Deerfield Project Area

Final

Environmental Impact Statement

1874 *Custer Expedition Stereograph by W.H. Illingworth "Lime Stone Peak in Castle Creek Valley."* 2000

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

Commonly Used Acronyms and Abbreviations

ARC	At Risk Community
ATV	All Terrain Vehicle
BA	Basal Area
BF	Board Foot
BHNF	Black Hills National Forest
BMP	Best Management Practices
CCF	Hundred Cubic Feet
CDA	Connected Disturbed Area
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CMAI	Culmination of Mean Annual Increment
DBH	Diameter Breast Height (of tree)
DEIS	Draft Environmental Impact Statement
EA	Environmental Analysis
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
FRCC	Fire Regime Condition Class
NFSR	National Forest System Road
FEIS	Final Environmental Impact Statement
FS	Forest Service
FSH	Forest Service Handbook
FSM	Forest Service Manual
GIS	Geographic Information System
IA	Initial Attack
ID Team	Interdisciplinary Team
MA	Management Area
MBF	Thousand Board Feet
MCF	Thousand Cubic Feet
MIS	Management Indicator Species
MMBF	Million Board Feet
MPB	Mountain Pine Beetle
NEPA	National Environmental Policy Act
NFMA	National Forest Management Act
NFS	National Forest System
ORV	Off-Road Vehicle
OHV	Off Highway Vehicle
PPA	Prairie Project Area
RNA	Research Natural Area
ROD	Record Of Decision
S&G	Standard(s) and Guideline(s)
SHPO	State Historic Preservation Office
T&E	Threatened and Endangered
TSI	Timber Stand Improvement
USDA	United States Department of Agriculture
WUI	Wildland-Urban Interface

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, DC 20250-9410, or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

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

Lead Agency:	USDA Forest Service
Cooperating Agencies:	None
Responsible Official:	Craig Bobzien, Forest Supervisor 25041 N. Highway 16 Custer, South Dakota 57730
For Information Contact:	Robert Thompson, District Ranger 803 Soo San Drive Rapid City, South Dakota 57702 (605) 343-1567

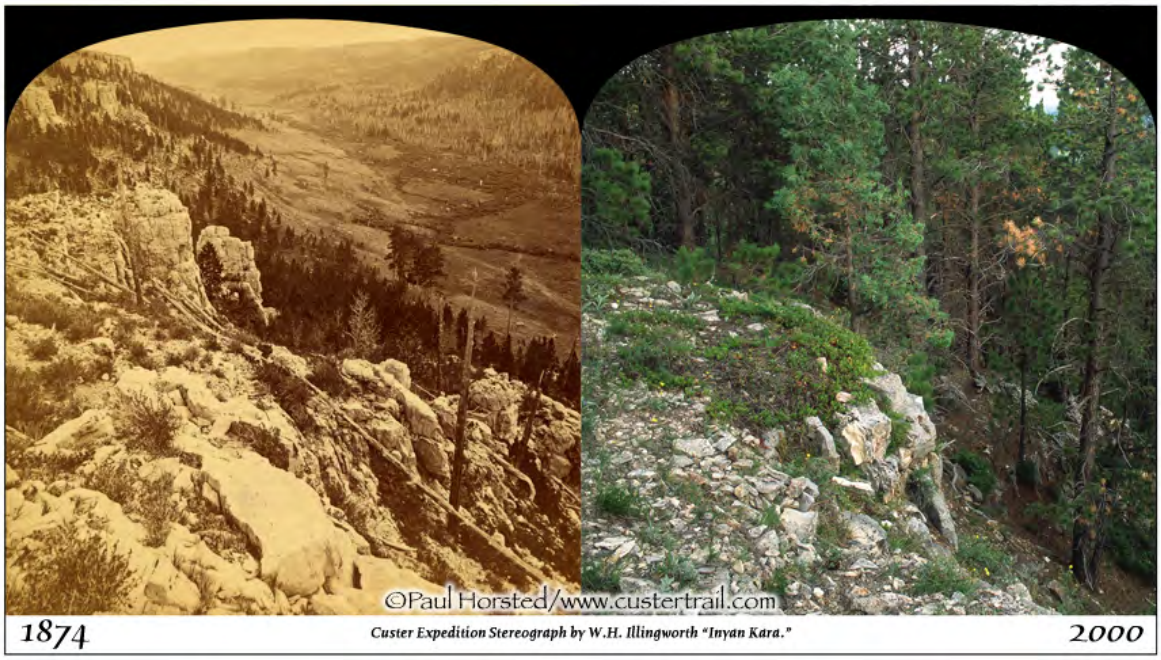
Abstract: The Mystic Ranger District of the Black Hills National Forest has prepared a Final Environmental Impact Statement (EIS) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. The Mystic Ranger District proposes to implement multiple resource management actions in the Deerfield Project Area as guided by the Black Hills National Forest Land and Resource Management Plan (Forest Plan) as amended. The primary purpose and need for actions proposed is to manage the vegetation to reduce the potential for large-scale mountain pine beetle (MPB) infestations, to break up the continuity of dense timber stands, reduce the potential for large-scale wildfire, and restore hardwoods and meadows. Four alternatives are considered in detail. Alternative A is the No Action Alternative. Alternative B is the proposed action. It includes aggressive thinning and harvest and prescribed burning. Fuel breaks would be placed along the boundary of all private lands within the project area. Travel management would be guided by current Forest Plan guidelines; cross-country motorized travel would be allowed over most of the area. Alternative C is the *preferred action*. It is less aggressive in tree thinning and harvest but includes more prescribed burning. It includes fuel breaks along most of the private land boundaries. Travel management would restrict motorized use to designated routes, with no cross-country motorized travel allowed. Alternative D includes limited tree thinning and limited prescribed burning. Fuel breaks would be placed next to existing structures (homes) only. It has a non-motorized use emphasis. No cross-country motorized use would be allowed, and many existing roads would be obliterated. This Final EIS discloses the direct, indirect, and cumulative environmental impacts resulting from the proposed action and alternatives.

THIS PAGE LEFT BLANK

Summary of Final Environmental Impact Statement

The Black Hills National Forest, Mystic Ranger District, proposes to implement multiple resource management actions within the Deerfield Project Area as guided by the Black Hills National Forest Land and Resource Management Plan as amended. The Deerfield Project Area is approximately 41,000 acres in size and includes about 5,200 acres of interspersed private land 11 miles northwest of Hill City, South Dakota. The project area includes the Deerfield Recreation Area, Deerfield Lake, Reynolds Prairie, and Hat and Flag Mountains. Resource management actions apply to National Forest System (NFS) lands only and do not include private lands.

Historically, fire and insects were a major force in shaping and determining the structure and composition of the ponderosa pine forests of the western United States, including the Black Hills. The Deerfield Project Area had a fire history of frequent low to moderate intensity ground fires, which thinned the forest and removed much of the ladder fuels, along with less frequent crown fires that created openings in the forest. Insect infestations, especially Mountain Pine Beetle (MPB), also played a role in thinning dense stands. The result was a more open forest, with varied structure, and abundant hardwood (deciduous) trees and open meadows.



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 and hardwoods due to the encroachment of pine trees.

The current vegetation conditions are at risk to large scale MPB infestations and massive wildfires. On a small scale, these natural events can have positive effects and can benefit both

plant and animal species by thinning or removing dense stands of trees, and providing food sources and habitats. On a large scale, however, MPB infestations and wildfire can damage soil productivity, increase soil erosion, expand noxious weeds, harm some plant and animal species, threaten and destroy life and property, destroy valuable commodities, and cause substantial economic harm to private landowners.

The primary purpose of and need for the Deerfield Project is to manage the vegetation to reduce large-scale mountain pine beetle infestations, to break up the continuity of dense timber stands, reduce the potential for large-scale wildfire, and restore hardwoods and meadows. Secondarily, it also includes various travel management approaches regulating the use of motorized vehicles within the area.

Through varied public involvement efforts, comments on the proposed action, potential concerns, and opportunities for managing the Deerfield Project Area were solicited from Forest Service employees, adjacent property owners, members of the public, American Indian Tribes, other public agencies, and organizations. A scoping letter was mailed to approximately 400 interested parties on April 23, 2004, soliciting comments. Comments received during initial scoping expressed the need for documenting project analysis in an Environmental Impact Statement (EIS) rather than an Environmental Assessment (EA). A Notice of Intent (NOI) to prepare an EIS was published in the *Federal Register* on Tuesday June 22, 2004.

Comments received during the scoping process were used to help in defining issues, develop alternatives and design criteria, and analyze effects. Through review and analysis of the scoping comments and input, the Deerfield Project Area Interdisciplinary Team (ID Team) identified five (5) prevailing key issues related to the proposed activities. The five key issues include: MPB susceptibility, wildfire/fuels hazard, biological diversity, socio-economic and recreation and travel management.

These issues led the Interdisciplinary (ID) Team to develop alternatives to the proposed action. The alternatives analyzed in detail in this EIS are briefly described below. More specific and detailed information about the Alternatives is presented in Chapter 1 (Proposed Action), throughout Chapter 2 of this document, and also in the Project File.

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. 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 conditions in the project area. However, such things as ongoing Forest protection efforts and recurring road maintenance on system roads would continue as directed by the Forest Plan.

Alternative B (Proposed Action) – Alternative B was developed in response to the purpose and need. It is the proposed action. It includes aggressive thinning and harvest with associated clean-up of the slash generated by this thinning. The thinning is designed to lower large-scale MPB risk by reducing the amount and continuity of MPB habitat--dense pine stands. This thinning and

associated fuel reduction is also designed to limit the potential for large scale crown fires. Mechanical tree removal also would be conducted in areas where pine trees have encroached into hardwood stands and meadows thus providing for expansion of natural fuel breaks and benefiting associated wildlife habitat. In previously harvested areas overstory removal is planned to encourage the growth of young pine stands. The scope of vegetation treatment under this alternative will require site-specific Forest Plan amendment(s).

Fuel breaks would be placed along the boundary of all private lands within the project area. These fuel breaks would be approximately 200 to 300 feet in width and constructed by thinning trees to limit the amount of fuel immediately adjacent to private land. Prescribed burning would be conducted over a relatively large area, much of which would be in the areas where tree thinning was conducted. This burning is designed to reduce fuels and lower the potential for crown fires, improve wildlife habitat, and return fire to its natural role in the environment under prescribed conditions.

Travel management would be guided by current Forest Plan guidelines; cross-county motorized travel would be allowed over most of the area. The existing motorized travel restrictions near the two botanical areas (McIntosh Fen and North Fork Castle Creek) and within the Deerfield Recreation Complex would remain in effect. A number of roads would be closed, obliterated, or relocated in order to protect water/soil resources and special habitats.

Alternative C (Preferred Action) – This alternative focuses on reducing large scale MPB and wildfire potential but with an emphasis on biodiversity and special habitat protection. It seeks to insulate the McIntosh Fen and North Fork Castle Creek Botanical Areas from catastrophic fire effects by treating the areas around these unique sites. It is less aggressive than Alternative B in treating dense pine stands, including less overall acres and more variable basal areas. Alternative C is more aggressive in enhancing hardwoods, especially in spruce dominated stands on the south side of Castle Creek. Alternative C generally leaves pine trees greater than 16 inches in diameter within commercial treatment areas. However, there is no tree size limitation for treatments associated with meadows, hardwoods and overstory removals. This alternative proposes similar amounts of non-commercial thinning as Alternative B. Many of these acres would overlap commercial treatments. The scope of vegetation treatment under this alternative will require site-specific Forest Plan amendment(s).

Mechanical fuel breaks, about 200 to 300 feet wide, would be constructed along some private land boundaries but not to the extent as Alternative B. Prescribed burning is increased compared to Alterative B. This burning provides some additional benefits to biodiversity and wildlife habitat but provides slightly less fuel hazard reduction.

Travel management in Alternative C recognizes the broad spectrum of recreation and travel uses in the project area. There would be no off-road (cross-country) motorized use. Motorized travel would be restricted to designated routes only. This alternative includes additional road closures and obliteration compared to that contained in Alternative B. These additional changes are intended to reduce overall road densities to benefit wildlife habitat and to provide walk-in recreation opportunities. Opportunities to develop motorized and non-motorized trail systems within the project area utilizing partnerships would be pursued wherever possible.

Alternative D – This alternative takes a more limited approach in addressing the purpose and need. Alternative D was developed in response to the view expressed by some during scoping that MPB and wildfire hazard reduction can be accomplished with limited commercial timber harvest. This alternative emphasizes denser stands, retaining larger diameter trees, and providing habitat for wildlife dependent on these stand characteristics. This alternative would limit pine harvest to trees less than or equal to 16 inches in diameter and there would be no overstory removal harvest. This alternative includes less non-commercial thinning than the other action alternatives. The scope of vegetation treatment under this alternative will require site-specific Forest Plan amendment(s).

Fuel breaks, about 200-300 feet wide, would be constructed only near existing structures (homes) along private land boundaries. Prescribed burning would be conducted on fewer acres than Alternative B and C to only acres that have been mechanically thinned.

Travel management in Alternative D emphasizes non-motorized use. Travel management is characterized by considerable road closures and obliteration in support of a non-motorized use experience and wildlife habitat with fewer disturbances from motorized use. There would be no off-road (cross-country) motorized use – travel would be on designated routes only. Opportunities would not be pursued to develop motorized and non-motorized trail systems in the project area.

The public and decision maker can make a relative comparison between the alternative effects on the key issues based on specific measurement indicators developed for each issue. Table 0-1-1 provides a comparative display of the alternative effects and/or outputs relative to the key issues in the Deerfield Project Area.

Table 0-1-1 Effects to Key Issues by Alternative

	Alt A	Alt B	Alt C	Alt D
Issue - Measurement Indicators				
MPB Hazard Rating				
MPB Hazard Rating – Low (acres)	15,500	24,500	20,700	16,900
MPB Hazard Rating – Moderate (acres)	9,300	2,600	5,300	7,800
MPB Hazard Rating – High (acres)	3,000	650	1,700	3,000
Fire Hazard and Fuels Reduction				
Crown Fire Hazard Reduction	Least Effective	Most Effective	Moderately Effective	Less Effective
Vegetation Treatment (acres)	0	25,500	21,200	11,700
Fuel Breaks - constructed (miles)	0	60	50	14
Fuels Breaks - hardwoods/meadows (acres)	0	5,000	6,100	4,400
Prescribed Burning (acres)	0	7,000 - 10,000	10,000 - 14,000	3,500
Accessibility for Fire Suppression (road miles)	259	258	239	202
Prescribed Fire				
Prescribed Burn Area (acres)	0	7,000 - 10,000	10,000 - 14,000	3,500
Burn Days Required (days)	None	55	70	30
Travel Management				
Miles of Open Roads	200	195	155	126
Miles of Closed Roads	28	28	28	28
Miles of Road Proposed for Closure	0	4	25	17

	Alt A	Alt B	Alt C	Alt D
Miles of Roads Proposed for Decommission	0	6	25	59
Miles of Roads Scheduled for Closure	31	31	31	31
Miles of Roads Scheduled for Decommission	14	14	14	14
Wildlife Habitat				
Pine Structural Diversity (acres)				
Closed Canopy (>70% crown closure)	2293	492	1727	2293
Open Canopy (<40% crown closure)	11882	22571	16288	14407
Vertical Diversity (acres)	22615	10901	14520	19144
Grass Forb Structural Stage (acres)	1394	1394	1394	1436
Late Successional Stands (acres)	1335	1335	1335	1335
Hardwood Communities (acres)	693	1057	1274	784
Grassland Communities (acres)	3991	4372	4764	4304
Snag Conditions (Best to Poor)	Excellent	Fair	Fair	Good
Dead and Down Woody Material (Best to Poor)	Excellent	Fair	Fair	Good
American Marten Habitat w/ High Potential for Occupancy (acres)	2226	1758	2054	2226
Screening Cover (acres)	529	529	529	529
Open Road Density (miles/square mile)	3.6	3.5	2.8	2.2
Total Road Density (miles/square mile)	4.6	4.6	4.2	3.6
Socio-Economic Factors				
Total Revenues (million)	NA	$6.8	$3.1	$1.1
Total Cost (million)	NA	-$14.9	-$13.5	-$5.7
Cost-Benefit Ratio	NA	.46	.23	.19
Volume Harvested - sawtimber (CCF)	0	94,000	40,000	14,000
Products - poletimber (CCF)	0	35,000	26,000	7,300
MPB and Wildfire Hazard Reduction (Effectiveness of contribution to safeguarding the health, values and lifestyle of local residents and Forest users by reducing insect and wildfire hazard.)	Least Effective	Most Effective	Moderately Effective	Less Effective

The Deerfield Project purpose and need provides the focus and scope for the proposal as related to Forest Plan policy and direction. Given this purpose and need, the Responsible Official (Forest Supervisor) 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 Responsible Official to make the following determinations which are disclosed in the Record of Decision (ROD):

- 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 Deerfield Project Area.
- Whether or not the information in this analysis is sufficient to implement proposed activities.
- Which action, if any, to approve (decide which alternative or combination of alternatives to implement).
- Whether there is a need for amendments to the existing Forest Plan.

Table of Contents

Summary of Final Environmental Impact Statement iii
CHAPTER 1 PROPOSED ACTION AND PURPOSE OF AND NEED FOR ACTION 1
Document Structure 1
Background 2
Management Direction 3
Forest Plan Direction 3
Other Direction 5
Purpose Of and Need for Action 5
Proposed Action 9
Decision Framework 10
Public Involvement and Scoping 10
Issues 11
Mountain Pine Beetle susceptibility 11
Wildfire/fuels hazard 12
Biological Diversity 13
Socio-Economic Concerns 14
Recreation and Travel Management 15
CHAPTER 2 ALTERNATIVES, INCLUDING THE PROPOSED ACTION 17
INTRODUCTION 17
ALTERNATIVES CONSIDERED IN DETAIL 17
Alternative A – No Action 17
Alternative B – Proposed Action 18
Alternative C 21
Alternative D 24
ACTIVITIES COMMON TO ALL ACTION ALTERNATIVES 26
DESIGN CRITERIA 26
MONITORING 26
ALTERNATIVES CONSIDERED but ELIMINATED FROM DETAILED STUDY 27
Limited Thinning and Harvest 27
Historic Condition – Range of Natural Variability 29
Maximize Prescribed Burning 30
COMPARISON OF ALTERNATIVES 30
MPB Susceptibility 30
Wildfire/fuels Hazard 32
Biological Diversity 33
Socio-Economic / Travel and Recreation Use 35
CHAPTER 3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES 39
INTRODUCTION 39
PHYSICAL ENVIRONMENT 41
WATERSHEDS, GEOLOGY, and SOILS 41
Aquatic Ecosystems – Physical 43
Aquatic Ecosystems – Chemical 51
Aquatic Ecosystems – Biological 54
Soil Productivity 55

Geologic Hazards ... 61
Special Areas ... 62
TRANSPORTATION ... 65
MINERALS ... 68
BIOLOGICAL ENVIRONMENT ... 69
VEGETATION ... 69
FIRE and FUELS ... 96
RANGE ... 131
NOXIOUS and INVASIVE WEEDS ... 136
WILDLIFE and BOTANY ... 139
Coniferous Forests and Woodlands ... 141
Grassland Communities ... 149
Hardwood Communities ... 150
Riparian and Wetland Communities ... 152
Management Indicator Species ... 154
Species of Special Focus ... 190
Threatened, Endangered Species and Sensitive Species ... 193
Roads and Travel Management ... 194
Botanical Areas ... 203
FISHERIES ... 206
SOCIAL ENVIRONMENT ... 213
TRAVEL and RECREATION USE ... 213
SCENERY ... 236
LAND and SPECIAL USES ... 243
HERITAGE ... 244
SOCIAL ... 249
ECONOMICS ... 251
IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES ... 254
SHORT-TERM USES AND LONG-TERM PRODUCTIVITY ... 255
UNAVOIDABLE ADVERSE EFFECTS ... 255
CHAPTER 4 INDEX ... 257
CHAPTER 5 BIBLIOGRAPHY/REFERENCES ... 261
CHAPTER 6 GLOSSARY ... 271
CHAPTER 7 LIST OF PREPARERS ... 291

List of Tables

Table 0-1-1 Effects to Key Issues by Alternative ... vi
Table 1-1 Management Area designations and acreage in the Deerfield Project Area ... 4
Table 2-1 Effects to Key Issues by Alternative ... 37
Table 2-2 Treatment Outputs by Alternative ... 38
Table 3-1 Transportation - Activities in Miles (approximate) ... 65
Table 3-2 Road Management - Total Road Miles ... 66
Table 3-3 Road Management - Open and Closed Motorized ... 66
Table 3-4 Landscape Vegetation ... 99
Table 3-5 Current Condition Class Compared to Fire Regime Condition Class ... 104
Table 3-6 Summary of Crown Fuels after Treatment ... 115

Table 3-7 Summary of Crown Fuels Twenty Years after Treatment 115
Table 3-8 Grazing Allotments 132
Table 3-9 Existing wildlife structural stages in the Deerfield Project Area 140
Table 3-10 Comparison of existing condition to Forest Plan DC for various landscape vegetative diversity components in the Deerfield Project Area. 141
Table 3-11 Changes in ponderosa pine structure in the Deerfield Project Area by Alternative (approximate). 142
Table 3-12 Proportion of the Deerfield Project Area that provides vertically diverse forested habitats (by Alternative). 143
Table 3-13 Acres of meadow treatments proposed for the Deerfield Project Area (by Alternative). 149
Table 3-14 Acres of hardwood treatments proposed for the Deerfield Project Area (by Alternative). 151
Table 3-15 Acres of riparian treatments proposed for the Deerfield Project Area (by Alternative). 153
Table 3-16 Summary of Forest Plan MIS selected for analysis, status, and habitat..... 154
Table 3-17 Acres of American marten habitat with high potential for occupancy (as defined by the FP) treated by alternative. 156
Table 3-18 Big game screening cover adjacent to Arterial and Collector Road in the Deerfield Project Area (by Alternative)..... 164
Table 3-19 Habitat effectiveness values for Deer and Elk in Management Area 5.1 of the Deerfield Project Area (by Alternative)..... 165
Table 3-20 Habitat effectiveness values for Deer and Elk in Management Area 8.2 of the Deerfield Project Area (by Alternative)..... 166
Table 3-21 Percentage of vegetation structuaral stages in the six goshawk post-fledgling areas in the Deerfield Project Area for all alternatives. 182
Table 3-22 Total road miles in the Deerfield Project Area (by Alternative). 195
Table 3-23 Road densities on National Forest System lands in the Deerfield Project Area 196
Table 3-24 Projected Ponderosa pine structural stage in twenty years as a result of management by alternative (number(s) are approximate)..... 199
Table 3-25 Developed Recreation Sites in the Deerfield Project Area 215
Table 3-26 Recreation Users, Preferences and Uses in the Deerfield Project Area 219
Table 3-27 Financial Measures by Alternative..... 253

List of Figures

Figure 2-1 Mountain Pine Beetle Years 2005-2025 31
Figure 3-1 Grasses, shrubs, and hardwoods (mixed with pine) dominated the uplands while willows covered low-lying areas along streams. 40
Figure 3-2 Cover Types 70
Figure 3-3 Age Class Distribution 71
Figure 3-4 Mountain Pine Beetle Risk Existing Condition 73
Figure 3-5 Mountain Pine Beetle Risk Existing Figure 3-6 Mountain Pine Beetle Risk 2025 . 75
Figure 3-7 Mountain Pine Beetle Hazard Rating Years 2005-2025 82
Figure 3-8 Average Large Fire Size..... 100
Figure 3-9 Cumulative Acreage Burned by Large Fires on the Black Hills..... 100

Appendices

Appendix A - Scoping and Public Involvement ….…….A-1
Appendix B - Design Criteria and Mitigation Measures ...……..B-1
Appendix C - Monitoring ……..……..C-1
Appendix D - Silvicultural Findings, CMAI, Site Data ……..D-1
Appendix E - Past, Present, Current Activities ……E-1
Appendix E – Summary – Deerfield Biological Assessment/Biological Evaluation……F-1
Appendix G - Maps …….…….G-1

Map 1 – Vicinity
Map 2 – Watersheds
Map 3 – Management Areas
Map 4 – Alternative B – Treatment Map
Map 5 – Alternative C – Treatment Map
Map 6 – Alternative D – Treatment Map
Map 7 – Alternative B – Prescribed Burn and Fuel Breaks
Map 8 – Alternative C – Prescribed Burn and Fuel Breaks
Map 9 – Alternative D – Prescribed Burn and Fuel Breaks
Map 10 – Alternative A – MPB Risk Rating Existing and Twenty Years Later
Map 11 – Alternative B – MPB Risk Rating Post Treatment and Twenty Years Later
Map 12 – Alternative C – MPB Risk Rating Post Treatment and Twenty Years Later
Map 13 – Alternative D – MPB Risk Rating Post Treatment and Twenty Years Later
Map 14 – Alternative A – Crown Fire Potential Existing and Twenty Years Later
Map 15 – Alternative B – Crown Fire Potential Post Treatment and Twenty Years Later
Map 16 – Alternative C – Crown Fire Potential Post Treatment and Twenty Years Later
Map 17 – Alternative D – Crown Fire Potential Post Treatment and Twenty Years Later
Map 18 – Alternative A – Travel Management, Existing
Map 19 – Alternative B – Travel Management
Map 20 – Alternative C – Travel Management
Map 21 – Alternative D – Travel Management

THIS PAGE LEFT BLANK

CHAPTER 1 PROPOSED ACTION AND PURPOSE OF 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 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 the proposed action and alternatives. The document is organized into seven chapters followed by Appendices A - G:

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 informed the public of the proposal and how the public responded.

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. These alternatives were developed based on key issues raised by public comments, other agencies, and internally. This chapter also provides a discussion on design criteria and monitoring required. Finally, this section includes summary tables displaying the activities planned by alternative and a comparison of effects on the key issues associated with implementing 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 and Soils, etc.

Chapter 4. Index: The index references page numbers for many key document topics and words.

Chapter 5. Bibliography/References: The bibliography provides a list of references supporting the documentation in the EIS.

Chapter 6. Glossary: The glossary provides a list and explanation of key words, acronyms, and terminology used throughout the EIS.

Chapter 7. List of Preparers: This chapter provides a list of preparers during the development of the environmental impact statement.

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 are a heavily settled area. There are numerous communities scattered throughout the 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. 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.

Historically, fire and insects were a major force in shaping and determining the structure and composition of the ponderosa pine forests of the western United States, including the Black Hills. The Deerfield Project Area had a fire history of frequent low to moderate intensity ground fires, which thinned the forest and removed much of the ladder fuels, along with less frequent crown fires that created openings in the forest. Insect infestations, especially Mountain Pine Beetle (*Dendroctonus ponderosae*) (MPB), also played a role in thinning dense stands. The result was a more open forest, with varied structure, and abundant hardwood (deciduous) trees and open meadows.

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 and hardwoods due to the encroachment of pine trees (see cover photo, page iii, and Figure 3-1).

Since 1997 there has been a noticeable increase in pine tree mortality caused by mountain pine beetle in the Black Hills. Mountain pine beetle has always been a part of the Black Hills forest ecosystem, with epidemic infestations occurring periodically. Tree mortality levels of 25% can be expected throughout the landscape surrounding epidemic areas and levels of up to 50% or more can occur in heavily infested stands.

Aerial and ground surveys show observable increases in mortality in and around the Deerfield Lake area. The mortality extends from west of Hill City to the Wyoming state line and south to Bear Mountain and beyond. Populations of MPB in the southern portion of the Deerfield Project Area and in the adjacent area are, in many places, approaching or at epidemic levels. The Project Area's MPB hazard rating is moderate to high because of the existence of large and continuous areas of dense pine stands, which is the favored habitat of MPB's.

This dense, continuous forest with fewer openings and hardwoods has resulted in more of the Black Hills being affected by large, intense forest fires. 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, Grizzly Gulch, Galena, Flagpole, Westberry Trails, and the Battle Creek Fire have burned about 238,500 acres. These fires covered large areas, moving as far as eleven miles in one day and as fast as five miles in three hours.

While MPB epidemics and wildland fires are natural occurrences, they can conflict with land management objectives by damaging soil productivity, increasing 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 scale wildfires threaten the lives of residents, tourists, and firefighters, destroy houses and other private property, and cause substantial harm to the local economy and private landowners.

People that live in this area have become increasingly concerned about the increase in MPB and the frequency and magnitude of wildfires that have occurred recently. The prevailing public attitude, and that of local, State, and Federal elected officials, is that the Black Hills National Forest needs to be aggressive in addressing beetle risk and fire hazard on National Forest System (NFS) lands. The overwhelming message conveyed by the public during the public involvement phase of this project was the need for action regarding the increasing MPB epidemic and potential for large-scale wildfire in this area.

The Deerfield Project Area serves the public with a wide variety of interests and resources year-round – such as developed and dispersed recreation, timber, wildlife, range, minerals, hunting, water production (Deerfield Reservoir) and recreation, snowmobiling and private property access. An emerging concern in the Black Hills, as well as Nation-wide, is travel management (road and off-road) non-motorized and motorized use. Recreation use in the area continues to grow, as do conflicts within and between both motorized and non-motorized groups. Opportunities exist to expand recreation uses, improve the effectiveness of travel management rules, and reduce conflicts between all users. As such, each action alternative has travel management as a component consistent with the alternative's overall theme.

Based on the desired condition included in the Forest Plan for the affected management areas, actions are needed to reduce the potential for large scale MPB infestations, to break up the continuity of dense timber stands, reduce the potential for large scale wildfire, and restore hardwoods and meadows. These actions address Goals 2 and 3 of the Forest Plan - to provide for biologically diverse ecosystems and provide for sustained commodity uses. Goal 4 addresses the need to resolve travel and recreation management.

In an effort to address these issues in the Deerfield Project Area, the proposed action has been developed to manage vegetation to minimize the potential for large-scale MPB infestations and wildfire, and promote hardwoods and meadows – to break up the continuity of dense timber stands. The intent of the proposed action is to reduce/limit the spread of MPB, reduce the potential for large-scale wildfire, and restore/enhance hardwoods and meadows for natural fuel breaks and for wildlife habitat.

Management Direction

Forest Plan Direction

The Black Hills National Forest Land and Resource Management Plan (Forest Plan) supported by its Final Environmental Impact Statement (FEIS) 1997, is the Forest programmatic document 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 was amended by the Phase I Forest Plan Amendment (Decision Notice (DN) dated May 18, 2001). This amendment provides revised and new Standards and Guidelines, as well as, additional protection measures applicable to a number of plant and wildlife species on the Black Hills National Forest. The Black Hills National Forest is currently in the process of amending the Forest Plan, referred to as Phase II.

The purpose of the Forest Plan (FP) is to provide 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 goals and objectives (FP Chapter I) as well as associated standard and guidelines (FP Chapter II) for management.

The Forest Plan establishes nine multiple use goals and associated objectives for management of the Forest. The first four goals are directed toward natural resource objectives for multiple use management of the Forest. Also, 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 for the basic direction for defining the purpose and need and ultimately developing the proposed action (Alternative B). The nine Forest Plan goals are discussed in Chapter I of the Forest Plan. The goals providing management emphasis and direction for the Deerfield Project Area are Goals 2, 3 and 4.

2. Provide for a variety of life through management of biologically diverse ecosystems.
3. Provide for sustained commodity uses in an environmentally acceptable manner.
4. Provide for scenic quality, a range of recreational opportunities, and protection of heritage resources to the needs of the Black Hills National Forest visitors and local communities.

The Forest Plan also sets management allocations for specific uses of land (Management Areas) within the Forest to meet multiple use objectives (FP Chapter III). The Deerfield Project ID Team reviewed Management Area (MA) direction and confirmed that no new information existed that would require reconsideration of Forest Plan Allocations. However, the ID Team recognizes that there remains a possibility that one or more site-specific amendments may be necessary within a management area in order to implement a needed action. The potential amendment are outlined in Chapter 2 under ‘Alternatives Considered in Detail’. The MAs designated in the Forest Plan for the Deerfield Project Area are described in Table 1-1 and displayed in Appendix G, Map 3.

Table 1-1 Management Area designations and acreage in the Deerfield Project Area

Management Emphasis	Acres
3.1 Botanical Areas	1,267
5.1 Resource Production	30,100
8.2 Developed Recreation Complexes	4,738
Total	36,105

Other Direction

As a result of the significant increase in motorized off-highway vehicle (OHV) use occurring nation-wide, new National level initiatives and policies regarding travel management have been generated. On July 15, 2004, the Forest Service published proposed regulations in the *Federal Register* to govern OHV's and other motor vehicle use on national forests and grasslands. The main focus of this draft proposal is to enhance recreational opportunities for the public and better protect the environment by requiring units to establish a designated system of roads, trails, and areas. Comments received on the proposed rule are currently under review with a final rule anticipated to be published in latter 2005.

While fire has 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 fight. The increase in catastrophic wildfire nation-wide has led to considerable new and/or revised National level initiatives and policies regarding fire and fuels management (Healthy Forest Restoration Act of 2003 (H.R. 1904), National Fire Plan, Federal Wildland Fire Management Policy, refer to the Prairie DEIS pages 6-7). The main focus of this National direction is an emphasis on reducing the probability and occurrence of catastrophic wildfire in fire adapted ecosystems, especially near at risk communities (ARC) and the wildland-urban interface (WUI).

The Deerfield Project Area has several communities at risk [At Risk Community] within or near the project area (Deerfield, Rochford, and Hill City – *Federal Register* / Vol. 66, No.160, pg. 43384) that would be negatively affected by catastrophic wildfire. There are approximately 5,200 acres of private land in the Deerfield Project Area. Moderate development has occurred on these lands and more is expected. The Deerfield Project Area is on the northern edge of a current large-scale MPB epidemic. Also, the 82,000 plus acre Jasper Fire (2000) burned south of the project area and demonstrates the potential effects of a large-scale crown fire that could occur in the Deerfield Project Area. This illustrates a need to reduce the potential for large scale MPB infestations, reduce the potential for large scale wildfire, and restore hardwoods and meadows.

Purpose Of and Need for Action

As described and referenced under the Management Direction Section, there are numerous Goals and Objectives identified in Chapter I of the Forest Plan. The Deciding Official for the Deerfield Project has chosen to propose resource management actions that respond to Forest Plan Goals 2, 3, and 4 as well as National emphasis on fire/fuels hazard reduction and off-highway vehicle use.

Associated with the three goals are specific resource objectives, as outlined in the Forest Plan (Chapter I). Each goal has objectives, some of which are key to defining the purpose and need and developing the proposed action. Key objectives providing management emphasis for this project are summarized below. Note that other Forest Plan goals and numerous objectives not mentioned below also provide guidance and are achieved to varying degrees depending on project accomplishment (see FP Chapter I). Based on the desired condition included in the Forest Plan Goals and Objectives and further described under the applicable Management Areas (FP Chapter III), the Deerfield Project Area ID Team identified multiple resource management opportunities within the Deerfield Project Area that respond to Forest Plan Objectives.

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

- Objective 201. During the planning period conserve existing hardwood communities and restore existing hardwood communities…

  The Deerfield Project Area includes about 770 acres of hardwoods (aspen, birch, and oak), with additional site that could be treated. Conifers are growing into many of these stands due to lack of disturbance. If left undisturbed, natural succession would eventually convert these stands to pine. There is a need to maintain diversity in forest cover type for wildlife, natural fuel breaks, scenery, and ecosystem health. An opportunity exists to remove conifers from hardwoods and meadows through timber harvest.
- Objective 205. Restore grassland (meadow and prairie) communities across the Forest by 10 percent…

  The Deerfield Project Area includes about 4,000 acres of grasslands. See objective 201 above.
- Objective 210. Implement at least one adaptive management project (fire simulation cut) in the next 10 years to simulate forest structural conditions following a stand-replacing fire (using primarily mechanical methods). Follow this treatment with low-intensity prescribed fire when ground fuels permit…
- Objective 213. Maintain or enhance existing riparian area biodiversity, physical structure and size.
- Objective 216. Manage to conserve or enhance the integrity of the following important botanical areas: g) North Fork Castle Creek and h) McIntosh Fen.

  Within the Project area, the North Fork Castle Creek Botanical Area encompasses 887 acres and the McIntosh Fen encompasses 318 acres. There is a need to maintain/enhance the botanical features of these areas and to protect the unique biodiversity (geological, historic, and paleontological) along with the botanical values for which these areas were designated. There is an opportunity to protect these areas from catastrophic wildfire, increase beaver populations, and maintain hydrological functions through thinning, fuel reduction, prescribed fire, and transportation system changes.
- Objective 219. Maintain or improve in-stream fisheries habitat.
- Objective 220. Conserve or enhance habitat for federally listed threatened, endangered and proposed species.

  The bald eagle is the only threatened, endangered, or proposed species known to use the general area. Eagles are winter residents in the Black Hills, but no nesting occurs. There is a need to conserve habitat for the bald eagle and an opportunity to provide prey species by thinning, fuel reduction, prescribed fire and improved riparian and lake health.
- Objective 221. Conserve or enhance habitat for sensitive species and species of special interest (Management Indicator Species).

  The Rocky Mountain Region of the Forest Service has listed 36 'sensitive' species that potentially occur or have been documented in the Black Hills. Of these 36, there are 29 wildlife and plant species that occur or have the potential to occur in the Deerfield Project Area. There are 19 species listed as Management Indicator Species (MIS) that occur or for which potential suitable habitat exists within the

project area (see wildlife section in chapter 3). There is a need to conserve or enhance habitat for these plant and wildlife species both short-term and long-term. Many species will benefit from thinning, fuel reduction, prescribed fire, and meadow/hardwood treatments which will increase browse production and help conserve and enhance habitat for R2 Sensitive Species and MIS.

- Objective 223. Use management ignited fires and prescribed natural fires to achieve desirable vegetative diversity and fuel profiles… Use natural fire on a limited basis under specifically prescribed conditions.
- Objective 224. Reduce or otherwise treat fuels commensurate with risks (fire occurrence), hazard (fuel flammability), and land and resource values common to the area…
- Objective 225. Manage wildfires using the appropriate suppression response (confine, contain or control) based on management area emphasis, existing values, risk of ignition and fuel hazards within a given area.
- Objective 227. Manage 28,900 acres of activity fuels and 4,000 acres of natural fuels each year during the next decade, consistent with the need to protect life, property and natural resources from the threat of wildfire…

  Years of fire suppression have increased the potential for large crown fires. There is a need to reduce this potential to protect sensitive species habitat, timber values, private land, and visual qualities of the area. There are opportunities to reduce fuels and the probability of large-scale wildfire.
- Objective 228. Within planning units (diversity unit, watershed and/or landscape association) where outbreaks of mountain pine beetle could threaten management objectives for ponderosa pine (especially where timber production is desired), maintain or reduce acreage of ponderosa pine stands that are in medium or high risk condition for infestation.

  The Deerfield Project Area encompasses the northern portion of a current large-scale MPB epidemic. Within the project area, approximately 9,300 acres are at moderate risk of MPB infestation, and approximately 3,000 acres are at high risk. There is a need and an opportunity to reduce the risk of MPB infestations.
- Objective 229. Using analyses of insect and disease populations, determine where suppression strategies are needed to meet management objectives and minimize value loss of tree vegetation affected by outbreaks of insect and disease pests.

  There has been an increasing population of MPB and associated increases in tree mortality over the past few years in areas surrounding Deerfield Reservoir. Populations in the Deerfield area are, in many places, at epidemic levels.

  There is a need to minimize the potential for loss of timber and other values to MPB. There is an opportunity to reduce the potential for infestation by thinning dense timber stands and conducting sanitation harvest.
- Objective 231. Prevent new infestations and manage to reduce established infestations of noxious weeds.

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

- Objective 303. Offer the Allowable Sale Quantity (ASQ) of timber on suitable and available timber lands in the next decade.

  This objective applies to the entire Forest. There is a need to provide sawtimber and products other than logs (POL) and there is an opportunity to harvest timber from suitable and available timber lands in the next decade.
- Objective 306. Only use clearcutting to meet ecosystem management objectives such as enhancing diversity, providing forage for wildlife, reducing insect and disease infestations…
- Objective 309. Provide… changes to the National Forest System roads and two-track roads in support of long-term sustainable production of commodities.

Goal 4 – Provide for scenic quality, arrange of recreational opportunities, and protection of heritage resources in response to the needs of the Black Hills National Forest visitors and local communities.

- Objective 407. Provide the following Recreation Opportunity Spectrum (ROS): Primitive, Semi-primitive non-motorized, Semi-primitive motorized, Roaded natural, Roaded natural non-motorized…
- Objective 416. Maintain and construct [motorized and non-motorized] trails…

  The project area contains approximately 200 miles of open roads. Average road density is 3.5 miles of roads per square mile of land. There is a need to reduce the total miles of roads to decrease maintenance costs, sedimentation, and negative effects on non-motorized users. There is an opportunity to work with individuals and groups to develop areas for motorized and non-motorized trails by converting some roads to trails (see Travel and Recreation Use, Chapter 3).
- Objective 417. …Develop trail facilities in cooperation with other agencies and partners.
- Objective 420. …b. Provide recreation facilities, trailheads, trail crossings and other road corridor components to meet demand. c. Include opportunities for pedestrians and bicycle ways. d. Use cooperative opportunities for development of outdoor facilities…
- Objective 421. Provide the following road systems: Roads suitable for public use--passenger car, high clearance vehicles, [and] roads closed to vehicles…
- Objective 422. Provide the following off-road travel opportunities: All motorized travel allowed yearlong-59% [of Forest], Seasonal restrictions apply-23%, Seasonal restrictions—no off-road travel-3%, Backcountry motorized recreation on designated trails-1%, Only OHV travel prohibited-11%, Motorized travel prohibited except snowmobiles-1%, All motorized travel prohibited-1%.

  The dispersed recreation within the project area is quite diverse. There is a need for access to conduct management activities and allow motorized recreation, but also the need to reduce disturbances to wildlife and the negative effects on non-motorized recreation users. There are opportunities to adjust off-road motorized use to ensure adequate recreation access while protecting wildlife and watershed resources (see Travel and Recreation Use, Chapter 3).

There is clearly a need to do something to reduce the potential for large scale MPB infestations, reduce the potential for large scale wildfire, and restore hardwoods and meadows. It is necessary to break up the continuity and reduce dense timber stands to meet these needs.

There is also a need to resolve travel management and recreation use issues. The project area includes the Deerfield Recreation Complex, is in close proximity to Hill City, Mount Rushmore and other Black Hills attractions. It makes this a destination area for travelers/recreationists year-round.

In association with the focus to reduce MPB infestations, large-scale wildfire, travel and recreation use and wildlife diversity issues, there is an opportunity to address other Forest Plan objectives such as those associated with scenic integrity, heritage resources, and other resource amenities/uses. The current Forest Plan management emphasis for the project area is principally resource production, developed recreation complexes, and botanical areas.

Proposed Action

The proposed action was introduced to the public during the scoping period (see Public Involvement and Scoping section discussed later in Chapter 1). This proposal was based on addressing the purpose and need which contained three elements: 1) reduce the potential for large-scale Mountain Pine Beetle infestations, 2) reduce the potential for large-scale wildfire, and 3) restore hardwoods and meadows.

During the scoping period the Forest Service received significant public response supporting the proposal and rationale for action (34 respondents provided 141 comments). Many who live within and adjacent to the project area are concerned with the current MPB epidemic within and to the south of the project area.

The proposed action includes thinning and harvest of the pine forest to minimize the potential for large-scale MPB infestation and large-scale crown fire from occurring. It also provides for landscape level and private property boundary fuel breaks (about 60 miles), expansion of hardwoods and reduction of pine encroachment into historic meadows, thereby expanding natural fuel breaks and increasing biodiversity in the project area. Considerable prescribed burning, about 7,000 - 10,000 acres, would occur to reduce fuels and enhance wildlife habitat. The proposed action would thin or harvest about 25,500 acres of vegetation within the project area. A variety of tools may be applied through the use of timber sale contracts, stewardship contracts, service contracts, and Forest Service crews. Thinning trees would reduce the potential for large-scale MPB infestation and catastrophic wildfire by breaking up vegetation continuity, establishing fuel breaks, and improving stand growth and vigor.

Recreation and travel management would be guided by current Forest Plan direction. The majority of the project area would be open to off-road motorized travel. The existing motorized travel restrictions near the two botanical areas (McIntosh Fen and North Fork Castle Creek) would remain in effect. A number of existing roads would be closed, obliterated, or relocated in order to protect water/soil resources and special habitats.

Decision Framework

The Deerfield Project purpose and need provides the focus and scope of the proposal as related to the programmatic goals of the Forest Plan and the Phase I Amendment. Given the purpose and need, the Deciding Official (Forest Supervisor) 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 Deerfield Project Area.
- Whether or not the information in this analysis is sufficient to implement proposed activities.
- Which action, if any, to approve (decide which alternative or combination of alternatives to implement).
- Whether there is a need for amendments to the existing Forest Plan.

If any action alternative is selected, project implementation could begin in the Summer 2006 and most actions would be accomplished within a decade. Certain actions (such as fuel break maintenance) could last into the foreseeable future.

Public Involvement and Scoping

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 Deerfield 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 300 interested parties, including adjacent landowners on April 23, 2004. This letter included a description of the project area, and overview of the NEPA process, a general explanation of the proposed actions, and an invitation to comment.

Some respondents requested that the Forest Service conduct an Environmental Impact Statement (EIS) rather than an Environmental Assessment. The Deerfield ID Team and Responsible Official reviewed the scope of analysis and made the decision to proceed with an EIS. The Notice of Intent (NOI) to prepare an EIS was published in the *Federal Register* on Tuesday June 22, 2004. The NOI extended the comment period for the Deerfield Project Area for an additional 30-days beyond the original scoping letter dated April 23, 2004. During the scoping period the Forest Service received significant public response supporting the proposal and rationale for action (34 respondents provided 141 comments).

A Notice of Availability (NOA) for the Deerfield Draft Environmental Impact Statement (DEIS) was published in the *Federal Register* on August 19, 2005. This initiated the official public

comment period on the DEIS. This comment period ended October 3, 2005. Also, an Opportunity to Comment notice was published in the Rapid City Journal on August 19, 2005.

There was considerable public participation during the DEIS comment period. 13 individuals, groups or agencies submitted comment letters on the DEIS. All public input received during this time period was evaluated using a content analysis process. Over 200 comments were identified and responded to by the Deerfield Interdisciplinary Team. These comments and associated responses are located in Appendix A of this Final Environmental Impact Statement (FEIS).

No public comments on the DEIS generated the need for reanalysis or required major substantive changes to the DEIS. Based on comments to the DEIS, the ID Team has made factual and clarifying corrections in the FEIS, (see Appendix A).

Issues

Comments received during the scoping process were used to help define issues, develop alternatives and design criteria, and analyze effects. A total of 34 respondents provided 141 comments. Through review and analysis of the scoping comments, the Deerfield Project Area ID Team identified five prevailing or key issues related to the proposed activities. Comments received and the agency response to comments are summarized in the Deerfield Project File (Project File) located at the Mystic Ranger District office in Rapid City, South Dakota.

The key issues represent those needing special emphasis and/or received the most public and internal specialist attention during the scoping period. Key issues identified are also characterized by the need to address a broad based internal or external resource management concern, the need to meet National or Forest level direction, and the desire to address the purpose of and need for action within the Deerfield Project Area. A brief description of the five key issues follows:

Mountain Pine Beetle susceptibility

Mountain Pine Beetle populations have been increasing across the Black Hills over the past few years. One of the areas that has had the greatest intensity of beetle activity is south and west of Deerfield Reservoir. Ground surveys found 24 trees per acre killed on average over the last three years, with approximately 63% of these trees being currently infested within the southern end of the project boundary (RCSC-R2-03-04).

The present mountain pine beetle epidemic within the project area and its potential for expansion is a major focus of the Deerfield Project Area. Currently, 45% of pine stands within the project area are at moderate to high risk for mountain pine beetle susceptibility. The issue will be approached by emphasizing that insect infestation and subsequent mortality cannot be eliminated, but through vegetative treatments such as thinning potentially susceptible stands, the risk of stand mortality due to MPB will be reduced.

Comments and feedback during the public involvement phase of the project indicates that there is broad public support for addressing the mountain pine beetle epidemic utilizing active management practices including commercial and non-commercial mechanical tree thinning. In addition to

supporting management actions, the public advocates that implementation of these actions occur as soon as possible. One commentor questions whether the proposed thinning to reduce stand density will actually reduce mountain pine beetle susceptibility.

The parameters listed below are measurement indicators for the multiple aspects of the mountain pine beetle issue in the Deerfield Project Area. These indicators are representative of a number of variables associated with mountain pine beetle infestations. These measurement indicators are intended to provide the public and decision maker a basis for making a relative comparison between alternative resolutions regarding the potential of reducing mountain pine beetle infestation. A comparison between alternatives is displayed in table format at the end of Chapter 2 (see Table 2-1 and Table 2-2). 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.

- MPB Hazard Rating (acres now/acres in 20 years – see Appendix G, Maps 10 - 13)
- Low Hazard Rating (acres)
- Moderate Hazard Rating (acres)
- High Hazard Rating (acres)

Wildfire/fuels hazard

Wildfire (fire/fuel) hazards are of paramount concern with the public and the agency at this time. Current public attitude, and that of local, State, and Federal elected officials, is that the Forest Service should aggressively address fire and fuel risks on National Forest lands. Reduction of fuels to reduce wildfire hazard is also a concern within the project area. The increase in beetle activity within the project area has also increased dead fuels. A large, high intensity wildfire in the project area would threaten not only important ecosystem components on National Forest lands, but private lands as well. This issue has become more of a concern in recent years given the massive wildfires and drought conditions in the western United States in general and the Black Hills, specifically.

Prescribed fire can be an effective tool to reduce fuels and contribute to wildlife habitat. The public generally supports the use of prescribed burning, but some have concerns about the threat of an escaped fire, especially on to private property. Also, the Agency is always concerned about controlling the timing and amount of smoke from prescribed fire and, thus, takes measures to limit potential health effects and nuisance caused by the smoke.

Nationally, a series of initiatives and streamlining of processes related to fuels and fire hazard reduction has been made available for use at the local level to address this issue. In recognizing that no management action could completely eliminate the potential for wildfire in the area, the issue will be addressed in terms of reducing the potential for catastrophic crown fire on National Forest System lands and private land.

Comments and feedback during the public involvement phase of the project indicates that there is broad public support for dealing with fire/fuel hazard reduction using active management practices including prescribed burning and commercial and non-commercial thinning. One

commentor proposed allowing natural processes such as the current insect infestation(s) and natural wildfires to naturally thin stands, therefore reducing the fire/fuel hazard.

The parameters listed below are measurement indicators for the multiple aspects of the fire and fuel hazard reduction issue in the Deerfield Project Area. These indicators are representative of a number of variables associated with fuels and fire hazard reduction. These measurement indicators are intended to provide the public and decision maker a basis for making a relative comparison between alternative resolutions regarding fuels and fire hazard reduction. A comparison between alternatives is displayed in table format at the end of Chapter 2 (see Table 2-1and Table 2-2). 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.

- Crown Fire Hazard Rating (acres now/acres in 20 years – see Appendix G, Maps 14 - 17)
- Fuel Breaks (miles)
- Prescribed Burning (acres)
- Burn Days Required (days)
- Accessibility for Fire Suppression (road miles)

Biological Diversity

Specific public concerns regarding wildlife were limited to providing diversity of habitats across the landscape, protecting and expanding hardwoods, eliminating pine encroachment from meadows, and protecting late successional habitat. A concern was raised that efforts to suppress and prevent a potential insect infestation would result in reduced snag densities, tree diameters and longevity across the landscape. In addition, there was concern that efforts to reduce the potential for wildfire in the project area may negatively impact wildlife species by reducing the complexity and diversity of available habitat.

Generally speaking, there is public support for wildlife habitat even though many did not list this as a key issue. Measurement indicators are listed below for the varied aspects of the wildlife habitat issue. These indicators are represented by wildlife habitat components applicable to the Black Hills National Forest as specified in the Forest Plan. The components selected are representative of the broad range and condition of wildlife habitat existing in the Deerfield Project Area. These habitat components provide the public and decision maker a basis for making a relative comparison between alternative resolutions regarding wildlife habitat. A comparison between alternatives is displayed in table format at the end of Chapter 2 (see Table 2-1 and Table 2-2). 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 Wildlife and Botany section in Chapter 3 of this EIS.

- Ponderosa Pine Structural Diversity (acres)
- Late Successional (acres)
- Aspen/Oak/Meadow Communities (acres)
- Vertical Diversity (acres)
- Screening Cover (acres)
- Grass Forb Structural Stage (acres)

- American Marten Habitat with High Potential for Occupancy (acres)
- Snag Conditions (Excellent to Poor)
- Dead and Down Woody Material (Excellent to poor)
- Total Road Density (mile/square mile)
- Open Road Density (mile/square mile)

Socio-Economic Concerns

The Deerfield Project Area contains many distinctive features that visitors look for when visiting National Forest System lands – solitude, fishing, hunting, camping, hiking, and motorized and non-motorized travel within a short distance of town. The Deerfield Recreation Complex provides a developed recreation area for camping, water access to Deerfield Lake, and several trail access points for hiking. The project area also contains two botanical areas that provide unique wildlife, plant, and geological features.

The local public strongly supports using multiple management tools (including commercial timber harvest) to reduce the potential for insect/disease infestations and reducing the potential for large-scale wildfire. Public comments also support commercial harvest because it utilizes a renewable resource and provides a needed commodity, employs local residents, adds favorably to the local and State economy, is environmentally acceptable, and can make an important difference in quickly and effectively reducing insect/disease infestations and wildfire potential. The management area direction for the Deerfield Project Area include: 3.1 Botanical Areas - 1,267 acres, 5.1 Resource Production - 30,100 acres, 8.1 Developed Recreation Complexes - 4,738acres.

There were comments about the need to preserve the scenic beauty of the area, and to maintain the balance of the need for insect/fuel treatment with the amount of development / use within the recreation area. Some expressed concern about the lack of scenic diversity (similar stand structure) in treatment areas when viewed from various points of interest (Deerfield Trail, Custer's route through the Black Hills).

One commentor questions whether the proposed thinning to reduce stand density will actually reduce mountain pine beetle risk. This commentor prefers an approach of either no active management or the use of prescribed burning as the way to naturally thin stands. Generally, support for this approach is based on a belief that commercial timber harvest has negative environmental effects, could actually increase wildfire potential, and is not warranted from an economic perspective.

A comparison between alternatives is displayed in table format at the end of Chapter 2 (see Table 2-1 and Table 2-2). 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 Socio-Economic section in Chapter 3 of this EIS.

The parameters listed below are measurement indicators for various aspects of this socio-economic issue. These indicators are intended to provide the public and decision maker a basis for making a relative comparison between alternative resolutions regarding the social and economic concerns as related to the proposal and mountain pine beetle conditions in the project area.

- Total Cost (millions)
- Total Revenues (millions)
- Cost-Benefit Ratio
- MPB Hazard Rating (acres now/acres in 20 years – see Appendix G, Maps 10 - 13)
- Commercial Timber Volume Harvested
- Wildfire Hazard Reduction (Effectiveness of safeguarding the health, values and lifestyle of local residents and Forest users by reducing insect and wildfire hazard).

Recreation and Travel Management

An emerging issue in the Black Hills, as well as State and nation-wide, concerns travel management (road and off-road) non-motorized and motorized use. Although public scoping comments did not specifically mention this issue, internal scoping determined travel management a key issue. As such, each alternative has travel management as a component consistent with the alternative's overall theme (see Chapter 2, Alternatives Considered in Detail).

The parameters listed below are measurement indicators for the multiple aspects of the travel and recreation use issue. These indicators are intended to provide the public and decision maker a basis for making a relative comparison between alternative resolutions regarding travel and access for recreation purposes. A comparison between alternatives is displayed in table format at the end of Chapter 2 (see Table 2-1 and Table 2-2). 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 Travel and Recreation Use section in Chapter 3 of this EIS.

- Total Miles of Roads
- Miles of Roads Open
- Miles of Roads Closed
- Miles of Roads Decommissioned
- Miles of Roads Scheduled for Closure
- Miles of Roads Scheduled for Decommission

CHAPTER 2 ALTERNATIVES, INCLUDING THE PROPOSED ACTION

INTRODUCTION

This Chapter provides a detailed description of the proposed action (Alternative B), the preferred action (Alternative C) and another action alternative (Alternatives D), as well as a No Action alternative (Alternative A) for the Deerfield Project Area. Maps of each alternative considered in detail are located in Appendix G of this EIS.

This chapter presents the alternatives comparatively by both defining 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 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 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 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.

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 Deerfield 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 raised during scoping for this project. There would be no effort to modify existing vegetation or related fuels conditions in the project area. No changes would be made to the existing road system or the rules concerning motorized and non-motorized use of the area. However, ongoing fire suppression efforts, noxious weed treatments, and recurring road maintenance on system roads would continue as directed by the Forest Plan.

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 they would change, maybe dramatically. This is related to the actions of nature and to the actions of people. Natural processes would include growth of existing trees and regeneration of new conifer trees creating more dense and crowded stands; encroachment of conifers into hardwoods and meadows which could greatly decrease the amount of hardwoods in the area; an increased killing of pine by mountain pine beetles; accumulation of ground and ladder fuels, and increased potential for large-scale crown fires that could kill trees and other vegetation over a large area with substantial effects on wildlife habitat and populations. Human caused changes include an increase in housing developments on private land, expanded recreation use, and likely a large increase in motorized use and development of new user-created roads and trails.

The theme of this alternative would be to postpone management actions intended to move resource conditions toward the Goals and Objectives of the Forest Plan (e.g. insect and disease reduction, fire hazard and fuels reduction, resolving travel management issues) within the Deerfield Project Area. This alternative is specifically characterized by:

- No vegetative treatments to reduce insect/disease infestations beyond current small-scale localized sanitation efforts approved under other management decisions
- No hazard/fuels reduction treatments
- No prescribed burning except for the small amount already approved in the area
- No changes to roads, access, and travel management rules (except for closures and decommissions based on past management decisions)
- Continue routine maintenance of roads and road improvements
- Roads open – 200 miles
- Roads closed – 28 miles
- Roads scheduled to be closed based on past management decisions – 31 miles
- Roads scheduled for decommission based on past management decisions – 14 miles
- Private roads – 19 miles

Alternative B – Proposed Action

Alternative B was developed in response to the purpose and need for action. This alternative is the Forest Service proposed action (see description of the purpose and need plus the proposed action in Chapter 1 of this EIS). Alternative B is designed to aggressively treat the vegetation to reduce the potential for Mountain Pine Beetle (MPB) infestations, and the potential for severe large-scale crown fires. It also includes fuel breaks along all private property boundaries. Alternative B proposes a substantial expansion of hardwoods and reduces pine encroachment into historic meadows, thereby improving biodiversity and wildfire suppression capabilities within the Deerfield Project Area. Travel management would be guided by existing Forest Plan guidelines. Opportunities would be pursued to develop motorized and non-motorized trail systems in the project area utilizing partnerships wherever possible.

Vegetative management in this alternative is characterized by three basic types of treatment. These treatments include thinning of pine stands with associated fuels reduction, restoration and expansion of hardwoods and meadows by conifer removal, and overstory removal of conifers to

increase the growth and health of young trees. This would be accomplished using commercial harvest contracts wherever possible in order to improve the economic viability of the operation. Non-commercial contracts or Forest Service work crews would be used to thin trees and reduce fuels in areas where commercial contracting is not feasible. A new type of contract – referred to as Stewardship Contracting – would be used where possible to bridge the gap between commercial and non-commercial activities. Both commercial and non-commercial treatments could be used; for example, a commercial thinning operation and non-commercial thinning of smaller trees would occur at the same time. The amounts of commercial and non-commercial acres are based on estimates at this time. The result, however, will be to maximize the economic efficiency of the overall operations through whatever contracting mechanisms are available.

Fuel breaks would be constructed along private land boundaries by thinning conifers approximately 200-300 feet wide strip in these areas, as needed. These fuel breaks are intended to moderate the effects of a wildfire moving onto or away from private land by providing a defensible line/space. Also included is a considerable amount of prescribed burning (approximately 7,000 - 10,000 acres). This burning would meet a number of objectives: reduce fuels within natural and constructed fuel breaks, and within other thinned areas; reduce the amount of pine regeneration; improve fire dependent plant and animal habitat; and return fire to its natural role in the ecosystem.

Recreation and travel management would be guided by current Forest Plan guidelines. On and off-road (cross-country) motorized travel is designed to meet Forest Plan Management Area guidelines. Management Area 5.1 dominates the Deerfield Project Area; the majority of the project area would be open to cross-country motorized travel, off existing roads and trails. The existing motorized travel restrictions near the two botanical areas would remain in effect, even though they include a portion of Management Area 5.1. A number of existing roads would be closed, decommissioned, or relocated in order to protect water/soil resources and special habitats.

See Table 2-1 and Table 2-2 at the end of this chapter for a comparison of alternatives. Appendix G, Maps 4 through 21 display the location of vegetation treatments, fuels reduction and prescribed fire activity, and travel management. Design criteria, mitigation and monitoring specific to this alternative are described in Appendix B and C. Specific actions planned and treatment activities in Alternative B include:

Commercial Harvest Treatment (14,500 acres)

- Thinning – 9,500 acres
- Overstory Removal – 3,000 acres
- Hardwoods (conifer removal) – 1,300 acres
- Meadows (conifer removal) – 900 acres

Non-commercial Treatments (22,000 acres)

- Thinning – 16,800 acres (includes 740 acres of non-commercial fuel breaks)
- Hardwoods (conifer removal) – 1,300 acres
- Meadows (conifer removal) – 3,800 acres

Total area of commercial and non-commercial treatment – 25,500 acres[1]
[1]Area total not additive due to treatment area overlap.

Volume of timber and other products removed

- Volume of sawtimber removed – 47 MMBF (94,000 CCF)
- Volume of products (pole timber) removed – 35,000 CCF

Other Treatments

- Constructed Fuel Breaks along Private Property – 60 miles
- Prescribed burning – 7,000 - 10,000 acres

Travel Management and Road Work

- Roads open – 195 miles
- Roads closed – 32 miles
- Roads to be decommissioned – 6 miles
- New road construction – 5 miles
- Road reconstruction – 38 miles
- Pre-use maintenance – 132 miles
- Roads scheduled to be closed based on past management decisions – 31 miles
- Roads scheduled for decommission based on past management decisions – 14 miles
- Private roads – 19 miles

Forest Plan Amendments

During analysis, the ID Team identified the need for some site-specific Forest Plan amendments to fully implement this alternative. Effects of implementing each alternative, including amendments, is presented in Chapter 3. The following is a brief description of each situation that would require an amendment.

- Removal of MPB infested trees in Management Area 8.2: MA 8.2 includes developed recreation complexes on the Forest, which are managed for recreational opportunities and visual qualities adjacent to developed recreation sites and bodies of water. Recreation activities occur in structured settings characterized by scenic beauty. Forest Plan direction is to remove dead trees that present an immediate hazard for developed recreation users (Standard 8.2-3202), but leave standing dead in other parts of the developed recreation area. This alternative would leave existing dead trees but would remove any actively infested MPB trees in an effort to limit the spread of MPB. These infested trees are in the process of dying and, if not removed, would remain standing dead until they fall to the ground. A Forest Plan Amendment would be required to remove MPB infested pine trees.
- Marten: Forest Plan Standard 3215 requires maintaining certain spruce and adjacent pine stands to provide for American marten habitat. This alternative includes some treatments in suitable American marten habitat in pine stands (43 acres) and white spruce stands

(374 acres) in an effort to reduce MPB expansion. Such treatments do not meet Standard 3215 and would require a Forest Plan amendment if this alternative were selected.

- Goshawk: Recent MPB infestations and wildfires have negatively affected or destroyed numerous goshawk nest stands and PFAs (post fledging areas) across the Forest. The Forest Plan includes Standards and Guidelines treated as Standards for nest stands and PFAs. These Standards and Guidelines treated as Standards provide for nesting habitat, and a mixture of habitat structural stages in ponderosa pine adjacent to nest stands to provide areas for goshawk feeding after the young leave the nest. This alternative would reduce the amount of closed, mature stands and replace them with more open stands in an effort to reduce MPB expansion and crown fires. Such treatments would reduce suitability of nest stands, and would not move toward the desired mix of vegetation structural stages for goshawk PFAs. This alternative would require Forest Plan amendments for Standard 3109, and Guidelines 3110 and 3112 (treated as Standards) for nest stands, and Guideline 3114 (treated as a Standard) for PFAs
- Big Game: There are a number of Forest Plan Standards and Guidelines treated as Standards that apply to big game. Generally, factors that affect big game include the amount and juxtaposition of forage and cover, as well as open road density. Some Standards concern seasonal habitats used by big game. Alternative B provides abundant forage with lesser amounts of cover, and provides little reduction in open road density. Meeting Forest Plan Guidelines treated as Standards for big game is particularly difficult for MA 8.2, which contains a large portion of the open grasslands in Reynold's Prairie and thus does not provide cover, as well as roads that access developed recreation sites. Alternative B is not consistent with Guidelines 5.1-3201 and 8.2-3203 (both treated as Standards), and would require Forest Plan amendments. Specifically, this alternative would not maintain or move toward habitat effectiveness requirements for white tailed deer and elk habitat effectiveness in the winter in MA 5.1, and for white tailed deer in winter and summer, mule deer in summer and winter, and elk in winter in MA 8.2.

Alternative C

This alternative focuses on reducing MPB and wildfire hazard but with an additional emphasis on issues related to biodiversity and special habitat protection. It seeks to insulate the McIntosh Fen and North Fork Castle Creek Botanical Areas from catastrophic fire effects. It is less aggressive in treating dense pine stands, including less overall acres and strives for more variable forest stand basal areas. Alternative C is more aggressive in enhancing hardwoods, especially in spruce dominated stands on the south side of Castle Creek. Alternative C generally leaves trees greater than 16 inches in diameter within commercial thinning areas. There is no size limit restriction for harvest treatments associated with meadows, hardwoods, and overstory removals. This alternative proposes similar amounts of non-commercial thinning as Alternative B. Many of these acres would overlap commercial treatments.

Alternative C has more prescribed burning than Alternatives B and D given the emphasis towards biodiversity. Burning is intended to provide multiple benefits: provide for biodiversity and wildlife habitat; limit fuel loads and lessen wildfire hazards; and re-establish fire and its natural role in the environment. Mechanical fuel breaks, about 200-300 feet wide, would be constructed along some private land boundaries, in lesser quantity than proposed in Alternative B.

Travel management in Alternative C recognizes the broad spectrum of recreation and travel uses in the project area. There would be no off-road (cross country) motorized use. Motorized travel would be restricted to designated routes only. This alternative includes additional road closures and decommission to that contained in Alternative B. These additional changes are intended to reduce overall road densities to benefit wildlife habitat and to provide walk-in recreation opportunities. Opportunities to develop motorized and non-motorized trail systems and areas within the project area utilizing partnerships would be pursued wherever possible.

See Table 2-1 and Table 2-2 at the end of this chapter for a comparison of alternatives. Appendix G, Maps 4 through 21 display the location of vegetation treatments, fuels reduction and prescribed fire activity, and travel management. Design criteria, mitigation and monitoring specific to this alternative are described in Appendix B and C. Specific actions planned and treatment activities in Alternative C include:

Commercial Harvest Treatment (11,000 acres)

- Thinning – 7,300 acres
- Overstory Removal – 800 acres
- Hardwoods (conifer removal) – 1,500 acres
- Meadows (conifer removal) – 1,400 acres

Non-commercial Treatments (18,100 acres)

- Thinning – 12,100 acres (includes 400 acres of non-commercial fuel breaks)
- Hardwoods (conifer removal) – 1,500 acres
- Meadows (conifer removal) – 4,500 acres

Total area of commercial and non-commercial treatment – 21,100 acres[1]
[1]Area total not additive due to treatment area overlap.

Volume of timber and other products removed

- Volume of sawtimber removed – 20 MMBF (40,000 CCF)
- Volume of products (pole timber) removed – 26,000 CCF

Other Treatments

- Constructed Fuel Breaks – 50 miles
- Prescribed burning – 10,000 – 14,000 acres

Travel Management and Road Work

- Roads open – 155 miles
- Roads closed – 53 miles
- Roads to be decommissioned – 25 miles
- New road construction – 5 miles

- Road reconstruction – 37 miles
- Pre-use maintenance – 129 miles
- Roads scheduled to be closed based on past management decisions – 31 miles
- Roads scheduled for decommission based on past management decisions – 14 miles
- Private roads – 19 miles

Forest Plan Amendments

During analysis, the ID Team identified the need for some site-specific Forest Plan amendments to fully implement this alternative. Effects of implementing each alternative, including amendments, is presented in Chapter 3. The following is a brief description of each situation that would require an amendment.

- Removal of MPB infested trees in Management Area 8.2: MA 8.2 includes developed recreation complexes on the Forest, which are managed for recreational opportunities and visual qualities adjacent to developed recreation sites and bodies of water. Recreation activities occur in structured settings characterized by scenic beauty. Forest Plan direction is to remove dead trees that present an immediate hazard for developed recreation users (Standard 8.2-3202), but leave standing dead in other parts of the developed recreation area. This alternative would leave existing dead trees but would remove any actively infested MPB trees in an effort to limit the spread of MPB. These infested trees are in the process of dying and, if not removed, would remain standing dead until they fall to the ground. A Forest Plan Amendment would be required to remove MPB infested pine trees.
- Marten: Forest Plan Standard 3215 requires maintaining certain spruce and adjacent pine stands to provide for American marten habitat. This alternative includes treatment of some spruce and pine stands (199 acres) within marten habitat in an effort to enhance hardwoods, provide habitat for beaver, and the restoration of the McIntosh Fen Botanical Area. Such treatments are not compatible with Standard 3215 and would require a Forest Plan amendment if this alternative were selected.
- Big Game: There are a number of Forest Plan Standards and Guidelines treated as Standards that apply to big game. Generally, factors that affect big game include the amount and juxtaposition of forage and cover, as well as open road density. Some Standards concern seasonal habitats used by big game. Alternative C provides abundant forage with lesser amounts of cover, and provides little reduction in open road density. Meeting Forest Plan Guidelines treated as Standards for big game is particularly difficult for MA 8.2, which contains a large portion of the open grasslands in Reynold's Prairie and thus does not provide cover, as well as roads that access developed recreation sites. Alternative C is not consistent with Guideline 8.2-3203 (treated as a Standard), and would require a Forest Plan amendment. Specifically, this alternative would not maintain or move toward habitat effectiveness requirements for white-tailed deer, mule deer, and elk habitat effectiveness in the winter in MA 8.2.

Alternative D

This alternative takes a limited approach in addressing the purpose and need, which is keyed to MPB and fuel hazard reduction. Alternative D was developed in response to the view expressed by some during scoping that MPB and wildfire hazard reduction can be accomplished with limited commercial timber harvest. This alternative emphasizes denser stands, retaining larger diameter trees, and providing habitat for wildlife that benefit from dense stands. This alternative would limit pine harvest to trees less than or equal to 16 inches in diameter. There would be no overstory removals. This alternative includes less non-commercial thinning than the other action alternatives.

Prescribed burning would be conducted on fewer acres than Alternative B and C. Only acres that have been mechanically treated would be burned. Mechanical thinning and associated fuel reduction is often needed prior to burning in order to achieve safe and effective burning. Fuel breaks, approximately 200-300 feet wide along private land boundaries, would be limited to those areas immediately adjacent to existing homes and structures.

Travel management in Alternative D emphasizes non-motorized use. Travel management is characterized by considerable road closures in support of a non-motorized use experience and wildlife security. There would be no off-road (cross-country) motorized use; motorized travel would be restricted to designated routes only. Opportunities would not be pursued to develop motorized and non-motorized trail systems in the project area.

See Table 2-1 and Table 2-2 at the end of this chapter for a comparison of alternatives. Appendix G, Maps 4 through 21 display the location of vegetation treatments, fuels reduction and prescribed fire activity, and travel management. Design criteria, mitigation and monitoring specific to this alternative are described in Appendix B and C. Specific actions planned and treatment activities in Alternative D include:

Commercial Harvest Treatment (3,700 acres)

- Thinning – 2,000 acres
- Hardwoods (conifer removal) – 900 acres
- Meadows (conifer removal) – 800 acres

Non-commercial Treatments (11,000 acres)

- Thinning – 6,500 acres (includes 98 acres of non-commercial fuel breaks)
- Hardwoods (conifer removal) – 900 acres
- Meadows (conifer removal) – 3,600 acres

Total area of commercial and non-commercial treatment – 11,700 acres[1]
[1]Area total not additive due to treatment area overlap.

Volume of timber and other products removed

- Volume of sawtimber removed – 7 MMBF (14,000 CCF)
- Volume of products (pole timber) removed – 7,300 CCF

Other Treatments

- Constructed Fuel Breaks – 14 miles
- Prescribed burning – 3,500 acres

Travel Management and Road Work

- Roads open – 126 miles
- Roads closed – 45 miles
- Roads to be decommissioned – 59 miles
- New road construction – 2 miles
- Road reconstruction – 24 miles
- Pre-use maintenance – 108 miles
- Roads scheduled to be closed based on past management decisions – 31 miles
- Roads scheduled for decommission based on past management decisions – 14 miles
- Private roads – 19 miles

Forest Plan Amendments

During analysis, the ID Team identified the need for some site-specific Forest Plan amendments to fully implement this alternative. Effects of implementing each alternative, including amendments, is presented in Chapter 3. The following is a brief description of each situation that would require an amendment.

- Removal of MPB infested trees in Management Area 8.2: MA 8.2 includes developed recreation complexes on the Forest, which are managed for recreational opportunities and visual qualities adjacent to developed recreation sites and bodies of water. Recreation activities occur in structured settings characterized by scenic beauty. Forest Plan direction is to remove dead trees that present an immediate hazard for developed recreation users (Standard 8.2-3202), but leave standing dead in other parts of the developed recreation area. This alternative would leave existing dead trees but would remove any actively infested MPB trees in an effort to limit the spread of MPB. These infested trees are in the process of dying and, if not removed, would remain standing dead until they fall to the ground. A Forest Plan Amendment would be required to remove MPB infested pine trees.
- Big Game: There are a number of Forest Plan Standards and Guidelines treated as Standards that apply to big game. Generally, factors that affect big game include the amount and juxtaposition of forage and cover, as well as open road density. Some Standards concern seasonal habitats used by big game. Alternative D provides abundant forage with lesser amounts of cover, and provides little reduction in open road density. Meeting Forest Plan Guidelines treated as Standards for big game is particularly difficult for MA 8.2, which contains a large portion of the open grasslands in Reynold's Prairie and

thus does not provide cover, as well as roads that access developed recreation sites. Alternative D is not consistent with Guideline 8.2-3203 (treated as a Standard), and would require a Forest Plan amendment. Specifically, this alternative would not maintain or move toward habitat effectiveness requirements for mule deer and elk in the winter in MA 8.2.

ACTIVITIES COMMON TO ALL ACTION ALTERNATIVES

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

Maintenance of Vegetative Conditions

All alternatives envision additional, unspecified treatments in approximately 15 to 20 years in the future to maintain vegetative conditions created by proposed treatments. Analysis indicates that after approximately 20 years, new pine growth would return the area to similar conditions to that which exists today, and additional vegetative treatments such as commercial and non-commercial mechanical treatments and prescribed burning may again be necessary. Although this project does not prescribe when or where such treatments might occur, all action alternatives envision the need for continued thinning to maintain reduced levels of crown fire hazard.

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 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. Reviews would be documented during and upon project completion.

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 Deerfield Project Area Monitoring Plan in Appendix C.

ALTERNATIVES CONSIDERED but ELIMINATED FROM DETAILED STUDY

A wide range of alternatives, using different approaches to address the purpose and need, are presented in this EIS. An overview of alternatives considered and reasons for eliminating them from detailed study is presented below.

Limited Thinning and Harvest

One scoping respondent submitted a list of eight alternatives for consideration. Some elements of these suggested alternatives have been incorporated into the alternatives evaluated in this EIS. Other elements have not. For clarity, each suggested alternative is presented here and an explanation provided as to whether it has been included for further analysis or eliminated.

- **An alternative that does not harvest or thin any stands of structural stage 4C and 4B**. Alternative D would not thin in structural stage (SS) 4C stands. All action alternatives, however, include harvest or thinning of SS 4B stands. An alternative that does not harvest any SS 4B would not meet the purpose and need of reducing the potential for large scale MPB infestation (RCSC-6-04, FVS- project file). SS 4B stands are the largest single structural stage category within the Project Area, constituting about half of all the pine stands. Most of these stands currently have a moderate to high risk for MPB infestation and crown fire hazard. Further growth of these stands will increase this risk and hazard. Therefore, an alternative that does not thin in SS 4B would not meet the purpose and need and has been eliminated from detailed study.
- **An alternative that addresses fragmentation concerns on the BHNF**. Fragmentation and connectivity was discussed in the Revised Forest Plan EIS III-247-276. This area was naturally fragmented prior to Euro-American settlement, and many species benefit or depend on vegetation patterns that some would refer to as fragmentation. The alternatives considered in this EIS would result in a wide range of vegetation patch sizes and tree sizes on the landscape, thereby addressing fragmentation to varying degrees. In the short term, Alternative A (No Action) and Alternative D, would result in larger patches of more dense, mature pine; whereas Alternatives B and C would favor more open pine stands intermixed with smaller, denser patches. In the longer term, these vegetation patterns would change due to natural growth and disturbance patterns such as MPB infestations and wildfire. An alternative designed to specifically address fragmentation was dismissed from further consideration because the issue is covered by the wide range of vegetation patterns that would result from Alternatives A, B, C and D. Further, an alternative focusing only on fragmentation - without consideration of the need to reduce MPB risk and crown fire hazard - would not meet the purpose and need.
- **An alternative that proposes no overstory removal to retain large diameter trees**. Alternative D contains no overstory removal treatments.

- **An alternative that does not allow harvesting of trees greater than 10" in diameter …to ensure an adequate amount of larger diameter trees are retained for future snag creation and for species dependent upon larger diameter trees.** Alternative C contains a provision that would limit the number of trees harvested that are greater than 16" in diameter, depending on the type of treatment, and Alternative D precludes the harvest of any trees greater than 16" in diameter for certain treatments. These design standards would maintain large diameter trees on the landscape for future snags and wildlife habitat. Dense stands in the 7-13 inch diameter range are at a higher risk of MPB infestation (Forest Health Evaluation R2-05-01 2004). Leaving all trees 10 inches in diameter and above would leave much of the area at a moderate to high risk for MPB infestation and crown fire hazard. The upper diameter limit of 10"(inclusive) was modeled using the Forest Vegetation Simulator (FVS) when analyzing an alternative that leaves all trees greater than 10". FVS is a model used for predicting forest stand dynamics that is used extensively in the United States. We were unable to achieve the desired stand density in most of the treated stands by leaving all trees greater than 10" dbh. (FVS - project file). An alternative that limits harvest to trees less than or equal to 10" in diameter would not meet the purpose and need and was, therefore, eliminated from detailed study.
- **An alternative that decommissions the maximum amount of roads and ways possible within the project area.** All action alternatives include a reduction in the amount of roads within the project area. Alternative D includes provisions to substantially reduce the amount of roads, eliminate all off-road motorized use, and reject any proposals to develop motorized trails within the project area.
- **An alternative that proposes to designate all management area prescription ("MAP") 5.1 [**Resource Production Emphasis] **within the project area as MAP 4.1** [Limited Motorized Use and Forest Product Emphasis]**.** A site-specific Forest Plan amendment would be needed to designate MAP 5.1 as MAP 4.1. The ID Team and Responsible Official reviewed the current allocations (management area prescriptions) and did not identify any need for change at this time. Alternatives C and D include provisions to limit motorized use to designated routes. Alternatives C and D propose to close and/or obliterate roads within the two botanical areas to expand non-motorized recreation opportunities. The Deerfield Recreation Complex (MAP 8.2) also provides non-motorized dispersed recreation opportunities. The alternatives analyzed provide a range of options relative to limiting motorized use. Thus a change of MA to address this issue was deemed unnecessary.
- **An alternative that designates all stands of structural stage 4C as MAP 3.7.** A site-specific Forest Plan amendment would be needed to designate structural stage (SS) 4C to MAP 3.7 (Landscape Old Growth). The ID Team and Responsible Official reviewed the current allocations (management area prescriptions) and did not identify any need for change at this time. Structural stage 4C stands are more susceptible to MPB infestation due to their overall density and closed canopies. Alternatives C and D contain provisions to retain larger diameter trees on the landscape for future snags and wildlife habitat and Alternative D does not propose treatments in SS 4C. Alternative A (No Action) addresses a portion of this proposed alternative with no timber harvest or vegetative treatments.

- **An alternative that proposes only road decommissioning and closure, but no timber harvesting, thinning or other vegetation treatment.** There is an ongoing MPB epidemic within the general area and strong public sentiment that the Black Hills National Forest needs to take action to minimize the spread of MPB infestations. Many of the stands within the Deerfield Project Area are at high risk of MPB infestation and the main focus of the purpose and need is to take action to limit the spread of MPB. Alternative A (No Action) addresses a portion of this proposed alternative – no timber harvest or vegetative treatments and closes roads based on past management decisions. However, an alternative that does not include any vegetation treatment would clearly not meet the purpose and need, and therefore has been eliminated from detailed study.

Historic Condition – Range of Natural Variability

During scoping a respondent recommended that the natural variability of the forest in this area be determined, and management practices be developed to achieve a random mosaic of diverse stand types and densities mimicking that which would result from natural disturbance processes. The stated goal would be to create a forest condition that could accept prescribed fire as a future management tool.

The concept of managing within the range of natural variability is based on an assumed range of conditions that existed prior to Euro-American settlement. One of the problems with this approach is in defining that range, which likely was quite large depending upon climatic and other factors. Frequent wildfire and episodic insect outbreaks were the main change agents affecting the vegetation pattern in the Black Hills. Vegetation patterns varied over the landscape with time. A snapshot in time of the conditions that existed in portions of the Deerfield Project Area can be seen in the photographs contained in *Exploring with Custer, the 1874 Black Hills Expedition (Grafe and Horsted, 2002).* This document includes twelve photos within the Project Area taken during the 1874 Custer Expedition and compares them to the same areas as they appear today. The difference in the vegetation between then and now is striking. The historic photos show far fewer pine trees, and more hardwoods and openings—the obvious effects of frequent and, in places, large fires on the landscape. The difference between then and now is largely the result of wildfire suppression and management activities over the past century.

The ID Team's interpretation of historic conditions in this area would include fewer pine trees, more open grown pine stands, more grasslands and hardwoods, larger openings, and higher numbers of snags. It would also include, in places, dense stands of small and larger diameter trees. Historically, these conditions evolved over millennia through wildfire and insect infestations. Today, conditions have dramatically changed due to heavy private land settlement throughout the Hills, the development of roads, powerlines and other infrastructure, suppression of wildfires, and various management actions. As a result, wildfire and insect outbreaks are still important but cannot be allowed to go unchecked. Management tools such as thinning, harvest and prescribed burning can be used to mimic but not replicate these "natural" conditions.

The Forest Plan EIS specifically examined a "Natural Variability" alternative (FPEIS II-19). That analysis determined that achieving pre-settlement conditions was not compatible with other

Forest Plan goals and objectives, and the alternative was eliminated from further analysis. For the same reason, a pure "Natural Variability" alternative has been eliminated from detailed study in the Deerfield Project. However, each of the Action Alternatives includes activities that would move the area closer to pre-settlement conditions to varying degrees. This includes expanding hardwoods and grasslands, lowering the density of some pine stands, using prescribed fire as a management tool, and reducing the amount of roads (in Alternatives C and D).

Maximize Prescribed Burning

Comments were made during scoping (both internally and externally) that an alternative be developed that maximizes prescribe burning. There are numerous benefits to prescribed burning—for example, it adds nutrients to the soil, increases forage, produces snags, opens up stands, regenerates hardwoods and other fire dependent species, and reduces fuel loading that can lead to large scale wildfire. The ID Team developed a preliminary alternative that would prescribe burn nearly all of the project area over an approximate ten year time period. Burning on such a large scale was considered impractical due to cost, limited suitable burning conditions, and the large amount of burning needed in other areas on the Forest. For these reasons, the preliminary alternative was dropped from detailed study. The Action Alternatives propose a wide range of prescribed burning.

COMPARISON OF ALTERNATIVES

This section presents a brief comparative discussion of the four 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 Table 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 Deerfield Project Area are more completely described in Chapter 3 of this EIS and information contained in the Project File.

MPB Susceptibility

Mortality from insects and disease in treated areas of low density is generally low and can be attributed to moderate stocking levels below thresholds favorable to MPB buildups. Generally, stands of sawtimber size pine greater than 120 BA are considered highly susceptible to MPB infestations. (Schmid RM-529) Recent work has shown that areas treated to 60 basal area can be expected to reach high hazard (120 basal area) again in about 25-50 years. Stands treated to 80 basal area can reach 120 basal area in 13-36 years, and stands treated to only 100 basal area will be back to 120 basal area in 9-16 years. The timeframes of when a forest can increase in hazard level are relatively short, often shorter than the time between treatments in a stand. Stands were rated using research work done by John Schmid (RM-529).

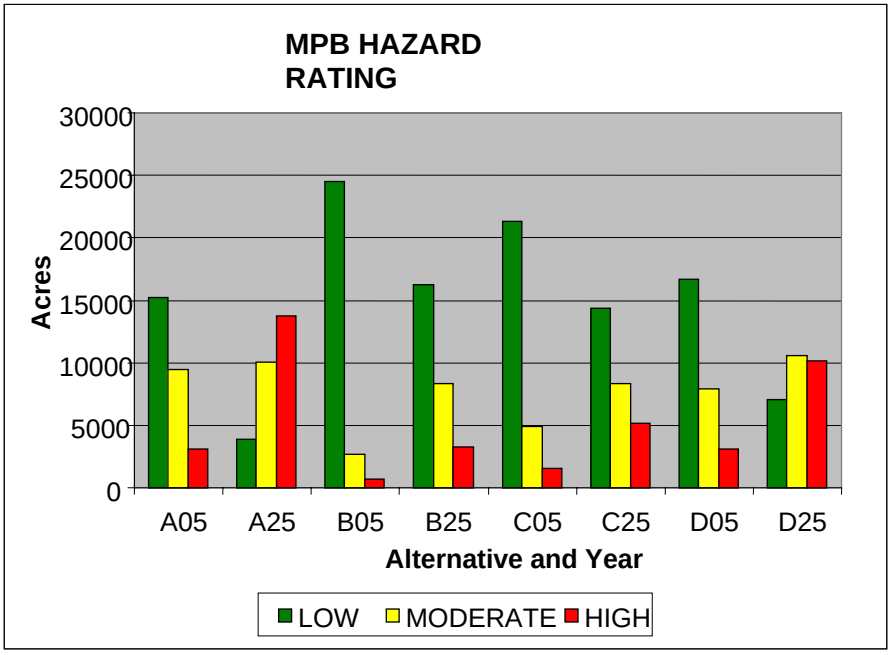
Currently 34% of the project area is in moderate and 11% in the high-risk rating. Twenty years later the MPB risk hazard will be 49% in high and 36% in moderate for the no action alternative.

