piles (Haskins and Gehring 2004). Once established, these exotic species can out-compete native vegetation causing a shift in the ecology of the area.

Other potential indirect effects result from greater use of existing roads for hauling resulting in an increase in dust pollution. Sensitive plant individuals that are undetected along roads could experience reduced photosynthetic capacity due to a coating of dust on the leaves. Also, removal of timber may also open access to areas previously protected from impacts by livestock and illegal off-road vehicle use. Increased livestock utilization and illegal off-road travel in previously inaccessible areas not only increases the potential for grazing, trampling, and other losses of individuals, but also increases the chance for non-native species invasion.

Indirect effects that could stem from not treating all of the acres proposed in Alternative C include attack by mountain pine beetle on remaining trees. Once infested, the trees would most likely die and fall, leaving heavy fuels, and increasing the chance of catastrophic wildfire. When a fire burns in heavy fuels, the result is a smoldering fire. Although smoldering fires have lower temperatures than flaming fires, they move slower through an area causing more profound soil impacts and greater vegetative mortality (Lentile et al. 2006).

Direct and Indirect Effects to Specific Suitable Habitat Types
If undetected populations are present in hardwood and white spruce drainages, direct negative effects of project activities could include risk of impact from hardwood restoration cuts and stream crossings. Hardwood retention treatments pose an even greater risk of direct impacts to undetected individuals in hardwood dominated drainages because this treatment requires personnel and equipment to access the interior of hardwood communities to remove conifers. This exposes the entire stand to direct impacts rather than only the edges (as would be experienced in a hardwood restoration cut).

If undetected populations exist in wet meadows, riparian areas, and spruce drainages they would be afforded more protection than those discussed in the Direct and Indirect Effects Common to All Suitable Habitat Types under Best Management Practices and Forest Service Manual 2509.25. Design criteria limit road construction, skidding, control lines, staging and parking in unique botanical areas including wet meadows, riparian areas and hardwood/white spruce drainages commonly associated with sensitive species. If such activities are unavoidable, a botanist would be available and would be consulted to mitigate impact to habitat.

Indirect effects of meadow and hardwood release treatments on hardwood/white spruce dominated drainages and wet meadow habitats (Table 3-34) include disruption of key fungal and other biological relationships that occur in the soils under meadows and hardwood leaf litter. Potentially beneficial indirect effects result from expansion of hardwood and meadow communities by removal of encroaching conifers (hardwood restoration and meadow release cuts). These treatments may result in direct impacts due to ground disturbance in the short term, but improve sensitive plant habitat over the long-term by preventing conversion of the stand to ponderosa pine.

Heavy equipment associated with mechanical treatments can loosen and displace soil, which can then collect in drainages and other low-lying habitat which is suitable for Region 2 sensitive plant species. Heavy equipment can also alter the microsite hydrology and fungal communities preventing dependant Region 2 sensitive species (such as prairie moonwort, narrowleaf grapefern, and yellow lady's slipper) from establishing.

One of the potentially beneficial indirect effects of the proposed action is the introduction of disturbance, such as burned areas and roads. These disturbed areas, if decommissioned and left undisturbed could become suitable habitat for Region 2 sensitive species such as narrowleaf grapefern and prairie moonwort as these species are associated with historically disturbed areas. In addition, the removal of fuels from the project area would decrease the chance of large-scale wildfire as discussed in the effects analysis for Alternative A.

Alternative C

Direct and Indirect Effects
Alternative C is similar to Alternative B with the difference being more acres treated, use of cable logging in areas non-conductive to ground based harvest, and helicopter logging in inaccessible areas. The direct and indirect effects would be similar to Alternative B, with a

slightly higher probability of directly impacting Region 2 sensitive species because 19 miles of additional roads would be constructed to access cable logged areas.

Prairie moonwort (*Botrychium campestre*) was the only Region 2 sensitive plant species confirmed within the project area and is restricted to one population. This population has design criteria associated with it that would limit the potential effects (see Appendix B). The population is buffered with an area that would not be vegetatively treated, not have landings or log decks constructed, not have equipment parked during any management activities, not have broadcast prescribed burn control lines constructed through, and would only be burned if a low intensity burn can be achieved.

Direct and Indirect Effects Common to All Suitable Habitat Types

Direct negative effects of the proposed action to undetected individuals include destruction of individuals during tree felling and skidding operations, burial, crushing, and burning of individuals by slash piles, trampling by equipment and/or personnel, and burning of at least above ground parts as part of broadcast prescribed burning. These impacts would be the same for Alternative C as Alternative B. Application of fire (either pile burning or broadcast prescribed burning) may result in the burning of undetected individuals, however most species recover quickly after low- to moderate-intensity prescribed burns (Knapp et al. 2007) and the areas exposed to high intensity pile burning are relatively small. Equipment used during construction and maintenance of roads and/or prescribed broadcast burn control lines could crush, bury, or uproot undetected individuals. Prairie moonwort and narrowleaf grapefern are particularly susceptible to these impacts because they frequently occur along road corridors and other disturbed areas. These impacts would be potentially greater for Alternate C than Alternate B because 19 miles of additional roads would be constructed to access cable logged areas. This potential effect is mitigated by limiting the grading of roads in areas of highest potential habitat.

Application of fire, particularly broadcast prescribed burning, removes the understory and litter layer from the forest floor. This loss of organic matter can decrease the moisture content of the soil. The heat generated by combustion of organic matter can also damage the ectomycorrhizal fungi community upon which some Region 2 sensitive species are dependent (narrowleaf grapefern, prairie moonwort, and yellow lady's slipper), however this effect is usually slight if fire intensity is kept low (Bastias et al. 2006). In addition, burning removes existing understory vegetation, reducing competition, and opening up habitat for invasion by other species. These effects are magnified in areas experiencing intense burns, such as slash piles (Haskins and Gehring 2004). Once established, these exotic species can out-compete native vegetation causing a shift in the ecology of the area.

Other potential indirect effects result from greater use of existing roads for hauling resulting in an increase in dust pollution. Sensitive plant individuals that are undetected along roads could experience reduced photosynthetic capacity due to a coating of dust on the leaves. Also, removal of timber may also open access to areas previously protected from impacts by livestock and illegal off-road vehicle use. Increased livestock utilization and illegal off-road travel in previously inaccessible areas not only increases the potential for grazing, trampling, and other losses of individuals, but also increases the chance for non-native species invasion.

Direct and Indirect Effects to Specific Suitable Habitat Types
If undetected populations are present in hardwood and white spruce drainages, direct negative effects of project activities could include risk of impact from hardwood restoration cuts and stream crossings. Hardwood retention treatments pose an even greater risk of direct impacts to undetected individuals in hardwood dominated drainages because this treatment requires personnel and equipment to access the interior of hardwood communities to remove conifers. This exposes the entire stand to direct impacts rather than only the edges (as would be experienced in a hardwood restoration cut).

If undetected populations existing in wet meadows, riparian areas and spruce drainages they would be afforded more protection than those discussed in the Direct and Indirect Effects Common to All Suitable Habitat Types under Best Management Practices and Forest Service Manual 2509.25. Design criteria limit road construction, skidding, control lines, staging and parking in unique botanical areas including wet meadows, riparian areas and hardwood/white spruce drainages commonly associated with sensitive species. If such activities are unavoidable, a botanist would be available and would be consulted to mitigate impact to habitat.

Indirect effects of meadow and hardwood release treatments on hardwood/white spruce dominated drainages and wet meadow habitats (Table 3-34) include disruption of key fungal and other biological relationships that occur in the soils under meadows and hardwood leaf litter. Potentially beneficial indirect effects result from expansion of hardwood and meadow communities by removal of encroaching conifers (hardwood restoration and meadow release cuts). These treatments may result in direct impacts due to ground disturbance in the short term, but improve sensitive plant habitat over the long-term by preventing conversion of the stand to ponderosa pine.

Heavy equipment associated with mechanical treatments can loosen and displace soil, which can then collect in drainages and other low-lying habitat which is suitable for Region 2 sensitive plant species. Heavy equipment can also alter the microsite hydrology and fungal communities preventing dependant Region 2 sensitive species (such as prairie moonwort, narrowleaf grapefern, and yellow lady's slipper) from establishing.

One of the potentially beneficial indirect effects of the proposed action is the introduction of disturbance, such as burned areas and roads. These disturbed areas, if decommissioned and left undisturbed could become suitable habitat for Region 2 sensitive species such as narrowleaf grapefern and prairie moonwort as these species are associated with historically disturbed areas. In addition, the removal of fuels from the project area would decrease the chance of large-scale wildfire as discussed in the effects analysis for Alternative A.

Cumulative Effects
The cumulative effects are bound in space by an area half a mile outside the project area, because the influence of other management activities (particularly timber management) on botanical resources is primarily determined by impacts on hydrology and a half-mile buffer is sufficient to capture this influence. The cumulative effects are bound in time ten years prior to the decision and ten years after the decision because this is the average amount of time between vegetation treatments in any given area.

Past actions within the Pactola Project Area are discussed in the "Description of the Proposal" section, as well as in the DEIS for the Pactola Project Area. Current actions in the adjacent Prairie Project Area include the Placer Timber Sale (7 acres). The Slate Castle Project Area (USDA Forest Service 2009b) is a 38,271 acre planning area adjacent to the Pactola Project Area on the southwest side. The Slate Castle Project is currently being implemented with treatments similar to those proposed in the Pactola Project.

Private land within and adjacent to the project area would most likely experience treatments similar to those used on NFS lands. Thinning activities used to create defensible space and fuel breaks around private property and structures within the Pactola Project Area, as well as fighting spread of mountain pine beetles are anticipated. Livestock grazing is also a current use on privately held land.

Firewood gathering occurs in designated areas, generally away from known occurrences of Region 2 sensitive species and their habitat, therefore the risk of firewood gathering to Region 2 sensitive plant species is low. This activity would most likely be more common in the project area if Alternative B or Alternative C is chosen over Alternative A because these areas are usually associated with slash piles and former timber sales. This activity would primarily affect the unknown habitat classification suitable habitat types (Table 3-34).

Because Christmas tree cutting occurs Forest-wide, it can affect Region 2 sensitive plant species and their habitat. Because this activity occurs when the ground is frozen and is small in impact area, the risk to Region 2 sensitive plant species is low and generally limited to removing spruce trees which provide shade and microhabitat. This activity would remain at current levels if Alternatives B or C is chosen. This activity would affect hardwood and white spruce drainages, wet meadows, and unknown habitat classification suitable habitat types (Table 3-34).

Road and utility right-of-way clearing affects areas already impacted by the presence of roads and utility corridors. Effects of these activities are similar to those of timber sales and include crushing, trampling, and uprooting of individual plants as well as changing the light and moisture regime within the project area. This activity would increase if Alternative B or C is chosen because trees would be cleared from new access roads. However, the long term need to clear trees from roads and utility right of ways would decrease because of lower tree density in the area. This activity would affect hardwood and white spruce drainages, wet meadows, and unknown habitat classification suitable habitat types (Table 3-34).

Range developments include fencing, dugouts, wells, and spring developments. These management activities are used to influence the distribution of livestock on the landscape. Range developments, particularly water developments, affect Region 2 sensitive plant habitat because they occur in drainages and wetlands (suitable habitat), however they tend to concentrate livestock use in these areas and exclude livestock from spring sources and other sensitive areas. This activity would continue at current levels if Alternative B or C is chosen. This activity would affect hardwood and white spruce drainages, wet meadows, and unknown habitat classification suitable habitat types (Table 3-34).

Livestock grazing affects most of the project area, with the greatest impacts on meadows, riparian, and wet areas. Impacts to Region 2 sensitive plant species includes trampling and grazing on individuals by livestock as well as soil disturbance and compaction. If Alternative B or C is chosen, livestock grazing may impact a wider area of NFS lands because thinning of timber would allow livestock to roam into areas that were inaccessible due to tree density. This could expose populations of Region 2 previously protected from impacts by livestock use. Livestock usage in previously inaccessible areas not only increases the potential for grazing, trampling, and other losses of individuals, but also increases the chance for non-native species invasion.

This activity would affect hardwood and white spruce drainages, wet meadows, and unknown habitat classification suitable habitat types (Table 3-34).

Any future projects would require separate environmental review and analysis of effects on resources to comply with the National Environmental Policy Act. This analysis addresses the direct and indirect effects the alternatives have on botanical resources in the Pactola Project Area.

SOCIAL ENVIRONMENT

This section will describe the affected environment and environmental consequences for each alternative to the Social Environment (Travel Management, Scenic Quality, Recreation Use, Lands and Special Uses, Heritage, and Social).

TRAVEL MANAGEMENT

Background

The Record of Decision (ROD) for the Black Hills National Forest Travel Management Plan was signed on May 7, 2010 and implementation began with publication of the Motorized Vehicle Use Map effective December 1, 2010. The Travel Management Plan will help meet the increasing demand for recreational travel opportunities and provide a range of quality experiences for other Forest users, while offering many recreational opportunities over time. The ROD designated 707 miles of system trails of various types Forest-wide, as well as 548 miles of roads open to all vehicles. These roads and trails were designated to provide diverse motorized recreation opportunities in off-highway settings rather than roaded settings, to meet user interests and best manage public safety risks, disperse users, and reduce crowding and conflicts with other users. Motorized cross-country travel is prohibited, other than for dispersed camping and game retrieval along selected routes.

The Travel Management Plan recognizes that the total number of off-highway vehicle miles included in the decision will not likely be available in a given year, with some trails being closed for project work or seasonal closures. The ROD also acknowledges that certain designated routes may not be available in any particular season or year because of contractor or timber purchaser operations, public safety, or resource concerns, leading to reduced miles available for OHV operation.

Affected Environment

Displayed in Table 3-35 below are the miles of various types of routes designated for motorized travel in the Pactola Project Area by the Forest Travel Management Plan Record of Decision (ROD). Also shown in the table below are the trail mileages that are currently open for motorized travel as shown on the 2011 Motor Vehicle Use Map (MVUM). Miles of trail currently open is lower that designated in the ROD, since a number of trails require improvement before accommodating motorized traffic. The majority of the trails and roads open to all vehicles are concentrated in the northern portion of the project area, south of the Rochford Road, although there are a few trails in the southwestern portion of the project area off the China Gulch Road.

Road and trail conditions vary throughout the project area. In areas with currently active timber sales, roads meet maintenance standards due to recent or ongoing maintenance activities by the timber purchaser. Other roads and trails that were system roads prior to becoming a designated trail likely do not meet maintenance standards. All or portions of some trails were "unauthorized" routes submitted by the public prior to designation. None of these routes have been maintained to any standard, and some of these routes may be poorly located, do not have adequate drainage structures, and may have steep grades with rutting and surface material loss resulting in sediment movement.

Table 3-35 Miles of routes designated for motorized travel in the Pactola Project Area

Route Type	Open Yearlong		Open Seasonally		Total	
	ROD	MVUM	ROD	MVUM	ROD	MVUM
Highway Legal Only	22	22	7	7	29	29
Roads Open To All	12	12	2	2	14	14
Trails Open To All	5	5	8	7	13	12
Trails Open to Vehicles ≤62"	13	10	16	15	29	25
Trails Open to Motorcycles	10	4	2	0	12	4
TOTAL	62	53	35	31	97	84

Note: Miles of National Forest System Roads closed yearlong = 60.

Environmental Consequences

Alternative A – No Action

Direct and Indirect Effects

Under Alternative A, the No Action Alternative, there would be no direct effects to motorized recreation or to designated routes because no proposed activities would occur in the project area. Some beneficial, indirect effects include no increased dust, noise, and traffic associated with project activities under Alternatives B and C.

Adverse, indirect effects of the No Action Alternative are that maintenance, relocation/reconstruction, and closures of routes not designated for motorized travel that are associated with and funded by timber harvest would not occur. Trails with steeper grades and those without adequate drainage structures would continue to erode and rutting would deepen as surface material continues to wash off the road. Soil and water resources would continue to

be negatively affected by soil movement and sedimentation. Motorized recreation experiences would be negatively affected as the condition of the roads and trails continues to deteriorate.

Unauthorized roads not designated for motorized travel would remain on the landscape, possibly leading to illegal use. Existing road closures in the project area that are currently ineffective would not be reinforced to restrict motorized travel until additional funding could be obtained. Continued motorized use of routes and areas meant to be closed to motorized travel would negatively impact those routes and areas, as well as the non-motorized recreational experiences of those seeking quiet and solitude.

Alternatives B and C

Direct and Indirect Effects

The action alternatives, to varying degrees depending on the alternative, propose maintenance, reconstruction, potential road closures, and reinforcement of some existing but ineffective road closures. Direct effects from these activities are short-term vegetation loss/removal, soil disturbance and compaction, and an increase in noise, dust, and traffic during project operations. It is also likely that some roads and trails currently designated as open yearlong could be closed seasonally (December 15 to May 15). Or some trails and roads open to all could be temporarily changed to open to highway legal only for the duration of the project to accommodate project activities. Project activities could also delay opening of designated trails that are not currently open, until after project activities are competed.

Beneficial direct and indirect effects include maintenance, and relocation/reconstruction of some trails and roads open to all that are utilized for project activities would occur. Closures associated with and funded by timber harvest of some routes not designated for motorized travel would also occur. All road work would comply with Best Management Practices and road design criteria. Safety issues would be addressed in the road design phase. Some routes would be realigned and relocated to reduce steep grades.

Approximately 19 miles of trails that are currently open yearlong could be affected if closed seasonally, and 55 miles of trails and roads open to all could be affected if changed to highway legal only for the duration of project activities. The duration of project activities in the vicinity of the majority of motorized routes is anticipated to be two years after initiation of project activities. Newly constructed routes could provide additional motorized recreation opportunities with the potential to be added to the designated trail system at some point in the future. The newly constructed closed roads could, however, lead to illegal motorized use of the routes.

Miles of roads and trails designated for motorized recreation would not change as a result of implementation of either action alternative, therefore the mileages shown in Table 3-35 above would remain the same post-project. As previously noted, the miles of roads and trails designated by the Travel ROD for motorized travel, as displayed above, are the maximum amount of routes available; not all the routes would be available for motorized recreation in any given year, regardless of project activities.

The number of miles of routes proposed to be maintained, reconstructed, converted, and constructed are very similar between Alternatives B and C, except that Alternative C proposes constructing an additional fifteen miles of road to facilitate cable harvest operations. These newly constructed routes would be closed to motorized vehicles upon completion of harvest activities.

Cumulative Effects
There are potential cumulative effects to the larger motorized trail system across the Forest. Temporary changes from trails to roads would likely be needed in other parts of the Forest, in addition to the Pactola Project Area, to respond to vegetation management needs associated with the ongoing mountain pine beetle epidemic. These additional temporary changes to the motorized trail system could affect the total amount of trails available to recreation users, and also affect the connectivity of various trails within the system.

SCENIC QUALITY

Affected Environment

The Pactola Project Area is located west of Rapid City, SD in the Black Hills National Forest. Recreationists, permittees, and homeowners travel through this project area on a daily basis. During the spring and fall, the area is well traveled by hunters. During the summer, the area is heavily used for camping, fishing, boating and hiking.

Valued Landscape Character Development
Landscape character gives a geographic area its visual and cultural image, and consists of the combination of physical, biological, and cultural attributes that make each landscape identifiable or unique. Existing landscape character may range from predominantly natural landscapes to those that are heavily culturally influenced. The landscape character units are derived from an ecological framework utilizing ecological land descriptions and existing landscape uses. Ecological units are the mapped landscape analysis units used for ecosystem planning and management. The visual image created by the physical, biological, and cultural factors in the ecological land unit description helps define the landscape character for scenery management.

Scenic Class measures the relative importance of, or value, of discrete landscape areas having similar characteristics of scenic attractiveness and landscape visibility. Scenic Class is used to compare the value of scenery with the value of other resources. The higher the Scenic Class, the more important it is to maintain the highest scenic value. The inventoried Scenic Class Values, on the Black Hills NF, are 1 (Highest), 2, 3, and 4 (Lowest). The scenic class values demonstrate the importance of the views in different areas. Approximately 29% of Pactola Project Area is designated as a Scenic Class 1, 47% in a Class 2, 23% in a Class 3, and 1% in a Class 4.

Inherent Scenic Attractiveness is obtained by classifying the landscape into different degrees of variety. This determines which landscapes are most important and those that are of lesser value from the standpoint of scenic quality. The classification is based on the premise that all landscapes have some value, but those with the most variety or diversity have the greatest potential for high scenic value. Scenic Attractiveness classifications are: A - Distinctive, B -

Typical and C - Indistinctive. Approximately 20% of the Pactola area is in the A - Distinctive classification, 60 % in the B - Typical and 20% in the C – Indistinctive.

Landscape Visibility is the portions of landscapes visible from travel ways and use areas are important to constituents for their scenic quality, aesthetic values, and landscape merits. Sensitivity Level 1 travel ways that lead to important scenic features, residential areas, resorts, recreation areas, unique natural phenomena, wilderness trailheads, national parks, state and county parks, attract higher percentage of users having high concern for scenic quality, thus increasing the importance of those travel ways.

Sensitivity Level 1 Corridors County and Forest Development Roads and Trails: 47% of the project area is visible. The project area is seen in the Foreground from US Highway 385, the Mickelson Trail, the Centennial Trail #89 - a designated 'National Recreation Trail', and the Deerfield Trail #40. The project area is seen in the Middleground and Background from US Highway 385. The most visible areas of the project area are in the eastern and central portions, where the project area provides a backdrop for campgrounds, water activities on Pactola Reservoir, and Pactola Visitor Center.

Sensitivity Level 2 Corridors County and Forest Development Roads and Trails: 56% of the project area is visible. This includes County Roads: 141 (Silver City), 237 (East Gimlet access to Silver City), 251 (Cross Over access from Silver City to Edelweiss), 251.1D (Edelweiss access), and National Forest Service Roads (NFSR): 157 (Jenny Gulch Picnic Ground access), 251 (Cross Over access to Edelweiss), 253 (Bear Creek Group Camp site access), 258 (Custer Gulch boat launch and Pactola Campground access), 269 (Pactola Boat Dock access), and 545 (Pactola Campground access).

Scenic Integrity Objectives (SIO) are management objectives that were adopted from the scenic class values. Scenic Integrity is a measure of the degree to which a landscape is visually perceived to be "complete." The highest scenic integrity ratings are given to those landscapes that have little or no deviation from the character valued by constituents for its aesthetic appeal. Within the Pactola Project Area, approximately 27% has a High, 44% Moderate, 29% Low, and less than 0.1% Very Low assigned SIO.

Existing Scenic Integrity represents the current status of a landscape. It is determined on the basis of visual changes that detract from the scenic quality of the area. Direct human alterations may be included if they have become accepted over time as positive landscape character values. Existing scenic integrity is the current visual state, which is measured in degrees of deviation from the natural appearance of the landscape character type. These ratings give an indication of the present level of visual quality and visual evidence of management activities. The frame of reference for measuring achievement of scenic integrity levels is the valued attributes of the existing landscape character unit being viewed. In natural or natural appearing character, this is limited to natural or natural appearing vegetative patterns, features of water and rock, and landforms.

The area is noted for conifer stands in gently rolling terrain, meadows that follow streams and intermittent streams, and pockets of Aspen and other hardwood trees. Forested areas are

predominantly populated by ponderosa pine communities, but spruce communities are found in the project area. Water features include Pactola Reservoir (approximately 868 acres) and are limited to narrow, quiet, low-flow streams. Apparent human alterations in the form of roads have generally been accepted over time as part of the positive cultural landscape character attributes – when they do not dominate the landscape in appearance or quantity, and are limited around non-motorized areas or recreation facilities. Vegetation alterations in the form of fuel treatments, commercial and non-commercial thinning are scattered, and only readily apparent when adjacent to a main road. Pine and spruce stands are expanding into meadows and hardwood stands.

In the portion of the project area (east of US Hwy 385, along the Silver City Road, etc.) there are isolated Foreground views (locations along the main roads) where past vegetative treatments are evident; however in the Middleground views (away from the main roads) vegetative treatments are not readily apparent. Mountain pine beetle activity is evident in this area in the form of red-needle trees that were recently killed. Trees that are under attack, visually clumps of pitch are apparent on the trunk when viewed up close, and the color of the needles is a lighter hue which is generally not apparent from a distance until the trees begin fading and the lighter hue begins to stands out from adjacent trees. The western portion of the project area, in and around the Canyon City Natural Research Area (RNA), appears to have the heaviest concentrations of mountain pine beetle activity (USDA Forest Service, 2010d). The eastern portion of the project area is 'natural-appearing' with a High Existing Scenic Integrity condition, and isolated pockets of mountain pine beetle activity are evident.

In the surrounding landscape, outside this project area, past vegetation treatments are evident in the middle ground and background views to the south of the Pactola Project Area. Areas to the north, east, and west are generally more natural appearing. Overall, the surrounding area has a slightly altered to altered appearance – a Moderate Existing Scenic Integrity condition.

Environmental Consequences

Alternative A – No Action

Direct and Indirect Effects

Existing conditions and natural processes of trees growing and regenerating would continue. The quantity of trees within the forest would become denser. These conditions are primed for normal ecological processes, in the form of wildland fire, insects, and disease, to take place. These ecological processes are not easily controlled and may affect natural resources in a manner that is undesirable or move the landscape vegetation away from the Desired Future Condition in areas that are valued for their scenic beauty.

Currently, there is a large outbreak of mountain pine beetle (MPB) on the forest. In areas similar to the Pactola Project Area, with a basal area of 90 or greater, the MPB have killed the majority of trees (approaching 100%). Currently, there is evidence (attacked and killed trees have needles that have turned red) of small pockets of MPB activity within the project area. These pockets, in areas of high tree densities, would expand killing greater and greater numbers of trees. The trees that are valued for their scenic beauty would likely be killed.

When trees are removed during commercial operations, the remaining tops and limbs ('slash') is treated and reduced or eliminated – creating a 'clean' forest floor (that mimics the effects of periodic wildfires that historically burned through the landscape) – that is desired by the public. In this case, that would not occur. The resulting decay and falling of these trees will create a 'jack-straw' of down trees - a very undesirable scenic condition.

Wildland fire (e.g. – lightning caused) is an essential ecological process in this ecosystem. Fire plays the dominant role in reducing competition for nutrients among pine trees; those that survive the fire generally become the dominant trees. Due to the proximity of private lands, homes, utilities, and other improvements, efforts are made to extinguish wildland fires as rapidly as possible to reduce the threat to human-made or valued natural resources. As a result, this management policy would continue to limit the natural role of fire in the landscape. Prescribed human initiated fires would mimic the beneficial ecological effects of wildland fires; however they cannot be conducted on the scale and frequency, to cover the landscape, to reduce the rapidly growing ponderosa pine. As a result, the vegetation would continue to grow densely, becoming thicker, and reducing visible open space. Views into the forest would become more limited as the trees grow more densely – reducing visual diversity such as wildflowers, shrubs, hardwoods, and open meadows. Should wildfires burn into stands of densely packed ponderosa pine trees, smaller trees can act as "ladder fuels" moving the fire up into the crowns of the trees, resulting in groups of fire killed trees. In this project area, hardwoods could move in and populate these openings where moist conditions are present. Otherwise, ponderosa pine would likely re-seed into these openings.

Efforts are made to keep the fires small. These efforts would likely continue to limit visual evidence of the effects of wildfires within the landscape. Should fires spread beyond initial containment, such as in drought and/or high wind conditions, and spread into hillsides of densely packed trees, we could expect to see hillsides of fire-killed trees. As these trees fall, these areas would be more visible in the landscape as large openings. During periods when the ground is snow covered, these areas would be highly visible in the landscape. Burned areas may, or may not, be similar in shape and size (scale) to meadows, and other existing natural open areas in the landscape. Eventually seeds carried by the wind, from the surrounding trees, would land in the area and new trees would sprout, as the process of re-growth begins anew. As in previous fire areas, we may see the burned areas move toward becoming aspen stands.

In areas with a High or Moderate SIO, should fires occur or insect activity levels pickup beyond natural levels - killing large areas of trees, the forested landscape would move away from the desired future condition for more open park-like stands. In small areas, such as one to three acres, where trees are killed, a mosaic of tree sizes and openings would be maintained that would move toward the desired future condition. In some areas where the insect attacks dominate the landscape, large open areas (exceeding the size of opening normally found in this area) could be created – dramatically changing the appearance of the forest, as viewed from private land interspersed throughout the project area. In these areas, we can expect a large amount of down trees, a greater amount than natural levels, would dominate the landscape. Should a wildfire occur in these areas of dead and down trees, we can expect long residence time of the fire which in turn can sterilize the soil – thus limiting the ability of seeds to sprout

and quickly reforest these areas (Jasper Fire (2000), Battle Creek Fire (2002), and on the Snowshoe and Sheep Fires in the Malheur National Forest).

Small openings interspersed with forested areas provide an opportunity to see into the forest - which in turn increases the potential to view wildlife, wildflowers, and flowering shrubs. In addition, an ever changing kaleidoscope of light and shadow, as well as a variety of sizes of vegetation, create an interesting and diverse visual landscape.

In areas where no disturbance occurs, the vegetation would grow into a thick dense forest, with competition for light, water, and nutrients. In some areas, the dense conifers are out-competing the hardwoods for these necessary components for plant growth. This dense vegetation provides the greatest potential for disturbance (fire or insect) that could greatly change the visual appearance of the vegetation across the landscape. The dense vegetation may shade out shrubs, wildflowers, and other low growing plants – reducing visual diversity.

Cumulative Effects

There are no cumulative effects that are common to the No Action Alternative. However, given the rapidly moving MPB outbreak, and the rate of spread across the Forest, the small pockets of MPB activity already in the area could spread in this project area due to the existing high basal area (see Vegetation section). Effects of this activity can be widespread and highly visible within five years of an outbreak of activity. The valued forest vegetation would likely be heavily impacted, and it will take a long time, more than 50 years, to approach the existing condition again.

Effects Common to Alternatives B and C

Direct and Indirect Effects

Management activities that would move forested stands to residual basal areas below 80, would reduce the potential of mountain pine beetle populations reaching epidemic levels (consultation with Kurt Allen, Entomologist, Rocky Mountain Research Station, March, 2010).

Commercial thinning can result in a uniform appearance of the remaining forest stand (both in size and spacing). The vertical lines of the remaining tree boles would be more evident. Thinning the understory would further increase the emphasis and visibility of the larger diameter trees in the landscape. Understory grasses and shrubs would be more evident offering seasonal variety of light and color (when spring flowers are evident). The visibility of larger diameter trees would add variety of color (orange and black bark on the tree boles), light and texture. When higher numbers of larger trees remain on the landscape, the evidence of this thinning is reduced, and can have a natural appearance. In the Foreground and Middleground, textural differences would be the most evident, in the Background textural changes may be evident, but form, lighting (shadows) and color differences can be the most evident.

Commercial Thin treatment method generally meets a Moderate to High SIO. Commercial Thin treatments with a remaining basal area of 50+, generally meet a Moderate to High SIO. Those with a basal area of 40 – 50 generally meet a Low to Moderate SIO, and those below 40 basal area generally meets a Low to Very Low SIO. In stands where there is a mixture of

tree sizes, including the understory, random spacing, and groups/clumps of remaining trees can help maintain an appearance in character with the landscape and improve the SIO rating.

Products Other Than Logs Thinning removes six to nine inch diameter trees (POL thinning) would open up views into the Forest. This treatment often leaves a moderate level of vegetation debris on the forest floor, reducing grasses and shrubs, and dominating foreground views. Once the slash is cleaned up, this treatment should meet a Moderate SIO. In the middleground and background, large diameter trees surrounding the treatment areas should be more dominant in this landscape. In the middleground and background, this treatment should meet a Moderate to High SIO.

Overstory Removals result in an open area with seedlings scattered across the opening, and three to six large (commercial-sized) trees, for wildlife remain per acre. There may be a few remaining trees as well. In the Foreground, the opening in the forest canopy and the seedlings across the forest floor would be the most evident. In the Middleground and Background, the form, or shape, of the unit would be most evident in the winter months when snow is present on the ground, creating a strong contrast from the darker surrounding forest. In the months when the snow is not present, the form and color would be most evident. During periods when snow is on the landscape, would likely appear as large white forms, with patches of dark vegetation (and corresponding shadow) in them – when larger trees remain on the landscape. These units have the greatest potential to appear out of scale and character with natural vegetative patterns. Overstory Removal treatments generally meet a Moderate to Low SIO, depending on how closely they appear in shape and size (scale) to mimic the natural openings in the characteristic landscape, and the size of the remaining seedlings. Liberation Cuts would meet a higher SIO when larger trees remain to be released from a dominant overstory. A Moderate SIO can be achieved if the size of the unit does not exceed the natural openings by more than 10%, otherwise it would likely meet a Low SIO. If the units do not borrow from the shape and size of the natural openings, a SIO higher than Very Low would not be expected to be met.