The effect of Alternative B on the current risk of MPB infestation will be very positive and further improve the overall risk rating to low. The protection provided for the area will extend into the next two decades and will remain low for much of that time. The lower mountain pine beetle risk is a result of reducing basal areas well below the levels preferred by pine beetle. Alternative B is more favorable than all other alternatives in reducing MPB risk both immediately after treatment and up to 20 years. There will be a reduction of 9,064 acres of stands from a risk rating of high/moderate to low. Upon completion of the treatments, there will be 9% of the area in a moderate and 2% in the high-risk rating (see Figure 2-1 below).

The effect of Alternative C on the current risk of Mountain Pine Beetle (MPB) infestation will be very positive and further improve the overall risk rating to low. The protection provided for the area will extend into the next decade and will remain low for much of that time. The lower mountain pine beetle risk is a result of reducing basal areas below the levels preferred by pine beetle. Alternative C is less favorable than Alternative B and more favorable than Alternative D in reducing MPB risk, especially in out years. There will be a reduction of 5,217 acres of stands from a risk rating of high/moderate to low. Upon completion of the treatments, there will be 19% of the area in a moderate and 6% in the high-risk rating category.

The effect of Alternative D on the current risk of Mountain Pine Beetle (MPB) infestation will be positive, but far less than the other action alternatives. The protection provided for the area will be short term however; within 20 years the rating will be higher than today. The move to a high-risk rating is because the non-commercially thinned stands will reach densities favored by MPB, generally over 120 basal area (BA). Alternative D is more favorable than Alternative A in reducing MPB risk, but when compared to Alternative C and especially Alternative B, Alternative D has a far less positive effect on MPB risk in out years. There will be a reduction of 1,500 acres of stands from a risk rating of high/moderate to low following the proposed treatments. Upon completion of the treatments, there will be 28% in moderate and 11% in high-risk rating category.

Figure 2-1 Mountain Pine Beetle Years 2005-2025



Wildfire/fuels Hazard

The Deerfield Project Area vegetation has deviated from its historical fire frequency by multiple fire return intervals. Most of the area is outside of its historical range of variability and can be classified as Condition Class 3, Fire Regime I or III. This has resulted in a forest much more dense and uniform than in the past. The forest would continue to deviate from its historical range in Alternative A with the forest becoming denser, more multi-storied and more susceptible to catastrophic fire.

It is not possible to prevent a large wildfire from occurring in the project area. The alternatives for the Deerfield Project have been evaluated on their effectiveness in reducing the potential for a large, high intensity crown fire. Alternatives B, C and D would help reduce the potential of a catastrophic fire by moving the forest closer to a Condition Class 1 or 2, by thinning the forest and by removing or treating some of the surface fuels, and by use of prescriptive fire. They would also reduce the impacts that a large fire would have on the ecosystem. Alternative B would have the greatest effect on reducing crown fire potential. This alternative would treat more of the forest and manage the forest at a lower density. Treatments would be at a landscape basis and designed so that it would complement existing features such as Castle Creek, Deerfield Reservoir, Hughes Draw, Lookout and Bombard Prescribed Burns, Reynolds Prairie, and North Fork of Castle Creek to reduce the potential of a large, catastrophic fire. Not all of the forest would be treated and portions of the area would continue to be managed at higher densities to provide habitat for goshawks, pine martens, snails and other species of interest or concern, for hiding or thermal cover and for old growth or late successional species. Some sites would be managed for regeneration and smaller trees. While these sites are susceptible to intense wildland fires, they would not exist in large contiguous blocks and are often adjacent to more open, less fire prone sites.

All three alternatives would provide for various intensities of fuel breaks around private property. The boundaries between the National Forest and private lands were evaluated to determine if they needed fuel breaks or if the forest should be thinned to provide protection from wildland fires. Treatments are more intensive with Alternative B and C in anticipation of continued rural development of private lands, and thus the need to protect the National Forest and vice-versa from ignitions. Alternative D's efforts are concentrated around existing private land structures where they adjoin the National Forest.

Prescribed burning has proven to be effective in reducing large wildfire intensities when completed on a landscape basis, and some studies have shown strategic placement of burn blocks will enhance their effectiveness against spreading fires. Alternative B would be the most effective in reducing the vulnerability to catastrophic fires because the burn units were designed to complement existing features and manage the forest on a landscape basis. In addition, the prescribed burning would be complemented with non-commercial and commercial thinning. Some of the beneficial effects from prescribed fire would be short term and begin to diminish as regeneration becomes established and natural fuels begin to accumulate. Additional burns or follow-up vegetative thins would need to be scheduled at recurring intervals to maintain the beneficial effects. It is estimated that a 20 year cycle for the next use of prescribed fire would be useful. The effectiveness of a large scale prescribed burn program in the Deerfield Project Area would be constrained by the amount of

future development that may occur in and adjacent to the project area, and burn plan development would need to be dynamic to appropriately deal with such changes. Prescribe burns may increase in level of risk and be more expensive to complete should rural development intensify in numbers and values. The number of acres burned per day may need to be reduced to avoid possible impacts to air quality, which may increase costs.

Alternative D would not treat as many acres as Alternative C and proposes limited prescribed burning after vegetative thins. In addition, the forest would be managed at higher densities. All of these factors would limit any beneficial effect that this alternative would have on fire and fuels.

Alternative A's travel management plan would have no impact on the access or response time to wildfires since existing condition is left unchanged. Alternative B provides the best access and response times to fires, and its road and trail network would provide a good infrastructure of potential control lines for wildfire and prescriptive fire use. Alternative C and D have increasing levels of delays brought by closed or decommissioned roads with regards to wildfire suppression response. It was estimated that a 15 and 20 minute increase respectively in response times would occur with Alternatives C and D, but that is not considered unworkable by suppression experts. The significant reduction in roads and trails as proposed in Alternative D is going to increase costs of implementing prescribed fires since more control lines will need to be constructed, and potentially may prevent control of some wildfires since a network of open and closed routes would not be as substantial as with Alternatives B and C.

Biological Diversity

Changes in wildlife habitat will occur in the Deerfield Project Area regardless of which alternative is selected, including the No Action Alternative. The vegetation structure of ponderosa pine habitats is dynamic and will continue to change over time, even with the No Action Alternative, through growth and other natural events like wildfire and insect outbreaks. Now-open canopied stands will trend toward more closed canopied structure, and stand densities and diameter classes will increase overall. Growth will slow in now-closed canopied stands, and they will become decadent, with higher mortality and susceptibility to insects, disease, and catastrophic wildfire. The overall short-term trend will be towards later successional stages in Alternative A, and species associated with such habitats would be favored. If the current MPB activity continues, or if large-scale wildfire occurs, the overall long-term trend for Alternative A would be towards early successional habitats.

Commercial harvest treatments will set back succession and the overall trend will be toward early seral stages of ponderosa pine in Alternatives B and C, and to a lesser extent Alternative D. Treatments to closed canopied stands will open the canopy, and stand densities and diameter classes will be reduced overall. The individual stands and the landscape would be less susceptible to insect, disease, and wildfire as a result of proposed commercial harvest treatments. Minimal commercial harvest is proposed in Alternative D, and overstory structure would remain even in non-commercially treated stands. Species associated with early seral pine habitats would benefit from treatments proposed in Alternative B and Alternative C, at the expense of species associated with more mature, later successional stages.

Non-commercial treatments and prescribed burning proposed in all action alternatives 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 a little effect on the overall structure and seral stage of the pine community.

In the absence of fire, early seral communities such as hardwoods and meadows will become further encroached by pine and spruce with the No Action Alternative, and there will be less habitat available for species associated with these communities. Hardwood treatments are proposed in all action alternatives, although Alternative C treats the most acres, followed by Alternative B and then Alternative D. Alternative C also treats more meadows for pine encroachment than Alternative B, followed by Alternative D. Alternative C would benefit species associated with hardwood and meadow communities the most, followed by Alternative B and Alternative D. Such species would not benefit by lack of treatment in Alternative A.

Riparian communities, water quality, and fisheries habitat in the Deerfield Project Area are currently negatively affected by improperly located and constructed roads, illegal motorized traffic, livestock grazing, heavy recreational use of some areas, and the increasing density of the adjacent pine community. Negative effects include sedimentation, changes in vegetation composition and structure, trampling and resource damage, and decreased water availability. Alternative A represents a continuation of the current condition of riparian areas, water quality, and fisheries habitat. Watershed improvement projects proposed for all action alternatives would enhance these habitat features by rehabilitating connected disturbed areas to reduce soil and erosion and sedimentation, stabilizing streambanks, and improving water quality, by varying degrees. The positive effects of these projects on riparian habitats, water quality, and fisheries habitat would be somewhat similar under all action alternatives. Additionally, vegetation treatments would reduce the density of adjacent pine communities, more so in Alternative B followed by Alternatives C and D, resulting in increased amounts of water available to riparian communities and streams relative to the number of acres treated in each action alternative. Negative impacts to riparian areas, water quality, and fisheries habitat from proposed activities in the action alternatives would be mitigated, and thus not substantially affect those habitats.

Snags will be created through natural processes over time in all action alternatives, but the number and size of snags created is directly proportional to the number of green trees available to become snags. Alternative A will leave the largest number of green trees/acre greater than 10” DBH with potential to become snags. While all action alternatives decrease the number of existing green trees/acre average available for snag recruitment compared to Alternative A, the number of green trees retained will be adequate to provide for desired levels of snag recruitment. Of the action alternatives, Alternative D leaves the largest number of green trees available for snag recruitment, followed by Alternative C. Alternative B leaves the fewest green trees available for snag recruitment.

Although the existing number of down logs and amount of down woody material in the Deerfield Project Area has not been quantified, it is assumed that MPB caused mortality has and will continue to increase the amount of down woody material. Alternative A would provide the greatest amount of down woody debris over time as a result of tree mortality from MPB in denser stands, followed by Alternative D and Alternative C. Alternative B would provide the

least amount of down woody material. Untreated sites in all actions alternatives will continue to accumulate down woody debris from ongoing MPB mortality and other natural events like blowdown. Prescribed burning will also reduce small diameter down woody material, but likely would not eliminate larger down logs.

Open road density in the Deerfield Project Area is currently nearly four miles/square mile, and existing road and area closures are for the most part ineffective. Roads displace habitat and their use can disturb wildlife and decrease habitat suitability and availability for most species, but especially for big game species. High road densities makes the area more easily accessible, facilitates poaching and illegal removal of snags for firewood, and results in increased disturbance to all wildlife species. Alternative B is similar to Alternative A in that the majority of the area would be open to off-road motorized travel, with the exception of the management areas where it is prohibited by the Forest Plan (MA 3.1 and 8.2). Alternatives C and D propose to close the project area to off-road motorized travel year-round, with more opportunities to establish designated trails and core use areas in Alternative C. Selected roads would remain open year-round throughout the project area in all action alternatives. Alternative D results in the lowest overall open road density of all alternatives, followed by Alternative C and Alternative B, with highest densities in Alternative A. Road closures and obliteration proposed in all action alternatives would substantially benefit wildlife and wildlife habitat.

Socio-Economic / Travel and Recreation Use

There would be no direct costs associated with Alternative A. Although potential costs associated with No Action (Alternative A) is not integrated into the cost/benefit analysis, the actual cost of no action could potentially be much higher than the action alternatives in economic, social and environmental terms. Recent wildfires on the Black Hills and in the western USA have experienced costs in the millions of dollars for suppression alone. For example suppression costs for the recent Battle Creek Fire are estimated at $6.5 million and the Jasper Fire around $11.5 million. Costs of rehabilitation, economic loss of resources and property values are significant additional costs of these wildfires.

The financial analysis illustrates that commercial harvest revenues offset costs of alternative implementation in proportion to the value and amount of merchantable timber removed. Revenues from Alternative B offset implementation costs to a greater degree than Alternative C. Because of the greater revenues generated more activities critical to meeting the purpose and need can be accomplished under Alternative B relative to the other action alternatives. The difference between revenues and costs in Alternative D is the least of the three action alternatives. However, this alternative achieves substantially less in terms of meeting the purpose and need than the other alternatives. Costs associated with the large number of non-commercial thinning acres planned (16,100 acres in Alternative B, 11,700 acres in Alternative C, and 6,400 acres in Alternative D) and the costs associated with the differences in prescribed burning acres: (up to 10,000 acres in Alternative B, 14,000 acres in Alternative C, and 3,500 acres in Alternative D) contribute to the high cost and revenue factors which influence the differences in the financial outcomes.

Mountain Pine Beetle and wildfire hazard reduction is an indirect indicator of how effectively the alternatives contribute to safeguarding the health, values and lifestyles of local residents and Forest

users by reducing insect and severe wildfire hazard. This is a qualitative indicator; however, this measure is supported by the effects to MBP and wildfire hazard resulting from the level of vegetative treatment to reduce potential for insects / disease and large-scale crown fire as disclosed in the analysis. The No Action alternative does nothing to address this issue and the potential for insect infestations and large-scale crown fire continues to increase. Alternative B, with its aggressive tree thinning and harvest treatments is the most effective at reducing the potential for insect infestations and probability of large-scale crown fire. Alternatives C and D have a moderately and less effective impact to address these social concerns.

No matter what decisions are made regarding travel and recreation use there will be changes in the amount and types of use in this area. This is because the population continues to grow and more people are interested in outdoor recreation. It is also a result of increasing use of off-highway vehicles (OHV) such as All Terrain Vehicles (ATV), dirt bikes, and 4x4's. Conflicts between user groups will continue and may expand.

All alternatives, even the No Action (Alternative A), would result in changes to the total road system based on past management decisions (31 miles of roads scheduled for closure and 14 miles of roads scheduled for decommissioning).

Alternative B follows current Forest Plan guidelines for road and off-road motorized use. On and off-road (cross-country) motorized travel is designed to meet Forest Plan Management Area guidelines. Management Area 5.1 dominates the Deerfield Project Area; the majority of the project area would be open to cross-country motorized travel, off existing roads and trails. The existing motorized travel restrictions near the two botanical areas would remain in effect, even though they include a portion of Management Area 5.1. A number of existing roads would be closed, obliterated, or relocated in order to protect water/soil resources and special habitats. Total miles of roads would be reduced in Alternative B from the current 292 miles to 277 miles.

Travel management in Alternative C recognizes the broad spectrum of recreation and travel uses in the project area. There would be no off-road (cross country) motorized use. Motorized travel would be restricted to designated routes only. Opportunities to develop motorized and non-motorized trail systems and areas within the project area utilizing partnerships would be pursued wherever possible. Total miles of roads in Alternative C would be reduced from 292 miles to 258 miles.

Travel management in Alternative D emphasizes non-motorized use. Travel management is characterized by considerable road closures in support of a non-motorized use experience and wildlife security. There would be no off-road (cross-country) motorized use; motorized travel would be restricted to designated routes only. Opportunities would not be pursued to develop motorized and non-motorized trail systems in the project area. Total miles of roads in Alternative D would be reduced from 292 miles to 221 miles.

Table 2-1 Effects to Key Issues by Alternative

	Alt A	Alt B	Alt C	Alt D
Issue - Measurement Indicators				
MPB Hazard Rating				
MPB Hazard Rating – Low (acres)	15,500	24,500	20,700	16,900
MPB Hazard Rating – Moderate (acres)	9,300	2,600	5,300	7,800
MPB Hazard Rating – High (acres)	3,000	650	1,700	3,000
Fire Hazard and Fuels Reduction				
Crown Fire Hazard Reduction	Least Effective	Most Effective	Moderately Effective	Least Effective
Vegetation Treatment (acres)	0	25,500	21,200	11,700
Fuel Breaks - constructed (miles)	0	60	50	14
Fuels Breaks - hardwoods/meadows (acres)	0	5,000	6,100	4,400
Prescribed Burning (acres)	0	7,000 - 10,000	10,000 - 14,000	3,500
Accessibility for Fire Suppression (road miles)	259	258	239	202
Prescribed Fire				
Prescribed Burn Area (acres)	0	7,000 - 10,000	10,000 - 14,000	3,500
Burn Days Required (days)	None	55	70	30
Travel Management				
Miles of Open Roads	200	195	155	126
Miles of Closed Roads	28	28	28	28
Miles of Road Proposed for Closure	0	4	25	17
Miles of Roads Proposed for Decommission	0	6	25	59
Miles of Roads Scheduled for Closure	31	31	31	31
Miles of Roads Scheduled for Decommission	14	14	14	14
Wildlife Habitat				
Pine Structural Diversity (acres)				
Closed Canopy (>70% crown closure)	2293	492	1727	2293
Open Canopy (<40% crown closure)	11882	22571	16288	14407
Vertical Diversity (acres)	22615	10901	14520	19144
Grass Forb Structural Stage (acres)	1394	1394	1394	1436
Late Successional Stands (acres)	1335	1335	1335	1335
Hardwood Communities (acres)	693	1057	1274	784
Grassland Communities (acres)	3991	4372	4764	4304
Snag Conditions (Excellent to Poor)	Excellent	Fair	Fair	Good
Dead and Down Woody Material (Excellent to Poor)	Excellent	Fair	Fair	Good
American Marten Habitat w/ High Potential for Occupancy (acres)	2226	1758	2054	2226
Screening Cover (acres)	529	529	529	529
Open Road Density (mile/square mile)	3.6	3.5	2.8	2.2
Total Road Density (mile/square mile)	4.6	4.6	4.2	3.6
Socio-Economic Factors				
Total Revenues (million)	NA	$6.8	$3.1	$1.1
Total Cost (million)	NA	-$14.9	-$13.5	-$5.7
Cost-Benefit Ratio	NA	.46	.23	.19
Volume Harvested - sawtimber (CCF)	0	94,000	40,000	14,000
Products - poletimber (CCF)	0	35,000	26,000	7,300
MPB/Wildfire Hazard Reduction (Effectiveness of contribution to safeguarding the health, values and lifestyle of local residents and Forest users by reducing insect and wildfire hazard.)	Least Effective	Most Effective	Moderately Effective	Moderately Effective

Table 2-2 Treatment Outputs by Alternative

TREATMENT	Alt. A	Alt. B	Alt. C	Alt. D
Commercial thinning with non-commercial thinning[#*]	0	5,791	4,004	1,310
Commercial thinning without non-commercial thinning[#]	0	1,867	2,038	64
Fuel Breaks – Commercial with non-commercial treatment[@]	0	660	600	92
Fuel Breaks – Non-commercial treatment[*]	0	740	400	98
Liberation Cut – Commercial with non-commercial thinning[#*]	0	65	153	0
Shelterwood Seed Cut - Commercial[#]	0	140	13	82
Seed Tree Cut – Commercial[#]	0	1,647	1,008	543
Shelterwood Overstory Removal with non-commercial thinning[#*]	0	3,039	785	0
Non-commercial Thinning[*]	0	7,175	6,764	5,128
Hardwood Treatments – Commercial and Non-commercial[#*]	0	1,260	1,476	906
Meadow Treatments – Commercial and Non-commercial[#*]	0	895	1,326	804
Meadow Treatments – Non-Commercial[*]	0	2,913	3,136	2,754
Total Area Treated	0	25,532	21,103	11,689
Prescribed Burning	0	10,000	14,000	3,500
Total Non-commercial Treatments w/o Prescribed Burning [*]	0	21,878	18,044	11,000
Total Commercial Treatments[#]	0	14,496	10,803	3,709
Volume Removed				
Sawtimber MBF	0	47,000	20,000	7,000
Sawtimber CCF	0	94,000	40,000	14,000
Products CCF	0	35,000	26,000	7,300

[@] - Accounted for in other commercial treatments
[#] - Commercial treatments
[*] - Non-commercial treatments
[#*] - Commercial and non-commercial treatments

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 Deerfield 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 and disclosure 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 differ from direct and indirect effects in that they take into account past, present, proposed, and reasonably foreseeable activities that could affect issues and resources. The area analyzed for cumulative effects is the project area for all resources unless otherwise stated. This area encompasses portions of five Hydrologic Unit Code (HUC) 7th level watersheds (see Appendix G, Map 2).

Past activities can have long-lasting and far-reaching effects regardless of whether they are active or passive in nature. Past activities or events that have been considered in the cumulative effects analysis include wildfires, timber harvest, livestock grazing, storms, insect infestations, residential development and fire suppression. Some of these activities and/or events have been affecting the area for over 100 years. A significant activity that has occurred in the past 100 years is fire suppression. Records indicate that the area was not as heavily timbered with pine in the late 19th century (see Figure 3-1 and Appendix E displaying past activities in a table format).

Pine occurred as scattered trees or in dense stands separated by meadows, hardwoods, and rock outcrops. A substantial increase in the extent of the coniferous forest in the project area has resulted from fire suppression. Hardwoods and shrubs such as aspen and willow have decreased in density and extent during the same timeframe. This change has occurred despite a long history of timber harvest in the project area that also began over 100 years ago primarily to provide timber in support of the gold rush. Since then timber harvest has occurred within the area during every decade.

Figure 3-1 Grasses, shrubs, and hardwoods (mixed with pine) dominated the uplands while willows covered low-lying areas along streams.

Establishment of mining claims and homesteading has resulted in many tracts of private land throughout the project area (5,200 acres) especially along riparian areas. Roads were also built along the easiest routes, generally parallel to streams.

Present activities are those activities currently occurring within the project area boundary. Present activities include livestock grazing on private and National Forest lands, residential development on private lands, timber and salvage harvest, spraying for noxious weeds, and dispersed recreation. Recreational activities include camping, hunting, hiking, OHV use, motorbike, snowmobiling, and ATV riding, horseback riding, bicycling, and wildlife watching. There are portions of the Deerfield trail and many roads (Federal, State, County, private, and National Forest roads). Weather-related events such as droughts have affected the project area in the past and more recently. Currently, four to five years of drought and mild winters has increased stress in the pine forest and contributed to a higher level of forest insect infestation resulting in pockets and hillsides of dying trees. These events have affected the forest in localized areas. Additional present activities considered by the ID Team are discussed under the resource sections in this chapter (see Appendix E displaying present activities in table format).

Reasonably foreseeable actions include those management activities that are anticipated or scheduled to occur within the next five to fifteen years. These activities may occur regardless of which alternative is selected for implementation. Foreseeable actions include continued livestock grazing and increased residential development on private lands. A continued increase in travel and recreation use is likely based on current trends. Vegetation treatment on public and private lands, spraying for noxious weeds, suppression of wildfires and prescribed burning at various levels is likely to continue. Additional foreseeable activities considered by the ID Team are discussed under the resource section in this chapter.

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).

WATERSHEDS, GEOLOGY, and SOILS

Affected Environment

The Deerfield Project Area watershed is comprised of different components and the varying characteristics of each component make each watershed unique. These components are: watershed boundaries, precipitation and climate, geology, soils, slope, watershed condition, streams, floodplains, beneficial uses, water quality and quantity, private land, connected disturbed area and roads. Some of these components are discussed below as they relate to the Deerfield Project Area (DPA). See the Watershed Specialist Report held in the project file for detailed information on each component.

Precipitation and Climate. The DPA elevation ranges from 5,550 feet at the confluence of North Fork Castle Creek and Castle Creek to 7,020 feet on an unnamed peak on the western most edge of the DPA. The DPA has a semi-arid climate with low humidity throughout the year. Temperatures range from near 100° F during the summer months to well below 0° F in winter. Average annual precipitation is 21 to 23 inches, increasing from South to North (Driscoll, Carter, Williamson and Putnam, 2002). Localized intense thunder storm cells can produce much greater rain in smaller areas than surrounding areas within one storm event (Fact Sheet Team, 2001).

Topography within the project area consists of canyons, ridges, hills and gently sloping terrain. The predominant bedrock is Precambrian aged metamorphic and igneous rocks. They are exposed over 58 percent of the area. Overlying these Precambrian rocks are younger layers of sedimentary sandstones and limestones that are exposed on the western portion of the project area.

Watershed Condition. The DPA is located within five Hydrologic Unit Code (HUC) 7 level watersheds. HUC 7 watersheds are generally 5,000 to 10,000 acres in size. The DPA is within two HUC 6 watersheds, which are the next larger watersheds. HUC 6 watersheds are generally 10,000 to 50,000 acres in size. All the Deerfield Project watersheds fall into the Low Sensitivity category for the sensitivity index and all watersheds fall into what is considered minor for the impact index. See the Project File for specific information on the Natural Watershed Sensitivity Index (NWSI) and the Impact Index.

Beneficial Uses. The South Dakota Department of Environment and Natural Resources (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, wildlife propagation and stock watering. Within the DPA Bjorland Draw Creek, Cabin Draw Creek, Castle Creek, Cement Draw Creek, Fulton Draw Creek, Gold Run Creek, North Fork Castle Creek and Silver Creek have additional designated beneficial uses. These include Coldwater Permanent Fish Life Propagation, Coldwater Marginal Fish Life Propagation and Limited Contact Recreation.

Water Quality and Quantity. No streams or waterbodies within the project area are listed in the South Dakota 303(d) Waterbody List.

The following statements were taken from the 'The 2004 South Dakota Integrated Report for Surface Water Quality Assessment' and is talking to the Black Hills as a whole but it does apply to the streams within the DPA. "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 that the highly erosive and leachable marine shales and badlands on the surrounding plains."

"Black Hill streams…usually have good to satisfactory water quality and fulfill their fishable/swimmable designated uses. They are, however, relatively small streams vulnerable to losses of flow exacerbated by periodic droughts in the Black Hills and high evapotranspiration rates characteristic of a dense and extensive ponderosa pine and spruce forest canopy. Grazing of streamside vegetation, which increase stream bank erosion, water temperature and nutrient loading, also continues to be a problem in a number of Black Hills streams."

The water quality of North Fork Castle Creek is not as good as some of the other streams in the area due to iron bogs along the streams. Dr. Scott Kenner, from the South Dakota School of Mines and Technology, has recently done a study on North Fork Castle Creek and a report is being drafted. Dr. Kenner concludes that current lower water quality of North Fork Castle Creek is pretty much natural (Kenner, S.J., 2004, personal communication, March 10).

Silver Creek has also been impacted from past activities, primarily from ranching. When the lower ½ mile was under private ownership, the creek was altered to enhance the haying of the bottom. Willows were removed and the channel straightened to divert water to a ditch. This has resulted in a segment of the stream that is currently unstable. The banks are bare and contributing sediment to the stream. This has also dried up the valley bottom and affected the local ground water and could possibly have affected the ground water supply to the McIntosh Fen. Peak flows on Castle Creek and contributing streams can occur any month from March to September.

Roads. Roads are generally the number one cause of problems in a watershed or project area. They tend to concentrate water and put it where it is not designed to go. During the Deerfield analysis, 22 system roads and 45 unclassified roads were identified as having a potential for causing problems with the soils and streams.

Environmental Consequences

The proposed project may affect the following watershed components: aquatic ecosystems, soil productivity, geologic hazards and special areas. Aquatic ecosystems include physical conditions (sediment, bed/bank stability and flow regimes), chemical conditions (temperature / oxygen and water purity) and biological conditions (aquatic life). Soil productivity includes soil erosion, soil compaction, nutrient removal, soil heating and regeneration hazard. Geologic hazards include landslides, soil failure and earthquakes. Special areas include riparian ecosystems, wetlands and floodplains. Below is a discussion of the above items as they apply to the DPA.

Aquatic Ecosystems – Physical

Sediment. "Most sediment delivered to streams comes from a source zone along streams whose width depends on topography, soils, and ground cover. Connected disturbed areas like roads and other disturbed soil near streams can deliver sediment during runoff events. Sediment deposits in stream beds harm insect populations and fish reproduction." (USDA Forest Service, 1996). Sediment deposits in stream beds results in a shift toward burrowing invertebrate taxa that are unavailable as prey (Suttle et al. 2004). Increased sedimentation alters the suitability of fish spawning and rearing reproduction.

The source zone along the streams is often referred to as the Watershed Influence Zone (WIZ). The Watershed Conservation Practices (WCP) Handbook (USDA Forest Service, 1999) defines the WIZ as 100 feet minimum from each bank. Best Management Practices (BMP) (South Dakota State University, 2004) defines it as a strip of at least 50 feet wide on each side of the stream. The width of the WIZ for the DPA will be 50 foot either side of the stream or 100 feet total width. Based on professional experience, this is by far an adequate distance for the Black Hills and this project area. If any sediment is produced from the WIZ it is generally produced in the first 25 feet from the stream. There is usually adequate lush vegetation to filter out the sediment.

Some activities are not of concern relating to sediment. Non-commercial timber activities, prescribed fire and fuel break construction are activities that are proposed for the DPA that are not of concern for producing sediment. Non-commercial timber activities generally are done without mechanized equipment and results in no or minimal ground disturbance. For the DPA some mechanized equipment may be used to address the fuels issue created from the thinned material. This still is of no concern as the material being removed is small in size. Disturbance from these activities will be minimal and organic mater on the ground will still be in place to protect the soil and absorb surface precipitation, thus no sediment will be produced.

Prescribed fire activities are also not of concern for producing sediment. Prescribed fire is done at times when there is moisture in the soil and organic material. Burning when there is soil moisture will reduce the fire severity/intensity, preserve some organic material over the soil and not destroy subsurface roots. This remaining organic material will still act like a sponge to absorb precipitation and the remaining root system will resprout to provide effective groundcover. Runoff is not expected from these areas, thus no sediment is expected to be produced.

Fuel break construction is not a concern for producing sediment. Most of the activities are upslope treatments. Limited fuel treatment activities will occur in the WIZ and many times these areas are meadows with adequate vegetative buffers. Therefore, no sediment is expected to be produced from fuel break construction.

Bed and Bank Stability. "Bed and bank stability can be damaged from trampling by animals or humans, vehicle impact, degraded bank vegetation, or excessive flow augmentations. Streams can be made wider and shallower, pools and overhanging banks can be destroyed, and much sediment can be added to streams." (USDA Forest Service, 1996).

Flow Regimes. "Flow regimes can be altered by major changes in cover type or ground cover, dense road networks, or water projects. Water temperature and chemistry, sediment transport, aquatic habitats, and aquatic life cycles can be degraded." (USDA Forest Service, 1996).

The biggest impact on flow regimes in the Black Hills and this project area is the result of the past fire suppression policies. These policies have resulted in the increase of tree biomass in the Black Hills. This increase in biomass uses more water through evapotranspiration, thus making less water available for streamflow and groundwater recharge.

Flow regimes do not appear to be adversely affected by dense road networks in the Black Hills. Roads have contributed to flow regimes, because roads are occupying areas where trees or biomass would be. Normally roads tend to change flow regimes by delivering water more quickly to the channels and streams making the peak flows higher. This does not appear to be a problem based on field observations.

Alternative A

Direct/Indirect Effects

Sediment. No new activities occur within the project area although existing approved projects will be completed. There were 10 Connected Disturbed Area (CDA) that were identified within the DPA and there are 143 road/stream crossings. Most of the CDAs will continue to contribute sediment except that the four on Road 132.1D will be corrected under the Mercedes Project Decision. The road/stream crossings are distributed among different categories.

Any road/stream crossing has the potential to contribute sediment to the stream because of the nature of roads and crossing the stream. The existing crossings do not necessarily contribute sediment. There will be a decrease in sediment being delivered to the streams because of the reduction of CDAs and scheduled closure of 11 road/stream crossings.

Wildfire is an unknown variable, but with this alternative the risk of wildfire will be the greatest with no treatment of the vegetation in the DPA. If a wildfire occurs, a large amount of sediment and ash would be delivered to the channels and streams. A wildfire will have both short and long-term effects on the streams for years to come.

Bed and Bank Stability. Under no action no new activities occur within the project area so the bed and bank stability will generally not be affected and will remain unchanged from its current state.

Flow Regimes. This alternative will not have any new activities within the project area so the flow regimes will generally not be affected and remain unchanged in the short-term. Biomass will generally continue to increase and consume more water, which will affect the flow regime over the long-term by making less water available for streamflow and ground water recharge over time, thus reducing flows. The increase of biomass and increased water consumption could be offset by insect/disease activity, but without intervention by man, the biomass will generally increase over time.

Cumulative Effects

Sediment. Past activities, usually road related, in the project area, can contribute the largest amount of sediment to the streams. As stated above, 10 CDAs were identified within the DPA and six will continue to contribute sediment. Sediment is a concern because all sources add up to have cumulative effects. Stream crossings will remain unchanged except what is planned for under previous activities. Sixty-nine stream crossing will remain open.

There will be a slight decrease to the cumulative effects from sediment in the project area with this alternative over present conditions, unless a wildfire occurs, which will have a large impact from sediment being delivered to the streams. If a wildfire occurs, this generally removes the organic layer and exposes the soil. This soil is subject to erosion during intense precipitation events and can be delivered to streams.

Bed and Bank Stability. Past activities in the project area that have contributed to bank instability primarily are cattle grazing. Grazing effects on stream bank stability has not been specifically looked at for this project other than through field observations. Grazing impacts if not mitigated will continue into the future.

There will be no increase or decrease to the cumulative effects on bed and bank stability, in this project area, with this alternative.

Flow Regimes. Past activities and events in the project area have influenced flow regime. Impacts from the past include fire suppression, which have reduced flows over time through the increase from the biomass and increased evapotranspiration. Past timber harvest has helped maintain the flow regime but it has not kept pace with the increase of biomass and water usage of the biomass. Water releases from Deerfield Dam will continue in accordance with the current operating plan to meet downstream water demands. Subsequently, flows in Castle Creek below the dam are expected to be within the current range and will be influenced primarily by downstream water demands and rainfall amounts and to a lesser degree the reduction of flow from increased biomass.

There will be no increase or decrease to the cumulative effects on flow regime with this alternative. However, over time, the flow regime can change through natural processes. One possible scenario is that the biomass will continue to increase, using more water, thereby

reducing the flow regime in the project area. Another scenario is the reduction of ponderosa pine with fire and/or insects and disease. This tree mortality will reduce the living biomass with a subsequent reduction in evapotranspiration losses, which will potentially increase the flow regime. Insect activity is currently increasing in the DPA.

Alternative B

Direct/Indirect Effects

Sediment. Commercial timber harvest proposes to treat approximately 14,500 acres in this alternative. Of these acres, 140 acres are located in the Watershed Influence Zone (WIZ). Fifty nine percent (59%) of these commercial harvest acres within the WIZ are primarily hardwood and meadow restoration. The other 41% are distributed across five other treatment prescriptions. The potential to generate sediment is very low. To say that no sediment will be generated from the commercial activities would be incorrect, but implementing the Forest Plan Standards and Guidelines (FPS&G), which include WCPs and BMPs, such as minimizing skid trails in the WIZ, would generate very little sediment.

Road construction, reconstruction, maintenance and temporary use of roads within the WIZ and at stream crossings have the potential to increase sediment. Alternative B plans on activities supported by 6 miles of road within the WIZ and 82 road/stream crossings. With the activity at stream crossings and roads in the WIZ there will be some sediment produced. It is extremely difficult to quantify how much sediment would be produced, so the amount of activity within the WIZ will be used as a comparison for the alternatives. With the implementation of the FPS&Gs, which include WCPs and BMPs, the amount of sediment generated should be minimal and should not have a great effect on the aquatics.

There will be 58 open stream crossings for this alternative. All the CDAs identified will be corrected as part of the commercial timber harvest and road package, except the one on FH 17, thus reducing sediment to the streams. The CDA remaining on FH 17 is on a county road, which is Pennington County jurisdiction. Road sand from the winter finds its way into an unnamed perennial tributary to Deerfield Lake because the way the road has been constructed. The county has been notified of the problem.

Wildfire is an unknown variable, but with this alternative the risk of wildfire will be the least of all alternatives with the treatment of the vegetation in the DPA and prescribe fire. If a wildfire occurs, a large amount of sediment and ash would be delivered to the channels and streams. A wildfire will have both short and long-term effects on the streams for years to come. The short-term effects come from the initial flush of ash and sediment from the newly burned area. The long-term effect is the sediment that has been added to the stream system that has to work its way through the system. This sediment can remain in the streams for years.

Bed and Bank Stability. This alternative includes commercial and non-commercial vegetation management activities and travel management. The proposed activities of this alternative will not have an impact on bed and bank stability within the DPA. This is because alternative design

incorporates protection measures so that activities will not effect or affect the bed and bank stability of the streams.

Flow Regimes. Commercial and non-commercial timber activities will have the greatest affect on the flow regime compared to the other alternatives. This is because vegetative treatment over 14,500 acres removes the most biomass resulting in the greatest reduction in evapotranspiration losses. This will in turn, move the flow regime back towards where it was prior to the era of fire suppression, but not entirely back to pre-settlement conditions. In order to get close to pre-settlement conditions the whole project area would need to be treated instead of the proposed 35%. The non-commercial timber activities will have a short-term positive effect, treating another 26% of the project area. This will be a short-term positive effect because of the reduction of the biomass (tree removal) and because the remaining trees will grow to take up the space that was occupied by the removed trees. This alternative does the best to restore flow regimes.

Cumulative Effects

Sediment. Past cumulative effects are described under Alternative A. There will be a potential to increase sediment from the proposed activity by harvesting 140 acres; road use of 6 miles, and 82 used stream crossings in the WIZ. A decrease of sediment is expected, by repairing the CDAs, one will be remaining (FH 17), reducing the number of open road/stream crossings to 58.

There will be a potential increase in the cumulative effects from sediment in some categories (harvesting, road use and used stream crossings) and potential to decrease the cumulative effects from sediment in other categories (CDAs and open crossings) in the project area with this alternative. Overall there may be a slight increase over Alternative A in the short term, while over the long term there should be a slight decrease.

Wildfire sediment risk will be reduced by vegetative and fuels treatment of stands including prescribed fire. There still exists a risk of large wildfire, which will have a large cumulative effect from sediment being delivered to the streams. The combination of treatments in alternative B will have the least risk of all alternatives should this occur.

Bed and Bank Stability. Past cumulative effects are described under Alternative A. There will be no change to the cumulative effects on bed and bank stability in the project area with this alternative.

Flow Regimes. Past cumulative effects are described under Alternative A. This alternative will have a positive, but likely immeasurable impact to the flow regime. Biomass will be reduced in the areas that will be treated and green trees removed. Biomass could continue to accumulate in the untreated areas, depending on insect/disease activity and could eventually offset the gain in flow that was achieved from the treatment.

Alternative C

Direct/Indirect Effects

Sediment. Commercial timber harvest will treat approximately 11,000 acres in this alternative. Of these acres, 122 acres are located in the WIZ. Ninety six percent (96%) of these commercial harvest acres within the WIZ are hardwood and meadow restoration. The other 4% are distributed across six other treatment prescriptions. The potential to generate sediment is very low. To say that no sediment will be generated from the commercial activities would be incorrect, but implementing the FPS&G, which include WCP and BMP, such as minimizing skid trails in the WIZ, would generate very little sediment.

Road construction, reconstruction, maintenance and temporary use of roads within the WIZ and at stream crossings have the potential to increase sediment. Alternative C activities will use 6 miles of road within the WIZ and 85 road/stream crossings. With the activity at stream crossings and roads in the WIZ there will be some sediment produced. With implementation the FPS&Gs, which include WCPs and BMPs, the amount of sediment generated should be minimal and should have negligible effect on aquatics.

There is one new constructed stream crossing planned on Castle Creek, above McIntosh Fen, to access a harvest unit. It could potentially introduce sediment into the stream at a previously undisturbed location. Adherence to road construction specifications and design criteria will provide the necessary protection to the stream.

There will be 35 open stream crossings for this alternative. All the CDAs identified will be corrected as part of the commercial timber harvest and road package, except the one on FH 17, thus reducing sediment to the streams. The CDA remaining on FH 17 is on a county road, which is Pennington County jurisdiction. Road sand from the winter finds its way into an unnamed perennial tributary to Deerfield Lake because the way the road has been constructed. The county has been notified of the problem.

Wildfire is an unknown variable, but with this alternative the risk of wildfire will be the similar to Alternative B but the risk will be slightly greater because less acres are being treated. If a wildfire occurs, a large amount of sediment and ash would be delivered to the channels and streams. A wildfire will have both short and long-term effects on the streams for years to come. The short-term effects come from the initial flush of ash and sediment from the newly burned area. The long-term effect is the sediment that has been added to the stream system that has to work its way through the system. This sediment can remain in the streams for years.

Bed and Bank Stability. This alternatives includes commercial and non-commercial vegetation management activities and travel management. The proposed activities of this alternative will have potential to impact the bed and bank stability of Castle Creek with one proposed stream crossing. Implementing mitigation measures identified (see Appendix B), by using a temporary bridge, minimizing the fill in the floodplain and not allowing equipment to drive through the stream upon installation and removal of the temporary bridge, will mitigate the potential effects. In this case there would be no effects to the bed and bank stability.

Flow Regimes. Commercial and non-commercial timber activities will have the greatest affect on the flow regime. The commercial timber harvest of 11,000 acres in this alternative will have a positive, but likely immeasurable effect on flow regime but less so than Alternative B because it removes less biomass. This will move the flow regime back towards where it was prior to the establishment of the Forest Reserves, but not entirely back. In order to get as close to pre-reserve flows the whole project area would need to be treated instead of the proposed 25%. The non-commercial timber activities will have a short-term positive effect on flow regimes, treating another 28% of the project area, because of the reduction of the biomass. This effect will be relatively short-term because the adjoining remaining trees will soon grow to take up the space that was occupied by the removed trees. This alternative does the second best to restore flow regimes.

Cumulative Effects

Sediment. Cumulative effects from past activities are described under Alternative A. There will be a potential to increase sediment from the proposed activity harvesting 122 acres, road use of 6 miles, and 85 used stream crossings in the WIZ. A decrease of sediment is expected, by repairing the CDAs, one will be remaining (FH 17), reducing the number of open road/stream crossings to 35.

There will be a potential increase in the cumulative effects from sediment in some categories (harvesting, road use and used stream crossings) and potential to decrease the cumulative effect from sediment in other categories (CDAs and open crossings) in the project area with this alternative. Overall it may be a slight increase over Alternative A and similar to Alternative B in the short term. Long term for Alternative C will have a decrease in sediment from having less open road/stream crossings. The biggest difference with this alternative is the new crossing on Castle Creek. This will contribute sediment in the short term and long term if it were to remain. If the crossing is removed, sediment will be produced until the area has been revegetated.

Wildfire sediment risk will be reduced by vegetative treatment and prescribed fire. There is still a risk from a large wildfire, which will likely have a substantial cumulative effect from sediment being delivered to the streams. The combination of treatments will have the second least risks of all alternatives and not much greater than Alternative B.

Bed and Bank Stability. Past cumulative effects are described under Alternative A. With implementation of the mitigation measures (see Appendix B), there will be no cumulative impacts to the Bed and Bank Stability with this alternative.

Flow Regimes. Past cumulative effects are described under Alternative A. This alternative will have a positive impact to the flow regime but to a lesser degree than Alternative B. Biomass will be reduced in the areas that will be treated where green trees are removed. Biomass could continue to accumulate in the untreated areas, depending on insect/disease activity and could eventually offset the gain in flow that was achieved from the treatment.

Alternative D

Direct/Indirect Effects

Sediment. Commercial timber harvest will treat approximately 3,700 acres in this alternative. Of these acres, 86 acres are located in the WIZ. Eighty-seven percent (87%) of these commercial harvest acres within the WIZ are hardwood and meadow restoration. The other 13% are distributed across three other treatment prescriptions. The potential to generate sediment is very low. To say that no sediment will be generated from the commercial activities would be incorrect, but implementing the FPS&G, which include WCP and BMP, such as minimizing skid trails in the WIZ, would generate very little sediment.

Road construction, reconstruction, maintenance and temporary use of roads within the WIZ and at stream crossings have the potential to increase sediment. Alternative D will use 4 miles of road within the WIZ and 67 road/stream crossings. With the activity at stream crossings and roads in the WIZ there will be some sediment produced. Implementing the FPS&Gs, which include WCPs and BMPs, should minimize sediment and have a minor effect on aquatics.

There will be 35 open stream crossings for this alternative. All the CDAs identified will be corrected as part of the commercial timber harvest and road package, except the one on FH 17, thus reducing sediment to the streams. The CDA remaining on FH 17 is on a county road, which is the jurisdiction of Pennington County. Road sand from the winter finds its way into an unnamed perennial tributary to Deerfield Lake because the way the road has been constructed. The county has been notified of the problem.

Wildfire is an unknown variable, but with this alternative the risk of wildfire will be the greatest of the action alternatives due to the small amount of vegetation treatments in the DPA and less prescribed fire. If a wildfire occurs, a large amount of sediment and ash would be delivered to the channels and streams. A wildfire will have both short and long-term effects on the streams for years to come. The short-term effects come from the initial flush of ash and sediment from the newly burned area. The long-term effect is the sediment that has been added to the stream system that has to work its way through the system. This sediment can remain in the streams for years.

Bed and Bank Stability. This alternative includes commercial and non-commercial vegetation management activities and travel management. The proposed activities of this alternative will not have an impact on bed and bank stability within the DPA. This is because alternative design incorporates protection measures so that activities will not effect or affect the bed and bank stability of the streams.

Flow Regimes. The commercial timber harvest of 3,700 acres in this alternative will have a minor effect on flow regime and less than Alternative B or C because it removes less biomass. This will move the flow regime slightly back towards where it was prior to the establishment of the Forest Reserves. In order to get as close to pre-reserve flows the whole project area would need to be treated and not the proposed 9%. The non-commercial timber activities will have a short-term positive effect, treating another 19% of the project area, because of the reduction of the biomass, but it will be short-term because the adjoining remaining trees will soon grow to

take up the space that was occupied by the removed trees. This alternative does the least of the action alternatives in improving flow regimes.

Cumulative Effects

Sediment. Cumulative effects from past actions are described under Alternative A. There exists a potential to increase sediment from the proposed activity harvesting of 86 acres, road use of 4 miles, and 67 stream crossings in the WIZ. A decrease of sediment is expected, by repairing the CDAs, one will be remaining (FH 17), reducing the number of open road/stream crossings to 32.

There will be a potential increase in the cumulative effects from sediment in some categories (harvesting, road use and used stream crossings) and potential to decrease the cumulative effect from sediment in other categories (CDAs and open crossings) in the project area with this alternative. Overall it may be a slight increase over Alternative A and not as a great of an increase as compared to Alternatives B & C in the short term. Long term for Alternative D will have the least amount of sediment resulting from less open road/stream crossings.

Wildfire sediment risk will be slightly reduced by vegetative treatment and from implementing prescribed fire. There is still a large risk of severe wildfire with so much untreated vegetation. A large wildfire will have a large cumulative effect from sediment being delivered to the streams. This combination of treatments will have the greatest risks for wildfire of all action alternatives because of the small amount of acres being treated.

Bed and Bank Stability. Cumulative effects from past actions are described under Alternative A. There will be no change to the cumulative effects on bed and bank stability in the project area with any alternative.

Flow Regimes. Past cumulative effects are described under Alternative A. This alternative will have a minimal positive effect to the flow regime and will be considerably less of a positive impact than Alternatives B and C. Biomass will be reduced in the limited areas that will be treated where green trees are removed. Biomass could continue to accumulate in the untreated areas, depending on the insect/disease activity and could quickly offset the gain in flow that was achieved from the treatment.

Aquatic Ecosystems – Chemical

Temperature/Oxygen. "Summer water temperature is increased, and winter water temperature is decreased, by removing shade, reducing low flows, or damaging banks so streams are wider and shallower. Dissolved oxygen is usually reduced when summer water temperature is increased. Such impacts impair or destroy the suitability of water bodies for aquatic biota." (USDA Forest Service, 1996).

Water Purity. "Water purity can be degraded by placing concentrated pollutant sources near water bodies, applying harmful chemicals in or near water bodies, or intercepting hazardous rock strata by roads. Degrading water purity can impair or destroy use of the water by aquatic biota and humans." (USDA Forest Service, 1996).

There are geologic deposits in the DPA that are currently degrading the water purity. They are primarily located in the North Fork Castle Creek drainage. North Fork Castle Creek runs turbid, which is very noticeable when it empties into Castle Creek.

Alternative A

Direct/Indirect Effects

Temperature/Oxygen. Under no action temperature/oxygen will not be affected and will generally remain unchanged from where it is now.

Water Purity. Under no action water purity will not be affected and will remain unchanged from current conditions.

Cumulative Effects

Temperature/Oxygen. An indirect effect to the stream temperature that is not very noticeable is the results of increased biomass across the entire forest. This increased biomass has resulted in an increase in evapotranspiration and less water available for groundwater recharge and streamflow, resulting in reduced base streamflows. These reduced base streamflows can result in increased stream temperature due to less water, but this change is slow to occur and happens over decades. Past timber activities have helped slow the increase of the biomass and insect/disease activity also has the capability of affecting/reducing the biomass.

Past and ongoing management activities on all land ownerships have reduced riparian shrub vegetation along stream courses that provides shade to moderate stream temperatures. Forest Service management activities within McIntosh Fen have improved conditions to sustain riparian shrub communities on this reach of Castle Creek.

There will not be an increase or decrease to the cumulative effects to temperature/oxygen within the project area with this alternative during this planning period. However, without reducing the biomass in the project area, there will be a general trend to reduce base streamflows slowly as the biomass increase, thus potentially increasing water temperature and reducing oxygen availability over the decades. Watershed-scale riparian shrub restoration is likely to be limited without major changes in land management practices.

Water Purity. The geologic strata located in the North Fork Castle Creek are affecting the water purity. In communication with Dr. Kenner, he believes that this is natural and this is as good as it is going to get (Kenner, S.J., 2004, personal communication). Other than what is mentioned above, there are no known concentrated pollutant sources in the project area from the past and no known harmful chemicals applications near water bodies in the past within the project area. There will be no increase or decrease to the cumulative effects to water purity within the project area with this alternative.

Alternative B

Direct/Indirect Effects

Temperature/Oxygen. Reducing the stand density on 61% of NFS lands within the Deerfield Project Area with commercial and non-commercial timber activities will have a positive effect on stream temperature. Biomass will be reduced, resulting in more water being available for streamflow. More water will help maintain stream temperatures. This alternative will have the greatest positive effect on water temperature.

Water Purity. None of the proposed activities involves placing concentrated pollutant sources near water bodies or applying harmful chemicals near water bodies. Forest Plan Standard 1211 addresses this concern by requiring vehicle service and fuel areas to be done on gentle upland sites.

Cumulative Effects

Temperature/Oxygen. Past cumulative effects are described under Alternative A. This alternative will have a positive effect to stream temperature and oxygen availability. Timber harvest will decrease biomass in the project area making more water available for streamflow or ground water recharge. No specific riparian shrub restoration is proposed.

Water Purity. Past cumulative effects are described under Alternative A. Activities in this alternative will neither increase nor decrease the cumulative effects to water purity within the project area.

Alternative C

Direct/Indirect Effects

Temperature/Oxygen. Reducing the stand density on 51% of NFS lands within the Deerfield Project Area with commercial and non-commercial timber activities will have a positive effect on stream temperature. Biomass will be reduced, resulting in more water being available for streamflow. More water will help maintain stream temperatures. This alternative will have the next greatest positive effect on water temperature, not too far behind Alternative B.

Water Purity. See Alternative B.

Cumulative Effects

Temperature/Oxygen. Past cumulative effects are described under Alternative A. This alternative will have a positive impact to stream temperature and oxygen availability but not as good as Alternative B. Timber harvest will decrease biomass in the project area making more water available for streamflow or ground water recharge. No specific riparian shrub restoration is proposed.

Water Purity. See Alternative B.

Alternative D

Direct/Indirect Effects

Temperature/Oxygen. Reducing the stand density on 28% of NFS lands within the Deerfield Project Area with commercial and non-commercial timber activities will have a positive effect on stream temperature. Biomass will be reduced, resulting in more water being available for streamflow. More water will help maintain stream temperatures. This alternative will have much less positive effect on water temperature, as compared to Alternatives B & C but it will be better than Alternative A.

Water Purity. See Alternative B.

Cumulative Effects

Temperature/Oxygen. Past cumulative effects are described under Alternative A. This alternative will have a positive impact to stream temperature and oxygen availability. Timber harvest will decrease biomass in the project area making more water available for streamflow or ground water recharge, but will fall well below the positive effects resulting from Alternatives B and C. No specific riparian shrub restoration is proposed.

Water Purity. See Alternative B.

Aquatic Ecosystems – Biological

Aquatic Life. "Aquatic life can be degraded by migration barriers, changed flow regimes, riparian damage, or big sediment loads or chemical loads." (USDA Forest Service, 1996).

Flow regimes are discussed under the flow regime section, sediment loads are discussed under the sediment section and chemical loads are discussed under water purity section of this section and the Hydrology Report held in the Project File. Additional information is contained in the Fisheries Specialist Report and the Biological Evaluation.

Alternative A

Direct/Indirect Effects

Aquatic Life. Under no action, aquatic life will not be affected and will generally remain unchanged from where it is now.

Cumulative Effects

Aquatic Life. Aquatic life has been affected in subtle ways over the past. Every time a road/stream crossing is constructed, sediment is added to the stream, usually in small quantities. This has not impacted aquatic life detrimentally, but the impacts are still there. Cattle also can have an effect on aquatic life by trampling the stream and banks. The discussion on sediment relates to aquatic life.

The more sediment produced the greater impacts on aquatic life. The discussion on flow regimes also relates to aquatic life, the more quality water, the more aquatic life.

There will be no increase or decrease to the cumulative effects to aquatic life within the project area with this alternative.

Alternative B, C, and D

Direct/Indirect Effects

These alternatives include commercial and non-commercial vegetation management activities and travel management. The only project that will affect aquatic life relates to the new stream crossing on Castle Creek. Standard 1203 requires stream crossings to be constructed to allow for the free movement of aquatic life. Therefore, no additional habitat fragmentation is likely to occur.

These alternatives have the potential to affect aquatic life. However, by implementing the FPS&G, which include WCPs and BMPs, very little sediment would be generated thus providing for minimal effect to aquatic life.

Cumulative Effects

Cumulative effects are described under Alternative A.

Soil Productivity

The long-term maintenance of site productivity is a goal of the 1997 Black Hills National Forest, Land and Resource Management Plan (LRMP) and a part of the mission of the Forest Service. Soil erosion, soil compaction, nutrient removal, soil heating and regeneration hazards can limit the long-term productivity of forested sites. All analysis is based on Natural Resource Conservation Service (NRCS) soil surveys (USDA Soil Conservation Service, 1990) and the Black Hills National Forest Soil Map Descriptions and Interpretations Notebook (Black Hills National Forest, 1997).

Soil Erosion. "Severe erosion can impair long-term soil productivity if soils are heavily disturbed on shallow or highly erodible soils. Evidence of severe erosion is rills or pedestals." (USDA Forest Service, 1996).

Soil Compaction. "Soil compaction is caused by excess weight of vehicles and animals. It impairs infiltration, root growth, and soil biota." (USDA Forest Service, 1996).

Nutrient Removal. "Soil fertility depends on organic matter and nutrients. Soil productivity can be degraded if humus and topsoil, or even excess leaves and limbs, are taken off site." (USDA Forest Service, 1996).

Soil Heating. "Soil heating is caused by severe fires that occur when humus and large fuels are dry and large fuels are consumed near the ground. Soil heating sterilizes the soil, alters soil physics, consumes organic matter, and removes much of the site's nutrients." (USDA Forest Service, 1996).

Regeneration Hazard. "Forests must be restocked within 5 years after regeneration harvest. Regeneration may be impeded on marginal sites due to seedling mortality, plant competition, and other factors." (USDA Forest Service, 1996).

Alternative A

Direct/Indirect Effects

Soil Erosion. Under no action, soil erosion will generally not be affected and remain unchanged. Problems where erosion is currently occurring will continue to occur. Erosion problems are generally road related and there are approximately 22 miles of open road on soils with a very high erosion rating.

Soil Compaction. No effect under No Action.

Nutrient Removal. No effect under No Action.

Soil Heating. The biomass and fuels will not be treated and will continue to accumulate. If a wildfire were to occur, the soils could be adversely affected.

Regeneration Hazard. Under no action, regeneration hazards will not be affected.

Cumulative Effects

Soil Erosion. There have been past activities or events in the project area that have caused soil erosion. The past activities are generally road related, where water has been concentrated.

There will be no increase or decrease to the cumulative effects from soil erosion in the project area with this alternative.

Soil Compaction. There have been past activities in the project area that may have caused soil compaction problems. These are generally activities that involve using heavy equipment at the wrong times. Areas with these problems have not been identified. Soil compaction is not permanent and when it occurs, "nature has built-in processes that reduces soil compaction, including cycles of wetting and drying, freezing and thawing, as well as plant growth and microbial activity" (Wortmann, 2003).

There will be no increase or decrease to the cumulative effects from soil compaction to the project area with this alternative.

Nutrient Removal. Past events in the project area have had limited effects on soil nutrients. The biomass has been increasing over the years, which continually puts nutrients back on the soils. There will be no increase or decrease to the cumulative effects to the soil nutrients in the project area with this alternative.

Soil Heating. Past events that could affect soil heating is wildfire. Wildfires generally occur when fuels are dry and result in soil heating that causes the problems listed above. There have been a few wildfires in the past within the project area. They generally occurred in the 1930s and any impacts that may have occurred are well on their way to recovery because it has been at least 65 years since the latest fire.

There will be no increase or decrease to the cumulative effects from soil heating in the project area with this alternative as long as a wildfire does not occur. A wildfire, with an effect to the soil from soil heating, has the greatest chance of occurring with this alternative because no activities will occur to reduce the fuels.

Regeneration Hazard. Past activities have not affected regeneration in this project area. This area is generally overstocked with trees. There will be no increase or decrease to the cumulative effects from regeneration hazards in the project area with this alternative.

Alternative B

Direct/Indirect Effects

Soil Erosion. Commercial timber harvest with a variety of treatments is planned on approximately 14,500 acres in this alternative. Of these acres, an estimated 2,380 acres or 16% are located on soils with a very high erosion hazard rating. To say that no soil erosion will occur from the commercial activities would be incorrect, but by implementing the FPS&G, which includes WCPs and BMPs, there would be very little soil erosion occurring. Erosion problems related to roads would be corrected through maintenance or reconstruction in conjunction with the timber harvest. There will be approximately 20 miles of open road on soils with a very high erosion rating.

Soil Compaction. Commercial timber harvest is proposed on approximately 14,500 acres in this alternative. Of these acres, approximately 9,070 acres or 63% are located on soils subject to compaction. This alternative has the highest potential to impact soils by compaction because it has the most acres being treated. By implementing the FPS&G, which include WCPs and BMPs, there would be very little soil compaction occurring.

Nutrient Removal. Commercial timber harvest is proposed on approximately 14,500 acres in this alternative. Of these acres, it is estimated that 200 acres or 1% are located on soils that have low organic matter. Implementing the FPS&G, which includes WCPs and BMPs, on these soils, will minimize any effects on soil nutrients.

Soil Heating. Prescribed fire is proposed on approximately 7,000 - 10,000 acres in this alternative. This alternative will have higher potential to effect soils by soil heating than

Alterative A because of prescribed fire treatment proposed. By implementing the FPS&G, which include WCPs and BMPs, soil heating would be kept to a minimum.

Regeneration Hazard. This alternative treats a variety of acres. Regeneration of these acres, if desired, will not be a problem. Ponderosa Pine tends to reproduce well in the Black Hills (Orr, 1975). This alternative will not have an affect on regeneration hazard.

Cumulative Effects

Soil Erosion. There will be potential for a minor short-term increase to the cumulative effects from soil erosion in project area from the proposed harvest units. Impacts to roads will be about the same as compared to Alternative A.

Soil Compaction. Cumulative effects from past activities are described under Alternative A. Due to the large amount of commercial activities proposed, there is a greater potential to incrementally increase the cumulative effect to the soil from compaction with this alternative, as compared with Alternative A. Adherence to prescribed mitigation measures will minimize this.

Nutrient Removal. See cumulative effects described under Alternative A. There is potential for increased cumulative effect to soil nutrients from this alternative within the project area. However the acreage is so small that the potential impacts are not much greater than Alternative A.

Soil Heating. There could be a slight increase to the cumulative effects from soil heating in the project area with this alternative because of the amount of planned prescribed fire. As far as a threat to soil heating from wildfire, the risk is less than Alternative A with the treatments prescribed that will reduce the wildfire potential.

Regeneration Hazard. There will be no increase or decrease to the cumulative effects from regeneration hazard in the project area with this alternative.

Alternative C

Direct/Indirect Effects

Soil Erosion. Commercial timber harvest is proposed on approximately 11,000 acres in this alternative. Approximately 1,350 acres or 12% are located on soils with a very high erosion hazard rating. By implementing the FPS&G, which includes WCPs and BMPs, there would be very little soil erosion occurring for short distances. Erosion problems related to roads would be corrected through maintenance or reconstruction in conjunction with the timber harvest. There will be approximately 13 miles of open road on soils with a very high erosion rating.

Soil Compaction. Commercial timber harvest is proposed on approximately 11,000 acres in this alternative. Of these acres, approximately 7,080 acres or 64% are located on soils subject to compaction. By implementing the FPS&G, which include WCPs and BMPs, soil compaction would be kept to a minimum and if it does it will disappear over time. Relative to Alternative B,

this alternative has less soil compaction potential because it has fewer acres subject to compaction being treated.

Nutrient Removal. Commercial timber harvest is proposed on approximately 11,000 acres in this alternative. Of these acres, it is estimated that 200 acres or 2% are located on soils that have low organic matter. Implementing the FPS&G, which includes WCPs and BMPs, on these soils, will minimize any impacts on soil nutrients.

Soil Heating. Prescribed fire is proposed on approximately 10,000 - 14,000 acres in this alternative. This alternative has a slightly higher potential than Alternative B to potentially effect the soils from soil heating due to more prescribed acres planned for treatment. By implementing the FPS&G, which include WCPs and BMPs, soil heating would be kept to a minimum.

Regeneration Hazard. See effects described under Alternative B.

Cumulative Effects

Soil Erosion. This alternative will have a minor short-term increase to the cumulative effects from soil erosion in the project area from the proposed harvest units but will be considerably less than Alternative B. Potential soil erosion from roads will be reduced as compared to Alternatives A and B.

Soil Compaction. The potential to contribute to a cumulative increase to soil compaction exists. This is due again to the large amount of commercial activities proposed. However, because of less acres being treated, there will be proportionately less potential to effect compaction. Again implementing specified mitigation will minimize this.

Nutrient Removal. Past cumulative effects are described under Alternative A. There is potential to increase the cumulative effect to soil nutrients from this alternative within the project area. However, the acreage is so small that the potential for additive effects is not much greater than Alternative A and comparable Alternative B.

Soil Heating. Past cumulative effects are described under Alternative A. There could be a slight increase to the cumulative effects from soil heating in the project area with this alternative because of the amount of planned prescribed fire and it would be greater than Alternative B. As far as a threat to soil heating from wildfire, the risk is less than Alternative A and similar to Alternative B with the treatments prescribed that will reduce the wildfire potential.

Regeneration Hazard. Past cumulative effects are described under Alternative A. There will be no increase or decrease to the cumulative effects from regeneration hazard in the project area with this alternative.

Alternative D

Direct/Indirect Effects

Soil Erosion. Commercial timber harvest is proposed on approximately 3,700 acres in this alternative. Approximately 390 acres or 11% are located on soils with a very high erosion hazard rating. By implementing the FPS&G, which includes WCPs and BMPs, there would be very little soil erosion occurring for short distances. Erosion problems related to roads would be corrected through maintenance or reconstruction in conjunction with the timber harvest. There will be approximately 10 miles of open road on soils with a very high erosion rating.

Soil Compaction. Commercial timber harvest is planned on approximately 3,700 acres in this alternative. Of these acres, approximately 2,260 acres or 61% are located on soils subject to compaction. By implementing the FPS&G, which include WCPs and BMPs, soil compaction would be kept to a minimum and will disappear over time. This alternative will have the least potential to impact soils with soil compaction because it has the least amount of acres being treated.

Nutrient Removal. Commercial timber harvest is proposed on approximately 3,700 acres in this alternative. Of these acres, it is estimated that 45 acres or 1% are located on soils that have low organic matter. Implementing the FPS&G, which includes WCPs and BMPs, on these soils, will minimize any impacts on soil nutrients.

Soil Heating. Prescribed fire is proposed on approximately 3,500 acres in this alternative considerably less than Alternatives B and C, thus there is less potential to impact soils. By implementing the FPS&G, which include WCPs and BMPs, soil heating effects would be kept to a minimum.

Regeneration Hazard. See effects described under Alternative B.

Cumulative Effects

Soil Erosion. Past cumulative effects are described under Alternative A. This alternative will have a minor short-term increase to the cumulative effects from soil erosion in the project area from the proposed harvest units but will be considerably less than Alternatives B and C. The potential for additive soil erosion from roads will be reduced as compared to Alternatives A, B and C.

Soil Compaction. Past cumulative effects are described under Alternative A. There is a moderate potential to increase the cumulative effect to the soil from compaction from this alternative. This is due to the moderate amount of commercial activities proposed relative to the other action alternatives.

Nutrient Removal. Past cumulative effects are described under Alternative A. There is a very slight potential to increase the cumulative effect to soil nutrients from this alternative within the project area. However the acreage is so small, even smaller than Alternatives B & C, that increased cumulative effects to soil nutrients is potentially not much greater than Alternative A.

Soil Heating. Past cumulative effects are described under Alternative A. There could be a slight incremental increased impact from soil heating in the project area with this alternative because of the planned prescribed fire, but considerably less than Alternatives B and C. As far as a threat to soil heating from wildfire, the risk is less than Alternative A but more than Alternatives B and C with the limited treatments prescribed that will reduce the wildfire potential.

Regeneration Hazard. See effects described under Alternative B.

Geologic Hazards

Landslides. "Soil creep, debris avalanches and flows, slumps, and earthflows can occur on unstable slopes if roads overload or undercut them, vegetation is removed from them, or runoff is emptied onto them. Hazard depends on type of disturbance, nature of earth material, and water content." (USDA Forest Service, 1996).

Soil Failures. "Soil failures include land subsidence, shrinking and swelling soils, and collapsing soils. Removal of subsurface fluids or materials, or changed hydrology on certain soil types, can induce soil failures." (USDA Forest Service, 1996).

Earthquakes. "Earthquake hazards can be increased if facilities are located in seismically-active areas. Areas of greatest potential are near the Colorado Front Range and in northwestern Wyoming." (USDA Forest Service, 1996).

Alternative A

Direct/Indirect Effects

Landslides. No effects under No Action

Soil Failures. None of the proposed activities or lack of activities will have an affect on soil failures. Soil failures are not a concern within the Deerfield Project Area.

Earthquakes. Earthquakes are not a concern in the Black Hills and not a concern within the DPA. None of these activities or lack of activities will have an affect on the earthquake risk.

Cumulative Effects

Landslides. Past activities within the project area have caused minimal problems with landslides. One small movement was observed as the result of the road cutting the toe of the slope, however this movement was only a few feet and additional movement is not expected. There will be no increase or decrease to the cumulative effects from landslides in the project area with this alternative.

Soil Failures. None of the activities in the project area in the past have affected soil failures or soil failure risks. There will be no increase or decrease to the cumulative effects to soil failures within the project area with any alternative.

Earthquakes. None of the activities in the project area in the past have affected earthquakes or earthquake risks. There will be no increase or decrease to the cumulative effects to earthquakes within the project area with any alternative.

Alternatives B, C, and D

Direct/Indirect Effects

Landslides. Vegetative treatment could potentially effect landslides because some activities occur on slopes greater than 20% and some greater than 40% with mass wasting potential soils. Activities on these soils will be restricted and will follow FPS&G to reduce the risk of landslides.

Soil Failures. See Alternative A.

Earthquakes. See Alternative A.

Cumulative Effects

Landslides. Past cumulative effects are described under Alternative A. There will be negligible cumulative effects from landslides in the project area with these alternatives.

Soil Failures. See Alternative A.

Earthquakes. See Alternative A.

Special Areas

Riparian Ecosystems. "Riparian ecosystems provide shade, bank stability, fish cover, and woody debris to aquatic ecosystems. They also provide key wildlife habitat, migration corridors, sediment storage and release, and surface-ground water interactions. Composition and structure of riparian vegetation can be changed by actions that remove certain species age classes." (USDA Forest Service, 1996).

Wetlands. "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, 1996).

Floodplains. "Floodplains are natural escape areas for floods that temper flood stages and velocities." (USDA Forest Service, 1996).

Alternative A

Direct/Indirect Effects

Riparian Ecosystems, Wetlands and Floodplains. No activities are proposed within the project area so there will be no impact or affect on riparian ecosystems, wetlands or floodplains.

Cumulative Effects

Riparian Ecosystems, Wetlands, and Floodplains. Activities in the past that have affected the riparian ecosystems are grazing and roads. Cattle effects on riparian areas are cattle grazing these areas and looking for water. Effects include trampling the area creating a hummocky landscape or damaging the stream bank because the area is wet. Grazing the vegetation too much for a long period of time can change the species composition of the area. Roads crossing riparian ecosystems have a direct effect by eliminating these areas at the crossing.

There will be no increase to the cumulative effects to riparian ecosystems within the project area with this alternative. Ongoing efforts to restore wet meadow conditions in McIntosh Fen will promote conditions to sustain and increase the riparian shrub community. Fencing of the riparian area to exclude livestock along Castle Creek downstream of Deerfield Dam has had positive benefits on riparian condition. Riparian ecosystems elsewhere in the DPA are likely to remain in their present condition assuming current land management activities continue.

Alternative B

Direct/Indirect Effects

Riparian Ecosystems, Wetlands, and Floodplains. No activities are planned within any riparian areas so there will be no new impacts as a result of the proposed projects.

Cumulative Effects

Riparian Ecosystems, Wetlands, and Floodplains. Past cumulative effects are described under Alternative A. There will be no increase or decrease to the cumulative effects to riparian ecosystems, wetlands and floodplains within the project area with this alternative.

Alternative C

Direct/Indirect Effects

Riparian Ecosystems, Wetlands, Floodplains. There will be one new road stream crossing on Castle Creek with this alternative. Without mitigation, this crossing will directly affect the riparian area by eliminating riparian vegetation with the construction of the road resulting in a CDA. If the road is removed, the riparian area will recover with time.

Cumulative Effects

Riparian Ecosystems, Wetlands, Floodplains. Past cumulative effects are described under Alternative A. There will be an incremental increase to past effects to a riparian area with this alternative with the construction of the one stream crossing previously described. There will be no increase or decrease to the cumulative effects to wetlands or floodplains within the project area with this alternative.

No activities are planned for in riparian areas other than one road crossing on Castle Creek. As stated, there will be an incremental short-term effect to the riparian environment but mitigation measures will minimize (see Appendix B) the effects.

Alternative D

Direct/Indirect Effects

Riparian Ecosystems, Wetlands, and Floodplains. See discussion under Alternative B.

Cumulative Effects

Riparian Ecosystems, Wetlands, and Floodplains. See discussion under Alternative B.

Summary of Cumulative Effects of All Alternatives

The DPA is located within two HUC 6 watersheds, Castle Creek and North Fork Castle Creek. Past, present and future land uses and events within these watersheds include; timber harvest, fire, grazing, private land ownership, roads and off road vehicles. All of these activities or events individually have an impact on the watershed. This results in a cumulative effect on the watershed, some more than others. Some are short-term effects that disappear with time, while with others the impacts persist. These combined uses in the watershed have not affected the watershed to the point that the beneficial uses have been affected.

The proposed action (Alternative B) will treat 27% of the Castle Creek watershed area with fuels and commercial harvest, 18% non-commercial thinning and fuels reduction activity, 23% with prescribed fire and a reduction of the road mileage. North Fork Castle Creek watershed will have 18% commercial harvest, 13% noncommercial timber activity, 17% with prescribed fire and a reduction of the road mileage. Effects from these activities approximate what the watersheds have been subject to in the past. The actions planned will not affect the beneficial uses in these watersheds or downstream.

As land managers it is wise to correct problems as opportunities arise or are identified, thus reducing the cumulative effects on the watershed. The CDAs that were identified in the DPA are the areas identified during the fieldwork that are directly affecting the watershed. Repairing these areas will reduce the cumulative effects to the watershed.

TRANSPORTATION

Affected Environment

The primary road that provides access to the Deerfield Project Area from Hill City is Forest Highway 17, also known as the Deerfield Highway. US Highway 85 and Forest Highway 17 (County road 306, south of Rochford) provide access to the area from the cities of Deadwood, Lead and Rochford.
The transportation system within the project area is comprised of approximately 292 miles of existing roads. Of this total, Forest Highway 17 accounts for 13 miles and county jurisdiction roads account for 7 miles. There are 171 miles of National Forest System Roads and 82 miles of unclassified roads on forest land. Roads on private property total approximately 19 miles. Current total road density in the Deerfield Project Area is 4.6 miles per section. Of this total, 28 miles are closed year long, resulting in an open road density of 4.3 miles per section. (Open road density does not include roads on private property).

Some activities from past management decisions, within the Deerfield Project Area, are not complete. These activities include closing 31 miles and decommissioning 14 miles. Once completed, the total road density will be 4.3 miles per section and the open road density will be 3.6 miles per section (activities from past decisions will occur independent of a decision on the Deerfield Project Area).

Environmental Consequences

The proposed transportation system varies somewhat between the action alternatives. Reconstruction activity would bring road standards up to the minimum necessary to accommodate commercial timber haul while protecting soil and water resources. Work on existing unclassified roads (NFSR conversion) would also bring roads up to minimum roads standards necessary for commercial haul while protecting soil and water resources. New road construction would be needed to access presently inaccessible commercial timber in alternatives B, C and D. Temporary roads may also be needed to access portions of proposed units and would be closed or decommissioned after activities. Proposed closures of forest system roads and decommissioning of existing system and unclassified roads would reduce the open road density in each action alternative. Table 3-1 through Table 3-3 summarizes mileages contained within the alternatives. (Appendix G, Maps 18-21 display the existing and proposed travel management activities).

Table 3-1 Transportation - Activities in Miles (approximate)

Activity	Alternative B	Alternative C	Alternative D
Maintenance	132	129	108
Reconstruction	38	37	24
New Construction	5	5	2.0
Estimated Cost*	$297,600	$288,700	$190,000

*The alternatives road cost summary and individual road costs are located in the Project File

Table 3-2 Road Management - Total Road Miles

	Alternative A	Alternative B	Alternative C	Alternative D
Beginning Road Miles	292	292	292	292
*Scheduled Decommission Per past decisions	14	14	14	14
Proposed Decommission with Deerfield Project	0	6	25	59
Decommission Costs	0	$14,600	$66,250	$127,050
Proposed New Construction	0	5	5	2
Total Road Miles	**278**	**277**	**258**	**221**
Total Road Density	4.3mi\section	4.3mi\section	4.0mi\section	3.4mi\section

*Scheduled decommissions are based on past decisions and will occur independent of a decision on the Deerfield project. They are shown in each alternative to clarify the total road mile changes.

Table 3-3 Road Management - Open and Closed Motorized

	Alternative A	Alternative B	Alternative C	Alternative D
Open Road Miles	200	195	155	126
Open Road Density (excludes roads on private property)	3.6mi\section	3.5mi\section	2.7mi\section	2.2mi\section
Existing Closed Road Miles	28	28	28	28
Proposed Closures within the Deerfield Project		4	25	17
*Scheduled Closed Miles per past decisions	31	31	31	31
Private Road Miles	19	19	19	19

*Scheduled closures are based on past decisions and will be implemented upon completion of activities generated from those decisions and will occur independent of a decision on the Deerfield project.

Open roads would include management strategies ranging from high standard suitable for all types of vehicles to those primitive roads where off-highway vehicles (OHV's) are required. Closed roads would be managed such that motor vehicles use is prohibited via a closure order or the road is physically barricaded to all traffic. Decommissioned roads would be obliterated. A more detailed description of these management strategies is provided in the Transportation Report held in the Project File. The existing and proposed Travel Management Strategy for each road segment by alternative is also listed in the Transportation Report held in the Project File and the Recreation and Travel Management Use section in this chapter.

Alternative A

Alternative A, the no action alternative, maintains the current road system with the exception of the past management decision activities mentioned above. No additional roads would be closed other than the scheduled closures from past decisions, open road density would remain 3.1 miles per section. Current road closures in the project area range from totally effective to non-effective. Additional funding would be needed to reinforce the non-effective closures.

Segments of roads are located in drainage bottoms creating drainage problems and rutting. Existing drainage crossings and structures are also not adequate to prevent sediment movement. Existing user defined roads have no drainage structures and poor alignment and location which are contributing to drainage problems. Direct, indirect and cumulative effects from possible continued sediment contribution would continue to occur and increase as new user defined roads are created.

As budgets continue to decline, fewer roads within the areas would be maintained at current standards. This may contribute to increased sediment delivery to drainages and decreased positive driving experiences as the roads become difficult to navigate.

Alternatives B, C, and D

Under all alternatives, the existing arterial and collector roads would remain open to the public year-round and also receive maintenance year-round, but the existing local roads would vary by alternative. Open local roads would be managed to accommodate high clearance vehicles but not low clearance passenger vehicles. These open roads would generally be maintained at 5-year intervals. Roads closed yearlong within Management areas 3.1 and 8.2 would be gated with use legally prohibited (closure order) and maintenance done at 5-year intervals as needed. Roads closed/stored would be physically barricaded and maintained every 5 years. Roads decommissioned would be removed from the forest road system.

The proposed transportation system under Alternative B would add 5 miles of road to the forest road system. Of this total mileage, 0.8 miles would remain open yearlong, 1.4 miles would be physically closed yearlong and 3.0 miles would be physically closed and 'stored' for future use. Any temporary road construction and all other unclassified roads would be decommissioned.

The proposed transportation system under Alternative C would add 5 miles of road to the forest road system. Of this total mileage, 1.4 miles would be physically closed yearlong and 3.8 miles would be physically closed and 'stored' for future use. Any temporary road construction and all other unclassified roads would be decommissioned.

The proposed transportation system under Alternative D would add 2 miles of road to the forest road system. Of this total mileage, 0.7 miles would remain open yearlong; 1.3 miles would be physically closed and 'stored' for future use. Any temporary road construction and all other unclassified roads would be decommissioned.

Alternatives B, C and D would reduce the open road density as shown in Table 3-3. Fewer road miles would be open and more road miles would be closed or decommissioned which would

enable the Forest Service to better meet their ability to maintain these roads. Direct, indirect and cumulative effects to the aquatic and terrestrial ecosystem would also diminish as roads are closed or decommissioned.

Roads utilized under the action alternatives would be reconstructed or constructed and maintained in accordance to the Engineering Design Guidelines and Best Management Practices Compliance that are listed later in this document. Proposed corrective actions for existing conditions with soil and water problems are listed in the Specific Concerns under the Best Management Practices Compliance. The direct, indirect and cumulative affects of sediment contribution would diminish as these actions are taken.

Cumulative Effects

Under all the action alternatives, fewer road miles would be open and more road miles would be closed or decommissioned which would reduce the overall road maintenance costs. Alternative D would reduce the open road miles and maintenance cost the most but would cost the most to close and decommission roads. Alternative B would have more open road miles than the other alternatives, except for the no action alternative, but would cost the least to close or decommission roads.

Under all action alternatives, identified roads would be reconstructed to stabilize road surfaces, to improve and provide adequate drainage structures, and possibly designed to a higher standard to reduce future maintenance costs and sediment contribution. Alternatives B and C would reconstruct and improve the most miles, followed by Alternative D.

MINERALS

Affected Environment

Minerals can be divided into three categories on National Forest System lands. This includes locatable, leasable, and saleable minerals. Locatable minerals are those such as gold, copper, silver, and other metals which can be claimed under the mining laws. A person or company files a mining claim when they have found something of value, and must get approval from the Forest Service before conducting any surface disturbing activities. There are mining claims located within the project area, but none that are conducting active operations.

Leasable minerals include deposits such as oil and gas or coal. Leases are awarded at the discretion of the government for these types of minerals. There are no mineral leases within the project area and the potential for these types of minerals is low in this area. Saleable minerals include such things as sand and gravel and building stone. The project area contains deposits of saleable type minerals but none are being developed at this time.

Environmental Consequences

There should be no direct, indirect, or cumulative effects to the mineral resource or to mining claimants from any of the alternatives.

BIOLOGICAL ENVIRONMENT

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

VEGETATION

Affected Environment

Timber has been harvested in this area for more than a century. Records indicate that harvesting in the general area has occurred as far back as the late 1800's and provided timber for the gold rush. Although there is no specific data on activities within the Project area, there are records of a sawmill in the Rochford area in the 1890's. Additional mills were operating in the Rochford and Mystic area by 1924, and a mill near Deerfield was added by 1932. More detailed information is available beginning in the early 1970's. The 1983 Forest Plan provided for a more detailed management plan for the Black Hills.

Commercial harvests and non-commercial thinning from the mid- '80's through the early '90's have taken place on about 60% of National Forest lands within the project area (23 timber sales yielding 137,000 mmbf and covering 36,000 acres in or near the project area, see Appendix E). Many treatments were designed to lower the basal area to promote increased growth and vigor as well as lessen susceptibility to Mountain Pine Beetle, Dendroctonus ponderosae, attack. The non-commercial thinning of 14,110 acres of ponderosa pine has occurred within the project area. Revenues from timber sales have funded a large number of resource improvement activities, which include:

- Fuel treatments
- Wildlife Habitat Improvements
- Range Habitat Improvements
- Harvest Treatments
- Reforestation
- Inventories and Surveys
- Wildlife Habitat Surveys
- Special Use Permits

Personal interviews with private industry Foresters reveal that limited silvicultural activities have occurred on land within the project area other than National Forest System Lands within the past 25 years. See the Silviculturist Report held in the Project File for detailed information.

Fuel-loading:

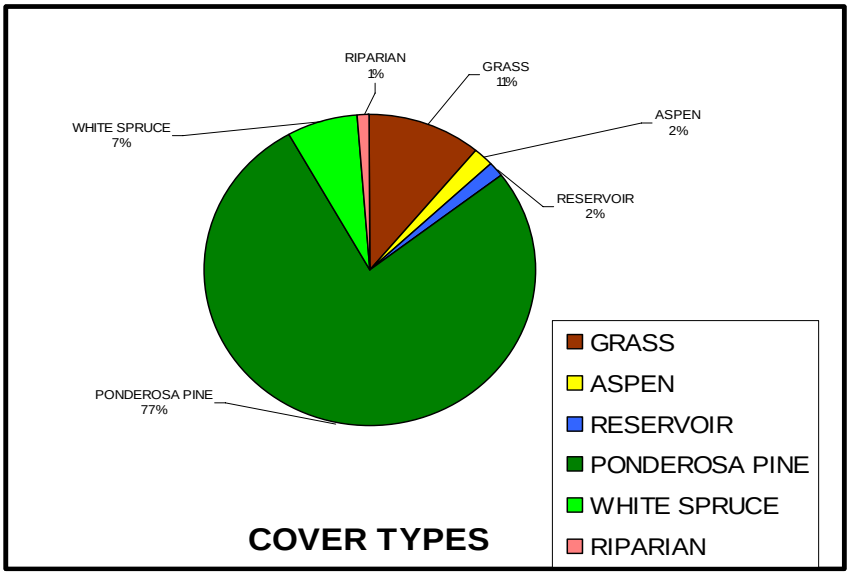
Most of the slash from past harvesting and non-commercial thinning has been treated to a point where existing fuels are at levels below forest plan standards. Approximately 27% of the area

has had treatments that have reduced the crown spacing to a level that would reduce the risks of a crown fire.

Plant Species Composition:

The vast majority of the forested acres are ponderosa pine (27,950 acres). Other cover types include 2,538 acres of white spruce and 693 acres of aspen. There are numerous small inclusions (10 acres or less in size) of aspen well distributed throughout the area. These are usually very productive sites where conifers will eventually take over the site if no treatment is done. In addition, there are 3,991 acres of grassland and 378 acres of riparian. Some of these areas have conifers encroaching on them.

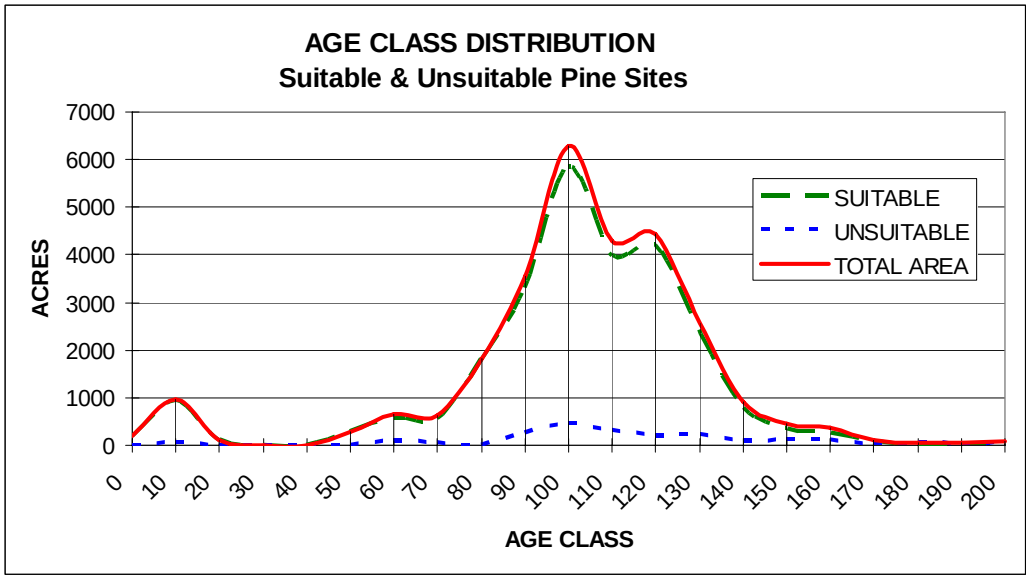
Figure 3-2 Cover Types



Age Class Distribution:

Approximately 12,113 acres (47%) of the suitable pine stands inventoried within the project area are greater than 105 years of age. 12,174 acres (47%) of the suitable pine stands are between 55 and 105 years old, and 1,599 acres (6%) are 55 years or less.

Figure 3-3 Age Class Distribution



The distribution of age classes ranges from 1 to 210 years with 76% of the pine cover type in the 90 to 130 year age classes. The age class curve is a bell shaped curve with the greatest acreage in the 100-year class (see Figure 3-3). 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 curve where the majority of acres occur is within the 90 to 130 age class which indicates that many of the stands were regenerated over a 50 year period from approximately 1875 until 1915. There is a period from about 1935 to 1975 where the amount of new stand regeneration declines rapidly, indicating that harvesting activities to regenerate stands 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 upward trend in acres in the 1 to 20 year age classes. To develop an even distribution of age classes across the landscape over a 200-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 very unlikely.