Hard wood Retention and Restoration and Meadow Retention and Restoration treatments are treatments to remove encroaching conifers, whether from hardwood stands or meadows. These treatments remove all pine trees – when the treatment is completed (piled tops and limbs [slash piles] are burned) only the low stumps would remain. In a hardwood stand, it would take time for new shoots to sprout and take advantage of the reduced competition for nutrients. In commercial treatments, pine trees larger than nine inch diameter are removed as well. These remaining trees create a transition zone between open meadows and the surrounding forest. These treatments would restore meadows and hardwood stands - ecological goals identified in the Forest Plan. If all the slash is treated or removed, these treatments should all meet a Moderate to High SIO when they are completed. As this is a “restoration” treatment, these treatments may not initially meet the assigned SIO, however the rapid sprouting and growth of hardwoods would quickly revegetate the area and meet the SIO within two to three years, and the restoration would have long-term benefits to the scenic quality.

There are state and county rights-of -ways throughout the project area. Many of these have both commercial and non-commercial timber in them. Hazard trees and timber within these rights-of-ways would be removed to reduce the risk to motorists from trees falling (e.g.- during

wind storms) and ice build up on the roads during the winter (due to shading). This would occur in areas where rights-of-ways are adjacent to timber harvest units. This treatment would be in the Immediate Foreground of the road. On the one hand it would reduce the feeling of driving in and among the trees; this treatment would allow opportunities for shrubs, flowers, and grasses to provide additional color, texture, and interest in the Immediate Foreground – while improving public safety. With hand-piling/burning slash, this treatment should meet a High SIO when completed.

Non-Commercial Vegetative Treatments can result in a uniform appearance of the remaining forest stand (both in size and spacing). Understory grasses and shrubs would be more evident offering seasonal variety of light and color (when spring flowers are evident). Uneven spacing of the remaining trees is the most desirable, as it creates a more natural appearance. In the Foreground and Middleground, textural differences would be the most evident, in the Background textural changes may be evident, but form, lighting (shadows) and color differences can be the most evident.

How well non-commercial treatments blend into the characteristic landscape, and meet the Scenic Integrity Objective (SIO), is based upon the slope, aspect, soil disturbance, residual tree spacing, and slash clean-up. Often reducing soil disturbance, uneven spacing of the remaining trees, and reducing the quantity of slash to natural levels, would result in a higher SIO being achieved. Evidence of vegetation management would generally be more visible when these landscapes are snow covered, so the shape of the treatment unit should not follow a geometric pattern (e.g. – square, rectangular, or angular shapes). As most of the project area is covered with treatments units, non-commercial treatments would extend over most of the area in a combination of treatments.

When activities are completed, non-commercial thin treatment methods generally meet a Moderate SIO. A High SIO can be achieved if the remaining trees vary both in spacing (including clumps) and height, to mimic a natural growing stand.

Road construction creates a road template with a cut and fill slope in the landscape. On steep slopes this road template can be highly visible; on flat slopes the road template is not readily evident unless the viewer is in a superior position. Any new road construction along the edge of private land has the potential to be highly visible.

By-products of vegetation removal - include ‘slash’ (tops and branches not utilized for commercial products or fuel are left on the ground, or piled, throughout the area of the vegetation removal) and stumps would likely be evident throughout the treatment areas. As a result of the treatment, slash is in quantities usually well above natural levels - creating strong contrasts (the slash reflects light) in color and texture. On steep slopes stumps can be highly evident, as they too would reflect light; on flat terrain grasses can grow up and hide them. With both byproducts, it is the quantity present that determines how natural the forest would appear after treatment. Additional slash treatments such as piling and burning, crushing, or moving to a large landing for treatment, can all greatly reduce the visual impact from the slash.

When slash is piled, it is usually then burned within one to two years. Burning of slash is dependent upon weather condition that aid in containing the fire to the immediate area. Generally, these conditions occur within two years of the time the slash is placed on the ground. Once the dried slash is burned, circular burn marks are clearly evident on the ground. Normally, these burn marks are no longer visible once new grasses and other vegetation grow up the following spring. Piling and burning can meet a range from High to Low SIO. A Low scenic integrity is usually only achieved when large burn bays are used and the soil is sterilized – even with seeding it can take a number of years to re-establish the vegetation.

However, due to the wetter snow conditions found within this planning in the winter (when burning of piles occurs), the slash often is not fully consumed, leaving piles of blackened slash – a visually negative element due to the concentration of material. This residual material is visually evident in the landscape for years. Where burn piles are placed within the foreground of visually sensitive roads - and the piles are not completely consumed, only a LOW SIO.

Prescribed Burning sends fire across the landscape, within a designated boundary, prescribed in a manner to keep the fire from getting into the tree tops is beneficial to the Scenic resource by removing dead plant material and slash, and stimulating plants, shrubs and hardwoods, that increase visual diversity and fall color in the landscape. Once the area is burned, ash and blackened tree bark are clearly evident across the landscape. Normally, these burn marks are no longer visible once new grasses and other vegetation grow up the following spring. Prescribed burning can meet a range from High to Low SIO, depending upon burn intensity. Most burns conducted on this Forest meet a High SIO one year after the burning is completed.

Skidding logs on, or across, steep slopes can remove vegetation and displace soil leaving trails that can be quite visible – creating lines or unusual color contrasts in the landscape. These skid trails would be evident until cleanup activities (slash treatment and seeded areas germinate) are completed. On gently rolling terrain, disturbance is generally kept to a minimum – however it is dependent upon the quantity of logs moved along the skid trails.

Locations where logs are brought, piled, and then loaded onto trucks and removed from the site. The size of these landings and amount of disturbance (vegetation removed and often soil displaced) would vary by location, depending upon the type of logging system employed (forwarder, etc.) and the volume of logs being brought to that landing. Once logging is completed, these landing sites are cleared of debris and reseed. The length of time before the site appears as a natural opening is generally one to four years, depending upon the level of disturbance, any remaining debris (slash), and how quickly grasses take over the site.

Alternative B – Proposed Action

Direct and Indirect Effects

The rolling nature of the terrain in this project area limits views to the Foreground and near Middleground. This alternative creates a variety of treatments. Areas that would remove the greatest number of trees are scattered around the area, so no single viewshed area is heavily impacted. In other areas, the treatments would reduce the density of trees, though still maintaining a natural appearing condition. Approximately 13,000 acres or 52% of the project

area would be mechanically treated under this alternative through commercial and non-commercial vegetation treatments, and meadow and hardwood enhancements.

Of the commercial treatments, Overstory Removals are the most evident (by creating large open areas) and have the greatest potential to negatively affect the scenery within the project area – these treatments would make up approximately 52% of the project area. The majority of these areas proposed for final Overstory Removal are heavily managed, have been thinned in the past, and have an understory of trees coming up. These units potentially could be the most visible in the Middleground and Background distance zones. However their location, in this project area, is predominantly located in drainages that are not readily visible from Sensitivity Level 1 and 2 routes. Generally only portions of these units are visible, minimizing the negative visual impacts.

Skidding logs on, or across, steep slopes can remove vegetation and displace soil creating opportunities for noxious weeds to become established in treated areas. These weeds (e.g. – Mullen) have shapes that are not common in the natural landscape, drawing attention to them. Noxious weeds are generally recognized as non-natives and out-of-place in the landscape by the general public. As the quantity of these weeds increase in the landscape, they out-compete native plants, resulting in the visual quality decreasing. Efforts are made to minimize this potential, so it is difficult to predict where and how wide spread this effect will be on the scenery.

Thinning and reducing the overall density of ponderosa pine vegetation can lead to amount of grasses, forbs, shrubs, and hardwoods increasing in the landscape. This could increase the variety of colors evident now, and in the future, across the landscape. Thinning trees to an even spacing can result in a managed, un-natural appearance.

There is a potential for hardwoods to increase (creating a greater amount of fall color in across the landscape) as a result of the removal of conifers in fuel breaks that traverse hardwood stands, however it would be limited to these corridors.

Alternative B would modify the vegetation across the landscape so that management activities would be more evident. The variety of treatments would also create a variety of textural patterns and improve opportunities to view hardwoods and wildlife. Overstory Removal treatments generally do not meet the High or Moderate Scenic Integrity Objective. However, due to the limited size and groupings of these units in this landscape, the rolling hills and ridges will reduce the visibility of these types of treatments – so they will be less evident in this landscape. Restoration treatments to increase hardwood sprouting, and thinning treatments to decrease potential for MPB to attack forest stands, should meet the assigned SIO. These various treatments would move the vegetation in this landscape to being less dense and more open, closer to conditions that emulate the effect of natural fire interval in this ecosystem. Hardwoods and meadows should be more evident and provide seasonal color and textural variety in the landscape, than currently exists.

Alternative C

Direct and Indirect Effects
The types of treatments and their effects are essentially the same as Alternative B, with the addition of the two treatments noted below. The key difference of this alternative, visually, from Alternative B, is additional units of Overstory Removals on steep slopes, and the associated new road construction and logging systems at the top of these slopes.

Roadside Treatments (Fuel Breaks) – These treatments remove all the smaller trees, and a portion of the overstory trees, to achieve basal area of 60. Visually, the viewer can see into the forest, while an overstory is maintained over the area. Groups of trees help maintain a more natural appearing condition. Long term, maintenance of these open areas, would reduce nutrient competition and allow these remaining trees to grow into larger diameter, and potentially "yellow bark" trees – highly desirable from a scenery resource standpoint. A key element is how the edges of the fuel breaks are treated – eliminate straight line boundaries and feather the edges and a High SIO can be met (see Appendix B).

When activities are completed, non-commercial thin treatment methods generally meet a Moderate SIO. A High SIO can be achieved if the remaining trees vary both in spacing (including clumps) and height.

Logging Systems – 'Cable', or 'Skyline', logging system would be employed to remove trees from steep slopes that are not accessible with ground based (rubber tire skidders and metal-tracked skidders) logging systems. Cable systems (on this forest) partially suspend the logs, and partially drag them, up the steep hills. This results in vegetation (grass shrubs and shall trees) being torn out in the corridors were logs are dragged up the hill, these corridors of bare soil, or 'drag marks', are highly visible – often for years, particularly when the viewer is in a position where they can look directly into the unit. These vertical lines that are created on the landscape are generally uniform in width, length, color, and spacing apart. This created pattern is not similar to any natural 'lines', or patterns, in the landscape. Avalanches, fires, or landslides, are generally singular on a landform, and do not create a pattern across a landform. As a result, this logging system, in conjunction with an overstory removal treatment, generally meets a Low or Very Low SIO due to its long-term heavily-managed appearing effect.

Roads – New road construction on ridge tops exposes cut and fill slopes that have limited opportunity to be hidden by other landforms or vegetation. These 'lines' of exposed brown and/or gray soil/rock create strong color contrasts to the green vegetation. In areas were the vegetation is removed below the road, such as with an overstory removal, the road is generally highly visible for 30-50 years while the vegetation grows back. The length of time is dependent upon the height and steepness of the cut and fill slopes, the steepness of the unit below the road, and the growing conditions within that unit. Lighting and seasonal conditions can also increase the visibility of roads in these locations. Over time, the soil-vegetation color contrast would diminish if grass can grow on the road cut and fill slopes. Where the road cut and fill slopes are steep, e.g. – 1:1, and grass has a difficult time getting established, the color contrast would continue. Unless the road template is returned to the original condition – slope and vegetation, the road would appear as a horizontal line in the

landscape that will be visible for decades. Roads in the ridge top locations generally are not rehabilitated to their natural condition and thus meet a Very Low SIO.

Unit 091404-5, directly across the reservoir (approximately 1.5 miles) from the Pactola Visitor Center, a new road is planned (with an overstory removal treatment below) is expected to be highly visible. The road is at the top of the slope. Skyline logging would be employed from this road, resulting in the removal of vegetation that could potentially screen the road's visibility. The road would introduce a highly visible horizontal line across the landscape, resulting in a Low, or Very Low, Scenic Integrity being achieved, in an area with Moderate SIO.

Units 091301-9, 091301-10, 091301-3. These three units treat both sides of a landform, Unit 091301-3 (Moderate SIO) on the west, and Units 091301-9 (High SIO) and 091301-10 (High and Low SIO) on the east. Road construction and the effects from cable logging would be highly evident. Units 091301-3, 091301-9, and the upper portion of Unit 091301-10 would not meet their assigned SIO. Helicopter logging these units (to avoid the effects of road construction and cable logging) would reduce the negative soil-vegetation color contrasts.

Thinning and reducing the overall density of ponderosa pine vegetation can lead to amount of grasses, forbs, shrubs, and hardwoods increasing in the landscape. This could increase the variety of colors evident now, and in the future, across the landscape. Thinning trees to an even spacing can result in a managed, un-natural appearance.

Alternative C would modify the vegetation across the landscape so that management activities would be more evident. The variety of treatments would also create a variety of textural patterns and improve opportunities to view hardwoods and wildlife. Overstory removal treatments generally do not meet the High or Moderate Scenic Integrity Objective. In this alternative, those units on the slopes above the reservoir would be highly visible; with the limited remaining vegetation, the effects from road construction and the logging systems and would be highly visible and have a dominant negative visual impact. These effects would be concentrated around, and highly visible from, the campgrounds along Pactola Reservoir, Pactola Visitor Center, and US Highway 385. Treatments along main access-egress roads in the area would provide visual diversity and the potential for hardwoods and shrubs to vegetate these areas. In the rest of the area, the effects would be similar to Alternative B.

Cumulative Effects

Understanding past, present, and reasonably foreseeable actions, is necessary in order to evaluate potential cumulative effects of the various alternatives. The boundary on the ground for analyzing cumulative effects is primarily that of the project area. This identified area is the landscape that is primarily evident in the foreground and middleground from the main travel routes (Sensitivity Level 1 and 2 corridors) – approximately 30% of the project area.

The time boundary for this analysis extends from 1980 to 2017, including known management activities and activities that are planned but have yet to be accomplished. Fire suppression over the past century has played a role in the increased density of the vegetation on the forest. Likewise, much of the Forest was non-commercially thinned by the Civilian Conservation Corp in the 1930s and 1940s, however we do not know if that

effort included any or all of this project area. During the period from 1980 to 2010, commercial harvests and non-commercial thinning has taken place on approximately 50% of the project area (see Appendix C). Of the commercial treatments, approximately 98% were Shelterwood cuts, and the remaining were Sanitation and/or Salvage cuts. These treatments resulted in a more open vegetated forest, allowing viewers to see into the forest – this open condition is similar to the ecological condition that resulted from natural-occurring fire in this ecosystem. The areas where these treatments occurred are evident locally, but do not stand out at the landscape scale, due to the limited viewing opportunities caused by the rolling terrain.

Under the action alternatives, trees of all sizes would be removed. The resulting appearance of vegetation treatments would change little for the first ten years after the treatments are completed. Any treatments would result in fewer trees across the landscape - reducing risk of mountain pine beetle infestation and fire risk. However, after ten years time, the understory in commercial treatments would start to be more evident in the landscape and the vegetation would have a less managed appearance.

The remaining commercial and non-commercial treatments, which are mostly viewed in Foreground and Middleground distance zones, should produce a natural appearing forest – but one that has fewer trees – as if fire had continued to play its natural role all along. As long as the beetle pockets, and the corresponding treatment, stay small and scattered, and the beetle activity can be reduced (as a product of these treatments), a less dense (but) forested landscape may be maintained across the landscape where large trees would be highly evident. Existing roads and other activities that change the natural contours may be more evident with the removal/thinning of the vegetation on the landscape. A forested backdrop to private land could be maintained with a Moderate level of Scenic Integrity being maintained in the project area.

RECREATION USE

Affected Environment

Recreation within Pactola Project area is primarily dispersed recreation with a concentrated public use area and reservoir on the far eastern project boundary providing a variety of developed activities.

The Pactola concentrated public use area (CPUA) contains two campgrounds (96 sites), two public boat launches, two picnic grounds, one swim beach, one accessible developed trail, three hiking trails, one visitor center, and one boat marina. In addition, a blue ribbon trout fishery, located below the Pactola dam, provides concentrated dispersed recreational opportunities, as well. There are also 11 individual summer homes located within Pactola Basin, at the inlet adjacent to Silver City, and near the south boat marina area.

The project area hosts a large number of local users in pursuit of both motorized and non-motorized trail opportunities. The Deerfield Trail (40), Centennial Trail (89), and Osprey Trail

(58) are located in the project area. Mountain bike riders, hikers, and horseback riders access these trails at four trailheads around Pactola Reservoir, mainly during the summer season.

Other dispersed recreational activities include big game hunting, fishing, and wildlife viewing. Authorized under special use permits, commercial use by outfitters and guides occur within the project area. Two permitted outfitters operate in the Pactola Project area offering mountain bike tours and kayak services. One permitted hunting and one permitted fishing outfitter operate west of Pactola Reservoir. Also, within the project area, recreation events such as the Silver City Annual Volksmarch occur under authorized special use permits as well.

Motorized recreation within the project area consists of All Terrain Vehicle (ATV) and Off Highway Vehicle (OHV) riding, motorcycle riding, jeep riding, and other vehicle driving on all levels of Forest System Roads. Motorized use is limited to designated roads and trails within the project area (USDA Forest Service, 2010).

Camping within the Pactola CPUA is allowed only in developed campgrounds. Dispersed camping is allowed in the rest of the project area, within 300 feet of a road or motorized trail.

Recreation in the project area is managed to allow moderate to high contact with other groups and individuals.

Environmental Consequences

Alternative A – No Action

Direct and Indirect Effects
Both dispersed and developed recreation users would benefit in the short term as there would not be any noise or dust or closures due to the logging activity. In the long run, the health of the forest would decrease as the area becomes more susceptible to insects, disease, and large-scale wildfire.

Alternatives B and C

Direct and Indirect Effects
Both Alternatives B and C propose vegetative treatments that would open up the forest and increase wildlife habitat (deer, turkey), meadows, and fuel breaks near developed recreation sites.

These treatments would increase wildlife habitat and meadows, thus increasing the opportunity for recreationists to view and observe deer and other wildlife. The proposed treatments would also open up the forest and enhance scenic viewsheds. Treatments around the Pactola CPUA would reduce MPB and wildfire hazard and improve safety conditions for recreationists. In Alternative C, 400 additional acres would be treated along roadways, as well as, additional acres of cable and helicopter logging. Roadside treatments would make travel within the forest safer by day lighting the road.

Recreation users in both the dispersed and developed portions of the project area are most affected by the visuals of tree removal which include skid trails, less screening, slash on the ground, slash piles, and piles of logs during and after project implementation. Recreationists perceive a healthy forest as a lot of trees and/or other vegetation in a "natural" looking environment (USDA Forest Service. 2009f). As the forest ground cover regenerates, the recreational users' visual experience would increase.

Recreationists would be displaced during project implementation, as some roads and motorized trails could be temporarily closed during logging operations for safety reasons and concerns.

Removing MPB infested trees adjacent to and west of the Pactola CPUA would help slow the spread of the MPB infestation, thus preserving scenic integrity.

Cumulative Effects
General maintenance and site specific hazard tree removal would continue to occur on developed recreation sites within the project area. This includes, but is not limited to: re-sanding beaches, painting and/or replacing signs, repairing picnic tables, etc.

LANDS and SPECIAL USES

Affected Environment

In 1862, Congress passed the Homestead Act that authorized the Federal Government to sell federal lands to settlers and/or land company speculators. The passage of the U.S. Mining Laws Act in May 1872 assisted the progress of miners and settlers to the west. Passage of the Organic Administration Act of 1897 established many Forest Reserves in the west.

The Pactola Project Area has several areas that have been administratively withdrawn for power lines, highway uses, mineral entry, reclamation, administrative site, and recreation. The purpose of a withdrawal is to withhold National Forest System land from operation of the mining laws and other public land laws, to either reserve the area for some future use or to maintain other public values of the area.

Of the more than 1.5 million acres within the Black Hills National Forest boundary, approximately 289,000 acres are in private, state, or other federal ownership. This creates a complex landownership pattern. This ownership pattern has provided a need for the Forest Service to acquire easements and to grant rights-of-ways to individuals, and local and state agencies.

The Pactola Project Area pattern of land ownership is typical for the Black Hills National Forest. That is, parcels of private property that are surrounded by the National Forest System lands. Also, typical of land ownership patterns in the Black Hills is the move towards subdividing the more historic working ranches into rural residential home sites and other developments. The project area contains approximately 30 miles of distribution and transmission overhead power utility lines under special use permits to Black Hills Power, Black Hills Electric Cooperative, Qwest, and Black Hills Fiber Com.

Most of the roads within and adjacent to the Pactola Project Area are utilized throughout the year to access special use permitted areas, such as utility lines right-of-ways, recreation residences, public water systems, electronic tower installations, subdivisions and private property. The existing road system provides excellent opportunities to adequately disperse the number of individuals engaged in recreational activities within the project area.

Within the project area, the Black Hills National Forest has completed one small tracts case involving the Silver City VFD.

There are a number of private road easements and public road easements that have been granted in the project area for access across the NFS lands, and easements that the Forest Service acquired to cross private land. There are also Special Use Permits and other authorizations issued for utility and water lines, outfitting and guiding permits and other uses of NFS lands within the project area. The project file contains information related to these easements and other special uses.

Environmental Consequences

All Alternatives

Direct, Indirect, and Cumulative Effects
All alternatives would continue existing easements and special use permits. The project area would continue to be maintained, used, and managed for: utility corridors, private land in holdings, subdivisions, land survey monuments/corners, FLPMA Private Road Easements, Forest Road Special Use Permits, National Forest System Roads, FRTA public easements, and special use permit areas.

FLPMA private road easement would continue to be granted to landowners and/or landowner associations that need access to private property. FRTA easement would also continue to be granted to Pennington County Highway Department for subdivisions, and County maintained roads. All identified Lands/Special Use Permit request would be completed under all alternatives.

Additional access roads may need to be constructed and/or reconstructed to provide access to overhead and underground utility lines to private property. Acquisition of easements by the Forest Service from individuals for access across their private property to reach NFS lands would continue, as well.

Road system changes would have potential adverse effects if access to permitted areas, facilities and private property is not accommodated. Certain access roads, private road easements, and public road easements must be provided for maintenance and management activities. Unclassified roads that are currently being used for private road easements, need to remain unclassified and maintained by the easement holder. If these roads are changed to system roads there would be increased road maintenance costs and increased time needed to convert private road easements to public road easements.

New construction of houses and subdivisions is anticipated. This would result in new requests for road access and utility access routes across the NFS lands. Regardless of which alternative is selected the Forest Service would continue to respond to requests for legal access and utility lines to private property would address each request on its own merits under existing land and policy direction.

There would be negligible direct, indirect, or cumulative effects to the lands or special use programs.

HERITAGE

Affected Environment

The central Black Hills contain a wide variety and number of cultural resources. Prehistoric period resources include habitation sites, hunting camps, stone quarries, and rock shelters. Historic period resources represent economic activities related to ranching, timber, and mining; occupation activities related to homesteading; infrastructure development related to water resources, transportation, and fire control; and recreational activities. Traditional cultural properties, which may fall under either time period, can include Native American individual or single family use prayer sites, current use Sundance locations, annual ceremonial sites such as Harney Peak, and locations associated with tribal origin and oral history such as Buffalo Gap and Wind Cave.

The Black Hills are part of the greater culture area of the Northwestern Plains (Rom et. al. 1996; Sundstrom 1989).

The rugged central Black Hills prehistory is mainly represented by summer and fall camps that exhibit habitation and hunting related activities. Time periods represented include the Middle Archaic, Late Archaic, and Late Prehistoric (Rom, et. al. 1996:2c.8-9). Other site types include short term camps associated with specific resource procurement, such as stone quarry sites (Rom, et. al. 1996:2c.9). Among the many sites discovered in the Pactola Project Area are a prehistoric lithic scatter, time period unknown, and a Middle Archaic isolated projectile point. However, the majority of the sites in the project area are associated with the Historic period. Site types include mining, Civilian Conservation Corps construction projects, railroad and stage lines, and recreation sites.

Between 1992 and 2007 archaeologists conducted a total of 25 cultural resource surveys on approximately 11,059 acres on NFS lands within the Pactola Project Area. A total of 13,804 additional acres were identified for survey on NFS lands to complete the coverage for this project. This last survey, as amended, was completed by Mystic Ranger District heritage staff between May 2008 and February 2011 (Boen, et. al. 2011; Harper 2010). All 26 surveys cover the entire 24,863 acres of NFS lands within the Pactola Project Area.

A total of 146 cultural resources were recorded on 24,863 acres of NFS lands in the Pactola Project Area between 1992 and 2009. Of this total, 120 were determined to be

Not Eligible and 26 were determined to be Eligible or were Unevaluated for listing on the National Register of Historic Places (NRHP).

No Traditional Cultural Properties are currently known to be present within the project area.

Eligible and Unevaluated cultural resources would be protected by following the compliance process mandated by Section 106 of the NHPA and recommendations outlined in the cultural resource reports. The regulations governing Section 106 review are contained in 36 CFR Part 800, which describes the compliance process.

All Eligible and Unevaluated sites would be protected by avoidance or other site-specific mitigations identified by the district archaeologist (see Appendix B).

Environmental Consequences

Heritage resource effects were assessed through a presence/absence determination of significant cultural resources and mitigation measures/design criteria to be employed during commercial thinning, prescribed fire (broadcast burning), fuel break construction and/or fuel reduction activities, road construction, and non-commercial thinning.

Alternative A – No Action

Direct and Indirect Effects

If there is no federal action, then there is no undertaking as defined in 36 CFR Part 800.16(y), for Section 106 of the National Historic Preservation Act (16 U.S.C. 470f) (NHPA). However, no action could result in the destruction or damage to cultural resources due to increased fuel loading and tree mortality from MPB. Twenty-six cultural resources in the Pactola Project Area are Eligible or Unevaluated for listing on the NRHP. Several of these cultural resources have wood-frame or log architectural features and surface artifacts.

The risk of damage to wood-frame or log architectural features and surface artifacts would increase as MPB trees die and fall on or in the vicinity of these cultural resources. The increased number of dead trees on and near cultural resources would increase the fuel load in these areas. The potential for wildfires would increase with higher fuel loads over time. This would create a high risk to flammable architectural features and surface artifacts. Wildfires, as seen in many areas of the Black Hills, could completely destroy these vulnerable cultural resources or permanently damage them.

Fighting wildfires creates another set of threats to cultural resources. These threats could include damage from tree felling, creating fuel breaks and access roads, and establishing fire camps to fight the wildfire. Erosion following the loss of protective vegetation could cause increased runoff across prehistoric sites, potentially damaging the context of artifacts and features. Wildfire could also expose sites to vandalism and unauthorized collecting due to the increased visibility.

Wildfire could also permanently destroy or damage glass, ceramic, stone, metal, cloth, and paper surface artifacts. Data loss would occur as a result. For example, a bottle with a temporally diagnostic marker's mark on the base could be completely melted and unrecognizable (Jackson 1998:17) or intact paper labels destroyed. Stone tools could heat rapidly and shatter or change color, affecting identification. Wildfire could also make identification of unintentional heat treatment versus intentional prehistoric heat treatment of stone materials virtually impossible. Again, this would lead to the permanent loss of data.

Appropriately managed fuel loads, using low intensity controlled burns, presents a considerably lower level threat to a cultural site than high intensity, uncontrolled wildfire (Jackson 1988:18).

Cumulative Effects
Archaeological resources are non-renewable. The cumulative effects of taking no action to reduce the threat of the MPB and reduce fuel loads is that more cultural resources would be destroyed or permanently damaged by falling trees and wildfires. Over time, fewer archaeological resources would be available to learn about past human lifeways.

Under Alternative A, the Pactola Project Area could ultimately lose its essential character with respect to prehistoric and historic use of the central Black Hills. The loss of these cultural areas could not be replaced by reclamation of any type.

Alternatives B and C

Direct and Indirect Effects
Under Alternatives B and C, there would be No Adverse Effect to any of the 26 Eligible or Unevaluated cultural resources if the design criteria and mitigation measures are implemented and followed (see Appendix B).

Cumulative Effects
Past, present, and reasonably foreseeable actions within the Pactola Project Area include mineral exploration and extraction, watershed control and development, timber harvest, road construction, prescribed fire, community growth, and recreation and associated improvements. All of these activities may have cumulative effects on cultural resources such as erosion, ground surface disturbance, increased visitor use and traffic, and vandalism. Although difficult to quantify, impacts could be avoided or minimized by implementing site-specific mitigation measures and design criteria developed in consultation with the SD SHPO and the Advisory Council on Historic Preservation.

Subsurface cultural resources are potentially present, but may not yet be identified in the Pactola Project Area. If previously unidentified cultural resources are discovered during project activities, all operations must cease within a 100 meter radius of the site location and a district archaeologist notified immediately. Any cultural resources located during project implementation would be protected based on the recommendations of the district archaeologist and the SD SHPO. All sites would be evaluated under the terms specified in 36 CFR Parts 60.4 and 800 and applicable Forest guidelines (FP Guidelines 4102, 6101, and 6106).

Consultation

The Heritage Resource Reports were sent to the South Dakota State Historic Preservation Officer (SD SHPO) for Review and Compliance for comment and eligibility determination for the heritage resources located within the project area. The SHPO letter dated June 4, 2010 has concurred with the determination of "No Historic Properties Affected." Likewise the reports were also sent to Tribal Historic Preservation Officers and tribal groups requesting the reports, for their review and comment, and additional recommendations for the protection of American Indian traditional use sites. Follow-up contact was made with the Tribal representatives, either no additional information was received or there were no concerns on the environmental document. In similar analysis, tribal representatives recommended landscape treatments that were implemented to enhance areas for tribal use. Concurrence for several additional sites involving roadside or mechanical treatments needs to be reviewed by the SD SHPO.

SOCIAL

Affected Environment

The Pactola Project Area lies in both Pennington and Lawrence Counties of South Dakota about 10 miles west of Rapid City, the regional trade center and second largest city in South Dakota. The project area encompasses the 'at risk' community of Silver City, 1,154 acres of private lands, subdivisions, businesses, and a major recreational complex. Forest resources play an important role for the people living in and adjacent to the project area. The project area provides great scenery and abundant dispersed recreation in a setting that is close to town, or for some, right out their back door.

The project area also encompasses the Pactola concentrated public use area (CPUA), which provides aquatic recreation opportunities such as fishing, motor boating, canoeing, etc. The Pactola CPUA contains two campgrounds (96 sites), two public boat launches, two day use picnic grounds, one designated swim beach, one developed trail, three hiking trails, a visitor center, and a boat marina. A blue ribbon trout fishery is located below the Pactola Lake dam and provides additional concentrated dispersed recreational opportunities.

Demographics

The examination of population trends is important to the understanding of the overall nature of an area. The use and occupation of the Black Hills is increasing due to population growth and a fairly diverse and flexible economy. Subdivisions and home construction building permits on private lands within and adjacent to the project area have increased steadily and demands for public access roads and utility lines across the project area will continue to exert additional pressure on the Forest. The average household size within the project area is between 2.35 and 2.62 persons. There are an estimated 60 housing units in the Silver City Community. Estimated housing units within the entire project area is approximately 300 (Census 2000).

Wildland-Urban Interface
Most of the Pactola Project Area within Pennington County and Lawrence County is categorized as wildland urban interface (PCCWPP)(LCCWPP).

Individuals that chose to live within the WUI or secluded areas are lured by solitude and the opportunity of being close to nature. Problems brought about by the influx of people are not just wildfire-related. Development of subdivisions and private lands within the project area are complete with forest insect/disease outbreaks, vegetation management, and urban forestry concerns. Many new residents moving to the area carry expectations of urban services with them. Residents with tenure have a strong tradition of multiple-use of resources and expect a balance of goods and services from these resources. Wherever there are people living in or adjacent to wildland areas there is a concern about the threat of wildfire.

Communities by nature of their location, play a key role in mitigating wildfire hazard. The resources, authorities and people share in the responsibility with adjacent landowners and managers, for developing healthy and disaster resilient communities. Without significant action by communities to mitigate hazards (i.e. homes, yards and private forested lands that are highly ignitable), there will be continued high probability for catastrophic wildfire in the wildland urban interface in spite of actions on Federal lands.