Stocking Level:

Approximately 4,751 acres (18%) of the suitable pine acres have a basal area greater than 100 square feet and is at or approaching an overstocked condition. Another 10,941 acres (43%) are between 60 and 100 basal area, which is usually considered fully stocked. 10,026 acres (39%) are less than 60 basal area, which can be considered under-stocked using basal area standards. A recent report on mountain pine beetle activity in the Deerfield area, Forest Health Evaluation R2-05-01, 2004 and RCSC-06-04, 2003, proposes leaving less than fully stocked stands when dealing with mountain pine beetle outbreaks. It states "When managing the forest to reduce beetle effects, silvicultural prescriptions will need to be more aggressive and will have fewer options as when beetle populations are low. Stand density may need to be reduced to lower basal areas, such as 40 [BA]." Although basal areas are generally a good indication of stocking in most sawtimber and

poletimber stands, it doesn't represent smaller diameter stands, less than 6" diameter at breast height (dbh), nor large diameter stands, >16" dbh, well.

Regeneration:

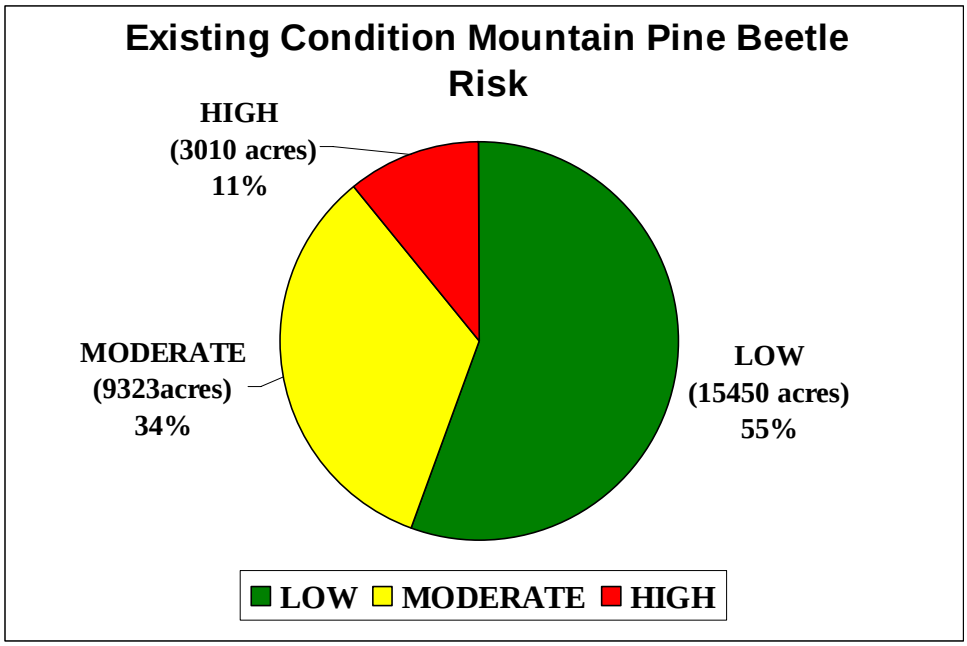
Pine regeneration is occurring in the project area where the crown canopy is open and where competition from grasses and forbs is low. In areas where grasses have invaded the site, regeneration is at moderate to low levels. Pine regeneration activities within the project area should be designed to reduce ground cover competition and expose mineral soil, increasing natural regeneration potential. The most common plant association in the area is ponderosa pine/snowberry, which appears to favor pine regeneration. 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 be excluded unless needed to retard regeneration for other resource needs (i.e. 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 5 to 10 years.

Insects & Disease:

The insect of greatest concern in this area now is the mountain pine beetle (Dendroctonus ponderosa) (RCSC-6-04). There has been an increasing population of mountain pine beetle (MPB) and associated increases in tree mortality over the past few years in areas surrounding Deerfield Reservoir. Populations in the Deerfield area are, in many places, at outbreak levels. Of special note are the areas west and south of Deerfield. Areas of new bug hits and mortality around Fulton Draw, Cabin Draw and Gold Run have increased greatly over the past year. A multi-stand, landscape-level episode of MPB-caused mortality is in progress and is intensifying. Entire slopes appeared to be fading in unison, in some cases with few green survivors. The best approach to reducing losses to the MPB for the long-term is forest management to reduce stocking densities. Decreases in stocking densities will lower the probability that beetle outbreaks will be initiated, but it is a continual process to keep stands in the low risk category.

Much of the area has had harvesting and non-commercial thinning activities. Slash buildup from these activities has a potential to favor a buildup of insects, especially the pine engraver or ips beetle (Ips pini). Where non-commercial thinning has occurred within the area, in the past 6 years, no major infestation has occurred and additional activities can be considered a minimal risk. Mortality from insects and disease in these treated areas is generally low and can be attributed to moderate stocking levels below thresholds favorable to MPB buildups. Generally, stands of sawtimber size pine greater than 120 BA are considered highly susceptible to MPB infestations. (Schmid RM-529) Recent work has shown that areas treated to 60 basal area can be expected to reach high hazard (120 basal area) again in about 25-50 years. Stands treated to 80 basal area can reach 120 basal area in 13-36 years, and stands treated to only 100 basal area will be back to 120 basal area in 9-16 years. The timeframes of when a forest can increase in hazard level are relatively short, often shorter than the time between treatments in a stand. Stands were rated using research work done by John Schmid (RM-529).

Figure 3-4 Mountain Pine Beetle Risk Existing Condition



The overall hazard of Mountain Pine Beetle infestation can be considered moderate to high (RCSC 05-01, 2004) in the project area. The hazard rating refers to the chance of losses within a stand if an infestation occurs within the area 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.

The second most important bark beetles in the Black Hills are Ips species. There are a number of Ips species that attack both pine and spruce. Armillaria root disease (Armillaria ostoyae) is an important disease in the Black Hills, although within the project area there is little evidence of armillaria centers and can be considered a minor problem.

Another common insect found throughout the Black Hills that causes mortality in ponderosa pine is the red turpentine beetle. In contrast to the mountain pine beetle, the red turpentine beetle is not aggressive. These beetles are usually not the primary cause of mortality in pine. Red turpentine beetles are opportunistic and typically attack trees already weakened by drought, fire, other insects, or logging damage. If enough damaged pine exist for their numbers to multiply, they can fly to otherwise healthy pine and be the primary cause of their death. In the Deerfield area red turpentine beetle activity is very low and is not expected to increase unless the disturbances mentioned above occur.

The western pine tip moth (Rhyacionia bushnelli) and the southwestern pine tip moth both can be found in the Black Hills. Both moths attack small trees (less than 10’ tall) and are not considered serious pests especially in the Deerfield Project area. Some areas of regeneration in the Flag Mountain area have had minor damage but it is very limited in nature and is not expected to increase dramatically.

Other insects affecting both pine and other species of trees in the project area that are present are having minimal impact on the area and will probably continue to have a low impact in the future.

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 1997 Revised Forest Plan FEIS. See the Silviculturist Report held in the Project File for detailed information.

ALTERNATIVE A:

Direct and Indirect Effects

Under this alternative, timber management activities would not occur other than on-going activities such as firewood gathering, right-of-way clearing and Christmas tree cutting.

There are state and county right-of-ways throughout the planning area. Many of these right-of-ways have both commercial and non-commercial timber in them. Hazard trees and timber within these right-of-ways will 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 unmerchantible timber, the timber may be removed as administrative free use. In almost all of the cases, the area involved would be less than ten feet from the edge of the road. 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.

The effects of deferring treatment in the project area would be an increase in yield as the size of the existing trees increases; a reduction of diameter growth due to age and overstocking; an increasing risk of mountain pine beetle infestations; and an increased risk of catastrophic wildfire.

With no treatments, the 1,414 acres of suitable pine type that are above management zone levels will experience reduced growth due to overcrowding and competition for nutrients, water and light. An additional 3,172 acres of suitable pine are currently in the upper end of the management zone, 50 – 60% AMD, and will decrease in health and vigor in the near future.

The likelihood of a widespread epidemic level infestation of mountain pine beetle within the project area is moderate. This risk will increase over time, with growth, due to increasing stocking levels. The risk should remain moderate for the first decade but would increase to high within the next two decades if not treated.

Figure 3-5 Mountain Pine Beetle Risk Existing

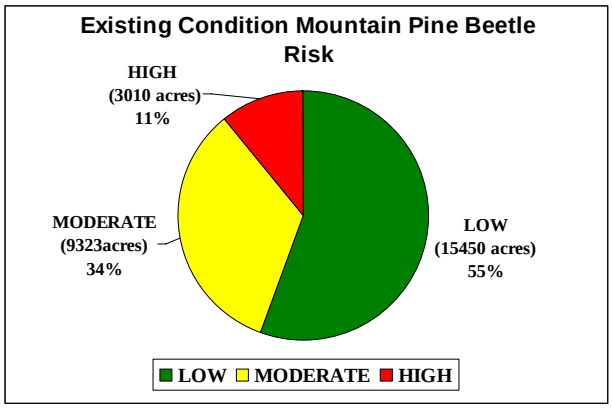
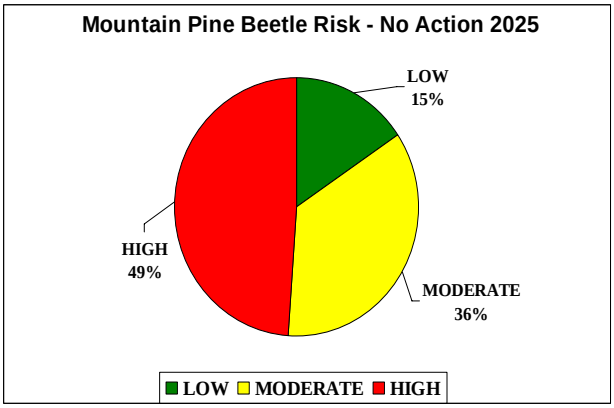


Figure 3-6 Mountain Pine Beetle Risk 2025



The pine engraver beetle (*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 within the area, the probability of a major buildup of these insects is very unlikely. Other insects and diseases are expected to remain at current levels barring natural disasters.

As the stands of pine become dense, they will 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 will most likely occur.

Age class distribution would not change except for changes created through natural processes such as insect infestations and wildfire. Long-term effects would be an increase in mortality due to competition between pine and an increase in merchantable defect due to disease

Periodic annual increment is declining in some of the stands and is less than desired due to overstocking and age. Deferment will cause a further drop in the periodic annual increment. Federal regulations (16 USC 1604) require 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, 471 stands were identified that had essentially reached CMAI. Net growth will remain positive, but it will be below it's potential. Overall, quality of the pine will remain the same, which is below its potential due to suppression, damage, disease and poorly formed trees.

Plant species composition and diversity will decrease. Conifers are encroaching into hardwood and meadow areas and filling in small openings in the forest canopy. As the canopy closes aspen, birch and other hardwoods will diminish in numbers until natural disturbances once again open up the canopy. Within many sites, forbs and grasses in the under story will be shaded out reducing benefits to other resources such as wildlife, range, recreation and the visual resource.

The risk of a stand replacing wildfire will be higher without treatment. Crown fires, such as the Jasper fire of 2000 just five miles south of the planning area, would kill many of the stands. The effect of such a catastrophic 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, and increase in insects, and a disruption of the natural regeneration process. Solarization will 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.

ALTERNATIVE B

Direct and Indirect Effects

Alternative B was developed to aggressively treat the vegetation to reduce the potential for and intensity of Mountain Pine Beetle (MPB) infestations. This alternative calls for management at lower basal areas than were typically used in the past, but still within Forest Plan guidelines. It also provides for landscape level and property boundary fuel breaks to lower the potential for large-scale crown fires, and proposes a substantial expansion of hardwoods and reduces pine encroachment into historic meadows, thereby improving wildfire suppression capabilities and increasing biodiversity within the Deerfield Project Area.

Under this alternative approximately 21,724 forested and 3,808 nonforested (25,532 total) acres would be treated, not including prescribed burning. Prescribed burning will treat about 7,000 - 10,000 acres. Many of the stands in the project area have inclusions of less than 10 acres in size that may have basal areas, age classes, size classes and tree species that differ from the majority of the stand. Treatments specified generally apply to 80% and more 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 i.e. an inclusion of polesize pine may be thinned if located within a stand scheduled for a seed tree 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: Non-commercial Thinning, Commercial Thinning, Liberation Harvests, Group Selection Harvests, Meadow Retention and Restoration Treatments, Hardwood Restoration and Retention Harvests which are designed to meet other than timber objectives. These treatments are proposed to meet the Forest Plan multiple-use and National Fire Plan objectives stated earlier in this analysis. See Appendix G, Maps 4-21.

Rights-of-Way:

There are state and county right-of-ways throughout the planning area. Many of these right-of-ways have both commercial and non-commercial timber in them. Hazard trees and timber within these right-of-ways will 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 right-of-ways will be included in the timber sale. 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.

Fuel Breaks:

Fuel Breaks using both commercial thinning and non-commercial thinning will occur on approximately 1,400 acres of the area. About 740 of those acres will receive non-commercial treatments only. The effects will be similar to commercial thinning as described below except for the amount of acres treated. There will be 400 more acres thinned in this alternative than Alternative C and 1,210 acres more than Alternative D.

Commercial Thinning:

Commercial thinning will occur on 7,658 acres of the area with 5,791 of those acres also having non-commercial thinning done. This alternative calls for a lower basal area than is normally prescribed for under the Forest Plan. Recent information on managing to decrease mountain pine beetle effects indicate that stocking as low as 40 BA may be desirable, and fire managers have determined a lower basal area and associated reduced bulk density of crown fuels reduce the potential for catastrophic wildfires. While the average BA will be reduced to 50 in the project area, some of the stands may have more or less BA depending on crown width and the diameter of the trees. Generally, the range of BA's for commercial thinning will be from 40 to 60 BA. Leave trees will not be uniformly spaced to create a more natural appearing stand. The thinning will reduce the stocking levels in overstocked stands.

The effect will 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 will develop larger diameters due to a reduction of competition which concentrates the stand growth on the fewer stems and a reduction of risk to the pine stands will occur due to the reduction of basal area below the level of susceptibility to pine beetle attack. Total yield will be lower over time than other treatments that would leave more basal area because the trees will not fully occupy the stand.

Non-commercial Thinning:

Non-commercial thinning will occur on 16,070 acres of the area. Of that, 7,175 acres will be non-commercially thinned only and 8,895 acres will have non-commercial thinning done in conjunction with other commercial treatments. Non-commercial thinning will 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 at a rate of 170 trees per acre. Spacing of leave trees will vary from 10 to 22 feet apart to create a more natural appearing stand. The thinning will reduce the stocking levels in overstocked stands and bring those stands into forest plan condition. The effect will be an increase in the quality of the timber through the removal of damaged, diseased, and poorly formed trees. There will be an increase in individual tree growth by releasing the remaining trees from competition for light, water and nutrients. Trees will develop larger diameters due to a reduction of competition, which concentrates the stand growth on the fewer stems. A reduction

of risk to the pine stands will occur due to the reduction of basal area below 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 risk reduction will 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 Seed Cuts:

Shelterwood Seed cuts will begin the regeneration process on 140 acres of pine. Pine will be left at a spacing of 45 feet leaving 21 trees per acre. Opening up the canopy allows sufficient sunlight to reach the forest floor to establish seedlings, yet provides enough shade to limit the harsh microclimates of full canopy openings. Leave trees will generally be dominant or co-dominant pine with full crowns and good form. These stands have reached culmination of mean annual and periodic annual growth. In order to provide thermal and/or hiding cover or meet other resource requirements not all stands that can be regenerated will be regenerated. In addition, many of the stands that were identified as having reached CMAI have a multi-storied structure or are all-aged and will be deferred for later treatment or treated using other methods. These stands have over-mature inclusions or stories within them. Treating these stands at this time using a silvicultural regeneration method, while appropriate for the over mature components of the stand, would not be appropriate for the mature or immature components of the stand. Mortality due to age in the over-mature pine within the stands should be minor over the next decade. This silviculture method has been extensively used in this area and regeneration success is very high.

Seed Tree Cuts:

Seed Tree cuts will begin the regeneration process on 1,647 acres of pine. Pine will be left at a spacing of 66 feet leaving 10 trees per acre. The seed tree method is similar to the shelterwood seed cut method described above except fewer trees are left to provide seed. Less shading and further seed cast distances can result in regeneration that is spotty and clumpy. However, resulting irregular stand structure can have positive effects for some resources such as wildlife or inhibiting fire spread.

Shelterwood Overstory Removals:

Shelterwood Overstory Removals with non-commercial thinning will occur on 3,039 acres. The overmature overstory stands have reached culmination of mean annual and periodic annual growth (CMAI) and is no longer needed for seed and shade. The removal of the pine overstory will release the established understory from competition for light, water and nutrients. All overstory pine 5” dbh and greater will be removed retaining only pine necessary for snag replacements or other resource needs. The effect will be an increase in growth of both the remaining pine, the establishment and production of forage for both cattle and wildlife and a reduction of aerial fuels inhibiting fire spread.

Hardwood Retention & Restoration:

The release of 896 (584 ac of aspen + 312 ac of other communities) acres of hardwoods (aspen/birch) from conifer competition will occur in this alternative. Commercial treatments and non-commercial treatments removing all of the conifers from hardwoods will occur on the 896 acres. An additional 364 acres of historical aspen stands that have been invaded by conifers will be restored by removing the conifers. Hardwood stands will be enlarged to include adjacent conifer stands that have encroached upon them. Pine will be removed from the area within 33' of the edge of the inclusion or, in the case of draws where there are remnants of past hardwood occupation, the pine will be removed to the boundary of the original stand which will normally be 33' to 100'. Included in the 364 acres are small inclusions of established hardwoods that are scattered throughout conifer stands to be treated in the project area. These hardwood stands will be enlarged by removing conifers from within and adjacent to the hardwood inclusions. Since most of these areas will be small (0.1 to 5 acres in size or narrow linear bands adjacent to existing hardwood stands), the amount of increase in acreage can only be estimated to be approximately 200 acres or < 1% of the pine type. Currently there are 693 acres of aspen stands. Upon completion of this alternative, there will be an increase of 53% in hardwood communities within the project area to approximately 1,057 acres. This will more than achieve the Forest Plan goal of conserving existing hardwood communities and restoring historic hardwood communities by 10% (LRMP I-10 – 201). The effects of this treatment will be an increase in vegetative diversity and increased vigor of hardwood communities by release from the competition of pine. Indirectly, the hardwood dependent wildlife species will have increased habitat. An additional indirect benefit would be the value of hardwood stands as fuel breaks. This alternative treats 216 acres less than Alternative C and 354 acres more than Alternative D.

Meadow Retention & Restoration:

Pine encroaching in meadows and draw bottoms will be removed on 3,427 acres and an additional 381 acres of historical meadows that have been successfully invaded by pine will be restored to their previous condition. Commercial treatments and non-commercial treatments removing all of the pine from meadows will occur on the 895 acres and the remaining 2,913 acres of meadows will be treated non-commercially. This will move the area toward the Forest Plan goal of conserving existing meadow acreage and restoration of some historic meadows. Currently there are 3,991 acres of meadow sites within the project area. Upon completion of this alternative, meadow acreage will increase by 381 acres or 9.6% to 4,372 acres. The effects of this treatment will be an increase in vegetative diversity and an increased in grass production in the meadow communities by the release from the competition of pine. Indirectly, meadow dependent wildlife species will have increase habitat. An additional indirect benefit would be the value of meadows as fuel breaks. This alternative treats 654 acres less than Alternative C and 250 acres more than Alternative D.

Prescribed Burning:

Low to moderate intensity broadcast prescribed burning will occur on up to 10,000 acres, reducing ground fuels and increasing vegetative diversity in the understory. In some of the stands, the understory vegetation is lacking due to needle cast and a closed canopy cover. A moderate

intensity prescribed fire will reduce inhibiting duff and stimulate residual grasses and forbs. Stands that will be seed cut generally will not be prescribed burned unless other resource needs dictate otherwise. 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, and due to the relative openness of the treated stands we expect 1% or less mortality with negligible reduction in yield. Seedling/sapling size pine stands will not be burned or burned at a time of the year to limit mortality and leave a minimum of 300 seedlings/saplings per acre well distributed throughout the stand. Burning in stands to be regenerated will favor grass establishment and reduce regeneration. The effects of prescribed burning on the timber resource will be a short-term increase in growth from the nutrients released into the soil. Total yield in the project area will be reduced by the mortality, but will be negligible due to the openness of the stands. Additional protection of the timber resource from catastrophic wildfire will be increased by the removal of ground fuels and ladder fuels. Burning will encourage grass and forb production, which compete with pine regeneration. Regeneration will be reduced which will reduce future maintenance treatments to keep regeneration from occurring. The competition with grasses also may reduce the opportunity to regenerate a stand once it has been identified as needing regeneration. At that time, site preparation and scarification may be needed to provide a seedbed for successful regeneration.

Stand Structure:

Stand structure within the project area generally will 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 pines will be either dominant or co-dominant. Most of the intermediate and suppressed pine will be removed in treatment areas to open up the stands to decrease risk of mountain pine beetle attack and raise crown heights and reduce ladder fuels for crown fire risk reduction.

Plant Species Composition:

Plant species composition will increase in this alternative. The amount of hardwood and meadow acreage will increase significantly with the largest increase in plant species composition increasing in the understory of the pine stands. As the pine is thinned out and prescribed burning occurs there will be a large increase of grasses, forbs, and inclusions of hardwoods. This alternative will result in more species diversity than Alternatives A and D.

Stocking Levels:

In this alternative, stocking levels will be decreased considerably compared to all other alternatives. Alternative B was designed to aggressively reduce mountain pine beetle risk by lowering the basal area of pine stands, therefore reducing the level of susceptibility to pine beetle attack and reducing crown fire risk. The hazard rating refers to the chances of losses within a stand if an infestation occurs within the area 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. Fire managers have determined lower basal areas and associated reduced bulk density of crown fuels reduce the potential for catastrophic wildfires. The effect will 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 will develop larger diameters due to a reduction of competition, which concentrates the stand growth on fewer stems. Total yield will be lower, over time, than all other alternatives that leave more basal area. The reduction in yield is because the trees will not fully occupy the stand. This alternative will contribute to the Forest Plan goal of providing for sustained commodity uses while using acceptable silvicultural systems. This alternative will also provide adequately stocked pine stands for future management.

Regeneration:

The natural regeneration of pine and other native species of trees within the project should be good with the treatments in this alternative. However, prescribed burning will have an adverse effect on pine regeneration. Existing pine seedlings will be killed resulting in a loss of up to 10 years of growth. Burning will encourage grasses and forbs crowding out new regeneration and reducing the initial stocking levels of pine seedlings. Past prescribed burning in the area has resulted in lower initial stocking levels but has not prevented successful regeneration within 5 to 10 years.

Age Class Distribution:

Age class distribution will improve the most in this alternative because we are treating more of the area than the other action alternatives. Commercial treatments allow the regeneration of new stands using the shelterwood regeneration method. Most of the change in age class distribution will come from overstory removals that will move almost 3,000 acres from the 100 – 140 year classes which currently make up two-thirds of the pine cover type. The age of the released understory will mostly be between 15 and 60 years old that currently comprise less than 4% of the pine type. Thinnings and prescribed burning may change age class distribution by removing younger pine but generally, the distribution will not change significantly.

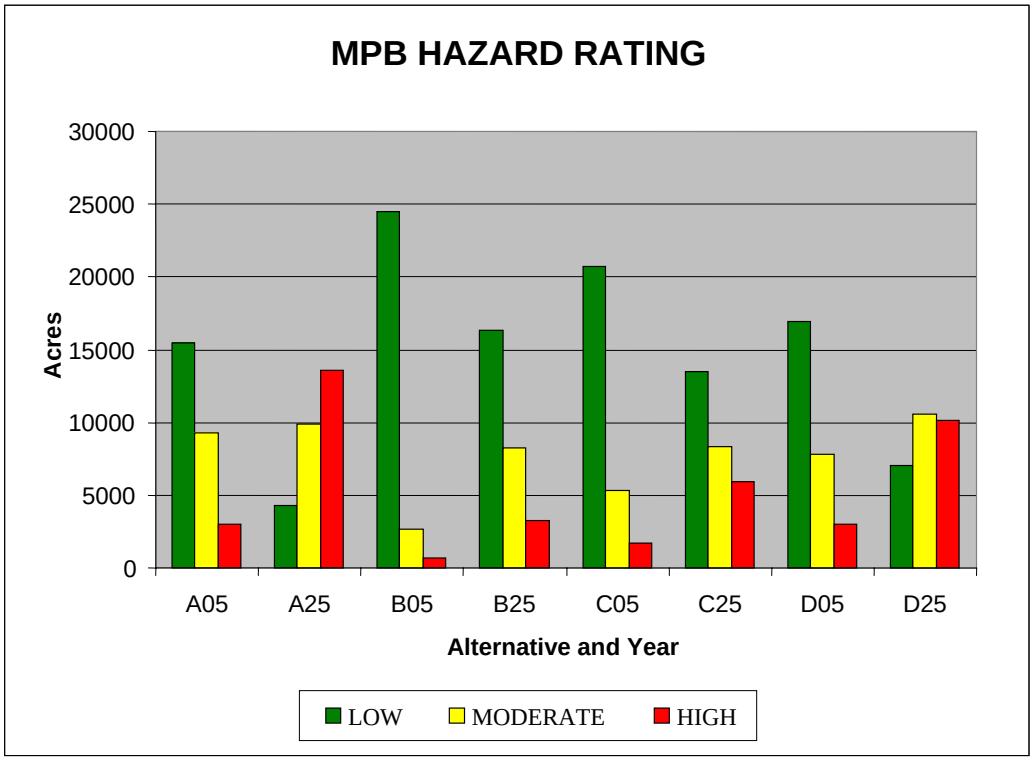
Growth and yield:

Growth within this alternative will be very good. Extensive thinning of the area will open up many stands where full crown closure has occurred and stand growth is slowing down due to crowding. An analysis was done using the Forest Vegetation Simulator provided by the USDA Forest Service Forest Management Service Center. Growth and yield calculations were made on the majority of stands in the project area for a period of 40 years. The action alternatives have less volume remaining than Alternative A both post treatment and in out years because of the volume removed. Merchantable cubic volume growth shows a marked increase in Alternative B, much higher than all other alternatives. The increased growth is due to thinning crowded stands and an increase in the number of non-merchantable stems growing into the merchantable size classes. Alternative D has only slightly less volume than Alternative A because the smaller trees removed have a low volume per tree. In all action alternatives, however, merchantable volume growth increases by over 50% within the next 20 years and almost doubles in 40 years.

Insects & Disease:

The effect of Alternative B on the current risk of MPB infestation will be very positive and further improve the overall risk rating to low. The protection provided for the area will extend into the next two decades and will remain low for much of that time. The lower mountain pine beetle risk is a result of reducing basal areas well below the levels preferred by pine beetle. Alternative B is more favorable than all other alternatives in reducing MPB risk both immediately after treatment and after 20 years. There will be a reduction of 9,064 acres of stands from a risk rating of high/moderate to low. There currently is 34% of the area in a moderate, and 11% in the high-risk rating. Upon completion of the treatments, there will be 10% of the area in a moderate and 2% in the high-risk rating. Figure 3-7 below illustrates the comparative differences in MPB risk by alternative, both immediately following treatment and after 2 decades:

Figure 3-7 Mountain Pine Beetle Hazard Rating Years 2005-2025



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. Additional fuel treatments for fire risk reduction will 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 will probably continue to have a low impact under this alternative.

ALTERNATIVE C

Direct and Indirect Effects

This alternative focuses on reducing MPB and wildfire potential but with an emphasis on issues related to biodiversity and special habitat protection. It is less aggressive in treating dense pine stands, including less overall acres and higher and more variable residual basal areas. It would also release hardwood inclusions within conifer stands including spruce dominated stands, and is more aggressive in meadow restoration. Alternative C generally leaves trees greater than 16 inches in diameter in commercial thinning units, although there would be no limit for treatments associated with meadows, hardwoods and overstory removals.

Under this alternative 16,641 (21,103 – 4,462 grass) acres of forestland would be treated. Prescribed burning will treat approximately 14,000 acres. Many of the stands in the project area have inclusions of less than 10 acres in size that may have basal areas, age classes, size classes and tree species that differ from the majority of the stand. Treatments specified generally apply to 80% and more 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. For example, an inclusion of pole-size pine may be thinned if located within a stand scheduled for a seed tree cut. Illustrations of these treatments can be found in the Silvicultural Report held in the Project File. 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: Non-commercial Thinning, Commercial Thinning, Liberation Harvests, Group Selection Harvests, Meadow Retention and Restoration Treatments, Hardwood Restoration and Retention Harvests which are designed to meet other than timber objectives. These treatments are proposed to meet the Forest Plan multiple-use and National Fire Plan objectives stated earlier in this analysis. See Appendix G, Maps 4-21.

Rights-of-Way:

Right of way clearing will occur as described in Alternative B.

Commercial Thinning:

Commercial thinning will occur on 6,042 acres of the area with 4,004 of those acres also having non-commercial thinning done. The effects within individual stands treated will be similar to those in alternative B. Thinning methods will be the same as in Alternative B with the exception that leave densities will differ in some stands. Stands identified for treatment were selected if they did not meet desired future conditions as outlined in the Forest Plan. Stand densities will range from 20 – 80 square feet of basal area. This alternative commercially thins 1,616 acres

less area than Alternative B and 4,668 acres more than D. Effects are similar to those described in Alternative B with proportionately less of an overall effect.

Fuel Breaks:

Fuel Breaks using both commercial thinning and non-commercial thinning will occur on approximately 1,000 acres of the area with about 400 of those acres receiving non-commercial treatments only. The effects will be similar to commercial thinning as described above except for the amount of acres treated. There will be 400 fewer acres thinned in this alternative than Alternative B and 810 acres more than Alternative D.

Liberation Cuts:

Liberation cuts will be implemented on 153 acres. The purpose of the liberation cut is to remove competing pine over an established understory allowing increased growth in the understory pine.

Shelterwood Seed Cuts:

Shelterwood seed cuts will begin the regeneration process on 13 acres of pine. This alternative treats 91% less acreage than Alternative B. Effects are the same as those described in Alternative B with proportionately less of an overall effect. There will be 127 fewer acres treated in this alternative than Alternative B, and 69 fewer acres than Alternative D.

Seed Tree Cuts:

Seed tree cuts will begin the regeneration process on 1,008 acres of pine. This alternative treats 39% less acreage than Alternative B. Effects are the same as those described in Alternative B with proportionately less of an overall effect. There will be 639 fewer acres treated in this alternative than Alternative B and 465 more acres than Alternative D.

Shelterwood Overstory Removals:

Shelterwood Overstory Removals with non-commercial thinning will occur on 785 acres. This alternative treats 74% less acreage than Alternative B. Effects are the same as those described in Alternative B with proportionately less of an overall effect. There will be 2,254 fewer acres treated in this alternative than Alternative B and 785 acres more than Alternative D.

Non-commercial Thinning:

Non-commercial thinning will occur on 11,706 acres of the area. Of that, 6,764 acres will be non-commercially thinned only and 4,942 acres will have non-commercial thinning done in conjunction with other commercial treatments. Non-commercial thinning will occur in pine stands and consists of the removal of pine one foot in height up to 8.9 inches in diameter leaving the best and largest pine at a rate of approximately 170 trees per acre. Spacing of leave trees will vary from 10 to 22 feet apart to create a more natural appearing stand. The thinning will reduce the stocking levels in overstocked stands and bring those stands into Forest Plan condition. The

effect will be as described in Alternative B above. There will be 4,704 fewer acres treated than Alternative B and 5,570 more acres than Alternative D.

Hardwood Retention & Restoration:

The release of 895 (594 acres of aspen + 301 acres of other communities) acres of hardwoods from conifer competition and the restoration of 581 acres of hardwoods that have been taken over by pine will occur in this alternative. Commercial treatments and non-commercial treatments removing all of the pine from hardwoods will occur on 1,476 acres. Treatments will be comparable to those described in Alternative B and have similar effects. In other areas of the project area hardwood stands will be enlarged to include adjacent conifer stands that have encroached upon them. On approximately 581 acres, all conifers will be removed from the area within 33' of the edge of the inclusion or, in the case of draws where there are remnants of past hardwood occupation, the conifers will be removed to the boundary of the original stand which will normally be 33' to 100'. This includes small inclusions of established hardwoods that are scattered throughout conifer stands to be treated in the project area that will be enlarged by removing conifers from within and adjacent to the hardwood inclusions. Currently there are 693 acres of hardwood stands. Upon completion of this alternative, hardwood acreage will increase by approximately 581 acres to approximately 1,274 acres which will be an increase of 84% in hardwood communities. This will more than achieve the Forest Plan goal of conserving existing hardwood communities and restoring historic hardwood communities by 10% (LRMP I-10 - 201). This alternative treats 216 acres more than Alternative B and 570 acres more than Alternative D.

Meadow Retention & Restoration:

Conifers encroaching in meadows and draw bottoms will be removed on approximately 3,689 acres and an additional 773 acres of historical meadows that have been invaded by pine will be restored to their previous condition. Commercial treatments and non-commercial treatments removing all of the conifers from meadows will occur on 553 acres of meadows and the 773 acres of restoration, while the remaining 3,136 acres of meadows will be treated non-commercially. This will move the area toward the Forest Plan goal of conserving existing meadow acreage and restoration of some historic meadows. Currently there are 3,991 acres of meadow sites within the project area. Upon completion of this alternative, meadow acreage will increase by 773 acres or 19% to 4,764 acres. The effects of this treatment will be an increase in vegetative diversity and an increase in grass production in the meadow communities by the release from the competition of conifers. Indirectly, meadow dependent wildlife species will have increased habitat. An additional indirect benefit would be the value of meadows as fuel breaks. This alternative treats 654 more acres than Alternative B and 904 acres more than Alternative D.

Prescribed Burning:

Low to moderate intensity broadcast prescribed burning will occur on up to 14,000 acres, reducing ground fuels and increasing vegetative diversity in the understory. In some of the stands, the understory vegetation is lacking due to needle cast and a closed canopy cover. A moderate intensity prescribed fire will reduce inhibiting duff and stimulate residual grasses and forbs. Stands that will be seed cut generally will not be prescribed burned unless other resource

needs dictate otherwise. 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 expected mortality to be much lower due to openness of most of the treated stands. Seedling/sapling size pine stands will not be burned or burned at a time of the year to limit mortality and leave a minimum of 300 seedlings/saplings per acre well distributed throughout the stand. Burning in stands to be regenerated will favor grass establishment and reduce regeneration. The effects of prescribed burning on the timber resource will be a short-term increase in growth from the nutrients released into the soil. Total yield in the project area will be reduced by the mortality. The reduction in yield should be in the magnitude of 70 ccf per year for the project area if burn mortality is less than 5%. Other effects are described in Alternative B above. There may be up to 4,000 acres more prescribed burning in this alternative than in alternative B, and up to 10,500 more acres than Alternative D.

Stand Structure:

Stand structure within the project area generally will 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 pines will be either dominant or co-dominant. Most of the intermediate and suppressed pine will be removed in treatment areas to raise crown heights and reduce ladder fuels for crown fire risk reduction. This alternative will have more stands with multiple age classes than Alternatives B and D.

Plant Species Composition:

Plant species composition will increase in this alternative. The amount of hardwood and meadow acreage will increase significantly with the largest increase in plant species composition increasing in the understory of the pine stands. Compared to the other action alternatives understory species diversity will be increased since more burning, which stimulates grass and forb production, occurs in this alternative.

Stocking Levels:

In this alternative, stocking levels will be decreased. The alternative was designed to bring stands into Forest Plan condition without the increased emphasis on bug and fire risk reduction as in Alternative B. The effect will 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 will develop larger diameters due to a reduction of competition, which concentrates the stand growth on the fewer stems. A reduction of mountain pine beetle risk to the pine stands will occur due to lowering of basal area to reduce the level of susceptibility to pine beetle attack. This will contribute to the Forest Plan goal of providing for sustained commodity uses while using acceptable silvicultural systems. This alternative will also provide adequately stocked pine stands for future management.

Regeneration:

The natural regeneration of pine and other native species of trees within the project should be good with the treatments in this alternative. Past regeneration, treatments have resulted in no

regeneration failures. Under this alternative, similar silvicultural treatments will be used and regeneration results should be the same. The seed tree cut method has not been used extensively in this area and may produce less regeneration than Shelterwood Seed Cutting. Patch clear-cuts that create harsher microclimates for regeneration have been successful in regenerating so the probability of regeneration success with seed tree cuts should be high.

Age Class Distribution:

Age class distribution will improve the second most in this alternative because we are treating more of the area than the alternatives other than B. Commercial treatments allow the regeneration of new stands using the shelterwood regeneration method. Most of the change in age class distribution will come from overstory removals that will move almost 800 acres from the 100 – 140 year classes which currently make up two-thirds of the pine cover type. The ages of the released understory will mostly be between 15 and 60 years old that currently comprise less than 4% of the pine type. Thinnings and prescribed burning may change age class distribution by removing younger pine but generally, the distribution will not change significantly.

Growth & Yield: See Alternative B above.

Insects & Disease:

The effect of Alternative C on the current risk of Mountain Pine Beetle (MPB) infestation will be very positive and further improve the overall risk rating to low. The protection provided for the area will extend into the next two decades and will remain low for much of that time. The lower mountain pine beetle risk is a result of reducing basal areas below the levels preferred by pine beetle. Alternative C is less favorable than Alternative B and more favorable than Alternative D in reducing MPB risk, especially in out years. There will be a reduction of 5,271 acres of stands from a risk rating of high/moderate to low. There currently is 34% of the area in a moderate, and 11% in the high-risk rating. Upon completion of the treatments, there will be 19% of the area in a moderate and 6% in the high-risk rating category. See the MPB Risk table under Alternative B which displays the comparative difference in MPB risk by alternative post-treatment and after 2 decades.

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. Additional fuel treatments for fire risk reduction will 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 will probably continue to have a low impact under this alternative.

ALTERNATIVE D

Direct and Indirect Effects

This alternative takes a limited approach in addressing the purpose and need, by limiting the amount of commercial timber harvest. This alternative emphasizes older, denser stands, larger diameter trees, and providing wildlife habitat for species dependent on these stand characteristics. Treatments will not occur in stands with the following characteristics: dense pole (3C) and sawtimber (4C) stands, stand age greater than 130 years old, Management Area 3.1 – Botanical Areas, and white spruce stands. There will also be no overstory removals in this alternative, and all treatments will be restricted to cutting only trees less than or equal to 16 inches in diameter at 4.5 feet above ground level.

Under this alternative approximately 8,131 (11,689 – 3,558 ac grass) acres of forestland would be treated, not including prescribed burning. Prescribed burning may treat up to 3,500 acres. The majority of the stands will be treated using non-commercial methods such as mechanical thinning, pine encroachment control in meadows and hardwood stands, and improvement cuts, taking out pine less than 9 inches DBH. The removal of both non-commercial and commercial size material 9" DBH and greater will occur in fuel-breaks around private land. Additional commercial material may be removed in connection with road reconstruction/construction and landing development associated with treatment activities. 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: Fuelbreak construction, Non-commercial Thinning, Improvement Harvests, Meadow Retention and Restoration Treatments, Hardwood Restoration and Retention Harvests, and Hardwood Regeneration Treatments which are designed to meet other than timber objectives. These treatments are proposed to meet the Project's Purpose and Need, Forest Plan multiple-use and National Fire Plan objectives stated earlier in this analysis. Illustrations of many of these treatments can be found in Appendix G.

Right-of-Ways:

Right of way clearing will occur as described in Alternative B.

Fuel Breaks:

Fuel Breaks using both commercial thinning and non-commercial thinning will occur on approximately 190 acres of the area with about 92 of those acres receiving commercial treatments. Generally, commercial treatments will be used to treat fuel breaks where topography and access allows. In some areas where it is not feasible to remove commercial products, only the non-commercial trees (8.9" DBH and smaller) will be removed. In both areas, non-commercial

material will be cut and the trees pruned up 6' to 8' in height. The thinning will reduce the stocking levels in overstocked stands and reduce the crown spacing to approximately 10 to 20 feet apart. Thinning will be from below removing the shorter suppressed, co-dominant pine and smaller diameter trees with the goal of raising the crown height and increasing the spacing to reduce the stands susceptibility to a sustained crown fire. The effects will be a reduction in stand yield due to the reduced number of trees in the stand. There will be an increase in the quality of the timber through the removal of damaged, diseased, and poorly formed tree and an increase in individual tree growth by releasing the remaining trees from competition for light, water, and nutrients. Trees will develop larger diameters due to a reduction of competition, which concentrates the stand growth on fewer stems and a slight increase in height growth. There will be a reduction of risk to the pine stands due to the reduction of basal area below the level of susceptibility to pine beetle attack. Once the stands are opened up, there will be an increase in natural regeneration. The amount of regeneration will vary from less than 100 trees/acre to as many as 10,000 trees/acre depending upon soil and moisture conditions. On north slopes, where remnants of forbs and grasses occur, regeneration will be low because of competing vegetation. On south and west slopes regeneration will be low due to low soil moisture and solarization. Where competing vegetation does not occur, regeneration will be abundant and will require periodic maintenance by removing regeneration to keep fuel breaks open. If maintenance does not occur, dense "dog hair" stands of pines will develop. This will reduce growth, yield, and health of the stands and increases the crown fire potential.

Non-commercial Thinning:

Non-commercial thinning will occur on 6,438 acres of the area. Of that, 5,128 acres will be thinned only. Non-commercial thinning will 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 at a rate of 170 trees per acre. Spacing of leave trees will vary from 10 to 22 feet apart to create a more natural appearing stand. The thinning will reduce the stocking levels in overstocked stands and bring those stands into forest plan condition. The effect will be an increase in the quality of the timber through the removal of damaged, diseased, and poorly formed trees. There will be an increase in individual tree growth by releasing the remaining trees from competition for light, water and nutrients. Trees will develop larger diameters due to a reduction of competition, which concentrates the stand growth on the fewer stems. A reduction of risk to the pine stands will occur due to the reduction of basal area below 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 risk reduction will 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.

Commercial Thinning:

Commercial thinning will occur on 1,374 acres of the area with 1,310 of those acres also having non-commercial thinning done. The effects within individual stands treated will be similar to those in alternative B. Thinning methods will be the same as in Alternative B with the exception

that leave densities will be greater in some stands. Stands identified for treatment were selected if they did not meet desired future conditions as outlined in the Forest Plan. Stands will be harvested to a leave basal area of approximately 40 to 80. Effects are similar to those described in Alternative B except many stands will have higher densities and larger trees due to the restriction of not cutting trees greater than 16 inches in diameter. This alternative commercially thins 82% less acreage than Alternative B and 77% less than Alternative C with proportionately less of an overall effect. There will be 6,284 fewer acres treated in this Alternative than in Alternative B and 4,668 fewer acres than Alternative C.

Shelterwood Seed Cuts:

Shelterwood Seed cuts will begin the regeneration process on 82 acres of pine. Effects are the similar to those described in Alternative B with proportionately less of an overall effect. There will be 58 fewer acres treated in this alternative than Alternative B and 69 acres more than Alternative C.

Seed Tree Cuts:

Seed Tree cuts will begin the regeneration process on 543 acres of pine. This alternative treats 67% less acreage than Alternative B and 46% less than Alternative C. Effects are the same as those described in Alternative B with proportionately less of an overall effect. There will be 1,104 fewer acres treated in this alternative than Alternative B and 465 less than Alternative C.

Hardwood Retention & Restoration:

The release of 798 (564 acres of aspen + 234 acres of other communities) acres of hardwoods from pine competition and the restoration of 108 acres of hardwoods that have been taken over by pine will occur by removing commercial and non-commercial pine in this alternative. Small inclusions of established hardwoods that are scattered throughout the stands in the project area will be enlarged by removing pine from within and adjacent to the hardwood inclusions. In other areas of the project area hardwood stands will be enlarged to include adjacent pine stands that have encroached upon them. Pine will be removed from the area within 33’ of the edge of the inclusion or, in the case of draws where there are remnants of past hardwood occupation, the pine will be removed to the boundary of the original stand which will normally be 33’ to 100’. Currently there are 693 acres of hardwood stands. Upon completion of this alternative, hardwood acreage will increase by approximately 108 acres to 801 acres which will be an increase of 16% in hardwood communities. This will move the area toward the Forest Plan goal of conserving existing hardwood communities and restoring historic hardwood communities by 10% (LRMP I-10 – 201). The effects of this treatment will be an increase in vegetative diversity and increased vigor of hardwood communities by release from the competition of pine. Indirectly, the hardwood dependent wildlife species will have increased habitat. An additional indirect benefit would be the value of hardwood stands as fuel breaks. Since the commercial sized pine greater than 16 inches DBH will not be removed, the remaining pine will be a seed source that will allow the pine to encroach on the hardwood communities sooner than if all of the pine was removed and the only seed source was from adjacent stands of pine.

Meadow Retention & Restoration:

Conifers encroaching in meadows and draw bottoms will be removed on 3,240 acres and an additional 318 acres of historical meadows that have been invaded by conifers will be restored to their previous condition. Commercial and non-commercial treatments removing all of the conifers from meadows will occur on 486 acres of retention and the 318 acres of restoration, and the remaining 2,754 acres of meadow retention will be treated non-commercially. This will move the area toward the Forest Plan goal of conserving existing meadow acreage and restoration of some historic meadows. Currently there are 3,991 acres of meadow sites within the project area. Upon completion of this alternative, meadow acreage will increase by 318 acres or 8% to 4,309 acres. The effects of this treatment will be an increase in vegetative diversity and an increase in grass production in the meadow communities by the release from the competition of pine. Indirectly, meadow dependent wildlife species will have increased habitat. An additional indirect benefit would be the value of meadows as fuel breaks. This alternative treats 250 fewer acres than Alternative B and 904 acres less than Alternative C.

Prescribed Burning:

Low to moderate intensity broadcast prescribed burning will occur on up to 3,500 acres, reducing ground fuels and increasing vegetative diversity in the understory. In some of the stands, the understory vegetation is lacking due to needle cast and a closed canopy cover. A moderate intensity prescribed fire will reduce inhibiting duff and stimulate residual grasses and forbs. Stands that will be seed cut generally will not be prescribed burned unless other resource needs dictate otherwise. 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. Seedling/sapling size pine stands will not be burned or burned at a time of the year to limit mortality and leave a minimum of 300 seedlings/saplings per acre well distributed across the stand. Burning in stands to be regenerated will favor grass establishment and reduce regeneration. The effects of prescribed burning on the timber resource will be a short-term increase in growth from the nutrients released into the soil. Total yield in the project area will be reduced by the mortality. The reduction in yield should be in the magnitude of 100 ccf per year for the project area if burn mortality is 10%. The reduction in yield would be reduced due to less competition for light and moisture in trees adjacent to openings and short-term nutrient release but the increase in growth would not make up for the mortality loss. Additional protection of the timber resource from catastrophic wildfire will be increased by the removal of ground fuels and ladder fuels. Burning will encourage grass and forb production, which compete with pine regeneration. Regeneration will be reduced which will reduce future maintenance treatments to keep regeneration from occurring. The competition with grasses also may reduce the opportunity to regenerate a stand once it has been identified as needing regeneration. At that time, site preparation and scarification may be needed to provide a seedbed for successful regeneration.

Stand Structure:

Stand structure within the project area generally will 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 pines are

either dominant or co-dominant. This alternative will have more stands with multiple age classes than the other action alternatives since commercial treatments are more limited.

Plant Species Composition:

Plant species composition will increase in this alternative. The amount of hardwood and meadow acreage will increase a minor amount with the largest increase in plant species composition increasing in the understory of the pine stands. As the pine is thinned out and prescribed burning occurs there will be a large increase of grasses, forbs, and inclusions of hardwoods. Compared to the other action alternatives this will have less species diversity but far more diversity than the no action alternative (Alternative A).

Stocking Levels:

In this alternative, stocking levels will be decreased where thinning and prescribed burning occur. However, this alternative will provide adequately stocked pine stands for future management. Decreased stocking levels will increase diameter growth of individual trees, increase plant species composition in the understory, reduce the risk to stands from insects and disease, and improve the general vigor of the stands treated. The more limited use of commercial treatments in this alternative reduces the opportunity in commercial size stands to reduce stocking levels and as a result this alternative does not bring as much of the area down to desired Forest Plan stocking levels as other action alternatives.

Regeneration:

The natural regeneration of pine and other native species of trees within the project should be good with the treatments in this alternative. Prescribed burning will have an adverse effect on pine regeneration. Existing pine seedlings will be killed resulting in a loss of up to 10 years of growth. Burning will encourage grasses and forbs crowding out new regeneration and reducing the initial stocking levels of pine seedlings. Past prescribed burning in the area has resulted in lower initial stocking levels but has not prevented successful regeneration within 5 to 10 years. A lesser amount of prescribed burning will occur in this alternative than in other action alternatives and will have the least effect on regeneration.

Age Class Distribution:

Age class distribution will improve in this alternative but not as much as in the other action alternatives where commercial treatments allow the regeneration of new stands using the shelterwood regeneration method. There are no overstory removal cuts in this alternative. Thinnings and prescribed burning may change age class distribution by removing younger pine but generally, the distribution will not change significantly.

Growth & Yield: See Alternative B.

Insects & Disease:

The effect of Alternative D on the current risk of Mountain Pine Beetle (MPB) infestation will be positive, but less than the other action alternatives. The protection provided for the area will be short term, however, and within the next 20 years will move back to high. The move to a high-risk rating is because the non-commercially thinned stands will reach densities favored by MPB, generally over 120 basal area. In addition, diameter growth in thinned stands will increase to a diameter over 6 inches where phloem thickness is adequate to sustain a large mountain pine beetle population. Alternative D is more favorable than Alternative A in reducing MPB risk, but when compared to Alternative C and especially Alternative B, Alternative D has a far less positive effect on MPB risk in out years. There will be a reduction of 1,500 acres of stands from a risk rating of high/moderate to low following the proposed treatments. There currently is 34% of the area in a moderate, and 11% in the high-risk rating. Upon completion of the treatments, there will be 28% of the area in a moderate and 11% in the high-risk rating. Twenty years later the risk hazard will be 37% high, 38% moderate versus 49% high and 36% moderate for the no action alternative. See the MPB Risk figure (Figure 3-7) under Alternative B which displays the comparative difference in MPB risk by alternative post-treatment and after 2 decades.

Cumulative Effects on Silviculture/Timber:

Alternative A:

Past Activities and Their Effects on Silviculture/Timber

Much of the area has had vegetative treatments within the past 20 years. Commercial harvests and non-commercial thinnings from the late ’70’s through the early‘90’s have taken place on about 54% of the project area. Many treatments were designed to lower the basal area to promote increased growth and vigor as well as lessen susceptibility to Mountain Pine Beetle attack.

The effect of past treatments has been an increase of merchantable volume growth; increase in the quality of timber and 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 risk to the pine stands due to the reduction of basal area below the level of susceptibility to pine beetle attack has also occurred.

Present Activities and Effects on Silviculture/Timber

Seven active timber sales are currently operating within Deerfield Project Area. These sales total 2,436 acres of commercial harvest units within the project area. Four timber sales, Castle, Hat, Nichols and Slice, covering 3,162 acres within the project area have completed cutting in the past year. Lookout Timber Sale covering 2,320 acres within the project area closed in 2000. All

of these sales have post-sale treatments planned that will be taking place in them over the next five years. These activities may include non-commercial thinning, noxious weed treatment, travel management, hardwood restoration and regeneration, meadow restoration, water developments for cattle and wildlife, and prescribed burning for habitat improvement and fuels reduction. The effects of these activities include decreased risk of mountain pine beetle infestation, reduced crown fire hazard, increased merchantable growth, improved health and vigor of the stands, and improved wildlife habitat. Very little harvesting has occurred on private land within the project area. Since private land comprises approximately 13% of the project area (5,272 acres) and approximately 20% (1,000 acres) of that is timberland, the effects of timber harvesting practices could affect the project area. The amount of timber harvesting during any one decade has been small and its effects on National Forest timberland should be minimal.

Proposed and/or Reasonably Foreseeable Activities and Their Effects on Silviculture/Timber

Anticipated future silviculture activities, not connected to this analysis, that will occur within the area are as follows: Salvage and sanitation of trees infested by MPB and killed by fire. Firewood gathering and Christmas tree cutting by permit will continue to occur within the area.

Other silvicultural treatments such as small salvage sales for the removal of storm damage, 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 10 acres) and the cumulative effects of these projects should not be of any measurable significance.

Activities that have a good probability of occurring on land within the Project area other than National Forest System Lands are as follows

With an increasing interest from private landowners to manage their forested land for profit and fire protection, an additional 600 acres may be treated within the next decade. However, lower timber prices may cause landowners to defer treatments until they can get a better price for their timber.

Since the amount of silvicultural activities not connected to this analysis will be minimal, the cumulative effects of these activities under any of the alternatives will also be minimal. Treatments on private land for fire risk reduction will contribute to both a reduction of risk from catastrophic wildfire and mountain pine beetle. This will reduce the risk on private land. However, the positive effect will be minimal since adjacent Forest System lands are not treated in this alternative.

Alternative B

Past Activities and Their Effects on Silviculture/Timber

Past activities are listed in Alternative A above. Cumulative effects of past treatments and treatments proposed in this alternative generally will be positive. Thinning of stands created with regeneration harvests will bring those stands into desired condition. Mountain Pine Beetle risk that was lowered with past treatments will again be lowered. Fire risk to pine stands reduced

with past treatments will be further reduced. Plant species diversity was increased with past treatments and will be increased further, especially with increased prescribed burning. An additional cumulative effect resulting from past treatments is a reduction in merchantable volume recovery. Volume removed in past harvest operations is not available for removal. Increased growth has made up for some of this but not entirely.

Present Activities and Effects on Silviculture/Timber

Present activities are minimal and their effects are listed under Alternative A above. Treatments in Alternative B will have a minimal effect over those discussed under direct and indirect effects for this alternative.

Proposed and/or Reasonably Foreseeable Activities and Their Effects on Silviculture/Timber

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

Activities that have a good probability of occurring on land within the Project area other than National Forest System Lands are as follows

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

Alternative C

Past Activities and Their Effects on Silviculture/Timber

Past activities are listed in Alternative A above. Cumulative effects of past treatments and treatments proposed in this alternative generally will be as described in Alternative B, above.

Present Activities and Effects on Silviculture/Timber

Present activities are listed under Alternative A above. Present activities are minimal and their effects are listed under Alternative A above. Alternative C treatments will have a minimal effect over those discussed under direct and indirect effects for this alternative.

Proposed and/or Reasonably Foreseeable Activities and Their Effects on Silviculture/Timber

Anticipated future silviculture activities, not connected to this analysis, that will occur within the area are as follows: Future silvicultural activities will be minimal and their effects are listed

under Alternative A above. Alternative C treatments will have a minimal cumulative effect over those discussed under direct and indirect effects for this alternative.

Activities that have a good probability of occurring on land within the Project area other than National Forest System Lands are as follows

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

Alternative D

Past Activities and Their Effects on Silviculture/Timber

Past activities are listed in Alternative A above. Cumulative effects of past treatments and treatments proposed in this alternative generally will be as described in Alternative C, above.

Present Activities and Effects on Silviculture/Timber
Present activities are minimal and their effects are listed under Alternative A above. Alternative D treatments will have a minimal effect over those discussed under direct and indirect effects for this alternative.

Proposed and/or Reasonably Foreseeable Activities and Their Effects on Silviculture/Timber

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

Activities that have a good probability of occurring on land within the Project area other than National Forest System Lands are as follows

Silvicultural activities on other than National Forest System lands will be minimal and their effects are listed under Alternative A above. Alternative D treatments will have a minimal cumulative effect over those discussed under direct and indirect effects for this alternative. Treatments on private land for fire risk reduction will contribute to both a reduction of risk from catastrophic wildfire and mountain pine beetle.

FIRE and FUELS

Affected Environment

The present condition class of vegetation is qualitatively characterized by moderately to well stocked stands of Ponderosa Pine, encroaching Black Hills White Spruce on south slopes under

pine, and a reduction in open grassy meadows, riparian areas and open vistas thru pine and spruce encroachment. There are large stands of White Spruce on north slopes. Hardwood stands show signs of pine or spruce tree invasion, and often appear to be declining when in direct competition with conifers. Some insect and disease agents are present in scattered locations where Ponderosa Pine stands have high stocking densities, particularly Mountain Pine Beetle hits and red and standing dead trees are noticeable. Additionally, an active timber management program has directly influenced many pine stands. Harvest prescriptions were geared towards increasing the stocking per acre to provide for sustained yield. Much of the area that was logged in the past did not have spruce trees or spruce stands cut, allowing these spruce to grow in size, increase in numbers, and compete with the remaining pine and hardwoods. Another significant event was and continues to be an aggressive interagency fire suppression program which has greatly curtailed fire's historic role in shaping the forested and grassland areas (GTR-RMRS-120), resulting in increased tree biomass. See the Fire and Fuels Report held in the Project File for detailed information).

Yet, in the pre-settlement era, fire was one of the active agents shaping and determining the structure and composition of the ponderosa pine forests of the western United States, including the Black Hills. Frequent low to medium intensity ground fires thinned these dry pine forests on a landscape scale, and removed much of the ladder fuels (GTR-RMRS-120, 2004 and GTR-PNW-648, 2005). High intensity, stand replacement fires did occur in predominantly Ponderosa Pine vegetation and kept up to 12% of the area open and relatively free of trees (Fire Regime Condition Class Handbook, Referenced Conditions, 2004).

In contrast, today's vegetative composition and structure appears to be the result of a combination of aggressive fire suppression and past management activities than from the effects of re-occurring fire. There are some opinions and research papers which suggest that the Black Hills pine and white spruce forests can be more dense, diverse and affected by relatively infrequent, stand replacement fires (mixed-severity fire regime) (Baker and Ehle, 2001, 2003)(Shinneman and Baker, 1997)(Schoennagle et al. 2004). Other researchers used a comparison of photos and records from the late 1800's (Custer Expedition) to present day (Grafe, 2002; Cook, 2003) to validate that now the forest is more continuous and uniform at a larger size class (70% (9" DBH or greater), with higher numbers of stems per acre than what has historically been documented, and that a more open forest existed in the past.

Active fire suppression has played a significant role in shaping the vegetative condition (more stems, larger trees) and fostered encroachment seen today and occurring in all plant communities. These suppression actions basically prevented fires from removing ground and surface fuels, particularly in the ponderosa pine forests. Note that current Forest Plan direction perpetuates this status quo by requiring suppression action designed to limit fire size and effect, with the intention of protecting a variety of resources. These actions are called Appropriate Suppression Response (ASR) as described in Chapter II-53-54 of the 1997 Black Hills Forest Plan, Standard 4101, and are intended to protect values at risk from fire damage.

Condition Class & Fire Regime

To establish benchmarks for measuring what is the vegetative condition class of the Deerfield Project Area, qualitative classification was completed using the Forest Service Rocky Mountain Research Station's General Technical Report entitled "Development of Coarse-Scale Spatial Data for Wildland Fire and Fuel Management" (RMRS-87), dated April 2000 as the guiding document. The determination was that the area meets Condition Class 3, Fire Regime I or III categories.

Using RMRS-87, the area's respective fire regime condition class has been: 1) significantly altered from historical ranges; 2) the fire frequencies have departed from historical frequencies by multiple return intervals – resulting in dramatic changes to the size, frequency, intensity, severity of fires and landscape patterns; 3) vegetative attributes have been significantly altered from the historical range of attributes; and 4) a significant risk exists of losing key ecosystem components from fire. This classification is also consistent with FRCC Handbook's declaration for Black Hills Ponderosa Pine as predominantly Fire Regime "I" (Fire Regime Condition Class Handbook, Referenced Conditions, Table 3-3, 2004).

The Mystic Fuels/Fire staff believes using Fire Regime "I" will best describe the drier, more open sites and southern slopes at lower elevations, with a frequency of fires from 0-35 years, dominated by pine, and characterized by Low Severity fires. There are also some areas we classified as Fire Regime "III" and are dominated by white spruce. These sites are described as subject to more rain and snowfall, at higher elevations, and when burned have fires of Mixed Severity and a frequency of 35-100 years. The presence of these types of stands would support those researchers who advocate a mixed-severity regime exists in the Black Hills (Arno, Allison-Bunnell, 2002).

The presence of Fire Regime III area is indirectly supported by the FRCC Handbook's categorizing of the Black Hills Ponderosa Pine to have up to 12% of the area was subject to stand replacement fires at any one time. While there are some stands of cutover pine where residual spruce is becoming dominant, field observations found solid spruce stands which apparently developed as stand-alone trees or under hardwood canopies. While historically a significant percentage of the pine forests could be burned off by stand replacement fires (FRCC, 2004), local experience and reviews of historical fires have shown that stand replacement fires within these treated stands or pure spruce stands are also possible. It is feasible since often the Regime I and Regime III sites are intermixed across the Deerfield landscape, and a spreading fire could very well move from one regime to the next as observed in the Bombard Prescribed Burn conducted in the fall of 2003 and 2004.

Fire regimes in the Deerfield Project Area have thus changed from a fire regime dominated by frequent, low to moderate intensity surface fires (Regime I, Condition Class 1) with some less frequent, mixed severity fires (Regime III – Condition Class 1) occurring to similar regimes with Condition Classes of "3" - where one would anticipate large, intense stand replacement fires – particularly in Ponderosa Pine (GTR-RMRS-120, 2004). This is because of changes in the forest structure and composition over the past 130 years caused by a variety of previously discussed factors – either active or suppressed. This classification is validated by recent large fire incidents in the Black Hills observed in Regime I situations. Future Regime I fires under severe burning conditions

(90th percentile weather) would exhibit increased fire intensity, be harder to contain and control, and generally last through multiple burning periods. Likewise, because of the intermixed nature of Regime I and III vegetation in the Deerfield Project Area, fire behavior in Regime III is expected (and has been observed in Bombard Prescribed Burn, 2003-2004) to be similar to Regime I.

Large Scale Fire Impacts, Changes in Black Hills Vegetation, & Fire Trends

Nationally, impacts from these types of large-scale fires in Ponderosa Pine can be severe and have a long-term impact upon the ecosystem and socioeconomic values. Vegetation has been consumed across multiple watersheds. Secondary impacts can be landslides, spread of noxious weeds, and continued soil erosion (RMRS-GTR-120, 2004).

Unfortunately, we are beginning to see the same trend of large-scale fires in the Black Hills. To begin with, the timber inventory on the Black Hills National Forest has increased from 1.5 billion board feet in 1897 to 2.3 billion in 1948 to 4.5 billion in 1977 to 6.1 billion board feet in 1999 (Cook, 2003). As illustrated in Table 3-4 (Cook, 2003), much more of the landscape is now forested and we are losing our open meadows and hardwood stringers – these are the natural fuel breaks. The reduction in natural fuel break acreage pares down the positive impact that spatial fragmentation of fuels can have towards changing fire size and behaviors (Finney, 2003). To demonstrate, Cook estimates that 40% of the forest was non-stocked or meadow in 1875 compared to less than 6% in 2000.

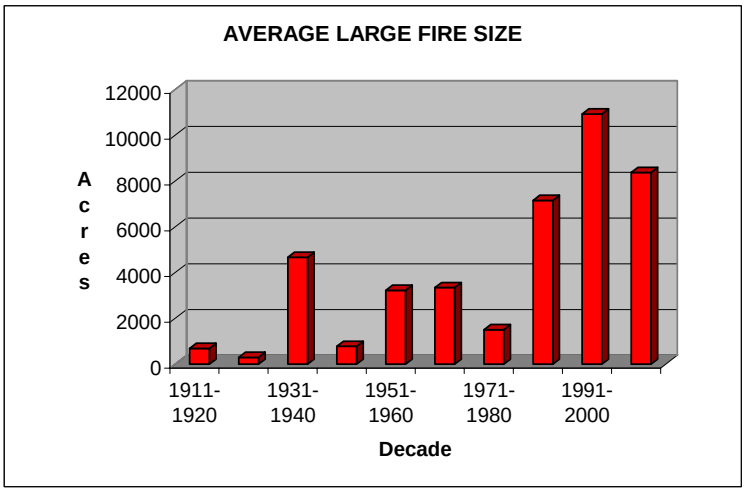
Table 3-4 Landscape Vegetation

	Percent of the Black Hills National Forest with			
Year	Trees >9”	5-9” in Diameter	Trees < 5”	Meadows/Seedlings
1875	20.0%	40.0%	0.0%	40.0%
1953	48.9%	19.7%	17.9%	13.5%
1973	63.8%	22.0%	13.9%	0.3%
2000	69.8%	21.8%	2.3%	6.1%

The development over the last 130 years of a well stocked, continuous forest with few openings has resulted in more of the Black Hills being available for and affected by large, intense forest fires, particularly during severe burning conditions (90th percentile fire weather). Basically, over 70% of the forest has trees over 9” DBH, in places with an understory consisting of smaller trees with some ground fuels. Ground fuels may include broken snow damaged trees. This understory of small trees and shrubs provides the fuel ladders for a surface fire to climb into the canopy.

The number of fires on the entire Black Hills National Forest system lands has remained fairly constant at 65–130 starts per year. The number of fires that have escaped initial attack has also remained constant. However, these “escaped” fires have become larger and are more difficult to control. When looking at fires over 300 acres, average fire size has increased from under 1000 acres per fire in the early 1900’s to over 8000 acres in recent years. Figures 3-8 and 3-9 describing fire history were supplied by Henry Goehle, former District FMO for Mystic RD 2000 – 2004.

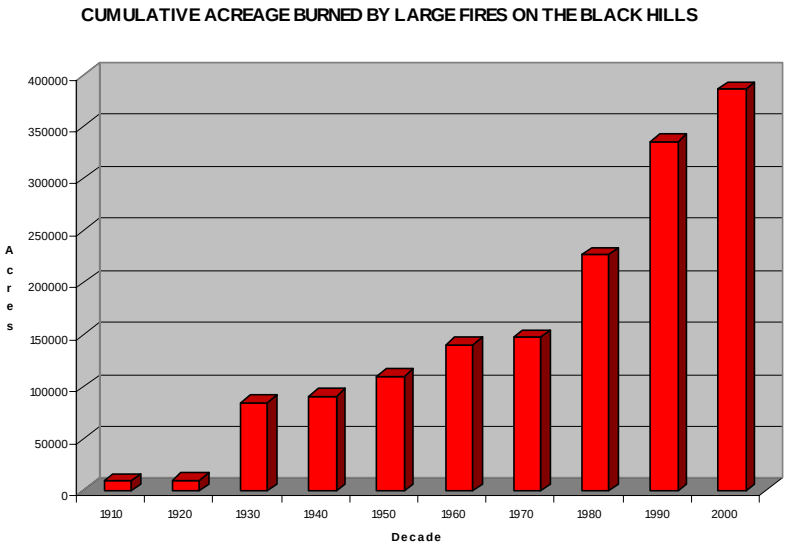
Figure 3-8 Average Large Fire Size



This has resulted in a significant increase in the effects that fire is having on the Black Hills. Large fires, fires greater than 300 acres, burned approximately 147,863 acres from 1900 until 1980. Recent fires, including but not limited to the Jasper Fire, Rogers Shack, Elk Mountain, Grizzly Gulch, Galena, Flagpole and Battle Creek, have burned approximately 238,490 acres since 1980.

The figure shows that more acreage has been burned in the last twenty years than during the preceding 70 years (1910-1980). This re-enforces the conclusion that the structure of the Black Hills National Forest environment has changed since the first documented visits. This change has resulted in a more burnable structure and composition on a landscape scale, which allows large scale fire growth to occur when fuels are dry and weather is hot and windy.

Figure 3-9 Cumulative Acreage Burned by Large Fires on the Black Hills



These escaped, large fires are having an impact on our environment, economy and personal lives. The 2002 Grizzly Gulch fire and subsequent landslides have threatened and caused sediment damages to the town of Deadwood. Three homes were burned in the 2002 Battle Creek Fire but the number burned could have been significantly higher. The 2000 Jasper fire, directly to the south of the Deerfield Project Area, burned 82,688 acres of forested land including 48,555 acres when it made an eleven mile run in a single day. Luckily, the fire occurred in a fairly remote area of the forest. The same fire in a different location could have been a catastrophe; a wildland/urban interface wildfire could have burned numerous structures, disrupted power transmission grids, and created significant demands on local suppression resources such as occurred during the 1988 Westberry Trails Fire. These types of fires risk the lives of residents and firefighters.

All of these fires have cost millions of dollars to suppress with substantial rehabilitation costs. Millions of board feet of timber have been destroyed as well as important wildlife habitat. These fires have short-term but significant negative impacts on tourism and affect the local economy.

Air Quality

Maintaining air quality levels in the Black Hills and western South Dakota that protect human health, safety, and welfare is desirable, yet smoke production from recent large scale wildland fires have temporarily, but adversely affected the air quality for municipalities. A major metropolitan area – Rapid City, South Dakota is located 30 miles to the east northeast. Other important city areas near the planning area include Custer, Hill City, Rochford, Lead, Deadwood, Spearfish, and Sturgis.

Additionally, any wildfire ignition on a large scale with the prevailing winds in alignment may affect the local air quality of several valued airsheds. The Deerfield Project Area is in the vicinity of two Class 1 airsheds, Wind Cave National Park located roughly 35 air miles southeast of the project area, and Badlands National Park (specifically Badlands Wilderness Area) located approximately 70 air miles to the east southeast. The South Dakota Department of Natural Resources (SD DNR) is in the process of developing a State Implementation Plan for recently passed Regional Haze Rules. These rules are intended to protect visibility in these two Class I airsheds.

The increase in size and numbers of crown fires in the past 10 years has contributed smoke emissions to municipal areas. These emissions are affecting public health and safety on a short-term but significant basis. Reduced visibilities pose a danger to vehicle drivers. Reduced air quality may require displacement of smoke sensitive individuals during the event. Such fire activity also impairs local viewsheds for the same duration.

Currently, Rapid City is not listed as a non-attainment city but has problems with particulate matter. Most of the problems have been associated with fugitive dust resulting from high wind events and not from prescribed burning. Rapid City has developed a Natural Events Action Plan for high winds to combat the effects of this situation. It is important that the alternatives do not exacerbate any problems with the air quality in Rapid City, the surrounding communities, or the Class I airsheds described above.

The State of South Dakota and Black Hills area county governments do not require burn permits for smoke produced from prescribed fire or slash pile burning on federal lands. There are ordinances for Rapid City and Pennington County established to maintain a compliance status with United States Environmental Protection Agency's National Ambient Air Quality Standards, with the emphasis on private lands and industrial activities.

In the interests of interagency and governmental cooperation, Mystic Ranger District personnel have successfully worked with the State of South Dakota's Wildland Fire Suppression Division, the former Pennington County Air Quality Office (now combined with the city's office), and Rapid City Air Quality Division, with assistance of the National Weather Service to avoid exceeding the air quality standards in Rapid City. This success has been demonstrated over the past 15 years by slash pile burning and broadcast burns with negligible impacts.

Currently, slash pile burning is accomplished by following Forest Supervisor memo direction (December, 1995) and using SASEM (Simple Approach Smoke Estimation Model) calculations to tailor slash pile burning actions as applicable. Site specific prescribed fire broadcast burns are developed for all complexity level projects using approved format from agency guides (Wildland and Prescribed Fire Management Policy Implementation Procedures Reference Guide, 1998; National Wildfire Coordination Group (NWCG) Complexity Guidebook (NFES #2474); Forest Service Manual 5100, Chapter 5140, Black Hills Supplement r2_bh_5100-2005-1; NWCG Smoke Management Guide for Prescribed and Wildland Fire, 2001 Edition, NFES #1279). Smoke management and air quality direction are developed for each project, and includes modeling outputs and management measures as necessary to address smoke issues. The following practices are often used to help manage possible impacts from smoke:

- Limit acres or piles burned in a day.
- Staggering ignitions to reduce the amount of smoke produced at one time.
- Specify wind directions that disperse the smoke away from a receptor.
- Specify minimum mixing heights to loft smoke over receptors.
- Prescribe acceptable wind speeds.
- Specify time of the day that ignitions can occur.
- Mop up smoldering fuels.

In order to meet current U.S. Environmental Protection Agency (EPA) policy regarding Wildland and Prescribed Fires, the SD DNR and Forest Service, National Park Service, Bureau of Land Management, and SD Wildland Fire Suppression Division are currently working together to develop Smoke Management Plans for the Black Hills region. This policy requires governmental and private entities using fire as a management tool to develop such a plan. The EPA specifically recognizes that prescribed fire is used to treat hazardous fuels and promote forest health, but because there is a potential health risk to the public due to air pollution created by these fires, a plan to document, assess, and administer such actions collectively is needed.

Additionally, the SD DNR is also developing a State Implementation Plan (SIP) for the EPA's recently passed Regional Haze Rules. Haze rules are intended to protect visibility in Class I airsheds (e.g., Badlands Wilderness within Badlands National Park) nationally. This plan will be developed by the State in conjunction with the Smoke Management Plan for the Black Hills

region. Once either or both plans are in effect, the Forest Service will comply with the goals and objectives in the plan(s), including project level operational criteria.

Fire Protection Assessment – Risks, Hazards, & Values

A Fire Protection Assessment (FPA) was completed by the Black Hills NF in 1995 -1996 to address Risk, Hazard and Values on the Forest, and is integrated into the Forest Plan. The purpose of the document was to identify and prioritize fire management activities to comprise an effective wildfire prevention program. The assessment rates the potential that: 1) a lightning or person-caused ignition will occur (Risk); 2) once ignited, the flammability of a fuel based on fuel type and condition, topography, and weather influences that can create dangerous fire line intensities (Hazard); and 3) the possible change in tangible and intangible assets from fire (Value). Areas with like value ratings were then aggregated together to form physical compartments, and specific activities are described in the FPA to aid fire managers in minimizing fire ignitions and their impacts.

The Deerfield Project Area includes portion of four compartments or areas identified as: 1) Nichols – LMM - #17; 2) Castle Creek - MMM - #18; 3) Deerfield – HMH - #23; and 4) Gillette – MMM - #24. The three letter alpha designation after the name of the compartment signifies the adjective rating for Risk, Hazard, and Value, with L = Low, M = Moderate, and H = High. For example, Nichols Compartment has a rating of LMM, so its Risk rating is Low, the Hazard rating is Moderate, and the Values are Moderate.

In assessing Risk, an overall, aggregate objective rating for the project area would be *Moderate* with some areas of *High* around Deerfield Reservoir. This rating is based on the potential for wildfire ignition; concentrations of lightning and human activities are identified. Forty-four possible risks were identified including lighting. Over a 25 year period (1971-1996), there have been 103 fires or about 4 fires per year, spread over the four compartments which encompass Deerfield Project Area. Therefore, we can expect about 100 fires over the next twenty years at a minimum, and probably more with increasing rural development and population growth. Seventy-eight percent of these fires were from lighting, and the remaining twenty-two percent from other causes. Fires were mostly Class A in size (less than ¼ acre), but several were Class B (¼ to 1 acre). Most of the fires were suppressed with FS Initial Attack resources with help from State Fire or Volunteer Fire Departments on occasion. Six large project fires have occurred in or adjacent to the project area.

In assessing Hazard, an overall, gross aggregate objective rating for the project area would be *Moderate*. This rating is supported by the Fire Hazard Rating Map as shown in Alternative G of the Black Hills NF Land and Resource Management Plan (LRMP). This map is directly linked to the FPA, and the map ratings of *Moderate* is based these three criteria being prevalent in the project area. These FPA plan criteria are: (1) Ponderosa Pine stands present on slopes of 10-30%; (2) Ponderosa Pine stands found above 6000’ elevation with slopes 30-100%; and (3) grasslands above 6000’ with or without Ponderosa Pine encroachment. The third criteria may also include Black Hills Spruce becoming established under the pine or entering grasslands and meadows.

In assessing Value, an overall, aggregate objective rating for the project area would be *Moderate* with some areas of *High* around Deerfield Reservoir because of developments by both private and Government. It contains one community at risk (CAR) as published in the Federal Register: Deerfield, and another CAR in the immediate vicinity on the north end – Rochford. From the FPA document, the following is a list of previously determined values in 1995-1996. The area has seen some development, most notably in individual housing on isolated private land tracts.

Structural Stages, Historic Range of Natural Variability, & Ecological Restoration based on Landscape Fuels Treatment Approach

A more detailed examination of the Hazard rating is best accomplished by reviewing known data regarding the arrangement of the vegetation, or structural stage. The most current Stage II Inventories (Wildlife Structural Stage (WSS) and Vegetative Structural Stage (VSS)) show the area is dominated by Structural Stage 4 - Mature. As defined by the Glossary, Black Hills NF LRMP: "Consists of trees larger and older than Structural Stage 3. Also classified by the same canopy closure categories as Structural Stage 3." By this referenced definition, the trees will be between 50 and 160 years old, greater than 7" DBH, and taller than 50 feet. The canopy closure classes are: A (less than 40 percent), B (40 to 70 percent), and C (greater than 70 percent). The current condition class is displayed in Table 3-5. When compared to the Fire Regime Condition Class - (Version 1.0.5) Reference Composition column, the departure from natural (historical) range and variability on a landscape scale is noted:

Table 3-5 Current Condition Class Compared to Fire Regime Condition Class

WSS (Wildlife Structural Stages)	WSS Current Condition Class Percentage	VSS Current Condition Class Percentage	Fire Regime Condition Class Reference Composition For Black Hills National Forest area	Vegetation-Fuel Class
1 – Grass/Forb	11	0	10	**AESP:** Early Seral; post-replacement disturbance & young age
2 – Shrubs/Seedlings	<1	0		
3A – Sapling/Pole (<40%)	4	5.6	25	**CMSO:** Mid Seral Open; mid age & disturbance maintained
3B – Sapling/Pole (40-70%)	4	1.6	15	**BMSC:** Mid Seral Closed; mid age & competition stress
3C – Sapling/Pole (>70%)	2	0.9		
4A – Mature (<40%)	28	23.3	40	**DLSO:** Late Seral Open; mature age & disturbance maintained
4B – Mature (40-70%)	38	38.4	10	**ELSC:** Later Seral Closed; mature age & competition stress
4C – Mature (>70%)	8	20.2		
5 – Old Growth	0	0		

The current vegetative conditions show 74-82% exists as SS 4A, 4B, & 4C versus an aggregate 50% of such stands in the Referenced Condition. Since these stands are the main component which causes the Hazard Rating to be *Moderate*, any management activities which may move the condition classes towards SS 2 & 3 should be given due consideration primarily within Fire Regime I areas, and secondarily within Regime III areas (Arno & Fiedler, 2005). The emphasis on Regime I is based on such areas are probably more distant from the natural fire frequency (0-35 years) than the longer-term Regime III (35-100 years), although field observations and actual prescribed fire results after initial commercial thinning show that fire entry would be beneficial for either regime in treating ground fuels, surface fuels, and achieving or maintaining prescribed needs for wildlife habitat needs.

This recommended treatment emphasis is also based on current science expressed in two technical reports (RMRS-GTR-120, 2004 and PNW-GTR-628) which advocate ecological restoration techniques to achieve fuels management on dry Western Forests, and accomplish that goal on a landscape, not stand basis. This is based on models and observations of landscape fire behavior having a more significant overall impact on fire spread, intensity, perimeters, and suppression capability than just treating isolated, individual stands (RMRS-GTR-120, 2004).

On-going research points to similar conclusions that landscape treatments may achieve significant and effective fuels treatment. Current assessments, on-going new projects, and other current theories are summarized in the USDA, Forest Service Briefing Paper dated May 15, 2004 and titled Area Protected Concept. For example, Dr. Finney's 2001 paper *Design of Regular Landscape Fuel Treatment Patterns for Modifying Fire Growth* theorizes that strategically-placed fuel treatments are better than randomly placed efforts with regards to minimizing large fire growth, particularly so when only a percentage of the landscape can be treated. His work with models also suggests that where the treatments are located is more important than the total amount of area treated. Other recent findings include: (1) It appears based on reviews of fuel treatments on the spread of the Rodeo-Chediski Fire, some protection for areas down-wind of treated area (sort of a wake-effect) occurred and this additional protected area amount to about 10-20% of original size of treatment unit, but the effect only occurred on areas that were prescribed burned in the last three years; (2) the Treatment Optimization Modeling (TOM) Project suggests treatments using a large number of small units kept fire sizes smaller but had shorter longevity of treatment effectiveness, and thus required more frequent maintenance to restore effectiveness versus having initially treated larger units resulted in more effectiveness; and (3) Fireshed Assessment Process being developed in California shows promise for landscape-scale analysis using large fire history to help design strategic pattern for fuel treatments to interrupt primary fire spread pathways and include measures to address resource protection needs, habitat improvements, and conduct responsible stewardship management of all resources. It must be noted that at this point in time, all findings are preliminary and no scientific information to date supports the conclusion that treating small amounts of the larger landscape will provide the same level of protection as treating a majority of the same area. The only conclusion established to-date is such limited, strategically placed fuels treatments will perhaps buy some time in order to complete additional treatments before an ignition.

It is noted that SS 4 is where the encroachment of White Spruce is seen, or plant succession towards a climax species (spruce) is occurring. This species creates fuel ladders and closed

canopies where fire spread is increased (spotting), resistance to control is progressively more difficult, and creates dangerous situations for firefighters. There is an opportunity to arrest or slow this conversion to a more dangerous fuel by changing the vertical arrangement and spacing of the stand, and at the same time make the vegetation more resistant to insects and diseases plus achieve wildlife habitat needs for martens and snails. This is supported by Pollet and Omi's (2000) research indicating fuels treatments which remove small diameter trees may be beneficial in mitigating crown fire hazard compared to stands without any treatment.

Current Fuels Situation & Expected Fire Behavior, Recent Agents which affect Fuels, & Types of Fuels Treatments to reduce Hazardous Conditions

Ground fuels within tree stands usually consist of duff, litter, and branchwood from Ponderosa Pine, White Spruce, Aspen, and Birch trees. There are several areas where harvest or thinning activities have resulted in slash adding to the fuel loading. Fuel loads can range from 5-8 tons/acre up to 13-15 tons/acre where created slash is present in the northwest portions of the project area. Open grassy areas can range from 1-2 tons per acre.

There are basically three types of fire; ground fires, surface fires and crown fires. Ground fires primarily burn in the ground fuels such as the duff, organic soil, buried logs, and roots. These fires burn at very slow Rate of Speed (ROS) and low intensities but can burn with very high moisture content. Major concern in fuels management is an increase in ground fuels from management activities or from natural accumulations may cause an increase in the duration of the fire. Therefore, we may increase the amount damage to the roots of trees, shrubs, grasses and to the soil structure. Another concern is that in a period of severe drought the ground fuels may dry out enough to become available to and increase intensity of the surface fire (Goehle, 2003).

Surface fires generally have fireline intensities ranging from 25 to 300 BTU/sec/ft, during the 50th to 70th (moderate to high fire burning conditions) percentile fire weather from Forest Service FireFamily Plus data analysis of historical fire records (Goehle, 2003). These types of fires are within the capabilities of dispatched hand crews and engines as flame lengths are generally less than 4 feet, although there would be instances where 5-6 foot flame lengths with head fires are expected, and resource capability would need to be re-enforced with additional units: perhaps a SEAT (Single Engine Air Tanker), Helicopter bucket drops, an Air Tanker, or mechanical suppression resources such as dozers. Tactics on fires with longer flame lengths may include indirect attack which will lead to larger fires, but generally fires within this range of BTUs are contained within the first 24 hours.

Crown fires are fires that burn through the aerial fuels or the canopies of the trees. Annually, about 1% of the largest fires accounted for 90-95% of the land burned annually, according to National Interagency Fire Center statistics. Crown fires are too intense to control with direct suppression and often start spot fires ¼ to ¾ miles in front of the fire. These fires can result in large catastrophic fires that can affect the entire landscape. Crown fires are generally considered the primary threat to ecological and human values and are the primary challenge to fire managers (GTR-628, 2005).

The problem exists when fires ignite during 90th percentile weather days within densely stocked stands as found in Deerfield Project Area. For perspective, fires igniting on these types of days

have demonstrated behaviors (Jasper Fire, 2000 and Grizzly Gulch Fire, 2002) of intensities greater than 500-1000 BTUs/ft/sec, torching of trees and passive to active crown fires, including such activity at night. Coupled with unstable atmospheres, these ignitions can produce extreme fire behavior, extensive spot fires, and even create their own local weather.

For reference, fires with intensities less than 100 BTU/ft/sec (flame lengths less than 4') can usually be controlled by hand crews. Fires with intensities of 100-500 BTU/ft/sec (flame lengths range 4-8') generally require additional support from engines, bulldozers, helicopters or air tankers. Fires with intensities over 500 BTU/ft/sec up to 1000 BTU/ft/sec (flame lengths greater than 8' up to 11') are considered to be too intense to be controlled by initial attack force. It is recommended that the majority of Deerfield Planning Area fuels be managed to maintain fire intensities below 200 BTU/ft/sec (4-5' flame lengths) where feasible so that most of the fires can be suppressed by hand crews and engines (NFES #1981 Field Guide, 1981). This is consistent with Forest Plan Guidelines for basing activity and natural fuels treatments so that potential fireline intensities do not exceed 200-300 BTUs/second/foot on 90 percent of the days when fires occur for areas with *Moderate to High* Risks, Hazards, and Values, with treated fuels not to exceed 10-15 tons/acre on low to moderately steep slope, recognizing that 2-8 tons/acre are considered natural fuel loads.

Storm damaged vegetative areas at this point are limited in size and scope, and not considered significant from a fuels hazard perspective. Insect killed trees are another matter; initial hits if concentrated can result in significant mortality to the canopy of pine, and then the trees exhibit red needles for 1-2 years. During this time they are very flammable and can easily torch under high burning conditions. Such activity would contribute to spot fires, increased rates of spread, and be more difficult to contain such a fire. Once the needles fall off, the trees are standing snags and relatively stable until weathering and decay causes the trees to fall or tops to come down. Eventually, these trees fall to the ground within 2-5 years generally, and the heavy fuels become available for fire consumption, but most of the material chars with fire initially. Large pockets of insect-killed trees would be susceptible to ignition and create control problems for up to a 25 year period, dependant on size of tree, climate, and moisture present to accelerate or retard active decay.

According to the September 16, 2004 memo from Rocky Mountain Region's Forest Health Management based at the Rapid City Service Center, the dramatically increasing trend in mountain pine beetle and *Ips pini* (pine engraver beetle) activity in the Black Hills National Forest is continuing unabated since 1999. This is a concern as untreated scattered pockets or slopes pose a hazard to the surrounding, unaffected forested areas by potentially serving as a ready location for fires to start and spread into adjacent values. Additionally, insect-killed trees can be lethal to responding firefighters as tops or whole trees can readily fall down without warning. Convective air currents from active fires, local winds, and fire damage to standing trees promote their structural failure.

History has shown us that it is not possible to exclude fire from a short interval fire regime indefinitely. However, we can affect the impact that fire will have on the ecosystem. Research, experience, and observation indicate that vegetation and fuels management (thinning, removal, pile and burn, broadcast burning) can mitigate the effects of wildfire in a short fire return

ecosystems such as the Black Hills ponderosa pine. One of the key points from GTR-120 is: "In forests that have not experienced fire for many decades, multiple fuel treatments - that is, thinning and surface fuel reduction - may be required to significantly affect crown fire and surface fire hazard." Ideally, one of the purposes for fuels management is to alter the structure of the fuels to reduce the risks associated with ignitions in vegetation on 90th percentile fire days, and cut down on the size and severity of crown fires.

The executive summary for the Fire Effects Summary Report for the Rodeo-Chediski fire stated that "even under the most severe drought conditions on record, and given an event with extreme fire behavior, positive benefits can be attributed to forest management activities that reduce crown densities, raise canopy heights and diminish surface fuel loadings". Two studies by Pollet and Omi (2002) and Omi and Martinson (2002) reported that that fuel treatments including thinning will moderate crown fire severity in short fire return interval systems. A review of the Hayman Fire in Colorado (Finney, et al. 2002) indicate that two ponderosa pine restoration projects seemed to have reduced fire intensity when compared to adjacent burn area.

Another method of fuels treatment is construction of fuel breaks by thinning the trees to spacing generally ranging from 18' X 18' up to 24'X 24'. The purpose of fuel breaks between private land and NFS lands is to protect either side from the spread of wildland fires, and to permit suppression crews to contain and control a fire. Ideally, private landowners are treating their fuels within a home ignition zone to complement the fuels treatment activities on the NFS land, and are building or remodeling structures to more resistant styles that lessen ignitability potential (Cohen, 1999 & 2003). Fires within a fuel break tend to be less intense, spread more slowly, remain as a ground/surface fire, and can be suppressed by hand and engine crews.

Conversely, fuel treatments do have the potential to actually increase fire behavior. Solar radiation is often increased when the forest is thinned. This increase in solar radiation can result in an increase in the amount of fine fuels such as grass and shrubs. Theoretically, these fuels should also dry out faster and be exposed to more wind, increasing surface fire intensities and rates of spread. However, live fuel moistures in the grasses and forbs can act as a heat sink and retard the fire's intensity during most of the growing season and into the early fall, when seasonal drying and the first hard frost can accelerate their curing out. Therefore, the effects of thinning on a surface fire can either increase or decrease the fire's intensities and rates of spread depending upon various factors. These factors include but are not limited to residual crown closure, time of season, rainfall, wind, and grazing. Still, most surface fires in the Deerfield Project Area will have low to moderate fire intensities and these fires can usually be successfully suppressed by firefighters.

Without any action, the progression to more densely stocked vegetative structural stages will continue to allow for stand replacement type fires to occur, which in turn have the potential to threaten: (1) firefighters and general public; (2) private property; (3) resource values; (4) and significantly alter the ecosystem. In some cases, these fires would move the vegetation to Early or Mid Seral stages (FRCC, 2004), and closer to the natural range of variability previously documented in the Custer Expedition photos. It also has the potential to move the vegetation back on a broad landscape scale with greater impacts to other critical resource values which may not be wanted by the public, municipalities, and agency. Just how widespread such a fire(s) are in this scenario will govern the effects on the ecosystem.

Use of Prescribed Fire based on Fire Intensity & Severity

Fire intensity is described in general terms as either Low or Low/Moderate for this document with regards to use of prescribed fire. "Low" intensity is considered to be where flame lengths vary from a few inches to up to an average of less than 4' and can vary with slope, fuel type(s), fuel condition, and experienced weather. Fireline intensities generally stay below 100 BTUs/Second/Foot. This type of fire is generally considered within capabilities of hand crews with or without water support to control, and a hand line should hold the fire. "Low/Moderate" intensity starts with flame lengths from a few inches and can average 4 - 6' in length depending on fuels, weather, and topography. When fires range within the 4 – 6' flame length, their fireline intensity pushes 500 BTU/Second/Foot which exceeds control efforts by hand crews or a hand line; equipment such as hoselays, engines, dozers with wider fire lines are generally necessary for effective control lines.

Fire severity is also described in general terms as either Low or Low/Moderate. In general, the more litter and soil organic material consumed by fire, the more severe the burn.

Based on experience on the Black Hills NF, Mystic R.D. we have noted that such fires may char larger woody materials beyond the 1000 hour size class (3-5"). Materials in the 1, 10, and 100 hour size range (<1/4 to <3") are consumed to varying degrees, with such burning contributing to consumption of litter and some of the duff layer in the immediate vicinity of the consumed material. It is possible to have larger materials beyond the 1000 hour size class burn up rather completely if prolonged drought conditions exist in the treatment area; in fact it appears this is what is necessary to maintain openings in structural stages other than 4C for White Spruce.

These burns tend to be spotty in their burn spread patterns, and may have portions which advance into unburned areas by backing thru drier, more open sites. In White Spruce stands these burns can consume needle cast under the trees, exposing the roots and contributing to downfall of individual or groups of trees. At the same time such burn patterns can allow unburned pockets of vegetation to survive and exist as reservoirs for plant introduction into burned areas. Incomplete consumption of the duff is noted and seed reservoirs exist even in burned areas. In most cases less than 15% of mineral soil is exposed by such burns, and is often found where jackpots of moderate to heavy slash had been observed, ignited, and persistent, higher temperatures of burning for longer periods of time occurred.

Areas with prescriptions which call for "Low" severity appear to be suitable for maintenance burning in White Spruce stands which are not rated as structural stages 4C or some 4B, and may be used in mixed stands of Ponderosa Pine and Spruce or solid pine. This is true even when substantial Common Juniper exists if some moisture exists or colder soil temperatures are present. One challenge is to plan such burns within the confines of previously burn areas or sufficient control lines since these burns persist into the season. It appears the fall burning window may be the best time to accomplish these types of fires.

Even though this type of burn is rated as "Low" it should be noted that in limited areas moderately severe fires will occur. It is estimated that that up to 1/3 of the stand could be affected by appearance of in the moderate severity burn spots. It appears that such openings are then reloaded

with spruce which fell over, lending the area to a maintenance burn in several years down the road if desired, yet at the same time the staggered appearance of the stand is maintained. In some cases aspen regeneration is possible from additional burning if not present from the first firing.

A "Low/Moderate" severity burn is a mix of both types of severity. Our observations on the Black Hills NF, Mystic R.D. have found that most of our broadcast burns under Ponderosa Pine tend to be a mix of "Low/Moderate" severity sites, with the tendency to be more area classified as Low than as Moderate. In the past, we have limited our prescriptions to 15% of the burned area exposed to mineral soil, and ocular monitoring has confirmed we often are reaching but not exceeding this objective. In general terms we can say about 15% of the area would be Moderate Severity, and 85% would be Low Severity results with respect to soil impacts

Fires in the "Low/Moderate" category have to capability to remove up to 50% of the fuel loading over 60% of the area based on past observations of Mystic R.D. burns especially in the 1000 hour and beyond size class. Often times the larger material is charred but not consumed during non-drought periods.

Prescribed burning has been effective at removing 50-70% of the 0-3" live trees (pine or spruce), and may in some instances thin up to 50% of the 3-5" trees. Limited mortality of the 5-9" sized pine and spruce has been observed although up to 20% has been permissible by prescription. Fire killed trees in the 9"+ size in pine are limited but has been noted in the larger White Spruce where ladder fuels exist or creeping ground fires have consumed supporting root structures and made trees susceptible to windthrow.

These types of fires can exhibit individual torching or short sustained crown fire bursts where creation of openings for wildlife is desired. It is a function of slope, topographic features such chutes, fuel loading, canopy configuration (tight, open, loosely space), presence or absence of ladder fuels, weather conditions, and ignition technique. In most cases these fires are contour strip or chevron ignition patterns (single strips downslope) to control intensity and severity.

Past Activities which have affected the Fuels Condition

Recent management activities have included 23 different commercial and salvage sales since the early 1970s to-date, with seven of the sales still active. The dominant silvicultural prescription applied was a Shelterwood System. The Intermediate Thinning associated with the Shelterwood System were generally to an 80 BA but also had some prep thins to 50 BA, which would put most treated stands in the Moderate Category for crown fire potential, and with growth over a twenty year period move them towards the High rating. A total of 36,040 acres are affected by these sales, but it is noted that some of these acres are follow-up treatment of the same acres previously managed. These sales have or will reduce the crown fire potential in some areas, but vegetative growth will move them back towards High Crown Fire Potential within 20 years (given anticipated tree growth rates) unless future treatments reduce basal area. This reduction is accomplished by creating wider spacing or openings between crowns of remaining trees to break up the horizontal continuity of the fuels, and by treating the surface fuels to reduce ladder and fire intensities. Salvage sales are removing green hit trees which will minimize standing red trees and associated hazards. Generally, silvicultural practices used in these sales will result in less Crown Bulk

Density and an increase in Canopy Base Height, although these stands were not run through FVS to determine calculated changes in the fuel structure compared to prior to treatment.

Areas to the south of the Deerfield Planning Area which have similar vegetative treatments were still subject to damaging effects from crown fire activity from the Jasper Fire in many cases. It is believed a combination of factors are responsible for why these stands were susceptible to crown fires: 1) basal areas left after treatment were in excess of 60-80 BA; 2) thinning and harvest slash were present in the understory negating the positive effects of raising canopy base height; 3) drought conditions lessened fuel moistures making fire intensities more than usually seen; 4) fire weather conditions were at or exceeding 90th percentile weather during ignitions; 5) plume dominated fire behavior occurred in some cases; and 6) terrain was in alignment with prevailing winds so channeling of fire flow with drainages and slope was possible.

Environmental Consequences

One of the objectives for the Deerfield Project Area is to reduce hazardous fuel conditions. Treatment efforts which move the vegetation closer to the historic range of natural variability also can reduce the potential for crown fires. Reducing crown fires protects individual sites and stands on a landscape basis, and thus reduces the risk of damages to a variety of designated values. Rothermel (1991) describes favorable conditions for a crown fire as:

- Dry fuels
- Low humidity and high temperatures
- Heavy accumulations of dead and downed litter
- Conifer reproduction and other ladder fuels
- Steep slopes
- Strong winds
- Unstable atmosphere
- Continuous forest of conifer trees

We do not have the ability to affect the weather or the topography, but we can affect the vegetation and the fuels (RMRS-GTR-120, 2004). The alternatives will be evaluated on how they affect the surface fuels and potential of crown fire initiation including torching, the ability of the forest to sustain a crown fire and on the potential of a plume dominated fire occurring. See the Fire and Fuels Report held in the Project File for detailed information.

The potential of a crown fire ignition is determined by surface intensities, vertical continuity of the fuels, minimum crown heights and stand density. As conditions for fire spread become more favorable, surface fire intensities will increase to a point where they will ignite the foliage of one or more trees consuming the entire tree in sections. This phenomenon is called torching. If conditions are not favorable for sustained spread through the canopies, the trees will quickly burn out but will often produce embers that cause spot fires ahead of the fire. Surface fires intensities often increase from both the torching trees and the multiple ignitions of spot fires, increasing the potential for additional torching. If conditions are favorable, this pattern can increase to a point where frequent torching can initiate a sustained crown fire (Goehle, 2003).

Passive crown fires can range from scattered individual trees torching to the mass ignition of large groups of trees that will often resemble an active crown fire in both fire intensity and in effects. While most of the current research has emphasized active crown fires, information on the initiation and spread of passive crown fires is weak. A fire model used in the "BEHAVE" fire prediction system uses surface fire intensity, ambient air temperature and midflame wind speed to predict the scorch height. Van Wagner (1977) indicates that crown ignition is based upon the distance of the surface fuels to the crown foliar moisture of the crown and surface fire intensity. Scott and Reinhardt (2001) developed a model "NEXUS" that uses "BEHAVE" fire spread equations and Van Wagner's work to predict active and passive crown fire potential. While these models are useful in predicting trends and effects of treatment, outputs should not be considered as absolute values. The "BEHAVE" fuel model was developed to an accuracy of approximately 60% and uses 13 broad fuel models to represent all of the fuels in the United States. Fire spread is based upon a single uniform flaming front.

Goehle (2003) noted thru personal observations (25 years of prescribed burning and 15 years of wildland fire experience as a Fire Behavior Analyst) that factors such as multiple ignitions, torching and unstable conditions can increase fire behavior at least 2-3 times what is predicted by the models. Van Wagner's crown initiation model does not factor in the influence of crown density on crown initiation. Dense forests will increase the amount of preheating in the canopy by trapping in the hot gasses and by reducing surface wind speeds.

Research and experience has shown that various types of fuels treatments can be used to reduce a fire's intensity and therefore the probability of torching and crown fire initiation. Vegetation management can be used to reduce crown density, raise crown heights and remove ladder fuels. This will make it harder for a crown fire to be initiated and make it harder to sustain a crown fire. Prescribed fire can be used to remove some of the ground fuels and ladder fuels. Fuels can also be removed from the site, piled and burned or chipped. Crushing the fuels will increase the packing ratio thus reducing surface fire intensities and increase decay rate. Lopping and scattering activity will increase the packing ratio but may increase fuel loadings significantly over natural conditions. All treatments can be effective in certain situations but there are limitations. We can use vegetation management and fuel treatments to reduce the threat of a large wildfire but can not eliminate the threat. Topography and weather still play a major role in determining fire behavior (Goehle, 2003).

Another advantage of thinning the forest to reduce crown fuel loadings is reducing the potential for plume dominated fires. Rothermel's (1991) research indicates that fireline intensities (BTU/ft.^{2}) in conjunction with wind are the factors that determine if a fire becomes plume dominated. Rothermel's models uses crown fuel loadings to help determine the power of a fire. However, if the thinnings of crown fuels are left on site, they are then increasing the total tons per acre of surface fuels, negating much of the benefits from opening the canopy. No matter how we treat the forest we still will have the potential of a large fire on extreme fire days. However, we can reduce the odds of a large fire from occurring, provide areas where we can fight the fire more effectively and safely and we can reduce the impacts that a large fire would have on the ecosystem (Goehle, 2003).

Vegetation management can also be used to maintain and expand hardwoods and meadows. This will provide natural firebreaks that will force a fire back to the surface. Additionally,

approximately 1332 cow/calf pairs are allotted to use the Deerfield Project Area annually. Range management experts estimated that over 90% of the Deerfield Project Area is either primary or secondary range for cattle grazing. These livestock will reduce fine fuel loadings on the areas they utilize, starting with the meadows and openings closest to watering sources. This use significantly reduces fuels in the meadow areas, resulting in a reduction in fire behavior and an increase in the effectiveness of these natural fuel breaks.

Process used for Evaluating Alternatives

The level of analysis chosen is an intermediate approach that focuses on a representative landscape for the alternatives. This acreage is projected by Forest Vegetation Simulator (FVS) growth models to depict changes in vegetation over time. Readily available stand data from 1993-2002 exams for Ponderosa Pine was used and covers approximately 87% of the project area or about 31,373 acres out 36,105 total acres.

The following factors were considered when evaluating the FVS output for various alternatives: acres treated, crown bulk density, basal area of the stand, the number of trees per acre, diameter of the residual stand, spacing between trees and their crowns, average crown base height, and surface fuel loadings. Basal area and crown bulk density changes over time by alternative were used to estimate crown fire potential and subsequent fire spread (see Appendix G, Maps 14 thru 17).

First, crown bulk density as a variable in estimating crown fire spread was determined. Alexander (1988) illustrated by using Van Wagner's models that crown fire spread was unlikely with a crown bulk density under .05 kg/m^3. The NEXUS model also indicates that .05 kg/m^3 is the minimum threshold. NEXUS Model runs by Goehle (2003) found that Ponderosa Pine crown fires were possible with crown bulk densities of .06-.08 but required wind speeds over 25 mph and that a bulk density greater than .08 was required for wind speeds less than 25 mph.

Crown bulk density (CBD) is very difficult to measure or estimate in the field and is not contained in most stand data. Crown bulk densities were estimated in this study by using the Forest Service's FVS (Forest Vegetation Simulator) Model – Fire and Fuels Extension Processor. For example, in the Prairie Project Area fuels analysis those stands with a low crown fire spread potential were classified as those with crown bulk densities less than .05, and moderate potential ratings assigned to those stands having crown bulk density equal to and greater than from .06-08 kg/m^{3,} and stands with a high potential ratings because crown bulk densities greater were than .08 kg/m^3.

For the purposes of the Deerfield Project Area fuels analysis, the ratings for crown bulk density were consolidated since areas with CBDs equal to or greater than .05 up to .08 kg/m^3 have the potential under a mix of fuels, weather, and topography to burn as crown fires. Therefore, there will be two ratings: 1) Low Crown Fire Spread Potential - < .05 kg/m^3; and 2) Moderate/High Crown Fire Spread Potential – greater than or equal to .05 kg/ m$^{3.}$

Secondly, there is not much research correlating basal area of the stand to crown fire potential. However, Henry Goehle, (former Mystic District Fire Management Officer) and Gale Gire, Supervisory Mystic District Silviculturist used over 50 years of experience in silviculture and

wildland fire to aggregate basal areas by crown fire potential for initiation and spread. This will estimate the ability of an individual stand to start and sustain a crown fire; data was produced from FVS Model runs using the Fire/Fuels Extension Processor.

It is Gire's and Goehle's professional opinion that stands with a basal area less than 60 $ft.^2$/acre tend to be open enough that fire spread from crown to crown is unlikely. Stands managed to maintain a basal area of 40-60 $ft.^2$/acre would be the most effective in reducing crown fire potential because they would still be dense enough to retard most grasses, decrease regeneration, and open enough to prevent an active crown fire. Crown fires are nearly impossible with basal areas less than 40 but grasses and regeneration become more prevalent. Grass dominated fuels burn much faster than litter and duff with rates of spread up to 10 times as fast. These higher ROS will make initial attack more difficult. However, initial attack aircraft and engines will be more effective in the more open stand. Eventually, advanced regeneration could lead to increased torching potential if not treated. Even though crown fires are unlikely in stands with basal areas of 60-90 $ft.^2$/acre, they were generally classified as having a moderate initiation potential because a crown fire is possible in wind events. Many of the moderate stands in the project area are young enough and dense enough that future growth will put the stands into the high category within the next twenty years.

For the purposes of the Deerfield Project Area fuels analysis, the ratings for crown fire initiation potential were consolidated to reflect that moderate areas may rapidly change to high hazard under that right mix of fuels, weather, and topography. Therefore, there will be two ratings: 1) Low Crown Fire Initiation Potential – Basal Area < 60 $ft.^2$/acre; and 2) Moderate/High Initiation Potential – Basal Area greater than or equal to 60 $ft.^2$/acre.

After determining BA and CBD, the ponderosa pine sites in the Deerfield Project Area were grouped into two broad categories based upon the site's crown fire initiation potential and crown fire spread potential. Sites with a low crown fire hazard generally do not have sufficient aerial fuels to start and support an active crown fire even under extreme conditions. An active crown fire is possible in sites with a moderate/high rating under very high to extreme conditions including dry fuels, high temperatures, low relative humidity and high wind speeds. Crown fire initiation and spread is also possible in sites which lean towards the high end of crown fire hazard under hot and dry conditions but does not require a wind event to sustain the crown fire.

Note that the possibility of a plume dominated fire can also be correlated with crown fire potential. Calculations based upon Rothermel's nomograms by Goehle, 2003 for crown fire spread indicated that stands with a high crown fire potential can develop into a plume dominated fire with wind speeds as high as 30-40 mph hour where stands with low crown fire potential do not have enough crown fuels to initiate a plume dominated fire.

This analysis will concentrate on the effects that the various treatments will have on crown fire initiation and spread using BA and CBD to examine the relative changes in vegetation from each Alternative if implemented. Additionally, Canopy Base Height (CBH) is displayed to show the relative changes in distance from the ground to the lowest limbs. In general, lower CBHs mean more opportunity for torching, crown fire initiation, and crown fire spread to occur.

Table 3-6 and Table 3-7 summarize the effects on the key elements of the aerial fuels for each of the four alternatives and 20 years after initial treatment, using a representative landscape of 31,373 acres of predominately ponderosa pine with some spruce and aspen, out of 36,105 acres total in the Deerfield Project Area. Note these tables include hardwoods and aspen. These fuel types will often serve as natural fuel breaks. They may not always stop the fire but fires usually burn through these areas with low enough intensities that they can be suppressed. Management activities that increase or maintain these vegetative types will help reduce the potential for a crown fire to occur.

Table 3-6 Summary of Crown Fuels after Treatment

Stand & Crown Fuel Elements with Adjective Hazard Rating		A	B	C	D
Low	Acres	16792	25784	22158	18140
	Basal Area 5”+ per acre	52 ft^2	40 ft^2	42 ft^2	49ft^2
	Average Canopy Base Height	23’	25’	24’	24’
	Canopy Bulk Density	<.05	<.05	<.05	<.05
M/H	Acres	14581	5589	9215	13233
	Basal Area 5”+ per acre	103 ft^2	100 ft^2	99 ft^2	106 ft^2
	Average Canopy Base Height	17’	14’	17’	17’
	Canopy Bulk Density	>=.05	>=.05	>=.05	>=.05

Table 3-7 Summary of Crown Fuels Twenty Years after Treatment

Stand & Crown Fuel Elements with Adjective Hazard Rating		A	B	C	D
Low	Acres	6656	20339	15719	9411
	Basal Area 5”+ per acre	69 ft^2	53 ft^2	54 ft^2	63 ft^2
	Average Canopy Base Height	14’	12’	13’	12’
	Canopy Bulk Density	<.05	<.05	<.05	<.05
M/H	Acres	24717	11034	15654	21962
	Basal Area 5”+ per acre	105 ft^2	101 ft^2	100 ft^2	106 ft^2
	Average Canopy Base Height	7’	9’	10’	8’
	Canopy Bulk Density	>=.05	>=.05	>=.05	>=.05

Alternative A, No Action

Direct/Indirect Effects

Alternative A would not affect surface and ladder fuels as no treatments or prescribed fires are planned. This alternative does not meet the objective of reintroducing stand and landscape fire to the ecosystem nor does it meet the direction to reduce the threat of wildfires. Currently in 2005 approximately 46% of National Forest Lands of High Hazard ponderosa pine are dense enough to initiate and sustain an active crown fire, and the potential for a catastrophic fire would increase with time. Low Hazard rated ground is about 54% of total project area in 2005.

Changes should be gradual and would not be apparent in the short term unless a major disturbance occurs. Ground fuels would continue accumulation from annual needle cast, dieback and breakage. Mortality of trees is likely to continue, adding to the surface fuel loadings. Natural tree growth and succession would gradually create a forest that is more dense and multi-storied in nature. Stand biomass would increase including the bulk density of the crowns. Natural regeneration of pine and spruce would continue, resulting in more acres of multistoried

stands with ladder fuels. These stands would become increasingly more susceptible to large-scale disturbances such as insect outbreaks that could significantly alter the fuel profile.

It is estimated that within 20 years, Moderate/High Hazard Rating would cover about 79% of the forested acreage in the Deerfield Project Area. This acreage would be susceptible to crown fire initiation and spread – almost a doubling of the number of Moderate and High Hazard acres listed in 2005. At the same time Low Hazard Rating acres decrease from 54% to 21% of the total area.

This alternative would provide the best access for fire protection. There are over 200 miles of open roads and 59 miles of closed roads (gated/posted for Administrative/Special Use or opened with equipment) that could be used to access a fire. The road system is dense enough that suppression forces could generally drive within a 1/4 -1/3 mile of most fires. Additional routes would be established from continued motorized use of the area, further improving fire suppression response access. These additional road and trail routes also increase the presence of humans in the forest, and such increases raise the possibility of more human-caused fires.

Alternative A would have no direct effects upon the existing air quality. With no treatment, emission and smoke production potential remains moderate to high. The potential of a large catastrophic fire is the greatest with Alternative A since more acres remain at Moderate to High Hazard Rating, and more acres will exist 20 years from now. A large wildfire in the project area would probably disperse smoke into Rapid City's airshed at a level that would exceed National Air Quality Standards. Effects would be short term and probably occur during major runs of the fire. There would be no long term or cumulative effects on air quality with this alternative.

Cumulative Effects

Wildfires are expected to remain at the same frequency and average size for the short term. Fire risk or hazard is not expected to change significantly in the short term, but hazard will increase in long-term as vegetation continues to grow in size and density; fire risk may increase with increased human activities and rural development. Most fires would continue to be low to moderate intensities with flame lengths ranging from 1 to 4 feet (25-100 BTU/sec/ft), although there would be instances where 5-6 foot flame lengths (200-300 BTU/sec/ft) with head fires are expected, and resource capability would need to be re-enforced with additional units. Fires with these intensities can be suppressed with initial attack resources. However, fires occurring during more extreme conditions would produce flame lengths from 8-11' and intensities ranging from 500-1000 BTU/sec/ft or greater, and would have the potential to develop into crown fires, make rapid rates of spread and fire growth of 5-10 miles in a single day as demonstrated by documented fire behavior from the Jasper Fire (Goehle, 2003). These ignitions can produce extreme fire behavior, extensive spot fires, and even create their own local weather.

Any fire of this magnitude would threaten land values both inside and outside of the project area, private property and possibly several low density developments and/or communities. These fires burn with increased severity and can effect soil productivity and increase short-term erosion after fires with heavy rainfalls. Such erosion events have the potential to affect watersheds and Deerfield Reservoir. Such fires will exhibit increased resistance to control, endanger responding suppression forces, and be unpredictable in behavior under 90th percentile weather conditions.

Crown fire potential would gradually increase with time. The potential for crown fire initiation would significantly increase with the development of multi-storied stands with ladder fuels and greater surface fuel loadings. The forest would become more susceptible to an active crown fire as the forest becomes denser and more continuous with fewer natural fuel breaks. History has shown that these forests are usually not sustainable over time and would eventually be affected by landscape disturbances such as fire and/or insects.

Recent management activities have included commercial and salvage sales since the early 1970s to-date, with seven of the sales still active. The dominant silvicultural prescription applied was a Shelterwood System. The Intermediate Thinning associated with the Shelterwood System were generally to an 80 BA but also had some prep thins to 50 BA, which would put most stands in the Moderate/High Category for crown fire potential, and with growth over a twenty to thirty year period move them towards the High rating.

A total of 36,105 acres are affected by these sales, but it is noted that some of these acres are follow-up treatment of the same acres previously managed. These sales have or will reduce the crown fire potential in some areas, but vegetative growth will move them back towards High Crown Fire Potential within 20 years (given anticipated tree growth rates) unless future treatments reduce basal area. Salvage sales are removing green hit trees which will minimize standing red trees and associated hazardous fuels.

Generally, these past silvicultural practices used in these sales will result in less Crown Bulk Density and an increase in Canopy Base Height, although these stands were not run through FVS to determine calculated changes in the fuel structure compared to prior to treatment. Data to run the past activities is sketchy and incomplete, so FVS model runs would be based on many assumptions which would weaken the outputs.

What is commonly known is stands cut to an 80 BA were susceptible to crown fires in similar vegetation to the south of the Deerfield Planning Area. These outlying areas having similar vegetative treatments were still subject to damaging effects from crown fire activity from the Jasper Fire in many cases. It is believed a combination of factors are responsible for why these stands were susceptible to crown fires: 1) basal areas left after treatment were in excess of 60-80 BA; 2) thinning and harvest slash were present in the understory negating the positive effects of raising canopy base height; 3) drought conditions lessened fuel moistures making fire intensities more than usually seen; 4) fire weather conditions were at or exceeding 90th percentile weather during ignitions; 5) plume dominated fire behavior occurred in some cases; and 6) terrain was in alignment with prevailing winds so channeling of fire flow with drainages and slope was possible.

Although regional haze increases on a sustained basis are not anticipated in Wind Cave or Badlands National Parks based on observations of recent wildfire events, there is an increased chance of more wildfire events of sufficient magnitude to create contributing emissions into these two parks. These emissions are expected to be of short duration and not sustained. These impacts are based on an anticipated increase in the number of crown fires per year on average expected over a twenty-year period as hazardous fuels conditions increase in acreage. This means more opportunity for an increased number of crown fire events which may contribute

smoke emissions to Class I airsheds, small developed housing areas within the forest, and municipal areas which affect public health and safety on a short-term basis. Such fire activity will also impair local viewsheds for the same approximate duration.

Alternative B

Direct/Indirect Effects

This alternative would meet the Forest Plan objectives of reintroducing fire to the ecosystem and the standard for reducing the threat of a wildfire damaging public and private developments. It is the most aggressive alternative for treating fuels by mechanized methods, and additionally the second highest number of acres by prescribed fire.

This alternative would treat 22,000 acres non-commercially, 14,500 acres commercially, and up to 10,000 acres could be treated with low to moderate intensities of prescribed fire on a landscape scale. Hardwood and meadows receive emphasis with various acres prescribed for retention or restoration treatments. Commercial plus non-commercial fuel breaks would be developed on lands adjacent to private lands. Since some of the treatments are follow-up or consecutive in nature, some acres are to receive more than one treatment plus could be followed up with a prescribed fire. The total number of unique acres treated is 25,400 which are 20% more than Alternative C.

The proposed activities would greatly reduce the potential of a severe crown fire for 15 to 20 years as compared to Alternative A. From FVS Models for Alternative B, after the initial treatments approximately 82% of National Forest Lands are rated as Low Hazard Rating, while 18% are rated as Moderate/High Hazard Rating. The potential for a catastrophic fire would not increase as much as Alternative A; it is estimated that within 20 years, only 35% of the forested acreage in the Deerfield Project Area is Moderate/High Hazard Rating and be susceptible to crown fire initiation and spread as opposed to 79% of all acres for Alternative A.

Fuel breaks would be completed adjacent to approximately 60 miles of private property and may treat up to 1400 acres. The fuel breaks would be approximately 200-300 feet in width and would be created by thinning the stand from below to minimum spacing of 18x18 feet up to 24x24 feet; some commercial fuel breaks could be spaced up to 40x40 feet where dominant trees exist and provide some shading of the forest floor. This would thin the forest to a density that would not support an active crown fire but not enough to encourage grass from becoming established in the understory in most cases. Minimum canopy heights would increase 5-10 feet which decreases the possibility of torching and spot fires. Activity fuels would either be removed from the site or piled. Piles would be disposed of by burning or by chipping. The purpose of these fuel breaks is to provide an area where crowning is not likely and give firefighters the opportunity to suppress or divert a fire before it reaches the private land or to help prevent a fire that starts on private property from moving onto National Forest Lands.

Hardwoods and meadows provide diversity and also provide natural fuel breaks under most conditions. Where it occurs, grazing would remove much of the annual growth of fine fuels and enhance their effectiveness as fuel breaks. Alternative B would help maintain or create 3,800 acres

of meadows and 1,100 acres of hardwood stands by removing the non-commercial conifers that are encroaching into these areas, as opposed to Alternative A where these untreated areas continue to be encroached upon by pine and spruce and lose their effectiveness as a natural fuel break.

Non-commercial thinning would be used to thin 16,100 acres from below to an average spacing of 16x16 feet. The proposed thinning would only remove stems that are less than 9" in diameter so some portions of the stand would still maintain higher densities. This would decrease the fire potential by reducing the bulk density of the crown, increasing the distance between the crowns and by increasing minimum crown heights. The thinning operation has the potential to increase surface fuel to an estimated 10-15 tons/acre. This amount of slash can negate many of the benefits of the thinning and fuels would need to be treated in some fashion to reduce surface fire intensities.

Lopping and scattering thinning slash to a 12" height standard would reduce fire intensities by decreasing fuel heights and increasing the bulk density of the fuels. Figures from the "Black Hills Fuels Guide" indicate that these actions would reduce fire intensities to 80-160 BTU/sec/ft. (based on 90% cumulative probability of fire days). These figures are below the Forest guidelines but the fuels remain on site and can be problem in droughty conditions. Removing the fuels by prescribed fire or mechanical means would be more effective and is recommended over lopping and scattering if expected fire intensities in the activity fuel are over 200 BTU/sec ft at the 90th percentile.

Prescribed fire is also proposed for up to 10,000 acres to treat residual fuel accumulations and raise canopy base height. This re-introduction of fire into the ecosystem after years of effective suppression has benefits from a forest health standpoint, and would thin natural regeneration which occurs after stem removal. For Alternative B, fire is re-introduced based on a strategic placement on the landscape with management measures in place to protect and enhance other values. Prescribed burn treatments are designated on a map (see Appendix G, Map 7) where the fuels specialists have determined their location would best minimize large fire growth (Finney, 2001); these efforts are not intended to treat every acre, rather they are designed to complement features which may retard or slow fire growth such as previous prescribed burns, old wildfires, north aspects, meadows, hardwood stands, water bodies, and terrain where fuels are sparse or less likely to burn with high intensities. Fuel loads can range from 5-8 tons/acre up to 13-15 tons/acre where slash is created. Open grassy areas can range from 1-2 tons per acre. The remaining acreage would be natural fuels, mostly ponderosa pine needles with fuel loadings ranging from 3-5 tons/acre. The proposed burns would reduce crown fire potential by decreasing surface fuels loadings by 50-80% to an estimated 2-5 tons/acre of fine fuels and by increasing minimum canopy heights to an estimated 25-30 feet (Goehle, 2003).

Prescribed burning can be an effective tool in thinning ponderosa pine on the Black Hills as demonstrated on recent prescribed fires in the central part of the forest. Ponderosa pine has thick bark that insulates the cambium. Tree mortality from basal scorching is minimal and most mortality occurs from crown scorch. Trees would be killed in small groups and patches and mortality usually would not occur uniformly throughout the stand. Prescribed fire can be effective in killing smaller seedlings and saplings that can create a multi-storied forest that serves as ladder fuels. Again, the effects of the prescribed burn would be patchy and minimum canopy heights would not be affected on all areas. The value of a burn is increased when conducted on a landscape scale where any new wildfire then entering the previous burn is slowed down, moves

along thru surface fuels, or basically stops forward spread and must laterally spread to enter untreated areas conducive to further expansion.

There are always risks associated with prescribed burning. Most problems often occur with smoke either from nighttime drift or when an unexpected subsidence causes the smoke column to surface. Based upon daily production rates of previous prescribed burns and on limitations imposed by burning in or adjacent to the scattered wildland/urban interface, it would take an estimated 45-55 days of burning distributed over a period of 5-7 years to complete the prescribed burns planned in Alternative B. Of course, funding for and availability of prescriptive burn windows to implement these burns may also be limiting. The most likely nearest municipal receptors for smoke would be Custer, Hill City, and Rochford.

There is also the threat of an escaped prescribed fire. The potential of an escape can be minimized by prescribing fuels and moisture conditions that limits fire behavior and by completing the burn with skilled and experienced personnel. However, there is always the chance that unexpected weather or fuels may cause the fire to escape and create a wildfire similar to the 1991 Horse Creek Fire that escaped control lines, burned 2,673 acres and threatened forest resources, watersheds, and private property.

Preliminary modeling with the "SASEM" smoke dispersion model indicates that approximately 1065 tons of total suspended particulates (TSP) would be produced from a representative prescribed fire day (Goehle, 2003). SASEM indicates that we can burn up to 300 acres of natural fuels and at least 75 acres of activity fuels in a single day without violating EPA standards for TSP, PM-10 or PM-2.5 for identified receptors, using a dispersal rating of Fair or better as a standard. The SASEM model also indicates that prescribed fire has the potential to reduce visibility at Mount Rushmore, Wind Cave and Rapid City. Badland National Park would not be significantly affected by prescribed burning. It is far enough away from the project area that the smoke would be dispersed before in reaches the Park.

The SASEM model is designed to give the worst case scenario and we can reduce or mitigate possible impacts with proper smoke management techniques. Burn days when wind directions (any wind but northwest) disperse the smoke away from and mitigate any effects on Mount Rushmore or Wind Cave are preferred. It is not possible to entirely avoid the Rapid City airshed because almost all of the acceptable burn days would have winds from a westerly direction. We can mitigate the possible impacts by limiting the acres burned in a day and by burning under atmospheric conditions that would loft the smoke over the sensitive receptors. Generally, smoke dispersal of Fair or better rating would reduce or eliminate the effects of smoke on receptors. Effects should be short term and should not violate any air quality standards. However, the smoke may be noticeable both visually and by smell.

Burning activity fuels from fuel break construction and non-commercial thinning would add an estimated 1,750 tons of TSP to the airshed. Chipping or removing the activity fuels from the area would reduce the amount of TSP but would increase project costs. A combination of chipping and burning is recommended depending on costs per method selected and desired end result.

This alternative provides the second best access for fire protection. This is basically the same system as Alternative A. There are over 195 miles of open roads and 63 miles of closed roads (gated/posted for Administrative or Special Use or opened with equipment) that could be used to access a fire. The road system is dense enough that suppression forces could generally drive within a 1/4 -1/3 mile of most fires. This is not expected to affect current IA engine and hand crew vehicle response times.

No additional routes would be allowed to be established from unauthorized/exploring type of motorized use of the area; law enforcement effort is required with education to achieve this result. The lack of additional unauthorized road and trail routes combined with six miles of planned road decommissioning will reduce the presence of humans in the forest. Less human activity in dispersed locations will reduce the possibility of human-caused fires, and make patrol efforts easier to accomplish during high fire danger periods.

Alternative B may have direct, short-term effects upon the existing air quality from prescribed burning and wildfires in untreated vegetation. However, emission and smoke production potential is significantly reduced compared to Alternative A by treating Moderate to High Hazard acres and converting them to Low Hazard acres. The potential of a large catastrophic fire is greater with Alternative A than Alternative B since more acres initially remain at Moderate to High Hazard Rating with Alternative A, and more said acres will exist 20 years from now.

A trade-off is that up to 10,000 acres would be burned with Alternative B under approved prescribed burn plans so substantial TSP would be produced. These emissions can be easier to regulate in numbers of acres burned per day, igniting with favorable winds, the time of day when burning occurs, the day of year ignited, and the number of acres ignited per year.

Conversely, a large wildfire in the project area could disperse smoke into Rapid City, Custer, Hill City, and Rochford at a level that could exceed National Air Quality Standards. This is because such burns generally occur at the time of year (summer, early fall) when wind direction towards Rapid City is predominant, and multiple burning periods are involved. Effects would be short term and probably occur during major runs of the fire. It is reasonable to expect less numbers of these types of fires with implementation of Alternative B since 82% of the treated acres will be in the Low Hazard Rating after initial treatment in 2005, versus only 54% of Alternative A's acres at Low in 2005.There would be no long term or cumulative effects on air quality with this alternative.

Cumulative Effects

Wildfires are expected to remain at the same frequency and average size for the short term. Fire hazard is expected to be reduced significantly in the short term, but gradually increase in long-term as vegetation continues to grow back in size and density; fire risk may increase with increased human activities and rural development. Initially 18% of all acres are rated as Moderate/High Hazard Rating. The potential for a catastrophic fire would not increase as much as Alternative A; it is estimated that within 20 years, only 35% of the forested acreage in the Deerfield Project Area would be susceptible to crown fire initiation.

Most fires would continue to be low to moderate intensities with flame lengths ranging from 1 to 4 feet (25-100 BTU/sec/ft), although there would be instances where 5-6 foot flame lengths (200-300 BTU/sec/ft) with head fires are expected, and resource capability would need to be re-enforced with additional units. Fires with these intensities can be suppressed with initial attack resources. However, fires occurring during more extreme conditions would be less frequent as substantial acres have been converted to Low Hazard Rating.

Alternative B prescribed burns would be effective in reducing the potential of large catastrophic fires for at least 3-5 years after each burn is completed. Research and recent fire such as the Hayman and Hi Meadows fires in Colorado and the Star Gulch fire in Idaho have shown that recent prescribed burns can be effective at either stopping or reducing the effects of large wildland fires. Benefits from prescribed fire would decrease with time as natural fuels begin to build up from needle cast, mortality and in-growth. This is supported by the fact that studies of the Hayman fire showed mixed results when comparing fire intensities in areas prescribed burned approximately 10 years ago to adjacent, untreated areas. It is anticipated that the treatments proposed in Alternative B would lose their effectiveness and additional treatments would be needed in approximately 20 years. This estimate is supported by research (Shepperd and Battaglia, 2002), which suggests a mean fire interval of 20-24 years for Jewel Cave National Park. Future management would be needed to maintain forest conditions that would reduce the long-term potential of a severe, crown fire occurring within or adjacent to the Deerfield Project Area.

Any fire of crown fire magnitude would threaten land values both inside and outside of the project area, private property and possibly several low density developments and/or communities, and effect soil productivity and temporarily affect watersheds. However, these types of fires should be less frequent after initial treatment than compared to Alternative A.

Crown fire potential would gradually increase with time after initial treatments occur with Alternative B. The potential for crown fire initiation would gradually increase with the development of multi-storied stands with ladder fuels and greater surface fuel loadings. The forest is a dynamic environment and is constantly changing so such progression is anticipated; how much change occurs towards a denser forest is dependent on the amount of treatment accomplished.

The effects of past, present, and reasonably foreseeable silvicultural activities as discussed in Alternative A's cumulative effects review are expected to be the same results.

Although regional haze increases on a sustained basis are not anticipated in Wind Cave or Badlands National Parks as explained in Alternative A's cumulative effects discussion, an increases in the number of crown fires per year on average are reasonable to expect over a twenty-year period although not as great as Alternative A. This means an increasing opportunity for a crown fire event which may contribute into Class I airsheds, small developed housing areas within the forest smoke emissions to municipal areas and affect public health and safety on a short-term basis. Such fire activity will also impair local viewsheds for the same approximate duration. These impacts would not be as great as anticipated in Alternative A.

Alternative C

Direct/Indirect Effects

This alternative would also meet the Forest Plan objectives of reintroducing fire to the ecosystem and the standard for reducing the threat of a wildfire damaging public and private developments. It is the second most aggressive alternative (after Alternative B) for treating fuels by mechanized methods, and contains the highest number of acres treated by prescribed fire.

This alternative would treat 18,100 acres non-commercially, 11,000 acres commercially, and up to 14,000 acres could be treated with low to moderate intensities of prescribed fire on a landscape scale. All treatments are geared towards promoting biodiversity more so than Alternative B. Hardwoods and meadows receive similar emphasis for treatment as in Alternative B, but there are significantly more acres dedicated for restoring and retaining hardwoods and meadows in Alternative C. Commercial plus non-commercial fuel breaks would be developed on lands adjacent to private lands. Since some of the treatments are follow-up or consecutive in nature, some acres are to receive more than one treatment plus could be followed up with a prescribed fire. The total number of unique acres treated is 21,200 which are 20% less than Alternative B.

The proposed activities would greatly reduce the potential of a severe crown fire for 15 to 20 years as compared to Alternative A, but not as much as Alternative B since fewer acres are subject to vegetative removal by commercial thinning. From FVS Models for Alternative C, after the initial treatments approximately 71% of National Forest Lands are rated as Low Hazard Rating, while 29% are rated as Moderate/High Hazard Rating. The potential for a catastrophic fire would not increase as much as Alternative A because of the proposed treatments and burns. It is estimated that within 20 years only 50% of the forested acreage in the Deerfield Project Area would be susceptible to crown fire initiation and spread as opposed to 79% of all acres for Alternative A. However, this is more than Alternative B where only 35% of the acres would be in the Moderate/High Rating after 20 years.

Fuel breaks would be completed adjacent to approximately 50 miles of private property and may treat up to 1000 acres. The fuel breaks would be constructed to the same standards as Alternative B. Minimum canopy heights would also increase 5-10 feet which decreases the possibility of torching and spot fires. Activity fuels would either be removed from the site or piled. Piles would be disposed of by burning or by chipping.

Hardwoods and meadows provide diversity and also provide natural fuel breaks under most conditions. Where it occurs, grazing would remove much of the annual growth of fine fuels and enhance their effectiveness as fuel breaks. Alternative C would help maintain or create 4,500 acres of meadows and 1,500 acres of hardwood stands by removing the non-commercial conifers that are encroaching into these areas, as opposed to Alternative A where these untreated areas continue to be encroached upon by pine and spruce and lose their effectiveness as a natural fuel break. Alternative C treats 1,100 acres more than Alternative B, so this alternative is better at creating natural fuel breaks.

Non-commercial thinning would be used to thin 12,100 acres from below to an average spacing of 16x16 feet, which is 4,700 acres more than Alternative B. The proposed thinning would again only remove stems that are less than 9" in diameter so some portions of the stand would still maintain higher densities and be burdened with 10-15 tons/acre of created activity fuels. As with Alternative B, this amount of slash can negate many of the benefits of the thinning and fuels would need to be treated in some fashion to reduce surface fire intensities.

For Alternative C, lopping and scattering thinning slash to a 12" height standard would be necessary to reduce fire intensities. Removing the fuels by prescribed fire or mechanical means would be more effective.

Prescribed fire is also proposed for up to 14,000 acres for treating residual fuel accumulations. Alternative C is similar to Alternative B in that re-introduction of fire into the ecosystem after years of effective suppression has benefits from a forest health standpoint. Alternative C's approach is different than Alternative B in that fire is re-introduced based on ecological needs first, rather than a strategic placement on the landscape. The result can be strategic, but was not the primary emphasis for selecting stands to treat with prescribed fire. It would also thin natural regeneration which occurs after stem removal. Fuel loads targeted for burning would be the same as Alternative B. Burning vegetation would reduce crown fire potential by decreasing surface fuels loadings by 50-80% to an estimated 2-5 tons/acre of fine fuels and by increasing minimum canopy heights to an estimated 25-30 feet (Goehle, 2003).

Based upon daily production rates of previous prescribed burns and on limitations imposed by burning in or adjacent to the scattered wildland/urban interface, it would take an estimated 60-70 days of burning distributed over a period of 5-7 years to complete the prescribed burns planned in Alternative C. Issues as previously stated with Alternative B regarding funding for each burn, availability of prescriptive windows, SASEM smoke dispersion modeling and TSP affects on receptors, smoke mitigation, and the possibilities for an escape fire are same issues experienced for Alternative C.

Burning activity fuels from fuel break construction and non-commercial thinning would add an estimated 1,250 tons of TSP to the airshed. Alternative methods such as chipping or removing the activity fuels from the area would reduce the amount of TSP, and costs associated would be slightly less than Alternative B since there are less acres involved. A combination of chipping and burning would probably be used with debris disposal depending on costs.

This alternative provides the third best access for fire protection. There are over 155 miles of open roads and 84 miles of closed roads (gated/posted for Administrative or Special Use or opened with equipment) that could be used to access a fire. The road system is dense enough that suppression forces could generally drive within a 1/4 -1/2 mile of most fires. This is expected to slightly increase response times by current IA engine and hand crew vehicles. It is estimated that walk-in to fires would add an additional 15 minutes prior to first forces arriving at a fire.

No additional routes would be permitted to establish from an unauthorized/exploring type of motorized use of the area; law enforcement effort is required with education to achieve this result. The lack of additional unauthorized road and trail routes combined with 25 miles of planned road decommissioning will reduce the presence of humans in the forest. The reduction

in human activity is expected to be greater than Alternative B's impact on such use. Such reduction in use at dispersed locations will reduce the possibility of human-caused fire.

Alternative C may have direct, short-term effects upon the existing air quality from prescribed burning and wildfires in untreated vegetation. However, emission and smoke production potential is significantly reduced compared to Alternative A by treating Moderate to High Hazard acres and converting them to Low Hazard acres. The potential of a large catastrophic fire is greater with Alternative A than Alternative C since more acres initially remain at Moderate to High Hazard Rating with Alternative A, and more said acres will exist 20 years from now. However, more acres in these hazard categories exist with Alternative C than B.

A trade-off is that up to 14,000 acres could be burned with Alternative C under approved prescribed burn plans so substantial TSP could be produced. In contrast, a large wildfire in the project area could disperse smoke into Rapid City, Custer, Hill City, and Rochford at a level that could exceed National Air Quality Standards. Effects would be short term and probably occur during major runs of the fire and are similar to those with Alternate B. It is reasonable to expect less numbers of these types of fires with implementation of Alternative C since 71% of the treated acres will be in the Low Hazard Rating after initial treatment in 2005, versus only 54% of Alternative A's acres and 82% for Alternative B in 2005. There would be no long term or cumulative effects on air quality with this alternative.

Cumulative Effects

Wildfires are again expected to remain at the same frequency and average size for the short term as experienced in Alternative B. Fire hazard is expected to be reduced significantly in the short term, but gradually increase in long-term as vegetation continues to grow back in size and density. Initially 29% of the acres are rated as Moderate/High Hazard Rating. The potential for a catastrophic fire would not increase as much as Alternative A, but would increase faster than Alternative B; it is estimated that within 20 years about 50% of all acres would be in the Moderate/High Hazard Rating in the Deerfield Project Area would be susceptible to crown fire initiation

Most wildfires that occur after Alternative C treatments would continue to be low to moderate intensities with flame lengths ranging from 1 to 4 feet (25-100 BTU/sec/ft), although there would be instances where 5-6 foot flame lengths (200-300 BTU/sec/ft) with head fires are expected, and resource capability would need to be re-enforced with additional units. This is similar to Alternative B. However, fires occurring during more extreme conditions would be more frequent than experienced with Alternative B's treatments.

Alternative C prescribed burns would be effective in reducing the potential of large catastrophic fires for at least 3-5 years after each burn is completed. It is anticipated that the treatments proposed in Alternative C would lose their effectiveness and additional treatments would be needed in approximately 20 years, which is the same situation as Alternative B's prescribed burns. To maintain forest conditions that would reduce the long-term potential of a severe, crown fire occurring within or adjacent to the Deerfield Project Area future treatments and burns would be required as the forest is not a static environment. The potential for crown fire initiation

would gradually increase with the development of multi-storied stands with ladder fuels and greater surface fuel loadings. Change is constant in this ecosystem.

Crown fires would threaten land values both inside and outside of the project area, private property and possibly several low density developments and/or communities, and effect soil productivity and temporarily affect watersheds. However, these types of fires should be less frequent after initial treatment than compared to Alternative A, but more than experienced if Alternative B's treatments and burns were implemented.

The effects of past, present, and reasonably foreseeable silvicultural activities as discussed in Alternative A's cumulative effects review are expected to be the same results.

Although regional haze increases on a sustained basis are not anticipated in Wind Cave or Badlands National Parks, an increases in the number of crown fires per year on average are reasonable to expect over a twenty-year period although not as great as Alternative A, but more than Alternative B. This means an increasing opportunity for a crown fire event, which contributes smoke emissions to municipal areas and affect public health and safety on a short-term basis. Such fire activity will also impair local viewsheds for the same approximate duration. These impacts would not be as great as anticipated in Alternative A but more than Alternative B.

Alternative D

Direct/Indirect Effects

This alternative would minimally meet the Forest Plan objectives of reintroducing fire to the ecosystem and the standard for reducing the threat of a wildfire damaging public and private developments. It is the least aggressive action alternative for treating fuels by mechanized methods, and contains the lowest number of acres treated by prescribed fire.

This alternative would treat 11,000 acres non-commercially, 3,700 acres commercially, and up to 3,500 acres could be treated with low to moderate intensities of prescribed fire on a mostly stand by stand basis rather than an ecological approach or landscape scale. Prescribed fire treatments basically follow up behind the limited thinning planned for MPB efforts. Hardwoods and meadows treatments cover fewer acres than treatments in Alternative B and C. Commercial plus non-commercial fuel breaks would be developed on National Forest Lands adjacent to known structures found on private lands. Most treatments are single entry with little or no follow-up action. Some acres would receive more than one treatment from follow up with a prescribed fire. The total number of unique acres treated is 11,700 which are 54% less than Alternative B.

The proposed activities would minimally reduce the potential of a severe crown fire for 15 to 20 years as compared to Alternative B and C. There would be some improvement of the existing situation over that portrayed by Alternative A. From FVS Models for Alternative D, after the initial treatments approximately 58% of National Forest Lands are rated as Low Hazard Rating, while 42% are rated as Moderate/High Hazard Rating. The potential for a catastrophic fire would not increase as much as Alternative A because of the proposed treatments and burns. It is estimated that within 20 years almost 70% of the forested acreage in the Deerfield Project Area

would be rated Moderate/High susceptible to crown fire initiation and spread as opposed to 79% of all acres for Alternative A. However, this is more than Alternative B where only 35% of the acres would be in the Moderate/High Rating after 20 years. And it is more than Alternative C where 50% of the acres would be in Moderate to High Rating.

Fuel breaks would be completed adjacent to approximately 9 miles of private property and may treat up to 190 acres. This is a substantial reduction in the number of acres compared to Alternative B and C – almost 1200 and 800 less acres respectively. The fuel breaks would be constructed to the same standards as Alternatives B and C. Minimum canopy heights would also increase 5-10 feet which decreases the possibility of torching and spot fires. Activity fuels would either be removed from the site or piled. Piles would be disposed of by burning or by chipping.

Hardwoods and meadows provide diversity and also provide natural fuel breaks under most conditions. Where it occurs, grazing would remove much of the annual growth of fine fuels and enhance their effectiveness as fuel breaks. Alternative D would help maintain or create 3,600 acres of meadows and 900 acres of hardwood stands by removing the non-commercial conifers that are encroaching into these areas, as opposed to Alternative A where these untreated areas continue to be encroached upon by pine and spruce and lose their effectiveness as a natural fuel break. Alternative D treats 1,500 acres less than Alternative C and 400 acres less than Alternative B, so this alternative creates substantially less acres of natural fuel breaks.

Non-commercial thinning would be used to thin 6,500 acres from below to an average spacing of 16x16 feet, which is almost 5,600 acres less than Alternative C, and over 10,300 acres less than Alternative B. The proposed thinning would again only remove stems that are less than 9” in diameter. Some portions of the stands would still maintain higher densities and be burdened with 10-15 tons/acre of created activity fuels. As with Alternatives B and C, this amount of slash can negate many of the benefits of the thinning and fuels would need to be treated in some fashion to reduce surface fire intensities.

For Alternative D, lopping and scattering thinning slash to a 12” height standard would be necessary to reduce fire intensities. Removing the fuels by prescribed fire or mechanical means would be more effective.

Prescribed fire is also proposed for up to 3,500 acres for treating residual fuel accumulations. Alternative D is similar to Alternatives B and C in that re-introduction of fire into the ecosystem after years of effective suppression has benefits from a forest health standpoint. Alternative D’s approach is different than Alternatives B and C in that fire is re-introduced only where prior vegetative treatments occur, rather than a strategic placement on the landscape, or areas targeted for special diversity or special habitat needs. Fire would also thin natural regeneration which occurs after stem removal. Fuel loads targeted for burning would be the same as Alternatives B and C. Burning vegetation would reduce again crown fire potential on a stand basis only by decreasing surface fuels loadings by 50-80% to an estimated 2-5 tons/acre of fine fuels and by increasing minimum canopy heights to an estimated 25-30 feet (Goehle, 2003).

Based upon daily production rates of previous prescribed burns and on limitations imposed by burning in or adjacent to the scattered wildland/urban interface, it would take an estimated 20-30

days of burning distributed over a period of 5-7 years to complete the prescribed burns planned in Alternative D. Issues as previously stated with Alternatives B and C regarding funding for each burn, availability of prescriptive windows, SASEM smoke dispersion modeling and TSP affects on receptors, smoke mitigation, and the possibilities for an escape fire are same issues experienced for Alternative D.

Burning activity fuels from fuel break construction and non-commercial thinning would add an estimated 238 tons of TSP to the airshed. Alternative methods such as chipping or removing the activity fuels from the area would reduce the amount of TSP, and costs associated would be significantly less than Alternatives B and C since there are less acres involved. A combination of chipping and burning would probably be used with debris disposal depending on costs.

This alternative provides the worst access for fire protection. There are over 126 miles of open roads and 76 miles of closed roads (gated/posted for Administrative or Special Use or opened with equipment) that could be used to access a fire. The road system is still dense enough that suppression forces could generally drive within a 1/3 -1/2 mile of most fires. This is expected to slightly increase response times by current IA engine and hand crew vehicles over Alternative C's times. It is estimated that walk-in to fires would add an additional 20 minutes prior to first forces arriving at a fire.

For Alternative D, the lack of additional unauthorized road and trail routes combined with 59 miles of planned road decommissioning will significantly reduce the presence of humans in the forest. The reduction in human activity is expected to be greater than Alternative C's impact on such use.

Alternative D may have direct, short-term effects upon the existing air quality from prescribed burning and wildfires in untreated vegetation. However, emission and smoke production potential is reduced compared to Alternative A by treating Moderate to High Hazard acres and converting them to Low Hazard acres. The potential of a large catastrophic fire is greater with Alternative A than Alternative D since more acres initially remain at Moderate to High Hazard Rating with Alternative A, and more said acres will exist 20 years from now. However, more acres in these hazard categories exist with Alternative D than Alternatives B and C.

A trade-off is that up to 3,500 acres would be burned with Alternative D under approved prescribed burn plans so moderate levels of TSP would be produced.

In contrast, a large wildfire in the project area could disperse smoke into Rapid City, Custer, Hill City, and Rochford at a level that could exceed National Air Quality Standards. Effects would be short term and probably occur during major runs of the fire, but impacts are expected to be greater those with Alternates B and Alternative C. It is reasonable to expect larger numbers of these types of fires with implementation of Alternative D since 58% of the treated acres will be in the Low Hazard Rating after initial treatment in 2005, versus 71% of Alternative C's acres and 82% for Alternative B in 2005.There would be no long term or cumulative effects on air quality with this alternative.

Cumulative Effects

Wildfires are expected at reduced frequency since human access has been greatly reduced, but average fire size is anticipated to remain unchanged for the short term. Fire risk or hazard is expected to be moderately reduced in the short term, but gradually return to pre-treatment levels as vegetation grows back in size and density. Initially 42% are rated as Moderate/High Hazard Rating. The potential for a catastrophic fire would not increase as much as Alternative A but would increase faster than Alternatives B and C; it is estimated that within 20 years about 70% of the forested acreage in the Deerfield Project Area would be in the Moderate/High Hazard Rating, and be susceptible to crown fire initiation

Most wildfires that occur after Alternative D treatments would continue to be low to moderate intensities with flame lengths ranging from 1 to 4 feet (25-100 BTU/sec/ft), although there would be instances where 5-6 foot flame lengths (200-300 BTU/sec/ft) with head fires are expected, and resource capability would need to be re-enforced with additional units. This is similar to Alternatives B and C. However, fires occurring during more extreme conditions would be more frequent and more intense than experienced with Alternatives B and C.

Alternative D prescribed burns would be effective in reducing the potential of large catastrophic fires for at least 3-5 years after each burn is completed. It is anticipated that the treatments proposed in Alternative D would lose their effectiveness and additional treatments would be needed in approximately 20 years, which is the same situation as Alternatives B and C prescribed burns. To maintain forest conditions that would reduce the long-term potential of a severe crown fire occurring within or adjacent to the Deerfield Project Area, future treatments and burns would be required as the forest is not a static environment. The potential for crown fire initiation would increase more rapidly with Alternative D than compared to Alternative B and C since the development of multi-storied stands with ladder fuels and greater surface fuel loadings is continuing over the landscape in greater numbers of acres.

Crown fires would threaten land values both inside and outside of the project area, private property and possibly several low density developments and/or communities, and effect soil productivity and temporarily affect watersheds. However, these types of fires should be less frequent after initial treatment than compared to Alternative A, but more than experienced if Alternatives B and C treatments and burns were implemented.

The effects of past, present, and reasonably foreseeable silvicultural activities as discussed in Alternative A's cumulative effects review are expected to be the same results.

Although regional haze increases on a sustained basis are not anticipated in Wind Cave or Badlands National Parks, an increases in the number of crown fires per year on average are reasonable to expect over a twenty-year period although not as great as Alternative A, but more than Alternatives B and Alternative C. This means an increasing opportunity for a crown fire event, which contributes smoke emissions to municipal areas and affect public health and safety on a short-term basis. Such fire activity will also impair local viewsheds for the same approximate duration. These impacts would not be as great as anticipated in Alternative A but more than Alternatives B and C.

Summary of Cumulative Effects

The Deerfield Project Area vegetation has deviated from its historical fire frequency by multiple fire return intervals. Most of the area is outside of its historical range of variability and can be classified as Condition Class 3, Fire Regime I or III. This has resulted in a forest much more dense and uniform than in the past. The forest would continue to deviate from its historical range in Alternative A with the forest becoming denser, more multi-storied and more susceptible to catastrophic fire.

It is not possible to prevent a large wildfire from occurring on the project area. Alternatives B, C and D would help reduce the potential of a catastrophic fire by moving the forest closer to a Condition Class 1 or 2, by thinning the forest and by removing or treating some of the surface fuels, and by use of prescriptive fire. They would also reduce the impacts that a large fire would have on the ecosystem. Alternative B would have the greatest effect on reducing crown fire potential. This alternative would treat more of the forest and manage the forest at a lower density. Treatments would be at a landscape basis and designed so that it would complement existing features such as Castle Creek, Deerfield Reservoir, Hughes Draw, Lookout and Bombard Prescribed Burns, Reynolds Prairie, and North Fork of Castle Creek to reduce the potential of a large, catastrophic fire. Not all of the forest would be treated and portions of the area would continue to be managed at higher densities to provide habitat for goshawks, pine martens, snails and other species of interest or concern, for hiding or thermal cover and for old growth or late successional species. Some sites would be managed for regeneration and smaller trees. While these sites are susceptible to intense wildland fires, they would not exist in large contiguous blocks and are often adjacent to more open, less fire prone sites.

All three alternatives would provide for various intensities of fuel breaks around private property. The boundaries between the National Forest and private lands were evaluated to determine if they needed fuel breaks or if the forest should be thinned to provide protection from wildland fires. Treatments are more intensive with Alternative B and C in anticipation of continued rural development of private lands, and thus the need to protect the National Forest and vice-versa from ignitions. Alternative D's efforts are concentrated around existing private land structures where they adjoin the National Forest.

Prescribed burning has proven to be effective in reducing large wildfire intensities when completed on a landscape basis, and some studies have shown strategic placement of burn blocks will enhance their effectiveness against spreading fires. Alternative B would be the most effective in reducing the vulnerability to catastrophic fires because the burn units were designed to complement existing features and manage the forest on a landscape basis. In addition, the prescribed burning would be complemented with non-commercial and commercial thinning. Some of the beneficial effects from prescribed fire would be short term and begin to diminish as regeneration becomes established and natural fuels begin to accumulate. Additional burns or follow-up vegetative thins would need to be scheduled at recurring intervals to maintain the beneficial effects. It is estimated that a 20 year cycle for the next use of prescribed fire would be useful. The effectiveness of a large, scale prescribed burn program in the Deerfield Project Area would be constrained by the amount of future development that may occur in and adjacent to the project area, and burn plan development would need to be dynamic to appropriately deal with

such changes. Prescribe burns may increase in level of risk and be more expensive to complete should rural development intensify in numbers and values. The number of acres burned per day may need to be reduced to avoid possible impacts to air quality, which may increase costs.

Alternative D would not treat as many acres as Alternative C and proposes limited prescribed burning after vegetative thins. In addition, the forest would be managed at higher densities. All of these factors would reduce the effect that this alternative would have on fire and fuels.

Alternative A's travel management plan would have no impact on the access or response time to wildfires since the existing condition is left unchanged. Alternative B provides the best access and response times to fires, and its road and trail network would provide a good infrastructure of potential control lines for wildfire and prescriptive fire use. Alternative C and D have increasing levels of delays brought by closed or decommissioned roads with regards to wildfire suppression response. It was estimated that a 15 and 20 minute increase respectively in response times would occur with Alternatives C and D, but that is not considered unworkable by suppression experts. The significant reduction in roads and trails as proposed in Alternative D is going to increase costs of implementing prescribed fires since more control lines will need to be constructed, and potentially may prevent control of some wildfires since a network of open and closed routes would not be as substantial as with Alternatives B and C.

It could be argued that any alternative that reduces fire intensities would increase firefighter and public safety is beneficial. Since no vegetative treatments or prescribed burns occur with Alternative A, this alternative would be the least effective. In fact, the potential for a serious accident would increase with increased fuel loadings and fire behavior. By having the largest number of acres treated overall and with prescribed fire use, Alternative B would provide the most protection in the short term, and can provide long, term benefits with maintenance treatments. Such treatments can be either vegetative thins or prescribed fire or both methods. Alternatives C and D provide progressively reduced levels of firefighter and public safety respectively as they do not treat as many acres as Alternative B. Alternatives B, C, and D increase the size and amount of meadows and hardwood stands. These would provide natural safety zones as well as some of the ponderosa pine savannahs created by some of the seed cuts. Landings required for timber operations would also create openings that are easily accessible by roads that can serve as possible safety zones.

RANGE

Affected Environment

The Deerfield Project Area overlaps eleven grazing allotments on the Mystic Ranger District and one on the Hell Canyon District (see Table 3-8).

The grazing season on these allotments generally begins on June 1 of each year and ends at variable dates, depending on the pasture, from September 15 to October 30. Approximately - cow/calf pairs utilize the 12 allotments. Numbers may vary if a permittee chooses to run some yearlings in place of cow/calf pairs or takes non-use. Bulls are generally removed during the month of August. At

any given time during the grazing season, all these cattle may be within the Deerfield Project boundary. Pasture rotation schedules are revised on an annual basis during the winter meetings with the permittees. The timing of use (on-off dates) for each pasture may vary annually. Livestock numbers and/or length of season can be adjusted on an annual basis to adapt to climatic conditions. Forage utilization monitoring is done periodically throughout the June through September/October grazing season to ensure Forest Plan Standards are met.

Allotment Management Plans (AMPs) were approved in 2002 for all involved allotments except Deerfield and Rimmer, which will be evaluated, and an AMP prepared in 2007.

Table 3-8 Grazing Allotments

ALLOTMENT NAME	GRAZING SYSTEM	PASTURES AFFECTED	DAYS/ SEASON	# OF CATTLE	# OF PERMITS
Baseline	3-pasture, deferred	Silver, Miller, Castle	122 days (6/6 – 10/5)	47 c/c	1
Bittersweet	Deferred rotation with Sixmile Allot.	Bittersweet	40 days (9/21 -10/30)	49c/c 10 yrlng	1
Clinton	2-pasture deferred 3-pasture deferred	Dutchman West Fork Matt	135 days Variable 6/1 - 10/13 137 days Variable 6/1 – 10/15	48 c/c 120 c/c	2
Deerfield	5-pasture deferred	Heely Gold Run Lakeshore McFen Trap	142 days 6/6 – 10/25	102 c/c	1
Dutchman	3-pasture deferred*	Castle Kinney Dutchman Walk-in Fishery*	137 days 6/1 – 10/15	30 c/c	1
Gillette Prairie	4-pasture deferred* 5-pasture deferred*	Cabin Cement Jackson Road	137 days 6/1 – 10/15 153 days 6/1 – 10/31	45 c/c 50 c/c	2
Horsethief	5-pasture deferred	West Miller Miller East Horsethief Lake	122 days 6/11 – 10/10	54 c/c	1
Reynolds Prairie	3-pasture & 4-pasture & 5-pasture	Y-Park Y-Park East Oberg Kinney Nancy Cornelison	122 days 6/11 – 10/10	135 c/c 65 yrlngs	1
Reynolds Prairie	*6-pasture deferred*	*Castle Creek* *Merry-go-round* *Taylor Springs*	*153 days* *6/1 – 10/31*	*182 c/c*	1

ALLOTMENT NAME	GRAZING SYSTEM	PASTURES AFFECTED	DAYS/ SEASON	# OF CATTLE	# OF PERMITS
		Seep Springs			
Rimmer	2-pasture deferred	Grandad Rimmer	122 days 6/11 – 10/10	33 c/c	1
Sixmile**	4-pasture rest rotation	Green Mountain	45 days Variable 6/1 – 10/5	71 c/c 52 c/c 49 yrlgs	1 1
Soholt/Lyons	2-pasture deferred	Soholt Lyons	122 days 6/11 – 10/10	100 c/c	1
Crows Nest Upper Beaver (Hell Canyon)	2-pasture deferred, 3-pasture deferred	Unit 1 Unit 2	112 days 6/11 – 9/30	122 yrlgs 214 c/c	2

The area encompassed by the Deerfield Project boundary provides excellent foraging opportunities for livestock. There are many large and small meadows found on both uplands and in valley bottoms. These areas are designated as primary range because they are accessible by livestock and produce primarily grasses.

The rangelands within this project area are in good to excellent condition with a static or upward trend. Pine encroachment is occurring within the open areas where there is no intervention by man or fire. As pine invades the meadows, the net result is reduced forage available for livestock.

Suitable rangelands are appropriate for grazing considering environmental and economic consequences, and alternative uses. The area within this project-planning boundary is currently under management for livestock grazing.

Range structural improvements play a crucial role in the management of livestock on the National Forest within the boundary of the Deerfield Project. Improvements include structures such as fences, water developments, corrals, and cattleguards. The following structures exist on the allotments within the Deerfield Project Boundary:

- Approximately 51 miles of fences
- 77 assorted water developments
- 23 cattleguards.

Pasture fences tend to cross roads. There would normally be gates in the fence to restrict cattle movement. Many motorists and ATV operators tend to open closed gates and leave them open after passing through them, therefore cattleguards exist in fencelines that cross roads. The cattleguards (autogates) allow motorized traffic, including logging trucks, unimpeded travel across the allotments while restricting cattle movement to within pasture boundaries.

The water developments provide an aid in distributing the cattle on the allotment(s). These structures are constructed to maximize water use while reducing resource impacts. Cattle and wildlife are provided suitable drinking water away from stream channels or spring sources. Existing water developments and new ones needing to be constructed because of a removal of natural vegetation barriers that have caused livestock to change grazing patterns and go places

where they were not able to access prior to the tree removal are critical. These developments are needed to improve water quality in the existing water passages and to conserve riparian habitat by directing livestock away to previously unused areas of the allotments. The fences on these allotments have been constructed to create pasture boundaries and control timing of cattle movement from pasture to pasture. These fences include R-O-W fences, pasture boundaries, allotment boundaries, and water development exclosures. This does not include private land fencing which is the responsibility of the private landowner.

There are few problems associated with permitted livestock getting onto private land, though when it happens, the private landowner is often quick to notify us. State law and court cases dictate that private landowners are responsible for fencing out their land to prevent National Forest permitted cattle from accessing it if they don't want them on their land. This includes private land adjacent to the National Forest Boundary. Problems occur when people buy land expecting to have the National Forest as their unencumbered backyard. Most private land within the project area is fenced appropriately. There have been fewer incidents of private livestock getting out onto the National Forest Land in recent years as ranchers within the Forest boundary have sold out and subdivisions have taken their place.

Environmental Consequences

ALTERNATIVE A

Direct Effects

Grazing will continue as permitted and authorized. There will be no change in carrying capacity (AUMs) as currently determined. Pine encroachment will continue to happen in meadows and removal of that pine invasion will continue to be authorized. Range structures will be maintained and improved as necessary to continue management at its current intensity.

The Range Recission Act will continue to change the management of the vegetation as it affects grazing by livestock within the boundaries of the Deerfield Project. Through the Recission Act NEPA process existing allotments already with approved Allotment Management Plans and the two allotments – Deerfield and Rimmer planned for both NEPA and new Allotment Management Plans in 2007 will have impacts on the current vegetation and associated habitats such as watersheds.

Indirect Effects

As per Forest Plan direction and Allotment Management Plans provide opportunities to convert any season-long grazing systems to a higher level of intensity such as deferred, multiple-pasture, or rest-rotation will be identified and implemented as budget and staffing allow.

Cumulative Effects

There are no anticipated cumulative effects that would impair or unduly influence management of the allotments within the boundary of the Deerfield Project if No Action were to occur

because existing and future Allotment Management Plans will dictate direction to be followed to improve range habitat.

ALTERNATIVES B, C, and D

Direct Effects

Grazing will continue as permitted and authorized by Recission Act NEPA and allotment management plans. There will be no change in carrying capacity (AUMs) as currently exists. Pine encroachment will continue in meadows but under this alternative a substantial expansion of hardwood stands and reductions of pine in historic meadows will improve range vegetation. This will help to increase the distribution of livestock in a more uniform way and provide for better utilization of the vegetation.

Proposed vegetative treatments would have a direct effect on providing additional open canopy's allowing sunlight into the ground providing a needed source of heat to increase the production of grasses and shrubs for livestock consumption. Both the quantity and quality of increased forage will provide better distribution of livestock throughout the entire area.

Fuel breaks and prescribed burning will also benefit livestock management by increasing the amounts and composition of grassland habitat throughout a larger area than would only occur with the burning of slash piles. Prescribed burning may have a negative effect on livestock based on the timing and location of burning. Coordination is critical between the fuels management specialist and the range management specialist prior to the following grazing season to determine the needs to relocate, adjust grazing seasons or administer non-use of livestock. Advanced warning needs to be given to range permittees to avoid problems with stocking the allotments. Based on the location of proposed burning areas, livestock grazing may be adjusted within their own permitted allotment(s) so that conflicts with pre-burn vegetative rest can be accomplished. Additionally, no grazing during the proposed burn year and rest from cattle grazing for at least one year (or a portion thereof) afterwards is required (Guideline 4107 Treated as a Standard). If this adjustment can not be accomplished, livestock grazing may need to be relocated to other portions of the Forest in consultation with the permittee.

The planned reduction in the numbers of roads, both system and non-system above that planned in Alternative C would greatly benefit the management of livestock in the project area. Current road gate closures are ineffective to stopping livestock from moving from authorized pastures to unauthorized ones. This alternative proposes to restrict motorized use to designated routes only which will be beneficial to the protection of livestock. The damage incurred to both vegetation and fencing by off-road motorized vehicles will be reduced thus helping to eliminate overgrazing and unauthorized use.

Although not allowing off-road motorized travel (Alternatives C and D) benefits the vegetative resources it can be detrimental to the range permittees and their employees. If they are denied off-road motorized access to maintain their range improvements and gather livestock for movement on and off the pastures and between them during the grazing season, a negative effect could occur to range management. Range structures may not be maintained and improved as

necessary to continue management at both its current and future intensities. It may reduce the number of times permittees inspect their allotments for livestock distribution and delay improvement maintenance because of the increased time necessary for horseback or walking as opposed to motorized travel. Getting materials to structural improvements would become more costly and labor intensive.

Indirect Effects

As per Forest Plan direction and Allotment Management Plans opportunities to convert any season-long grazing systems to a higher level of intensity such as deferred, multiple-pasture, or rest-rotation will be identified and implemented as budget and staffing allow.

Any creation of logging or thinning slash in areas where livestock grazing is occurring and treatment of the slash is to leave it scattered on the ground, will cause the livestock not to be able to effectively use the grass under the slash and/or move through the area to reach other grassland areas for forage. Overgrazing can be the result if livestock movements and grass become limited.

Cumulative Effects

There are no anticipated cumulative effects that would impair or unduly influence management of the allotments within the boundary of the Deerfield Project.

There are no foreseen unavoidable adverse effects to the Range Program by implementation of any of the Deerfield Project Alternatives. However, if administrative privileges are not granted to allow permittees to use ATVs to monitor livestock and maintain range structural improvements in those areas closed to motorized use by the public, then the permittees need to conduct permit responsibilities is adversely affected.

NOXIOUS and INVASIVE WEEDS

Affected Environment

Known noxious weed sites within the perimeter of the Deerfield Project Area cover approximately 755 Acres. National Forest lands and private lands adjacent and in the project area that have established noxious weed populations include, 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. Treatment within this area has been done on a yearly basis due to the Canada thistle and Leafy spurge infestations. County and private lands surrounding and interior 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.

Biological control sites were established in two or more areas within the project area with an Aphthona Flea beetle mix for Leafy spurge control and an additional Canada thistle insect mix in approximately 10 sites. Aggressive biocontrol methods are maintained in this area to help establish insect colonies, thus controlling the spread of Leafy spurge and Canada thistle.

Fieldwork is conducted on project area almost on a weekly basis to evaluate biological control measures, determine and document losses of vegetation and determine areas of potential infestations of noxious weeds. Note: One mile of road at 200 feet (width) is equal to 24 Acres.

Environmental Consequences

ALTERNATIVE A

Direct/Indirect/Cumulative Effects

Under existing conditions, on and off road activities will increase the chances of the spread of noxious weeds and new invasives introduced into new areas. Known noxious weed sites and new infestations will be managed as funds become available. Through normal use of FS and county roads within the project area the rate of the spread of noxious weeds could be as high as 10 percent of the 755 known noxious weed sites with ground disturbance. Any other off road recreational use could increase the percentage of noxious weed infestations and the possibility of new exotics being introduced. These areas would be treated as funds become available.

Noxious weeds have a high spread rate even when left alone without any treatment. Recreation will continue in the project area because of the Deerfield Recreation Complex, trail system and being a high traffic area in general. Experience from previous wildfires (such as Jasper and Battle Creek Fires), that fire has the potential to increase noxious weed infestations by 30-40 percent of the known noxious weed population. Noxious weeds such as Leafy spurge can increase in area by normal seed spread and by rhizomes. Seeds are expelled up to 15 feet in any direction. As existing timber sales close, noxious and invasive weed treatment would continue and the area monitored for new species and/or infestations.

ALTERNATIVE B

Direct/Indirect/Cumulative Effects

Commercial and non-commercial treatments (25,400), 7,000-10,000 acres of prescribed burning and 1,400 acres of fuel breaks will potentially increase the presence of noxious weeds two fold over existing area if not mitigated. In addition 38 miles of road reconstruction (912 acres), 132 miles of pre-use maintenance (3,216 acres) and 5 miles of new construction (120 acres) will have to be added for treatment of noxious weed control. Any ground disturbance will create a favorable seedbed to establish noxious weed populations, especially in and around skidder areas. Noxious weeds will establish quickly is areas that take native vegetation much longer to establish, taking advantage of the resources (soil nutrients, soil moisture) with little competition.

During the timber harvest efforts, vehicles and heavy equipment will move throughout the sale area(s) and through the weed infested lands. 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 above the known 755 acres. Ground disturbances such as skidder trails and landing decks created during timber harvesting efforts are expected to further increase

the potential for noxious and invasive weed infestations. NFS roads, county roads and NFS trails are expected to continue to contribute to the spread of noxious weeds. Experience from previous wildfires (such as Jasper and Battle Creek Fires), that fire has the potential to increase noxious weed infestations by 30-40 percent of the known noxious weed areas. Incorporation of integrated weed management practices is specified as part of Design Criteria and Mitigation (see Appendix B). This will minimize the potential for unabated spread and contribute little to any cumulative increase in noxious weed infestations in the Project Area.

ALTERNATIVE C

Direct/Indirect/Cumulative Effects

Commercial and non-commercial treatments (21,200), 10,000-14,000 acres of prescribed burning and 1,200 of fuel breaks the ground disturbance will potentially increase the presence of noxious weeds two fold over existing if not mitigated. In addition 37 miles of road reconstruction (936 acres), 129 miles of pre-use maintenance (3,144 acres) and 5 miles of new road construction (120 acres) will have to be added for treatment of noxious weed control.

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 above the known 755 acres. Ground disturbances such as skidder trails and landing decks created during timber harvesting efforts are expected to further increase the potential for noxious and invasive weed infestations. NFS roads, county roads and NFS trails are expected to continue to contribute to the spread of noxious weeds. Experience from previous wildfires (such as Jasper and Battle Creek Fires), that fire has the potential to increase noxious weed infestations by 30-40 percent of the known noxious weed areas. Incorporation of integrated weed management practices is specified as part of Design Criteria and Mitigation (see Appendix B). This will minimize the potential for unabated spread and contribute little to any cumulative increase in noxious weed infestations in the Project Area.

ALTERNATIVE D

Direct/Indirect/Cumulative Effects

Commercial and non-commercial treatments (11,700 acres), 3,500 acres of prescribed burning and 400 acres of fuel breaks will potentially increase the presence of noxious weeds two fold over existing if not mitigated. In addition 24 miles of road reconstruction (576 acres), 108 miles of pre-use maintenance (2,592 acres) and 2 miles of new road construction (48 acres) will have to be added for treatment of noxious weed control.

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 above the known 755 acres. Ground disturbances such as skidder trails and landing decks created during timber harvesting efforts are expected to further increase the potential for noxious and invasive weed infestations. NFS roads, county roads and NFS trails are expected to continue to contribute to the spread of noxious weeds. Experience from previous wildfires (such as Jasper and Battle Creek Fires), that fire has the potential to increase noxious weed infestations by 30-40 percent of the known noxious

weed areas. Incorporation of integrated weed management practices is specified as part of Design Criteria and Mitigation (see Appendix B). This will minimize the potential for unabated spread and contribute little to any cumulative increase in noxious weed infestations in the Project Area.

WILDLIFE and BOTANY

Introduction

In very broad, general terms, the goals and objectives for the Deerfield Project Area for wildlife resources are to provide a variety of life through management of biologically diverse ecosystems. These goals and objectives along with Black Hills National Forest Land and Resource Management Plan (Forest Plan) Standards and Guidelines will provide and maintain an appropriate mix and balance of habitats over the long term. This diversity will provide habitats to maintain populations of all vertebrate and invertebrate wildlife and plant species in the area and will not result in any individual species trending toward or becoming listed as threatened or endangered.

Analysis of the No Action Alternative (Alternative A) and the action alternatives (Alternatives B, C, and D) was conducted on a watershed level. Direct, indirect and cumulative effects of each alternative are disclosed. Additional information regarding wildlife and botany resources can be found in the Wildlife and Botany Report and the Deerfield Biological Analysis and Evaluation (BA/BE) held in the Project File.

The Deerfield Project Area is located within the Limestone Plateau and Crystalline basin of the Black Hills. The limestone plateau is usually dry, due to the porosity of the limestone soils but provides various ecological communities, such as hardwoods, coniferous forests, and montane grasslands. The steep, lower slopes and deep valleys create mesic conditions due to lack of continuous sunlight. The crystalline basin, which lies below the limestone, exhibits moderately rolling uplands, made up of mostly slate and mica schist soils. These crystalline rocks also provide for various ecological communities (Marriott et al. 1999, 2000), such as montane grasslands, hardwoods, wet meadows, fens, and conifer forest and woodlands. Where these two formations meet, a clay shale formation occurs that increases overland water flow from the porous limestone to the crystalline basin drainages below, thus providing a moisture rich area of streams, seeps, springs, and mesic conditions.

The ponderosa pine ecosystem in the Black Hills evolved with recurrent disturbances, especially fire, insects, and short and long-term climatic cycles (Parrish et al. 1996). Frequent recurring disturbances, like fire and insects, maintained a generally open, mature pine canopy with a productive and diverse understory by thinning pine stands and creating open stands with abundant grasses, shrubs, and forbs in the understory (Sieg and Severson 1996). A century of fire suppression has caused widespread alteration and degradation of wildlife habitat in the Black Hills. In the absence of frequent low-intensity fires, the increase in the density and canopy cover of pine stands has resulted in broad, contiguous expanses of higher density mid-age trees with abundant pine regeneration and sparse understories (Parrish et al. 1996). Such stands are vulnerable to large-scale insect epidemics and wildfires. These shifts have increased habitat for species that prefer dense mid-age forests while decreasing habitat availability for wildlife associated with a forest that is more open. Historically, frequent fires created many different age classes of ponderosa pine, thus

enhancing diversity across the landscape (Uresk and Severson 1998). Fire regimes in the Deerfield Project Area have changed from a fire regime dominated by frequent, low to moderate severity / intensity surface fires with some less frequent mixed intensity/severity fires to a fire regime with large, high severity/intensity stand replacing fires such as the Jasper Fire to the south of the Deerfield Project. Fire suppression has resulted in conversion of hardwood forest stands such as aspen and birch to conifer, which has reduced diversity (Uresk and Severson 1998). The encroachment of pine into meadows has reduced grass, forb, and shrub availability.

A MPB outbreak is currently affecting large areas of the Black Hills, reaching epidemic proportions in some areas. Of special note is the area west and south of Deerfield Lake, within and adjacent to the Project Area. The MPB outbreak has affected cover for big game and late-successional stands, where denser, older trees are dead or dying. This has created more open canopies and large openings where whole hillsides of dense stands are dying, making these areas less effective for cover, which also affects important habitat for a variety of other species. It is also building up fuel loads, thus setting the stage for potentially large scale crown fires that could eliminate important wildlife habitat.

The Deerfield Project Area encompasses 41,377 acres, of which 5,272 acres are private. Ponderosa pine communities dominate vegetation on the 36,105 acres of Forest Service land (27,950 acres or 77%). Table 3-9 provides a summary of community types along with structural stages (SS). Structural stages were determined using the structural stage definitions in Thomas et al. (1979), and Hoover and Willis (1984). These figures might not exactly correlate to the figures derived from the RIS database, because of field verification and examination of aerial photographs to correct for mis-typing and changes not reflected in the RIS database (e.g. 3A stand classified as 4B).

Table 3-9 Existing wildlife structural stages in the Deerfield Project Area

Structural Stages[1]	SS 0	SS 1	SS 2	SS 3A	SS 3B	SS 3C	SS 4A	SS 4B	SS 4C	SS 5	Total
Lakes	555 (2)	-	-	-	-	-	-	-	-	-	555 (2)
Upland Meadow	-	2613 (7)	-	115 (<1)	-	-	166 (1)	-	-	-	2894 (8)
Wet Meadow	-	863 (2)	-	50 (<1)	-	-	184 (<1)	-	-	-	1097 (3)
Riparian Forest	-	-	-	-	-	34 (<1)	152 (<1)	127 (<1)	65 (<1)	-	378 (1)
Aspen	-	-	30 (<1)	344 (1)	105 (<1)	-	127 (<1)	87 (1)	-	-	693 (2)
Ponderosa Pine		1394[2] (4)	-	963 (2)	1222 (3)	754 (2)	9525 (26)	12553 (35)	1539 (5)	-	27950 (77)
White Spruce	-	-	30 (<1)	-	-	65 (1)	325 (1)	1027 (3)	1091 (3)	-	2538 (7)
Total	555 (2)	4870 (13)	60 (<1)	1365 (4)	1327 (4)	853 (2)	10479 (29)	13794 (38)	2891 (8)	-	36105 (100)

[1]Acres (percent). Based on 36105 National Forest acres.

[2]Based on 2005 flight for MPB, it is estimated that >5% of the ponderosa pine SS 4B and 4C have reverted to SS1.

Table 3-10 displays a comparison between existing condition and the Forest Plan Desired Condition (DC) for several habitat components. Included in Table 3 are Forest-wide Standards and Guidelines, as well as several Management Area-specific Standards and Guidelines.

Table 3-10 Comparison of existing condition to Forest Plan DC for various landscape vegetative diversity components in the Deerfield Project Area.

HABITAT COMPONENT	EXISTING CONDITION (ALT. A)	FOREST PLAN DC (Minimums)	FOREST PLAN REFERENCE
Hardwoods	693 (2)	762 (2)[1]	Objective 201
Grassland communities	3991 (11)	4390 (12)[1]	Objective 205
Vertical diversity	22608 (66)	6082 (20)[2]	Objective 206
Grass/forb	1394 (5)	1521 (5)[2]	Objective 209
Snags	>4	2-4[3]	Objective 211
Down logs	>100	50 linear feet[4]	Objective 212
Big game screening cover	543 (22)	485 (20%)[6]	Guideline 3203[5]
Management Area 5.1			
Habitat effectiveness	See Big Game	See Big Game	Guideline 5.1-3201[5]
Management Area 8.2			
Habitat effectiveness	See Big Game	See Big Game	Guideline 8.2-3203[5]

[1]Acres (percent) based on 36105 NFS acres. [2]Acres (percent) based on 30,412 forested NFS acres. [3]Hard snags per acre average across the 8th order watersheds, >10"DBH and >25' tall. [4]Minimum diameters of >10", lengths of 10 feet. [5]Guideline treated as Standard. [6]Acres (percent based on 2,423 acres within 300 ft either side of a major road.