These same communities are also concerned with the mountain pine beetle epidemic that is currently expanding within and adjacent to the project area. As trees are killed, they fall to the ground adding dead, dry fuels within an area already rated as having high wildfire hazard. These dead falling trees also have the potential to damage fences, structures, power lines, and block access.

Lifestyles
Although population growth is bringing in more people with new and different ideas, there is little evidence that attitudes or lifestyles are changing in a major way. The beauty of the area brings in new residents and those with tenure are tied to the way the Forest is already managed, either by employment such as the logging/ranching industries or people are outdoor-oriented and have developed varied and specific outdoor user expectations (hunting, fishing, biking, off-road use and tourist based activities). Some residents in the area consider the forest resources and forest health as an important part of their quality of life. Visitors, both local and non-local use the area for a wide range of dispersed recreation activities including, hunting, fishing, boating, camping, wildlife viewing, and off-road vehicle use.

Human Health and Safety
Public safety is more often affected by the choices people make on their own while visiting the project area, or by the consequences of natural events, like wildfires, flooding or wind and hail storms. Despite being in close proximity to Rapid City and Hill City, the project area is rural forested and in places semi-remote. Hazards exist in the form of natural and human-caused conditions. Wild animals, insects, like ticks which may carry lime disease, are present. Weather-related events can be life threatening, and probability of a wildfire is a risk every month the year. Most human activities in the Forest, including hunting, hiking, mountain biking, boating, and driving a vehicle, carry some inherent risk.

Vegetative treatments that reduce the existing MBP epidemic and potential of a large scale wildfire from occurring also help to protect human health and safety. Fuel treatment areas are marked and signed to make travelers aware of individuals and actions associated with the activity. Smoke from prescribed broadcast burning and wildfire could be a nuisance and may pose a threat to human health and safety.

Currently, there is an extensive road system throughout most of the project area for fire suppression. A main concern is the ability of the Forest Service and local volunteer fire departments to have access and that important arterial and access roads are not closed in order to suppress most fires while they are still small in size (see Fire/Fuels Report discussion on access).

Environmental Consequences

Alternative A – No Action

Direct and Indirect Effects

Under this alternative there would be no reduction to current insect or fire/fuels hazards or changes to roads/access relative to implementing any proposed actions in the Pactola Project.

The mountain pine beetle epidemic is expanding within and adjacent to the Pactola Project Area. This epidemic is killing large numbers of mature pine trees. This epidemic is changing vegetation structure and wildlife habitat on a landscape scale. As trees are killed they fall to the ground adding dead, dry fuels within an area already rated as having high wildfire hazard. The mountain pine beetle is at epidemic levels across parts of this area right now and is going to continue to increase across the entire project area over the next few years (USDA Forest Service, 2010d).

A great deal of attention has also been focused on the increasing size and severity of wildfires occurring on forested lands, particularly pine forests of the west. Recent wildfires on the Black Hills National Forest have demonstrated that these fires are larger, hotter and more lethal to vegetation and soils than historic fires in ponderosa pine ecosystems. Additionally, these wildfires are more dangerous or damaging to human settlements, property, and values because of settlement patterns of humans within these environments.

A large, uncontrolled fire could threaten the numerous subdivisions and homes previously described within the surrounding wildland-urban interface. These homes may have dense and continuous vegetation surrounding them, inadequate space between flammable fuels, lack of fire-resistant landscaping, and woodpiles or other flammable debris near structures. Although not noted for loss of life in the Black Hills to date, fires in the wildland/urban interface are responsible for extremely large property losses (Alabaugh Canyon Fire, 2007 included one human fatality, 33 homes lost, and a burn over of firefighters).

If a large scale wildfire were to happen, aesthetics, privacy, and economic property values in the burned area would likely be considerably diminished in the short-term. Also, highways and roads, transmission lines, and municipal watersheds values could be affected by large-scale wildfires. As vegetation grows back and burned dead timber falls and deteriorates, the long-

term (beyond 10-15 years) effects of the wildfire on property values would be lessened. Sense of loss of amenities and property values gradually fades. People become accustomed over time to changes in scenery and other impacts like loss or damage to structures. Large amounts of smoke could affect the city of Rapid City and surrounding communities during a fire event. Smoke from such a wildfire would present health problems to elderly and persons with respiratory problems (see Fire and Fuels section).

There would be no effect to access and travel beyond current impacts, as management activities would not change. The Black Hills National Forest issued a forest-wide Travel Management Plan (USDA Forest Service, 2010) designating routes for motorized use (see Transportation and Travel Management sections).

Alternatives B and C

Direct and Indirect Effects
Under alternatives B and C, forest vegetation would be treated on a broad landscape scale to reduce the rapidly expanding MPB epidemic and fire and fuel hazards within the Pactola Project Area.

Prescribed broadcast burning (5,037 acres) would occur under both Alternatives B and C. The potential social effects from prescribed broadcast burning and pile burning include the risk of fire escape, smoke impacts to health and safety, and associated costs. These risks are minimized by design criteria such as construction of fire lines, the use of suppression engines and crews, and adherence to prescribed burn plans.

The reduced MPB risk and fire hazard in the treatment areas and the completion of fuel breaks along private lands would reduce the potential for large scale wildfire and would increase the likelihood that firefighters would be suppressing, from defensible positions, low to moderate intensity fires that may threaten private property, at-risk communities and forest resources versus a high intensity one.

The Black Hills National Forest issued a forest-wide Travel Management Plan (USDA, Forest Service, 2010) designating routes for motorized use (see Transportation and Travel Management sections).

Cumulative Effects
The population will continue to grow in the future. The majority of this growth is expected on private lands in and near the forested areas located outside, but near established towns and communities.

Fuel treatments that reduce the potential for large-scale wildfire occurrence helps to protect human health and safety. Since no vegetative treatments or prescribed broadcast burns occur with Alternative A, this alternative would be the least effective in protecting human health and safety. In fact, the potential for a serious incident would increase with increased fuel loadings and fire behavior under the No Action Alternative. Both Alternatives B and C reduce insect and fire hazards in the short-term. Alternative B would provide slightly fewer benefits in the long-term to protecting human health, well-being, and safety than Alternative C (see Fire and Fuels, and Vegetation sections).

Environmental Justice

Executive Order 12898 (February 11, 1994) directs Federal agencies to focus attention on the human health and environmental conditions in minority communities and low-income communities. The purpose of the Executive Order is to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects on minority populations and low-income populations.

None of the communities in the project area contain low-income or minority populations as defined by Executive Order 12898. During the course of this analysis, no alternative resulted in any identifiable effects or issues specific to any minority or low-income population or community. The agency has considered all input from persons or groups regardless of age, race, income status, or other social and economic characteristics.

Civil Rights

No civil rights effects associated with age, race, creed, color, national origin, or sex have been identified.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. Irretrievable commitments are those that are lost for a period of time such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line rights-of-way or road. For further discussion of the effects on the resources listed below, see Chapter 3 under the respective resource topics.

There are no **irreversible commitments** of resources with any of the alternatives analyzed.

Irretrievable commitments of resources include the following:

Soil productivity and **timber productivity** is lost where road construction is planned in Alternative B and C (about 3 and 19 miles).

Air quality is temporarily impacted (lost) to varying degrees by smoke generated from prescribed burning and dust from road use resulting from implementation of the action alternatives.

Wildlife habitat loss or modification for certain wildlife species is likely under the action alternatives. As vegetation recovers, habitat would eventually return over various periods of time depending on the amount of vegetation treatment and/or disturbance.

Noxious and invasive weeds resulting from alternative implementation could potentially have an irretrievable commitment of resources if allowed to persist. Infestation can impact native plan communities that lead to losses in wildlife habitat, soil productivity, soil erosion, forage for grazing, and vegetative diversity.

Scenic conditions will be modified to varying degrees depending on the action alternative implemented.

SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

NEPA requires consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). For further discussion of the effects on the resources listed below, see Chapter 3 under the respective resource topics.

Actions under Alternatives B and C are implemented using design measures that protect soil productivity. Any decrease in long-term soil productivity resulting from actions will be negligible.

As provided for by the Forest Plan, minimum management requirements guide implementation of the action alternatives. Adherence to these requirements ensures that long-term productivity of the land is not impaired by short-term uses. Monitoring specified in this EIS and the Forest Plan validates that the management requirements and mitigation are effective in protecting long-term productivity.

UNAVOIDABLE ADVERSE EFFECTS

The following is a description of adverse effects that are unavoidable with implementation of action alternatives. For further discussion of the effects on the resources listed below, see Chapter 3 under the respective resource topics.

Forest Insect and Disease will continue in the project area, at epidemic levels, in some areas and endemic levels in others.

Wildlife habitat for certain species will be adversely affected to varying levels with implementation of the action alternatives. The Wildlife section of this EIS discloses those effects.

Air quality will be adversely affected on a temporary/seasonal basis as a result of planned prescribed burning and dust from roads and activities.

Scenic quality will be affected adversely for some observers by the various levels of vegetation treatment and other actions planned.

Fire/Fuels hazard will be increased during the short-term in some areas as a result of slash created from vegetation treatment. With disposal treatment this hazard will be reduced. There exists a higher long-term potential for large-scale wildfire under Alternative A versus the action alternatives.

Soils can be eroded wherever vegetation and soils are disturbed. Compaction can occur where vehicles and equipment are used.

Heritage resources can be disturbed or destroyed where human or natural activities take place.

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CHAPTER 5 GLOSSARY

Access The opportunity to approach, enter and make use of public or private lands.

Activity Fuels Fuels resulting from or altered by forestry practices, such as timber harvest or thinning, as opposed to naturally created fuels.

Adaptive Management Implementing policy decisions as science-driven management experiments that test assumptions and predictions in management plans.

Age Class Groups of trees or shrubs approximately the same age.

Air Quality Classes Classification established under the "Prevention of Significant Deterioration" portion of the Clean Air Act, which limits the amount of air pollution considered significant within an area. Class I applies to areas where almost any change in air quality would be significant; Class II applies to areas where the deterioration normally accompanying moderate, well-controlled growth would be permitted; Class III applies to areas where industrial deterioration would generally be allowed.

Appropriate Suppression Response (Fire Management) The planned strategy for suppression action (in terms of type, amount, and timing) on a wildfire that most efficiently meets the Forest Plan fire-management direction under current and expected burning conditions. The planned response can range from prompt control to one of containment or confinement.

Confine: To limit the spread of wildfire within a predetermined area principally by use of natural or pre-constructed barriers or environmental conditions. Suppression action may be minimal and limited to surveillance under appropriate conditions.

Control: To complete the control line around a fire, any spot fire there-from, and any interior unburned areas to be saved; to burn any unburned fuel or areas adjacent to the fire side of the control line and to cool all hot spots that are immediate threats to the control line until the control line can reasonably be expected to hold under foreseeable conditions.

Contain: To surround a fire and any spot fires there-from with a control line, as needed, which can reasonably be expected to check the fire's spread under prevailing conditions.

Aquatic Ecosystem The stream channel, lake or estuary bed, water, biotic communities, and the habitat features that occur within an ecosystem (biological and physical components and their interactions) in which water is the principal medium. Examples include wetlands, streams, reservoirs, and areas with plants or animals characteristic of either permanent or seasonal inundated soils.

Area of Potential Effects The geographic area or areas within which an undertaking may cause changes in the character or use of historic properties, if any such properties exist.

Artificial Regeneration The renewal of a tree crop by seeding or planting.

At-Risk Community An area (A) that is comprised of —(i) an interface community as defined in the notice entitled “Wildland Urban Interface Communities Within the Vicinity of Federal Lands That Are At High Risk From Wildfire” issued by the Secretary of Agriculture and the Secretary of the Interior in accordance with Title IV of the Department of the Interior and Related Agencies Appropriations Act, 2001 (114 Stat. 1009) (updated 66 Fed. Reg. 43384, August 17, 2001); or (ii) a group of homes and other structures with basic infrastructure and services (such as utilities and collectively maintained transportation routes) within or adjacent to Federal land; (B) in which conditions are conducive to a large-scale wildland fire disturbance

event; and (C) for which a significant threat to human life or property exists as a result of a wildland fire disturbance event."

Basal Area (Timber Resource) The cross-sectional area of a stand of trees measured at breast height. The area is expressed in square feet per acre.

Best Management Practices (BMPs) Land management methods, measures, or practices intended to minimize or reduce water pollution. Usually BMPs are applied as a system of practices rather than a single practice. BMPs are selected on the basis of site-specific conditions that reflect natural background conditions and political, social, economic, and technical feasibility.

Big Game Certain wildlife that may be hunted for sport under state laws and regulations. In the Black Hills, these animals include deer, elk, turkey, mountain goats, and bighorn sheep.

Biological Control Methods Use of natural organisms such as insects, diseases, parasites, and predators to reduce pest populations of insects, diseases, or weeds. Methods may include importation and release; conservation of native natural-enemy species; and augmentation (supplementation through rearing and release or genetic improvement) of biological control agents.

Biological Diversity The full variety of life in an area including the ecosystems, plant, and animal communities; species and genes; and the processes through which individual organisms interact with one another and with their environments.

Biological Evaluations As defined by FSM 2670.5, a biological evaluation is a documented Forest Service review of Forest Service programs or activities in sufficient detail to determine how an action or proposed action may affect any threatened, endangered, proposed, or sensitive species. FSM 2672.4 identifies biological evaluation objectives and standards.

BMPs (See "Best Management Practices.")

Board Foot A unit of timber measurement equaling the amount of wood contained in a board one-inch thick, 12-inches long, and 12-inches wide.

Broadcast Burning A fire ignited under specific conditions (prescriptions) and within established boundaries to achieve some land-management objective.

BTU British thermal unit. The quantity of heat required to raise the temperature of one pound of water by one degree Fahrenheit at or near its maximum density.

Burning Index A relative number related to the contribution that fire behavior makes to the amount of effort needed to contain a fire in a specified fuel type. Doubling the burning index indicates that twice the effort will be required to contain a fire in a specified fuel type, providing all other parameters are held constant.

Canopy, Canopy Closure (Canopy Cover), Canopy Layer (Silviculture)

> **Canopy**: The cover by vegetation and/or branches. Often but not always restricted to the tree layer or greater than six feet tall.
>
> **Canopy Closure/Cover**: The percentage of the ground and/or sky covered by vegetation and/or branches. These are perceived from a human point of view perpendicular to flat ground.
>
> **Canopy Layer**: Cover by vegetation and branches in different height intervals. These intervals are often defined in terms of vegetation, such as herbaceous or grass/forbs less than two feet tall, shrubs less than six feet tall, and overstory greater than six feet tall.

Cavity Nesting Species Wildlife species that depend on cavities in trees for their shelter and/or nesting. These species include primary cavity nesters, such as woodpeckers, which excavate

cavities in soft or decayed wood for nesting, and secondary cavity nesters that typically nest in natural cavities or those excavated by another species.

CFR Code of Federal Regulations.

Closed Road An intermittent service road in Maintenance Level 1 that is closed to all vehicular traffic for more than one year. The closure may be ordered under 36 CFR 261.

CMAI (See "Culmination Mean Annual Increment.")

Commercial Thinning (See "Thinning.")

Commercial Timber Sales The selling of timber from National Forest System (NFS) lands for the manufacture of commercial products such as lumber, plywood, etc.

Community (Social) The people who reside in one locality and are subject to the same laws or who have common interests, etc.

Community Life-styles The ways in which residents conduct their everyday routines and how the "way they live" is associated with the National Forest.

Condition Class 2 This term means the condition class description developed by the USDA-Forest Service Rocky Mountain Research Station (RMRS) in the Development of Coarse-Scale Spatial Data for Wildland Fire and Fuel Management (RMRS-GTR-87, http://www.fs.fed.us/rm/pubs/rmrs_gtr87.html), dated April 2000 (including any subsequent revisions), under which

- Fire regimes on the land have been moderately altered from historical ranges;
- A moderate risk exists of losing key ecosystem components from fire;
- Fire frequencies have increased or decreased from historical frequencies by one or more return intervals, resulting in moderate changes to

—The size, frequency, intensity, or severity of fires;

OR

—Landscape patterns

AND

—Vegetation attributes have been moderately altered from their historical ranges.