Coniferous Forests and Woodlands

Approximately 50% of the Deerfield Project Area consists of Dry Coniferous Forest and Woodlands. Plant associations include ponderosa pine/bearberry, ponderosa pine/sedge, ponderosa pine/Oregon grape, and ponderosa pine/little bluestem. Ponderosa pine/little bluestem association is very limited, found on more xeric portions of the Project Area. Canopy cover for these associations are usually less than 50% but can reach greater than 70%. These xeric coniferous forests provide habitat for deer, elk, pygmy nuthatch, and several woodpecker species.

Approximately 30% of the Deerfield Project Area consists of Mesic Coniferous Forest and Woodlands. Plant associations include ponderosa pine/common juniper, white spruce/twin flower, white spruce/grouseberry, and ponderosa pine/mountain ninebark. These associations are found in moist areas, such as north-facing slopes, shaded stands, deep valleys, and along streams. Canopy cover is typically greater than 60%. White spruce/grouseberry and ponderosa pine/mountain ninebark associations are the least common with less than 3% in the project area. These dense, moist conditions provide habitat for American marten, ruffed grouse, several rare plant species, most snail species, brown creeper, and several woodpecker species.

Soil studies near the southwest edge of the Limestone Plateau suggest that the ponderosa pine forest has replaced the grasslands that were present prior to Euro-American settlement of the Black Hills. Both open and closed stands of pine, often with many trees over 100 years old have been found on soils typical of grasslands. Due to changes in the area's natural fire regime, white spruce is invading more xeric site conditions such as grasslands, hardwoods, and ponderosa pine communities.

Structural Diversity

Since the majority of the Deerfield Project Area (and the Black Hills National Forest) consists of ponderosa pine communities, providing structural diversity within the pine dominated plant associations becomes an important factor for wildlife and plant species. Some species prefer more open pine stand structure while other species prefer older, more mature and decadent pine stand structure. Forest Plan Goals and Objectives are to maintain a diverse mix of structural diversity across the landscape to provide for various wildlife species. Table 3-11 displays the direct changes in forest stand structure for the pine cover type resulting from the implementation of vegetation treatments for each of the alternatives. All of the action alternatives change some pine stands to hardwoods and grassland communities.

Table 3-11 Changes in ponderosa pine structure in the Deerfield Project Area by Alternative (approximate).

Structural Stage		Alt. A		Alt. B		Alt. C		Alt. D	
1	Grass/forb	1394	(5)[1]	1394	(5)[2]	1394	(5)[3]	1394	(5)[4]
2	Seedling/sapling	0	(0)	0	(0)	0	(0)	0	(0)
3A	Young, open canopy	963	(3)	4159	(15)	2021	(8)	1075	(4)
3B	Young, variable canopy	1222	(4)	717	(3)	979	(4)	1051	(4)
3C	Young, closed canopy	754	(3)	155	(1)	549	(2)	754	(3)
4A	Mature, open canopy	9225	(34)	17018	(62)	12873	(47)	11896	(43)
4B	Mature, variable canopy	12553	(45)	3768	(13)	7951	(30)	9886	(36)
4C	Mature, closed canopy	1539	(6)	336	(1)	1178	(4)	1539	(5)
5	Mature, decadent	0	(0)	0	(0)	0	(0)	0	(0)

[1]Acres (percent). Based on 27950 acres ponderosa pine on National Forest lands. [2]Acres (percent). Based on 27608 acres ponderosa pine. [3]Acres (percent). Based on 26945 acres ponderosa pine. [4]Acres (percent). Based on 27637 acres ponderosa pine.

Structural stage distribution is included as a Forest-wide indicator of the vegetative diversity and structure, monitoring item in the Monitoring Implementation Guide (USDA Forest Service 2003a, 2004c). Refer to the annual Monitoring Reports (USDA Forest Service 1998-2005) for monitoring results and additional information.

Alternative A (No Action) does not directly affect pine structural stages. It appears to maintain older, more closed canopy pine structural stages. However, the ongoing MPB mortality in the area has already altered the SS3C, SS4B, and SS4C, either to a SS1 or to young ponderosa pine stands of open canopy closure (SS2, SS3A, and SS4A) in some areas. Some but not all of these changes are reflected in the figures shown in Table 3-11. Indications are that the MPB population levels have not peaked in the Deerfield Project Area. Natural processes will continue to affect denser, more closed canopied mature pine stands (Allen 2005). The indirect effects of No Action is an increasing potential for MPB mortality and large scale crown fires, both of which could significantly affect the long term amount and distribution of ponderosa pine structural stages throughout and beyond the project area. See discussion of increased MPB mortality in the Vegetation Section and increased wildfire potential in the Fire/Fuels Section. Such an indirect effect cannot be fully quantified, but a large wildfire in this general area in 2000 (Jasper Fire) notably affected the structural stages and wildlife habitat over an area larger than the entire Deerfield Project Area.

In general, the action alternatives would change stands from mature, variable/closed canopy to mature and young open canopy structured stands, although to varying degrees. Alternative B is

the most aggressive in reducing closed canopy pine stands and moving these stands to more open canopies. Alternative C is similar to Alternative B but aims to retain more mature, moderate canopied stands. Alternative D is similar to Alternative A in retaining denser, mature stands. These stands, however, have a higher potential for MPB infestations and crown fires and could lead to the long term reduction in mature and dense pine stands.

The indirect effect of prescribed burning would reduce crown fire potential within the areas treated. Prescribed burning in the action alternatives would reduce understory conifer and shrub growth (e.g. juniper), with occasional torching of overstory trees that would create holes in the tree canopy. Alternative C would directly affect the most acres, followed by Alternatives B and D.

Vertical Diversity

Vertical diversity, or the complexity of the above ground vegetation structure, is enhanced by improving understory productivity, or creating openings within the canopy. The Forest Plan provides direction to "maintain or establish a minimum of 20% of the forested areas of a planning unit to provide vertical diversity" (Objective 206). Vertical diversity is included as a Forest-wide indicator of the vegetative diversity and structure, monitoring item in the Monitoring Implementation Guide (USDA Forest Service 2003a, 2004c). Refer to the annual Monitoring Reports (USDA Forest Service 1998-2005) for monitoring results and additional information.

A stand is considered vertically diverse if there is more than one canopy layer present within the stand. All hardwood stands are considered vertically diverse. The RIS database was used to determine the number of layers within conifer stands. Table 3-12 displays the acreages and proportions of the Deerfield Project Area that provide vertically diverse habitats for each alternative.

Table 3-12 Proportion of the Deerfield Project Area that provides vertically diverse forested habitats (by Alternative).

	Forest Plan DC	Alt. A	Alt. B	Alt. C	Alt. D
Two-storied	n/a	11251 ac.	6021 ac.	9416 ac.	9728 ac.
Multi-storied	n/a	11364 ac.	4880 ac.	5104 ac.	9416 ac.
Total Vertically Diverse Habitat	6082 ac.[1] (20)	22615 ac. (74)	10901 ac. (36)	14520 ac. (48)	19144 ac. (63)

[1]Acres (percent). Based on 30412 forested NFS acres.

Stands treated in the action alternatives are considered no longer vertically diverse unless treatment consisted of multi-density selection. Alternative A would continue to provide abundant vertical diversity unless stands succumb to MPB or catastrophic fire. Alternative B decreases the acreage of stands providing vertical diversity, while Alternatives C and D reduce the acreage to a lesser degree than Alternative B (see Table 3-12).

Prescribed burning could increase or decrease understory diversity within the treatment areas depending on the intensity/severity of the fire. Prescribed burning in all action alternatives reduce the acreage of stands providing vertical diversity as compared to Alternative A. However, all alternatives maintain consistency with the Forest Plan Objectives for vertical diversity.

Snags

Standing dead trees, or snags, provide nesting, roosting, or foraging habitat for at least 23 species of wildlife in the Black Hills (Spiering and Knight 2004). Snags can be found in most forested ecological groups in the Deerfield Project Area. Cavity dependent species also serve as important prey for predatory species like the American marten, mountain lion, or northern goshawk. Large diameter snags are critical for some primary cavity nesters such as black-backed and Lewis's woodpecker because they require a large cavity for nesting (Raphael and White 1984, Vierling 2004, Anderson 2002). Secondary cavity nesters are dependent on the availability of previously excavated cavities; therefore providing suitable habitat for primary cavity nesters becomes very important.

Wildfire affects snag densities, with an initial increase in snag numbers and woodpeckers, but through time, snag densities will decrease. Salvage of fire or bug killed trees decreases the amount of snags in an area. Wildfire will reduce green trees, decreasing potential snag availability long-term. MPB mortality increases numbers of snags and thus habitat for species like black-backed woodpeckers and brown creepers (Rumble 2002, Wiggins 2005). Snags created as a result of MPB activity, however, are relatively short-lived with most such snags standing approximately 5-10 years before falling down.

Forest Plan Objective 211 specifies "Maintain an average of two hard snags per acre on south facing slopes and four hard snags per acres on north-facing slopes, well dispersed across the watershed". Standards 2301 and 2302 and Guidelines 2303, 2304, and 2306 (treated as Standards) provide additional detailed direction for snag management, including specifying that snags be 10" DBH or larger and at least 25 feet in height, or the largest size classes available. Snag retention is included as a monitoring item in the Monitoring Implementation Guide (USDA Forest Service 2003a, 2004c) and is monitored Forest-wide as directed by the Forest Plan. Refer to the annual Monitoring Reports (USDA Forest Service 1998 -2005) for monitoring results and additional information.

For analysis purposes, snag density requirements were not applied to plant communities that do not support a forested environment such as mountain grasslands and wet meadows. Snag surveys conducted in 1997 in the east-central portion of the project area indicated approximately 0.43 snags per acre average (>10"DBH and 15' height). Since the MPB outbreak snag densities have not been quantified. However, the number of snags has increased in recent years in the southern portion of the project area due to MPB infestation and mortality. Data collected over the past several years indicates a large area, within and adjacent to the Project Area, is undergoing an increasing epidemic of MPB (Allen 2003, 2004, 2005). These infestations are significantly increasing the number of snags over a large area. While not all trees killed by MPB meet the diameter and height criteria specified by Standard 2301, MPB generally infest stands with an average DBH of 7" or greater, so at least a portion of trees killed by MPB would meet those criteria. It is assumed for analysis purposes only, that the Deerfield Project Area is below Forest Plan Standards and Guidelines for snag numbers, size, and height. This is a very conservative estimate of existing snag densities. Based on Allen (2005), it is likely that the southern portion of the Deerfield Project area is likely currently at or above snag densities specified by the Forest Plan. Distribution of snags across the project area may be lacking. Past and current salvage and fuel treatments have reduced the number of dying trees but have not affected the number of trees considered non-merchantable or dead. Stands that are not treated

(i.e. steep slopes) contribute to higher large snag densities long-term. Currently, fuel wood gathering in the southern portion of the Project Area that allows the removal of standing dead trees has had a minimal effect of snag densities due to the distance from large communities and terrain.

All existing snags in treated stands will be retained unless they are deemed a safety hazard, consistent with Guideline 2305 (treated as a Standard). Mortality of trees currently infested with MPB is expected within the next one to two years. Alternative A leaves the largest number of actively infested trees that will soon become snags, closely followed by Alternative D. Alternative B would leave the least number of actively infested trees that will soon become snags, with Alternative C leaving somewhat more actively infested trees. According to Allen (2005), there is still an increasing population of MPB in the area which will continue to contribute to snag densities short-term for all alternatives. Given the current numbers of snags from MPB mortality, at least for the short-term, all alternatives are likely consistent with Forest Plan direction for snags, at least in the southern portion of the project area. Long-term, mortality in untreated stands, as well as MPB progression would continue to contribute to increasing densities of large snags. All alternatives would move toward meeting Forest Plan Standards and Guidelines long term, but at different scales and rates through time.

The Forest Plan provides direction to "retain dead standing trees that do not present a safety hazard" in MA 8.2 (Standard 8.2-3202). However, this Standard conflicts with the stated Goals and Objectives for this management area. Goal 8.2-204 is to manage fuels to retain a natural forest appearance and to reduce the threat of wildfire damage to Forest resources. Goal 8.2-206 is to control insect and disease pest populations in and adjacent to the area through active monitoring and reducing the potential through vegetative management. Objective 8.2-205 is to reduce fuel loading to 8 tons per acre. Actively infested MPB trees are in the process of dying and, if not removed would remain standing dead until they fall to the ground. Infested MPB trees will be removed in all action alternatives in MA 8.2, to varying degrees. As previously stated, all existing standing dead will be retained unless they are deemed a safety hazard. The treatments are designed to prevent further infestation of stands in the vicinity of the Deerfield Recreation Area by removing trees actively infested with MPB, consistent with the Goals and Objectives for the management area. The action alternatives may not be consistent with Standard 8.2-3202, depending on the interpretation of the standard.

The Landscape Level Snag and Green Tree Retention Model (USDA Forest Service 2001c) was not used to estimate the number of green trees needed, because all the action alternatives were designed to incorporate adequate green tree retention into the silvicultural prescriptions for a given stand. The snag recruitment model (SRS 1995) indicates that an average of 40 green trees per acre, (greater than 10 inches DBH) is needed across a watershed to move towards an average of four snags per acre on north and east-facing slopes. An average of 20 green trees per acre is needed to move towards an average of two snags per acre on south and west-facing slopes. Although there is no specific Forest Plan direction to maintain these numbers of green trees, alternative design incorporated retention of the levels described.

Alternative A leaves the largest number of green trees per acre greater than 10 inches DBH. Alternative D is similar to Alternative A, but some treatment would occur that would reduce the

number of green trees on the landscape. Both Alternatives A and D, however, have the highest probability of large scale wildfire, and, therefore, have a higher risk of not maintaining adequate green trees over the next 100 years to provide a continuous level of snags. Alternative B would leave the least number of green trees/acre (greater than 10 inches DBH). Alternative C is similar to Alternative B but would leave higher densities of green trees greater than 10 inches diameter per acre on average. Alternatives B and C have the lowest probability for large scale wildfire. A minimal effect is expected on larger green trees as a result of prescribed burning in each of the action alternatives.

Down Woody Material

Dead and down woody material (DWM) is important as a foraging substrate for most cavity dependent species. It provides important cover and forage for small rodents such as voles and red squirrels. Piling DWM on treated sites, especially near forest/opening interfaces, provides habitats for rabbits and other small mammals. DWM also provides a substrate for fungal and detrital food webs. Slow decomposition of DWM has important implications in terms mineral recycling, nutrient immobilization, and nitrogen fixation.

The existing number of down logs in the Deerfield Project Area has not been quantified. Therefore it is assumed, for analysis purposes only, that the Deerfield Project Area does not meet Forest Plan DC for DWM. However, the MPB caused mortality has and will continue to increase the amount of DWM (Allen 2005). Spruce plant associations and mesic conditions, especially north facing slopes have a higher down-dead component due to snow damage/breakage, windfall, and heart-rot.

Forest Plan Objective 212 specifies to provide 5-10 tons per acre of DWM at least 3 inches in diameter at least once during a rotation (approximately 100 years). Forest Plan Standard 2308 specifies retention of an average of at least 50 linear feet per acre of coarse woody debris with a minimum diameter of 10 inches, where available.

Alternative A would provide the greatest amount of DWM in the short-term because of the expected increased in the amount of MPB mortality, followed by Alternative D. For Alternatives A and D, the probability for large scale wildfire is greater, thereby potentially reducing the amount and distribution of DWM in the long term. Alternatives B and C provide the least amount of DWM in the short term, due to fuel treatments and the use of prescribed fire. Alternatives B and C have the least probability of large scale wildfire; therefore have the highest potential to maintain coarse wood material over the long term. All alternatives would move toward meeting Forest Plan Objective 212, Standard 2308 and Guideline 2307 (treated as a Standard) for DWM in the short term.

Late Succession Forests

The Forest Plan provides direction to “manage at least 5% of the forested land base for late-succession” (Objective 207). The late succession acreage should include acres in Management Area 3.7, as well as “smaller late-successional patches to meet specific resource elements” (Objective 208). The Forest Plan also provides several Standards and Guidelines specific to Management Area 3.7. Late succession is included as a Forest-wide monitoring item in the Monitoring Implementation

Guide (USDA Forest Service 2003a, 2004c). Refer to the annual Monitoring Reports (USDA Forest Service 1998 -2005) for monitoring results and additional information.

None of the Deerfield Project Area is designated as Management Area 3.7 (managed for late succession landscape). However, stands totaling 1,631, acres in the Deerfield Project Area are designated as scattered stands to be managed for late successional characteristics. Approximately 855 acres are managed for late-successional characteristics and botanical features. Most of these stands range from SS3C to SS4C. These stands contribute toward Forest Plan Objective (208) for management of small-scale late successional stands through the forest.

Since white spruce and ponderosa pine are considered climax species in the Black Hills, only these two cover types could achieve late-successional or old forest conditions. Stand conditions exist in the project area that reflect both of Mehl's (1992) late succession classifications (SS5). SS5 created by periodic, low intensity fire regime (xeric pine associations) and SS5 created by the non-periodic, moderate to high intensity fire regime in mesic conditions. For the most part, historic low intensity fires were periodic and ranged from a 15-30 year interval in the Deerfield Project Area (Brown and Sieg 1996). For the central and northern portions of the Black Hills, large natural disturbances such as catastrophic fire and insect outbreaks have contributed to the current plant communities found in the Deerfield Area (Shinneman and Baker 1997).

Alternatives A, C, and D will not directly affect the smaller scale late-successional stands, thereby meeting Forest Plan Objectives 207 and 208. Alternative B proposes non-commercial thinning on some of these stands, as well as meadow and hardwood restoration. No replacement stands have been designated in this alternative. It is unclear whether such treatments will alter late successional character, thus Alternative B may not be consistent with Forest Plan Objectives 207 and 208.

For all alternatives, stands that exhibit late seral conditions could be negatively affected by MPB, and large scale wildfire that may set back succession. Later successional stands and those with more climax plant associations (e.g. ponderosa pine/common juniper) are most likely to experience large scale wildfire events such as that experienced in the Jasper Fire of 2000. Current drought conditions have exacerbated the higher potential of large scale natural disturbances that could reduce or eliminate late successional stands from the area. These large scale effects are most probable under Alternatives A and D, with less risk associated with Alternatives B and C.

Edge, Interior Habitat, and Fragmentation

Habitat fragmentation is usually defined as a landscape-scale process involving both habitat loss and the breaking apart of habitat (Fahrig 2003). There is a growing concern that fragmentation of wildlife habitat will result in species becoming imperiled through isolation of individuals of the same species or result in increased susceptibility to predation. This has occurred in some parts of the United States where large areas of natural habitat have been converted to agricultural lands, development, and urbanization. Fragmentation and connectivity in relation to vegetative patterns on the landscape scale were discussed in the Revised Forest Plan EIS (USDA Forest Service 1996, pages III-247-276). The forest of the Black Hills have evolved under a heavy influence of fire, fire suppression, insect and disease process and increased post European settlement impacts (Shinneman and Baker 1997, Brown and Sieg 1996, and Parrish et al. 1996).

This evolution, combined with the variation in terrain, aspect, and geology has resulted in the Black Hills exhibiting a wide variety of vegetation structure and composition, varying densities, and forest/meadow edges. However, fire suppression may have had the greatest effects to changes in vegetation structure and composition (Covington and Moore 1992, Brown and Sieg 1996, Shinneman and Baker 1997). For some species (brown creeper, black-backed woodpecker), there has been some studies on the Black Hills that have identified fragmentation of preferred habitat as a threat to these species (Crompton and Anderson, Shinneman and Baker 2000, Vierling 2004, Dykstra 1996). Fragmentation and their effects to MIS and/or R2 Sensitive Species are discussed in the MIS Section and the Deerfield BA/BE.

For all of the alternatives, MPB activity will increase edge within ponderosa pine habitats, especially those in late seral stand structure. The potential for large-scale wildfire increases with MPB mortality and DWM from dead trees. Alternative A addresses no further fragmentation of conifer communities from management actions but does not maintain or enhance seral communities such as grasslands, meadows, hardwoods, or riparian habitats. Alternative B followed by Alternative C, changes vegetation structure and composition to less seral habitat conditions by providing more open pine stands, both young and mature, as well as reducing competing conifers from grassland / meadows, hardwoods, and riparian habitats. Alternative D is similar to Alternative A, but allows some treatments to increase vegetation structure and composition to less seral habitat conditions pine communities, as well as reducing some competing conifers from some grassland/meadow, hardwood, and riparian habitats.

Alternative A increases the potential of increased edge due to roads and trails created by OHV use. Alternative B is similar to Alternative A, but reduces road density. Alternatives D followed by Alternative C reduces road density and the potential of increased edge due to roads and trails created by OHV use.

Grass/Forb

The Forest Plan provides specific direction to “manage at least 5% of a timber harvest project area for the grass/forb structural stage” (Objective 209). Only created grass/forb openings (structural stage 1) within a forested community type is considered when calculating the proportion of grass/forb in the project area. Natural meadows do not contribute towards Forest Plan direction for 5% grass/forb openings.

According to the RIS database, there are no stands greater than 10 acres in size of existing grass/forb openings in forested portions of the Deerfield Project Area. However, based on field reconnaissance, there is currently approximately 5% grass/forb (SS1) across the landscape created by timber sale activity (i.e. landings) and MPB caused openings (Allen 2005).

All alternatives meet Forest Plan Objective 209 for grass/forb structural stage. No specifically designed silvicultural treatments were utilized to increase the amount of this structural stage in the action alternatives. As a consequence of treatments that remove actively infested trees as part of reducing MPB and fuel hazards, this seral stage would be created, the most in Alternative B, followed by Alternatives C and D. For Alternatives A and D, it is probable that without silvicultural treatment that many of the dense ponderosa pine stands will succumb to MPB, thus

creating grass/forb stage at a higher rate and percentage than Alternatives B and C (Allen 2005). Based on current knowledge of the MPB outbreak, it is anticipated that this structural stage will continue to increase due to MPB mortality in the next 5 years in dense stands that are not treated (Allen 2005). The probability of large scale wildfire is greater in Alternatives A and D, which could also increase this structural stage by a substantial amount within in the project area (See Fire/Fuels Section). Alternatives B and C were designed to reduce the potential for large scale wildfire, therefore the effects of wildfire may be more localized and less likely to increase grass/forb structural stage to the same extent as Alternatives A and D.

Grassland Communities

Approximately 8% of the project area is in this group. Some of these plant associations are endemic to the Black Hills, typically forb-rich and diverse with native Black Hills flora. Reynolds and Slate Prairies and a small portion of Gillette Prairie (Southeast of the Project Area) are representative of this endemic plant association. Grassland species such as prairie falcon, sharp-tailed grouse, antelope, butterflies, northern harrier, grasshopper sparrow, vesper sparrow, black-billed magpie, lark bunting, western meadowlark, and mountain bluebirds are commonly found.

Changes from grassland to conifer communities reduce the productivity of these plant communities, and their ability to provide habitat for wildlife and plant species. Maintaining habitat quality and large un-fragmented grasslands are important for many grassland species. Changes in fire regimes, woody invasion, invasive species (smooth brome grass) and successive cattle rotations emerge as problems for maintaining many populations of birds (Rich et. al 2004) and butterflies (Swengel 1995, 1997). Historically, grassland communities provided natural fuel breaks, reducing the potential for large stand replacing fire. Conifer encroachment threatens the existence of this community on the landscape in the Black Hills.

There are approximately 1,330 acres of the Deerfield Project Area identified as soils that have formed under grass communities but are typed conifer sites in RIS Oracle (Ensz et al. 1994). The Forest Plan provides direction to restore meadow and grassland communities across the Forest by 10%, based on landform and soils (Objective 205).

Table 3-13 Acres of meadow treatments proposed for the Deerfield Project Area (by Alternative).

Meadow Treatment Acres	Alt. A	Alt. B.	Alt. C	Alt. D
No treatment	3991	564	302	751
Retention (commercial and non-commercial)	0	656	553	486
Retention (non-commercial)	0	2771	3136	2754
Restoration (commercial and non-commercial)	0	381	773	313
Total Meadow Area[1]	3991 (11)[2]	4372 (12)	4764 (13)	4304 (12)

[1]Acres (percent) based on 36,105 NFS acres.

Alternative A does not reduce pine encroachment into meadow habitats nor provide for restoration of montane grassland ecosystems. If encroaching pine is not removed, large overstory trees will continue to serve as seed sources, perpetuating the encroachment problem. Alternative A would not move toward Forest Plan Objective 205, to restore meadow communities by 10 percent.

Alternatives B and C propose commercial and non-commercial treatments (see Table 3-13) in ponderosa pine stands where the soil has formed under grassland conditions. Meadow restoration converts current conifer stands to historic grassland communities. Meadow retention would remove commercial and non-commercial conifers from existing grassland communities. Alternative C is the most aggressive in removing pine from grassland communities, followed by Alternative B and Alternative D. All action alternatives meet Forest Objective 205 for restoration of grassland community types.

Prescribed burning in all of the action alternatives has the potential to reduce suitable habitat for many grassland species such as butterflies, grasshopper sparrow, and sharp-tailed grouse, negatively impacting grassland communities. However, prescribed burning may enhance grassland communities and species habitat if utilized carefully. Utilizing design criteria for all action alternatives would provide enhancement and restoration of grassland communities, while protecting the ecological processes that provide habitat for Sensitive and MIS species. Therefore, all action alternatives would meet FP Objective 221.

Hardwood Communities

Hardwood communities (birch, poplar, and aspen) provide valuable habitat for many species along with structural diversity within the larger conifer ecosystem. Hardwoods also provide habitat for ruffed grouse, bats, cavity dependent species such as woodpeckers and squirrels, while providing important foraging and fawning/calving sites for big game. Hardwood stands often follow drainage bottoms. This - combined with the presence of higher moisture levels and less flammable foliage relative to surrounding pine stands, makes hardwood stands valuable as natural fuel breaks.

Aspen abundance is historically a function of fire that stimulates reproduction by root suckers. Fire suppression in the past century has affected aspen and other hardwood communities. In the absence of fire, regeneration of old decadent stands to young vigorous stands has not occurred, and stands have become more vulnerable to insects and disease. Both mechanical treatments and prescribed burning would stimulate reproduction of aspen and birch.

Hardwood communities have declined dramatically across the Black Hills, as well as the Deerfield Project Area. The abundance of deciduous forest wildlife has also probably declined in concert with the decline of hardwood communities (Parrish et al. 1996, Rich et al. 2004). Ponderosa pine and white spruce have encroached upon and taken over many hardwood sites. Without removal of conifers either naturally or through management, the plant associations in these groups will move toward their climax conditions (i.e. dense conifer stands). Most riparian areas are experiencing encroachment of conifer communities into the aspen/birch ecotone that historically were hardwoods.

In the Deerfield Project Area, there are 693 acres (2%) typed as hardwoods in the RIS database, mostly as aspen (stands greater than 10 acres). Found along the mid-slope of the limestone ridges and in drainages, aspen and birch are often found as inclusions in conifer stands. Hardwood presence indicates higher moisture due to slope, aspect, or to the changes in geologic conditions.

No hardwood treatments are proposed in Alternative A. In the absence of large scale wildfire, hardwood plant associations in conifer communities will decrease due to conifer encroachment. With the higher probability of large scale wildfire for this alternative, there is a greater long term potential for hardwood expansion - an indirect effect of the No Action alternative. However, short-term effects would be the reduction of larger diameter hardwoods, thus reducing habitat for species dependent on mature hardwoods.

In all alternatives, openings in the pine canopy caused by natural disturbance (i.e. MPB, wildfire) would stimulate regeneration of hardwoods. All of the action alternatives propose treatments for hardwood communities, to varying degrees. These differences are shown in Table 3-14. Hardwood retention is proposed in all action alternatives on sites currently typed and managed as hardwoods by removing encroaching pine from hardwoods. Hardwood restoration is proposed in conifer communities that support hardwood communities (Table 3-14) either as inclusions or as a larger understory component of a conifer stand.

Table 3-14 Acres of hardwood treatments proposed for the Deerfield Project Area (by Alternative).

Hardwood Acres	**Alt. A**	**Alt. B.**	**Alt. C**	**Alt. D**
Hardwoods – No Treatment	693	86	41	106
Retention (commercial and non-commercial)	0	607	652	587
Restoration (commercial and non-commercial)2	0	364	581	91
Total Hardwood Acres[1]	693[2] (2)	1057 (3)	1274 (4)	784 (2)

[1]Additional hardwood restoration may occur in other treatment units (see Silvicultural Report). [2]Acres (percent) based on 36,105 NFS acres

Forest Plan direction (Objective 201) is to conserve and restore hardwood communities by 10 percent. Alternative A does not move toward this Forest Plan Objective. All action alternatives meet Forest Plan Objective 201 by increasing existing hardwood stands (See Table 3-14). Alternative C completes more hardwood retention and hardwood restoration treatment in conifer stands than the other action alternatives. Alternative B follows Alternative C, with less treatment proposed for hardwoods. Alternative D does the least treatment to improve hardwoods in the Deerfield Area. It is likely that Alternative A (No Action) would meet Forest Plan standards and guidelines in the long term, if large scale wildfire eliminates pine and stimulates hardwood recovery (Allen 2005, Fire/Fuel Section).

Prescribed fire, as proposed in the action alternatives, is very effective in stimulating regeneration (Sheppard and Asherin 2004) while reducing the potential for large scale wildfire. This tool should enhance hardwood expansion and increase hardwood regeneration, while maintaining more mature hardwood communities. Prescribed burning in Alternative C (10,000 -14,000 acres) would have the greatest potential to increase hardwood habitat for wildlife followed by Alternative B (7,000-10,000 acres). In addition, expansion of these hardwood communities would provide natural fuel breaks that would minimize the potential for large scale wildfire effects on the landscape. Alternative D (3,500 acres) would limit prescribed fire to treated areas, providing less hardwood habitat than Alternatives C and B.

Riparian and Wetland Communities

Riparian ecosystems are transition zones between aquatic and upland terrestrial ecosystems, characterized by soil characteristics or distinctive plant communities that require free or unbound water (USDA Forest Service Manual 2526.05). Wetlands are areas inundated by surface or ground water to support vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction (USDA Forest Service Manual 2527.05). "Riparian" and "wetland" are not synonymous but overlaps do exist (Marriott et al. 1999, 2000)

Custer's Expedition records show that drainages in the Deerfield Project Area were expansive and dotted with many small lakes. The reduction in beaver populations and changes in groundwater and hydrologic processes (i.e. water diversion, impoundments, re-channeling streams, livestock grazing, roads and mining) have caused a loss of riparian habitat in the Black Hills.

Historically, beaver may have been the most important biological influence on riparian ecosystems in the Black Hills (Parrish et al. 1996). Dams constructed by beaver, act as sediment traps, provide deep pools for fish habitat, alter stream flows, and provide water that supports willow and other riparian vegetation as well as groundwater recharge. The presence of beaver is considered an indicator of good riparian health. Beaver are present in localized areas on Castle Creek, North Fork of Castle Creek and their tributaries within the Project Area.

Due to high iron ore content (North Fork Castle and Slate Creeks), some areas have lost their vegetative cover and shrub component contributing to poor water quality down stream. These vegetative buffers normally act as a filter for sediments and decreases iron oxidization. The poor condition of these iron ore riparian areas reduces habitat for wildlife, plants and aquatic species.

Approximately 5% of the Deerfield Project Area is in the High Elevation Riparian Forest and Shrub lands group. Plant associations found in the project area include beaked willow scrub, water birch/red-osier dogwood shrubland, and white spruce alluvial Black Hills forest. Current conditions indicate that some plant associations have degraded, missing overstory shrubs and hardwoods such as willow and water birch. These plant associations are indicative of very mesic drainages at high elevations on the Limestone Plateau and Crystalline Basin. Many wildlife species utilize this habitat including Swainson's thrush, great blue heron, kingfisher, black-billed magpie, black-billed cuckoo, wetland plant species, butterflies, reptiles, amphibians, and small mammals. White spruce is a common invader of riparian systems that have lost their natural water table levels. Spruce can change riparian communities usually associated with wet meadows, fens, and hardwood associates. Field review indicates that a majority of the riparian areas in the Deerfield Area show only remnants of the historic riparian vegetation normally found in the High Elevation Riparian Forest and Shrublands or Fen ecological groups.

Approximately 3% of the Deerfield Project Area is in the Riparian/Wet Meadows group. Plant associations found in the project area include Nebraska sedge wet meadow, Baltic rush wet meadow, Black Hills streamside vegetation, northern Great Plains cattail marsh and Canadian reedgrass wet meadow. This type is indicative of very mesic drainages at high elevations on the Limestone Plateau and Central Core. Species found in these plant associations include song

sparrow, great blue heron, mountain bluebird, bobolinks, beaver, wetland plant species, butterfly species, amphibians, and small mammals.

Fens are wetlands with water-saturated substrates and an accumulation of about 30 cm or more of peat (organic soil material). Peat lands, which include fens, bogs, and muskegs, are widely distributed across boreal regions. However, fens are rare in the lower latitudes of the continental United States, where fens occupy only a small percentage of the landscape in Region 2 (see Botany Section for more information on fens).

Activities that affect ground cover, soil structure, water budgets, drainage patterns, and long-term plant species composition have the potential to impair the many values provided by riparian areas. Refer to the Forest Plan for extensive direction for riparian communities (Objectives 213-215).

Alternative A represents a continuation of the existing condition of riparian habitats in the Deerfield Project Area, including degradation from uncontrolled motorized traffic and sedimentation from improperly located roads. Encroaching pine will not be removed from hardwoods and meadows that are in some cases associated with riparian areas. Therefore, Forest Plan Standards and Guidelines 1203, 1302, and 1304 for riparian communities would not be met under Alternative A.

Table 3-15 Acres of riparian treatments proposed for the Deerfield Project Area (by Alternative).

Riparian Treatment[1]	Alt. A	Alt. B.	Alt. C	Alt. D
Non commercial Conifer removal from Wet Meadow Communities	0	905	1029	720
Non commercial Pine Removal from Riparian Communities	0	162	203	55
Total Riparian Communities Treated	0	743	1232	775

[1]Based on 1491 acres of High Elevation Riparian Forest and Shrub land, Fens, and Riparian/Wet Meadows Ecological Groups.

Under all of the action alternatives, the conditions of riparian habitats improve directly and indirectly, especially with the proposed watershed improvement projects (see Hydrology/Soils Section). The positive effects of correcting road and stream/riparian conflicts through changes in road prisms, proposed road obliteration/decommissioning, and watershed improvement projects would be the same under all action alternatives. Travel management in Alternative D followed by Alternative C will reduce road density by varying degrees that will decrease the indirect effects of road/trails in the Deerfield Project Area. There is potential for negative effects to riparian areas and aquatic ecosystems resulting from proposed activities in the action alternatives (e.g. erosion, sedimentation, noxious weed control). Such effects will be minimal by implementation of Best Management Practices (South Dakota-Division of Forestry, 1994), Watershed Conservation Practices (Forest Service Handbook 2509.25, USDA Forest Service 2001), and Forest Plan Standards and Guidelines related to riparian habitats, watershed, soils, hydrologic function, sedimentation, and water quality (see Hydrology/Soils Section). Therefore, all action alternatives will move towards meeting Forest Plan Objectives 213-215 and Forest Plan Standards 1203, 1302, 1304, 3210-3213 for riparian areas.

Management Indicator Species

Management Indicator Species are representative of a variety of habitats and can indicate overall changes in the forest ecosystem. MIS identified in the Forest Plan (USDA Forest Service 1997, USDA Forest Service 2001) include Threatened, Endangered, or Sensitive species, and species of special interest. The direct, indirect and cumulative effects to MIS that are also designated as R2 Sensitive species are disclosed in the Deerfield BA/BE and the effects determinations for these species are summarized in the Threatened, Endangered, or Sensitive species section. Additional MIS not included in the Deerfield BA/BE, were also selected for analysis due to suitable habitat in the project area and/or are known to occur in the Deerfield Project Area. These additional selected MIS are brook trout, brown creeper, brown trout, Cockerel's striate disc, elk, Merriam's turkey, mountain goat, mountain lion, mule deer, osprey, pygmy nuthatch, and white-tailed deer. The finescale dace was not selected because no occurrences have been reported in the Black Hills of South Dakota (Isaak et al. 2003).

Regulations at 36 CFR 219.14(f) allows consideration of data and analysis relating to habitat unless the plan specifically requires population monitoring or population surveys for the species, therefore site-specific monitoring or surveying of a proposed project or activity area is not required. The Monitoring Implementation Guide (USDA Forest Service 2003a, 2004c) established monitoring protocols for MIS species, as directed by the Forest Plan (i.e. Monitoring Items 18, 25, and 26). Refer to the annual Monitoring Reports (USDA Forest Service 1998 -2005) for additional results of monitoring, including the discussion on determination of Forest-wide MIS population and habitat trend, snag estimates, DWM and other monitored items. Table 3-16 is a summary of Forest Plan MIS selected for analysis for the Deerfield Project, their Forest Plan status, and representative habitat.

Table 3-16 Summary of Forest Plan MIS selected for analysis, status, and habitat

Forest Plan MIS	Status[1]	Habitat
American marten	R2	Late seral stage spruce, down woody material, predator
American three-toed woodpecker	R2	Late seral stage spruce, primary cavity nester
Bald eagle	TE	Large lakes and rivers, predator
Black-backed woodpecker	R2	Closed pine canopy, primary cavity nester, burn specialist
Brook Trout	SPI	Cold, clean headwater streams and lakes
Brown creeper	SPI	Late seral stage conifer, cavity nester
Brown Trout	SPI	Cold to cool streams and lakes
Cockerel's striate disc	SPI	Mesic conifer and hardwood habitat. Formally R2 Sensitive.
Coopers Rocky Mountain snail	R2	Mesic conifer and hardwood habitat, limestone outcrops
Elk	SPI	Early successional pine, game species
Fringed myotis	R2	Caves and mines, insectivore
Lake Chub	R2	Cool, clear lakes with clean cobble/gravel substrates
Merriam's Turkey	SPI	Early successional pine, game species
Mountain goat	SPI	Rocky, rugged forest types, herbivore
Mountain lion	SPI	Habitat generalist, large predator, remote areas
Mountain Sucker	R2	Cool, clear mountain streams
Mule deer	SPI	Ponderosa pine, shrublands, game species
Northern goshawk	R2	Habitat generalist, mature pine habitat, predator
Osprey	SPI	Lakes, perennial flow streams, predator. Formally R2 Sensitive

Forest Plan MIS	Status[1]	Habitat
Pygmy nuthatch	SPI	Late seral stage open canopied ponderosa pine, cavity nester. Formally R2 Sensitive
Regal fritillary	R2	Native prairie habitat specialist (nectar)
Townsend's big-eared bat	R2	Caves and mines, insectivore
White-tailed deer	SPI	Early successional pine, game species

[1]TE = Threatened/Endangered. R2 = Region 2 Sensitive. SPI = Species of Special Interest

American Marten (*Martes americana*)

Direct and Indirect Effects

The American marten is an R2 Sensitive species and is discussed in the Deerfield BA/BE. The American marten needs mixed conifer and hardwoods and forested wetlands, riparian forest and cool moist drainages that have a high course woody debris component, standing snags and dead/dying components. This habitat is also used by other species such as woodpeckers, small mammals, birds, reptiles, and amphibians. American marten is a carnivore, where its prey species are mostly small mammals, birds, insects and carrion. This species will also forage on berries and other vegetable matter when in season. American marten uses dens in trees or in rocks when rearing young but will utilize subnivean habitat especially with dead/downed debris (NatureServe 2005). American marten are sensitive to habitat fragmentation, not moving through large, non-forested, or open canopy forest. Important prey species for American marten are red-backed vole (*Clethrionomys gapperi)* and red squirrel (*Tamiasciurus hudsonicus)* (Buskirk 2002). Risk factors include loss of preferred habitat, habitat fragmentation, reductions in prey species and trapping (i.e. fur trade).

American marten is found in the Deerfield Project Area, primarily associated with mature White Spruce/Twinflower Forest and White Spruce/Grouseberry Forest plant associations. Downed dead or snags, and rocky terrain are an important understory component for the prey species of the American marten. In addition, this species uses various forested riparian habitats such as White Spruce Alluvial Black Hills Forest plant association (Fecske 2003, Marriott et al. 1999, 2000). Fecske (2003) identified six patches (121,600 acres) that met the conditions for American marten detection, representing high quality habitat (as defined by Fecske 2003) for this species Forest-wide, with one patch along Castle Creek. In addition, Fecske (2003) identified an additional 127,000 acres high quality habitat (Fecske's rank 9) Forest-wide. High quality habitat (rank 9) was identified for the American marten along Castle, North Fork of Castle, and Ditch Creeks in the project area, where spruce/pine mixed stands are present. District personnel completed FS winter surveys for American marten presence, using baited track plates, in suitable habitat in the Deerfield Project Area. These surveys resulted in negative results (See Mystic District Project Files).

All Alternatives maintains habitat capability levels at .07. Alternative A proposes no treatments in American marten habitat. This alternative allows climax communities (white spruce) to continue to expand until a catastrophic event such as fire sets back seral communities in the area. MPB mortality in the area has increased the potential for large-scale wildfire to occur.

As shown in Table 3-18, Alternative B will remove the ponderosa pine overstory from stands adjacent to white spruce that meet Forest Plan criteria for marten occupancy ($\geq$ 30% basal area in

white spruce and with canopy covers greater than 40%, Standard 3215) on 411 acres to move these stands to white spruce community types (Objective 204). Riparian habitat utilized as travel corridors for this species will have limited treatment to restore willow communities. However, treatments will still provide connectivity for the American marten.

Table 3-17 Acres of American marten habitat with high potential for occupancy (as defined by the FP) treated by alternative.

Cover Type	Alt. A	Alt. B	Alt. C	Alt. D
White Spruce[1]	2183	1758	2011	2183
White Spruce with Hardwood Restoration[1]	0	8	172	0
White Spruce with Other Treatments[1]	0	374	0	0
Ponderosa Pine[2]	43	0	43	43
Ponderosa Pine[2] with treatments	0	43	0	0

[1.] SS3B, SS3C, SS4B, SS4C, and SS5. [2.] Adjacent to high quality white spruce habitat with spruce understory and >40%AMD.

Alternative B treats approximately 8 acres and Alternative C treats approximately 172 acres of American marten habitat with high potential for occupancy (white spruce) to restore hardwoods. These treatments were part of the design in Alternatives B and C to meet Forest Plan Objectives 201, 204, and 221 for the McIntosh Fen. Spruce and pine have invaded many of the hardwood sites adjacent to the McIntosh Fen due to the exclusion of fire over the past hundred years. This is very evident in the photos from Custer's 1874 Black Hills Expedition (Grafe and Horsted, 2002, pages 172-190). Specifically, the area had far more hardwoods and openings and far fewer conifers than exist today. Hardwood restoration treatments are planned on inclusions of hardwoods within dense white spruce cover types and adjacent pine/spruce stands to increase hardwood availability for beaver (Hornbeck et al. 2003a, Glisson 2003), thus maintaining water tables in the fen area.

Alternative B will also treat 374 acres of optimum spruce habitat and 43 acres of ponderosa pine that meet Forest Plan Guideline 3215 (treated as a standard) direction to reduce MPB activity and fuels. For all of the action alternatives, treatments in spruce communities not considered American marten optimum habitat will remove remaining pine and provide structural diversity in spruce communities on the landscape.

Alternative D maintains existing high potential marten habitat and meets Forest Plan Standard 3215 without fragmenting habitat. Alternatives B and C will reduce habitat with high potential for occupancy for American marten to varying degrees to meet other Forest Plan Objectives (201, 204, and 221) for R2 Sensitive plants in the McIntosh Fen. Therefore, Alternatives B and C do not meet Forest Plan Standard 3215 for American marten. Design criteria should protect other American marten habitat components within these stands that will not limit the use of these areas by American Marten.

Alternative D will reduce open road density and OHV activity the most use followed by Alternative C. Alternative B reduces open road density less that Alternatives D and C but allows OHV use within MA 5.1. Unregulated motorized travel may reduce available habitat directly or indirectly by disturbance within American marten habitat, fragment habitat by roads/trails, and a reduction in snag and DWM densities.

Monitoring protocol has been developed for wildlife, including the American marten (USDA Forest Service 2003c, 2004a). Forest-wide monitoring indicates the population and habitat trend

of American marten is relatively stable in the Black Hills (USDA Forest Service 2004d). Alternative A would move toward Forest Plan Objectives 204 and 221 and meet Standard and Guidelines 3215 for American marten short-term but may not meet this Standard and Guideline long-term. Alternative D is similar to Alternative A and would not affect marten habitat. Therefore, Alternative A and D would have no influence on Forest-wide habitat or population trends, or attainment of Objective 221.

In the Deerfield Project, there is an estimated 2,593 acres of spruce habitat, which represents 10% of the total amount of habitat available Forest-wide (USDA Forest Service 2004b). Out of 2183 acres of existing optimum habitat, Alternative B will reduce optimum pine marten habitat by 537 acres or 26% from existing (SS3B, SS3C, SS4B, SS4C). Alternative C will reduce optimum habitat by 170 acres or 8% from existing. The number of acres of American marten habitat affected by Alternatives B and C are relatively small compared to Forest-wide habitat. The amount of habitat affected represents .02% (Alternative B) and .01% (Alternative C) of the total amount marten habitat available Forest-wide. Alternatives B and C therefore likely would have no affect on Forest-wide American marten population or habitat trends nor attainment of Objective 221.

American Three-toed Woodpecker (*Picoides dorsalis*)

The American Three-toed Woodpecker (*Picoides dorsalis*) is an R2 Sensitive species which has been evaluated in the Deerfield Project Area and is discussed in the Final Deerfield BA/BE. The American three-toed woodpecker inhabits boreal forests where late seral stage communities exist and snag densities are 42-52 snags per 100 acre. This species prefers snags that occur in clumps, measuring 12-16 inches DBH and 20-40 feet tall with most of the bark still present. Coniferous forests are preferred habitat but they are known to utilize mixed forest, aspen, bogs, and swamps. This species is a primary cavity nester, with nest in large diameter dead or dying trees. American three-toed woodpecker forages for insects, such as wood-boring beetles, caterpillars, ants, nuts, berries, cambium, and sap (NatureServe 2005, Anderson 2003a). The American three-toed woodpeckers are closely tied to insect outbreaks and stand replacing fires, and are adapted to this highly variable and unpredictable resource.

In the Black Hills, Forest-wide monitoring indicates American three-toed woodpecker preference for spruce habitats (Panjabi 2002-2005). This species has not been found in burned areas in the Black Hills (Panjabi 2002-2005, Vierling 2004). Fire suppression in the last 100 years has likely increased spruce habitat for this species (Shinneman and Baker 1997, Parrish et al. 1996, Anderson 2003). Risks to this species include incompatible forestry practices and deforestation, loss of old growth forest, fire suppression, salvage treatments, and prescribed burning (reduction in down woody material).
The American three-toed woodpecker is known to occur in the Deerfield Project Area (Panjabi 2002-2005, Rumble 2002). Potentially suitable habitat is present in the project area in the form spruce communities, hardwood communities, snags created by MPB activity and late succession stands.

All of the action alternatives decrease existing habitat capability (.45) by varying degrees with Alternative B decreasing habitat capability the most (.38) followed by Alternative C (.43) and Alternative D (.43). Alternative A proposes no treatments American three-toed woodpecker

habitat. This alternative allows climax communities (white spruce) to continue to expand until a catastrophic event such as fire sets back seral communities in the area. In addition, MPB activity provides suitable habitat (dying and dead trees). However, MPB activity has increased the potential for large-scale wildfire to occur which may reduce spruce habitat, snags and decrease prey availability long-term depending on the intensity/severity of its effects. Alternative A would move toward Forest Plan Objectives 204 and for the American three-toed woodpecker, short-term but may not meet this Standard and Guideline long-term.

Alternatives B and C would have the greatest potential to directly affect this species habitat. Alternative D would have the least potential to directly affect this species habitat. Design criteria and mitigation should provide adequate protection for nesting woodpeckers. All action alternatives will negatively affect this species short-term by reducing actively infested MPB trees, snags, DWM, and spruce communities by varying degrees. Removal of commercial-sized trees (>12”DBH) would reduce abundance of future nesting habitat in treated areas.

Alternative D will reduce open road density and OHV activity the most use followed by Alternative C. Alternative B reduces open road density less that Alternatives D and C but allows OHV use within MA 5.1. Unregulated motorized travel may reduce available habitat directly or indirectly by disturbance to nest sites and decrease snag densities through illegal fuel wood gathering.

Monitoring protocol has been developed for birds, including the American three-toed woodpecker (USDA Forest Service 2003c, 2004a). Forest-wide, observations are limited but indicate that the population trend for American three-toed woodpecker is increasing, where habitat trend is appears to be stable (USDA Forest Service 2004d). Small fires and increased MPB mortality may increase habitat for this species Forest-wide. MPB activity in the area will continue to increase snag habitat for this species at a rate of 6-23%. Alternative A and D by varying degrees would not affect American three-toed woodpecker habitat and therefore would have no influence on Forest-wide habitat or population trends or attainment of Objective 221.

In 2004, there were an estimated 178,540 acres of ponderosa pine in structural stages SS3C, SS4C, and SS5 Forest-wide and 25,000 acres of spruce habitat, most of which are in late seral conditions (USDA Forest Service 2004b). In the Deerfield Project, there is an estimated 2, 293 acres of these ponderosa pine structural stages and 2,593 acres of spruce habitat, which represents 1% and 10% respectively of the total amount of habitat available Forest-wide (USDA Forest Service 2004b). Alternative B will reduce ponderosa pine SS3C and SS4C to 451 acres or 80% from existing and late seral spruce conditions (SS3C, SS4B, SS4C) by 537 acres or 26%. Alternative C will reduce SS3C and SS4C to 1727 acres or 25% from existing and late seral spruce conditions by 170 acres or 8%. Alternative B has the most affect on the American three-toed woodpecker followed by Alternative C. Both alternatives would enhance and conserve American three-toed woodpecker habitat long-term by insulating suitable habitat from large-scale wildfire and potentially reduce MPB effects. Given the uncertainty regarding Forest-wide habitat and population trends for the American three-toed woodpecker, it is difficult to determine what contribution Alternatives B and C would make toward those trends. It is possible but unlikely that either Alternative B or C would affect Forest-wide American three-toed woodpecker population or habitat trends, or influence the attainment of Objective 221 short-term.

Bald Eagle (*Haliaeetus leucocephalus*)

The bald eagle is closely associated with lakes and large rivers in open areas, forest, mountains and along seacoasts. Bald eagles need large trees adjacent to water, preferably snags, but also live trees or boulders that provide good visibility for perching and roosting. These areas are protected from harsh weather and human disturbance. Eagles tend to use the same roosts each year. Bald eagles winter in coastal habitats and inland where ice-free waters allow access to prey or occasionally take fish from an osprey. Eagles will feed on waterfowl, other birds, carrion, small to medium sized mammals, and turtles. In the Black Hills, this species utilizes winter habitat where carrion is available (along highways and in big game winter range) and where there are open lakes and streams. Key components to winter habitat include perch sites, roost sites way from human disturbance, and adequate food supply (NatureServe 2005). Potential nesting habitat occurs around the major reservoirs and creeks. There are no known traditional roost sites in the Black Hills, it can be assumed that bald eagles utilize mostly ponderosa pine habitats that have snag components, dense crown cover (greater than 50%) that are near food sources that are either prey or carrion (NatureServe 2005). Risk factors include loss of habitat, disturbance by humans, biocide contamination, decreasing prey base, electrocution, poisoning, and illegal shooting (NatureServe 2005).

In the Black Hills, this species is a winter resident only (Tallman et al. 2002). No nesting has been documented on the Forest, but an unsuccessful nesting attempt was reported adjacent to the Forest in the Southern Hills in 2004 (USDA Forest Service 2005a). Suitable wintering habitat is present in the Deerfield Project Area with bald eagle known to winter in the area, particularly along the Ditch, North Castle, and Castle Creek corridor and at Deerfield Reservoir. Potentially suitable nesting habitat occurs in the Deerfield Project Area adjacent to Deerfield Reservoir, on steep slopes along the Ditch Creek, North Castle, and Castle Creeks and along riparian corridors.

Alternative A proposes no treatments in the Bald Eagle winter habitat. This alternative allows climax communities to continue to expand until a catastrophic event such as fire or insects and diseases sets back seral communities in the area. Alternative A would move toward Forest Plan objectives 220 and 221, meet standards 3101 and 3204 for Bald Eagles. A continuation of existing conditions will not affect fish or carrion availability. MPB mortality in the area has increased the potential for large-scale wildfire to occur, which may reduce roost trees long-term and may affect fish habitat short-term.

Alternatives B and C would have the greatest potential to directly affect this species habitat. Alternative D would have the least potential to directly affect this species habitat. Some winter roost trees may be lost by MPB mortality and/or removed during timber harvest or road construction activities short-term. Potentially suitable nesting habitat will not be treated due to steep terrain, soil, and water considerations. Project activities will not affect fish or carrion availability.

Alternative D will reduce open road density and OHV activity the most use followed by Alternative C. Alternative B reduces open road density less that Alternatives D and C but allows OHV use within MA 5.1. Unregulated motorized travel may reduce available habitat directly or indirectly by disturbance to roost sites and a reduction in snag densities.

The bald eagle is monitored Forest-wide (USDA Forest Service 2003c, 2004a). Forest-wide monitoring indicates population and habitat trend is stable (USDA Forest Service 2004c, 2004d). However, the number of bald eagle sightings on the Black Hills has increased over the last 5 years of monitoring. In the Deerfield Project area, habitat capability for the bald eagle is .15 for Alternatives A and B. Alternative C decreases in habitat capability to .12, due to reduction in cover values and feeding values. Alternative D increases habitat capability to .16 due to increase in feeding values. It is unlikely that any of the alternatives will affect Forest-wide bald eagle population or habitat trends due to the abundance of fish species and carrion available for this species during the winter.

Black-backed Woodpecker (*Picoides arcticus*)

The black-backed woodpecker (*Picoides arcticus*) is an R2 Sensitive species which has been evaluated in the Deerfield Project Area and is discussed in the Deerfield BA/BE. The black-backed woodpecker is a primary cavity nester that inhabits dense coniferous forests, especially in burned, swampy, cutover, or beetle-killed forests where large dead trees are numerous (DeGraaf et al. 1991). The black-backed woodpecker forages for larvae of wood-boring insects beneath loose bark on dead trees. This species is closely tied to stand replacing events such as insect outbreaks or large wildfires (Anderson 2003). This woodpecker requires dense un-logged stands (greater than 70% crown closure pre-burn) for nesting and foraging (Saab and Dudley 1998, Vierling 2004). Their nest tree is usually a hard snag (>15" DBH), but they will nest in smaller diameter snags (> 9" DBH), or live trees with dead heartwood. The black-backed woodpecker in the northern Black Hills have been found in sapling and pole-sized pine with moderate canopy cover, and elsewhere in the Black Hills in similar stands but with open canopy cover (USDA Forest Service 2000a). Rumble (2002) confirms that beetle-killed areas are important habitat for this species in the Black Hills. Risk factors identified for the black-backed woodpecker by Anderson (2003) include fire suppression, loss of prey abundance, salvage logging, and the practice of replacing over mature stands with young stands. This species is susceptible to human disturbance when nesting.

This woodpecker is widely distributed in the Black Hills, and although rare in most locations, numbers have increased significantly in the Jasper Fire area since 2001 and in active MPB areas, where it now occurs in moderately low density (Mohren and Anderson 2000, Panjabi 2002-2005, Vierling 2004, Rumble 2002). The black-backed woodpecker is known to occur in the Deerfield Project Area (Panjabi 2002-2005, Rumble 2002). Potentially suitable habitat is present in the project area due to snags created by actively infested MPB, climax conifer conditions and late succession stands.

All of the action alternatives decrease existing habitat capability (.65) by varying degrees with Alternative B decreasing habitat capability the most (.60) followed by Alternative C (.62) and Alternative D (.64). Alternative A would have no direct effects because no new activities would occur. Stand conditions would continue toward climax (denser) conditions that would increase suitable habitat for this species. Due to MPB mortality, openings will occur in denser stands, where snag densities would increase nesting and foraging habitat. Down woody material would enhance prey species habitat. MPB would increase the presence of insects and other prey items short-term. The high probability of large-scale wildfire would increase habitat for this woodpecker short-term, but would reduce snags and prey availability long-term.

Alternative B and C will negatively affect this species short-term by reducing snags, fuel loadings, and large diameter green trees. Dense stands, and late-seral conifer stands will be thinned to prevent MPB losses. Actively infested MPB trees will be removed through salvage or fuel treatments reducing habitat for this species. Loss of some snags due to safety concerns will reduce the amount of potential nesting habitat available, although snag and green tree retention will provide adequate snags per Forest Plan direction (See Snag Section). Removal of commercial-sized trees (>9"DBH) would reduce abundance of future nesting habitat in treated areas. Herbicide treatment of noxious weeds may affect prey species.

Alternative D will be similar to Alternative A in effects for untreated stands. Areas of treatment will remove actively infested MPB trees through salvage or fuel treatments reducing habitat for this species.

Alternative D will reduce open road density and OHV activity the most use followed by Alternative C. Alternative B reduces open road density less that Alternatives D and C but allows OHV use within MA 5.1. Unregulated motorized travel may reduce available habitat directly or indirectly by disturbance to nest sites and decrease snag densities through illegal fuel wood gathering.

The black-backed woodpecker is monitored Forest-wide (USDA Forest Service 2003c, 2004a). The population and habitat trend of black-backed woodpecker in the Black Hills appears to be increasing due to preferred habitat increasing (fires and insect outbreaks) (USDA Forest Service 2004d).

Alternatives A and D by varying degrees would maintain suitable habitat for the black-backed woodpecker, therefore these alternatives will have no influence on Forest-wide habitat or population trends, or attainment of Objective 221.

In 2004, there were an estimated 178,540 acres of ponderosa pine in structural stages SS3C, SS4C, and SS5 Forest-wide (USDA Forest Service 2004b). In the Deerfield Project, there is an estimated 2, 293 acres of these ponderosa pine structural stages which represents 1% of the total amount of habitat available Forest-wide (USDA Forest Service 2004b). Alternative B will reduce SS3C and SS4C to 451 acres or 80% from existing. Alternative C will reduce SS3C and SS4C to 1727 acres or 25%. Both alternatives would enhance and conserve black-backed habitat long-term by insulating suitable habitat from large-scale wildfire. Snag densities will be above FP levels due to MPB. Therefore, Alternatives B and C likely would have not affect on Forest-wide black-backed woodpecker population or habitat trends, nor influence the attainment of Objective 221.

Big Game

White-tailed Deer (*Odocoileus virginianus*), Mule Deer (*Odocoileus hemionus*), and Elk (*Cervus elaphus*)

These species require a diversity of habitat types, especially with a mix of cover and forage habitat components. In addition, these species are important to the economic base (hunting) of the Black Hills area. The South Dakota Department Game, Fish, and Parks consider white - tailed deer, mule

deer, and elk big game animals, with established hunting seasons. Hardwoods are heavily utilized for calving/fawning, bedding and cover habitat (Harthun-Holte 2003). Open structural stages in ponderosa pine, riparian, and open meadows provide foraging habitat, while dense pine regeneration, dense ground cover, and mature pine stands are used as cover that provides security and thermal regulation and fawning/calving habitat (NatureServe 2005, DePerno, 1998). Big game species rely more on grass and forbs during the summer but their diet changes to shrubs, hardwoods, and lichen during the winter. Harthun-Holte (2003) suggests that elk in the Black Hills concentrated in stands of aspen due to the high diversity and forage value of the aspen understory. Elk also select spruce stands that are moist, cooler, and provide security from disturbance (Harthun-Holte 2003). Risk factors for these species include predation (mountain lions, coyotes, dogs), lack of suitable forage, lack of cover, over-harvest, livestock overgrazing that reduces ground cover for fawning/calving, and increased human disturbance during critical periods (winter and birthing) (NatureServe 2005, Lyon and Ward 1982, DePerno 1998) and, motorized use, especially the growing OHV use. Competition for forage can become an issue between all of the above big game species, with elk being the dominant competitor. Livestock competition for forage, especially where forage is limiting, may have a negative impact on these species (Harthun-Holte 2003).

For the Deerfield Project area, white-tailed deer and mule deer utilize most of the area. However, elk are more prevalent on the landscape. This is likely due to the steep topography, flat plateau, dense juniper understory, and high moisture levels of the area (Harthun-Holte 2003). Compared with other areas of the forest, there are still areas where motorized vehicles cannot access that provide security for big game, especially during the hunting season. Field reconnaissance indicated elk overgrazing areas, especially along narrow drainages of wet meadows and hardwoods. In some areas, grass heights were less than 2” during spring green-up. Grazed areas utilized by elk were close to forested cover and away from arterial and collector roads.

Forage, although abundant throughout the uplands, is reduced due to more climax habitat conditions (dense canopy closure) because of changes in fire frequency. Harthun-Holte (2003) found that elk concentrated in mixed conifer stands where mean canopy cover was <=40%, especially where there were less roads and less traffic volume. Browse species important to big game species such as elk sedge, wild rose, and others respond vigorously to fire as well as to harvest treatments that open the tree canopy. Browse production in burns typically increases for 3 to 5 years following the burn and then returns to pre-burn browse conditions. DePerno et al. (2002) found that central Black Hills deer selected burned pine/grass/forb habitats in winter, but avoided burned pine/litter types in summer and winter. Selection of burned habitats in winter is likely due to persistent presence of bearberry, snowberry, and juniper in the understory of burned pine stands, species that are typically absent in the understory of unburned pine communities (DePerno et al. 2002). Elk prefer the pine/juniper plant association that provides cover. This plant association is at risk from catastrophic wildfire, since juniper is a ladder fuel that contains volatile substances, increasing understory heat intensity. In addition, most pine/juniper association is interconnected with few breaks in the canopy.

The Forest Plan provides specific direction for big game forage production. However, it does not provide any direction pertaining to forage quality. Effects of nutrition on population demography of free-ranging ungulates have been well established, yet in the context of large-scale habitat management, the effects of nutrition generally have been ignored, and the need for adequate

nutrition should not be discounted (Cook et al. 1998). In addition, the long-recognized inverse relationship between forage production and canopy closure indicates that emphasis of thermal cover over food production can reduce availability of quality forage. The study by Cook et al. (1998) indicates that the assumption that thermal cover compensates for marginal or inadequate forage conditions is insupportable, and the authors contend that greater emphasis be placed on forage quantity and quality.

Management actions that remove pine and spruce in hardwoods, reduce the canopy closure on ponderosa pine sites, removes pine encroachment from meadows, and open forested riparian plant associations will enhance the shrub component in the understory. Prescribed fire should emphasize the maintenance and enhancement of shrub seral stages without setting the seral stages to grass on a large scale. In addition, providing security from predators during critical times such as fawning should be an important consideration.

Alternative A would allow seral communities to move toward climax conditions, reducing hardwood communities and grassland communities on the landscape. MPB will continue to affect dense stands (>50% canopy closure), moving these stands to more open seral conditions, thus providing forage area while reducing cover values. Alternative A provides more closed canopy conditions that would provide cover for big game but reduce forage.

All action alternatives open up most of the dense pine canopies, reducing competition between the pine overstory and understory forage by varying degrees. In addition, these alternatives expand grassland communities and hardwood communities to varying degrees. Depending on the amount of treatment an increase in forage availability and fawning/calving habitat for big game would provide benefits to these species. Alternative B would provide the most foraging habitat for these species, followed by Alternatives C and D. Open canopy pine stands (SS4A, <50% canopy closure) would be less likely to succumb to MPB, but would not provide thermal cover for the remaining rotation of the stand. However, Alternative C provides for moderately open canopies (SS4B). Although denser canopies have a higher risk of MPB infestation, these stands would provide thermal cover in the next 10 years if not affected by MPB. Alternative D is similar to A, in providing more closed canopy conditions that would provide cover for big game. For all action alternatives, summer habitat capability increases for the most part for all big game compared to existing conditions. For Alternatives B and C, winter habitat capability decreases for the most part for all big game compared with existing condition. For Alternative D, winter habitat capabilities remain stable to slightly increasing for all big game.
OHV use has significantly increased in the Deerfield Project Area over the past 5 years based on the growing numbers of user-created trails (See Roads and Travel Management Section). Disturbance to big game will be more noticeable as motorized travel increases. It is unknown at this time whether the current timber sales have provided adequate forage/cover juxtaposition across the landscape or reduce the effects of motorized travel for big game species. However, motorized use, especially the growing OHV use, negatively influences big game use of suitable habitat (See Habitat Effectiveness Section). Alternative D will reduce open road density and OHV activity the most followed by Alternatives C and B. Alternatives A and B will not restrict OHV use within MA 5.1.

Monitoring protocol has been developed for wildlife, including white-tailed deer, mule deer, and elk (USDA Forest Service 2003c, 2004a). Forest-wide monitoring indicates that the population

trend for white-tailed deer is increasing but the population trend for mule deer is decreasing. The combined deer populations have fallen short of the SDGF&P objectives (USDA Forest Service 2004d). Indications of decline are supported by reported low reproductive rates, low fawn survival, and poor condition of deer range (summer and winter). Forest-wide habitat trends (summer and winter) for both deer species are stable (USDA Forest Service 2004d).

Forest-wide population and habitat trend for elk appears to be increasing. Forest-wide monitoring indicates that prey habitat for the mountain lion (big game, turkeys) has remained relatively stable to increasing. The elk population level meets or exceeds the SDGFP objectives, which is causing depredation problems during the winter on private land (USDA Forest Service 2004d).

Screening Cover, Hiding Cover and Security Cover

Forest Plan Guideline 3203 (treated as standard) provides Forest-wide direction to provide big game screening along at least 20% of the edges of arterial and collector roads. The amount of screening cover that currently exists in the Deerfield Project Area is 22%. Most of the cover is not immediately adjacent to roads but is within 300 ft of a road and is isolated in small patches (less than 5 acres in size). Screening cover figures are conservative because topography also functions to provide screening cover, but was not considered in the analysis. All action alternatives will maintain current levels of screening cover; therefore Forest Plan Guideline 3203 will be met.

Table 3-18 Big game screening cover adjacent to Arterial and Collector Road in the Deerfield Project Area (by Alternative).

	Alt. A	Alt. B	Alt. C	Alt. D
Screening Cover[1]	529 (22)	529 (22)	529 (22)	529 (22)

[1]Acres (percent) of total buffer area 2,304 acres.

There is no Forest Plan direction specific to big game hiding cover or security cover, although these habitat components are incorporated into the HABCAP model and is shown through habitat effectiveness numbers for a given management area. Hiding and security cover have been shown to be very important to big game populations in areas with numerous open roads, especially during hunting season (Harthun-Holte 2003, Millspaugh 1995, 1999). Elk tend to be more sensitive to human disturbance than deer, and open road density (more specifically vehicle traffic) affects habitat use (Benkobi et al. 2004). Hiding cover is vegetation capable of hiding 90% of a standing deer or elk from the view of a human at 200 feet. Security is defined as protection that allows an animal to remain in a defined area despite increases in stress and disturbance associated with hunting season or other human activities. Security cover ameliorates the effects of open road densities, to reduce human disturbance. Neither hiding cover or security cover has been quantified for the Deerfield Project Area, but these components can be evaluated qualitatively.

Cover stands are very susceptible to MPB due to the dense crown conditions. Mature ponderosa pine >7” are the main hosts for MPB infestations, therefore MPB epidemic conditions will probably affect some hiding cover stands, which have higher DBH. In terms of vegetation to provide cover, Alternative A would provide the most, followed by Alternative D and Alternative C, while

Alternative B would provide the least cover. In terms of roads, Alternative D would have the fewest open roads, followed by Alternative C, while Alternative B and A have the most open roads.

All alternatives may reduce thermal cover, either through vegetation treatment, or loss from MPB. The lack of thermal cover may reduce the use of some areas by big game, especially in winter. Alternative D and C would provide the most security for big game by reducing human/big game interactions by leaving moderately closed canopied stands and restricting motorized travel, followed by Alternative B then Alternative A.

Management Area 5.1 (Resource Production Emphasis)

The Forest Plan provides specific direction regarding big game habitat in Management Area 5.1 in the form of habitat effectiveness thresholds (Guideline 5.1-3201, treated as standard). The Black Hills version of GIS HABCAP (USDA Forest Service 1992) was used to calculate habitat effectiveness for MA 5.1. Data and maps generated by the HABCAP model for analysis of alternatives can be found in the Deerfield Project File. Table 3-20 summarizes deer and elk overall habitat effectiveness values for MA 5.1 by alternative and season.

Table 3-19 Habitat effectiveness values for Deer and Elk in Management Area 5.1 of the Deerfield Project Area (by Alternative).

Species	Forest Plan DC[1]	Alt. A	Alt. B	Alt. C	Alt. D
White-tailed deer					
Summer	.40[2]	.42	.41	.47	.47
Winter	.35	.38	.33	.42	.43
Mule deer					
Summer	.40	.52	.52	.60	.58
Winter	.35	.36	.39	.44	.41
Elk					
Summer	.43	.43	.44	.49	.48
Winter	.34	.38	.28	.38	.39

[1]Forest Plan Guideline 5.1-3201 (treated as standard).
[2]Habitat effectiveness index

Existing white-tailed deer, mule deer and elk habitat effectiveness values (Alternative A) for both summer and winter are above Forest Plan levels in the Management Area 5.1 portion of the Deerfield Project Area (Table 3-20). Increases in habitat effectiveness correlate to the level of habitat improvement in each alternative. A number of factors, including seasonal and year-round road closures, retention of hiding and thermal cover, improved distribution of cover, forage, and restoration and retention of hardwood stands account for the increases in habitat effectiveness. All alternatives meet Forest Plan Guideline 5.1-3201 for big game in the summer. Alternative B does not meet Forest Plan Guideline 5.1-3201 for white-tailed deer and elk in the winter. Of the action alternatives, Alternative D provides the greatest increases for white-tailed deer and elk followed by Alternative C. Alternatives C and D result in increased habitat effectiveness values relative to Alternative A, therefore meeting Forest Plan Guideline 5.1-3201.

Management Area 8.2 (Developed Recreation Emphasis)

The Forest Plan provides specific direction regarding big game habitat in Management Area 8.2 in the form of habitat effectiveness thresholds (Guideline 8.2-3201, treated as standard). The Black Hills version of GIS HABCAP (USDA Forest Service 1992) was used to calculate habitat effectiveness as discussed under Management Area 8.2 section previously. Table 3-20 summarizes deer and elk overall habitat effectiveness values for MA 8.2 by alternative and season.

Table 3-20 Habitat effectiveness values for Deer and Elk in Management Area 8.2 of the Deerfield Project Area (by Alternative).

Species	Forest Plan DC[1]	Alt. A	Alt. B	Alt. C	Alt. D
White-tailed deer					
Summer	.37[2]	.35	.32	.36	.36
Winter	.33	.33	.23	.32	.33
Mule deer					
Summer	.37	.37	.35	.37	.37
Winter	.33	.25	.26	.24	.24
Elk					
Summer	.40	.31	.31	.31	.31
Winter	.35	.31	.20	.28	.30

[1]Forest Plan Desired Condition (DC) Guideline 8.2-3201 (treated as standard).
[2]Habitat effectiveness index

Existing white-tailed deer, mule deer and elk habitat effectiveness values (Alternative A) are at or below Forest Plan desired condition in Management Area 8.2. Therefore, this alternative does not meet Forest Plan Standard and Guideline 8.2-3201. Low habitat effectiveness values may be explained by the presence of a large grassland community (33% of the MA) resulting in poor spatial distribution of cover/forage values, lack of thermal cover, and the amount of open roads within this developed recreation area. Alternative B reduces habitat effectiveness for white-tailed deer (summer and winter), mule deer (summer) and elk (winter) from existing condition. Alternative C reduces habitat effectiveness for white-tailed deer, mule deer, and elk in winter from existing condition. Alternative D reduces habitat effectiveness for mule deer and elk in winter from existing conditions. Generally, for all action alternatives vegetative management in MA 8.2 does not result in increased habitat effectiveness for big game.

Brown Creeper (*Certhia americana*)

The brown creeper is closely associated with unmanaged late-successional ponderosa pine forests and white spruce communities. This habitat is used by other species such as the American three-toed woodpecker, Swainson's thrush, and several orchid species. Snags with loose bark and insect infested trees are important habitat features of brown creeper habitat (Wiggins 2005). Large, un-fragmented, late successional stage conifer stands with a large number of snags are essential for nesting, which are usually constructed behind loose slabs of bark still attached to large diameter snags. This species is "area sensitive", needing patch size greater than 30 acres (Dykstra 1996). The brown creeper is considered insectivorous but will forage on nuts, invertebrates, and seeds (Wiggins 2005). The brown creeper is known to take advantage of major tree die-offs (insect and disease) where local populations will increase temporarily. Foraging habitat is very similar to nesting habitat with the majority of foraging

occurring on large (>12” DBH), furrowed barked trees. Risk factors for this species include fragmentation of suitable habitat (Wiggins 2005, Dykstra 1996), loss of late-successional components (nesting and foraging habitat) through vegetative treatments (including partial or patch cut treatments) and large-scale wildfire (Wiggins 2005). Positive habitat influences for this species include small-scale disturbance events such as light to moderate burns and disease and insect outbreaks that provide improved nesting substrates as well as increased insect abundance (Wiggins 2005).

This species has been recorded in the Deerfield Project Area in ongoing bird monitoring program (Panjabi, 2001-2005) and during field reconnaissance. Suitable habitat occurs in the Deerfield Project Area, mostly in Mesic Coniferous Forest and Woodlands and High Elevation Riparian and Shrublands Ecological groups. Plant associations that exhibit dense overstory (SS3C, SS4C and SS5), abundant DWM on the forest floor, abundant snags, and moist microclimates provide suitable habitat for this species. Table 18 is a summary of the changes in habitat capability for the brown creeper by alternative.

All of the action alternatives decrease existing habitat capability (.37) by varying degrees with Alternatives B and C decreasing habitat capability the most (.35) followed by Alternative D (.36). Alternative A provides late seral stages preferred by the brown creeper, especially in the conifer ecological groups. Alternative D will be similar to Alternative A in providing late seral habitat by not treating SS3C or SS4C stands. MPB will continue to create snags and dying trees that will provide foraging and nesting substrates. Abundance of prey items will increase due to dead and dying process and local population levels may increase short-term. Conifer communities will continue toward climax conditions, thus increasing overall habitat components for this species. However, MPB effects have the potential to reduce patch size and structure of these late seral pine communities. With this alternative, there is a high probability for large-scale wildfire, which could eliminate suitable habitat long-term.

Alternatives B and C decrease brown creeper habitat, B more so than C, by reducing patch sizes of late seral conifer communities, therefore reducing potential habitat. Alternatives B and C reduce suitable habitat for this species through treatments that open the conifer canopy, remove DWM and forest litter, and reduce fuel hazards, thereby negatively impacting this species. Treatments will reduce the number of actively infested trees that would soon become snags and be available for this species. Alternatives B and C restore hardwood inclusions within stands typed as white spruce by removing spruce on 8 and 199 acres respectively. These treatments were part of the design in Alternatives B and C to meet Forest Plan Objectives 201, 204, and 221 for the McIntosh Fen. Such treatments are not expected to alter suitability of brown creeper habitat.

The brown creeper is monitored Forest-wide (USDA Forest Service 2003c, 2004a). Forest-wide monitoring of brown creeper within the Black Hills indicates that the population densities appear stable to slightly decreasing but variation between years makes it difficult to determine overall population trend. Forest-wide habitat capability appears to be stable or slightly decreasing (USDA Forest Service 2004d). MPB activity in the area will continue reducing this species most suitable habitat, but will also increase snag habitat at that same rate.

Alternatives A and D will not affect habitat for the brown creeper. Therefore, these alternatives move toward meeting Forest Plan Objectives 218 and 221. In 2004, there were an estimated 178,540 acres of ponderosa pine in structural stages SS3C, SS4C, and SS5 Forest-wide (USDA Forest Service 2004b). In the Deerfield Project, there is an estimated 2, 293 acres of these ponderosa pine structural stages which represents 1% of the total amount of habitat available Forest-wide (USDA Forest Service 2004b). Alternative B will reduce SS3C and SS4C to 451 acres or 80% from existing. Alternative C will reduce SS3C and SS4C to 1727 acres or 25%. Both alternatives would enhance and conserve brown creeper habitat long-term by insulating suitable habitat from large-scale wildfire and potentially reduce MPB effects. Given the uncertainty regarding Forest-wide habitat and population trends for the brown creeper, it is difficult to determine what contribution Alternatives B and C would make toward those trends. It is possible but unlikely that either Alternative B or C would affect Forest-wide brown creeper population or habitat trends, or influence the attainment of Objective 221 short-term.

Cockerell's Striate Disc (*Discus shemekii*)

This species is considered a management indicator that needs moist microclimates, spruce habitats, mosses, and advanced decay processes. This habitat is used by other species such as woodpeckers, several sensitive plants, reptiles, and amphibian species. This species is often found in litter in rich lowland forest, generally on shaded, north-facing slopes, often bordering stream floodplains (Frest and Johannes 1993, 2002). In the Deerfield Project Area, this snail is associated with white spruce plant associations in the Mesic Coniferous Forest and Woodland ecological group, and is mostly associated with soils derived from limestone. Its habitat needs are moist microclimates with decayed leaves from herbaceous plants, mosses, and downed woody debris associated with deep litter layers (Beetle 1997, Frest and Johannes 2002). Predators to this species include birds, small mammals, amphibians, reptiles, and insects.

Risk factors include barriers to dispersal caused by habitat loss (i.e. xeric habitats and roads), direct trampling and compaction, loss of moist habitat conditions, and loss of foraging habitat (i.e. deep litter layer with mycorrhizae, mosses) through vegetation manipulation and fire (Anderson 2004, 2005). Fire can have direct negative impact to this species. Snails may escape the direct effects of summer fires or prescribed fires with low intensity and low severity by being dormant or in refugia (underground, limestone crevasses) but may suffer loss of suitable forest-floor habitat (Applegarth 1999, Anderson 2004, 2005). Prescribed fires that are conducted during more moist conditions (spring and fall) when mollusks are most active would negatively affect this species. Stand replacing fires (high intensity and high severity conditions) usually overheats or destroys refugia of most gastropods along with destroying habitat, eliminating colonies within these areas.

All of the alternatives protect known Frest colonies of Cockrell's striate disc, therefore, Standard 3103 would be met. Alternative A will have no impact on suitable habitat for this species short term. By varying degrees of treatment, all action alternatives could fragment suitable habitat by creating xeric site conditions between these habitats short term, with Alternative B having the most effect, followed by Alternatives C and D. All action alternatives decrease suitable habitat for this species by varying degrees. With the higher potential of large scale wildfire in Alternatives A and D, these alternatives might provide less suitable habitat for this snail long term. Design criteria

that limits prescribed burning in suitable habitat especially along limestone cliffs with mesic conditions and would reduce the intensity and severity of prescribed burning for the burn areas.

Alternatives A and B would allow continued cross-country motorized use over much of the area, thus potentially affecting snail sites. Alternative C and D would restrict OHV use to designated trails, thus protecting snail colonies adjacent to and off roads/trails. Unregulated motorized travel may reduce available habitat directly or indirectly by disturbance colonies, increasing soil compaction, increase solar radiation, and create barriers to dispersal.

The Cockerel's striate disc is monitored Forest-wide (USDA Forest Service 2003c, 2004a). Forest-wide monitoring of this species indicate population and habitat trend appear to be stable (USDA Forest Service 2004d). Frest and Johannes (2002) found this species at one out of twenty-four sample sites within the Deerfield Project Area. Not all suitable habitats have been sampled; therefore, this species may occur elsewhere in the Deerfield Project Area. Alternative A and D will have no influence on Forest-wide habitat and population trends. Forest-wide habitat and population trends would not be affected because the Frest sites (Forest Plan Standards 3103) would be protected under all alternatives. Additional suitable habitats (outside of Frest sites) may be negatively affected short-term by all alternatives, but habitats would be enhanced and conserved long-term by insulating areas from large-scale wildfire. The action alternatives contribute to the attainment of Forest Plan Objective 211, therefore would contribute to positive Forest-wide population and habitat trends.

Cooper's Mountain Snail (*Oreohelix strigosa cooperi*)

The Cooper's mountain snail (*Oreohelix strigosa cooperi*) is an R2 Sensitive species which has been evaluated in the Deerfield Project Area and is discussed in the Final Deerfield BA/BE. Mountain snails (*Oreohelix* species) are calciphious, most of them restricted to limestone outcrops and their vicinity. They are usually found on edges of course, angular limestone talus protected from rapid evaporation by overhanging bushes. They also occupy crevices among the rocks (Pilsbry 1939-1948). *Oreohelix strigosa* may occur in various plant community types from sagebrush to deciduous shrubs, coniferous forest and barren rock slides (NatureServe 2005). Although calcareous substrates are important, this species can be found on other substrates (i.e. sandstone). Slope may be important, where the presences of moisture, lime, and leaf mold may be important components necessary for this species (NatureServe 2005). In the Black Hills, the Cooper's mountain snail is found in the higher elevations of the Limestone Plateau, in calcareous soil substrates, along limestone outcrops, talus, and isolated exposed limestone (Anderson 2005). They are found in dry-to very mesic conditions that are somewhat protected from sunlight throughout most of the day or in limestone cracks and crevices that are shaded from direct radiation and wind. Microclimate conditions at most known sites, include a complex litter layer, mycorrhizae diversity and the presence of mosses and lichens. Sites range from open to closed canopy coniferous overstory to mixed-coniferous to deciduous tree overstory (Anderson 2005). Dead and down woody debris is important characteristic at the micro-site level. There are no known occurrences of this snail at the lower elevation, calcareous soil types (Frest and Johannes 1993, 2002, Anderson 2003b). Land snails do have mechanisms that can protect them for short periods of time when moisture is limited (i.e. hibernation) and can recolonize previously disturbed areas (Beetle 1997). The larger sized morphs are usually associated with less mesic

condition, open canopies (Frest and Johannes 1993, 2002) with a majority of the sites having undergone large-scale wildfire in the last 75 years as evident from 1939aerial photos (Froiland 1990, BHNF files). Limiting factors for this species are loss of constant moisture (climatic or at the micro-site level) to sustain oxygen exchange for their life cycle (e.g. foraging, mating, and egg deposition) and barriers to dispersal (inhospitable habitat) between colonies. Risk factors for the Cooper's mountain snail are loss of moist habitat conditions through drought, wildfire, and prescribed fire, vegetative management, trampling by ungulates, overgrazing, development, road construction, habitat fragmentation, and loss of adjacent colonies.

Based on limited field review and Frest and Johannes survey sites (Frest and Johannes 2002), the smaller morph of the Cooper's mountain snail has been found in suitable habitat in the Deerfield Project Area. The larger morph of this species was not found during field reconnaissance, but it may occur in the area due to its presence adjacent to the project boundary. In the Deerfield Project Area, this species is found mostly on the Limestone Plateau and limestone uplifts near the Crystalline Basin. Colonies are larger on north facing slopes, but colonies also occur in suitable habitat conditions on other slopes where radiant heat and wind is minimal. Based on field review, this species is most abundant on TuG soil types within the area (USDA Soil Conservation Service 1990).

All of the alternatives protect known Frest colonies of Cooper's mountain snail, therefore, Standard 3103 would be met. Alternative A will have no impact on suitable habitat for this species short term. By varying degrees of treatment, all action alternatives could fragment suitable habitat by creating xeric site conditions between these habitats short term, with Alternative B having the most effect, followed by Alternatives C and D. All action alternatives decrease suitable habitat for this species by varying degrees. With the higher potential of large scale wildfire in Alternatives A and D, these alternatives might provide less suitable habitat for this snail long term. Design criteria that limits prescribed burning in suitable habitat especially along limestone cliffs with mesic conditions and would reduce the intensity and severity of prescribed burning for the burn areas.

Alternatives A and B would allow continued cross-country motorized use over much of the area, thus potentially affecting snail sites. Alternative C and D would restrict OHV use to designated trails, thus protecting snail colonies adjacent to and off roads/trails. Unregulated motorized travel may reduce available habitat directly or indirectly by disturbance colonies, increasing soil compaction, increase solar radiation, and create barriers to dispersal.

Monitoring protocol has been developed snails, including the Cooper's mountain snail (USDA Forest Service 2003b, 2004c). Forest-wide monitoring of the Cooper's mountain snail indicates that population and habitat trend for this species is stable (USDA Forest Service 2004d). Frest and Johannes (2002) found the smaller morph of this species at eight out of twenty-four sample sites within the Deerfield Project Area. Not all suitable habitats have been sampled; therefore, this species may occur elsewhere in the Deerfield Project Area. All alternatives contribute to the attainment of Forest Plan Objective 211, Forest-wide habitat and population trends would not be affected by the action alternatives because the Frest sites (Forest Plan Standards 3103) would be protected under all alternatives. Additional suitable habitats (outside of Frest sites) may be negatively affected short-term by all alternatives, but habitats would be enhanced and conserved

long-term by insulating areas from large-scale wildlife. All alternatives will contribute to Forest-wide habitat and population trends for the Cooper's mountain snail.

Fish MIS

The 1997 Forest Plan as amended by the Phase I Amendment identified In-stream Fisheries Habitat as an ecological indicator and several fish species as management indicators of in-stream health. Brook trout and brown trout are important game species, which are not native to the Black Hills. The direct, indirect, and cumulative effects to fish MIS and In-stream Fisheries Habitat are disclosed in the Fisheries section of this EIS.

Brook Trout

Brook trout (*Salvelinus fontinalis*) are not native to the Black Hills, originally introduced prior to the 1900's. Brook trout provide recreational fishing opportunities but are limited to specific stream reaches, where some stream reaches may have reduced or declining populations due to site-specific environmental conditions (USDA Forest Service 2005a). This small trout species is considered wild, with no additional stocking done by SDGF&P (Erickson 1979 and Koth 2002). Brook trout prefer cold, clear, well-oxygenated streams and lakes. This species spawns usually over gravel beds in shallow headwaters but also may spawn in gravelly shallows of lakes if flow is moderate. The brook trout is considered a carnivore, invertivore, and Piscivore, feeding opportunistically on various invertebrate and vertebrate animals, including primarily terrestrial and aquatic insects and planktonic crustaceans. Risk to this species includes loss of suitable habitat (foraging and spawning) from changes in water quality and quantity, predation, competition, loss of food resources, and barriers to dispersal. Introduced brook trout have contributed to decline of native fishes, amphibians, and invertebrates in cold streams and lakes in Western North America (NatureServe 2005).