Condition Class 3 This term means the condition class description developed by the Rocky Mountain Research Station (RMRS) in RMRS-GTR-87 (see above) under which

- Fire regimes on land have been significantly altered from historical ranges;
- A high risk exists of losing key ecosystem components from fire;
- Fire frequencies have departed from historical frequencies by multiple return intervals, resulting in dramatic changes to

—The size, frequency, intensity, or severity of fires;

OR

—Landscape patterns

AND

—Values of vegetation attributes have been significantly altered from their historical ranges.

Confine (Fire Management) (See "Appropriate Suppression Response.")

Conifer A group of cone-bearing trees, mostly evergreen, such as the pine, spruce and juniper.

Conservation The management of a renewable natural resource with the objective of sustaining its productivity in perpetuity while providing for human use compatible with sustainability of the resource; for a forest this may include managed periodic cutting and removal of trees followed by regeneration.

Construction (Roads) The displacement of vegetation, soil, and rock and the installation of human-made structures involved in the process of building a complete, permanent road facility. The activities occur at a location, or corridor, that is not currently occupied by a road.

Contain (Fire Management) (See "Appropriate Suppression Response.")

Continuous Fuel Concentrations (Fire Management) An uninterrupted distribution of fuel particles (surface or aerial) in a fuel bed, which allows a fire to sustain combustion and actively continue to spread.

Control (Fire Management) (See "Appropriate Suppression Response.")

Cord A unit of gross volume measurement for stacked roundwood based on external dimensions; generally implies a stack of 4 feet by 4 feet vertical cross sections 8 feet long (128 stacked cubic feet).

Cost Effective Achieving specified outputs or objectives under given conditions for the least cost.

Cost Efficient A comparative measure of economic efficiency determined by maximizing the present net worth or value of an alternative, subject to meeting the objectives of the alternative.

Council on Environmental Quality (CEQ) An advisory council to the President established by the National Environmental Policy Act NEPA) of 1969.

Cover Type The vegetative species that dominates a site. Cover types are named for one plant species or non-vegetated condition presently (not potentially) dominant, using canopy or foliage cover as the measure of dominance. In several cases, sites with different species dominant have been lumped together into one cover type; co-dominance is not necessarily implied.

Critical Ecosystems Specific areas, including riparian areas, wetlands, winter range, and habitat for threatened and endangered species.

Crown (Vegetation) The upper part of a tree or other woody plant carrying the main branch system and foliage and surmounting at the crown base a more or less clean stem.

Crown Closure (See "Canopy Cover.")

Crown Density The thickness both spatially in depth and in closeness of growth (compaction) of an individual crown, such as its opacity as measured by its shade density.

Crown Height For a standing tree, crown height is the vertical distance from ground level to the base of the crown, measured either to the lowest live branch-whorl or to the lowest live branch, excluding shoots arising spontaneously from buds on the stem of a woody plant or to a point halfway between.

Cubic Foot A unit of measure usually referring to wood volume (1 foot wide by 1 foot long by 1 foot thick).

Culmination Mean Annual Increment (CMAI) The point at which a tree or stand achieves its greatest average growth, based on expected growth, according to the management systems and utilization standards assumed in the Forest Plan.

Cultural Element Attributes in a human-altered landscape; scenically positive cultural elements, most of which have historical backgrounds or nostalgic connotations. Examples include split-rail fences, stone walls, barns, orchards, hedgerows, and cabins.

Cultural Landscapes Human-altered landscapes, especially those with slowly evolving landscapes, scenic vegetation patterns, or scenic structures. Addition of these elements creates a visually pleasing complement to the natural character of a landscape.

Cultural Properties (See "Historic Property.")

Cultural Resources (See "Heritage Resources.")

Cumulative Effects Collective results of past, present, and reasonably foreseeable future actions, regardless of which agency or person undertakes the actions.

Cutover Area Timber stands that have been cut.

DBH (See "Diameter at Breast Height.")

Dead Fuels (Fire Management) Fuels with no living tissue within which moisture content is governed almost entirely by solar radiation.

Dead Woody Material (See "Down Woody Material.")

Decision Documents Documents that provide the criteria and information used in the formulation and evaluation of alternatives and the preferred alternative.

Desired Future Condition, Desired Ecological Condition

> A portrayal of the land or resource conditions that are expected to result if goals and objectives are fully achieved.
>
> A description of the landscape as it could reasonably be expected to appear at the end of the planning period if the Plan's goals, objectives, standards, and guidelines for that landscape are fully achieved.

Desired Landscape Character Appearance of the landscape to be retained or created over time, recognizing that a landscape is a dynamic and constantly changing community of plants and animals. It is a combination of landscape design attributes and opportunities as well as biological opportunities and constraints.

Diameter at Breast Height (DBH) The diameter of a standing tree at a point 4 feet, 6 inches from ground level.

Direct Effects Results of an action occurring when and where that action takes place.

Diversity Diversity refers to the distribution and abundance of different plant and animal communities and species within the area covered by a land and resource management plan (LRMP). This term is derived from the National Forest Management Act (NFMA). This term is not synonymous with "biological diversity."

Down and Dead Woody Material, Down Logs, Down Woody Material (Vegetation) Woody material from any source that is dead and lying on the forest floor.

Draft Environmental Impact Statement (DEIS) The statement of environmental effects required for major federal actions under Section 102 of the National Environmental Policy Act (NEPA) and released to the public and other agencies for comment and review.

Easement A right held by one person to make use of the land of another for a limited purpose, such as a special-use authorization for a right-of-way that conveys a conditioned interest in National Forest System (NFS) land and is compensable according to its terms.

Ecosystem A community of living plants and animals interacting with each other and with their physical environment. A geographic area where it is meaningful to address the interrelationships with human social systems, sources of energy, and the ecological processes that shape change over time. The complex of a community of organisms and its environment functioning as an ecological unit in nature.

Ecosystem Management A concept of natural resources management where-in National Forest activities are considered within the context of economic, ecological, and social interactions within a defined area or region over both short-and long-term.

Egress Path by which a person goes out; exit. The means or act of going out. Often used with the word "access."

EIS (See "Environmental Impact Statement.")

Eligible (Heritage Resources) Indicates a specific heritage resource qualifies for or is already listed in the National Register of Historic Places.

Endangered Species Any species of animal or plant in danger of extinction throughout all or a significant portion of its range and so designated by the Secretary of Interior in accordance with the 1973 Endangered Species Act.

Environmental Impact Statement (EIS) A document prepared by a federal agency in which anticipated environmental effects of a planned course of action or development are evaluated. A federal statute requires that such statements be prepared. It is prepared first in draft or review form and then in a final form. An impact statement includes the following points: the environmental impact of the proposed action; any adverse impacts that cannot be avoided by the action; the alternative courses of actions; the relationships between local short-term use of the human environment and the maintenance and enhancement of long-term productivity; and a description of the irreversible and irretrievable commitment of resources that would occur if the action were accomplished.

Ephemeral Streams A stream or portion of a stream that flows briefly in direct response to precipitation in the immediate vicinity and whose channel is at all times above the water table. Ephemeral areas drain water to intermittent or perennial stream channels. Any sediment created by soil erosion during logging or road-building activities can be carried by way of the ephemeral, intermittent, and perennial stream channels to the watershed outlet. Ephemeral areas generally occur above the upper reaches of intermittent or perennial streams. Since they can direct water into intermittent or perennial stream channels, care should be taken to minimize disturbing soil in these areas.

Erosion The wearing away of the land surface by running water, wind, ice, gravity, or other geological activities.

Erosion Hazard Rating The probability of soil loss resulting from complete removal of vegetation and litter. It is an interpretation based on potential soil loss.

Escape Route (Fire Management) A path of travel to get away from danger, such as the threat of wildfire.

Even-aged Management The application of a combination of actions that results in the creation of stands in which trees of essentially the same age grow together. Managed even-aged forests are characterized by a distribution of stands of varying ages (and therefore, tree sizes) throughout the forest area. The difference in age between trees forming the main canopy level on a stand usually does not exceed 20 percent of the age of the stand at harvest rotation age. Regeneration in a particular stand is obtained during a short period at or near the time of harvest. Clear-cut, shelterwood, or seed-tree cutting methods may produce even-aged stands.

Existing Road System All existing roads owned or administered by various agencies that are wholly or partly within or adjacent to and serving the National Forests and other Forest Service-administered areas or intermingled private lands. These roads may or may not be included on the current Forest Transportation Inventory but are evident on the ground as meeting the definition of a road.

Fire Incidence The average number of fires in a specified area during a specified time period.

Fire Occurrence Number of fires per unit time in a specified area (synonym for fire frequency).

Fire Protection Assessment (FPA) (Fire Management) A computer software based analysis to assist managers in determining where specific types and intensities of fire-management activities should occur. The analysis uses three map overlays depicting fuel flammability (Hazard); potential value change from fire (Value); and the potential that an ignition will occur (Risk) as a means of identifying and prioritizing appropriate fire- management activities for a given land unit.

> **Risk**: A term within the Fire Protection Assessment identifying the potential for an ignition to occur in a given land unit based on historical data associated with frequency of natural ignitions and the probability of human ignitions based on an assessment of human activities.
>
> **Hazard**: A term within the Fire Protection Assessment that represents a function of potential fire line intensity based on fuels, topography, and weather influences.
>
> **Value**: In the context of the Fire Protection Assessment, value refers to the potential for negative value change from wildfire. Value considerations would include the value of developments and natural resources, including aesthetics, all of which are subject to change from wildfire.

Fire Risk The chance of a fire starting, as affected by the nature and incidence of causative agents, including lightning, people, and industry. Three risk scales are used: high, moderate, and low. High-risk areas include locations where lightning, people, or industry have commonly caused fire in the past; moderate-risk areas include locations where lightning, people, or industry have periodically caused fire in the past; and low-risk areas include locations where lightning, people, or industry have infrequently caused fire in the past.

Fire Suppression All the work and activities connected with fire-extinguishing operations beginning with discovery and continuing until the fire is completely extinguished.

Fire Suppression Objective To suppress wildfires at minimum costs consistent with land and resource management objectives and fire-management direction as determined by National Fire Management Analysis System (NFMAS). This includes all work and activities associated with fire-extinguishing operations beginning with discovery and continuing until the fire is completely extinguished. An example might be that a fire suppression objective is set at 5 acres, based on a cost-effectiveness analysis.

Fireline Intensity The rate of heat energy released per unit time per unit length of a fire front. Numerically, it is the product of the heat combustion, quality of fuel consumed per unit area in the fire front, and the rate of spread of a fire as measured in BTUs per second per foot of the fire front.

Firewood (See "Fuelwood.")

Fiscal Year (FY) Within the Forest Service, the fiscal year includes October 1 to September 30. The fiscal year is referred to by the calendar year beginning January 1. For example, October 1, 1991, to September 30, 1992, is referred to as Fiscal Year 1992.

Forage Vegetation used for food by wildlife, particularly ungulate wildlife and domestic livestock.

Forbs Any herbaceous plant other than those in the grass, sedge, and rush families. For example,

any non-grass-like plant that has little or no woody material.

Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA) An Act of Congress requiring the preparation of a program for the management of the National Forest's renewable resources, and of land and resource management plans for units of the National Forest System (NFS). It also requires a continuing inventory of all National Forest System (NFS) lands and renewable resources.

Forest Interior Habitat That portion of the stand not affected by edge is termed interior habitat. The value of forest stands in providing interior habitat depends on the effects of edge on the microclimate of the stand. In the Black Hills, forest interior is defined as that portion of a forest stand more than 300 feet from an opening.

Forest Supervisor Official responsible for administering the Black Hills National Forest. The Forest Supervisor reports to the Regional Forester.

Forest System Roads Roads that are part of the Forest Development Transportation System that includes all existing and planned roads as well as other special and terminal facilities designated as part of the Forest Development Transportation System.

Forested Area Land at least 10 percent of which is occupied by trees of any size or formerly having had such tree cover and not currently developed for non-forest use. Lands developed for non-forest use include areas for crops; improved pastures; residential or administrative areas; improved roads of any width; and adjoining road clearing and powerline clearing of any width.

FSH Forest Service Handbook.

FSM Forest Service Manual.

Fuel Breaks Generally wide strips of land 60 to 1,000 feet in width on which native vegetation has been modified so that fires burning into them can be more readily controlled. Some fuel breaks contain fire lines such as roads or hand lines that can be widened.

Fuel Continuity Degree or extent of continuous or uninterrupted distribution of fuel particles (surface or aerial) in a fuel bed that affects a fire's ability to sustain combustion and spread.

Fuel Loading The volume of the available or burnable fuels in a specified area, usually expressed in tons per acre.

Fuel Reduction Treatments Prescribed burn, non-commercial thin, mechanical fuel treatment, and product other than log (POL) sales.

Fuel Treatment Any manipulation or removal of fuels to reduce the likelihood of ignition and/or to lessen potential damage and resistance to control, including lopping, chipping, crushing, piling, and burning (synonym for fuel modification).

Fuels The organic materials that will support the start and spread of a fire: duff, litter, grass, weeds, forbs, brush, trees, and dead woody materials.

Fuelwood Round, split, or sawed wood cut into short lengths for burning as fuel.

Goal Broad, general statement that encompasses the desired future conditions that the U.S. Forest Service seeks to attain.

Grass/Forb, Grass/Forb Stage (Structural Stage 1) (See Structural Stages - Structural Stage 1)

Green Slash Wood residue left on the ground after logging that still contains moist phloem tissue and wood and may be susceptible to attack by bark beetles, generally within 1 year after cutting.

Guideline Preferred or advisable courses of action; deviations from guidelines are permissible, but the responsible official must document the reasons for the deviation.

Habitat The place where an organism (plant or animal) lives.

Hard Snags (Vegetation) A dead or partially dead tree composed primarily of sound wood, particularly sound sapwood.

Hardwood Pertains to broadleaf trees or shrubs.

Hazard (Fire Management) (See "Fire Protection Assessment.")

Hazard Reduction (See "Fuel Treatment.")

Heavy Fuels Fuels of large diameter, usually 3 inches or more, like snags, logs, large branchwood, and peat that ignite and burn more slowly than fine fuels (synonym for coarse fuels).

Herbaceous Fuels Grasses, forbs, and other plants that contain little woody tissue.

Herbicide A chemical substance used for killing or suppressing plants.

Heritage Resources The physical remains (including but not limited to artifacts, structures, landscape modifications, rock art, trails, or roads) and conceptual content or context (as a setting for legendary, historic, or prehistoric events, such as a sacred area for native peoples) of an area.

High Risk (Fuels) (See "Fire Risk.")

Historic Property Any prehistoric or historic district, site, building, structure, or object included in or eligible for inclusion in the National Register. This term includes artifacts, records, and remains related to and located within such properties.

Human-caused Risk (Fire Management) A number related to the potential of fire starts originating from human activities to which a protection unit will be exposed during the rating period.

IDT (See "Interdisciplinary Team.")

Ignition (Fire Management) The initiation of combustion.

Implementation Those activities necessary to initiate the actions in the approved land and resource management plan (LRMP).

Indirect Effects Results of an action occurring at a location other than where the action takes place and/or later in time but in the reasonably foreseeable future.

Infrastructure The facilities, utilities, and transportation systems needed to meet public and administrative needs.

Ingress The act or right to enter; access; entrance.

Inholdings Lands within the proclaimed boundaries of a National Forest that are owned by some other agency, organization, or individual.

Insect and Disease Epidemics High population levels of insect-or-disease pests that cause substantial injury to plant or animal hosts.

Insect and Disease Suppression Management practices applied to reduce insect-and-disease pest populations or damage. Insect- and-disease suppression includes actions taken to limit the spread of pests or to reduce susceptibility of hosts in imminent danger of being attacked.

Intensity (Fire Management) How hot a fire is. Specifically, a measure (in BTUs per foot per second) of the energy released per unit of time in an area of actively burning fire. The amount of heat released per foot of fire front per second.

Interdisciplinary Team (IDT) A group of individuals with different specialized training assembled to solve a problem or perform a task. The team is assembled out of recognition that no one discipline is sufficiently broad to adequately solve the problem. Through interaction, participants bring different points of view and a broader range of expertise to bear on the problem.

Intermediate Cut (Timber Management) Any removal of trees from a stand between the time of their regeneration and the final harvest.

Intermittent Stream A stream that flows only at certain times of the year, as when it receives water from springs or from a surface source, such as melting snow. A stream that does not flow continuously, as when water losses from evaporation or seepage exceed the available streamflow.

Ips (Pine Engraver Beetle) A genus of bark beetle that feeds beneath the bark of pines, typically killing branches, tops, or entire trees. These beetles often breed in logging slash or attack stressed and injured pines.

Irretrievable, Irretrievable Commitments Applies to losses of production or use of renewable natural resources for a period of time. For example, road construction leads to an irretrievable loss of the productivity of the land under which the road is located. If the road is later obliterated, the land may eventually become productive again. The production lost is irretrievable, but the action is not irreversible.

Irreversible, Irreversible Commitments Decisions causing changes that cannot be reversed. For example, if an area is mined, that area cannot, at a later date, be allocated to some other resource activity, such as Wilderness. Once mined, the ability of that area to meet Wilderness criteria, for instance, has been irreversibly lost. Irreversible commitments often apply to non-renewable resources, such as minerals and heritage resources.

Land Unit (Watershed) A mapped land type polygon; or a mapped soil unit.

Landline (Land Survey) For Forest Plan purposes, National Forest property boundaries.

Landscape (Silviculture) The primary unit of analysis for silviculture. A landscape for purposes of silviculture is a sixth-level watershed.

Landscape Character Particular attributes, qualities, and traits of a landscape that give it an image and make it identifiable or unique. Valued landscape character creates a "sense of place" and describes the image of an area. The landscape character provides a reference for defining the inherent scenic attractiveness classes.

Landscape Scale A heterogeneous land area composed of a cluster of interacting ecosystems that are repeated in similar form throughout. Landscapes vary in size from many thousands of acres to only a few acres.

Late Succession Ecosystems distinguished by old trees and related structural features. This term encompasses the later stages of stand development that typically differ from earlier stages in structure, composition, function, and other attributes.

There are two types of late-successional ponderosa pine defined for the Black Hills. The first type, open-canopy late-successional ponderosa pine, occurs where periodic, low-intensity fires have been part of the ecosystem. These late-successional stands would consist of clumps or groups of trees with grasses in the openings between the clumps. They would contain large old trees with open branches, irregular, and flattened crowns. The clumps or groups of trees would contain little down dead material and few small trees.

The second type, closed-canopy late-successional ponderosa pine occurs where periodic, low-intensity high-frequency fires have not been a significant part of the ecosystem. These stands would contain large old trees with open branches and irregular crowns. The stands would have multiple canopy layers made up of various-aged trees. They would be well stocked with trees and contain standing dead and down trees.

Local Roads (See "Road Functional Classification.")

Logging Debris Unmerchantable tree parts like crowns, rotted logs, and uprooted stumps that remain after harvest.

Logging Slash The wood residue left on the ground after harvesting. It includes unused logs, uprooted stumps, broken or uprooted stems, tops, branches, and leaves.

Lopped, Lopping (Timber Management) Cutting off one or more branches of a tree, whether standing, dead, or fallen.

Lopping and Scattering Lopping logging debris and spreading it more or less evenly on the ground.

Low Risk (Fuels) (See "Fire Risk.")

Maintenance Levels (See "Road Maintenance Level.")

Management Indicators (Wildlife) Plant or animal species or habitat components selected in a 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.

Management Objectives Clearly stated objectives describing the intended post-management status of an area. Typically, objectives are disclosed in the NEPA documentation.

MBF Thousand board feet.

MCF Thousand cubic feet.

Meadow An area of perennial, herbaceous vegetation, usually grass or grass-like. A natural opening in a forest, generally at higher elevations, that produces exceptional levels of herbaceous plants, which is usually a consequence of high soil/water content or a perched water table. Generally, a prairie grassland will occupy a convex surface while a meadow will occupy a concave surface.

Midstory (Vegetation) Vegetative layer 10 to 40 feet tall between the overstory trees and ground layer. May consist of trees and/or shrubs.

Mitigation Includes avoiding the impact altogether by not taking certain action or parts of an action; minimizing impacts by limiting the degree or magnitude of the action and its implementation; rectifying the impacts by repairing, rehabilitating or restoring the affected environment; reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; or compensating for the impact by replacing or providing substitute resources or environments.

MMBF Million board feet.

MMCF Million cubic feet.

Moderate Risk (Fuels) (See "Fire Risk.")

Moisture Regime (Soils) The presence or absence of groundwater or water held at a tension of less than 15 bars in the soil or in specified horizons by periods of the year.

Monitoring The sample collection and analysis of information regarding Forest Plan management practices to determine how well objectives have been met as well as the effects of those management practices on the land and environment.

Multi-storied Stands (Vegetation) Plant communities having two or more recognizable canopy layers or height levels.

Multiple Use According to the Multiple-use Sustained-yield Act of 1960, multiple use is the management of all the various renewable surface resources of the National Forest System (NFS) so that they are utilized in the combination that will best meet the needs of the American people; such management makes the most judicious use of the land for some or all of these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in use to conform to changing needs and conditions. Some lands will be used for less than all of the resources. Harmonious and coordinated management of the various resources is employed, each with the other, without impairment of the productivity of the land. Consideration is given to the relative values of the various resources and not necessarily the combination of uses that will give the greatest dollar return or the greatest unit output.

National Environmental Policy Act of 1969 (NEPA) An act declaring a national policy to encourage productive harmony between people and their environment; to promote efforts that will prevent or eliminate damage to the environment and the biosphere and simulate the health and welfare of people; to enrich the understanding of the ecological systems and natural resources important to the nation; and to establish a Council on Environmental Quality.

National Fire Management Analysis System (NFMAS) A broad umbrella process to help fire managers identify the most efficient fire program meeting the direction in the Forest Plan. This includes information for the planning record on program composition, annual programmed costs, emergency firefighting costs, expected resource impacts, and net value change.

National Forest Management Act (NFMA) A law passed in 1976 amending the Forest and Rangeland Renewable Resources Planning Act that requires the preparation of Regional and Forest Plans and the preparation of regulations to guide that development.

National Forest System (NFS) Land Federal lands designated by Executive Order or statute as National Forests, National Grasslands or Purchase Units, or other lands under the administration of the Forest Service.

National Register of Historic Places (NRHP) A list of heritage resources that have local, state, or national significance. The list is maintained by the Secretary of the Interior.

Natural Fuels Fuels resulting from natural processes and not directly generated or altered by land-management practices (compare activity fuels).

Natural Regeneration The renewal of a tree crop by natural means without seeding or planting done by people. The new crop is grown from self-sown seed or by vegetative means, such as root suckers.

Net Public Benefit The overall long-term value to the nation of all outputs and positive effects (benefits) less all associated inputs and negative effects (costs) whether they can be quantitatively valued or not. Net public benefits are measured by both quantitative and qualitative criteria rather than a single measure or index.

Non-motorized Activities Activities that do not incorporate the use of a motor, engine, or other non-living power source. Non-motorized activities exclude such machines as aircraft, hovercraft, motorboats, automobiles, motor bikes, snowmobiles, bulldozers, chainsaws, rock drills, and generators.

Noxious Weeds Those plant species designated as weeds by federal or state laws. Noxious weeds generally possess one or more of the following characteristics: aggressive and difficult to manage; poisonous; toxic; parasitic; a carrier or host for serious insects or diseases; and generally non-native.

Objective Concise statement of desired measurable results intended to promote achievement of specific goals. Attainment of objectives is limited by the application of standards and guidelines.

Obliteration (Transportation) The reclamation and/or restoration of the land occupied by a transportation facility for purposes other than transportation.

Off-Highway Vehicle (OHV) Any motorized vehicle designed for or capable of cross-country travel on or immediately over land, water, snow, ice, marsh, swampland, or other natural terrain.

Openings (Tree Canopy) The hole created by removing the majority of the tree canopy. This includes the harvesting of the majority of trees in a given area.

Overstory (Biological Diversity) The portion of vegetation in a forest forming the uppermost foliage layer.

Pine Engraver Beetle (See "Ips.")

Piling and Burning (Timber Management) Piling slash resulting from logging and subsequently burning individual piles.

Plant Associations A grouping of plants that has reached dynamic equilibrium with the local environmental conditions and is equivalent to climax. On site, there is no evidence of replacement by other dominant plant species (and there is no evidence of serious disturbance.)

Plant Communities Assemblage of plant species living in an area. It is an organized unit to the extent that it has characteristics in addition to the individuals and populations and functions as a unit.

Pre-commercial Cutting (See "Thinning.")

Preparation Cut (Silviculture) A timber harvest method that removes trees near the end of a rotation so as to open the canopy and enlarge the crowns of seed bearers to improve conditions for seed production and natural regeneration, as typically in a shelterwood method.

Preparedness Level (Fire Management) Planning levels of suppression readiness dependent on fire activity, fuel moisture, drought conditions, fire weather, fire danger, and resources deployed or available. There are five preparedness levels with level five being the most active state of readiness.

Prescribed Burning Controlled application of fire to wildland fuels in either their natural or modified state under specified environmental conditions that allows the fire to be confined to a predetermined area and at the same time produce the fireline intensity and rate of spread required to attain planned resource management objectives (synonym for controlled burning).

Prescribed Fire A fire burning within prescription resulting from planned or unplanned ignition.

Prescription (Fire Management) A written statement defining objectives to be attained, as well as temperature; humidity; wind direction and wind speed; fuel-moisture content; and soil moisture, under which the fire will be allowed to burn, generally expressed as acceptable ranges of the various indices, and the limit of the geographic area to be covered.

Present Net Value (PNV) The difference between the discounted value (benefits) of all outputs to which monetary values or established market prices are assigned and the total discounted costs of managing the planning area.

Pre-suppression (Fire Management) Activities required in advance of fire occurrence to ensure an effective suppression action. It includes recruiting and training fire forces; planning and organizing attack methods; procuring and maintaining fire equipment; and maintaining structural improvements necessary for the fire program.

Products Other than Logs (POL), Products Other Than Sawlogs, Products Other Than Sawtimber Products such as posts, poles, and fiber from trees or parts of trees less than sawlog size. POL usually include trees greater than 5 inches diameter breast height (dbh) (4.5 feet from ground level) and less than 7.9 inches diameter breast height (dbh), with tops of trees greater than 4 inches to less than 6 inches in diameter.

Project One or more site-specific activities designed to accomplish a specific on-the-ground purpose or result. Projects are tiered to the Forest Plan and will have further site-specific analysis.

Public Access Usually refers to a road or trail route over which a public agency has secured a right-of-way for public use.

Ranger District Administrative subdivisions of the Forest supervised by a District Ranger who reports to the Forest Supervisor.

Raptor Habitat Habitat required by hawks, falcons or owls, especially for nesting.

Rate of Spread (Fire Management) Relative activity of a fire in extending its horizontal dimensions, expressed as rate of increase of the perimeter, rate of increase in area, or rate of advance of its head, depending on the intended use of the information, generally in chains or acres per hour for a specified period in the fire's history.

Reforestation Reestablishment of a tree crop on forested land.

Regeneration (Silviculture) The renewal of vegetation whether by natural or artificial means. Also, the new growth itself.

Resource Value-at-risk (Fire Management) Fire-suppression planning tool providing a relative expression in five classes of fire effects on all resources but not the value of the resources themselves (compare values at risk).

Resource Values The tangible and intangible worth of forest resources.

Responsible Official The Forest Service employee who has the delegated authority to make a specific decision.

Retention (Vegetation Management) To keep the existing extent of a vegetative component. Usually refers to a species, such as aspen, birch, or bur oak.

Revegetation The reestablishment and development of a plant cover. This may take place naturally through the reproductive processes of the existing flora or artificially through the direct action of reforestation or reseeding.

Rights-of-way Land authorized to be used or occupied for the construction, operation, maintenance, and termination of a project or facility passing over, upon, under, or through such land. The privilege that one person or persons particularly described may have of passing over the land of another in some particular line.

Rights-of-way Corridors A linear strip of land identified for the present or future location of transportation or utility rights-of-way within its boundaries.

Riparian Area (See "Riparian Ecosystem.")

Riparian Communities Repeating, classified, defined, and recognizable assemblages of plant-or-animal communities associated with riparian areas.

Riparian Ecosystem The moist transition zone between the aquatic ecosystem and the relatively drier, more upland, terrestrial ecosystem(s). This transition zone can extend both laterally and longitudinally away from aquatic ecosystems, sometimes into headwater swales that have no defined stream channel. The riparian ecosystem is the area whose soil is relatively more moist than the adjacent upland and whose vegetation growth reflects the greater accumulation of available water.

Risk (Fire Management) (See "Fire Protection Assessment.")

Risk Index (Fire Management) A number related to the probability of an ignition of a fire (Compare "Human-caused Risk.")

Roads A general term denoting a way with at least two-wheel tracks for purposes of travel by vehicles greater than 50 inches in width.

Road Functional Classification The way in which a road services land and resource management needs and the character of service it provides. Functional classifications for roads are forest arterial, forest collector, and forest local.

> **Forest Arterial Road:** Provides service to large land areas and usually connects with public highways or other Forest arterial roads to form an integrated network of primary travel routes. The location and standard are often determined by a demand for maximum mobility and travel efficiency rather that specific resource management service. It is usually developed and operated for long-term land and resource management purposes and constant service.
>
> **Forest Collector Road:** Serves smaller land areas than a Forest arterial road and is usually connected to a Forest arterial or public highway. Collects traffic from Forest local roads and/or terminal facilities. The location and standard are influenced by both long-term multi-resource service needs, as well as travel efficiency. May be operated for either constant or intermittent service depending on land use and resource management objectives for the area served by the facility.
>
> **Forest Local Road:** Connects terminal facilities with Forest collector or Forest arterial roads or public highways. The location and standard are usually controlled by a specific resource activity rather than travel efficiency. Forest local roads may be developed and operated for either long- or short-term service.

Road Maintenance Level Defines the level of service provided by and maintenance required for a specific road consistent with road management objectives and maintenance criteria. The maintenance levels are

> **Maintenance Level 1**: Assigned to intermittent service roads during the time they are closed to vehicular traffic. The closure period is 1 year or longer. Basic custodial maintenance is performed.
>
> **Maintenance Level 2**: Assigned to roads open for use by high-clearance vehicles. Passenger car traffic is not a consideration.
>
> **Maintenance Level 3**: Assigned to roads open and maintained for travel by a prudent driver in a standard passenger car. User comfort and convenience are not considered priorities.
>
> **Maintenance Level 4**: Assigned to roads that provide a moderate degree of user comfort and convenience at moderate travel speeds.
>
> **Maintenance Level 5**: Assigned to roads that provide a high degree of user comfort and convenience. Normally, roads are double-laned and paved or aggregate-surfaced with dust abatement.

Road Prism Equivalent to the term "roadway." The portion of the road within the limits of excavation and embankment, including slope rounding. A similar term is "road template," the shape and cross-sectional dimensions of the roadway to be constructed as defined by the construction staking notes and the characteristics of the typical sections.

Roadside Corridors A passageway that frames a road or travelway. The corridor includes the viewing area and facilities, which may be within the immediate roadside area or part of a sweeping distance panorama.

Roadway (See "Road Prism.")

Salvage Harvest Removal of damaged, dead or dying trees resulting from insect and disease epidemics, wildfire, or storms to recover logs before they have no commercial value for production.

Salvage of Dead Material (See "Salvage Harvest.")

Sanitation Cutting, Sanitation Harvest (Silviculture) The removal of trees occupied by insect or disease pests to reduce pest populations and limit their spread.

Sawtimber Trees suitable in size and quality for producing logs that can be processed into lumber. For planning purposes, trees with an 8-inch diameter or more are classified as sawtimber.

Scarify To abrade, scratch, or modify the surface of the ground to expose mineral soil.

Scenery The composition of basic terrain, geologic features, water features, vegetative patterns, and landrise effects that typify a land unit and influence the visual appeal the unit may have for visitors.

Scenic Class Scenic classes measure the relative importance or value of discrete landscape areas having similar characteristics of scenic attractiveness and landscape visibility. Scenic classes are used during forest planning to compare the value of scenery with the value of other resources, such as timber, wildlife, late succession, or minerals. The higher the scenic class, the more important it is to maintain the highest scenic value. Scenic classes are determined and mapped by combining the three classes of scenic attractiveness with the distance zones and concern levels of landscape visibility. A numerical value of 1 to 7 is assigned to Forest lands. Generally, scenic classes 1-2 have high public value; classes 3-5 have moderate value; and classes 6 and 7 have low value.

Scenic Integrity (Existing or Objective) State of naturalness or conversely the state of disturbance created by human activities or alteration. Integrity is stated in degrees of deviation from the existing landscape character in a national forest. It is the measure of the degree to which a landscape is visually perceived to be complete. The highest scenic integrity ratings are given to those landscapes that have little or no deviation from the character valued by constituents for its aesthetic appeal. Scenic integrity is used to describe an existing situation, standard for management, or desired future conditions.