Monitoring protocol has been developed for fish, including the brook trout (USDA Forest Service 2003c, 2004a). Recent surveys suggest that brook trout occur in many of its historic drainages throughout the Black Hills (Isaak et al. 2003), though changes in local populations have occurred (Erickson 1979 2002, USDA Forest Service 2005a). Forest-wide monitoring indicates fluctuations in population levels throughout the monitoring periods but indicates that overall brook trout population trend appears to be stable (USDA Forest Service 2005a). Forest-wide monitoring indicates the habitat has been affected by drought conditions (lack of water). Therefore, habitat trend for this species is relatively stable to slightly decreasing (USDA Forest Service 2005a). All alternatives will continue to provide habitat conditions to sustain brook trout, thereby contributing to a stable Forest-wide population and habitat trend.

Brown Trout

Brown trout are native to Europe but have been extensively introduced through the United States. Brown trout (*Salmo trutta*) are not native to the Black Hills, originally introduced prior to the 1900's. Brown trout provide recreational fishing opportunities, where stocking of brown trout commonly occurs. Brown trout prefer cold, clear, well-oxygenated streams and lakes with medium to high gradients, although brown trout are more tolerant of deeper, warmer, slower

waters than other trout. This species spawns in natal waters ranging from large streams to small spring-fed tributaries, ins shallow gravelly headwaters, rocky lake margins or sometimes over sand or hard clay if no gravel is available The brown trout is considered a invertivore, and piscivore, feeding on aquatic and terrestrial insects and their larvae, crustaceans, mollusks, fishes and other animals. This large trout species preys on other species of trout and competes with them for food and space. Risk to this species includes loss of suitable habitat (foraging and spawning) from changes in water quality and quantity, predation, loss of food resources, and barriers to dispersal. Brown trout have contributed to decline of native fishes in North America (NatureServe 2005).

Monitoring protocol has been developed for fish, including the brown trout (USDA Forest Service 2003c, 2004a). Recent surveys suggest that brown trout occur in many of its historic drainages throughout the Black Hills (Isaak et al. 2003), though changes in local populations have occurred (Erickson 1979, USDA Forest Service 2005a). Forest-wide monitoring indicates that brown trout population trend appears to fluctuate but have persisted in all targeted sites, therefore population trend appears to be stable (USDA Forest Service 2005a). Forest-wide monitoring indicates the habitat has been affected by drought conditions (lack of water). Therefore, habitat trend for this species is relatively stable to slightly decreasing (USDA Forest Service 2005a). All alternatives will continue to provide habitat conditions to sustain brown trout, thereby contributing to a stable Forest-wide population and habitat trend.

Lake Chub

The lake chub (*Couesius plumbeus*) is an R2 Sensitive species which has been evaluated in the Deerfield Project Area and is discussed in the Final Deerfield BA/BE. This species is widely distributed across Canada and the northern portions of the U.S. Rangewide, it is found in lakes and streams that usually have cool waters and clean gravel or cobble substrates (Isaak et al. 2003). The basic ecology of lake chubs has not been studied on the BHNF and is poorly understood. Only generalized descriptions of its habitat requirements are known. The lake chub is considered an herbivore and invertivore, eating insect larvae, zooplankton, algae, and sometimes fishes (NatureServe 2005). Lake chub is native to the Black Hills. Currently the lake chub is only found on the Forest in Deerfield Reservoir though this species was historically more widespread (Isaak et al. 2003). The Black Hills population is isolated and believed to be a glacial relic. Risks to this species include loss of suitable habitat (foraging and spawning) from changes in water quality and quantity, predation, loss of prey species and barriers to dispersal (Isaak et al. 2003).

Monitoring protocol has been developed for fish, including the lake chub (USDA Forest Service 2003c, 2004a). In Deerfield Reservoir, the population has declined in recent years based on catch rates from 1994-2004 (USDA Forest Service 2005a), but this species is certainly more abundant than when the reservoir was chemically renovated in 1982 to reduce the white sucker (*Catostomus commersoni*) population (Isaak et al. 2003). The Forest-wide population trend which consists of the one population in Deerfield Reservoir, is downward (USDA Forest Service 2005a), though it is probably greater than that which occurred immediately after Deerfield Reservoir was chemically renovated in 1982 (Isaak et al. 2003). Forest-wide habitat trend appears to be stable based on trophic state of Deerfield Reservoir (total weight of plant biomass in a water body at a specific

location and time (Piroutek 1991, USDA Forest Service 2005a). All alternatives will move toward attainment of Forest Plan Objective 217 and 221 by varying degrees. All alternatives will contribute to a stable Forest-wide population and habitat trend for the lake chub.

Mountain Sucker

The mountain sucker (*Catostomus platyrhynchus*) is an R2 Sensitive species which has been evaluated in the Deerfield Project Area and is discussed in the Final Deerfield BA/BE. The mountain sucker range extends from Canada and in portions of the western United States with reported declines in several states. Mountain sucker occur most often in cool, clear mountain streams with moderate water velocities. Stream substrate associated with mountain sucker habitat varies widely and ranges from mud to sand, gravel, and boulders, although cobbles are most common. This species is found on the stream bottom and is closely associated with cover, (exposed roots, undercut banks, log jams and boulders). Mountain suckers are benthic feeders and their diet is primarily simple plants like diatoms and green algae, but small invertebrates are also ingested. Spawning occurs in late spring; probably in riffles and a short migration may be made to spawning areas (Isaak et al. 2003). Risks to this species includes loss of suitable habitat (foraging and spawning) from changes in water quality and quantity, predation, competition from introduced fish, hybridization with other suckers, loss of benthic foods and barriers to dispersal (Isaak et al. 2003, NatureServe 2005).

Mountain sucker populations in the Black Hills are the eastern-most extension of the species. The nearest population outside of the Black Hills is in the Powder River drainage of Wyoming. Historic surveys indicate the mountain sucker was widely distributed across the Black Hills (Evermann and Cox 1896, Bailey and Allum 1962, Stewart and Thilenius 1964). In the Deerfield Project Area, mountain sucker are documented in Castle Creek upstream and downstream of Deerfield Dam and North Fork Castle Creek. This species has not been documented in fish surveys in Deerfield Reservoir (Erickson et al. 2001).

Monitoring protocol has been developed for fish, including the mountain sucker (USDA Forest Service 2003c, 2004a). Recent surveys suggest that mountain suckers occur in many of its historic drainages throughout the Black Hills (Isaak et al. 2003), though changes in local populations have occurred (Erickson 2002, USDA Forest Service 2005a). Forest-wide monitoring indicates that the mountain sucker population trend appears to be stable (USDA Forest Service 2005a). Forest-wide monitoring indicates the habitat has been affected by drought conditions (lack of water). Therefore, habitat trend for this species is relatively stable to slightly decreasing (USDA Forest Service 2005a). All alternatives will continue to provide habitat conditions to sustain mountain suckers, thereby contributing to a stable Forest-wide population and habitat trend.

Fringed Myotis (*Myotis thysanodes*)

The fringed myotis (*Myotis thysanodes*) is an R2 Sensitive species which has been evaluated in the Deerfield Project Area and is discussed in the Final Deerfield BA/BE. The fringed myotis is closely associated with mines, caves, snags, and adequate prey base (insects) components. They are considered indicators of cave and mine habitat. This habitat also used by other species such as woodpeckers, small mammals, birds, reptiles, amphibians and invertebrates. The fringed

myotis occupies a variety of habitats including mid-elevation desert, grass and woodland habitats and is found at higher elevations in spruce-fire habitat and in mixed timber of ponderosa pine, white spruce, and aspen (Schmidt 2003a, Keinath 2004).

The fringed myotis is insectivorous and require efficient use of its energy reserves. Distance from roosting sites to foraging and drinking areas is important and can have large repercussions on daily energy balance for this species. Roosting with groups and finding thermo-neutral habitats help with maintaining adequate daily energy reserves. Day and night roosts may include caves, mines, and buildings, under bridges, rock crevices, underneath bark, and inside hollows of dead trees (Keinath 2004). Maternity roosts have been found in buildings, caves, dead trees (snags) and rock crevices that provide warmer microclimates for rearing and brooding pups (Tigner and Aney 1994, Schmidt 2003a, Keinath 2004). Hibernacula (winter hibernation habitat) have been found in cool caves and mines with little temperature fluctuation that facilitate uniform low metabolic rates during hibernation (Keinath 2004). Foraging habitat is usually described along heavily vegetated edges of water bodies, streams where prey species are most abundant. Prey for the fringed myotis is mostly beetles and moths but they are opportunistic, feeding on a variety of insect classes when they become abundant (Tigner and Stukel, 2003, Schmidt 2003a, Keinath 2004). Risk factors for this species include roost disturbances, roost destruction, human disturbance during parturition or hibernation, availability and vulnerability of roost sites, a low reproductive rate, and habitat loss that affects prey base (Tigner and Stukel 2003, Schmidt 2003a, Keinath 2004).

In the Black Hills, abandoned mines, natural caves, and deep rock crevasses are used as hibernacula. Lightning-struck snags, snags with exfoliating bark, or existing cavities are used for maternity roosts and may occasionally be used for daytime roosting. Snags, rock cracks and crevices, and human structures may also be used for day or night roosts (Schmidt 2003a, Tigner and Stukel 2003). The fringed myotis is more closely related to the forested communities than other bat species, given that they are not found away from forested areas during the summer. The fringed myotis has been found in the Deerfield Project Area in suitable habitat. The project area also provides snags and rock outcrops for roosting habitat, as well as other habitat features important to bats such as water sources and riparian habitats. Several mines in the area could be potential habitat for this species.

For all the action alternatives, mitigation and design criteria provide protection of maternity and hibernacula habitats from harvest activities and reduce the impact from human disturbance. Alternative A provides abundant roosting and maternity sites, late seral stages and decay processes. Alternative D will be similar to Alternative A in providing late seral habitat by not treating dense pine and spruce stands. MPB will continue to create snags and dying trees that will provide habitat. Abundance of prey items will increase somewhat by MPB activity. With Alternatives A and D, there is a high probability for large-scale wildfire, which could eliminate suitable habitat long-term. Alternatives A and D will conserve habitat for the fringed myotis short-term.

Alternatives B and C would have the greatest potential to directly affect this species habitat. Alternative B would reduce snag habitat the most followed by Alternative C but may reduce the potential for large-scale wildfire. Heavy equipment could potentially collapse abandoned mines

or caves that have not been identified prior to operations. Vegetation treatment near undocumented cave or mine entrances could change the interior microhabitat. Herbicide treatment could affect this species' prey base. Prescribed burning may improve foraging habitat by stimulating shrub development. Proposed watershed improvement projects will enhance riparian vegetation and improve foraging habitat.

Travel management that restricts recreational activity near critical bat habitat would protect bat habitat from disturbance to reproductive females, and reduce access for illegal fuel wood gathering. Alternative D will reduce open road density and OHV activity the most use followed by Alternative C. Alternative B reduces open road density less that Alternatives D and C but allows OHV use within MA 5.1. Unregulated motorized travel may reduce available habitat directly or indirectly by disturbance to roost sites and a reduction in snag densities.

Monitoring protocol has been developed for bats, including the fringed myotis (USDA Forest Service 2003b, 2004c). Forest-wide monitoring indicates population trend of the fringed myotis cannot be determined due to lack of quantitative data (USDA Forest Service 2004c). The substantial protection of known hibernacula provided in 2003 reflects and upward trend in known bat habitat (USDA Forest Service 2004d). Alternative A and D would not affect the fringed myotis habitat (hibernacula and snag densities), and therefore would contribute to Forest-wide habitat or population trends or attainment of Objective 221. Alternatives B and C will protect known hibernacula and provide snag densities above FP levels due to MPB mortality. Therefore, Alternatives B and C likely would contribute to Forest-wide population and habitat trends and move toward attainment of Objective 221.

Merriam's Turkey (*Meleagris gallopavo*)

The Merriam's turkey is closely associated with more open ponderosa pine where grasses and forbs are abundant along with pine seeds and ground insects. The habitat is used by other species such as robins, woodpeckers and deer. Merriam's turkey occurs in a variety of habitats, from agricultural fields to coniferous forest, and roosts in trees at night to avoid predators. In the Deerfield Project Area, this species is associated with mostly Dry Coniferous and Mesic Coniferous Forest and Woodlands ecological groups, but can be observed in all plant communities in the area. In the Black Hills, this species' main diet item is pine seed (Rumble and Anderson 1996). Merriam's Turkeys are herbivores and insectivores, normally foraging on seeds, fruits, grains, and insects. Turkeys are also known to eat small vertebrates (frogs, toads, and snakes). Principal winter foods include pine seed, acorns, corn, ferns, and mosses. Turkey hens select nesting sites that provide adequate cover from predators (Rumble and Anderson 1993, NatureServe 2005). In the Black Hills, turkeys selected ponderosa pine communities with greater than 70% overstory canopy cover and greater than 32 m2/ha, basal area (SS4C, SS5) stands for winter habitat. However, habitat selection by turkeys reversed to more open overstory canopies during the summer (Rumble and Anderson 1993). This species is non-migratory in the Black Hills. Merriam's Turkey is considered a big game animal with an established spring and fall hunting seasons with the South Dakota Game, Fish, and Parks. Risk factors for this species include loss of foraging and nesting habitat, reduced herbaceous biomass necessary for invertebrate food items, and loss of cover for young. Impacts to this species include severe winters, cold wet springs, predators, poaching, and over-harvest.

All action alternatives improve habitat capability from existing condition for Merriam's turkey in the summer. All of the action alternatives decrease existing (.72) habitat capability by varying degrees with Alternative B (.64) decreasing habitat capability the most followed by Alternative C (.67) and Alternative D (.71) in the winter.

Alternatives A and D emphasize providing more closed canopy conditions that would provide winter habitat for turkeys but would decrease summer habitat. Alternative A would allow seral communities to move toward climax conditions, reducing hardwood and grassland communities on the landscape. MPB will continue to affect dense stands, moving these stands to more open seral conditions, thus providing forage while reducing cover values. Alternative D would allow some seral communities to move toward climax conditions, reducing hardwood and grassland communities. MPB will also affect dense stands, moving to open early seral stages in pine stands. Alternative D will open some pine stands along with some management of hardwoods and grassland communities compared to Alternative A.

Alternatives B and C are similar in treatments that open up the dense pine canopies. These treatments would reduce turkey winter habitat (cover) but would increase summer habitat. Treatments in Alternatives B and C reduce the negative effects of MPB infestations by increasing the health and vigor of the remaining overstory. However, Alternative C provides for moderately closed canopies (SS4B) compared to Alternative B. Although denser canopies have a higher risk of MPB infestation, moderately closed stands would provide winter habitat for turkeys. Alternatives B and C are similar in treatments to expand grassland communities to historical conditions and hardwood communities, although Alternative C restores more hardwood communities in the Castle Creek drainage. These treatments would provide forage and nesting habitat for turkeys.

Alternatives A and B would not restrict motorized access, thereby providing increased access for hunting. Alternative C reduces road density and restricts cross-country motorized travel, thereby limiting hunting access and benefiting turkeys. Alternative D restricts motorized travel the most compared to the other action alternatives. This will limit hunting access, benefiting turkeys.

Monitoring protocol has been developed for wildlife, including Merriam's turkey (USDA Forest Service 2003c, 2004a). Forest-wide monitoring of Merriam's turkey population trend indicates that this species is increasing and that Forest-wide habitat trend appears to be stable (USDA Forest Service 2004d). All alternatives move toward Forest Plan Objectives 217 and 221 for the Merriam's turkey and will meet Guideline 3205 both short and long term. All alternatives will contribute to maintaining or improving Forest-wide habitat and population trend by varying degrees.

Mountain Goat (*Oreamnos americanus*)

This species prefers coniferous forest with steep rocky, remote areas with suitable forage habitat. This habitat is used by other species such as American marten, mountain lion, sensitive plants, reptiles, and amphibian species. This species range extends from the northern United States Rocky Mountains to Southeast Alaska (NatureServe 2005). It inhabits rugged terrain, including cliffs, rock faces, and talus slopes, typically above timberline. Mountain goat forage includes

chokecherry, Russian buffaloberry, grasses, sedges, hardwoods, and willow (Richardson 1971). Risk to this species includes hunting, winter starvation, accidental death from rockslides and rock climbers, and predation. In the Black Hills, this species was introduced in the Norbeck Wildlife Preserve in 1924, where most of the population is still located. Isolated observations of mountain goat have been noted elsewhere on the forest. The mountain goat is considered a big game animal with a limited hunting season set by the South Dakota Department of Game, Fish, and Parks.

The Deerfield project area exhibits suitable habitat for the mountain goat due to the steep limestone uplift, areas way from large communities, and abundance of forage. However, this species has not been documented in the area. A single mountain goat was observed near Castle Peak campground, approximately 5 miles to the northeast. Management activities that open canopies, increase hardwood and grassland communities will improve foraging habitat for this species. Travel management that reduce human and mountain goat interactions through road obliteration and/or restrict motorized recreation, and reduce recreation use in remote areas will enhance and conserve habitat for the mountain goat (Richardson 1971).

Alternative A continues with existing activities in the Deerfield area, including unregulated motorized recreation use, which could negatively impact this species by increasing human/mountain goat encounters. MPB will continue to reduce pine overstory, enhancing forage species. However, increases in DWM from MPB will provide concealment cover for its predator, the mountain lion. The potential for catastrophic fire is greater with Alternative A, which could have a negative effect on this species habitat short-term.

All action alternatives will increase open forest canopies, increase hardwoods, and grassland communities by varying degrees with the most treatment in Alternative B followed by Alternatives C and D. Treatments that open canopies, thinning, fuel reduction, and prescribed fire will increase forage for the mountain goat while reducing concealment cover for its predator the mountain lion.

Motorized travel on and off road would negatively affect the security of the mountain goat, increasing human/mountain goat interactions. In addition, increases in recreation use through development of recreational facilities and trail systems could increase human/mountain goat interactions. All action alternatives reduce road densities, with Alternative D reducing open road densities the most followed by Alternative C and D. Alternatives A and B will not limit OHV use the Deerfield Area. Alternatives C and D will restrict OHV use.

Monitoring protocol has been developed for wildlife, including mountain goat (USDA Forest Service 2003c, 2004a). Forest-wide monitoring indicates that the mountain goat population trend is stable and that Forest-wide habitat trend has remained relatively stable. Alternative A would move away from meeting Forest Plan Objectives 218 and 221 short-term but may meet these objectives long-term. Alternative B would move towards Forest Plan Objectives 217 and 221 for this species by increasing foraging habitat, although this alternative will increase human/mount goat encounters. Alternatives C and D would move towards Forest Plan Objectives 217 and 221 for this species by varying degrees based on increased foraging habitat and a reduction in human/mountain goat encounters. Since the mountain goat is not usually found within the Limestone Plateau and Crystalline Basin, all alternatives will have no effect on Forest-wide population trend. Alternative

A will have no influence on Forest-wide habitat trend for this species. All action alternatives will contribute to maintaining or improving Forest-wide habitat trend.

Mountain Lion (*Puma concolor*)

The mountain lion is the largest predator in the Black Hills, seeking habitats with little to no human contact similar to other predator species such as coyotes, mustelids, and birds of prey. The range includes the western portion of North America, Mexico and South America. Currently the mountain lion is restricted to mainly mountainous, relatively unpopulated areas throughout its range. Mountain lions are the top predator in the food chain in the Black Hills. This carnivorous species likes fresh prey and seldom eats carrion. Their natural enemies include other large predators, such as bears and wolves, neither of which are permanent residents of South Dakota. Mountain lions prefer remote, steep rugged terrain for the seclusion these places offer from human interaction, but for the most part, they are habitat generalists as long as their primary prey such as deer, elk, and turkey are available. Risk factors for this species include loss of secluded habitat (remote, undisturbed areas), declines in prey species abundance, reduction in suitable travel corridors and increased human presence (urbanization) (NatureServe 2005). In the Black Hills, accidents, disease, other lions, vehicles, and people usually cause mortality to individuals (Fecske 2003).

There are approximately 150 lions in the Black Hills with the population increasing. This species is no longer listed as a state threatened species in South Dakota. The South Dakota Game, Fish, and Park Department consider the mountain lion as a big game animal, with an established hunting season and limits.

Alternative A continues with existing activities in the Deerfield area, MPB will continue to reduce cover/forage ratios, thus reducing the effectiveness of the Deerfield Area to provide habitat for the mountain lion's prey species (i.e. White-tailed Deer, Mule Deer, and Elk). Increases in DWM from MPB will provide concealment cover for hunting, rearing and resting for the mountain lion.

All action alternatives reduce concealment cover for the mountain lion through vegetative treatments by varying degrees. Alternative B reduces this cover the most, followed by Alternatives C and D. For all action alternatives, summer habitat capability for prey species increases but decreases in the winter; this will enhance hunting opportunities for the mountain lion. The potential for large scale wildfire is greater with Alternatives A and D, which would have a negative effect on this species short-term. For both Alternatives A and D, little to no treatments in hardwoods would reduce habitat components for prey species such as foraging, bedding and fawn/calving areas.

Monitoring protocol has been developed for wildlife, including mountain lion (USDA Forest Service 2003c, 2004a). Forest-wide monitoring indicates that the mountain lion population trend is increasing. It is difficult to determine habitat trend for this species, since the Black Hills is at saturation for estimated territories and may use many habitats to seek prey. However, Forest-wide monitoring indicates that prey habitat for the mountain lion (big game, turkeys) has remained relatively stable to increasing (USDA Forest Service 2004d). Alternative A and B

would move away from meeting Forest Plan Objectives 218 and 221 due to the potential for human/lion interactions and lack of undisturbed remote areas. Alternatives C and D would move towards Forest Plan Objectives 217 and 221 for this species by varying degree based on increased prey habitat, reducing human/lion interactions and providing undisturbed remote areas. It is possible but unlikely that either Alternative A or B would affect Forest-wide mountain lion population or habitat trends, or influence the attainment of Objective 221. Alternatives C and D will contribute to maintaining or improving Forest-wide population and habitat trends.

Northern goshawk (*Accipiter gentilis*)

The northern goshawk is an R2 Sensitive species which has been evaluated in the Deerfield Project Area and is discussed in the Deerfield BA/BE.

The northern goshawk is considered a forest generalist and nests in most forest types throughout their geographic range (Reynolds et al. 1992, Kennedy 2003). Forest stands containing nests are often small but are mostly closed canopy, late successional forest and in close proximity to small forest openings and water. Prey species vary based on region, season, and availability, although main food items include small mammals, small to medium birds, reptiles and some insects.

In the Black Hills, this species usually nests in ponderosa pine, and nest stands are typically mature, closed canopy (greater than 50%), with high basal area (Bartelt 1977, Erickson 1979). The most important prey species in the Black Hills are flickers, tree squirrels, rabbits, and jays (USDA Forest Service 2000a). Little is known about migration of this species (NatureServe 2005). Limiting factors for this species are adequate nesting and foraging habitat (increased tree stand density and dense canopy cover). Risks to this species are changes in preferred habitat (opening forest canopy) through vegetative treatment, large-scale wildfire, and insect and disease epidemics that reduce suitable habitat, reducing hunting strategy effectiveness, and increase predation. Prey availability within established territory may play an important role on nesting (Reynolds et al. 1992, Kennedy 2003).

The northern goshawk has been found in the Deerfield Project Area in suitable nesting and foraging habitat. Two known territories within the Deerfield Project Area have been active recent years (Lyons Draw and Deerfield). The Lyons Draw territory was initially identified in 1991. Within the Lyons Draw territory there are two known alternative nest sites, one of which was active in 2003 (as reported by SDGF&P) and in 2004. This active nest stands was treated by the Castle Hughes timber sale leaving the nest tree intact but the stand was treated and is likely no longer suitable nesting habitat. Suitable nesting habitat is available in the alternate nest site and adjacent to the treated nest site.

The Deerfield territory was initially identified in 1999. Within this territory, there are two known alternative nest sites. One of these nest sites was last noted active in 1999 and the other nest was active in 2001. Both of the nest stands within this territory are being affected by MPB activity. Four additional potential territories were considered for the goshawk analysis and alternative design (See Wildlife and Botany Specialist Report).

Surveys for northern goshawk were conducted during the 2003 and 2004 field seasons in suitable nesting habitats in the remainder of the Deerfield Project Area. The surveys were performed following protocol developed in Region 3 (Kennedy 1993) that was modified in that only SS3C, SS4B or greater were surveyed. No additional goshawk territories were located.

The Forest Plan provides specific guidance for management of goshawk nesting and post-fledgling areas (Standards 3108, 3109, and 3111, Guidelines 3110 and 3112-3114, which are treated as Standards apply to all projects involving the removal of trees in suitable habitat). In addition to the two known territories, there is a potential for additional goshawk territories within the Deerfield Project Area (for analysis purposes named Silver, Reynolds, Dutchman, and Nipple Butte). The location of these potential territories were based on availability of suitable nesting habitat, distance from adjacent known territories (at least three miles from territory center), and observations of birds during the nesting season. Identification and location of these four potential post fledgling areas (PFAs) is consistent with Forest Service Manual Supplement direction (Black Hills Supplement #2600-2001-1 dated April 30, 2001) that "if goshawk nesting territories are not currently known within the landscape area (5,000-10,000 acres) project alternatives would locate post-fledging family areas around suitable nesting habitat appropriate for the landscape areas. These PFAs would consider known goshawk nest distribution and would be designed to fill holes or gaps where needed between the known goshawk territories." Due to the diverse ecological groups found in the Deerfield Project Area, PFAs were located in community types that are not dominated by ponderosa pine (i.e. white spruce) for analysis purposes. Current data from the Black Hills indicates that this species can nest in a mix of community types as long as ponderosa pine is present (USDA Forest Service 1998-2005).

Forest Plan Standard 3109 directs that "protected acreage will include 180 acres best suited for nesting habitat within one-half mile of the historically active or currently active nest or within the goshawk territory. The acreage need not be contiguous but must occur in 30-acre units or larger. If these conditions cannot be met, then the acreage will include stands that are not currently suitable but that could be managed to meet nesting conditions over time." At least 180 acres of nesting habitat were identified in the two known goshawk territories, including stands containing actual nest(s) and additional stands best suited for nesting habitat within 600 acres of a known goshawk nest. These stands provide optimal nest stand characteristics (e.g. large trees, closed canopy). Approximately 180 acres of potential stands best suited for nesting habitat were identified for the Silver, Reynolds, Dutchman, and Nipple Butte potential goshawk territories. Some stands of less than optimal quality were selected because several optimal quality stands have been moderately infested by MPB. Even though not all of the potential nest stands are best suited for nesting habitat, they currently provide goshawk nest stand characteristics, or will do so in the near future.

Alternatives C and D are consistent with Standard 3109 by maintaining at least 180 acres best suited for nesting habitat in known goshawk territories, and approximately 180 acres of nesting habitat or future nesting habitat in potential territories. Treatments are proposed in nest stands in Alternative B to meet insect and fire/fuel objectives, therefore Alternative B does not meet Standard 3109.

Forest Plan Guideline 3110 (treated as a standard) specifies that activities should not reduce the structural and compositional integrity of active and alternate nest stands. Guideline 3112 (treated as

a standard) directs that management of goshawk nest sites be designed to conserve or enhance site conditions (e.g. thin regeneration). Alternative C and D maintain nest stands in known and potential territories, so both alternatives are consistent with Guidelines 3110 and 3112 (treated as standards). Treatments are proposed in nest stands in Alternative B to meet insect and fire/fuel objectives, therefore Alternative B is not consistent with Guidelines 3110 and 3112 (treated as standards).

With the current MPB infestation in the southern portion of the project area and the potential for expansion, the nest stands retained in Alternatives C and D could be negatively affected long-term. Pine stands with greater than 50% canopy closure have a greater risk of infestation and mortality from MPB (Allen 2005). MPB mortality within nest stands could be unfavorable for the northern goshawk, moving these stands to younger age classes. Even though Alternatives C and D are consistent with Forest Plan direction for goshawk nesting habitat short term, they may not provide nesting habitat long term due to MPB mortality and the higher potential of large scale wildfire as compared to Alternative B.

Forest Plan Guideline 3114 (treated as a standard) provides direction to "design silvicultural prescriptions and manage activities to enhance prey species habitat by maintaining vegetative diversity and striving for a balance of structural stages, from stand initiation to late successional, within goshawk fledgling habitat (approximately 420 acres) around each historically active goshawk nest and alternate nests." For the goshawk post fledgling area analysis in the Deerfield Project, vegetation structural stages (VSS) were used. These VSS describe regeneration, growth, and development of ponderosa pine in the Black Hills that meet specific requirements for goshawk nesting and post-fledgling habitat (approximately 420 acres centered on the 180 acres of nest stand(s). VSS were derived from Reynolds et al. (1992) and modified to reflect conditions in the Black Hills (Guideline 3114 treated as a Standard). VSS were used in the Post-fledgling Model (USDA Forest Service 2001b) for goshawk analysis only, and although somewhat similar, they are different from the five structural stages used for the remainder of the Deerfield Project analysis.

Table 3-17 displays the results of the analysis for all of the alternatives, indicating the proportion of each VSS in each known and potential PFA. Alternative A reflects the current stand conditions but does not incorporate changes due to MPB mortality. Overall, stand conditions in the PFAs are deficient in the smaller VSS (1, 2, and 3), and in the older, denser VSS (460 to 650 are below desired levels or absent). Primarily due to past vegetation treatment, the majority of all PFAs are in either VSS 300 (young trees with 5-9" DBH) or VSS 400 (9-14" DBH with <50% canopy closure, characterized as mid-aged forest). Mature VSS with less than 50% canopy closure are not considered as a desirable structural stage for goshawk in the PFA (Guideline 3114, treated as a standard). Therefore, VSS 400, 500 and 600 currently do not contribute to management of suitable habitat for northern goshawk in the short-term, but are important because they will move into the 450/550/650 long-term.

Alternative A would have no direct effects on vegetation in the PFA stands in the project area. However, with the current MPB infestation in the southern portion of the project area and the potential for expansion, the mature VSS structure in PFA stands could be negatively affected long-term. Maintaining pine stands with greater than 50% canopy closure have a greater risk of infestation and mortality from MPB (Allen 2005). MPB mortality within nest stands could be unfavorable for the northern goshawk, moving these stands to VSS 1-3 or to VSS400, 500 or 600.

This natural disturbance is likely to have negative effects on the northern goshawk distribution in the project area, even if adequate prey exists. The potential for large scale wildfire in the Alternative A could also negatively affect the territory distribution and habitat availability in the Deerfield Project area. There are a number of examples in the Black Hills of MPB mortality and wildfire destroying goshawk nest stands and PFA's.

Table 3-21 Percentage of vegetation structuaral stages in the six goshawk post-fledgling areas in the Deerfield Project Area for all alternatives.

Vegetative Structural Stage[1]	**1**	**2**	**3**	**400**	**450**	**460**	**500**	**550**	**600**	**650**
VSS DC% (Range)	**10% (7-13)**	**10% (7-13)**	**20% (15-25)**	**n/a**	**13% (8-18)**	**7% (2-12)**	**n/a**	**20% (15-25)**	**n/a**	**20% (15-25)**
1. Lyons PFA (491 acres)										
Alt. A	0	0	45	7	10	28	10	0	0	0
Alt. B	0	0	45	22	5	28	0	0	0	0
Alt. C	0	0	45	7	10	28	10	0	0	0
Alt. D	0	0	45	7	10	28	10	0	0	0
2. Silver PFA (495 acres)										
Alt. A	0	0	0	62	8	20	10	0	0	0
Alt. B	11	0	6	54	8	17	4	0	0	0
Alt. C	0	0	0	62	8	20	10	0	0	0
Alt. D	0	0	0	62	8	20	10	0	0	0
3. Reynolds PFA (453 acres)										
Alt. A	18	19	17	33	0	0	13	0	0	0
Alt. B	19	19	16	44	0	0	2	0	0	0
Alt. C	18	19	17	33	0	0	13	0	0	0
Alt. D	18	19	17	33	0	0	13	0	0	0
4. Dutchman PFA (507 acres)										
Alt. A	0	0	11	89	0	0	0	0	0	0
Alt. B	0	14	11	75	0	0	0	0	0	0
Alt. C	0	0	11	89	0	0	0	0	0	0
Alt. D	0	0	11	89	0	0	0	0	0	0
5. Nipple Butte PFA (475 acres)										
Alt. A	0	0	3	35	52	4	5	0	1	0
Alt. B	2	32	3	63	0	0	0	0	0	0
Alt. C	0	0	3	35	52	4	5	0	1	0
Alt. D	0	0	3	35	52	4	5	0	1	0
6. Deerfield PFA (443 acres)										
Alt. A	<1	0	7	61	9	11	12	0	0	0
Alt. B	3	0	7	79	0	0	11	0	0	0
Alt. C	<1	0	7	61	9	11	12	0	0	0
Alt. D	<1	0	7	61	9	11	12	0	0	0

[1.] Forest Plan Guideline 3114. Refer to Forest Plan Phase I Amendment, Appendix A for a description of the six vegetation structural stages.

Treatments within PFAs are proposed in Alternative B to reduce the risk for insect/disease and large-scale crown fire. Management of VSS stages, especially stands with ≥50% canopy cover will decrease the risk of MPB mortality within PFAs. Treatments proposed in Alternative B move the majority of all PFAs to the more open, younger age classes (VSS1, 2, 3 and 400) while reducing most older, closed canopy classes (VSS 450-600). For this alternative, VSS 400 will

dominate habitat within the PFAs due to treatments to reduce MPB infestation and the potential for large scale crown fire. Treatments that decrease the amount of VSS 450, 460, 500, 550, 600, and higher will have a negative, long-term effect on the balance of structural stages for the affected PFA, because those stages can only be obtained through growth over long periods of time (e.g. 50-80 years). Alternative B therefore moves away from achieving the desired balance of structural stages in the PFAs specified by Guideline 3114 (treated as a standard).

Alternative C treats hardwood inclusions in the Silver PFA, but treatments will not affect overall VSS of the conifer portion of the stands. Hardwood inclusions in larger conifer stands are being encroached upon by spruce, and through time will convert to spruce without treatment. These treatments were part of the design in Alternatives B and C to meet Forest Plan Objectives 201, 204, and 221 for the McIntosh Fen. Hardwood inclusions represent only a small portion of the larger conifer strands, and treatments would not affect the VSS category the stands are currently in.

The remainder of the stands that make up the known and potential PFAs are retained in Alternative C, and none of the stands are treated in Alternative D. Since the older, denser VSS (450, 500, 600) are currently deficient in all PFAs, these alternatives maintain those stands, as well as stands in the 400 VSS so they will be available to move into the more mature, dense VSS through time. While a portion of the 400 VSS stands could be treated to move them to the younger, more open VSS (VSS 1 and 2), it is expected that MPB effects will result in some of mature, denser VSS (450 and above, 400 with 40-49% canopy cover) moving into VSS 1 and 2. Since the extent and degree of the impact of MPB on PFA stands is somewhat uncertain at this time, maintaining all stands in VSS 400 and above represents a more conservative approach that will maintain options for the long term. Alternatives C and D do not provide the preferred balance of structural stages short term. However, by deferring treatments until the current MPB outbreak has passed, more options will be available for goshawk habitat management in the future as stands not subject to MPB mortality grow into the denser VSS classes. Alternatives C and D move toward achieving the desired balance of structural stages in the PFAs long term without precluding options, and therefore are consistent with Forest Plan Guideline 3114 (treated as a standard) for the northern goshawk.

All alternatives would increase prey base due to the residuals of slash, downed woody debris and snag levels in the Deerfield Project Area in the long-term. Forest Plan Standard 3111 directs that additional human-caused noise and disruption beyond that occurring at the time of nest initiation (e.g. road traffic, timber harvests, construction activities) be minimized within one-fourth mile of all active goshawk nests from March 1 through August 31, will be included as design criteria and thus be met for all action alternatives. Guideline 3113 (treated as a standard) directing that timber harvest schedules which cause simultaneous, widespread disturbance across active goshawk fledgling habitat be avoided from March 1 through September 30 will also be included as design criteria and thus be met for all action alternatives.

The northern goshawk is monitored Forest-wide (USDA Forest Service 2003c, 2004a). Forest-wide monitoring indicates the population trend for the northern goshawk is relatively stable or decreasing due to loss of nests to fire. Forest-wide habitat capability for the northern goshawk habitat is relatively stable over the past five years. However, nesting habitat trend appears to be decreasing due primarily to fire (USDA Forest Service 2004d). Alternative A would move toward Forest Plan Goal 221. For all action alternatives, Forest Plan Guideline 3114 (treated as a

standard) is not attained through management activities, but will likely be attained through MPB activity. Management activities in Alternatives A and D would have minimal affect on northern goshawk habitat; therefore these contribute to attainment of Forest Plan Goal 221. Alternative B and C provide for treatment within the goshawk PFAs but on a limited basis to reduce MPB activity within dense stands, therefore move toward attainment of Objective 221. All alternatives would contribute to Forest-wide northern goshawk population and habitat trends by varying degree.

For more details on the analysis of goshawk PFAs and vegetation structural stages, see the Deerfield Project file.

Osprey (*Padion haliaetus*)

The osprey is an avian MIS at the top of the aquatic food chain, which makes it a good indicator for detecting stream habitat loss, dwindling fish populations, and environmental contaminants (DDT). Their foraging habitat includes streams, shallow water estuaries, lakes, and rivers. Although 98% percent of their diet is fish, they eat other prey items (e.g. snakes, birds) and even carrion. Nesting habitat varies from cliffs and forested areas to electrical poles and chimneys that are within close proximity to suitable foraging habitat. Osprey may produce more young or nest in close proximity to each other when there is an increase in food abundance. Threats to this species include loss of suitable nesting habitat, pesticides, electrocution, drowning caused by fishing debris, shooting, and or decline of prey species.

In the Black Hills, osprey are known to nest on utility poles, snags, and nest platforms. In the Deerfield Project area, the osprey is associated with Mesic Coniferous Forest and Woodland, High Elevation Riparian Forest and Shrublands and Riparian/Wet Meadows ecological groups. Ospreys frequent the Deerfield Lake vicinity and permanent cold-water fisheries (streams) where fish are abundant. There have been frequent reports of osprey “fishing” in Deerfield Lake and surrounding areas but to date, there is no known nest in the area. It is highly probable that osprey will be nesting adjacent to Deerfield Lake in the near future.

All action alternatives increase habitat capability for the osprey by maintaining adequate nesting habitat adjacent to Deerfield Lake, in addition to the utility corridors that cross the project area near Deerfield Lake. MPB will affect denser tree canopies that will increase nest/roost trees short-term but reduce available nest trees long-term. All action alternatives would reduce mature trees that could be utilized for nests near the lake to varying degrees, with Alternative C having the greatest effect adjacent to the lake. In addition, all action alternatives would protect any potential nest sites to prevent disturbance during the nesting season. Prey species would not be affected the alternatives. Alternatives A and D have the greatest potential for large scale wildfire that could negatively affect prey species habitat and prey species availability within the Deerfield watersheds in the long term. All of the action alternatives increase existing habitat capability (.20) for osprey by varying degrees with Alternative B increasing habitat capability the most (.25) followed by Alternative C (.22) and Alternative D (.21).

Monitoring protocol has been developed for the osprey (USDA Forest Service 2003b, 2004c). Forest-wide monitoring of ospreys within the Black Hills indicates an increasing population trend. Habitat trend appears to be stable in the Black Hills (USDA Forest Service 2004d). All

alternatives would move toward Forest Plan Objective 218 and 221 for osprey. All alternatives contribute to maintaining or improving Forest-wide habitat and population trend.

Pygmy Nuthatch (*Sitta pygmaea*)

The pygmy nuthatch is closely associated with un-fragmented, unmanaged late-successional ponderosa pine forests. They are considered indicators of undisturbed mature pine forest. The habitats are used by other species such as the white-breasted nuthatch, red-breasted nuthatch, sharp-shinned hawk, and rare plants. The pygmy nuthatch breeds in nest cavities and usually excavates its own cavity or uses existing cavities in snags. This species is unusual in that it often breeds and roosts cooperatively. This species typically reaches their highest population levels in mature pine forests unaffected by disturbance and with a large number of standing dead trees (Ghalambor 2003). Abundance of this species positively correlates directly with snag density and foliage volume of the pine forest, but negatively with trunk volume, implying that the pygmy nuthatch needs diverse stands with a mixture of well-spaced, old pines and vigorous trees of intermediate age.

The pygmy nuthatch is considered insectivorous, seeking static insect food in needle clusters, cones, twigs, branches, and trunks of trees. These nuthatches forage higher in trees and further from the trunk than the white-breasted nuthatch or mountain chickadee. They will also forage on invertebrates, nuts, and seeds (Ghalambor 2003). Foraging habitat is very similar to nesting habitat with the majority of foraging occurring on large (>9”DBH), furrowed barked trees. In the Black Hills, this uncommon permanent resident in usually found at lower elevations (<5,550 feet) (Tallman et al. 2002). However, the pygmy nuthatch has been detected at higher elevations in ponderosa pine, late-successional pine, pine-juniper shrubland and white spruce habitats (Panjabi 2002-2005). Risk factors for this species are loss of suitable nesting and roosting habitat, with the loss of higher density of large snags, loss of un-fragmented, late-successional stands (high canopy density, low canopy patchiness and increased vertical density) through vegetative treatments, catastrophic fire, and loss of sufficient numbers of large cone-producing trees for food. Predators that affect adults and nest success include Accipiter hawks, jays, and squirrels. Population densities of some predator species generally increase in disturbed stands (Ghalambor 2003).

Attempts to restore ponderosa pine forests to their pre-settlement structure and function (prior to fire suppression) should have a positive influence on this species, especially if low intensity ground fire is utilized (Ghalambor 2003). Decades of fire suppression has also increased the risk of large stand replacing fires, thus the potential to destroy this species’ habitat. Large-scale epidemics of MPB that result in large amounts of tree mortality could have negative consequences on pygmy nuthatches because of the reliance on live pine tree foliage (Ghalambor 2003).

Alternative A provides the late seral stages and foliage volume preferred by the pygmy nuthatch, especially in the conifer ecological groups. Alternative D will be similar to Alternative A in providing late seral habitat by not treating SS3C or SS4C pine stands. MPB will continue to create snags and dying trees that will provide foraging and nesting substrates for this species. Conifer communities will continue toward climax conditions, thus increasing overall habitat components for this species. However, MPB effects have the potential to reduce patch size, forage availability, and structure of these late seral pine communities and increase the potential

for catastrophic wildfire, which could eliminate suitable habitat long-term. Alternatives A and D will move toward Forest Plan Objectives 218 and 221 for this species short-term.

Alternatives B and C decrease pygmy nuthatch habitat, the most in Alternative B followed by Alternative C, by reducing late seral stages and canopy densities in conifer communities, therefore reducing potential habitat for this species. Alternatives B and C reduce suitable habitat through treatments that reduce late seral habitats and other suitable habitat components. Patch sizes of dense, late seral stage conifer communities will be reduced through vegetative treatment.

Monitoring protocol has been developed for birds, including the pygmy nuthatch (USDA Forest Service 2003b, 2004c). The pygmy nuthatch is very rare in the Black Hills, and neither the current bird monitoring (Panjabi 2002-2005) nor the BBS routes will yield reliable trend estimates. Indications are that it is very difficult to monitor this species population trend due to its scarcity and unpredictable distribution. Forest-wide habitat trends appear to be stable to slightly decreasing (USDA Forest Service 2004d). MPB activity in the area will continue reducing this species habitat at a rate of 6-23% but will also create snags at the same rate.

Alternative A and D would not affect the pygmy nuthatch habitat, and therefore would contribute to Forest-wide habitat or population trends and attainment of Objective 221. In 2004, there were an estimated 178,540 acres of ponderosa pine in structural stages SS3C, SS4C, and SS5 Forest-wide (USDA Forest Service 2004b). In the Deerfield Project, there is an estimated 2, 293 acres of these ponderosa pine structural stages which represents 1% of the total amount of habitat available Forest-wide (USDA Forest Service 2004b). Alternative B will reduce SS3C and SS4C to 451 acres or 80% from existing. Alternative C will reduce SS3C and SS4C to 1727 acres or 25%. Both alternatives would enhance and conserve pygmy nuthatch habitat long-term by insulating suitable habitat from large-scale wildfire, provide large diameter trees, and potentially reduce MPB effects. Given the uncertainty regarding Forest-wide habitat and population trends for this species, it is difficult to determine what contribution Alternatives B and C would make toward those trends. It is possible but unlikely that either Alternatives B or C would affect Forest-wide pygmy nuthatch population or habitat trends or influence the attainment of Objective 221 short-term.

Regal Fritillary Butterfly (*Speyeria idalia*)

The Regal Fritillary Butterfly (*Speyeria idalia*) is an R2 Sensitive species which has been evaluated in the Deerfield Project Area and is discussed in the Final Deerfield BA/BE. This species appears to be restricted to intact native prairies dominated by little bluestem (*Schizachyrium scoparium),*western wheatgrass *(Pascopyrum smithii),* big bluestem *(Andropogon gerardii)* and green needlegrass (*Nassella viridula),* especially where violets provide a nectar source (Royer and Marrone 1992, NatureServe 2005) and other open sites including damp meadows, marshes, wet fields and mountain pastures (Opler et al 1995). This species relies heavily on *Viola spp.*, mostly the birdfoot violet (*Viola pedata),* in the spring for larval host plants. After hatching, the unfed caterpillar over-winters on the ground beneath leaves. Adult nectar plants may include hoary vervain, wild bergamot, milkweeds, thistles, and purple coneflower. This species is suspected to disperse to isolated mountain meadows. Suitable habitat is limited to larger native meadows in the Black Hills where native violets exist (Royer and Marrone 1992, Marrone 2002).

In the Black Hills, this species has been recorded in all South Dakota counties as transient or rare and only in suitable habitat (Royer and Marrone 1992, Marrone 2002). The Black Hills is on the very edge of this species range, which would account for sporadic observations on the Black Hills (Royer and Marrone 1992). Loss of adequate nectar sources (abundance and *Viola spp*.) is the limiting factor for this species (NatureServe 2005). Risk factors that may influence this species are drought, overgrazing by livestock, and habitat destruction and or habitat fragmentation through development and agricultural practices (haying and cultivation), biocide and herbicide use, fire, and invasion of non-native/non-prairie plants (Royer and Marrone 1992, Moffat and McPhillips 1993, Swengel 1995, 1997, NatureServe 2005).

The regal fritillary has been historically documented in the Deerfield Area but there are no current (last 5 years) observations within the area. Potentially suitable habitat occurs in the Deerfield Project Area in wet meadows, riparian areas such as Castle Creek, North Castle Creek, Ditch Creek, and upland grasslands of Slate and Reynolds Prairies. Pre-project monitoring of tawny-crescent butterfly sites within the Deerfield Area did not indicate presence of regal fritillary. Based on Royer and Marrone (1992) this species use of the area may be sporadic in nature or transitory based on natural factors (climate, precipitation). Most of the upland grassland and riparian community is privately owned and used for haying and grazing practices.

Alternative A will result in a denser pine-dominated forest and decrease plant and animal diversity short-term. Loss of grassland habitat due to conifer encroachment may affect suitable habitat and prey availability. The high probability of large-scale wildfire may cause direct mortality and reduce or eliminate nectar sources, especially during critical periods (April through October). Large-scale wildfire may increase or decrease suitable habitat depending on the timing, intensity and severity of the fire and the effects to the grasslands, especially if invasive species replace native communities.

All action alternatives will improve this species' habitat by increasing native grass/forb seral stage in treated areas. Alternative C followed by Alternative B and D will increase grassland communities in the project area. However, most treatments in riparian areas and grassland habitats will be accomplished through non-commercial thinning/pine encroachment and should not have a direct impact. Alternative B, C, and D will reduce the effects of MPB, thus reducing the potential for large-scale wildfire fire, especially during the spring summer season. Prescribed fire may negatively affect this species since most regal fritillary populations are localized and fragmented, and large scale prescribed fire may extirpate localized populations. Design criteria and mitigation measures will provide protection measures for this species and enhance native grassland communities.

Alternatives A and B allow OHV use within MA 5.1, with Alternative B reducing open road density from existing conditions. Alternative D followed by C will reduce open road density by varying degrees and restricts OHV use to designated roads/trails. Unregulated motorized travel may reduce available habitat directly or indirectly by fragmentation of native grassland habitat, spread of noxious weeds, degradation of riparian habitat, and compaction. Herbicide treatment of noxious weeds may negatively affect larval host plants and nectar plants, especially if large areas of grasslands/meadows are treated.

Monitoring protocol has been developed for this species (USDA Forest Service 2003c, 2004a). Forest-wide monitoring of the regal fritillary, has not established population status on the Forest, therefore population, and habitat trend for this species cannot be determined (USDA Forest Service 2004d). Alternative A will conserve habitat for the regal fritillary butterfly short-term but may not long-term. Therefore, this alternative moves toward meeting Forest Plan Objective 221. For Alternative A Forest-wide habitat trend would not be affected. The action alternatives contribute to the attainment of Forest Plan Objective 211. Forest-wide habitat trend would not be affected by the action alternatives because suitable habitat would be enhanced and conserved long-term by expansion of native grassland/wet meadow, insulating areas from large-scale wildlife from negative effects on nectar and host plants.

Townsend's Big-eared Bat (*Plecotus townsendii*)

The Townsend's big-eared bat (*Plecotus townsendii*) is an R2 Sensitive species which has been evaluated in the Deerfield Project Area and is discussed in the Deerfield BA/BE. The Townsend's big-eared bat is closely associated with mines, caves, snags, and adequate prey base (i.e. insects). Its habitat is also used by other species such as woodpeckers, small mammals, birds, reptiles, amphibians and invertebrates. The Townsend's big-eared bat inhabits a variety of habitats across its range that include shrub-steppe, forest edge, and pinon-juniper, mesic coniferous and deciduous forests.

The Townsend's big-eared bat is insectivorous and requires efficient use of its energy reserves. Distance from roosting sites to foraging and drinking areas is important and can have large repercussions on daily energy balance for this species. Roosting with groups and finding thermo-neutral habitats help with maintaining adequate daily energy reserves. Day and night roosts may include caves, abandoned mines, rock crevices, underneath bark, inside hollows of dead trees, and buildings under bridges, (Schmidt 2003b). Hibernacula and maternity roosts are usually caves, but occasionally mineshafts, or buildings. Hibernacula roosts are usually cooler and drier than for most *Myotis* species (Tigner and Aney 1994, Tigner and Stukel 2003). Maternity roosts are typically near riparian areas because of prey abundance (Schmidt 2003b). Caves with high humidity, cool temperatures, and numerous crevices and fractures are preferred for roosting. This species usually roosts on more open rock surfaces at underground sites where they are more susceptible to disturbance.

The Townsend's big-eared bat is recognized for their apparent site fidelity, or tendency to return yearly to the same maternity roost (Schmidt 2003b). Foraging habitat is usually described along heavily vegetated edges of water bodies, streams where prey species (moths) are most abundant (Schmidt 2003b, Tigner and Stukel 2003). Although the Townsend's big-eared bat have been found to roost in trees or snags in other portions of its range, roosting in trees or snags have not been documented in the Black Hills (SDBWG 2004, USDA Forest Service 2000a). Limiting factors are suitable maternity and hibernacula habitat. Risk factors for this species include roost disturbances, roost destruction, human disturbance during parturition or hibernation, availability and vulnerability of roost sites, a low reproductive rate, and habitat loss that affects prey base (Schmidt 2003b). Since this species habitat preference is caves and abandoned mines, the lack of suitable roost may be the limiting factor for most populations (Schmidt 2003b, SDBWG 2004, and Tigner and Stukel 2003).

The Townsend's big-eared bat has been found in the Deerfield Project Area in potentially suitable habitat. Limestone creates many crevices and small caves that could provide suitable maternity/hibernacula for this species. Several mines in the area could be potential habitat for this species. The project area provides snags and rock outcrops for roosting habitat, water sources, and riparian habitats.

For all the action alternatives, mitigation and design criteria provide protection of maternity and hibernacula habitats from harvest activities and reduce the impact from human disturbance. Alternative A provides abundant roosting and maternity sites, late seral stages, and decay processes. Alternative D will be similar to Alternative A in providing late seral habitat by not treating dense pine and spruce stands. MPB will continue to create snags and dying trees that will provide habitat. Abundance of prey items will increase somewhat by MPB activity. With Alternatives A and D, there is a high probability for large-scale wildfire, which could eliminate suitable habitat long-term. Alternatives A and D will conserve habitat for the Townsend's big-eared bat short-term.

Alternatives B and C would have the greatest potential to directly affect this species habitat. Alternative B would reduce snag habitat the most followed by Alternative C but may reduce the potential for large-scale wildfire. Heavy equipment could potentially collapse abandoned mines or caves that have not been identified prior to operations. Vegetation treatment near undocumented cave or mine entrances could change the interior microhabitat. Herbicide treatment could affect this species' prey base. Prescribed burning may improve foraging habitat by stimulating shrub development. Proposed watershed improvement projects will enhance riparian vegetation and improve foraging habitat.

Travel management that restricts recreational activity near critical bat habitat would protect bat habitat from disturbance to reproductive females, and reduce access for illegal fuel wood gathering. Alternative D will reduce open road density and OHV activity the most use followed by Alternative C. Alternative B reduces open road density less that Alternatives D and C but allows OHV use within MA 5.1. Unregulated motorized travel may reduce available habitat directly or indirectly by disturbance to roost sites and a reduction in snag densities.

Monitoring protocol has been developed for bats, including Townsend's big-eared bat (USDA Forest Service 2003b, 2004c). Forest-wide monitoring indicates that the Townsend's big-eared bat population trend is stable to slightly increasing (USDA Forest Service 2004d). The substantial protection hibernacula habitat provided in 2003 reflects and upward trend in known bat habitat (USDA Forest Service 2004d). Alternative A and D would not affect Townsend's big-eared bat habitat, and therefore would not influence Forest-wide habitat or population trends or attainment of Objective 221. Alternatives B and C would protect all known caves and mines through design criteria and mitigation measures. These alternatives will reduce snag densities and large diameter snags but snag densities will be above FP levels due to MPB activity. In addition, these alternatives will provide large diameter green trees on the landscape long-term. Therefore Alternatives B and C would have no affect on Forest-wide fringed myotis population or habitat trends or attainment of Objective 221.

Species of Special Focus

State Listed Species

South Dakota Natural Heritage Database (SDNHP 2002, 2005) tracks wildlife and plant species that are considered uncommon or rare in the state. Species listed as threatened or endangered by the State of South Dakota (SDNHP 2002, 2005) that occur or may occur in the Deerfield Project Area include the American dipper, peregrine falcon, bald eagle, osprey, and black bear. The peregrine falcon and bald eagle are discussed in the Deerfield BA/BE. The osprey is discussed as an MIS species. Although habitat may be suitable for the American dipper and black bear, these species have not been documented in the Deerfield Project Area. A list of the South Dakota Heritage Programs species of concern, for which records indicate at least historical occurrence, current presence in the project area, or have suitable habitat, is found in the Wildlife and Botany Specialist Report, Appendix C. A list of plants found during plant surveys is in the Deerfield Project File.

The Deerfield Project Area as described through the eight different ecological groups. Marriott et al. (1999, 2000) provides habitats where many state species of concern have been found. Many of the species of concern or emphasis can be managed following Forest Plan Goals, Objectives, Standards, Guidelines and implementing project design criteria, mitigation measures, and/or Best Management Practices (BMPs). These design criteria will protect wildlife and plant species and their habitats, including but not limited to management specifically for R2 Sensitive species and MIS (See Deerfield BA/BE and Deerfield Wildlife and Botany Specialist Report). All of the action alternatives will move toward meeting Forest Plan Objectives 217, 218, 220, and 221 for maintaining species diversity in the Deerfield Project Area.

Snails

The Forest Plan provides direction to ensure that all snail colonies identified by Frest and Johannes (1993, 2002) are protected from adverse effects of livestock use and other management activities (Standard 3103). Species identified by the Forest Plan include one R2 Sensitive snail species, one MIS snail species, and an additional five snail species. The Monitoring Implementation Guide (USDA Forest Service 2003a, 2004c) established Forest-wide monitoring protocols for snails, as directed by the Forest Plan. Refer to the annual Monitoring Reports (USDA Forest Service 1998-2005) for results and additional information.

The R2 Sensitive species, Cooper's Rocky Mountain snail is discussed in the Draft Deerfield BA/BE. The Forest Plan MIS species, Cockrell's striate disc is discussed in the MIS section of this document. Most of the Frest and Johannes sites are adjacent to roads, and are not adequately protected from land management activities, including recreational use. These sites are not protected due to the difficulty in protecting them from indirect negative impacts associated with their proximity to roads (i.e. provide public safety, noxious weed treatment).

Effects of the alternatives would be similar to the effects to all land snails found in the area. Habitat requirements for the Cooper's Rocky Mountain snail and the Cockerel's striate disc are similar to other land snails. All action alternatives will avoid known Frest and Johannes snail

colonies through design criteria. Therefore, all alternatives will meet Forest Plan Standard 3103. For analysis results and additional information, see the Deerfield Wildlife and Botany Specialist Report and the Deerfield BA/BE.

Bats

The Forest Plan provides direction related to bat habitat, specifically "for caves … manage to protect or enhance biological, … ecological, … and physical characteristics … avoid ground disturbance within 500 feet of an opening of a natural cave … take measures to prevent human caused changes in cave ecosystem, … air flow, humidity, or temperature regimes" (Guideline 1401, treated as a Standard). Guideline 3102 (treated as a Standard) specifies, "Where caves and mines are important nurseries or hibernacula for bats protect the caves and mines and their microclimates when designing management activities (e.g. timber harvest, road construction, recreation facilities) protect known bat day and night roosts." and also "protect known bat nursery roosts and hibernacula" (Standard 3207). The Monitoring Implementation Guide (USDA Forest Service 2003a, 2004c) established monitoring protocols for bats, as directed by the Forest Plan. Refer to the annual Monitoring Reports (USDA 1998 - 2005) for results and additional information.

The South Dakota Natural Heritage database contains records of two R2 Sensitive bat species, Townsend's big-eared bat (*Plecotus townsendii*) and fringed myotis (*Myotis thysanodes*). These two species are discussed in the Draft Deerfield BA/BE. In addition, other bat species have been found in the Deerfield Project Area: Big Brown Bat (*Eptesicus fuscus*), Western Small-footed Myotis (*Myotis ciliolabrum*), Long-legged Myotis (Myotis volans), Northern Myotis (*Myotis septentrionalis*), Eastern Pipistrelle (*Pipistrellus subflavus*), and probably Little Brown Bat (*Myotis lucifugus*).

Due to the presence of limestone, there is high potential for bat habitat in the form of natural caves. Several mines in the area provide critical habitat for bat species (Schmidt 2003a, 2003b). The project area also provides snags and rock outcrops for roosting habitat, as well as other habitat features important to bats such as water sources and riparian habitats.

All alternatives would move toward meeting Forest Plan Objective 221 and Standards and Guidelines 3102, 3207-3208 for bat habitat in the area to varying degrees. Alternative A would not directly affect bat habitat. Ongoing MPB mortality would increase prey base and potential habitat (snags/dead trees) in the short term, but this alternative has the greatest potential of large scale crown fire, which could reduce prey base and may impact bat habitat long-term. Alternative D may have the similar effects as Alternative A. Alternative B and C would reduce snag habitat for bat species that require this type of habitat. These alternatives would reduce the potential for large scale wildfire, thereby maintaining prey habitat. For all the action alternatives implementation of design criteria and mitigation will provide protection of maternity and hibernacula habitats from harvest activities, reduce the impact from human disturbance, and, if necessary, allow bat friendly structures to be installed in critical habitat (mines and caves) within the next 10-15 years. Travel management that restricts recreational activity near critical bat habitat (Alternatives C and D) would protect bat habitat from further disturbances.

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 Black Hills National Forest 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.

A variety of Forest Plan objectives, standards, and guidelines further the conservation of migratory birds. The most relevant objectives for bird conservation are those relating to vegetation diversity, landscape structural diversity, snags and down woody material, riparian condition, habitat improvements, and disturbance processes (see Forest Plan Objectives 201-232). The most relevant standards and guidelines to migratory birds are 2101-2109 (Forested Landscapes), 2201-2208 (Hardwoods and Shrubs), 2301-2308 (Snags and Down Woody Material), 2505-2508 (Proper Use or Residual Levels – Riparian/Uplands), 3101-3115 (Endangered, Threatened or Sensitive Species Protection and Management), and 3202-3212 (General Fish and Wildlife Direction).

Bird monitoring is conducted at the Forest-level to determine species distribution, abundance, and trend (Panjabi 2002-2005). 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 will assist the Forest in determining whether additional conservation measures are necessary.

Species of concern applicable to project-level conservation are identified by many sources including the Endangered Species Act, the Regional Forester's Sensitive species list, and the Black Hills National Forest Management Indicator Species (MIS) list. All of the above sources and their respective species of concern have been examined in the MIS section of this document and/or in the Draft Deerfield BA/BE. For migratory bird species, the USFWS (USDI Fish and Wildlife Service 2002) has provided additional Bird Species of Conservation Concern (BCC) Watch list and the National Partners in Flight Program (PIF) has identified priority lists of PIF species (Rich et al. 2004) which is geared to increase conservation efforts throughout North America. BCC and PIF species that have been identified as needing priority can be found in the Deerfield Wildlife and Botany Specialist Report.

The Deerfield Project area as described through the eight different ecological groups (Marriott et al. 1999, 2000) provides habitat for many migratory birds. Habitats for many of the BCC/PIF species is managed following Forest Plan goals, objectives, standards, and guidelines, project level design criteria, mitigation measures, and/or Best Management Practices (BMPs).

Butterflies

The regal fritillary (*Speyeria idalia*) and the Ottoe Skipper (*Hesperia ottoe*) are R2 Sensitive butterfly species. Both species are discussed in the Draft Deerfield BA/BE. Other rare butterflies such as the atlantis fritillary (*Speyeria atlantis pahasapa*) and the tawny crescent (*Phycoides*

batesii) have also been have been documented in the Deerfield Project Area. For these four species, habitat requirements and preferences are similar. Wet meadows, riparian areas, and upland grasslands of Reynolds and Slate Prairies are suitable habitat, where host plants (*Viola* spp.) and grass plant associations (*Sporobolus heterolepis / Stipa richardsonii/Danthonia intermedia*) are available along with nectar sources.

Management activities within the montane grassland and riparian/wet meadow/fen plant associations would include those that enhance nectar and larval host species for these and other invertebrates, enhance or restore native grassland communities, native wet meadow communities, and riparian areas in the Deerfield Project Area. Effects to these species habitats are discussed in the Grassland and Riparian Community sections of this FEIS, Deerfield BA/BE and the Wildlife and Botany Specialist Report.

Threatened, Endangered Species and Sensitive Species

The Deerfield Biological Assessment/Biological Evaluation (BA/BE) has been completed for the Deerfield Project Area and can be found in the Deerfield Project File. The effects of the various alternatives and activities proposed were evaluated for all Endangered, Threatened, Proposed, and Sensitive species, and their habitats.

The U.S. Fish and Wildlife Service website (http://southdakotafieldoffice.fws.gov) was consulted on May 3, 2005 to determine the current list of Threatened, Endangered, or Proposed species that occur or potentially occur, or for which suitable habitat exists in the Black Hills. The website identified the bald eagle (*Haliaeetus leucocephalus*, threatened) and black-footed ferret (*Mustela nigripes*, endangered) as federally listed species for which potentially suitable habitat occurs in the Black Hills. The bald eagle occurs in some locations in the Deerfield Project Area, particularly near Deerfield Lake and Reynolds Prairie, as a winter resident or seasonal migrant. There are no known bald eagle nesting sites in the Deerfield Project area. A determination of “No Effect” was made for the bald eagle for all alternatives in the Deerfield Project Area.

Although there are grasslands in the Reynolds and Slate Prairies portion of the Deerfield Project area, soil conditions are not conducive for black-tailed prairie dogs (for burrowing), primary prey species for the black-footed ferret. Therefore, there are no known locations of the black-footed ferret or its habitat in the Deerfield Project Area. There are no known Threatened, Endangered, or Proposed plant species on the Black Hills National Forest.

R2 Sensitive wildlife species known to occur in the Deerfield Project Area include fringed myotis, Townsend’s’ big-eared bat, American marten, northern harrier, northern goshawk, black-backed woodpecker, American three-toed woodpecker, Lewis’s woodpecker, grasshopper sparrow, northern leopard frog, Black Hills red-bellied snake, and regal fritillary butterfly, lake chub and mountain sucker. Other R2 Sensitive wildlife species that may occur in the project area include yellow-billed cuckoo, American peregrine falcon, flammulated owl, loggerhead shrike, Cooper’s mountain snail, and the Ottoe skipper.

Three R2 Sensitive plant species, lesser yellow lady’s slipper, sageleaf willow (*Salix candida*), and autumn willow (*Salix serissima*) are known to occur in the project area. Other R2 Sensitive

plants that may occur in the Deerfield Project Area include prairie moonwort (*Botrychium campestre*), narrowleaf grapefern (*Botrychium lineare*), leathery grapefern (*Botrychium multifidum*), trailing clubmoss (*Lycopodium complanatum*), large roundleaf orchid (*Platanthera orbiculata*), highbush cranberry (*Viburnum opulus var. americanum*), and the great-spurred violet (*Viola selkirkii*).

For R2 Sensitive species, Alternative A would not implement Forest Plan direction, the Forest Plan Phase I Amendment, and/or any project specific action or mitigation measures that have been developed to protect wildlife and botanical resources in the Deerfield Project area.

For all R2 Sensitive species all action alternatives "may adversely impact individuals, but not likely to result in a loss of viability in the Planning Area, nor cause a trend toward federal listing. All known locations of R2 sensitive species will be protected through Forest Plan Standards and Guidelines. Design criteria and mitigation measures specified in the Deerfield BA/BE will provide additional protection to their habitat and to individuals (See Deerfield BA/BE for details and information).

Threatened, endangered, and R2 sensitive species, both plant and animal, are included as monitoring items in the Monitoring Implementation Guide (USDA Forest Service 2003a, 2004c) to be monitored Forest-wide as directed by the Forest Plan. Refer to the annual Monitoring Reports (USDA Forest Service 1998 - 2005) for monitoring results and additional information.

Roads and Travel Management

Forest Plan direction regarding roads and travel management Forest-wide specifies in Standard 9101 that "newly constructed Forest Development roads are open all year to appropriate motorized vehicle use, unless a documented decision shows … seasonal travel restrictions are required … to prevent unacceptable wildlife conflict or habitat degradation." Guideline 9108 (treated as a standard) specifies that vehicle traffic … will be restricted to roads and trails in riparian areas. The Forest Plan provides additional road and travel management direction specific to Management Areas. Forest-wide road mileage and off-road vehicle access are included as monitoring items in the Monitoring Implementation Guide (USDA Forest Service 2003a, 2004c) to be monitored as directed by the Forest Plan. Refer to the annual Monitoring Reports (USDA Forest Service 1998 -2005) for monitoring results and additional information.

The extensive road network in the Black Hills has multiple negative effects on wildlife habitat, including direct conversion of habitat to roads, construction in riparian areas and meadows, and decreased habitat quality for some species. Roads and associated motorized traffic negatively affect many wildlife species. Direct effects include road-kill, harassment, and disturbance, especially during critical periods like winter and the nesting season. Indirect effects on habitats include improved access for recreation, fuel woodcutting (which decreases snag densities), and poaching, as well as riparian area degradation from illegal motorized vehicle use. Roads also facilitate the spread of noxious weeds, which displace native vegetation and cause increased expense and effort to control or eradicate. Such indirect effects apply to varied species such as mountain lions, bats, snails, small mammals, and many birds (USDA Forest Service 2000).

Roads displace habitat and their use can disturb wildlife and decrease habitat suitability and availability for most species, but especially big game. The GIS HABCAP model incorporates open road density along with the amounts and special distribution of cover and forage areas to calculate habitat effectiveness for big game species only. Effectively closing roads, either through seasonal or yearlong travel restrictions or road decommissioning (elimination), decreases the amount of vehicular travel and subsequent human disturbance, thus providing big game and other wildlife species relatively undisturbed habitats. Areas free from disturbance are particularly important during the critical winter period when animals are already stressed by weather conditions. Table 3-22 summaries the miles of road within the Deerfield Project Area by each alternative.

Table 3-22 Total road miles in the Deerfield Project Area (by Alternative).

Miles of Road	Alt. A	Alt. B	Alt. C	Alt. D
Existing Road	292	292	292	292
Private Road	19	19	19	19
Roads Decommissioned[1]	14	20	39	73
Roads Closed Year-round[2]	59	63	84	76
New Construction	0	5	5	2
Total N.F. Roads	259	258	239	202
Total N.F. Open Roads	200	195	155	126

[1] Includes past decisions requiring road/trail obliteration and/or decommission independent of the Deerfield Project.
[2] Includes past decisions requiring yearlong motorized travel restriction independent of the Deerfield Project.

Big game habitat security and habitat effectiveness are reduced by the presence of roads and the human disturbance associated with them. Road access equates to an increase in the 'vulnerability' of big game to hunters as well as illegal poachers. Elk tend to avoid areas near roads with traffic, human disturbance associated with roads, trails, logging, and other activities can influence elk habitat selection (Lyon and Ward 1982, Harthun-Holte 2003). Rowland et al. (2000) found that cow elk in Oregon consistently selected areas away from open roads in both spring and summer during calving season. Harthun-Holte (2003) found in the Black Hills that total road density has a greater effect than primarily or secondary roads combined. Elk in Custer State Park responded to ATVs with long distance displacement from the disturbed area (Millspaugh 1995). Harthun-Holte (2003) suggests that elk are unable to select for sites with less road density when they are not available due to road pattern and distribution in the Black Hills. In addition, Harthun-Holte (2003) suggests that landscape road pattern may have a greater influence on elk than overall road density, where elk concentrated in areas with larger portions of land not transected by roads.

The effects of roads on big game have been most studied with elk (Christensen et al. 1993) and deer, but it also applies to many other species of wildlife (Fecske 2003). For example, experts interviewed for the Phase I Amendment indicated roads negatively affect (from human disturbance or the roads themselves) sensitive plants, woodpeckers, American marten, bats, northern goshawk and several other bird species, snakes, butterflies and snails (USDA Forest Service 2000). Nesting birds may abandon nests due to human disturbance, and roads can present a physical barrier to some species like snails and small mammals. Roads can increase visibility and indirectly increase mortality from predation in species like amphibians and small mammals (Smith 2003, Smith and Stephens 2003, Fecske 2003, USDA Forest Service 2000). Vehicles can cause direct mortality from collisions with wildlife (e.g. big game, snakes, birds, small mammals, butterflies). Collisions with vehicles accounted for mortality of 1400 deer/year

in the Black Hills during the 1990s (Parrish et al. 1996). Vehicles can be the cause of additional indirect mortality by allowing easy human access to hunt, poach, collect, or otherwise kill a variety of game and non-game species (USDA Forest Service 2000).

Recurring disturbance can negatively affect foraging, courtship, mating, and reproductive activities of most wildlife species to varying degrees. Fecske recommends minimizing human/mountain lion interactions in optimum habitat (remote areas of the BHNF) by reducing open road density and restricting motorized access. People often bring pets (primarily dogs) on recreational visits that can harass and kill game and non-game wildlife. Access for illegal plant and animal collection is made easier by roads. In general, roads tend to increase human visitation, which in turn decreases wildlife seclusion, interferes with reproductive success, and causes increased energy expenditures.

The existing, overall total road density in the Deerfield Project Area (both NFS and private) is 4.3 miles/square mile with over 292 miles of existing roads. Approximately 39 miles of road are arterial (county jurisdiction) or private roads, 171 miles of Forest System roads with an addition 82 miles of non-system roads and trails. Road densities include all types of roads, from user-created two-tracks to paved highways. Unclassified roads, or user-created roads not maintained by the Forest Service, account for 28-30% of all roads in the area. Table 3-23 summaries motorized travel management proposed in each alternative.

Table 3-23 Road densities on National Forest System lands in the Deerfield Project Area

	Alt. A	Alt. B	Alt. C	Alt. D
Total Road Density[1]	4.6	4.6	4.2	3.6
Open Road Density[2]	3.6	3.5	2.8	2.2

[1] Based on NF acres – 36,105 (56.41 square miles) - includes road prisms still on the landscape (year-round).
[2] Based on NF acres - 36, 105 (56.41 square miles) - roads that are open to motorized travel (not restricted).

The proximity of the Deerfield Project Area to Deerfield Lake Recreation Area along with ease of access via paved highways and county maintained gravel roads contributes to concentration of recreation use (fishing, camping etc). Private rental concessionaires of snowmobiles and ATVs in the Deerfield Project Area provide services and access to an extensive snowmobile trail system, along with an extensive network of forest system roads. User created trails increase the high levels of on and off-road motorized and non-motorized use throughout the entire area. The developed recreation area along with unregulated recreation use on an extensive road system lowers wildlife seclusion values by increasing the frequency and number of human/wildlife interactions in the area. The road system fragments habitat and creates edges that adversely affect some species.

Finally, habitat availability and capability in an area is reduced by the fact that roads remove habitat. One mile of road, 20 feet wide equates to 2.4 acres of habitat loss. For the Deerfield Project Area with 292 miles of roads on National Forest lands, about 700 acres or over one square mile of wildlife habitat is lost due to roads, nearly one third of which is due to unclassified roads.

Alternative A continues with current travel management direction, allowing cross-country use throughout most of MA 5.1. User created trails will continue to increase in the Deerfield Project Area, largely the result of areas being open to cross-country use. Travel Restrictions in MA 3.1

and 8.2 and a portion of 5.1 (motorized use on designated trails only) will remain. Total road density on NFS land for Alternative A would be 4.6 miles per square mile, with open road density at 3.6 miles per square mile. Negative effects to wildlife habitat and species related to current road and travel management direction are presented above. These effects include increased road-kill, harassment, poaching and disturbance to species, removal or degradation of habitat, and increased spread of noxious weeds.

Alternative B is very similar to Alternative A. It allows cross-country travel over most of MA 5.1. User created roads would expand over time. Existing area closures affected MA's 3.1, 8.2 and a portion of 5.1 would remain in effect. For Alternative B, total road density would be 4.6 miles per square mile (same as Alternative A), with open road density slightly below Alternative A at 3.5 miles per square mile. The effects to wildlife habitat and species related to road and travel management would be similar to the Alternative A.

Alternatives C and D would continue with current travel management for MA 3.1 and 8.2. In MA 5.1, motorized travel would also be restricted to designated routes, with no cross-country motorized travel permitted. Watershed problems associated with existing roads/trails would be corrected. For Alternative C, road density would be reduced from Alternatives A and B to 4.2 miles per section. For Alternative D, road density would be reduced to 3.6 miles/section. Road density will be the lowest compared to all of the other alternatives. Open road density would be reduced to 2.2 miles per section, where open road density will be the lowest compared to other alternatives.

Wildlife Cumulative Effects

Cumulative effects take into account activities or events through time (past, present, and reasonably foreseeable future activities), and through space (activities on adjacent Forest Service lands as well as private lands). The Forest Plan addresses the Forest as a whole in terms of cumulative effects at the landscape scale. The Forest Plan Monitoring Implementation Guide (USDA Forest Service 2003a, 2004c) provides guidance to implement the monitoring and evaluation requirements of the Forest Plan.

For Deerfield, the area analyzed for cumulative effects is the project area. The size of the cumulative effects analysis area is large enough to include the home range of most wildlife species considered. Cumulative effects vary among species due to the diversity of habitat required by the various species. Vegetation treatments in the Deerfield Project Area would improve habitat for some species at the expense of others. Proposed activities that may contribute to cumulative effects include non-commercial and commercial timber harvest, prescribed burning, roads, and travel management (reconstruction, decommissioning, closures, etc.)

Numerous past events and activities have influenced the condition of wildlife habitats in the Deerfield Project Area. Past activities or events considered include fire suppression, wildfires, timber harvest, mining, weather-related events, livestock grazing, insect infestations, and residential development. Some of these activities or events have been affecting the project area for over 100 years. Perhaps the most influential effect on wildlife habitat in the Black Hills and the Deerfield Project Area has been suppression of wildfire. Historically, more open pine stands interspersed with meadows, shrubs, and hardwoods dominated the Black Hills because of

relatively frequent low-intensity fires. A century of fire suppression has resulted in increasingly dense and dominant pine communities with higher levels of natural fuels characteristic of later successional communities. Fire suppression has also caused reductions in early successional communities like meadows, shrubs, and hardwoods due to encroachment of conifers. Species associated with early successional conditions and communities have been negatively affected by fire suppression, while species associated with later successional conditions and communities have benefited. Fire suppression will continue to influence habitats in the Deerfield Project area, regardless of alternative selected.

None of the alternatives analyzed would negatively affect SS5 forest-wide. There is currently is no SS5 in the Deerfield Project Area. Moreover, as the existing designated stands within the Deerfield Project Area are managed for late successional objectives, over time they will contribute to the SS5 component forest-wide. Timber harvest has occurred in the area since the early 1900's. Over the last two decades, commercial and non-commercial treatments have occurred on two-thirds of the NFS lands in the project area. Refer to the Silvicultural Report for further discussion of past vegetation treatment activities in the Deerfield Project Area. Cumulative effects of past and current timber management activities include moving much of the dense, mature conifer forest that resulted from fire suppression toward younger, more open stands. Older (>160 years), larger diameter class stands were harvested, and medium-aged stands were precluded from achieving late successional character through treatment. The Bugtown Gulch Project, approximately six air miles southeast of the Deerfield Project Area is currently being considered for treatment to reduce the effects of the epidemic MPB activity. The Coulsen (DN June 2004) and Canyon/Nest (DN March 2003) Projects adjacent to the Deerfield Area, will be treated to reduce the effects of widespread MPB activity and to reduce fire hazard. This project will likely reduce late seral and mature ponderosa pine forest to more open canopied, younger seral stages of ponderosa pine. In addition, several small salvage sales (West Mystic Bugs Projects) have sanitized stands in the southern end of the Project Area.

The incremental effect to late successional conditions resulting from vegetative treatment in the Deerfield Project, combined with other projects on Mystic Ranger District and the forest, will probably reduce the amount of SS4B and SS4C forest-wide. Vegetative diversity in terms of species composition, structure, and late succession are included as monitoring items (i.e. 7a, 7b, and 8) in the Monitoring Implementation Guide (USDA Forest Service 2003a, 2004c) and are monitored Forest-wide as directed by the Forest Plan (USDA Forest Service 1998-2005). It is expected that Forest-monitoring will demonstrate that mature late seral ponderosa pine will be maintained to meet Forest Plan desired condition. Commercial and non-commercial treatments proposed in the Deerfield Project Area would continue this trend by setting back succession relative to the acreage treated, further contributing to cumulative effects of past timber management activities. The change from mature, dense forest to younger, open canopy forest has benefited and will continue to benefit species associated with those habitats such as foraging big game and foraging goshawk. Conversely, species associated with mature, closed-canopy pine habitat such as the brown creeper, pygmy nuthatch, black-backed and American three-toed woodpeckers and nesting goshawk will continue to be negatively affected.

Present and reasonably foreseeable future activities are those activities ongoing and anticipated in the project area. These activities include continued fire suppression, current or foreseeable

actions to manage forested stands for health and timber products, road maintenance, noxious weed treatments, livestock grazing on both private and National Forest lands, residential and road development on private lands, and recreation use. Recreational activities include fishing, hunting, hiking, camping, ATV and dirt bike riding, horseback riding, and mountain biking and snowmobile use. Residential development on private lands and recreational use of the area (especially ATV use) is expected to increase, along with associated trails and user-created roads. Increased use correlates with increased disturbance to wildlife. As discussed, salvage of MPB affected stands is ongoing, along with fuel treatments to reduce fuels created by salvage operations within the watersheds of Deerfield Project Area (see MPB Treatment map held in the Project File).

Changes in ponderosa pine communities will vary by alternative. Alternative A would not contribute to cumulative effects of past harvest. All of the action alternatives will reduce seral stages of ponderosa pine, depending on the amount and type of treatment. Table 3-24 summarizes the changes in structural stages projected to occur over the next 20 years. Structural stage outcomes incorporate an estimate of MPB mortality.

Table 3-24 Projected Ponderosa pine structural stage in twenty years as a result of management by alternative (number(s) are approximate).

Structural Stage		**Alt. A[1]**		**Alt. B[2]**		**Alt. C[3]**		**Alt. D[4]**	
1	Grass/forb	3147	11	728	3	918	3	2400	9
2	Seedling/sapling	696	3	696	3	696	3	696	3
3A	Young, open canopy	734	3	2551	10	821	3	798	3
3B	Young, variable canopy	0	-	74	<1	0-	-	11	<1
3C	Young, closed canopy	76	<1	95	<1	153	<1	87	<1
4A	Mature, open canopy	4171	15	8660	31	7508	28	5936	22
4B	Mature, variable canopy	9288	33	11355	41	12231	45	10008	36
4C	Mature, closed canopy	9762	35	3373	12	4842	18	7625	27
5	Mature, decadent	0	-	0	-	0	-	0	-

[1]Acres (percent)

Alternatives B and C propose active management within American marten optimum habitat, which would result in decreasing, patch size and increased edge within these stands. Doing this will require a Forest Plan amendment. No other project selected action on the Forest has resulted in a reduction of American marten habitat that required a Forest Plan amendment for Standard 3215. The amount of habitat affected represents .02% (Alternative B) and .01% (Alternative C) of the total amount marten habitat available Forest-wide.

Alternative B proposes active management of goshawk PFAs and nest stands. Cumulatively, natural large-scale disturbances such as wildfire and MPB activity are more likely to decrease the amount of suitable nesting habitat for this species. No other project selected action on the Forest has specified treatment within goshawk nest stands that required a Forest Plan amendment. It is unlikely that Alternative B will have a negative effect on Forest-wide trends for this species.

Species that require denser canopies and late successional stand structure in conifer communities such as big game, American marten, brown creeper, pygmy nuthatch and northern goshawk will

be least affected by Alternatives A and D. Alternatives B and C will reduce a majority of the dense canopied stands and late succession stand structure. Treatments through small projects (e.g. West Mystic Bug Projects) to counter the current MPB epidemic in the area have reduced crown densities in some stands that were heavily infested with MBP.

Past treatments have also affected snag densities by decreasing the number of trees available to become snags. The current MPB outbreak has affected portions of mature, dense pine habitat in the southern portion of the project area in addition to the south and west of the Project Area. Treatments along with MPB mortality in the Deerfield Project Area will change late seral ponderosa pine communities to early seral communities. MPB mortality increases snag densities short-term. However, snags created by insect and disease decay at a faster rate therefore snags will not be available long-term. Firewood gathering has also reduced snag densities. Firewood gathering regulations on the Forest were modified in 2000 to restrict cutting of snags, which should result in increased snag densities throughout the Forest. Due to MPB mortality and fuel loading concerns, designated areas for fuel wood gathering occur in the project area, allowing the cutting of standing dead trees in some areas (See Silviculturist and Fire/Fuels Specialists Reports). Trees actively infested by MPB that will soon become snags will be reduced through management activities and fuel wood gathering. However, there are areas with high mortality that cannot be treated (>40% slopes) or accessed throughout the Deerfield area. These stands will contribute to Forest Plan snag density levels short-term. Alternatives A and D will provide increased snag densities short-term but may not provide green tree replacements for future snags long-term. Alternatives B and C will reduce actively infested trees that would soon become snags and green tree replacements short-term but may provide green tree replacements for future snags long-term.

Thirty three percent of MA 8.2 is in native grassland communities, which is probably less than historical conditions. Much of this occurs in the area called Reynolds Prairie. Pine encroachment and lack of fire has negatively influenced this community. Alternative B and C propose treatments to restore grassland communities, enhance visual qualities, protect facilities, protect the public from wildfire, and reduce the effects of MPB. Alternatives B and C reduce habitat effectiveness for big game that would require a Forest Plan amendment in MA 8.2. No other project analysis on the Forest has resulted in a decline in habitat effectiveness values for MA 8.2 under the 1997 Forest Plan, as amended. An emphasis on recreation in this management area has the potential to conflict with big game use of the area. It is unlikely that Alternatives B and C will have a negative effect on Forest-wide trends for these species.

In MA 5.1, treatments in Alternative B will reduce white-tailed deer and elk (winter) habitat effectiveness values. This will require a Forest Plan amendment. The Canyon/Nest Project (DN March 2003), west of the Deerfield Project Area amended the Forest Plan to allow for a reduction in elk habitat effectiveness. The Coulsen Project (DN June 2004), southwest of the Deerfield Project amended the Forest Plan to allow for a reduction in elk and deer (winter) habitat effectiveness values. These projects along with Alternative B could result in nothing more than a minor reduction in the use of this large area by these species. Vegetative diversity in terms of species composition and structure, forage production, rangeland trend and forage utilization are included as monitoring items (i.e. 7a, 7b, and 8,15, 16, 17) in the Monitoring

Implementation Guide (USDA Forest Service 2003a, 2004c) and are monitored Forest-wide as directed by the Forest Plan (USDA Forest Service 1998-2005a).

In addition, big game (MIS) habitat is monitored Forest-wide as Monitoring Item 26. Recent forest-wide monitoring indicates that hardwood and grassland communities have increased by approximately 5-8%. Forage utilization that incorporates livestock stocking levels indicates that enough forage is available for big game population numbers (USDA Forest Service 2004b). The elk population is estimated at or near South Dakota Game, Fish and Parks goal of 4,190 elk. Forest-wide monitoring indicates habitat trend is increasing. Deer population is approximately 46,000, being stable over the past five years. Forest-wide monitoring indicates that summer habitat trend is increasing and winter habitat trend has remained stable (USDA Forest Service 2004b). It is unlikely that the action alternatives will have a negative effect on Forest-wide trends for these species.

Catastrophic beetle outbreaks and occasional large stand replacing fires occurred historically (McIntosh 1948) that have influenced the composition and structure of the Deerfield Area (Shinneman and Baker 1997). It is evident through Illingworth's (1939) photos and historical aerial photos that large stand replacing fires have occurred in the Deerfield Area, creating a mosaic of late seral forest, early seral forest, hardwoods, and grassland communities. Shinneman and Baker (1997) described historical stand conditions similar to the current conditions found in the Deerfield area that would initiate catastrophic stand replacing disturbances such as MPB epidemics and stand replacing fire. In recent history the Deerfield Project Area has been spared from large-scale wildfires that have occurred in other areas across the Black Hills. The area is now affected by a MPB epidemic. Numerous, primarily small wildfires have occurred in and adjacent to the project area over the past several decades. The 82,000 acre plus Jasper Fire extended to within 4 miles south of the project area in 2000. Proposed activities, including commercial and non-commercial harvest and prescribed burning, have been specifically designed to reduce the potential for catastrophic wildfire and large scale MPB infestation in the Deerfield Project Area. The extent of the potential reduction is directly related to the type of treatments and acreage affected as proposed in each action alternative. Severe wildfire and MPB potential is reduced the most in Alternative B, followed by Alternative C with the least in Alternative D, and would increase in Alternative A. Refer to the Fire and Fuels Report for the Deerfield Project Area for additional discussion of wildfire and effects of proposed treatments. The Silvicultural Report provides further details on the MPB situation. Catastrophic wildfire can drastically alter or eliminate, ecologically valuable communities, wildlife habitat for most species long-term, and recovery of soils and vegetation can take decades. Management of pine ecosystems through even-aged silviculture may be appropriate where restoration efforts are required to preserve small, remnant old-growth patches, or ecologically valuable areas from impending destructive disturbances (Shinneman and Baker 1997).