Very High: A scenic integrity level that generally provides for ecological change only.

High: A scenic integrity level meaning human activities are not visually evident. In high scenic integrity areas, activities may only repeat attributes of form, line, color, and texture found in the existing landscape character.

Moderate: A scenic integrity level that refers to landscapes where the valued landscape character "appears slightly altered." Noticeable deviations must remain visually subordinate to the landscape character being viewed.

Low: A scenic integrity referring to the landscapes where the valued landscape character "appears moderately altered." Deviations begin to dominate the valued landscape character

being viewed, but they borrow valued attributes such as size, shape, effect, and pattern of natural opening, vegetative type changes, or architectural styles within or outside the landscape being viewed. They should not only appear as valued character outside the landscape being viewed but compatible or complimentary to the character within.

Very Low: A scenic integrity level that refers to landscapes where the valued landscape character "appears heavily altered." Deviations may strongly dominate the valued landscape character. They may not borrow from valued attributes such as size, shape, edge effect, and pattern of natural openings, vegetative type changes, or architectural styles within or outside the landscape being viewed. However, deviations must be shaped and blended with the natural terrain so that elements such as unnatural edges, roads, landings, and structures do not dominate the composition.

Unacceptable Low: A scenic integrity level that refers to landscapes where the valued landscape character being viewed appears extremely altered. Deviations are extremely dominant and borrow little if any line, form, color, texture, pattern, or scale from the landscape character. Landscapes at this level of integrity need rehabilitation. This level should only be used to inventory existing integrity. It must not be used as a management objective.

Second Growth (Silviculture) Forest growth that has become established after some disturbance with the previous forest stand, such as cutting, serious fire, or insect attack.

Sediment Material suspended in water or that has been deposited in streams and lakes.

Sediment Load The solid material transported by a stream and expressed as the dry weight of all sediment that passes a given point in a given period of time.

Sediment Yield Amount of sediment leaving an analysis area and entering a channel.

Seed Cutting (Silviculture) A harvest method that removes all mature trees from a stand except for selected seed-bearing trees retained on the site to provide a seed source for stand regeneration. In a two-step shelterwood cutting method, the first of the shelterwood cuttings.

Seed Tree, Seed-tree Cutting Small number of seed-bearing trees left singly or in small groups after timber harvest to provide seed for regeneration of the site.

Selection Cut (Silviculture) A harvest method that periodically removes mature trees individually or in small groups from an uneven-aged forest. By this method, both regeneration cutting and tending of immature stand components are accomplished at each entry.

Sensitive Species Those plant and animal species identified by the Regional Forester for which population viability is a concern, as evidenced by significant current or predicted downward trends in population numbers or density; or significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.

Seral (Ecology) A biotic community that is in a developmental, transitory stage in an ecological succession.

Seral Stages (Ecology) The sequence of a plant community's successional stages to potential natural vegetation.

Severely Burned Soil A condition in which most woody debris and the entire forest floor is consumed down to bare mineral soil. Soil may have turned red due to extreme heat. Also, fine roots and organic matter are charred in the upper one-half inch of mineral soil.

Shelterwood, Shelterwood Method (Silviculture) A harvest method in which a portion of the mature stand is retained as a source of seed and/or protection during the period of regeneration. The mature stand is removed in two or more cuttings commonly termed seed cutting and removal cutting. The seed cutting may or may not be preceded by a preparatory cutting.

SHPO (See "State Historic Preservation Officer.")

Silvicultural System A management process that tends, harvests, and replaces forests, resulting in a forest of distinctive form with a desired condition.

Silvicultural Treatment A management practice that utilizes a method of tree culture, harvest, or replacement (See "Single-tree Selection," "Shelterwood Method," "Group Selection," "Even-aged Management," "Uneven-aged Management," and "Clearcutting.")

Silviculture Generally, the science and art of tree management, based on the study of the life history and general characteristics of forest trees and stands, with particular reference to local factors; more particularly, the theory and practice of controlling the establishment, composition, constitution, and growth of forests for desired conditions.

Site An area considered in terms of its physical and/or biological environment; for example, a riparian zone, a homogenous stand of vegetation, or a campground.

Site Index A measure of the relative productive capacity of an area for growing trees. Measurement is based on height of the dominant trees in a stand at a given age.

Site Preparation (Silviculture) The activity that prepares a site for natural regeneration or the planting of seedlings. The objective is to create a favorable environment for establishing and growing the desired vegetation classes. Treatments could include chemical, mechanical, or fire.

Site Productivity Production capability of specific areas of land.

Skid Trails (Timber Management) Any way, more or less prepared, over which logs are dragged. Any road or trail leading from stump to landing.

Skidding (Timber Management) Moving logs from the stump to a collecting point.

Skyline Logging Taking logs from the stump area to a landing using an overhead system of winch-driven cables to which logs are attached with chokers.

Slash (Timber Management) The residue left on the ground after harvesting, sanitation operations, windstorm, or fire. It includes such material as unutilized logs, uprooted stumps, broken or uprooted stems, tops, branches, and leaves.

Snag (Vegetation) Standing dead tree or standing portion from which at least the leaves and smaller branches have fallen; often called a stub if it is less than 20 feet tall.

Snag-dependent Species (See "Cavity Nesting Species.")

Soft Snags (Vegetation) A snag composed primarily of wood in advanced stages of decay and deterioration, particularly in the sapwood (outer) portions; generally there are no live branches on the snag.

Softwood A conventional term for both the timber and the trees belonging to the evergreen group, as the pine, spruce, fir, etc.

Soil Compaction A physical change in soil properties that results in a decrease in porosity and an increase in soil-bulk density and strength.

Soil Erosion The detachment and movement of soil from the land surface by water or wind. Soil erosion and sediment are not the same (See "Sediment.")

Soil Productivity The inherent capacity of a soil to support the growth of specified plants, plant communities, or a sequence of plant communities. Soil productivity may be expressed in terms of volume or weight/unit area/year, percent plant cover, or other measures of biomass accumulation.

Soil Surveys The systematic examination, description, classification, and mapping of soils in an area.

Standard Mandatory courses of action; any deviation from standards requires amendment of the LRMP.

Stand (Vegetation) A community, particularly of trees, possessing sufficient uniformity as regards to vegetation type, age class, risk class, vigor, size class, and stocking class that distinguishes it from adjacent communities and thus forms a management or silvicultural unity. Within a stand, a dominant or primary species and age class is identifiable, but there may be inclusions or clusters of different species or ages. R2 RIS stands are typically greater than 10 acres. IRI stands are typically greater than 5 acres.

Stand-replacing Fire A fire that kills all or most living overstory trees in a forest and initiates secondary succession or regrowth.

Stand Risk Rating (Insects) A ranking of relative forest stand conditions that reflects the degree of susceptibility to attack by a particular insect species and the potential level of damage if an outbreak occurs. It does not indicate where or when an infestation will actually occur. For mountain pine beetles in ponderosa pine, a computer model exists to determine low-, medium- and high-risk stands based on measures of stand structure, average basal area, and average tree diameter.

State Historic Preservation Officer (SHPO) A person appointed by a state's governor to administer the State Historic Preservation Program.

Stream Health The condition of a stream relative to robust health for that stream type and landscape, considering indicators such as channel pattern; slope; particle size; pool frequency and depth; bank vegetation; and woody debris that reflect the stability and habitat quality of the stream.

Structural Stages (Vegetation) Any of several developmental stages of tree stands described in terms of tree size and the extent of canopy closure they create. They include

> **Structural Stage 1 (Grass/Forb)**: An early forest successional stage during which grasses and forbs are the dominant vegetation. At the RIS site level, Structural Stage 1 is defined as nonstocked, with an AMD less than 10 percent. Small-scale Structural Stage 1 within RIS sites are at least one acre in size, do not meet the seedling stocking criteria, and contain no saplings, poles, or mature trees.
>
> **Structural Stage 2 (Shrubs/Seedlings):** Developmental stage dominated by tree seedlings (less than one inch dbh) and shrub species.
>
> **Structural Stage 3 (Sapling/Pole):** Developmental stage dominated by young trees 1 to 7 inches dbh, 10 to 50 feet tall, and usually less than 50 years old. This stage is subdivided into three canopy closure classes: A (less than 40 percent); B (40 to 70 percent); and C (greater than 70 percent).
>
> **Structural Stage 4 (Mature):** Consists of trees larger and older than structural stage 3. Also classified by the same canopy closure categories as structural stage 3.
>
> **Structural Stage 5 (Late Succession):** This structural stage is characterized by trees 160 years of age and older.

Subdivisions Areas of previously undeveloped land divided into individual home sites and/or blocks of lots.

Successional Stages (Seral Stages) The relatively transitory communities that replace one another during development toward a potential natural community.

Suitability The appropriateness of applying certain resource management practices to a particular area of land, as determined by an analysis of the economic and environmental consequences and the alternative uses foregone. A unit of land may be suitable for a variety of individual or combined management practices.

Suppress a Fire To extinguish a fire or contain it within specified boundaries.

Suppression (See "Fire Suppression" and "Insect and Disease Suppression.")

Temporary Roads (See "Short-term Transportation Facility.")

Thinning (Silviculture) The practice of removing some of the trees in a stand to meet desired conditions. Two types of thinning may be done:

> **Pre-commercial, Non-commercial**: Removing trees that are too small to make a merchantable product.
>
> **Commercial**: Removing trees that have reached sufficient size to be manufactured into a product and to improve tree spacing and promote more rapid growth.

Threatened Species Any species likely to become endangered within the foreseeable future throughout all or a significant portion of its range and that has been designated in the Federal Register by the Secretary of Interior as such.

Timber A general term applied to tree stands that provide a wood-fiber product.

Timber Stand Improvement (TSI) The elimination or suppression of the less desirable vegetation in favor of the more desirable tree growth, such as thinning, cleaning, weeding, and release cuttings.

Trail A general term denoting a way usually less than 50 inches wide for purposes of travel by foot, stock, or trail vehicle.

Transportation System All roads needed to manage and administer Forest resources. A road network.

Transportation/Utility Corridor A linear strip of land identified for the present location of transportation or utility rights-of-way within its boundaries.

Travel Corridor A strip of land that includes up to a maximum of 1,000 feet for major roads (500 feet either side of the road's centerline) or 500 feet for major trails (250 feet either side of the trail's centerline); travel corridors form a passageway that allows travelers to experience and interact with the quality and character of the landscape.

Travel Management Travel management is the movement of people and products to and through national forests and grasslands. It connects many different varieties of users and multiple uses on National Forest System (NFS) lands.

Treated Area Area on which management such as timber harvesting or prescribed burning occurs.

Tree Improvement (See "Timber Stand Improvement.")

Understory (Vegetation) The lowest layer of vegetation in a forest or shrub community composed of grass, forbs, shrubs, and trees less than 10 feet tall. Vegetation growing under the tree canopy.

Uneven-aged Management (Silviculture) The application of a combination of actions needed to simultaneously maintain tall, continuous cover, recurring regeneration of desirable species, and the orderly growth and development of trees through a range of diameter or age classes to provide a sustained yield of forest products. Cutting is usually regulated by specifying the number or proportion of trees of particular sizes to be retained within each area, thereby maintaining a planned distribution of size classes. Cutting methods that develop and maintain uneven-aged stands are single-tree selection and group selection.

Value (Fire Management) (See "Fire Protection Assessment.")

Values at Risk (Fire Management) Any or all natural resources, improvements, or other values that may be jeopardized if a fire occurs (Compare "Resource Values-at-risk.")

Vegetative Buffer Strips Strips of grass or other erosion-resisting vegetation between areas of ground disturbance and areas needing protection from sedimentation.

Vegetative Management, Vegetative Manipulation, Vegetative Treatment Any activities undertaken to modify the existing condition of the vegetation.

Vertical Diversity The diversity in an area that results from the complexity of the above-ground structure of the vegetation; has two or more layers; the more tiers of vegetation or the more diverse the species makeup, or both, the higher the degree of vertical diversity.

Viable Population Group of individuals of a particular species that produces enough offspring for long-term persistence and adaptation of the species or population in a given place. 36 CFR 219.19 defines a viable population for planning purposes as one that has the estimated numbers and distribution of reproductive individuals to insure that a continued viable population is well distributed in the planning area. Planning area is further defined by 36 CFR 219.3 as the "area of the National Forest System covered by a regional guide or forest plan." Direction from the Forest Service Manual (FSM) defines a viable population as one that has the estimated numbers and distribution of reproductive individuals to ensure the continued existence of the species throughout its existing range (or range required to meet recovery for listed species) within the planning area.

Viewshed Total visible area from a single observer position or the total visible area from multiple observer positions. Viewsheds are accumulated seen areas from highways, trails, campgrounds, towns, cities, or other view locations. Examples are corridors, feature, or basin viewsheds.

Water Influence Zone The land next to streams and lakes where vegetation plays a major role in sustaining the long-term integrity of aquatic ecosystems. Includes the geomorphic floodplain, riparian ecosystem, and inner gorge, and has a minimum horizontal width (from top of each bank) of 100 feet or the mean height of mature dominant late-seral vegetation, whichever is greater.

Watershed The area of land bounded by a divide that drains water, sediment, and dissolved materials to a common outlet at some point along a stream channel or to a lake, reservoir, or other body of water. Also called drainage basin or catchment.

Watershed Level The number assigned to an entire drainage basin contributing to the stream segment of a given level and bearing an identical designation; for example, a first-level watershed contains all the drainage area of a first-level stream (See "Stream Level.")

6th Level Watersheds: A watershed coded with a 12-digit code, typically 10,000 to 30,000 acres in size.

Waters of the United States Waters used for navigation and all other waters such as lakes, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes or natural ponds, and their tributaries.

Wetlands Those areas that are inundated by surface water or groundwater with a frequency sufficient to support and under normal circumstances do or would support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas such as sloughs, potholes, wet meadows, river overflows, mud flats, and natural ponds.

Wildfire Any wildland fire not designated and managed as a prescribed fire within an approved prescription. All wildfires will be given an appropriate suppression action.

Wildland-Urban Interface In applying Title I of the HFRA, this term means:

- An area within or adjacent to an at-risk-community (ARC) identified in recommendations to the Secretary in a Community Wildfire Protection Plan

OR

- In the case of any area for which a Community Wildfire Protection Plan is not in effect:

—an area extending ½ mile from the boundary of an at-risk community (ARC)

—An area within 1-1/2 miles of the boundary of an at-risk community (ARC), including any land that

Has a sustained steep slope that creates the potential for wildland fire behavior endangering the at-risk community (ARC)

Has a geographic feature that aids in creating an effective firebreak, such as a road or ridgetop

OR

Is in Condition class 3 as documented by the Secretary in the project-specific environmental analysis

AND

An area that is adjacent to an evacuation route for an at-risk community (ARC) that the Secretary determines—in cooperation with the at-risk community (ARC)—requires hazardous-fuel reduction to provide safer evacuation.

CHAPTER 6 LIST OF PREPARERS

Interdisciplinary Team

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Shirlene Haas	Travel Management Specialist / Wildlife Biologist - Master of Science in Wildlife Ecology, Utah State University, 1991; Bachelor of Science in Biology, University of Nebraska, 1986. Twenty years of Forest Service experience at the district and forest level in South Dakota, Wyoming, and California in project and forest planning, and wildlife program management. Planning experience includes vegetation management, special uses, lands, minerals, prescribed fire and fuels, range management, travel management, and recreation.

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Gary Haag	Geologist/Minerals Specialist –Master of Science, Geology, Rutgers University, 1982. Bachelor of Arts, Geology, Rutgers University, 1979. New Jersey Dept. of Environmental Protection 1984-1989, groundwater discharge permit program. South Dakota Dept. of Environment and Natural Resources 1989-2010, groundwater discharge permit program. February 2010 - present on BHNF as a geologist working on locatable and mineral material projects and mineral potential reports for mineral withdrawals and timber sales.
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Rodney Brown	Lands/Recreation Forester – Bachelor of Science, Michigan State University, 1977. Over 30 years working for the US Forest Service at the District level in Michigan and South Dakota working in special use permit administration, recreation residence permits, small tract act and land exchange cases; acquired and granted road and trail easements; working with utility companies on new and existing over head and underground power lines, telephone and fiber optic lines.

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