Construction of the Deerfield Lake altered historic hydrologic flow regimes. The construction of the lake, along with low minimum flows allowed during the winter and during a drought has resulted in changes to water temperature, riparian community health, and changes to associated biota down stream. Past over-harvest of beaver has also negatively affected riparian habitats, stream flows, and wet meadow water tables. Watershed improvement projects proposed for the Deerfield Project Area are expected to benefit stream and riparian communities. Alternative A

represents a continuation of the current condition of these habitats. Proposed activities are similar in all action alternatives, so effects would also be similar. Refer to the Watershed Specialists Report for additional discussion of effects of past activities, current effects and any cumulative effects on streams and riparian resources.

Livestock grazing has occurred in the Deerfield Project Area for at least the past 100 years, on both private and public lands. Intensive grazing likely occurred initially, resulting in altered plant communities favoring less palatable species, decreasing or loss of the shrub component, and degraded riparian habitats. The current grazing practices of the past 20-30 years have improved, allowing most areas to recover from impacts of early intensive grazing. However, negative impacts from grazing still occur on both National Forest land and private land, especially to riparian communities. There will be no changes in livestock grazing as part of the Deerfield Project; therefore effects of grazing would be the same under all alternatives.

Roads displace habitat and their use can disturb wildlife and decrease habitat suitability and availability for many species. High road densities makes the forest more easily accessible, increases recreational activities, facilitates invasive species spread, illegal removal of snags for firewood, and results in increased disturbance to all wildlife species and plant communities. Roads and their location can have negative effects by changing the hydrologic function of drainages, impacting water tables, stream discharge, and alter riparian communities. A well-worn trail noted during Custer's Expedition in the area started the growth and expansion of roads and trails that access the area. Road densities have increased cumulatively through time in the Deerfield Project Area because of vegetation management activities, access for private lands, and growing recreational demands. Alternative A represents a continuation of the current road densities, increased recreation use, and increased ORV and snowmobile use on and off current roads and trails that will continue to negatively impact wildlife and botanical resources. Road decommissioning proposed in the action alternatives would, to varying degrees, protect erosive soils, vegetation and stream courses, and reduce human/wildlife interaction. Travel management would be similar under Alternatives A and B and would not reduce the effects of roads on the wildlife and botanical resources from current conditions. Alternative D followed to a lesser extent by Alternative C would reduce the effects of human disturbance, reduce the potential for invasive species spread, and protect rare plant communities from destructive disturbances by varying degrees. Alternative D would provide the most protection for wildlife and botanical resources in the area.

Like much of the Black Hills, the Deerfield Project Area was homesteaded and subject to patenting of mining claims in the late 1800s and early 1900s. Most of the land homesteaded, was along streams and in meadows of valley bottoms. Over 60% of Reynolds Prairie is in private ownership with current use for agricultural purposes (haying and grazing). Development of this portion of the Reynolds Prairie has a high probability of negatively impacting wildlife and plant species. These impacts are additive but small compared to the negative impacts that are normally associated with subdivisions and development. Agricultural use does not preclude the use of the area by wildlife, nor increase disturbance to wildlife. With increased development and subdivisions, there is an additive loss of habitat for wildlife and botanical resources. Associated negative impacts include invasive species spread, increased access to the forest, and disturbance to wildlife. For the McIntosh Fen area, increased development above the fen along Castle Creek

has the potential to reduce or eliminate the rare plant communities in the area if the hydrologic processes are negatively impacted.

Botanical Areas

Plant communities in the project area have also undergone changes resulting in extirpation of some plant species from the area (Marriott et al. 1999, 2000). Portions of the area first noted by A.B. Donaldson and photographed by W.H. Illingworth during the 1874 Custer Expedition describe Castle Creek headwaters as grasslands, wet marshes, bogs, and small ponds. Custer Expedition photos and notes describe open park-like landscape with large limestone outcrops "appearance of castles constructed from masonry…named Castle Creek". Later, Rydberg (1896) documented the botanical characteristics of the area. A.C. McIntosh was the first botanist to describe and investigate the unique characteristics of Castle Creek and surrounding grassland communities in the area (McIntosh 1930). In his descriptions, McIntosh notes that pine forest communities are invading the grassland communities. He suggests that lack of historic fire and human presence on the landscape have changed the plant communities within the area (McIntosh 1948). Montane plant communities first described by McIntosh (1930, 1931), are no longer found in the area. These were altered or converted through hydrological modification, grazing, development, cultivation, and invasion of exotics such as timothy and brome (Marriott et al. 1999, 2000). Management actions in the area will continue to change plant communities indirectly and cumulatively.

MANAGEMENT AREA 3.1 – BOTANICAL AREAS

McIntosh Fen Botanical Area

The McIntosh Fen was first noted by A.B. Donaldson and photographed by W.H. Illingworth during the 1874 Custer Expedition. Pictures of the area in historic times provides a valuable record of the area, prior to the influence of modern day man, and the value of the area for American Indians, wildlife, fish and native plants.

The Black Hills National Forest acquired the McIntosh Fen and surrounding land (approximately 320 acres) from private ownership in 1980. This is the only known calcareous fen to occur in the Black Hills (Marriott et al. 1999, 2000) but other areas such as the sphagnum bog at Black Fox are considered fens by definition (Bedford and Godwin 2003). While in private ownership, the McIntosh Fen was used for agricultural use (hay meadows and grazing) which necessitated installing drainage ditches, changing stream channels, and introduction of non-native grass species to produce more livestock forage. The McIntosh Fen area includes portions of Silver and Castle Creeks. Past management resulted in changes in the water table, ultimately changing the width of the adjacent riparian areas that resulted in the loss of unique characteristics and plant species diversity associated with a larger sized fen. Lack of adequate water holding capabilities, noxious weeds, invasive species, and conifer encroachment continue to be concerns within this botanical area. There have been historical collections of several rare plant and wildlife species in this area, including the Region 2 Sensitive regal fritillary.

Approximately 40% of Castle Creek riparian area above the McIntosh Fen is in private ownership. Most of this private land is managed for agricultural purposes (haying and grazing).

There are some new homes above the botanical area, mostly used as seasonal residences. Livestock no longer graze this botanical area.

The McIntosh fen is home to the largest population of autumn willow (only 3 other sites known on Black Hills National Forest land) and the only area where sage-leafed willow can be found in the Black Hills (USDA Forest Service 1998-2005). Both are R2 Sensitive plant species. Conservation assessments for both species have been completed (Hornbeck et al. 2003a; Glisson, 2002) that further describes these willow species, their habitat (McIntosh Fen), current management conditions, and conservation practices necessary to conserve the McIntosh Fen and these R2 Sensitive species. Further discussion for these species can be found in the Draft Deerfield BA/BE. Monitoring of these species is completed based on the Forest Plan Monitoring Implementation Guide (USDA Forest Service 2003a, 2004c). Current monitoring indicates that there is a stable trend in willow species in the area (USDA Forest Service 1998-2005).

Beaver are vital in maintaining wetland types such as the McIntosh Fen. Beaver use should be encouraged where adequate food sources are available. Beaver dam construction and water impoundment may help to raise the water table to levels approaching pre-settlement conditions. Beaver have just recently returned to the area, with small dams being constructed at various places along Castle Creek. Maintaining the water table in the McIntosh Fen is especially critical during severe drought conditions, where loss of the saturated groundwater increases the potential for wildfire to destroy the fen's peat substrate. Sources of water and recharge areas surrounding the McIntosh Fen have become the focus for conservation of this botanical area.

Environmental Consequences to McIntosh Fen

All alternatives will move the McIntosh Fen towards Forest Plan objectives 221, 216, and 3.1-201 and meet Standard 3.1-1001 to varying degrees. All alternatives would continue current restoration activities. However, Alternative A is limited in moving toward restoring, enhancing, or even maintaining this rare ecosystem and the R2 Sensitive species in the area, and does not implement recommended conservation measures adjacent to the botanical area. In addition, the higher potential for large-scale wildfire could have negative impacts on the continued existence of McIntosh Fen.

Alternative C will provide a greater benefit to the area by reducing upland conifer densities and restoring hardwood inclusions in conifer plant associations. Restoration of hardwood communities along Castle Creek will encourage beaver to inhabit the area. Beaver dams will increase the groundwater maintenance of the area, while adding the potential for spread of willow species. Alternative B will provide the next greater benefit by reducing the amount of pine in the upland sites but would be less aggressive than Alternative C in restoring hardwoods along Castle Creek. Both alternatives enhance structural diversity within conifer plant associations. Fuels from MPB mortality and dense canopy conditions will be treated to reduce the potential of high intensity/severity fires surround this botanical area. Alternative D would have similar effects to the McIntosh Fen as Alternative A. Treatments would be limited in scope, and would not be adequate to protect botanical resources in the McIntosh Fen botanical area from large-scale wildfire. Conservation measures would be limited in scope. Alternative D

is limited in restoring, enhancing, or maintaining this rare ecosystem and the Sensitive species that are found in the area.

North Fork Castle Creek Botanical Area

This botanical area is approximately 887 acres in size, exhibiting late seral climax conditions with very old trees along with proper functioning riparian communities. The area was designated MA 3.1 in the 1997 Forest Plan due to the rare plant communities found in the area. This botanical area is irregular in shape, surrounded by limestone outcrops on the east, west, and south sides of two drainages; the headwaters of the North Fork of Castle Creek. This topography is shaded most of the day creating mesic site conditions. The area has been isolated from past human disturbance and management activities due to steep topography, numerous springs/seeps, presence of erosive soil types, and spruce dominated plant communities of Mesic Coniferous Forest and Woodland ecological group (i.e. *Picea glauca/Linnaea borealis* plant association). In this MA, most of the north facing slopes and lower drainages are dominated by spruce. Some upland sites are drier with late successional structure. A fire that occurred in the early 1900's is still evident on the southern exposures of these drainages.

Aspen and birch are present along the benches where the limestone plateau and the crystalline basin formations converge. Many springs and seeps along the shale layer provide moist to saturated soil conditions that recharge the area with water and feed the North Fork of Castle Creek. Although there are several roads that provide access to the perimeter of this botanical area, only old trails/road prisms can be found through the area. The beaver population is growing in the area, creating a wider riparian influence zone in the lower drainages. Hardwoods are important in providing habitat for beaver and R2 Sensitive species. In the bottom, white spruce alluvial plant associations are succumbing to higher water tables, resulting in a change toward wetland plant associations that are ideal for some rare plant species.

Threats to the North Fork Castle Creek botanical area are large-scale wildfire, loss of hydrologic function, off-road vehicle use, overgrazing by livestock, invasion of noxious weeds, and invasive plant species. Mesic conditions created by springs and seeps as well as the North Fork of Castle Creek are important in maintaining the uniqueness of this botanical area. Moderate to high intensity/high severity fires in the area would move late seral communities to early seral communities eliminating the diverse forest floor (mosses, fungi) that make this botanical area unique. Based on field reconnaissance and survey information, ungulate and livestock grazing, especially during drought conditions have negative effects on R2 Sensitive species found in the area. In addition, recreational use of the area, in the form of ATVs and snowmobiles are increasing with user created trails that now access the interior of this area. An increase in motorized recreation increases the potential for invasion and spread of noxious weed and invasive species in the area (i.e. purple loosestrife). Motorized travel is restricted by a travel order prohibiting motorized travel in the headwaters area of the North Fork of Castle Creek and Rhoades Fork drainages.

Environmental Consequences to North Castle

All alternatives will move the North Fork Castle Botanical Area towards Forest Plan Objectives 221, 216, and 3.1-201 and meet Standard 3.1-1001 to varying degrees. Alternative A would

continue to move this area toward climax conditions with naturally occurring disturbances. However, Alternative A is limited in moving toward restoring, enhancing, or even maintaining this rare ecosystem and the R2 Sensitive species found in the area. No actions are included to protect botanical resources adjacent to this botanical area. The higher potential for large-scale wildfire could have negative effects on the continued existence of the late successional characteristics of this botanical area.

Alternatives B and C will treat areas adjacent to this botanical area by opening the pine canopy to reduce crown fire spread, reduce fuel loadings, and thin regeneration. These treatments will reduce MPB susceptibility and the potential for large-scale wildfire. Alternatives B and C provide added benefit to the MA by actively restoring adjacent grasslands, hardwood, riparian/wet meadow communities that would provide natural fuel breaks in the event of catastrophic stand replacing fire. Increases in hardwoods would encourage beaver to build dams, further increasing the groundwater maintenance of the area and improving habitat for expansion of wetland communities. Construction of fuel breaks would help insulate this botanical area from the effects of catastrophic stand replacing fire. These fuel breaks could be used as defensive positions under the right conditions to slow or stop a fire from entering the botanical area. Alternative D would provide limited protection to the botanical area. It would do little to minimize MPB and crown fire potential.

Current travel management direction restricts cross-country travel in this Management Area. Alternatives A and B would not further restrict motorized travel along existing roads. Alternative D and to a lesser extent Alternative C will limit the total amount of roads and restrict motorized travel to designated routes. High recreation activity in the area may increase the potential for invasive species introduction and increase the potential for human caused fire.

FISHERIES

Affected Environment

A variety of native and non-native fish species occur in Deerfield Reservoir and streams within the Deerfield Project Area. These species and their habitat are described below. Additional information related to water resources can be found in the Watersheds, Geology and Soils Affected Environment section. More detailed fisheries information is available in the Fisheries Specialist Report in the project file.

Fish Species. Native species within the project area include mountain sucker, lake chub, longnose dace, fathead minnow and white sucker (SDGFP 1995, SDGFP 1996, SDGFP 2001a). Non-native fish include primarily brook trout and brown trout in project area streams and rainbow trout, brook trout, splake (brook trout/lake trout hybrid), golden shiner, rock bass, yellow perch and black bullhead in Deerfield Reservoir (SDGFP 2001a). The South Dakota Department of Game, Fish and Parks manage the fish populations within the project area through fishing regulations and supplemental stocking of trout, mostly in Deerfield Reservoir. Several illegal introductions of fish species have occurred in the reservoir, including the rock bass, yellow perch and largemouth bass. Yellow perch and rock bass are established and will continue to increase in numbers, while the largemouth bass died-off in 1993 and have not been collected since (SDGFP 2001a).

The mountain sucker, lake chub, brook trout and brown trout are designated as Management Indicator Species (MIS) and are further described under Wildlife and Botany, in the MIS section for reading ease. Both the lake chub and mountain sucker are designated as Region 2 sensitive species and are further analyzed in the Deerfield BA/BE. Finscale dace are also designated as an MIS and R2 Sensitive species, but they occure outside the project area and will not be affected.

Aquatic Habitat. Instream fisheries habitat includes those factors associated with the physical, chemical and biological characteristics of a stream that affect both the quality and quantity of fisheries habitat. Such factors include flow, water temperature, gradient, pH, substrate, embeddedness, bank stability, cover, food availability, etc.

The DPA includes the following perennial streams: Castle Creek, North Fork Castle Creek, Gold Run Creek, Dutchman Creek, Silver Creek, and Lyons/Hughes Draw. These streams are generally low gradient, flowing through grassy meadows though patches of white spruce or willows can be found in places. Landownership adjacent to these streams is a combination of private and National Forest System lands.

Castle Creek is the largest stream in the project area. It flows for approximately 12 miles within the DPA. About halfway through the project area it is impounded by Deerfield Dam which was completed in 1947. The dam is operated by the U.S. Bureau of Reclamation. Stream flow upstream of the reservoir show more abrupt peaks during April, May and June in response to rainfall events. Flows downstream of the dam reflect a more sustained plateau of higher water releases during April through September to meet irrigation and municipal water demands downstream. Deerfield Reservoir (415 acres) supports a high value recreational trout fishery as well as the only population of lake chub on the Forest. Two “Walk-in Fisheries” on Castle Creek provide good trout fishing; one in the McIntosh Fen area and the other immediately below Deerfield Dam.

North Fork Castle Creek is the second largest stream in the project area and joins Castle Creek downstream of Deerfield Reservoir. The creek has extensive leeching of iron from natural or disturbed sources within the watershed, which gives the water a red color and limits productivity.

The other streams within the project area have limited suitability for fish species, especially during drought conditions when flows are low or non-existent and overwintering habitat may be limiting. Flows in Silver Creek appear adequate, but the creek has been channelized above its confluence with Castle Creek and habitat conditions are degraded. These streams do serve as additional sources of water to augment flows in Castle Creek where habitat conditions for fish are more suitable.

Environmental Consequences

Effects to Instream Fisheries Habitat represent the indirect effects to brook trout, brown trout and mountain sucker. Additional analysis of the physical, chemical and biological components of aquatic ecosystems is contained in the Watershed, Geology and Soils Section in this Chapter and the Project File. The potential for adverse effects to fish MIS is generally limited to those activities that are within or adjacent to streams and Deerfield Reservoir. Historically, brown trout were stocked in Castle Creek upstream of Deerfield Reservoir, but current management is for a brook trout fishery

above the dam and a brook trout/brown trout fishery downstream of the dam. Brown trout and mountain sucker are not documented in Deerfield Reservoir (Erickson et al. 2001), whereas, lake chub will only be affected by activities that indirectly affect aquatic habitat in Deerfield Reservoir.

Alternative A

Under this alternative, none of the proposed management activities will occur, therefore, no direct or indirect effects occur that would result in an additive incremental impact. Subsequently, there would no cumulative effects.

Past, present and reasonably foreseeable actions under the no action alternative will continue to affect fish species and aquatic habitat, both positively and negatively. Deerfield Dam will continue to fragment stream habitat, but also provides suitable habitat for lake chub and other fish species. The "no-wake" boating restriction to reduce shoreline erosion in Deerfield Reservoir will continue. Stream habitat fragmentation also results from the existing road network where culverts at road crossings block the passage of fish. The existing road network also concentrates and diverts surface runoff and contributes sediment. Most of the road-related CDAs will continue to contribute sediment except that four CDAs on Road 132.1D will be corrected under the Mercedes Project Decision. Livestock grazing, mining and recreational activities along with the natural erosion process also contribute sediment into streams and the reservoir. Fire suppression has resulted in more ponderosa pine trees in the project area, contributing to increased evapotranspiration losses that likely have affected stream flows. Natural disturbance processes, such as fire and insects, will eventually reduce the density of ponderosa pine. This would have an effect on stream flow proportional to the tree biomass removed. The introduction of non-native game fish may affect native aquatic species through predation and/or competition for food and habitat. Recreational fishing results in the harvest of game fish species, primarily trout. Monitoring of fish populations may result in fish mortality or injury due to handling stress or sampling techniques. Fencing to exclude livestock from the McIntosh Fen and the Walk-In Fishery below Deerfield Dam has improved riparian and stream habitat. Modifications to Deerfield Dam and stream restoration work below the dam have improved flows and habitat conditions in Castle Creek.

Fisheries management in the Deerfield Project Area and Forest-wide has emphasized benefits to non-native game fish, such as trout. Brook trout and brown trout are well-distributed on the Forest, and most suitable habitat is currently occupied by one or both species (USDA Forest Service 2005a). Restoration efforts to improve stream habitat conditions has maintained or improved populations of brook trout and brown trout in the project area, particularly in Castle Creek. This has had a positive effect on the Forest-wide population trend of these two species and the quality and amount of Instream Fisheries Habitat. Recent surveys suggest mountain sucker occur in many of its historic drainages throughout the Black Hills (Isaak et al. 2003), but localized population reductions or absence at selected sites may have occurred (Erickson 2002, USDA Forest Service 2005a). Mountain sucker populations may not fully benefit from stream habitat improvements given the management emphasis to provide for recreational fisheries, especially where large brown trout occur. Project area streams, though fragmented by Deerfield Dam and other instream barriers, will continue to provide habitat conditions to sustain mountain suckers, thereby contributing to a stable Forest-wide population trend, albeit at levels probably

lower than historic conditions. The lake chub population in Deerfield Reservoir, which represents the Forest-wide population, is likely to continue to decline or stabilize at levels lower than the levels reported in the mid-1990s. This decline does not appear to be linked to aquatic habitat conditions which are suitable and stable (Piroutek 1991, Forest Service 2005).

Alternatives B, C and D

Direct Effects

The construction and reconstruction of road-stream crossings is the only in-water activity that has the potential to directly affect fish species. Alternative C proposes one new temporary stream crossing on Castle Creek upstream of the reservoir (see Watershed, Geology and Soils section in this Chapter). Roads identified for maintenance, reconstruction or temporary use may require in-water work at stream crossings though not all crossings occur on fish-bearing streams. Brook trout, brown trout and mountain sucker may be affected. The likelihood of injury or death to these species is minimal because construction activities will proceed slowly enough that fish will be able to swim away, the area impacted will be small and the placement of the crossing will only take a matter of days to install/remove. Direct effects to incubating fish eggs will be avoided if construction occurs in August-September, assuming suitable spawning habitat exists at the stream crossing. Lake chub will not be directly affected because no in-water activities are proposed in Deerfield Reservoir.

Indirect Effects

The effects of proposed activities on Instream Fisheries Habitat represent the indirect effects to brook trout, brown trout and mountain sucker. The lake chub would only be affected by activities occurring upstream of Deerfield Dam. The majority of indirect effects are likely to be associated with activities that occur within the Water Influence Zone (WIZ) adjacent to streams and Deerfield Reservoir. A total of 725 acres exist within the WIZ in the project area. Of which, 391 acres occur upstream of Deerfield Dam. Project activities in the WIZ across the range of alternatives are described in the Watershed, Geology and Soils Report and the Fisheries Report held in the Project File.

Increased runoff and sediment caused by soil disturbances are the major source of stream impacts. The main effect from timber harvest and prescribed burning is expected to be accelerated rates at which sediment is transported into the stream network and into Deerfield Reservoir (Isaak et al 2003). Increased sediment in streambeds results in a shift toward burrowing aquatic insects that are unavailable as prey (Suttle et al. 2004), and also alters the suitability of fish spawning and rearing habitat.

Commercial timber harvest results in soil disturbance that displaces the ground cover. Aquatic habitat is likely to be affected only if sediment is mobilized and transported into streams or Deerfield Reservoir. This is more likely to occur where the disturbance is concentrated or continuous, such as at log landings or along skid trails, in close proximity to water. Alternative B proposes the most commercial logging (140 acres) in the WIZ. Of this, 53 acres are proposed upstream of Deerfield Dam and would have the potential to indirectly affect the lake chub. The potential to generate

sediment is reduced, but may not be completely avoided by the implementation of Forest Plan Standards and Guidelines, watershed conservation practices and BMPs that incorporate buffer strips to trap sediment, avoid harmful increases in surface water runoff, restrict equipment movement and provide for the directional felling of trees away from water.

Non-commercial harvest treatments are generally done without mechanized equipment and results in no or minimal ground disturbance. Some mechanized equipment may be used to pile or remove slash, but the impacts should be negligible because the majority of these treatments overlap commercial harvest treatments. Where they don't, the impact is minimal because of the small size of the slash being handled, the use of rubber-tired equipment and ground cover will still be in place to protect the soil and absorb surface precipitation, thus no sediment will be produced. Slash piles scheduled for burning will be located outside of meadows that contribute to Waters of the United States and vegetative buffers will be used to keep sediment, ash and debris out of stream channels (Guideline 4111, treated as a Standard) under all action alternatives.

The removal of overstory vegetation along stream channels may increase water temperatures by reducing the stream shading and may reduce the recruitment of large woody debris. No measurable changes in water temperature are anticipated under any of the action alternatives because timber harvest treatments within the WIZ occur infrequently along the stream network and continuous openings will be limited to less than 600 feet of stream length to prevent increases in water temperature (South Dakota State University 2004). Within treatment areas, not all trees will be removed and trees that stabilize streambanks will be retained (South Dakota State University 2004) so the future recruitment of large woody debris and residual overstory shading will be provided.

Vegetative harvest/thinning and fire reduce the standing biomass (vegetation density). Generally, the removal of biomass will decrease evapotranspiration losses, allow more precipitation to reach the ground and may increase surface water runoff. Aggressive tree cutting has been shown to increase small peak flows and channel erosion, but stream health was not damaged if watershed conservation practices were used (USDA Forest Service 1999). As real as these increases may be, they are such a small increment of total water yield that they can rarely be measured in larger watersheds (USDA Forest Service 1999). The proposed levels of biomass reduction may increase flow regimes in the short-term but will not be sustainable as vegetation regrows and it is not likely to be measurable given the scale of treatments. Annual climate variations are much more important and water releases from Deerfield Dam will have an overriding influence on Castle Creek flows below the dam as compared to flow regimes augmented by tree removal. Alternative B has the greatest potential to affect flow regimes because it removes the greatest volume of trees (47 mmbf) as compared to Alternative C (20 mmbf) and D (7 mmbf).

In the case of timber harvest, greater erosion rates stem mainly from the system of roads to access and remove the timber (Isaak et al. 2003). Gucinski et al. (2001) provide a synthesis of scientific information on the effects of forest roads. Roads may result in aquatic/riparian habitat loss due to floodplain encroachment or stream channel realignment. Unpaved road surfaces are a long-term source of sediment input. Roads may divert and concentrate surface flows altering the normal runoff pattern and thereby transporting more sediment into streams, lakes or wetlands. Poorly designed, installed or maintained culverts may create barriers to fish passage, fragment

aquatic habitat or contribute sediment during their placement/removal or if fill material is washed out due to debris blockage or the design flow is exceeded during high flow events.

Alternatives B and C propose 5.6 miles of road-related activities in the WIZ. These activities include the construction, reconstruction, and/or maintenance of new, existing or temporary roads. Alternative D proposes 4.4 miles of similar activities in the WIZ. All action alternatives have a similar mileage of these activities upstream of Deerfield Dam that may affect reservoir habitat for the lake chub. Alternative B and C obliterate about 0.3 miles of road in the WIZ above the dam. This would have a positive, but minimal effect related to sediment reduction. Alternative D does not obliterate any roads in the WIZ upstream of the dam.

Alternative B and C have a higher number of stream crossings in use, 82 and 85, respectively, than Alternative D (67 crossings) which increases the potential for sediment input into streams. Alternative C has the most open stream crossings (14) above Deerfield Dam as compared to Alternative B with eleven crossings and Alternative D with ten. Alternative C proposes one new temporary road-stream crossing on Castle Creek that may contribute sediment during placement and/or removal. This temporary crossing will not fragment stream habitat because Forest Plan Standard 1203 requires all stream crossings to provide for the passage of flows and debris and to allow for the free movement of resident aquatic life. The obliteration of stream crossings has the potential to reduce sediment into streams. Alternative B obliterates the most stream crossings (6) and Alternative D obliterates none above Deerfield Dam. Site-specific considerations such as traffic volume, road slope and surface, vegetative buffers and rainfall amount/intensity will affect the amount of sediment contributed by the road network.

Alternatives B and C propose up to 10,000 and 14,000 acres, respectively, of prescribed burning. Alternative D proposes 3,500 acres of burning. The amount of prescribed fire in the WIZ is greatly reduced. Alternatives B, C and D propose 50, 81 and 16 acres, respectively in the WIZ. The acreage of burning in the WIZ upstream of Deerfield Dam is further reduced and the majority is proposed adjacent to Deerfield Reservoir for meadow restoration. The effects of prescribed fire will vary due to fire intensity/severity, connectivity to the stream network or reservoir and other site-specific conditions. Prescribed fire is generally of low to moderate intensity/severity which protects soil characteristics and allows for the reestablishment of ground cover the first growing season after burning. The use of heavy equipment for fireline construction and control activities is avoided. Burning occurs during the time of year when subsequent precipitation is likely to be either snow or light, steady rain versus the high intensity summer thunderstorms. These factors avoid or minimize surface erosion and runoff. No prescribed fire treatments are proposed in Lyons Draw, below Deerfield Dam along Castle Creek and some wet meadows or riparian areas to protect existing willow communities or spruce stands which also avoid indirect impacts to aquatic habitat.

Alternatives B, C and D propose varying levels of fuel break construction involving commercial and non-commercial timber harvest. Fuel break construction is focused around the Wildland Urban Interface. About 36 acres of fuel breaks are proposed in the WIZ in Alternatives B and C, of which 20 acres are commercial treatments. Alternative D proposes eight acres of fuel breaks, with five acres of commercial treatments. In the WIZ upstream of Deerfield Dam, Alternatives B and C propose similar levels of commercial and non-commercial treatments and Alternative D

proposes just one acre of commercial treatment. As disclosed above, greater impacts are likely to occur from the road network used to access the commercial treatments then the fuel break activity itself. The Wildland Urban Interface is generally characterized as intermittent private lands in the valley bottoms surrounded by NFS lands. The gentle terrain and vegetative buffers associated with the Wildland Urban Interface in the WIZ will prevent sediment from fuel break construction from entering the stream network. Fuel break construction in the WIZ that removes commercial-sized trees is not likely to increase stream temperatures due to reduced shading because fuel break width is limited to 200-300 feet wide and trees along the bank will be retained.

Implementation of Forest Plan Standards and Guidelines, watershed conservation practices and BMPs will avoid and minimize the majority of impacts to water quality and instream fisheries habitat but they may not completely prevent all sediment from entering streams or Deerfield Reservoir.

Alternatives B, C and D all improve nine of the ten CDAs in the project area. These nine CDAs occur downstream of Deerfield Dam and would have no effect on the lake chub, but would have benefits to instream fisheries habitat by reducing sediment into the stream network. The one remaining CDA is on the Deerfield Road upstream of the dam. It would continue to add sediment that may eventually get transported and deposited into the reservoir.

Cumulative Effects

The effects of past, present and reasonably foreseeable actions under the no action alternative serve as the environmental baseline for cumulative effects analysis. The cumulative effects analysis area includes the two 6th-level watersheds draining into Deerfield Reservoir and the 6th-level watershed immediately downstream of Deerfield Dam that includes Castle Creek and North Fork Castle Creek. Additional cumulative effects analysis related to water resources is contained in the Watershed, Geology and Soils Section.

Deerfield Dam and its effect on sediment transport, aquatic habitat and flow regimes will persist. Alternatives B, C and D would not have an additive impact on fish movement or distribution because no new in-water barriers would be constructed that impede fish passage or further fragment stream habitat. The reduction in tree biomass from timber harvest may have a positive incremental impact on flow regimes, but it is not likely to be measurable and will be overshadowed by annual rainfall amounts and dam releases.

Project activities that result in the mobilization and transport of sediment into the stream network and Deerfield Reservoir would have a negative incremental impact that would be additive to existing and future sediment input resulting from natural erosion and other human-influenced activities. Piroutek 1991 estimated a 0.3 percent annual loss in Deerfield Reservoir volume due to sedimentation. The low rate of sedimentation was attributed to the small watershed area with underlying rock formations resistant to erosion and the absence of large-scale agricultural activities or extensive development in the drainage. Proposed activities occur at different times and places which allows for the recovery of some areas prior to ground disturbance in other areas. Sediment that enters low gradient streams above Deerfield Reservoir may settle out and not enter the reservoir or it may be mobilized and transported later in time during higher stream flows.

Remedial actions to eliminate CDAs would have a positive incremental impact to reduce sediment sources. Any sediment input from project activities is likely to be less than sediment input that may result from a large-scale wildfire, should one occur.

The one new temporary stream crossing proposed in Alternative C would have a negative incremental impact that is additive to stream habitat modification from other structures or crossings existing in the project area. This impact is minimal because it is a temporary crossing, the stream banks will recover after the crossing is removed and the area impacted is only the road width (20-25 feet).

Forest Plan Objectives 217, 219 and 221 relate to fish MIS by; a) maintaining habitat for fish populations to meet State objectives, b) maintaining or improving instream fisheries habitat and c) conserving or enhancing habitat for MIS, respectively. Fish MIS habitat will be maintained under all action Alternatives through the implementation of Forest Plan standards and guidelines, watershed conservation practices and BMPs that avoid or minimize potential effects to aquatic habitat. No additional habitat fragmentation or permanent degradation will occur that would further restrict the distribution of brook trout, brown trout and mountain sucker or appreciably reduce their ability to interact and reproduce in the project area. Alternatives B, C and D will have a neutral effect on the Forestwide population trend of these species. Generally, Alternative D proposes the lowest level of activities in the WIZ, with the exception of commercial timber harvest, but it also does the least to reduce the tree biomass that increases the risk of catastrophic wildfire and results in higher evapotranspiration losses. Any sediment that may reach Deerfield Reservoir would be a negligible amount and will not appreciably reduce the amount or quality of habitat or the design life of the reservoir. The action alternatives would have a neutral effect on the lake chub population, which may continue to decline due to other reasons.

SOCIAL ENVIRONMENT

This section will describe the affected environment and environmental consequences for each alternative to the Social Environment (Travel and Recreation Use, Scenery, Special Uses, Heritage, Social and Economic).

TRAVEL and RECREATION USE

Affected Environment

The Deerfield Project Area is an important area for developed as well as dispersed recreation. It is considered to be rural with scattered tracts of private land.

Recreation in this area is largely concentrated around Deerfield Reservoir, a 415 surface acre water impoundment. The primary purpose of this reservoir is for drinking water for Rapid City and down stream irrigators in Rapid Valley and below to the Cheyenne River confluence. A direct benefit of this impoundment is as a centerpiece for recreation in the area. This area hosts a large number of local and visiting recreationists in pursuit of a wide variety of opportunities.

Deerfield Reservoir is very tranquil and picturesque. There are speed restrictions on the water that limit watercraft to 5 mph. In general, this and the distance from population densities help set

the stage for a different type of recreation experience than might be achieved along the east slope of the Black Hills or at Pactola and Sheridan Reservoirs.

Recreation activities include, but are not limited to camping, hiking, biking, swimming, boating, fishing, hunting, on and off-road vehicle travel, bird watching, sightseeing, berry picking, picnicking, horseback riding, photography, recreational gold panning, caving, cross country skiing and snowmobiling.

Developed Recreation

Developed recreation facilities including fishing sites and trailheads in the Deerfield Project Area are displayed in Table 3-25. Campgrounds on National Forest System lands are at the primitive end of the development spectrum. There are no sites with electricity, sewer, water, etc. for the general public. There is potable water available in the campgrounds. Private campgrounds in the area offer sites with full hookups.

The Deerfield Recreation Area is designated as a Concentrated Public Use Area (CPUA). This CPUA is 4736 acres and coincides with the area designated as 8.2 Management Area (MA). CPUA's have special laws or regulations that are specific to the area. A copy of the Special Order is in the Project File.

The existing vegetation within the developed sites is generally ponderosa pine overstory with a grass understory. Pine regeneration is limited within these areas due to the dense tree canopy cover. A concern to Recreation Program Managers is, without adequate regeneration, there is limited potential to maintain enough trees for future generations to enjoy. Spruce, aspen and birch are scattered and very limited. Within the ponderosa pine overstory, mountain pine beetle is an ever-present threat. Each year, the beetles infest and kill numerous ponderosa pines. Recreation Managers inventory and remove pines that are a hazard to public safety within the developed sites each year.

All developed recreation sites have an assortment of manmade attributes such as picnic tables, fire rings or grates, water delivery systems, vault toilets, fences, gates, signs, bulletin boards, boat ramps and other items designed to protect resources, enhance comfort and provide information.

Beginning in 2006 and continuing into 2007, major construction/reconstruction is planned within the boundaries of Dutchman Campground. The existing toilet buildings will be replaced with more modern up-to-date structures. Some two-stall toilets will be replaced with single-stall restrooms. Other changes include replacing water faucets with disability accessible ones; replacing old water lines with new water line pipes using as many current pipe locations as possible; replacing the water storage tank; widening roads; widening and lengthening campsite spurs as ground conditions allow; changing location or direction of access on some spurs; and replacing wooden barrier posts with natural rocks and trees.

Table 3-25 Developed Recreation Sites in the Deerfield Project Area

Developed Site Name	*PAOT Capacity	Size in Acres	**Development Scale	***ROS
Dutchman Campground	225	45	3	R
Whitetail Campground	85	17	3	R
Custer Trails Campground	75	15	2	R
Custer Trails Boat Site	50	4	2	R
Deerfield Cove Boat Site	80	4	2	R
Lakeshore Picnic	50	10	3	R
Mountain City Picnic	70	14	3	R
Custer Camp Fishing Site	10	2	3	RN
Little House Fishing Site	10	2	3	RN
Miller Fishing Site	10	2	3	RN
Silver Fishing Site	10	2	3	RN
Kinney Canyon Walk-In Area	45	2	3	RN
Custer Trail Trailhead	25	2	3	RN
Gold Run Trailhead	60	2	3	RN
Hill Top Trailhead	25	2	3	RN
Kinney Canyon Trailhead	40	2	3	RN
North Shore Trailhead	30	2	3	RN
Totals	900	125		

***People At One Time (PAOT)** Capacity is described as the engineered limit of the number of people that can be in the developed recreation site at any one time. ****Development Scale** is a numerical rating with 1 being minimum site modification and 5 being a high degree of site modification. *****Recreation Opportunity Spectrum (ROS)** All developed sites within the Deerfield Project Area are classified Rural (R) or Roaded Natural (RN).

Roads and Trails

The existing road system, Forest System Road (FSR) 607, 421 and 417, which provides access to all of the developed recreation sites is maintenance level 3. Maintenance level 3 is 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.

There are three system trails within the Project Area. The Deerfield Lake Loop Trail #40L is a 10-mile loop trail that surrounds Deerfield Reservoir. The Deerfield Trail #40 begins its eastward trek from Custer Trails Trailhead with approximately 5 miles of this trail within the Project Area. The Dutchman Loop Trail #47 provides a hiking opportunity in and around Dutchman Campground. Non-motorized use of these system trails depends on where they are located on the Forest. Portions of trails #40 and #40L are not favorable to all uses on every section of the trail due to trail grades and widths. Motorized use from all terrain vehicles (ATV), dirt bikes and four-wheel drive vehicles is not allowed on the trails. In addition to the developed trailheads, these trails have numerous improvements built into the trail tread. These improvements consist of water bars, grade dips, retaining walls, turnpikes and puncheons. Trails are typically marked with carsonite posts and plastic gray diamond blazers affixed to trees with aluminum nails. Directional signing for trails has also been installed to help show direction and distance to trailheads.

There is a large network of non-system or user-created roads and trails that have developed over the past several years in the Project Area. These roads and trails were usually developed to provide access to someone's favorite hunting or fishing spot. In addition, there are 18 miles of snowmobile trails within the project area. These trails are largely on existing roads, however there are segments

of trail that traverse General Forest Areas (GFA). Snowmobile season is open December 15 through March 31 each year. These trails are marked on the ground using carsonite posts with orange adhesive blazers and with aluminum orange blazers affixed to trees using aluminum nails.

Dispersed Recreation

Dispersed recreation within this project area is quite diverse. Included are motorized uses such as ATV's, dirt bikes, snowmobiling, driving for pleasure, boating and non-motorized uses such as hunting, fishing, hiking, biking, horseback riding, berry picking, recreational gold-panning, bird watching, cross country skiing, and canoeing. Deerfield Reservoir is a very popular winter ice fishing destination.

Much of the dispersed recreation activity in the area is supported by the developed camping opportunities that exist on federal and private lands. The overnight lodging opportunities are significant in describing the "destination" aspect of dispersed recreation. This creates a situation where individuals and families tend to stay in the area for longer periods of time. A full weekend outing, up to several days in the area, is not uncommon. There is still, however, quite a bit of day use activity such as fishing, hunting, hiking, picnicking, biking, ATV use, etc. that takes place in the area.

Hunting is a seasonal dispersed activity that occurs primarily in September through December and April and May each year. Deer, elk and turkey are key game species in the area.
Fishing is also an important activity on Deerfield Reservoir and along the many miles of fishable streams within the planning area. Castle Creek below the Reservoir is a successful walk-in fishery area known as Kinney Canyon that attracts fly-fisherman from all over the country. Castle Creek above Deerfield Lake goes through the McIntosh Fen, a Botanical Area closed to motorized vehicles. Several parking areas along FSR 110 serve walk-in fishing here.

Flag Mountain, an old fire lookout site, is accessible by both motorized and non-motorized travel. The site provides a scenic view of Deerfield Lake and the surrounding area.

Travel Management

Travel Management consists of all modes of transportation whether motorized or non-motorized and all manner of travel surfaces from high speed paved roads to single-track trails for hiking or biking only. Travel Management is a function of all the resource areas involved in managing the National Forest, from timber harvest to sensitive habitats. Travel management is as much about where travel is acceptable as it is unacceptable, regardless of the form of travel.

All recreation activities rely on a transportation system of some type, if for no other reason than to provide access to an area. Also, many of the Forest management goals and objectives cannot be met without a transportation system. It is the function of Travel Management to combine all of the issues and concerns of the resources, the public and the management emphasis into a comprehensive plan that meets these needs in a responsible manner.

Within the Deerfield Planning Area, there are three specific travel designations as indicated by Management Areas (see Appendix G, Map 3). The majority of the area is in MA 5.1 or Resource Production Emphasis. Motorized travel is allowed on the majority of roads as well as off-road within this area. MA 8.2 (Deerfield CPUA) and MA 3.1 prohibit off-road motorized vehicle use with the exception of snowmobile use from December 15 to March 31 of each year.

The roads within the Deerfield Project Area were inventoried in 2002 and 2003. The total length of all roads in the planning area is 292 miles. Forty-four miles can be broken into the following: maintenance level 3 roads (suitable for passenger car), maintenance level 4 roads (moderate degree of user comfort) and maintenance level 5 roads (high degree of user comfort roads). Maintenance level 1 roads (basic custodial care) and maintenance level 2 roads (high clearance vehicles) make up 145 miles. Unclassified roads are unplanned or user-defined and account for almost thirty percent (82 miles) of all roads in the area. Current road density within the Deerfield Planning area is 4.3 miles per square mile.

There are 18 gates within the planning area and most of these are associated with the Deerfield CPUA, MA.8.2 or MA 3.1. Most of these gates or closures have been effective, but there is still evidence of motorized vehicle users violating some of the closures.

Off-road use can be divided into several motorized categories that include ATV's, jeeps and four-wheel drives and dirt bikes. All forms of motorized uses have expanded in recent years and are becoming an issue in the planning area and all across the Forest. As stated previously, there are almost 82 miles of unclassified roads. These were roads that were never intended to be used long term. The user-defined roads and trails are often not in the best location with regard to natural resources. They may traverse riparian areas or streams in a manner that damages these sensitive sites. There may be problems with slope and grade, or the location may not be compatible with the soils found in the area. Sometimes habitats needed by sensitive plant and animal species become compromised by unknowing off-road riders.

Off-road users have a wide range of interests and varying needs. Some are hunters and use their machines to scout or retrieve their game; others enjoy traveling around the Forest on low standard roads and trails for the pleasure of being in the woods. Still others require the challenge of steep or rough terrain, and a small number enjoy muddy, wet areas. Some dirt bike enthusiasts prefer single-track trails to roads or two-tracks. Hardcore 4X4 users sometimes prefer "rock crawling" areas where other motorized users are not likely to go. There is a private resort/business in the area that rents ATV's and caters to ATV and equestrian users.

Snowmobile use is a very important wintertime activity in the area. There are 18 miles of system trail in the planning area. Deerfield Lake also attracts snowmobilers for races and as a play area.

There are approximately 14 miles of non-motorized system trails in the planning area. System trails are trails the Forest Service actively maintains. These trails are used primarily for hiking, biking and horseback riding. Mountain bike use is expanding in the Black Hills and the Forest is becoming a popular destination area. Most mountain bikers prefer single-track trails just like their motorized dirt bike counterparts. Less favorable are the larger roads and two-tracks available to the motorized groups. Equestrian use occurs in the area. There are no Forest Service

camping facilities dedicated to horseback riders, however, there is a private campground that caters to them and consequently, use is evident in the area. They also like to ride in the Deerfield CPUA because of the motorized restrictions.

The predominant recreational activities that users pursue within the project area include the following:

- Viewing scenery and wildlife is one of the dispersed recreational pursuits in the area. Both motorized and non-motorized users value this activity.
- Hunting is a seasonal activity that occurs throughout the area during the fall and spring months. Deer, elk and turkeys are key game species in the area. Both motorized and non-motorized users value this opportunity.
- Fishing for trout, primarily along Castle Creek and in Deerfield Lake, is a very popular activity in the area. Several outfitter guides and the general public value the opportunity to participate in this activity. Many fishermen drive to a parking area and then walk to a more secluded spot to enjoy fishing.
- Dispersed camping is found normally on the back roads away from noise and heavily used motorized traffic areas within and adjacent to the Deerfield Lake Recreation Area. Forest visitors drive to a site and then set up camp, mostly in hunting season. Non-motorized users along the Deerfield Trail also camp. Both groups value the opportunity to participate in this activity.
- Mountain bike riding is very popular in the area. Bike races are permitted under a permit with the Forest Service. The opportunity to enjoy the area by groups and individuals is highly valued.
- Hiking is a popular activity along the Deerfield trails and within the developed campgrounds. Hikers either drive to one of several trailheads providing access to these trails or just pass through the area on the trails. Hikers also enjoy walking on roads closed to motorized vehicles and cross-country through the woods. Hikers either drive to the area and find a place to park, often in front or next to a gate, or walk out of the campgrounds onto the Forest. The travel route used by General Custer in the late 1800's goes through the planning area. It is starting to get additional use both by those hiking the trail and those driving to certain segments of the trail to see the overlooks pictured in photos documenting the exploits of Custer.
- Snowmobiling/cross country skiing/ snowshoeing are all great winter activity sports occurring throughout the planning area. Snowmobiling is predominately on snowmobile trails maintained by the State of South Dakota Game, Fish and Parks Department. Skiing occurs within the campgrounds on the paved roads with snowshoeing occurring in all parts of the planning area.
- Other activities include berry picking, fuel wood gathering, Christmas tree cutting, gold panning, and cave exploring. Recreational gold panning is limited in locations found along creeks on National Forest System lands. Gathering wood products is appealing and valued by the local public because of its proximity to other activities such as berry picking, fishing and hunting. Christmas tree cutting in this area is good for those wanting the perfect spruce tree. Cave exploring occurs in the areas near private land on Reynolds Prairie.
- Challenging the riding skills of dirt bike, ATV, and modified 4X4 users is a popular activity in the area. These motorized users strongly value the opportunity to pursue this

activity. This is evidenced by the large amount of unclassified roads and trails used in the area and the number of these vehicles owned by residents in the project area. They value the opportunity to experience both road and "ad-libbing" challenges.

Recreation users can be separated into nine distinct groups that have specific preferences. The activities they pursue are often the same as stated above. The exact figures on what percentage of the total recreation users fall into each of the nine groups is not known. However, past management practices, road building, and established uses in the area have created an environment that more closely meets the motorized user preferences. The non-motorized users, especially the mountain bikers are becoming a more dominant user group as noted by all the recreation events and outfitter/guide permits in the Deerfield Project Area. Based on previous work dealing with both motorized and non-motorized users in other areas of the district, there is a distinction between all terrain vehicles, dirt bikes and 4x4 vehicles. The non-motorized user groups also want to be considered as individuals rather than grouped together. Each of these user groups desires different types of experiences and value different opportunities (see Table 3-26).

Table 3-26 Recreation Users, Preferences and Uses in the Deerfield Project Area

User group	Method of travel	Experience preferences	Trail or road preferences	Forest uses	Time of year uses occur
Non-motorized	• Mountain bikes	• Natural • Backcountry • Solitude - see or hear little or no motorized uses	Single track	• Biking • Hunting • Fishing • Camping • Backpacking • Nature study and viewing wildlife	Primarily non-winter
Non-motorized	Horseback	• Natural • Backcountry • Solitude	• Single track • Cross country	• Horseback riding • Hunting • Fishing • Camping • Nature study and viewing wildlife	Primarily non-winter
Non-motorized	Foot traffic	• Natural • Backcountry • Solitude • No noise	Single track	• Hiking • Hunting • Fishing • Camping	Primarily non-winter
Non-motorized	X-C skiing Snowshoeing	• Natural • Solitude • No noise • Backcountry	Single track	• Hiking • Backpacking • Nature study and viewing wildlife	During the winter
Motorized	Dirt bikes	• Backcountry • No all terrain vehicles or jeeps on trails (to keep the trails single track)	• Single track • Cross country "adlibbing"	• Scenic rides • Wildlife viewing • Berry picking • Challenge motorbike riding skills	All year
	All terrain vehicles (ATV)	• Varied topography • Varied roads and trail types • Share roads and trails with all other users	• Lower level roads • Some trails • Cross country	• Hunting • Challenge their riding skills • Racing • Scenic riding • Fishing	All year

User group	Method of travel	Experience preferences	Trail or road preferences	Forest uses	Time of year uses occur
	Modified vehicles	• Backcountry • Varied topography • Varied roads and trail types Share roads and trails with all other users • Rocky areas	• All level roads to access rock crawl areas • Rocky areas for challenging their skills	• Viewing scenery • Challenge their driving skills and vehicle modifications • Picnicking • Fishing • Berry picking	Primarily non-winter
	Pickups and cars "stock vehicles"	• Rural setting • Varied scenery • Safe logical routes	• Maintain gravel roads • Asphalt roads	• Viewing scenery • Gathering forest products	All year in good weather
	Snowmobiles	• Designated trails • Cross-country	• Snowmobile trails • Roads	• Viewing scenery • Recreation pleasure	Winter Trail use – Dec 1 to March 31

Some of the users concentrate their activities in favorite spots that are very important to them. Residents living within and adjacent to the area enjoy being able to walk or drive into the area from their private property. Others appreciate the short distance from their homes in Hill City or the surrounding vicinity that allows them to quickly access the area.

There is support among most users to maintain road and off-road motorized access that is needed for much of the dispersed recreation use in the area. There is also support among many other users to have areas free from motorized use so they can enjoy the activities that are important to them. This area surrounds the Deerfield Lake Recreation Area.

Along with the positive aspects of abundant dispersed and developed recreation opportunities, there are undesirable actions and negative effects to natural resources. These effects are invariably tied to motorized access into the area. The better the access, the more these undesirable actions and negative effects occur. These actions are committed by a small group of people, and spoil the area and experience for the majority of users. Such actions include:

- Vandalism includes shooting and destroying signs, damaging gates, cutting fences, damaging campground facilities and illegal firewood collection.
- Damage to soils and water resources includes rutting and soil compaction from motorized use in wet areas and soil erosion from overuse, poorly located or un-maintained roads and motorized trails, and effects to stream channels from crossings on some road and motorized trail segments.
- The spread of noxious weeds along travel routes is increasing due to more users and a lack of education concerning weed identification and their methods of transport.
- Disturbance to wildlife from the noise and presence of motorized vehicles varies according to species and time of year.

Special Use Permits

Special Use permittees in the area include Outfitter and Guides (O/G) and Recreation Event Holders. Outfitter and Guides are private entities or businesses that operate with a permit on

National Forest System lands. They provide various guided recreation opportunities to the general public such as hunting, fishing, hiking and biking. Recreation Event Holders use the area under permit for bike races, snowmobile races, horseback rides and even religious ceremonies. O/G use in the area can occur year round with hunting seasons in fall and winter and fishing opportunities in spring and summer. Recreation events are scheduled events and will have specific dates assigned. The following list displays the active Special Use Permittees that are currently operating in the area.

Outfitter and Guide Permits
Dakota Anglers and Outfitters, Inc. – Fishing
G-Man Outdoor Adventures – Deer, Elk, Turkey Hunting
Turkey Track Club – Turkey Hunting
Forest City Adventures – Biking
Western Spirit Cycle – Biking

Recreation Events
Black Hills Mountain Bike Association – Bike Race
Black Hills Snowmobile Club – Race
Custer Trail Riders – Horseback Event
Journey Back to the Heart – Sundance – Native American Religious Ceremony

The Mystic District is currently under a self imposed restriction to delay all new outfitter/guide permits on the district until a determination can be made for the number of available primary and temporary service days on the district and if budget and staffing is sufficient for additional permit administration.

Environmental Consequences

Effects Common to All Alternatives

The developed recreation complex within the Deerfield Project Area will remain under its current management (MA 8.2) with the concessionaire, Forest Recreation Management (FRM), through 2009 and then with any future concessionaire operator until all actions are completed as decided by this document.

The proposed reconstruction of the Dutchman Campground will occur in 2006 and 2007 under all alternatives considered.

All developed trail systems, including snowmobile trails maintained by the State of South Dakota will remain in their present locations. Any re-route of existing trails or new trail proposals will be evaluated on a case-by-case basis.

The Mystic District's current policy to defer any additional outfitter/guide special use permits until new direction is established will continue under all alternatives.

Recreation special events will continue to be allowed under all the alternatives.

The Flag Mountain Lookout Point of Interest will remain in its current condition in whatever alternative is selected.

The newly created North Fork/Castle Creek Botanical Motorized Closure Area will benefit dispersed non-motorized recreation users by providing a larger area for their use. The area ties to the Tilson/Swede Gulch Closure Area to the north on the Northern Hills Ranger District providing a very large area for dispersed recreation users.

A continuation of the existing treatment and removal of hazard trees within the developed recreation sites will occur as trees are identified.

The amount, location, and quality of roads, trails, and areas open to off-road motorized use directly influence the public's recreational opportunities in the Deerfield Project Area. The different approaches to travel management in each alternative would change future recreational opportunities and land uses of motorized and non-motorized users. All alternatives would result in changes to recreation use and motorized and non-motorized access. Some of this change is a result of actions directed by each alternative. Some are the result of overall trends that are not directly influenced by the alternatives, such as an increase in outdoor recreation activities, increasing sales and use of Off-highway Vehicles (OHV) such as ATV's, dirt bikes and 4x4's and the increase in sales of mountain bikes.

For all alternatives, the Forest Service would continue to repair and maintain roads and trails under its jurisdiction. New and existing user-created roads that are causing resource damage would be rehabilitated or removed as funding becomes available. Emergency restrictions would be implemented as needed, such as temporarily closing roads during wet conditions to prevent rutting and erosion, or closing an area to off-road motorized use during periods of high fire danger. The Forest Service would continue to patrol and enforce regulations to protect surface resources. None of the alternatives affect State, County or private road management. Under any alternative, all areas of the Forest within the project area would remain open to non-motorized use such as hiking, biking and horseback riding cross-country. Areas within MA 3.1 and 8.2 will continue to not allow off-road motorized travel.

The general trend in recent years is to close roads and off-road areas to motorized use either seasonally or yearlong within the Black Hills National Forest. Some of these closures are the result of recent wildfires where soil, water and wildlife protection required closures. Other limitations on motorized use have been the result of implementing Forest Plan guidelines, as project areas are analyzed and site-specific decisions made. As motorized use continues to expand within this area and other areas of the Black Hills, overall satisfaction for non-motorized use appears to be declining.

Comparison of Road Management

See Table 3-3 in the Transportation Section for a comparison of the alternatives showing proposed road open and closed mileages. The differences will be discussed under each alternative and how they affect motorized travel management.

Alternative A

This alternative is responsive to those users who do not want to see a change in current authorized travel management and recreational opportunities in the area. It also serves as a point from which to compare other action alternatives.

Developed Recreation

Direct Effects

Under the No Action Alternative, all recreation facilities in MA 8.2 will not have any interrupted use. Projects such as the reconstruction of the Dutchman Campground will occur as proposed under a previous decision.

Road closures within the developed sites will continue as determined from previous decisions. There will be six roads obliterated as a result of previous decisions in the Deerfield Recreation Complex Area. None of these roads, currently considered as spur or loop roads, would cause any significant impact to the motorized users because of short distances involved and available access by non-motorized use.

Indirect Effects

The number of pine trees infected and killed by mountain pine beetles and ips beetles will continue within the developed recreation sites because of the lack of treatments. This will lead to an unsafe area for the developed campground users.

Trees currently being used for shade, screening and aesthetics have the potential to be infected because of the lack of treatment in the surrounding area and removal of trees already infected or with a high probability of becoming infected.

Without treating fuels created by standing and down dead trees, the campground and surrounding recreation complex area are very susceptible to fire.

Cumulative Effects

The effects of not treating the stands of dead and dying trees infested with beetles and susceptible stands may result in campgrounds with few trees of measurable size reducing the quality of the recreation experience. Without large trees (greater than 14 inches in diameter), the feeling of camping in the “woods” would be greatly diminished. The aesthetic feeling of isolation through screening of each campsite will cause campers to go to other areas for the enjoyment they had experienced at Deerfield Lake Complex. The occupancy rate will go down thus reducing revenue to both the concessionaire and the return to the U.S. Treasury.

The lack of prescribed burning and other fuel treatments within and on the perimeter of the developed recreation complex will increase the density of trees thus reducing the view of the lake and natural features.

Motorized and Non-Motorized Dispersed Recreation

Direct and Indirect Effects

No changes would be made in dispersed recreation management that would directly affect both motorized and non-motorized recreation use. Indirect effects would result from an increasing trend to participate in motorized outdoor recreation activities away from heavily used areas and a rapidly expanding use of off-highway vehicles.

The number of pine trees infected and killed by mountain pine beetles and ips beetles will continue within the dispersed recreation user areas because of the lack of treatments within timber stands. This will lead to an unsafe area for the recreating users.

All current types of dispersed recreation would continue. Those activities that rely on motorized access, such as driving for pleasure or sport will see an increase in use based on current observations in the existing condition. Activities such as fishing, snowshoeing, cross-country skiing and dispersed camping likely would see no effect from this alternative. Hunters who desire a more motorized experience - driving the roads, short walks, motorized game retrieval - would not be affected and would probably see increased access over time as additional recreation user-created roads are developed. Hunters who desire a more non-motorized experience - longer hikes, less noise, no disturbance during the hunt would see a gradual decline in their hunting opportunities unless they use the Deerfield Recreation Complex.

Because of the relatively high open road density and large areas available for off-road motorized use, this alternative should meet the desires of many motorized users, including those that drive stock vehicles, ATV's, and 4x4's. Specific types of motorized use would be affected in different ways.

- Dirt bike users prefer open areas for ad-libbing and single-track use secured from wider motorized vehicles. However, their single-track opportunities would be compromised when ATV's widen the single tracks, which then lead to jeep and pickup use.
- Modified vehicles, stock vehicles and ATV users prefer a diverse road system and an opportunity to experience off-road riding. These vehicles would continue to travel on existing open roads and open off-road areas. New recreation user-created roads would also be available for use, primarily by off-highway vehicles.

Negative effects related to motorized access - partying, littering, trash disposal, vandalism, damage to soils and water resources, spreading of noxious weeds, and disturbance to wildlife would increase over time. These indirect effects would negatively affect the use and enjoyment of the area for many recreation users, especially non-motorized users.

This alternative would likely not meet the desires of many non-motorized users such as hikers, cross country skiers, mountain bikers and horseback riders who prefer opportunities away and separate from motorized use areas. Some users seeking more secluded, quiet, non-motorized experiences would move to other areas for their recreation activities. Generally, this would

cause them to travel away from the Deerfield Recreation Complex Area to enjoy these types of experiences.

- Hikers and horseback users in the area prefer a quiet, natural setting free of motorized use and activities. Alternative A gives them less opportunity to enjoy these activities. This is partly because the Deerfield trails prohibit motorized use but the area adjacent to the trails does not. They would continue to share the areas with motorized users.

- Mountain bikers currently share their traditional race areas with motorized users except within the Deerfield Recreation Complex. Mountain bike users would seek out more seclusion and areas for trail systems away from motorized users outside the project area.

Increased conflicts between users would be expected, especially conflicts between motorized and non-motorized users. Motorized use would expand and additional user-created roads would be developed by off-highway vehicles, thereby increasing the total number of roads within the area.

Cumulative Effects

The cumulative negative effects on motorized dispersed recreation opportunities from this alternative are low based on the scattered number (31 miles) of existing roads that are planned to be closed through previous decisions in comparison to the total of 292 miles of road in the entire planning area. The existing user-defined roads/trails will continue to multiply and far exceed the 31 miles of roads currently planned for closure resulting in a no loss road situation. Any closure of roads is a benefit to the non-motorized user groups, however this would be short lived because of the user defined increase in roads/trails.

Population and recreation use will continue to grow in the Black Hills. New houses and developments will be constructed within and adjacent to the project area. Increased competition and conflicts will occur among users. The result would be a gradual decline in solitude and non-motorized recreation opportunities within the project area because population centers within the Black Hills will move out towards the forest, moving users farther into the hills to the Deerfield Project Area.

Motorized Travel Access

Direct Effects

There would be minimal direct effects to road and off-road motorized use under Alternative A. This alternative would not directly result in any increase or decrease of the 200 miles of roads open for motorized use (19 miles of additional roads exist on private land and are subject to jurisdiction by Pennington County or landowners). It would not directly affect the area that is currently open on a yearlong basis for off-road motorized use. The existing motorized road closures both on and off-roads will continue in MA 3.1, 5.1 and 8.2. No changes will occur to the open road maintenance schedules. Road use changes will occur as a result of previous decisions by allowing 200 miles of road to remain open; and closure of 73 miles of roads.

Indirect Effects

There are a number of indirect effects resulting from this alternative. These indirect effects are largely the result of users being denied off-road motorized travel adjacent to large population areas such as Rapid City and a rapidly expanding use of off-highway vehicles. New user-created roads would be developed over time in areas open to off-road motorized use. Some of these new user-created roads would be developed along paths where current snowmobile trails exist. This effect could drive future development of trail systems that are used year round – winter by snowmobiles and summer by ATV's. The increase in additional trails would likely be fairly small compared to the existing road system, but could grow by several miles a year. This would indirectly increase the overall road density in the area.

Current off-road area closures would continue in three areas. The effectiveness of these closures would vary based on a number of factors, including proper signing, public support and law enforcement patrols.

Cumulative Effects

Alternative A does not change the existing travel management direction for this area, and therefore it would not contribute to this cumulative effect.

Non-Motorized Travel Access

Direct and Indirect Effects

There would be no new travel construction or area closures limiting use to only non-motorized users under this alternative.

Cumulative Effects

Use and enjoyment of non-motorized travel for hiking, cross country skiing, biking and horseback is affected by the proximity to motorized use.

Alternative B

This alternative would benefit both developed recreation and dispersed recreation for motorized users more than non-motorized users. Recreation and travel management would be guided by the current Forest Plan guidelines. On and off-road travel is designated to meet Forest Plan MA direction.

Developed Recreation

Direct Effects

Within the Deerfield Recreation Complex in MA 8.2, existing uses for both motorized and non-motorized users will continue except for two roads planned to be decommission and 20 roads planned to be closed representing 4 miles.

The benefit to the developed recreation area will be the treatment of vegetation to reduce the potential for Mountain Pine Beetle infestations helping to eliminate hazards to the public.

The vegetative treatments planned under this alternative are the best in bringing the recreation complex immediately into a visually and aesthetically appealing landscape and produces stands of structural diversity which allow for screening opportunities throughout the recreation area.

Indirect Effects

The proposed treatments of vegetation using a variety of silvicultural methods to reduce existing stands of dense overstory to create multi-stage and multi-age stands of trees will help reduce potential crown fires resulting in total loss of visual attractions sought by the public. Hardwood and Meadow Restorations will provide the recreation users with areas to view wildlife within the vicinity of their campsites. Other treatments such as thinning will help reduce stagnant stands of trees that make non-motorized travel difficult throughout the recreation complex. In other areas, treatments that do not look uniform in appearance will create long-term benefits for future recreation users to enjoy that differs from the immediate benefits discussed in direct impacts.

The proposed fuels treatments outside the recreation complex and MA 8.2 will provide for a buffer area or fuel break to the developed sites by reducing the fuels adjacent to the complex if a wildland fire were to occur near the complex. It will not directly benefit the recreation complex because the treatments are not within the areas where heavy concentrations of the recreation users create the potential for accidental fires.

Without treating fuels created by standing/down dead trees resulting from mountain pine beetle attacks and other natural causes, the campground and surrounding recreation complex area are very susceptible to fire. Fuel treatment recommendations would be to machine and/or hand pile slash created by vegetative treatments.

Cumulative Effects

If the stands of trees and meadows are treated within the Deerfield Recreation Complex, safety of the recreation users over the long-term will benefit by the removal of potentially hazardous trees dying from Mountain Pine Beetle attacks. The long-term benefits of treating the slash created by both vegetative management and natural slash will be a reduction in the potential for large-scale wildland fires resulting in protection of recreation infrastructures.

Motorized and Non-Motorized Dispersed Recreation

Direct Effects

This alternative is very similar to Alternative A in that the existing motorized closure areas that deny access to motorized vehicle recreation users continues. Within MA 3.1 and 8.2, vehicles are limited to designated existing roads. Dispersed non-motorized recreation opportunities outside the recreation complex would change from the current situation by closing 4 miles of roads and obliterating 6 miles of roads. These roads are not located in any one area, but scattered throughout the planning area. No additional areas would be closed to motorized vehicles.

Indirect Effects

Indirect effects would result from an increasing trend to participate in outdoor recreation activities away from heavily used areas and a rapidly expanding use of off-highway vehicles.

Because of the relatively large amount of open roads (195 miles of open roads) and large areas available for off-road motorized use, this alternative like Alternative A should meet the desires of many motorized users. The same negative effects that would occur in Alternative A would also occur in Alternative B. Non-Motorized activities such as fishing, snowshoeing, cross-country skiing would likely be affected from this alternative.

In summary, Alternative B favors motorized users, both on and off roads/trails and the opportunity to create new roads/trails for motorized use and would likely not meet the desires of many non-motorized users.

Cumulative Effects

With this alternative, opportunities would be pursued to develop motorized and non-motorized trail systems in the project area and surrounding area, utilizing partnerships whenever possible. Past user created roads/trails and previous decisions to close/obliterate roads/trails will have to be dealt with to determine their effectiveness and benefit to add to the existing forest road/trail system.

Any additional closures to reduce dispersed motorized recreation use will have to be implemented in other decision documents which will create delays to a process that could be initiated at this time.

Motorized Travel Access

Direct Effects

There are a number of direct effects resulting from this alternative. This alternative would directly result in a decrease of 5 miles of open roads beyond Alternative A for motorized use for the purpose of water/soil resource and special habitats protection. Motorized Travel Access is

directly related to both developed and dispersed recreation travel and therefore they are directly connected.

The number of user defined access points will increase because of the vegetative treatments occurring in areas where trees previously denied access to motorized users to sites once only available to non-motorized users.

Indirect Effects

The indirect effects are the same as those for Alternative A.

Cumulative Effects

Because Alternative B does not change the existing travel management direction for this area, it would not contribute to a cumulative effect.

Non-Motorized Travel Access

Direct and Indirect Effects

There would be no new uses or area closures limiting use to only non-motorized users under this alternative which is similar to Alternative A. The road closures using obliteration, in the short term, would help provide more non-motorized opportunities but in the long-term, user defined roads/trails will increase and off-set what was closed and therefore no net gain.

Cumulative Effects

There is no difference in Alternative B and Alternative A.

Alternative C

This alternative would also benefit developed recreation within the Deerfield Recreation Complex by treating fewer acres than Alternative B to reduce possible ground and crown fires that would devastate the campground facilities and aesthetics.

Dispersed recreation benefits would increase for the non-motorized recreation users and decrease for the motorized users who like to go off-road.

Travel management would be restricted for motorized users to existing roads/trails with a reduction in the quantity of access. Non-motorized users would benefit but could be affected by less access to get to their favorite spots.

Developed Recreation

Direct Effects

Within the Deerfield Recreation Complex in MA 8.2, existing uses for both motorized and non-motorized users will continue, however a large percentage of roads are planned for decommission (~39 miles), and/or closure (~56 miles) allowing additional area for non-motorized users.

The benefit to the developed recreation area will be the treatment of vegetation to reduce the potential for Mountain Pine Beetle infestations thus helping to eliminate hazards to the public throughout the recreation complex and reducing crown fire hazard.

The vegetative treatments planned under this alternative are the second best of all alternatives in bringing the recreation complex into a visual/aesthetic appealing landscape and producing stands of structural diversity which allow for screening opportunities throughout the recreation area. The treatments planned in this alternative, are less than those proposed in Alternatives B and greater than Alternative D, to provide developed recreation users privacy and aesthetic contentment.

Indirect Effects

The proposed treatments of vegetation under Alternative C provide the same benefits to developed recreation as Alternative B. The proposed fuels treatments in this alternative are similar to Alternative B.

Cumulative Effects

The Cumulative Effects in Alternative C are the same as Alternative B.

Motorized and Non-Motorized Dispersed Recreation

Direct Effects

This alternative will allow all motorized traffic only on designated routes in the planning area. Dispersed non-motorized recreation opportunities outside the recreation complex would see an increase in recreation user activities over that in the existing Alternative A and Alternative B.

The motorized recreation users would see a decrease in available space allowed for their recreational experiences, mainly those that want to travel off-road. Those that use roads and trails will still be able to experience those activities but to a lesser extent. Many of the existing roads and trails would be closed to motorized use and/or obliterated, leaving approximately 50% of the roads/trails still usable.

Opportunities would be pursued similar to those planned in Alternative B to develop motorized and non-motorized road and trail systems within the project area supported by partnerships with groups interested in developing high-class recreation experiences.

Indirect Effects

Activities that rely on motorized access, such as driving for pleasure or sport will still see an increase in use based on current observations in the existing condition; however, they will be restricted to designated roads and trails. Activities such as fishing, snowshoeing, cross-country skiing and dispersed camping likely would see both negative and positive effects from this alternative. Access to those areas will be more limited which will benefit those who want more non-motorized access to their favorite spots. Hunters who desire a more motorized experience - driving the roads, shorter walks and motorized game retrieval - would not benefit because of less roads and no cross country use. Hunters who desire a more non-motorized experience - longer hikes, less noise, no disturbance during the hunt would see a gradual increase in their hunting opportunities.

Because of the relatively large amount of open roads (155 miles of open roads) still planned to be used, this alternative should still meet some of the desires of many motorized users.

The same negative effects that will occur in Alternatives A and B related to motorized access would continue over time, but it is hoped to a lesser degree, because motorized use will be restrictive. The use and enjoyment of the area for many motorized recreation users would be reduced.

This alternative would likely help to meet the desires of many non-motorized users such as hikers, cross country skiers, mountain bikers and horseback riders who prefer opportunities away and separate from motorized use areas. Some users seeking more secluded, quiet, non-motorized experiences would move into this area for their recreation activities.

A decrease in user conflicts would be expected, especially conflicts between motorized and non-motorized users. Motorized use would expand on designated routes and decrease on off-road areas. Unauthorized user created roads/trails will likely be developed by those users upset by any new restrictions to motorized vehicles. Additional law enforcement efforts will be required to minimize such activities.

With the increase in vegetative treatment areas comes the indirect effect of opening areas of previously dense vegetation to possible access by motorized vehicles.

Cumulative Effects

New houses and developments will continue to be constructed within and adjacent to the project area. Increased competition and conflicts will occur among users. The result would be a gradual increase in motorized recreation opportunities within the project area on designated routes.

With this alternative, opportunities would be pursued to develop motorized and non-motorized trail systems in the project area and surrounding area utilizing partnerships whenever possible.

Motorized Travel Access

Direct Effects

There are a number of direct effects resulting from this alternative. This alternative would directly result in a decrease of 45 miles of open roads beyond Alternative A for motorized use. No changes will occur to the open road maintenance schedules. Road use changes will occur as a result of this alternative by allowing 155 miles of road to remain open and closure, using natural features or gates, of 84 miles of roads and total decommission of 39 miles of roads. Motorized travel will be restricted to designated roads/trails with no cross country (off-road) travel allowed. The major effect with this alternative is the impact of closing the entire planning area to off-road motorized vehicles.

New access points similar to those expected in Alternative B will be available to unauthorized motor vehicles once vegetative treatments open areas previously denied to motorized users.

Indirect Effects

The effectiveness of the new area closure would vary based on a number of factors, including proper signing, public support, and law enforcement patrols. The law enforcement patrols would need to be supplemented with district forest protection officers, employees hired for other duties but also able to support law enforcement.

Cumulative Effects

Alternative C changes the existing travel management direction for this area. It would contribute to a long-term change in the way the Forest Service and the public have access to the national forest using motorized vehicles.

This alternative would continue the trend of closing roads and off-road areas to motorized use within the Black Hills National Forest and requiring users to keep their activities on designated routes only. This would result in a lower total and open road density in both the Deerfield Project Area and in the entire Black Hills. Designated routes will continue to be located on existing roads and trails throughout the project area.

Non-Motorized Travel Access

Direct and Indirect Effects

There would still be interactions between non-motorized users and motorized cross country users under this alternative until such time as the motorized users begin to obey the regulations to stay on designated routes.

Several areas within the project area that are currently accessible to off road motorized vehicles will become large areas for non-motorized user activities. Non-motorized travel channels leading from the project area into adjoining non-motorized areas will occur. The North Fork Castle

Creek Botanical Area and its adjoining boundary with the Black Fox Valley Botanical Area, Black Fox Late Successional Forest Landscape Area and the Swede Gulch Limited Motorized Use Area will connect to an area that does not allow off-road motorized travel and limited road access. One mile to the east of the project area are the McVey Off-Road Motorized Travel Closure and the McVey Seasonal Road Closure Area.

Cumulative Effects

Use and enjoyment by non-motorized users will continue to push motorized users out of cross country locations. As motorized use continues to expand on the designated routes, this area and other areas of the Black Hills will need to continue to provide areas for non-motorized travel separate from roads and trails for motorized users.

Alternative D

This alternative will be less favorable to reducing wildland fire potential in the Deerfield Recreation Complex by vegetative treating fewer acres than Alternative B and C.

Dispersed recreation benefits will increase for the non-motorized recreation users and decrease for the motorized users.

Travel will be restricted for motorized users to designated roads/trails with a reduction in the quantity of access. Non-motorized users will benefit for the experience but also would be affected by less access to get to their favorite spots.

Developed Recreation

Direct Effects

Within the Deerfield Recreation Complex in MA 8.2, existing uses for both motorized and non-motorized users will continue. More roads are planned for decommission (6 miles), and less for closure (34 miles) than was planned in Alternative C. This will allow additional area for non-motorized users.

This alternative benefits to a lesser extent than Alternatives B and C the developed recreation area by treating less vegetation. It will result in greater potential for Mountain Pine Beetle infestations and be less helpful in eliminating tree hazards throughout the recreation complex.

The vegetative treatments planned under this alternative are less conducive than Alternatives B and C in bringing the recreation complex immediately into both a visual/aesthetic appealing landscape and producing stands of structural diversity allowing for screening opportunities in the recreation area.

Indirect Effects

This alternative will do little to reduce potential crown fires that would result in total loss of visual attractions sought by the public. Treating the least amount of acres will not support a benefit to the developed recreation users. The additional increase in no treatment areas than those proposed in Alternative C will not benefit the recreation users because it leaves the vegetation in the same state as Alternative A.

Cumulative Effects

The Cumulative Effects are similar to Alternatives B and C.

Motorized and Non-Motorized Dispersed Recreation

Direct Effects

This alternative will restrict all motorized travel to designated routes throughout the planning area. Dispersed non-motorized recreation opportunities outside the recreation complex would see an increase in recreation user activities over that in Alternative A and Alternative B. Alternative D has the lowest amount of roads open to motorized use and the largest amount of roads to be obliterated. Non-motorized users who want to avoid the sights and sounds of motorized use would benefit under this alternative.

The motorized recreation users would see a decrease in available space allowed for their recreational experiences. Those that use roads and trails will still be able to experience those activities but at a reduced level. A larger percentage of the current existing roads and trails would be closed and/or obliterated, leaving the vast majority unusable for the motorized recreation users.

Opportunities that were pursued in Alternative B and C to develop motorized and non-motorized road and trail systems within the project area supported by partnerships with groups interested in developing high class recreation experiences would not be pursued. Only the main routes would be open and large sections of the planning area would be closed to motorized use.

Indirect Effects

Indirect effects would result from an increasing trend to participate in outdoor recreation activities away from heavily used areas and a rapidly expanding use of off-highway vehicles.

All current types of dispersed recreation would continue. Those activities that rely on motorized access, such as driving for pleasure or sport will still see an increase in use on a smaller open road system. Activities such as fishing, snowshoeing, cross-country skiing and dispersed camping likely would see more effect from this alternative because of the large number of roads being eliminated from the landscape. Access to those areas will be more limited, which will benefit those who want more non-motorized access to their favorite spots. Hunters who desire a more motorized experience - driving the roads, shorter walks and motorized game retrieval—would not benefit because of less roads and no off-road use. Hunters who desire a more non-

motorized experience - longer hikes, less noise, no disturbance during the hunt would see an immediate increase in their hunting opportunities.

The fewer number of open roads (126 miles of open roads) than any other alternative will minimally meet the desires of some motorized users. It will not meet the desires of off road (OHV) enthusiasts.

The negative effects that will occur in all other alternatives related to motorized access - partying, littering, trash disposal, vandalism, damage to soils and water resources, spreading of noxious weeds, and disturbance to wildlife will be less because motorized use will be very restrictive. The use and enjoyment of the area for many motorized recreation users will be greatly reduced.

This alternative would likely meet some of the desires of many non-motorized users such as hikers, cross country skiers, mountain bikers and horseback riders who prefer opportunities away and separate from motorized use areas. Some users seeking more secluded, quiet, non-motorized experiences would move into this area for their recreation activities.

Alternative D will have a similar decrease in user conflicts as Alternative C.

Cumulative Effects

Alternative D will provide less designated routes for motorized users than Alternative C. The impacts associated with Alternative C will also be seen in this alternative.

With this alternative, opportunities would not be pursued to develop motorized and non-motorized trail systems in the project area and surrounding area, utilizing partnerships.

Motorized Travel Access

Direct Effects

No changes will occur to the open road maintenance schedules. Road use changes will occur as a result of this alternative by allowing 126 miles of road to remain open and closure of 48 miles of roads and obliteration of 73 miles – more than any other alternative. This is over a 50% reduction in roads within the planning area.

Alternative D would have similar non-motorized travel corridors as Alternative C.

The uses of existing roads currently being used for Forest Service management programs such of timber, fire, fuels, wildlife, range and recreation will greatly be diminished because of the closure of 126 miles of roads. With less motorized travel comes the expense to travel using means other than motorized, thus increasing the time to get the work completed.

Indirect Effects

The indirect effects are similar to those discussed in Alternative C.

Cumulative Effects

The general trend to close roads and off-road areas to motorized use either seasonally or yearlong will continue to occur under this alternative. Alternatives C and D provide similar effects to the users in the planning area.

Non-Motorized Travel Access

Direct and Indirect Effects

There would still be interactions between non-motorized vehicle users and motorized users under this alternative, which is the same as discussed in Alternative C.

Non-motorized users in the Deerfield Area fall predominately into the dispersed recreation user category and as such, effects to them have already been stated under the Non-Motorized Dispersed Recreation section of this alternative.

Cumulative Effects

Use and enjoyment of non-motorized travel for hiking, cross country skiing, biking and horseback are similar to those discussed in Alternative C.

SCENERY

Affected Environment

The Deerfield project area is located in the central portion of the Black Hills National Forest. The majority of recreationists travel from the communities along the eastern portion of the Forest (Rapid City, Hill City, and Custer), into this planning area, to reach Deerfield Lake and recreation complex (including Whitetail Dutchman & Custer Trail campgrounds; Lake Shore & Mountain City picnic grounds; two boat launches, trailheads, trails, and snowmobile trails). In addition, this route through the planning area continues on to provide access to the western side of the Forest, and Wyoming.

Most of the Deerfield planning area has a Scenic Integrity Objective of Moderate to High. The Deerfield Project Area has a scenic make up of several components as described below.

Landscape Character

Landscape character gives a geographic area its visual image and consists of the combination of physical, biological, and cultural attributes that make each landscape identifiable or unique. Landscape character embodies distinct landscape attributes that exist throughout an area. This project is located within the Mountainous / Mixed Forest Landscape Character Unit – Limestone Plateau Portion. Landscape use patterns in this area are primarily natural appearing – pastoral/recreational. Management of this area includes botanical areas (3.1) (non-motorized), resource production emphasis (5.1), and developed recreation complexes (8.2). Evidence of

management activities are evident, but they are subtle in this area when viewed from main roads and recreation sites, suppression of wildland fires has resulted in a denser forest, which is helping to hide other activities (roads, vegetation management, vehicle access/movement), as well as provide cover for big game.

There are two main drainages in this planning area, Castle Creek and the North Fork of Castle Creek. Along the bottom of these drainages meadows can be found. Along the North Fork of Castle Creek, agricultural activities appear to be maintaining the meadows.

Human use is scattered throughout the area, including: agricultural uses in the prairie areas, snowmobile, cross-country ski, hiking, camping, boating, fishing, and off highway / all-terrain vehicles. Dispersed recreation occurs throughout the area, throughout the year. The complex of recreation sites around Deerfield Lake are a major development and receive moderate to heavy use during the spring, summer, and fall. Once the lake freezes over and snow blankets the area, this planning area is a popular location for ice fishing, snowmobiling, and other winter recreation activities.

Inherent Scenic Attractiveness

Scenic attractiveness is obtained by classifying the landscape into different degrees of variety. Scenic attractiveness classifications are: Class A - Distinctive, Class B - Typical and Class C - Indistinctive. Class A refers to those areas where landform, vegetative patterns, water characteristics and cultural features combine to provide unusual, unique or outstanding scenic quality. Class B refers to those landscapes where landform, vegetation patterns, water characteristics and cultural land use combine to provide ordinary or common scenic quality. Class C refers to those landscapes where landform, vegetation patterns, water characteristics and cultural land use have low scenic quality.

Within the Deerfield planning area, the majority of the areas that have a Class A Scenic Attractiveness classification are located along the water bodies of: North Fork of Castle Creek, Castle Creek, and Deerfield Lake, as well as the upper portions of the escarpment above Reynolds Prairie. Areas with a Class B Scenic Attractiveness classification, comprised of a typical Black Hills National Forest scene, are primarily in the rolling prairie and forested areas northeast and southwest of Reynolds Prairie, as well as the upper elevations north of Castle Creek (above Deerfield Lake), as far north as FSR 189. The majority of the remaining portions of the planning area are in Class C Scenic Attractiveness classification, which is generally associated with dense spruce and ponderosa pine forest, few dominant rock formations, flat to gently rolling topography, and little or no water bodies/streams. Approximately 27% of the Deerfield area is in the Class A - Distinctive classification, 40 % in the Class B - Typical and 33 % in the Class C – Indistinctive.

Landscape Visibility

Travelways and use areas are identified and classified during the Forest-wide planning process, in order to determine which observer locations, and their importance, to use in the landscape visibility analysis. Sensitivity Level 1 travelways 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 travelways.

Sensitivity Level 1 travelways include County Road 308, and FSR 17 (north of the planning area), as well as the Deerfield Lake Recreation Complex. Sensitivity Level 2 travel ways in the planning area include: County Roads T303, 306, 307, and 309; Forest Service Roads 189, 291, 157, 233, 417, 421, 607. The remainder of the roads in the planning area are Sensitivity Level 3.

Existing Scenic Integrity

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 measured in degrees of deviation from the natural appearance of the landscape character type.

The existing scenic integrity of the planning area, when viewed from the Sensitivity Level 1 highways, in background, is High; and from Sensitivity Level 2 roads and trails, viewed in foreground and middleground to be Moderate to High, except up on the plateau where the condition in the foreground of FSR 189 is Moderate to Low. There may be other areas on the plateau that may be in a Moderate to Low condition. The planning area appears in a slightly altered, to near natural condition to most viewers.

Inventoried Scenic Class

Scenic Classes measure the relative importance of, or value, of discrete landscape areas having similar characteristics of scenic attractiveness & landscape visibility. Scenic Class is used to compare the value of scenery with the value of other resources.

Scenic Integrity Objectives (SIO)

Scenic Integrity Objectives were adopted from the scenic class values. Areas with High Scenic Integrity Objectives should appear natural; management activities should be un-noticeable within one year after the completion of the project. Areas with Moderate Scenic Integrity Objectives should appear only slightly altered from the more natural appearing forest. Spacing and age diversity is not as important as in areas of High Scenic Integrity Objectives. Management activities should not be noticeable within two years after the completion of the project. Areas with Low Scenic Integrity Objectives should appear moderately altered with management deviations becoming more noticeable. Management activities, in the form of slash and logging systems, should be unnoticeable within three years after the completion of the project.

Within the Deerfield Project Area, approximately 22% of the planning area has a HIGH SIO, 49% a MODERATE SIO, and 29% a LOW SIO.

Recreation Opportunity Spectrum (ROS)

The ROS classifications for this project area are:

Semi-Primitive, Non-motorized (Mgmt Areas 3.1 - Botanical Areas)
Roaded Natural (Mgmt Areas 5.1 - Resource Production Emphasis)
Roaded Natural (Mgmt Areas 8.2 - Recreation Complexes)

The ROS is identified for each management areas. The physical, social and managerial settings support the Forest Plan ROS classifications of this area. The ROS is compatible with the Scenic Integrity Objectives (For further discussion, see the Travel and Recreation section in this chapter).

Alternative A

Direct Effects

No management activities as outlined in Alternatives B, C or D would occur.

Indirect Effects

Existing conditions and natural processes of trees growing and regenerating will continue. Wildland fire is an essential ecological process in this ecosystem, which will continue to be extinguished as quickly as possible. This management will continue to try to limit the natural role of fire in the landscape. As a result, the forest will continue to grow densely, becoming thicker and reducing visible open space. Views into the forest will become more limited as the trees grow more densely. Should wildfires burn into stands of densely packed growing 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.

Efforts are made to keep the fires small. These efforts likely will continue to limit visual evidence of the effects of wildfires within the landscape. Should fires spread beyond initial containment, such as in drought or high wind conditions, and there are contiguous hillsides of densely packed trees, we could expect to see hillsides of fire-killed trees. These fire-killed, or in the event of a major insect attack, trees will generally remain standing for 5 to 15 years (depending upon wind, rate of decay, and size of the tree). As these trees fall, these areas will be more visible in the landscape as large openings. During periods when the ground is snow covered, these areas will 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 in the wind, from the surrounding trees, will land in the area and new trees will sprout and the area will recover.

In areas with a High or Moderate SIO, large areas of trees killed by fire, or insects, the forested landscape would move away from the desired future condition for more open park-like stands. In small areas, such as 1 to 3 acres, where trees are killed, a mosaic of tree sizes and openings would be maintained that would move toward the desired future condition.

In areas where fire does not play its natural role in thinning out the forest, the trees will grow more densely, and move the forested landscape away from the desired future condition.

Cumulative Effects

The Existing Scenic Integrity within the planning area would not appreciably change in the short term, but slowly the aesthetic appeal will decrease, as the lack of open space diminishes and the forest becomes thick with small diameter trees. Visibility into the forest will diminish. The forest vegetation can appear as "walls" along a trail, a highway, or adjacent to private land. Aspen and other hardwood stands will be choked out, as they are competing for the same nutrients with the pine trees.

Long term, as the forested stands move away from the desired condition, the visual diversity and variety will likely be reduced. The dense understory will limit views into the landscape while hardwood and meadow components will be reduced. Natural changes in the landscape, such as from high intensity fire, insect activity and disease, will potentially change the character from a landscape with a forest overstory, to one that would likely contain large open hillsides, hillsides with fire-killed trees, and hillsides of young trees. Depending on how wide spread, or concentrated, these natural processes occur would determine how dramatically these changes would be evident in the landscape.

Alternative B

Direct Effects

Vegetation treatment will create stumps, slash, areas of reduced vegetation, and can create unnatural appearing edges between areas of cut / no cut, or areas of heavy / light vegetation density. Treatment methods can create impacts that are evident in the landscape; i.e. – paths or other locations where skidders or other equipment are used can displace soils that create noticeable color difference.

Skid trails (which can result in lines being created on the landscape), from vehicles moving logs through the forest, will be evident until clean up activities are completed. On gently rolling terrain, disturbance is kept to a minimum and often not evident one year after the completion of activities. Log landings - 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 will vary from location to location. Once logging is completed, these sites are cleared of debris and reseed. The length of time before the site appears as a natural opening is generally 1 to 4 years, depending upon the level of disturbance.

Aspen clones & hardwood trees should become more visible in the landscape, as the conifers that compete with, or screen, them are removed.

Due to the rolling nature of the topography on top of the plateau, Overstory Removal, Seed Cut, Commercial Thinning, and other treatments should appear less obtrusive in the landscape.

However, these units often result in a more open and managed appearing landscape when viewed close up, from forest roads.

The overstory removals along the east side of Flag Mtn., Nipple Butte, Castle Rock, and between County Road 308 and Deerfield Reservoir Dam, will be evident from the recreation complex around Deerfield Lake, as well as from Sensitivity Level 1 & 2 Roads. The scale of these openings is much larger than any natural openings. These treatments centered at Nipple Butte, and extending north and south, will create large open areas in the landscape. These openings, visible in the middleground, will dominate the view from the surrounding areas. In addition, existing roads that cross the face of Nipple Butte, currently hidden by vegetation, will be highly evident in the spring & fall when snow is on it, and snow is not as evident on the surrounding hill sides.

Overstory removals in other areas run parallel to the contours, or along the tops of ridges. In these cases these units mimic natural patterns in the landscape and expose hidden rock formations. These treatments and others should meet the assigned SIO.

Indirect Effects

The quantity of visible fall foliage should increase as the conifers that are competing with the Aspen clones and hardwood trees would be removed. Wildlife browse should increase in commercially thinned and burned areas, resulting in greater opportunities to view wildlife in their natural setting. Flowering plants may also increase, providing more spring/summer color in the landscape. A greater variety of native plants could be more evident in the landscape.

Cumulative Effects

Past activities within this planning area have included vegetation treatments, road, trail, and utility corridors. Due to the gently rolling nature of the terrain, west of Flag Mountain on the top of the plateau, areas of past vegetation treatment, cannot easily be seen in the distant middleground and background, when viewed from other locations (including during the months when snow covers the ground). The overstory removal treatments, evident from Sensitivity Level 1 & 2 roads, trails, and the Deerfield Lake Recreation Complex, will move the forest away from a natural appearance and toward a managed appearance.

The Deerfield area is used for trail riding, hunting, fishing, camping, Christmas tree cutting, and snowmobiling by the recreating public. The level of concern for a natural appearing landscape will likely continue at the same level. However, should development on the private land (within the planning area) increase, the concern may increase accordingly.

Alternative B will modify the vegetation across the landscape so that management activities will be more evident than with Alternatives C and D.

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. A Moderate SIO can be met if the size of the unit does not exceed the natural openings by more than 10%, otherwise it will 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.

Alternative C

Direct Effects

The direct effects of individual treatments are similar to Alternative B. The size of intensive overstory removal units is reduced.

Indirect Effects

The indirect effects, with regard to season color would be similar, to Alternative B. There would no indirect effects to the Recreation Complex, as identified in Alternative B

Cumulative Effects

Treatments would have a more natural appearance that Alternative B. The landscape would still appear in a natural condition when viewed from the Deerfield Lake Recreation Complex.

Alternative C will modify the vegetation across the landscape so that management activities will be evident, but appear natural, more open, condition.

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. A Moderate SIO can be met if the size of the unit does not exceed the natural openings by more than 10%, otherwise it will 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.

Alternative D

Direct Effects

This alternative would not create any forms or lines that would be evident on the landscape, as no overstory removals would occur. Vegetation treatments would appear as a natural condition in the landscape.

Indirect Effects

The indirect effects, with regard to season color would be similar, to Alternative B. There would no indirect effects to the Recreation Complex, as identified in Alternative B

Cumulative Effects

This alternative would maintain a natural appearance to the area. Alternative D would modify the vegetation across the landscape in a manner that management activities would appear as a natural condition.

LAND and SPECIAL USES

Affected Environment

The existing complicated land ownership pattern in this area was set in motion by the Euro-American settlement that exploded in this area immediately after the Custer Expedition of 1874. This settlement started as a gold rush, and quickly evolved to include cattle grazing, agriculture, and logging – largely in support of the mining camps and operations. Associated with this were roads and trails to provide access to markets. Lands were removed from the Federal domain into private ownership as mining claims and homesteads. The earliest patent was issued for a mining claim in 1903 and the last for a homestead in 1916.

Lands that are now part of the Black Hills National Forest are a result of the Organic Administration Act of 1897, which established many Forest reserves in the west. A large amount of land within the project area that is now National Forest was formerly private land. Thousands of acres were brought into the NFS through exchanges in the 1930's up through 1945 under authority of the General Exchange Act.

There are a number of private and public road easements that have been granted in the project area for access across the National Forest Systems lands, and easements that the Forest Service acquired to cross private lands. There are also Special Use and other authorizations issued for utility and water lines, outfitting and guiding 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 would continue existing easements and special use permits. New construction of houses and subdivisions is anticipated. They will result in new requests for road and utility access routes across NFS lands. All alternatives would respond to continuing requests for legal access and utility lines to private land and would address each request on its own merits under existing land and policy direction.

There are no direct, indirect, or cumulative effects related to lands and special uses from any of the alternatives, with the possible exception of Alternative C. Alternative C includes provisions to consider proposals from groups or individuals to develop and maintain use areas for motorized and non-motorized trails and roads. This could possibly result in the issuance of a special use permit or other authorization for these activities.

HERITAGE

Affected Environment

There have been 46 Level III Heritage Surveys conducted within the boundaries of the Deerfield Analysis area. The Heritage resource reconnaissance was performed by a professional archaeologist using a system that surveys potentially affected resources within the analysis area with equal thoroughness. A sample reconnaissance survey was used within the recently completed Mercedes Project Area Analysis (Garcia 1998), which overlaps the Deerfield Analysis area. Those acres were covered using a survey strategy (Sheveland 1998) that was approved through the State Historic Preservation Office prior to implementation. The strategy was based on existing knowledge of resources, landforms in the area, and the high to moderate probability areas for site location.

The sites located in the Deerfield Analysis area consist of historic period cabins, prehistoric and historic habitation sites, historic period trails, roads, lookouts, rail roads, and historic and prehistoric artifact scatters. Protection measures for these sites are keyed to determinations of each site's eligibility for inclusion in the National Register of Historic Places. Heritage sites determined eligible or heritage sites with an undetermined eligibility are of concern. Non-eligible sites are dropped from management concerns, and determinations of effect on these properties are not addressed in this analysis.

A total of 152 sites and isolates are located within the Deerfield Analysis Area. Thirty-four sites are considered eligible or potentially eligible for inclusion into the National Register of Historic Places. The remaining 118 sites are considered to be not eligible. Specific areas of concern for the heritage resource program include the protection of class I (eligible) and class II (unevaluated) archeological/historical sites, appropriate consultation with local American Indian groups, and the protection of spiritual sites, Traditional Cultural Properties (TCPs), recent and historic graves, and Euro-American cemeteries. There were two potential TCPs identified within the Deerfield Project Area during this analysis and subsequent tribal contacts. There are two locations that have been identified during field visits and conversations with tribal representatives, as being spiritual and traditional use properties. These areas are locations of continuing spiritual practices. The two spiritual locations have not been formally evaluated or designated as Traditional Cultural Properties. A formal evaluation is being proposed for these sites. The greater area around Ditch Creek, Castle Creek, and the Deerfield Lake has been identified as having cultural and environmental importance for local tribal groups, and management recommendations from the consulting parties have been incorporated into the Environmental Impact Statement. These comments included fuels reduction needs, opening of vistas at high points, removal of pine encroachment in meadows and within hardwood stands.

Environmental Consequences

Heritage resource effects were qualitatively assessed through a presence/absence determination of significant cultural resources and mitigation measures to be employed during commercial harvest, prescribed fire (broadcast burning), fuel break construction, and/or fuel reduction activities. The affected environment includes both known heritage resource sites and sites that

will be located in the future as more of the Forest is surveyed. Most of these surveys and site documentations have been done in order to evaluate the effect of other projects (e.g., timber or range projects) on heritage resources.

Alternative A

Direct / Indirect Effects

The No action Alternative would not directly affect heritage resources through any activity, pertaining to this decision.

Alternative A does not provide any mitigation measures, resource protection, or stabilization of currently affected sites. If some forest stand densities remain unnaturally high with no removal of any live trees, then the fire hazard in these areas would remain high and the potential for large, high intensity crown fires would remain. Such a fire, should it occur, would directly and indirectly, through soil erosion and exposure to the elements, damage and/or destroy heritage resource sites within its path.

Cumulative Effects

In the long-term, risk of wildfire and potential damage of heritage sites would increase as forest conditions continue to deteriorate. In the event of a wildfire, any remaining combustible materials at sites could be damaged or destroyed, and all heritage resources would be subject to exposure and erosion. If present, traditional use areas such as plant and firewood gathering areas, and Traditional Cultural Properties (TCPs) could also be damaged by future wildfire.

Alternative B

Direct / Indirect Effects

General impacts to heritage resource sites under Alternative B can result from maintaining and/or upgrading existing roads, building fire lines, timber harvest activities, some non-commercial thinning activities, and prescribed burning. This Alternative proposes the greatest number of vegetative treatments. Recreation and travel management would be guided by current Forest Plan guidelines. A number of existing roads would be closed, obliterated, or relocated in order to protect water/soil resources and special habitats.

There are 27 sites that could be directly affected by Alternative B. These sites could be affected by both vegetation management and prescribed burn activities. Activities such as access, skidding, and landing could affect or displace artifacts. Building of fuel breaks and fire lines could also adversely affect heritage resources. However, these sites can be protected with adherence to site specific protection measures that have been incorporated into the alternative design. These sites could be adversely affected by large wildfire activity. This alternative provides the most beneficial results to heritage resources in the form of fuel reducing treatments around heritage resources.

Minor indirect effects to cultural resources are expected from prescribed burning, prescribed fire and thinning activities. These actions have the potential to expose unknown archeological sites and TCPs. There are a number of resource sites that could be potentially affected by the proposed thinning activities. This alternative, proposes ground-disturbing activity that, in turn, could increase the chances of damage to known and/or unrecognized heritage sites.

Cumulative Effects

The proposed ground disturbing activities have the potential to add to the cumulative effects on heritage resources currently affected by the various land uses allowed on National Forest Lands. These include past timber harvest activity, rangeland management, wildlife restoration, habitat improvement projects, recreational uses, and natural events, and can occur in the form of increased soil erosion, increased visitor traffic, vandalism, and alteration of historic landscapes. This alternative would greatly increase the potential for cumulative adverse effects to sites if not protected. However, the alternative design incorporates resource protection measures including Forest Plan Standards and Guidelines that minimize any incidental increase in impact to the sites. Also, hardwood and meadow restoration is planned as recommended during Tribal Consultation.

Alternative C

Direct / Indirect Effects

Proposed activities with the potential to impact heritage resources directly, include maintaining and/or upgrading existing roads, building fire lines, thinning, gathering forest products and prescribed burning. There is a potential for indirect effects to sites due to the proximity of proposed logging activities to known sites and the increase of traffic to and through harvest units containing these sites. This potential is greater than Alternative B because more sites are involved.

There are 30 sites that could be affected by Alternative C. These sites could be affected by actions proposed in alternative C as they were described in Alternative B. Additionally, under this alternative sites could be subject to adverse affects by additional prescribed burn activity proposed. Four sites could be affected by proposed timber harvest activities, including access, skidding, and landing, as well as prescribed burn activities. Broadcast burning could potentially have the greatest effect, while pile burning would have minimal effects due largely to the area extent of treatment. These sites could be adversely affected by large wildfire activity, so reductions in fuels would be desirable. This alternative provides the most beneficial results to heritage resources in the form of fuel reducing treatments around heritage resources. As with Alternative B, Alternative C design provides for site specific protection measures that minimize potential effects from actions planned.

Cumulative Effects

The proposed ground disturbing activities have the potential to add to the cumulative effects on heritage resources currently affected by the various land uses allowed on National Forest Lands. These include past timber harvest activity, rangeland management, wildlife restoration, habitat

improvement projects, recreational uses, and natural events, and can occur in the form of increased soil erosion, increased visitor traffic, vandalism, and alteration of historic landscapes. This alternative would increase the potential for cumulative adverse effects to sites. However, it also would provide for the implementation of resource protection measures as part of the alternatives design. Alternative C proposes a greater number of acres of hardwood and meadow restoration.

Alternative D

Direct / Indirect Effects

The number of resource sites potentially affected by prescribed burning would not occur under this alternative because prescribed burning is minimal. Less vegetation treatment activity would help minimize the risk of disturbing currently unrecognized sites. General impacts to heritage resource sites under Alternative D would be similar to those described under the other Action Alternatives. The minimal amount of prescribed burning (broadcast burning) would also minimize the possibility of accidental damage to heritage sites that are combustible. The potential for effecting known and undiscovered resources are lower with the lower amount of proposed activities in the analysis area.

There are 30 sites in Alternative D that could potentially be affected by this alternative. The effects primarily result from vegetative treatments, prescribed burning, and road obliteration efforts. Because of the minimum amount of fuels and vegetation treatments proposed under this alternative there is a greater risk that these sites could be adversely affected by large wildfire activity.

Cumulative Effects

The proposed ground disturbing activities have the potential to add to the cumulative effects on heritage resources currently affected by the various land uses allowed on National Forest Lands. These include past timber harvest activity, rangeland management, wildlife restoration, habitat improvement projects, recreational uses, and natural events. There would be some additional effects from the proposed activities. Resource protection measures and less hardwood and meadow restoration efforts are part of the alternative design.

Effects Common to All Action Alternatives

Direct Effects

The direct effects of the proposed action alternatives include beneficial actions such as, reduction of potential for catastrophic fire impacts to resources. Increased visuals for sacred sites, and the restoration of hardwoods and meadows as requested during field visits with tribal representatives. There are also opportunities to implement protective measures and the potential for the stabilization of sites, and interpretation of historic resources.

Indirect Effects

As harvest activity increases in area and density (greater volume of timber per acre removed), access is also increased. While the access may not always increase in area density, it will increase in duration and intensity. Surface and subsurface effects due to disturbance from repeated equipment/product traffic could occur. Additionally, this increased access would create opportunities for post-sale noncommercial activity such as fuel wood cutting, which places the heritage resources at further risk of disturbance and vandalism. Some form of burning (either broadcast or pile) is proposed under all action alternatives. Forest Plan Standard 4102 provides for the protection of heritage resources within proposed prescribed burn areas. Site-specific protection measures will be outlined in the Prescribed Burn Plan, prior to implementation.

Indirect effects can lead to significant cumulative alterations to individual sites or all of the sites that represent a particular type of forest use. For example, illegal surface collection of time-sensitive artifacts from most of the American Indian sites on the Forest has compromised our ability to date many of these sites without expensive excavation techniques. Extensive surface collection, illegal digging, and vandalism can lead to complete destruction of a site. The relatively undisturbed and legally protected sites on National Forest System land will be of increasing value to national forest visitors.

Cumulative Effects

The cumulative effects assessment for the proposed Deerfield Analysis considers the past, present, and reasonably foreseeable actions on land uses that could add to (intensify) or offset (compensate for) the effects on the resources and that may be affected by the proposed Deerfield Project action alternatives. In some instances, activities may result in both negative and positive impacts when considering the short and long-terms.

The combination of forest activities such as timber harvesting, recreation, and range activities may have a cumulative effect on Heritage resources in the form of increased soil erosion, increased visitor traffic, vandalism, and alteration of historic landscapes. Cumulative effects of these types are difficult to quantify, but may be avoided or minimized through the implementation of appropriate, site-specific treatments, when deemed necessary through the consultation process with the State Historic Preservation Officer and the Advisory Council on Historic Preservation.

Reasonably foreseeable actions that will directly or indirectly affect heritage resources include local population growth and increasing numbers of visitors to the Forest. As the number of visitor's increases, so will the Black Hills National Forest need to inform and involve its users in its' management. The history of past Forest use provides a useful context for expanding that dialogue. Another foreseeable action will be heritage budgets that may not significantly increase, or may in fact decrease, creating a need for further partnerships with local and national organizations and individuals to care for heritage resources. This will be the case particularly with historic Forest Service facilities, such as guard stations. Ultimately, as public land management becomes increasingly complex, conflicts over resource values will increase.

Consultation

The Forest consults with the South Dakota State Historic Preservation Officer (SHPO). The Forest also consults with the Tribal Historic Preservation Officers (THPO's) from the Standing Rock Sioux Tribe and Cheyenne River Sioux Tribe in the same manner and with the same documentation for each undertaking. If a site is eligible or has been identified as a sacred site, heritage personnel consult with tribal government officials and the appropriate SHPO on protection, avoidance or mitigation measures. As part of the consultation process heritage personnel request field visits by tribal government representatives to identify or verify sacred site locations. The Deerfield Project Area Heritage Resource report was sent to the South Dakota State Historic Preservation Office of Review and Compliance for comment and eligibility determinations for the heritage resources located within the project area. Likewise the reports were also sent to Tribal Historic Preservation Offices for their review and comment, and additional recommendations for the protection of American Indian spiritual use sites. In a letter dated June 26, 2003, the State Historic Preservation Office concurred with the determination of "No Historical Properties Affected for this undertaking." Additional consultation was conducted in October of 2003 with members of the Standing Rock Sioux Tribe and the Grey Eagle Society. Follow-up contacts were made following the mailing of the initial scoping letter and during the comment period for the DEIS with Tribal representatives to determine if additional information on the environmental document is needed.

SOCIAL

Affected Environment

The Deerfield Project Area lies in Pennington County, South Dakota 11 miles northwest of Hill City, South Dakota. The project area is approximately 41, 000 acres in size and includes about 5,200 acres of interspersed private land. The project area includes the Deerfield Recreation Area, Deerfield Lake, Reynolds Prairie, and Hat and Flag Mountains. 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 Hill City and Rapid City (the regional trade center and second largest city in South Dakota).

Pennington County represents one of the more culturally diverse counties in South Dakota. During the last decade, Pennington County witnessed a growth rate of nearly 9%. The 2000 census indicated that Pennington County grew by 7,222 people to a total population of 88,565. Approximately 30% of the increase in population in the last decade was located outside of any town or municipality (2000 census).

Individuals that chose to live within and adjacent to the Deerfield Project Area 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. Values associated with these developments that could be directly or indirectly affected by wildfire include highways and roads, transmission lines, municipal watershed and reservoirs such as Deerfield Reservoir.

The beauty of the area brings in new residents; those with tenure have a strong tradition of multiple-use of resources and expect a balance of goods and services from these resources. 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, camping, wildlife viewing, and off-road motorized travel, as well as, utilizing the Deerfield Recreation Complex.

Motorized use in the Black Hills has a fairly long history and people have been utilizing roads to access most parts of the Forest. The rise in off-road use is not restricted to local users. The Black Hills is increasingly becoming a destination area for off-road use, due in part to its popularity, but also the increasing restrictions in off-road use in other parts of the country.

Environmental Consequences

The population of Pennington County and surrounding municipalities will continue to grow in the future. Thirty percent of this growth is expected outside of any town or municipality, as well as development of private inholdings within and adjacent to the project area.

The expected increase in area population and related increase in both motorized and non-motorized recreation activities, would, in general, lead to more conflicts among users on roads, trails, and areas that remain open to off-road use. All of the alternatives, except the No Action, act to alleviate some of the conflicts between motorized and non-motorized users, which are expected to increase in the future.

Although a small percentage of motorized travel actually occurs off roads and trails, the fact that motorized travel has gradually been restricted on many public lands, would add to some motorized users' concerns regarding control and management of public lands. All alternatives except the No Action could add to these feelings.

Fuel treatments that reduce the potential of a large, catastrophic fire from occurring also help to protect human health and safety. Since no vegetative treatments or prescribed burns occur with Alternative A, this alternative would be the least effective. In fact, the potential for a serious accident would increase with increased fuel loadings and fire behavior under No Action. By having the largest number of overall acres treated, Alternative B would provide the most protection in the short term and can provide long-term benefits through maintenance treatments. Alternatives C and D provide progressively reduced levels of safety respectively as they do not treat as many acres as Alternative B.

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.

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.

ECONOMICS

The following is a summary of the analysis used to calculate a variety of financial measures describing the alternatives in the Deerfield EIS. The Quick-Silver program is used to perform the analysis (QS Version 5.004.45 (USDA-Forest Service, North Central Experiment Station, February 16, 2000). The financial analysis was done both from a short-term and long-term perspective. The complete analysis including reports generated resides in the Deerfield project file.

The objective of the analysis is to provide a relative comparison of the costs and revenues associated with implementing the four alternatives being analyzed. There are costs and benefits associated with activities occurring in the Deerfield Project Area that are not included in this analysis. This analysis does not include these activities (e.g., recreation management, Christmas trees, fuelwood gathering.) because they occur across the District and Forest and they are not directly related to the proposed action. The action alternatives will not significantly change these other items.

This EIS discusses three action alternatives for managing the Deerfield Project Area for the next ten to fifteen years. The financial analysis includes those actions connected to the vegetation treatment planned over this management time-frame. The benefits included in the analysis were the revenues generated from the volume of timber and products other than logs (POL) harvested per action alternative. Also included were projected revenues from anticipated future treatments. This analysis does not include revenues generated in the local and regional economies relative to wages, equipment and supplies purchased, and taxes paid.

The action alternatives described in this EIS are consistent with National level initiatives and policy such as the National Fire Plan, Healthy Forest Initiative, Healthy Forest Restoration Act and direction provided by the Forest Plan, Phase I Amendment and associated economic assumptions. Any future project proposal will receive a separate environmental analysis, including financial and/or economic analysis as appropriate.

Table 3-27 displays the financial measures summarized by alternative.

Table 3-27 Financial Measures by Alternative

	Alternative A	Alternative B	Alternative C	Alternative D
Present Net Value (PNV)	NA	-$8.1 million	-$10.4 million	-$4.6 million
Benefit/Cost Ratio (B/C)	NA	.46	.23	.19
Benefits (PV)	NA	$6.8 million	$3.1 million	$1.1 million
Costs (PV)	NA	-$14.9 million	-$13.5 million	-$5.7 million

High cost and revenue factors influencing the differences in these financial outcomes are:

- The varying revenues (benefits) generated from the alternative volumes removed through commercial vegetation treatment: (129,000 ccf in Alternative B, 66,000 ccf in Alternative C and 21,300 ccf in Alternative D).

- Costs associated with the large number of non-commercial thinning acres planned: (16,300 acres in Alternative B, 13,700 acres in Alternative C, and 7,400 acres in Alternative D).

- Costs associated with the differences in prescribed burning acres: (up to 10,000 acres in Alternative B, 14,000 acres in Alternative C, and 3,500 acres in Alternative D).

- Costs associated with the anticipated large number of disturbed acres needing noxious and invasive weed treatment: (about 10,500 acres in Alternative B; 10,000 acres in Alternative C; and 5,400 acres in Alternative D).

Although costs associated with No Action (Alternative A) is not integrated into this financial analysis, the actual cost of no action could potentially be much higher than the action alternatives in both economic and environmental terms. Recent wildfires on the Black Hills and in the western USA have experienced costs in the millions of dollars for suppression alone. For example suppression costs for the recent Battle Creek Fire are estimated at $6.5 million and the Jasper Fire around $11.5 million. Costs of rehabilitation, economic loss of resources and property values are significant additional costs of these wildfires.

The cost of fully implementing Alternative C exceeds the revenues generated by $10.4 million dollars. There are lower revenues generated in this alternative because of the lower amount of commercial harvest planned as compared to Alternative B. Implementation costs ($13.5 million) are not quite as high as Alternative B ($14.9 million). Thus, implementation costs of Alternative C are defrayed to a lesser degree by revenues than Alternative B. To fully implement Alternative C additional funding such as appropriated fuels dollars or other sources will be necessary to accomplish activities planned. Alternative C has a greater uncertainty of being funded (greater negative PNV) than Alternative B and therefore is subject to a greater risk of not being entirely funded/accomplished.

This analysis illustrates that commercial harvest revenues offset costs of alternative implementation in proportion to the value and amount of volume removed. Revenues from Alternative B offset implementation costs to a greater degree than Alternative C. As the Table above illustrates, Alternative B generates $6.8 million and has costs associated with implementing activities totaling

$14.9 million. Other funding sources such as appropriated fuels dollars or external contributions would also be needed to accomplish all the activities planned in Alternative B. Because of the greater revenues generated, more activities critical to meeting the purpose and need could be accomplished under Alternative B relative to the other action alternatives.

In similar fashion, the cost of fully funding and completing activities planned in Alternative D exceeds revenues. Alternative D generates $1.1 million and has costs associated with implementing activities totaling $5.7 million. Again, other funding sources would be needed to fully accomplish all the activities planned. The difference between revenues and costs in Alternative D is the least of the three action alternatives at $4.6 million. However, this alternative achieves substantially less in terms of meeting the purpose and need than the other alternatives.

With Alternative B, there is a greater accomplishment in terms of meeting the purpose and need. This difference is reflected in the benefit/cost (b/c) ratio of the respective alternatives as shown in the table above. Alternative D has a very low b/c ratio of .19. Alternative C has a b/c ratio nearly comparable at .23. Alternative B has the highest b/c ration at .46. Alternative B has greater certainty of being fully funded. Revenues come closer to off-setting costs in Alternative D because considerably less work is being accomplished relative to Alternatives B & C.

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 (about 5 miles), Alternative C (about 5 miles) and Alternative D (about 2 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 plant

communities that lead to losses in wildlife habitat, soil productivity, soil erosion, forage for grazing and vegetative diversity.

Travel and Recreation Use such as motorized and non-motorized travel would be curtailed, modified and/or eliminated to varying degrees and in certain portions of the project area depending on the action alternative implemented.

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, C and D are implemented using design criteria and mitigation 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 insects and disease will continue within the project area, at epidemic levels, in some areas.

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.

Travel and Recreation Use on the part of the public will experience some adverse effects in terms of what users are currently used to doing versus changes resulting from implementation of the various alternatives.

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 removed. There exists a higher long-term potential for catastrophic 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.

CHAPTER 4 INDEX

Access 198, 227, 228, 230, 231, 233, 234, 236, 237, 238, 273, 291
air quality 103, 104, 118, 122, 123, 127, 130, 133
Allotment Management Plans
AMPs 134, 136, 137, 138
American marten
marten 20, 23, 143, 146, 156, 157, 158, 159, 178, 195, 197, 202
American Three-toed Woodpecker..... 159
at risk communities
ARC 5
bald eagle 6, 161, 162, 192, 195
Basal Area
BA 2, 116, 117, 273
Best Management Practices
BMP 2, 26, 45, 70, 155, 194, 265, 268, 273, 274
big game
white-tailed deer
mule deer
elk21, 23, 25, 36, 142, 152, 164, 165, 166, 167, 168, 177, 179, 197, 200, 202, 239
Black-backed Woodpecker 162
Botanical Areas..... v, 4, 14, 21, 90, 205, 241
Brown Creeper 168, 271
CMAI ..... 2, xi, 77, 80, 274, 275
Concentrated Public Use Area
CPUA 216
Connected Disturbed Area
CDA 2, 46
crown bulk density
CBD 115
crown fire 5, 9, 12, 26, 33, 37, 72, 82, 88, 91, 96, 108, 110, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 123, 124, 125, 126, 127, 128, 129, 131, 132, 145, 184, 193, 208, 232
culmination of mean annual increment
CMAI 77
design criteria..... iv, 1, 11, 26, 50, 152, 185, 193, 194, 257
Desired Condition
DC 143
diversity. iv, 6, 7, 8, 9, 13, 14, 77, 81, 82, 87, 88, 92, 93, 94, 97, 120, 125, 129, 141, 142, 143, 144, 145, 152, 163, 183, 194, 199, 205, 206, 229, 232, 235, 240, 242, 257, 276, 280, 281, 292
down woody material
DWM 36, 148, 194
Environmental Impact Statement... 1, 2, i, iv, 1, 3, 10, 246, 269, 271, 276, 277
Fire Protection Assessment
FPA 105, 277, 278, 280, 286
Fire Regime Condition Class
FRCC 2, 99, 100, 106, 270, 278
fire suppression ... iii, 2, 7, 17, 41, 46, 47, 49, 99, 118, 141, 187, 199, 200, 201, 293
Forest Plan . i, iv, v, vii, 3, 4, 5, 9, 10, 13, 17, 18, 19, 20, 21, 23, 25, 26, 28, 29, 36, 38, 48, 55, 71, 78, 79, 81, 83, 85, 86, 87, 88, 90, 92, 93, 94, 99, 105, 109, 120, 125, 128, 134, 136, 138, 141, 143, 144, 145, 146, 147, 148, 149, 150, 151, 153, 155, 156, 164, 166, 167, 168, 182, 183, 184, 185, 188, 192, 193, 194, 196, 199, 202, 206, 207, 212, 213, 214, 215, 224, 228, 241, 247, 248, 250, 253, 257, 270, 275, 283
Forest Supervisor ..... i, vii, 10, 279, 285
Fragmentation 149, 279
fuel breaksi, v, 3, 6, 9, 18, 19, 21, 22, 24, 34, 78, 81, 87, 90, 92, 93, 101, 110, 115, 117, 119, 120, 125, 128, 129, 132, 139, 140, 151, 152, 153, 208, 213, 247
grass/forb..... 150, 164, 292
habitat effectiveness..... 21, 23, 26, 166, 167, 168, 197, 280
Healthy Forest Restoration Act..... 5, 253
Interdisciplinary (ID) Team iv
Ips.. 74, 75, 77, 80, 84, 89, 91, 109, 281, 284
late succession..... 148, 149, 202, 281
late successional. 13, 34, 132, 149, 183, 200, 202, 207, 208, 281

Management Area
MA . 2, 4, 19, 20, 23, 25, 38, 90, 143, 148, 149, 167, 168, 208, 216
Management Indicator Species
MIS 2, 6, 156, 194, 209
McIntosh Fen . v, 6, 9, 21, 23, 44, 50, 54, 65, 185, 204, 205, 206, 209, 210, 218
McIntosh Fen Botanical Area 23, 205
monitoring .. 1, 19, 22, 24, 26, 112, 134, 144, 145, 146, 148, 156, 158, 159, 162, 165, 166, 169, 171, 172, 173, 174, 175, 177, 178, 179, 180, 185, 186, 188, 189, 190, 191, 192, 193, 194, 196, 199, 206
motorized .... i, iv, v, vi, 3, 5, 8, 9, 14, 15, 17, 18, 19, 22, 24, 28, 35, 36, 38, 118, 123, 126, 135, 137, 138, 155, 164, 167, 178, 179, 196, 197, 198, 199, 207, 208, 217, 218, 219, 220, 221, 222, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 241, 245, 252, 257, 283, 284, 285, 286
Mountain Pine Beetle (MPB).. iii, 18, 32, 78, 89, 95
MPB 2, i, iii, iv, v, vi, vii, xi, 2, 3, 5, 7, 9, 11, 18, 20, 21, 23, 24, 25, 28, 29, 30, 31, 32, 35, 36, 39, 74, 78, 84, 85, 89, 95, 96, 128, 142, 144, 145, 146, 147, 148, 149, 150, 153, 165, 166, 167, 178, 179, 180, 182, 183, 184, 185, 186, 187, 193, 201, 202, 203, 206, 208
National Environmental Policy Act
NEPA ..... 2, i, iv, 1, 17, 276, 277, 283
National Forest Management Act
NFMA 2, 4, 78, 85, 90, 276, 283
non-motorized .... i, v, vi, 3, 8, 14, 15, 17, 18, 22, 24, 28, 38, 198, 218, 219, 220, 221, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 245, 252, 257, 286
North Fork Castle Creek .. v, 6, 9, 21, 43, 44, 54, 66, 207, 209, 214, 235
northern goshawk
goshawk 146, 181, 182, 183, 184, 185, 186, 195, 197, 202
noxious weed 17, 96, 138, 139, 140, 155, 192, 201, 207
off-highway vehicle
OHV 5
Outfitter and Guides
O/G 222
Phase I Forest Plan Amendment 4
post fledging areas
PFAs 21
prescribed burning .... i, 9, 12, 14, 18, 19, 21, 26, 29, 30, 34, 35, 37, 42, 74, 78, 81, 82, 83, 87, 89, 90, 93, 94, 96, 97, 114, 122, 123, 127, 130, 132, 133, 137, 139, 140, 145, 148, 152, 199, 203, 211, 213, 225, 247, 248, 249, 255, 256, 257
prescribed fire 293, 294
purpose of and need ..... iv, vii, 1, 10, 11
Quick-Silver
QS 253
R2 Sensitive 7, 157, 192, 193, 194, 195, 196, 206, 207, 208
R2 Sensitive species156, 159, 162, 171, 174, 175, 181, 188, 190, 192, 206, 209
Rate of Speed
ROS 108
Scenic Integrity Objectives
SIO 240, 241
snags28, 29, 30, 36, 109, 143, 146, 147, 148, 186, 187, 193, 194, 202, 204
snail
snails .. 143, 156, 170, 171, 172, 173, 192, 195
Snails 192, 263
South Dakota State Historic Preservation Officer
SHPO 251
Species of Special Focus 192
structural stage
SS ... 27, 28, 106, 142, 150, 151, 183, 201, 290, 291, 292
structural stages 21, 110, 111, 142, 144, 164, 183, 184, 185, 186, 201, 274, 291, 292
Townsend's big-eared bat
bat 157, 190, 191, 193
Tribal Historic Preservation Officers
THPO 251
Water Influence Zone
WIZ 211

Watershed Conservation Practices
WCP 45, 155, 270
Watershed Influence Zone
WIZ 45, 48
wildfire .... i, iv, v, vi, vii, 3, 5, 6, 7, 9, 12, 13, 14, 15, 18, 19, 21, 24, 29, 30, 33, 34, 35, 37, 39, 46, 47, 48, 49, 50, 51, 52, 53, 58, 59, 60, 61, 63, 76, 77, 78, 82, 85, 93, 96, 97, 98, 103, 105, 109, 114, 118, 119, 120, 121, 122, 123, 125, 127, 128, 130, 132, 133, 144, 148, 149, 151, 153, 164, 180, 183, 184, 186, 188, 193, 199, 203, 206, 207, 208, 215, 247, 248, 249, 251, 258, 278, 287
wildfires .... iii, 2, 3, 7, 12, 13, 21, 29, 34, 37, 41, 42, 59, 79, 82, 117, 123, 127, 130, 131, 133, 139, 140, 141, 199, 203, 224, 241, 255, 292
wildland-urban interface
WUI 5

CHAPTER 5 BIBLIOGRAPHY/REFERENCES

Allen, K., 2005. "Consequences of the No Action Alternative in the Deerfield Area." Memo to Deerfield Interdisciplinary Team Leader, L. Van Alstyne. April 4, 2005. pp 3.

American Wetlands Campaign. 2004. American Wetlands Campaign Kit, Wetland Definitions. Available: http://www.iwla.org/sos/awm/kit_defn.html

Anderson, T.A. 2003. *Conservation Assessment of Woodpeckers in the Black Hills National Forest.* USDA Forest Service, Rocky Mountain Region. Accessed March 15, 2005. Available: http://www.fs.fed.us/r2/blackhills/projects/planning/assessments/woodpeckers.pdf

Anderson, T.A. 2004a. *Mystery Vertigo (Vertigo paradoxa): A Technical Conservation Assessment.* USDA Forest Service, Rocky Mountain Region. Accessed May 15, 2005. Available: http://www.fs.fed.us/r2/projects/scp/assessments/mysteryvertigo.pdf

Anderson, T.A. 2004b. *Callused Vertigo (Vertigo arthuri): A Technical Conservation Assessment.* USDA Forest Service, Rocky Mountain Region. Accessed May 15, 2005. Available: http://www.fs.fed.us/r2/projects/scp/assessments/callusedvertigo.pdf

Anderson, T.A. 2005. *Oreohelix strigosa cooperi (Cooper's Rocky Mountain Snail): A Technical Conservation Assessment.* USDA Forest Service, Rocky Mountain Region. Accessed May 15, 2005. http://www.fs.fed.us/r2/projects/scp/assessments/coopersrockymountainsnail.pdf

Applegarth, J.S., N. Duncan, P. Jeske. 1999. *Management Recommendations for Terrestrial Mollusk Species: Megomphix hemphille, the Oregon Megomphix.* Washington, D.C.: U.S. Department of Agriculture, Forest Service: U.S. Department of Interior, Bureau of Land Management, 1999. http://www.or.blm.gov/surveyandmanage/MR/TM4Species/2000-015_2.pdf

Arno, Stephen F. and S. Allison-Burnell. 2002. Flames in Our Forest: Disaster or Renewal. Island Press, Washington, DC, pp 228.

Arno, Stephen F. and Fiedler. 2005. Carl E. Restoring Fire-Prone Forests in the West. Island Press, Washington, DC 242 pp

Baker, W. L. and Ehle, D. 2003. Uncertainty in surface-fire history: the case of ponderosa pine forests in the western United States. Canadian Journal of Forest Research Vol. 31, no 7: p. 1205-1226.

Baker, W. L. and Ehle, D. 2001. Uncertainty in Fire History and Restoration of Ponderosa Pine Forests in the Western United States. Fire, fuel treatments, and ecological restoration: Conference proceedings; 2002 16-18 April; Fort Collins, CO. Proceedings RMRS-P-29. Fort Collins, CO: USDA, Forest Service, Rocky Mountain Research Station. pp 319-333.

Bedford, B.L. and K.S. Godwin. "Fens of the United States: Distribution, Characteristics, and Scientific Connection Versus Legal Isolation." *The Society of Wetland Scientist, Wetlands.* Vol. 23, No. 3. September 2003. pp 608-29.

Beetle, D.E. "Recolonization of Burned Aspen Groves by Land Snails." *Yellowstone Science*. 1997. Vol. 5, No. 3. pp 6-8.

Benkobi, L., M.A. Rumble, G.C. Brundige, and J.J. Millspaugh. 2004. *Refinement of the Arc-Habcap Model to Predict Habitat Effectiveness for Elk*. Res. Pap. RMRS-RP51. Fort Collins, CO. USDA Forest Service, Rocky Mountain Research Station. pp 18.

Black Hills NF. 1997. Soil Map Descriptions and Interpretations Notebook.

Brown, P. and C. Sieg. 1996 "Fire History in the Interior Ponderosa Pine Communities of the Black Hills, South Dakota, USA." *Int. J. Wildland Fire* 6(3): 97-105.

Christensen, A.G., L.J. Lyon,and J.W. Unsworth. 1993. *Elk Management in the Northern Region: Considerations in Forest P lans Updates or Revisions.* U.S. Forest Service, General Technical Report INT-303.

Cohen, Jack D. "Reducing the Wildland Fire Threat to Homes: Where and How Much?" USDA Forest Service General Technical Report PSW-GTR-173. 1999.

Cohen, Jack. "Thoughts on the Wildland-Urban Interface Fire Problem." June 2003. *International Association of Wildland Fire*. Pp 2.

Cook, Blaine. Personal Communication of Forest Silviculturist. B. Cook with Henry Goehle, District Fire Management Officer, Mystic RD. 2003.

Cook, J.G., L.L. Irwin, L.D. Bryant, R.A. Riggs, and J.W. Thomas. 1998. "Relationship of Forest Cover and Condition of Elk: A Test of the Thermal Cover Hypothesis in Summer and Winter." *Wildlife Monograph.* No. 141. pp 61.

DePerno, C.S. 1998. "Habitat Selection of a Declining While-Tailed Deer Herd in the Central Black Hills, South Dakota and Wyoming." Ph.D. Dissertation, South Dakota State University, Brookings, SD.

Driscoll, Daniel G., Janet Carter, Joyce E. Williamson, and Larry D. Putnam. 2002. *Hydrology of the Black Hills Area, South Dakota.* Water Resources Investigation Report 02-4094. USDI, U.S. Geological Survey. Pp 150.

Dykstra, B.L. 1996. *Effects of Harvesting Ponderosa Pine on Birds in the Black Hills of South Dakota and Wyoming*. MS Thesis. South Dakota State University, Brookings, SD. Pp 43.

Ehle, D. and Baker, 2003. Disturbance and stand dynamics in ponderosa pine forests in Rocky Mountain National Park, USA. Ecological Monographs. Vol. 73, no 4, pp 543-566.

Ensz, E.H., S. Anderson, K.A. Emerson, R.K. Kraus, A.C. Meland, and D. Hoeft. 1994. *Soil Survey of Custer and Pennington Counties, Black Hills Parts, South Dakota*. USDA Soil Conservation Service and Forest Service in Cooperation with the South Dakota Agricultural Experiment Station. Pp 295.

Erickson, J., L. Ferber, G. Galinat, G. Simpson, and E. Unkenholz. 2001. *Statewide Fisheries Surveys, 2000.* Surveys of Public Water. Part 1 Lakes, Region 1. South Dakota Department of Game, Fish and Parks. Annual Report No. 02-11.

Fact Sheet Team. 2001. Fact Sheet 043-99. USDI U.S. Geological Survey. Pp 6. Available: http://water.usgs.gov/pubs/FS/FS-043-99/

Fecske, D.M. 2003. *Distribution and Abundance of American Martens and Cougars in the Black Hills of South Dakota and Wyoming.* Dissertation: Dr. of Philosophy, South Dakota State University. Pp 170.

Finney, Barlette, Bradshaw, Close, Gleason, Langowski, McHugh, Martinson, Omi, Shepperd, Zeller. 2002. Hayman Fire Review: Case Analysis. "Report on Fire Behavior Fuel Treatments and Fire Suppression." Rocky Mountain Research Station; Special Report.

Finney, M.A. *Spatial Strategies for Landscape Fuel Treatment*. Proc. Inter-Regional Mechanical Fuels Treatment Workshop. Boise, Idaho. Feb. 2003.

Frest, T.J. and E.J. Johannes. 1993. *Land Snail Survey of the Black Hills National Forest, South Dakota and Wyoming.* Unpublished Report prepared for USDA Forest Service, Black Hills National Forest. Custer, SD.

Frest, T.J. and E.J. Johannes. 2002. *Land Snail Survey of the Black Hills National Forest, South Dakota and Wyoming.* Summary Report 1991-2001. Unpublished Report prepared for USDA Forest Service, Black Hills National Forest. Custer, SD. Pp 127 and appendices.

Garcia, Juanita D – 1998. *Level III Heritage Resource Inventory of the Mercedes Project Area* (Forest ID# R1998020300025). Report on File at the Black Hills NF Supervisors Office, Custer, SD.

Ghalambor, C. 2003. *Conservation Assessment of the Pygmy Nuthatch in the Black Hills National Forest, South Dakota and Wyoming.* USDA Forest Service, Black Hills National Forest, Custer, SD. Pp 55. Accessed March 22, 2005. http://www.fs.fed.us/r2/blackhills/projects/planning/assessments/pygmy_nuthatch.pdf

Gire, Gale. Personal Experiences Provided through Verbal Discussions Regarding Basal Areas, Fuels, and Observed Fire Behavior in Black Hills Area Fuel Types. 2003-2004.

Goehle, H. Personal Experiences Provided through Verbal Discussions regarding Basal Areas Fuels, and Observed Fire Behavior in Black Hills Area Fuel Types. 2003-2004.

Grafe, Ernest. And P. Horsted. *Exploring with Custer-The 1874 Black Hills Expedition.* 2002.

Graham, R. T.; McCaffrey, S.; Jain, T.B. (tech. eds.) (2004) *Science Basis for Changing Forest Structure to Modify Wildfire Behavior and Severity.* Gen. Tech. Rep. RMRS-GTR-120. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. Pp 43.

Gucinski, H., M.J. Furniss, R.R. Ziemer, M.H. Brookes. 2001. *Forest Roads: A Synthesis of Scientific Information.* Gen. Tech. Rep. PNW-GTR-509. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. pp 103.

Harthun-Holte, C. 2003. *A Multi-Scale Analysis of Elk Distribution and Habitat Use in the Central Black Hills, South Dakota.* Ph.D. Dissertation, South Dakota School of Mines and Technology, Rapid City, SD. Pp 167.

IFPC, Idaho Forest Products Commission. 2003. Best Management Practices. Available: http://www.idahoforests.org/bmp.htm

Isaak, D.J., W.A. Hubert, and C.R. Berry Jr. 2003. *Conservation Assessment for Lake Chub, Mountain Sucker, and Finescale Dace in the Black Hills National Forest, South Dakota and Wyoming.* USDA Forest Service, Rocky Mountain Region, Black Hills National Forest. Custer, SD.

Lynch, Patrice C. Deerfield Project Area. *Wildlife and Botany Existing Condition Report.* USDA, Forest Service: Black Hills NF, Mystic R.D. 2004.

Lyon, L.J., and A.L. Ward. 1982. "Elk and Land Management." In J.W. Thomas and D.E. Toweill (ed). *Elk of North America*. Stackpole Books, Harrisburg, PA.

Marriott, Hollis. *Survey of Black Hills Montane Grasslands.* Wildlife Division, South Dakota Game, Fish, and Parks, February 25, 2000. pp 65.

Marriott, H.J., D. Faber-Langendown. 2000. *Riparian and Wetland Plant Communities of the Black Hills.* The Nature Conservancy Midwest Conserv. Sce. Cent. and Assoc. for Biodiversity. Info Midwestern Resource Office, Minneapolis, MN. Pp 179.

Marriott, H.J., D. Faber-Langendoen. 2000. *The Black Hills Community Inventory;* Vol. 2: Plant Community Descriptions. The Nature Conservancy Midwest Conserv. Sci. Cent. and Assoc. for Biodiversity Info. Midwestern Resource Office, Minneapolis, MN. Pp 326.

Marriott, H.J., D. Faber-Langendoen, A. McAdams, D. Stutzman, and B. Burkhart. 1999. *The Black Hills Community Inventory: Final Report.* The Nature Conservancy Midwest Conserv. Sci. Cent. and Assoc. for Biodiversity Info. Midwestern Resource Office, Minneapolis, MN. Pp 176.

McKinney, Michael L. and Robert M. Schoch. 2003. *Interactive Glossary Definition for Soil.* Environmental Science Systems and Solutions, Third Edition. Available: http://environment.jbpub.com/mckinney/interactive_glossary_showterm.cfm?term_soil%20

Mehl, M.S. 1992. *Old-Growth Descriptions for the Major Forest Cover Types in the Rocky Mountain Region.* Old-Growth Forests in the Southwest (Workshop). Pp 106-20.

Millspaugh, J.J. 1995. *Seasonal Movements, Habitat Use Patterns and the Effects of Human Disturbances on Elk in Custer State Park, South Dakota.* MS Thesis. South Dakota State University, Brookings, SD.

Millspaugh, J.J. 1999. *Behavioral and Physiological Responses of Elk to Human Disturbances in the Southern Black Hills, South Dakota.* Ph.D. dissertation. University of Washington, Seattle, WA. Pp 260.

NatureServe. 2005. *NatureServe Explorer: An Online Encyclopedia of Life.* Version 1.8. NatureServe, Arlington, VA. Accessed May 2005. Available: http://www.natureserve.org

Omi, P. and E. Martinson. *Effect of Fuels Treatment on Wildfire Severity.* Western Fire Research Center, CSU. March 2002.

National Interagency Fire Center. Wildland and Prescribed Fire Management Policy Implementation Procedures Reference Guide. August, 1998. pp 108 plus Appendices.

National Wildfire Coordination Group. Smoke Management Guide for Prescribed Fire and Wildland Fire 2001 Edition. NFES #1279. December, 2001. pp 226.

National Wildfire Coordination Group. Prescribed Fire Complexity Rating System Guide. NFES #2474. January, 2004. pp 43.

Omi, P. and J. Pollet. "Effect of Thinning and Prescribed Burning on Crown Fire Severity in Ponderosa Pine Forests." *Journal of Wildland Fire.* 2002. pp 16.

Orr, Howard K. 1975. "Watershed Management in the Black Hills: The Status of Our Knowledge." *USDA Forest Service Research Paper RM-141.* Rocky Mountain Forest and Range Experiment Station. pp 12.

Panjabi, A. 2002-2005. *Monitoring Birds of the Black Hills: Years 1-4.* Annual Report submitted to the Black Hills National Forest. Rocky Mountain Bird Observatory. Brighton, CO. pp 125. http://www.fs.fed.us/r2/blackhills/projects/wildlife/index.html

Parrish, J.P., D.J. Herman, and D.J. Reyher. 1996. *A Century of Change in Black Hills Forest and Riparian Ecosystems.* USDA Forest Service, Agricultural Experiment Station, USDA, South Dakota State University. Custer, SD. Pp 20.

Pettingill, O.S., and N.R. Whitney. 1965. *Birds of the Black Hills*. Special Pub. No. 1, Cornell Lab. of Ornithology. Cornell University, Ithaca, NY. Pp 139.

Piroutek, R. 1991. *Water Quality and Eutrophication Status of Deerfield Lake, Western South Dakota.* Masters Thesis, South Dakota School of Mines and Technology. Rapid City, SD. pp 247.

Raphael, M.G. and M. White. 1984. *Use of Snags by Cavity-Nesting Birds in the Sierra Nevada.* Wildlife Monographs. 86: 1-66.

Reynolds, R.T., S.M. Joy, and D.G. Leslie. 1994. *Nest Productivity, Fidelity, and Spacing of Northern Goshawks in Arizona.* Studies in Avian Biology, No. 16: 106-13.

Rich, T.D., C.J. Beardmore, H. Berlanga, P.J. Blancher, M.W. Bradstreet, G.S. Butcher, D.W. Demarest, E.H. Dun, W.C. Hunter, E.E. Inigo-Elias, J.A. Kennedy, A.M. Martell, A.O. Panjabi, D.N. Pashley, K.V. Rosenberg, C.M. Rustay, J.S. Wendt, T.C. Will. 2004. *Partners in Flight North American Landbird Conservation Plan.* Cornell Lab of Ornithology. Ithaca, NY. Pp 85.

Richardson, A.H. 1971. *The Rocky Mountain Goat in the Black Hills.* Bulletin Number 2. Department of Game, Fish, and Parks. Pierre, SD.

Robichaud, P.R., J.L. Beyers, and D.G. Neary. *Evaluating the Effectiveness of Post-Fire Rehabilitation Treatments*. USDA Forest Service, Rocky Mountain Research Station, General Technical Report, RMRS-GTR-63. 2000.

Rothermel, Richard C. 1991. *Predicting Behavior and Size of Crown Fires in the Northern Rocky Mountains.* USDA Forest Service Research Paper INT-438.

Rowland, M.M., M.J. Wisdom, B.K. Johnson, and J.G. Kie. 2000. "Elk Distribution and Modeling in Relation to Roads." *Journal of Wildlife Management.* 64: 672-84.

Royer, R.A. and G.M. Marrone. 1992. *Conservation Status of the Regal Fritillary (Speyeria idalia) in North and South Dakota*. USDI Fish and Wildlife Service. Denver, CO.

Rumble, M.A. and S.H. Anderson. "Microhabitat Associations of Merriam's Turkeys in the Black Hills, South Dakota." *Northwest Science.* Vol. 67, No. 4. 1993.

Rumble, M.A. and S.H. Anderson. "Feeding Ecology of Merriam's Turkeys (Meleagris gallopavo merriami) in the Black Hills, South Dakota." *American Midland Naturalist.* Vol. 136: 157-71. 1996.

Rumble, M.A. 2002. *Evaluation of Mountain Pine Beetle Epidemics as Habitat or Cavity Nesting Birds.* Preliminary Findings for ISA 203-02-020 to Black Hills National Forest. Rocky Mountain Research Station, Rapid City, SD. Pp16.

Sauer, J.R., J.E. Hines, and J. Fallon. 2005. *The North American Breeding Bird Survey, Results and Analysis 1966-2004.* USGS Patuxent Wildlife Research Center, Laurel MD. Accessed May 15, 2005. Available: http://www.pwrc.usgs.gov/search/htm

Schmid, J.M., S.A. Mata, and R.A. Obedzinski. *Hazard Rating Ponderosa Pine Stands for Mountain Pine Beetles in the Black Hills.* Research Note. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, 1994. RM-529.

Schmidt, C.A. 2003a. *Conservation Assessment for the Fringed Bat in the Black Hills National Forest, South Dakota and Wyoming.* USDA Forest Service, Black Hills National Forest. Custer, SD. pp 24. Accessed March 15, 2005. Available: http://www.fs.fed.us/r2/blackhills/projects/planning/assessments/fringed_bat.pdf

Schmidt, C.A. 2003b. *Conservation Assessment for the Townsend's Big-Eared Bat in the Black Hills National Forest, South Dakota and Wyoming.* USDA Forest Service, Black Hills National Forest. Custer, SD. Pp 27. Accessed March 15, 2005. Available: http://www.fs.fed.us/r2/blackhills/projects/planning/assessments/big_ear_bat.pdf

Schonennagel, Tania., Veblen, T., Romme, W. *The Interaction of Fire, Fuels, and Climate Across Rocky Mountain Forests*. July 2004.

Scott, J.H. 1999. Nexus: A System for Assessing Crown Fire Hazard. Fire Mgt. Notes 59(2): 20-24.

Scott, J.H. and E.D. Reinhardt. 2001. *Assessing Crown Fire Potential by Linking Models of Surface and Crown Fire Behavior.* USDA Forest Service Research Paper RMRS-RS-29.

Shepperd, Wayne D. and Michael A. Battaglia. 2002. *Ecology, Silviculture, and Management of Black Hills Ponderosa Pine*. General Technical Report RMRS-GTR-97. Ft. Collins, CO: Rocky Mountain Research Station, United States Department of Agriculture - Forest Service.

Sheppard, W.D. and L.A. Asherin. 2004. *Assessment of Aspen Colonal Conditions on the Black Hills National Forest.* Final Report on Collaborative Work Agreements between the Rocky Mountain Research Station (RWU4451) and the Black Hills National Forest. Rocky Mountain Research Station, Ft. Collins, CO. October 25, 2004. pp 24.

Sheveland, Glenna – 1998. *Survey Strategies for Bitter, Bullock, Mercedes, and Cabin Analysis Areas* (Forest ID# R1998020300024). Report on File at the Black Hills NF Supervisors Office, Custer, South Dakota.

Shinneman, D.J. and W.L. Baker. "Non-Equilibrium Dynamics between Catastrophic Disturbances and Old-Growth Forest in Ponderosa Pine Landscapes of the Black Hills." *Conservation Biology*. 1997. Vol. 11. No 6. pp 1276-88.

Smith, B.E. 2003. *Conservation Assessment for the Northern Leopard Frog in the Black Hills National Forest, South Dakota and Wyoming.* USDA Forest Service, Black Hills National Forest. Custer, SD. Pp 78. Accessed March 15, 2005. Available: http://www.fs.fed.us/r2/blackhills/projects/planning/assessments/northern_leap_frog.pdf

South Dakota Department of Environment and Natural Resources. 2004. The 2004 South Dakota Integrated Report for Surface Water Quality Assessment. Steven M Pirner, Secretary. Pierre, SD.

South Dakota Game, Fish, and Parks Department. 2003. *Big Game Harvest Projects.* South Dakota Game Report No. 2003-01. pp 87.

South Dakota Game, Fish, and Parks. 1995. Statewide Fisheries Surveys, 1994. Survey of Public Waters. Part 2; Streams. Annual Report No. 95-4.

South Dakota Game, Fish, and Parks. 1996. Statewide Fisheries Surveys, 1995. Survey of Public Waters. Part 2; Streams. Annual Report No. 96-13.

South Dakota Game, Fish, and Parks. 2001a. Statewide Fisheries Surveys, 2000. Survey of Public Waters. Part 1; Lakes – Region 1. Annual Report No. 02-11.

South Dakota Natural Heritage Program. 2002. South Dakota Dept. of Game, Fish, and Parks, Pierre. Accessed March 24, 2005. Available: http://www.sdgfp.info/Wildlife/Diversity/rareplant2002.htm

South Dakota Natural Heritage Program. 2005. South Dakota Dept. of Game, Fish, and Parks, Pierre. Accessed March 24, 2005. Available: http://www.sdgfp.info/Wildlife/Diversity/index.htm

South Dakota State University, South Dakota Cooperative Extension Service, U.S. Environmental Protection Agency, South Dakota Department of Environment and Natural Resources and South Dakota Department of Agriculture. 2004. Forestry Best Management Practices for South Dakota.

Spierling, D.J. and R.L. Knight. 2004. *Snag Study II, Black Hills National Forest.* Final Report. May 2004.

SRS Model. 1995. *Snag Recruitment Simulator (SRS).* Custer District In-Growth Version 2.0. USDA Forest Service, Black Hills National Forest. Custer, SD.

Suttle, K.B., M.E. Power, J.M. Levine, and C. McNeely. 2004. "How Fine Sediment in Riverbeds Impairs Growth and Survival of Juvenile Salmonids." *Ecological Applications 14(4)* pp 969-974.

Swengel, A.B. "Effects of Management on Butterfly Abundance in Tallgrass Prairie and Pine Barrens." *Biological Conservation.* 1997. Vol. 83. No. 1. pp 77-89.

Tallman, D.A., D.L. Swanson, and J.S. Palmer. 2002. *Birds of South Dakota.* Midstates/Quality Quick Print. Aberdeen, South Dakota. Pp. 441.

Thomas, Stephanie. 2002-2004. BMP/WCP Monitoring Report. Black Hills National Forest. Mystic Ranger District. Rapid City, SD.

Uresk, D.W., and K.E. Severson. 1998. *Response of Understory to Species to Changes in Ponderosa Pine Stocking Levels in the Black Hills.* Great Basin Nat. 54: 4.

USDA Forest Service. 1999. Roads Analysis: Informing Decisions about Managing the National Forest Transportation System. Misc. Rep. FS-643. Washington, D.C.: U.S. Dept. of Agriculture Forest Service. pp. 222

USDA, Forest Service. Forest Service Manual 5100, Chapter 5140 – Prescribed Fire, Black Hills Supplement r2_bh_5100_2005-1. February 4, 2005. pp 4.

USDA Forest Service. 1996 *Final Environmental Impact Statement - Land and Resource Management Plan*. Custer, SD: Black Hills National Forest, United States Department of Agriculture Forest Service.

USDA Forest Service. 1992. *HABCAP (Habitat Capability Model).* Rocky Mountain Region, Black Hills Version. Documentation and User Guide.

USDA Forest Service. 1998. *Black Hills National Forest Monitoring and Evaluation Report for Fiscal Year 1998.* [Online]. Black Hills National Forest, Custer, SD. Available: http://www.fs.fed.us/r2/blackhills/projects/planning/fy1998_report.pdf 54pp.

USDA Forest Service. 2000b. *Black Hills National Forest Monitoring and Evaluation Report for Fiscal Year 1999.* [Online]. Black Hills National Forest, Custer, SD. Available: http://www.fs.fed.us/r2/blackhills/projects/planning/fy1999_report.pdf 65pp.

USDA Forest Service. 2001d. *Black Hills National Forest Monitoring and Evaluation Report for Fiscal Year 2000.* [Online]. Black Hills National Forest, Custer, SD. May 2002. Available: http://www.fs.fed.us/r2/blackhills/projects/planning/fy2000_report.pdf 67pp.

USDA Forest Service. 2001f. *Phase I Biological Assessment and Biological Evaluation. Phase I Forest Plan Amendment, Supplement to the Forest Plan.* Black Hills National Forest, Custer, SD. 76pp.

USDA Forest Service. 2002b. *Black Hills National Forest Monitoring and Evaluation Report for Fiscal Year 2001.* [Online]. Black Hills National Forest, Custer, SD. Available: http://www.fs.fed.us/r2/blackhills/projects/planning/fy2001_report.pdf 93pp.

USDA Forest Service. 2003d. *Title 2600: Wildlife, fish, and sensitive plant habitat management.* FSM Supplement No: 2600-2003-1, Date Approved 11/18/2003. Effective December 1, 2003. Forest Service Manual, Rocky Mountain Region, Denver, CO.

USDA Forest Service. 2004b. *Black Hills National Forest Monitoring and Five-Year Evaluation Report.* [Online]. Black Hills National Forest, Custer, SD. January 2004. Available: http://www.fs.fed.us/r2/blackhills/projects/planning/2002Monitor/all.pdf 123pp.

USDA Forest Service. 2004c. *Black Hills National Forest Monitoring and Evaluation Report for Fiscal Year 2003.* [Online]. Black Hills National Forest, Custer, SD. June 2004. Available: http://www.fs.fed.us/r2/blackhills/projects/planning/2003Monitor/all.pdf

USDA Forest Service. 2005a. *Black Hills National Forest Monitoring and Evaluation Report for Fiscal Year 2004.* [Online]. Black Hills National Forest, Custer, SD. March 2005. Available: http://www.fs.fed.us/r2/blackhills/projects/planning/2004Monitor/2004_mon_rpt_all.pdf

USDA Forest Service 2005b. *Region 2 Regional Foresters Sensitive Species List.* [Online]. USDA Forest Service. Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/sensitivespecies/index.shtml.

USDA Forest Service. 1999. Forest Service Handbook, 2509.25-Watershed Conservation Practices Handbook.

USDA Forest Service. 2000. Expert Interview Summary for the Black Hills National Forest Land and Resource Management Plan Amendment. Black Hills National Forest. Custer, SD.

USDA Forest Service, 2001. Black Hills NF Land and Resource Management Plan Environmental Assessment: Phase I Amendment. Report on File at the Black Hills NF Supervisors office. Custer, SD.

USDA Forest Service. 2001b. *Existing Condition Post-Fledging Area Model for the Black Hills National Forest.* Black Hills National Forest. Custer, SD.

USDA Forest Service. 2001c. *Landscape Level Snag and Green Tree Retention Model for the Black Hills National Forest.* Black Hills National Forest. Custer, SD.

USDA Forest Service. 2002a. *Draft Framework for Revising Deer and Elk Strategic Management Direction on the Black Hills National Forest.* Science Applications International Corporation Project Number 01-0209-04-4456-106. pp. 12.

USDA Forest Service. 2003. "Effects of Fire Exclusion in Rocky Mountain Ecosystems." *RMR Science.* Rocky Mountain Research Station.

USDA Forest Service. 2003a. *Monitoring Implementation Guide: Black Hills National Forest Plan.* Black Hills National Forest. Custer, SD. June 2003. pp 71.

USDA Forest Service. 2004. *Draft Black Hills National Forest Phase II Amendment.* Black Hills National Forest. Custer, SD.

USDA Forest Service. "Analysis to Support Hazardous Fuel Reduction Projects." Fire and Aviation Briefing Paper. November 2002.

USDA Forest Service. "Area Protected Concept." Fire and Aviation Briefing Paper. May 15, 2004.

USDA Forest Service. "The Nature Conservancy." et. al. *Interagency Fire Regime Condition Class Guidebook.* April 2004. pp 108.

USDA Forest Service. 1996. NEPA Guidance for Watershed.

USDA Forest Service. Black Hills National Forest's Fire Danger Pocket Cards. 2004.

USDA Forest Service. *Essential FVS: A User's Guide to the Forest Vegetation Simulator*. FMSC. October 2004. pp 196.

USDA Forest Service. "Forest Structure and Fire Hazard in Dry Forests of the Western United States." Peterson et al. General Technicial Report PNW-GTR-628. February 2005. pp 31.

USDA Forest Service. "Science Basis for Changing Forest Structure to Modify Wildfire Behavior and Severity." Graham et al. General Technical Report RMRS-GTR-120. April 2004. pp 43.

USDA Forest Service. *Development of Coarse-Scale Spatial Data for Wildland Fire and Fuel Management.* GTR-RMRS-87. April 2000.

USDA Forest Service. 1997. Black Hills National Forest Land and Resource Management Plan Final Environmental Impact Statement (FEIS). Custer, SD.

USDA Forest Service. 2002. Deerfield Project Area Roads Analysis Report, Mystic Ranger District, Black Hills National Forest. Rapid City, SD.

USDA Soil Conservation Service. 1990. Soil Survey of Custer and Pennington Counties, Black Hills Parts, South Dakota. US Department of Agriculture.

USDC. 2000. Census 2000. Washington, D.C.: USDC Bureau of the Census. Population Division.

Van Wagner, C.E. 1977. "Conditions for the Start and Spread of Crown Fires." *Canadian Journal of Forest Research.* Vol.7, pp 23-34.

Vierling, K. 2004. *Report on Woodpecker Breeding in Jasper Fire.* Submitted to the U.S. Forest Service February 19, 2004. South Dakota School of Mines and Technology. Rapid City, SD. pp. 11.

Wiggins, D.A. 2005. *Brown Creeper (Certhia Americana): A Technical Conservation Assessment.* USDA Forest Service, Rocky Mountain Region. Accessed May 4, 2005. Available: http://www.fs.fed.us/r2/projects/scp/assessments/browncreeper.pdf

Wortmann, C.S. and P.J. Jasa. 2003. "Management to Minimize and Reduce Soil Compaction." *Nebraska Cooperative Extension G89-896*. pp 8.

CHAPTER 6 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 tests assumptions and predictions in management plans.

Age Class
Groups of trees or shrubs approximately the same age.

Arterial Road
(See "Road Functional Classification".)

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.

Big Game Security
Protection that allows an animal to remain in a defined area despite increases in stress and disturbance associated with hunting season or other human activities (Lyon and Christensen 1990).

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 (Rocky Mountain Regional Guide 1992).

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.

Black Hills HABCAP Model
A model designed to evaluate the capability of habitats to support individual species based on the combination of plant communities and structural stages.

BMPs
(See "Best Management Practices")

Broadcast Burning
A fire ignited under specific conditions (prescriptions) and within established boundaries to achieve some land management objective.

Browse
That part of the current leaf and twig growth of shrubs, woody vines and trees available for animal consumption (Schwarz et al. 1976).

Canopy Closure (Canopy Cover), Canopy Layer (Silviculture)
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 2 feet tall, shrubs less than 6 feet tall, and overstory greater than 6 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 1 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 lands for the manufacture of commercial products such as lumber, plywood, etc.

Connected Disturbed Area (CDA)
Areas that contribute sediment to streams or wetlands causing degradation of physical function, degraded water quality and increased peak flows that may alter physical channel processes.

Conifer
A group of cone-bearing trees, mostly evergreen, such as the pine, spruce and juniper.

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.

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.

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 Habitat (Threatened, Endangered and Proposed Species)
Habitat of federally listed threatened or endangered species where those physical and biological features essential to conservation of the species are found and which may require special management considerations or protection. This habitat may currently be occupied or determined by the Secretary of the Interior to be essential for areas outside the species' current range.

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.

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.

Cumulative Effects
Collective results of past, present and reasonably foreseeable future actions, regardless of which agency or person undertakes the actions.

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.

Design Criteria
Standard practices and operating procedures (including, but not limited to: BMPs and Standard and Guidelines) and any other practice, deemed necessary, included as part of the design of a project proposal to minimize resource impacts. Design criteria are typically included in contract provisions and operating plans.

Diameter at Breast Height (DBH)
The diameter of a standing tree at a point 4 feet, 6 inches from the ground.

Direct Effects
Results of an action occurring when and where that action takes place.

Dispersed Recreation
This type of recreational use requires few, if any, improvements and may occur over a wide area. This type of recreation involves activities related to roads, trails and undeveloped waterways and beaches. The activities do not necessarily take place on or adjacent to a road, trail, or waterway, only in conjunction with them. Activities are often day-use oriented and include hunting, fishing, boating, off-road vehicle use, hiking and others.

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. 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 and released to the public and other agencies for comment and review.

Effects (Heritage Resources)
Impacts to the characteristics that qualify a heritage resource for the National Register of Historic Places. These can include alterations in location, setting, use, design, materials, feeling and association. Adverse effects include: (1) physical destruction or damage, (2) isolation from or alteration of setting, (3) introduction of visual, audible or atmospheric elements, (4) physical deterioration from neglect or from any action, and (5) transfer, lease or sale.

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".)

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 (Section 102 of the National Environmental Policy Act of 1969) 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: (1) the environmental impact of the proposed action, (2) any adverse impacts that cannot be avoided by the action, (3) the alternative courses of actions, (4) the relationships between local short-term use of the human environment and the maintenance and enhancement of long-term productivity, and (5) a description of the irreversible and irretrievable commitment of resources, which would occur if the action were accomplished.

Ephemeral Streams
(1) 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. (2) 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.

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.

Fire Occurrence
Number of fires per unit time in a specified area (syn. 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 which 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 Regime Condition Class (FRCC)
The description of the role fire plays in an ecosystem in regards to plant adaptations plus fire characteristics like frequency, intensity, extent, season, and synergism. Condition Class is the degree of shift in historical fire regime:

Condition Class I: Within historical range.
Condition Class II: Moderate shift out of historical range.
Condition Class III: Large shift out of range.

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; 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.

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.

Floodplain
That portion of a river valley, adjacent to the channel, which is built of sediments deposited during the present regimen of the stream and covered with water when the river overflows its banks at flood stages.

Forage
Vegetation used for food by wildlife, particularly ungulate wildlife and domestic livestock (Thomas et al. 1979).

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 (Wildland Planning Glossary 1976).

Forest Development Roads
A Forest road under the jurisdiction of the Forest Service. Forest Development roads are not intended to meet the transportation needs of the public at large. Generally, these are roads constructed to a standard to serve expected traffic generated by resource management. Although generally open and available for public use, the Forest Service may restrict or control use to meet specific management direction.

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 (Lehmkuhl and Ruggiero 1991). 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, which includes all existing and planned roads, as well as other special and terminal facilities designated as part of the Forest Development Transportation System.

Fragmentation (Wildlife)
Habitat fragmentation is a process that occurs wherever a large, contiguous habitat is transformed into smaller patches isolated from each other by a landscape matrix unlike the original. This matrix can differ from the original habitat in either composition or structure. The crucial point is that fragmentation functions as either a partial or total barrier to dispersal for species associated with the original habitat (Thomas et al. 1990). A clear threat to population viability occurs when the process of fragmentation isolates populations.

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 fuelbreaks contain fire lines, such as roads or handlines, which can be widened.

Fuel Continuity
Degree or extent of continuous or uninterrupted distribution of fuel particles (surface or aerial) in a fuel bed, which thus 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 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 (syn. 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.

Grass/Forb, Grass/Forb Stage
(See Structural Stages)

HABCAP Model
(See "Black Hills HABCAP Model".)

Habitat
The place where an organism (plant or animal) lives (Odum 1971).

Habitat Capability (Wildlife)
The capacity of a certain vegetative community to support selected wildlife species for all or a part of its life cycle. Habitat capability is estimated using the Black Hills HABCAP model.

Habitat Effectiveness (Elk and Deer)
As used in this document, habitat effectiveness refers to the capability of an area to support elk or deer based on forage, cover, open roads and the spatial distribution of the three factors, regardless of the time of year.

Hardwood
Pertains to broadleaf trees or shrubs.

Hazard (Fire Management)
(See "Fire Protection Assessment".)

Hazard Reduction
(See "Fuel Treatment".)

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.

Hiding Cover (Wildlife)
Vegetation capable of hiding 90 percent of a standing adult deer or elk from the view of a human at a distance equal to or less than 200 feet.

High Risk (Fuels)
(See "Fire Risk".)

Horizontal Diversity (Vegetation)
The diversity in an area that results from the number and arrangement of plant communities or successional stages or both; the greater their number, the greater the horizontal diversity. Also, the greater the amount of edge, the higher the degree of horizontal diversity (Thomas et al. 1979).

ID Team
(See "Interdisciplinary Team".)

Ignition (Fire Management)
The initiation of combustion.

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.

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.

Intermittent Stream
(1) 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. (2) 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.

Landscape (Silviculture)
The primary unit of analysis for silviculture. A landscape for purposes of silviculture is a diversity unit, or sixth-level watershed.

Landscape Scale
A heterogenous 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 (Forman and Godron 1986).

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 (Kaufmann et al. 1992).

There are two types of late succession ponderosa pine defined for the Black Hills. The first type, open-canopy late succession 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 (Mehl 1992).

The second type, closed-canopy late succession 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.

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.

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.

MBF
Thousand board 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.

Mitigation
Includes (a) avoiding the impact altogether by not taking certain action or parts of an action, (b) minimizing impacts by limiting the degree or magnitude of the action and its implementation, (c) rectifying the impacts by repairing, rehabilitating or restoring the affected environment, (d) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action, (e) compensating for the impact by replacing or providing substitute resources or environments (40 CFR 1508.20).

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.

Motorized Recreation
A recreational opportunity provided through the use of a motorized vehicle. This includes travel on and off highways, Forest roads, and four-wheel-drive primitive roads and trails. Travel regulations may be established for the protection of forest resources, to minimize use conflicts and to promote user safety.

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 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 being 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 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.

Natural Fuels
Fuels resulting from natural processes and not directly generated or altered by land management practices (compare activity fuels).

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 (FSM 2080).

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.

Off-Road Vehicle (ORV)
(See "Off-Highway Vehicle".)

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.

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, to produce the fireline intensity and rate of spread required to attain planned resource management objectives (syn. 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 (1) recruiting and training fire forces, (2) planning and organizing attack methods, (3) procuring and maintaining fire equipment, and (4) maintaining structural improvements necessary for the fire program.

Products Other than Logs (POL), Products Other Than Sawlogs, Products Other Than Sawtimber Error! Bookmark not defined.
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 (4.5 feet from ground level) and less than 7.9 inches diameter breast height, with tops of trees greater than 4 inches to less than 6 inches in diameter.

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.

Raptor Nests
Any active nest of eagles, hawks, falcons or owls.

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.

Recreation Opportunity Spectrum (ROS)
A system for planning and managing recreational resources that categorizes recreation opportunities into seven classes. Each class is defined in terms of the degree to which it satisfies certain recreational experience needs based on the extent to which the natural environment has been modified, the type of facilities provided, the degree of outdoor skills needed to enjoy the area and the relative density of recreation use. The seven classes are:

Primitive: Area is characterized by an essentially unmodified natural environment of fairly large size. Interaction between users is very low and evidence of other users is minimal. The area is managed to be essentially free from evidence of human-induced restrictions and controls. Motorized use within the area is not permitted.

Semi-primitive Non-motorized: Area is characterized by a predominantly natural or natural-appearing environment of moderate to large size. Interaction between users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but would be subtle. Motorized recreation use is not permitted, but local roads used for other resource management activities may be present on a limited basis. Use of such roads is restricted to minimize impacts on recreational experience opportunities.

Semi-primitive Motorized: Area is characterized by a predominantly natural or natural-appearing environment of moderate to large size. Concentration of users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but would be subtle. Motorized use of local primitive or collector roads with predominantly natural surfaces and trails suitable for motor bikes is permitted.

Roaded Natural: Area is characterized by predominantly natural-appearing environments with moderate evidence of the sights and sounds of people. Such evidence usually harmonizes with the natural environment. Interaction between users may be moderate to high, with evidence of other users prevalent. Resource modification and utilization practices are evident, but harmonize with the natural environment. Conventional motorized use is allowed and incorporated into construction standards and design of facilities.

Roaded Natural Non-motorized: Areas closed to motorized use, yet have been heavily modified or are not large enough to be set aside as semi-primitive non-motorized.

Rural: Area is characterized by a natural environment that has been substantially modified by development of structures, vegetative manipulation or pastoral agricultural development. Resource modification and utilization practices may be used to enhance specific recreation activities and to maintain vegetative cover and soil. Sights and sounds of humans are readily evident, and the interaction between users is often moderate to high. A considerable number of facilities are designed for use by a large number of people. Facilities are often provided for special activities. Moderate user densities are present away from developed sites. Facilities for intensified motorized use and parking are available.

Urban: Characterized by a substantially urbanized environment, although the background may have natural-appearing elements. Renewable resource modification and utilization practices are often used to enhance specific recreational activities. Vegetative cover is often exotic and manicured. Sights and sounds of humans are predominant on the site. Large numbers of users can be expected both on the site and in nearby areas. Facilities for highly intensified motor use and parking are available with forms of mass transit often available to carry people throughout the site.

Resource Values
The tangible and intangible worth of forest resources.

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 (36 CFR 251.51). The privilege that one person or persons particularly described may have of passing over the land of another in some particular line (FSH 2709.12).

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 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".)

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 Density
Road density refers to the miles of road per square mile. There are different road densities depending on what road types are being considered. These densities include:

Forest Development Road Density: The miles of Forest Development Roads per square mile. This is the road density of the road system managed by the Forest for resource management.

Open Road Density: The miles of Forest Development Road and other private and public roads and highways open for public travel.

Wheel-track Density: The miles of established wheel tracks per square mile. Wheel tracks are not managed as part of the Forest Development Road System and are formed by repeated travel off system roads by Forest users.

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 (FSH 7709.58, Section 12.3). 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.

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.

Sawtimber
Trees suitable in size and quality for producing logs that can be processed into lumber. For planning purposes, trees with a 9-inch diameter or more are classified as sawtimber.

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 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 which 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 complementary 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.

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.

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: (a) significant current or predicted downward trends in population numbers or density; (b) significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution (FSM 2670.5.19).

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".)

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.

Silvicultural Treatment
A management practice that utilizes a method of tree culture, harvest or replacement (see "Shelterwood Method", "Group Selection", "Even-aged Management", "Uneven-aged Management", and "Clearcutting").

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 (Thomas et al. 1979).

Snag-dependent Species
(See "Cavity Nesting Species".)

Soil Compaction
A physical change in soil properties that results in a decrease in porosity and an increase in soil-bulk density and strength.

Special-use Authorization, Special-use Permits
A permit, term permit, lease or easement that allows occupancy or use rights or privileges on National Forest System lands (36 CFR 261.2).

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, which 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. R2RIS 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.

State Historic Preservation Officer (SHPO)
A person appointed by a state's governor to administer the State Historic Preservation Program.

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 (Hoover and Wills 1987). 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 I 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 (SG2416) 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 (Old Growth): This structural stage is characterized by trees 160 years of age and older.

Suppression
(See "Fire Suppression" and "Insect and Disease Suppression".)

Temporary Roads
(See "Short-term Transportation Facility")

Thermal Cover (Wildlife)
Cover used by animals to ameliorate the effects of weather. Optimally, thermal cover is provided by a stand of coniferous trees, 30 to 60 acres in size, at least 40 feet tall, with a canopy cover of at least 70 percent. South of Highway 16, thermal cover may be provided by shorter trees due to poorer site indices.

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 (FSM 2670.5).

Timber
A general term applied to tree stands that provide a wood-fiber product.

Timber Production
The purposeful growing, tending, harvesting and regeneration of regulated crops of trees to be cut into logs, bolts or other round sections for industrial or consumer use, except fuelwood.

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.

Trailheads
The parking, signing and other facilities available at the beginning of a trail.

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 lands (Report of the National Access and Travel Management Team 1992).

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.

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").

Vegetation Structural Stages**
A generalized description of forest growth and aging stages based on the majority of the trees in the specific diameter distributions of the stand. For the goshawk balance of structural stages for the Phase I Amendment, five growth and aging stages were identified. As an example, if the majority of the stems of a stand (based on basal areas) were in the 9-14 inch diameter class, the stand would be classified as a structural stage 4 (adapted from Reynolds, et.al. 1992, p. 90).

The diameter range and description for the balance of structural stages are:

Stage	DBH range (inches)	Description
1	0-1	Grass/Forb
2	1-5	Shrubs/Seedling
3	5-9	Sapling/Pole
4	9-14	Mature
5	14-20	Old Growth

The following tables show how the vegetation structural stage classes correspond to Region 2's structural stage classes.

Post-Fledging Family Area Balance of Structural Stages:

Vegetation Structural Stages Adapted to the Black Hills				
Tree Size Class	**Diameter range (inches)**	**Minimum canopy closure %**	**Percent of balance (range)**	**Correlation to Region 2 Structural Stage***
1 grass/forb/shrub	0-1	None	10 (7-13)	1, 2
2 seedling/sapling	1-5	None	10 (7-13)	3A, 3B, 3C (in part)
3 young forest	5-9	None	20 (15-25)	3A, 3B, 3C (in part)
4 mid-aged forest	9-14	50	13 (8-18)	4B (in part) and 4C
4 mid-aged forest	9-14	60	7 (2-12)	4B (in part) and 4C
5 mature forest	14-20	50	20 (15-25)	4B (in part) and 4C
6 old forest	>= 20	50	20 (15-25)	4B (in part) and 4C

***** The Region 2 Structural Stages are provided for comparison purposes only. The percent of balance and canopy closure requirements apply to tree size classes only, not to the Region 2 structural stages. Region 2 structural stage 5 is not shown, as it is not a calculated value in Resource Information System (RIS).

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 (Thomas et al. 1979).

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 (Soule 1987). 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 2670.5) defines a viable population as one which 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.

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 (Dunne and Leopold 1978), or to a lake, reservoir or other body of water. Also called drainage basin or catchment.

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 (33 CFR 328.3(a) and 40 CFR 230.3(s)).

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.

******Indicates an Amendment 1 change.

CHAPTER 7 LIST OF PREPARERS

Interdisciplinary Team	
Robert Thompson	District Ranger - Bachelor of Science, Geology, University of Montana, 1979. Twenty-six years of Forest Service experience at district and forest level in Montana and South Dakota. Fourteen years experience as geologist conducting mineral appraisals, permitting, environmental analysis and compliance. Certified Review Mineral Examiner. Twelve years as District Ranger on two ranger districts responsible for managing a full range of resources, goods and services. Fire experience includes firefighter, squad and crew boss, field observer, fire information officer, and agency administrator on Type I and Type II fire incidents.
Katie Van Alstyne	ID Team Leader/Writer/Editor - Bachelor of Arts, Biology, Hollins University, 1990. Eleven years with the National Park Service as an interpreter and law enforcement dispatcher. Four years of Forest Service experience at the district and national level in planning. Fire experiences include: emergency medical technician-basic, initial attack dispatcher, dispatch recorder, aircraft time recorder, and helicopter operations.
Phill Grumstrup	Financial Analyst (Deerfield Project), District Environmental Coordinator - Master of Science, Forestry and Remote Sensing, University of Minnesota, 1979; Bachelor of Sciences, Forestry, University of Minnesota, 1974. Five years at U of Minnesota Remote Sensing Laboratory as a Research Specialist; Three years with Bureau of Indian Affairs in Montana as a Timber, Silviculture and Planning Forester; Twenty-three years of Forest Service experience in Montana and South Dakota in Planning, Timber, Silviculture, Wildlife, Fire/fuels, Heritage, Range and Minerals. Fire experience and qualifications include Division Group Supervisor, Infrared Interpreter, Holding Specialist Type 1 and Ignition Specialist Type 2.
Steven Hirtzel	Fisheries Biologist - Bachelor of Science, Fisheries and Wildlife Sciences, South Dakota State University, 1987. Fourteen years of experience in wildlife and fisheries research, management and regulatory protection working for the U.S. Fish and Wildlife Service, National Marine Fisheries Service, and Bureau of Indian Affairs in Washington, Utah and California. Three years of experience with the Forest Service in fisheries program management and environmental analysis at the Forest level in the Black Hills. Fire experience includes firefighter and Burned Area Emergency Rehabilitation (BAER) team member.
Randall Rick	Silviculturist - Bachelor of Science, Forest Resources: Ecosystems and Silviculture, University of Minnesota, 1984. Continuing Education in Ecosystem Management, 2002. Twenty-two years of Forest Service experience at the district level in timber sale preparation, fire, and silviculture, including 6 years as Sale Prep Forester and 3 years as Silviculturist. Twenty years of experience in wildland fire suppression and prescribed burning.
Les Gonyer	Hydrologist - Bachelor of Science, Forestry minor in Hydrology, University of Minnesota, 1977. Twenty-eight years of Forest Service experience at the district and forest level in Utah, New Mexico, Oregon, Idaho, Wyoming, California and South Dakota in watershed, timber, special uses, minerals, fire, engineering and

	environmental analysis. Red carded firefighter, FFT2. BAER (Burned Area Emergency Rehabilitation) and RAT (Rapid Assessment Team) experience.
Juanita D. Garcia	Heritage Resource Specialist - Bachelor of Arts, Anthropology, California State University, Bakersfield 1991. ABT Master of Arts, Prescott College (in progress). Thirteen years with the U.S. Forest Service as an archeologist. Ten years working as an Interdisciplinary Team Member for Environmental Analysis. Fire experiences include: Line Archeologist, Cultural Resource Advisor, Resource Advisor, and BAER Team Archeologist.
Gale Gire	Mystic District Silviculturist - Bachelor of Science, Forest Management, Oklahoma State University, 1973. Four years as a Assistant Forest Manager for Hoerner Waldorf Corporation & Champion Timberlands Corporation, Roanoke Rapids, N.C. Twenty-eight years with US Forest Service on the Pactola & Mystic Ranger Districts of the Black Hills National Forest in Timber Sale Planning, Silviculture, Timber Sale Preparation, Timber Sale Administration and Timber Stand Improvement. Region 2 Certified Silviculturist since 1982. Fire experience includes 35 years of wildland fire fighting and prescribed burning. Current fire qualifications include, Type 2 Fire Safety Officer, Prescribed Burn Ignition Specialist Type 1.
Darci Collins	Roads and Travel Management Engineering Technician and Forest Accessibility Coordinator - Twenty two years of Forest Service experience at the District and Forest level in transportation planning, road design, contract administration, environmental analysis, law enforcement, timber marking and recreation facilities maintenance and design. Firefighting experience includes fireline construction, squad boss, engine operator, sawyer, ground support, ordering manager, dispatch recorder, radio operator, driver and food unit leader trainee.
Patti Lynch	Wildlife Biologist - Bachelor of Science Wildlife Resource with and emphasis on habitat resources from the University of Idaho 1986. Two years as engineering technician and two years as a wildlife/range technician. Sixteen years as a district wildlife biologist with the USDA Forest Service, Black Hills NF working with wildlife/botany/fishery resources. Experience as team member and team leader on various ID Teams at the district and forest level. Fire experience includes firefighter II, initial attack and support dispatcher, fire behavior monitor, prescribed burn planning, BAER and RAT team member.
Eugene F. Bolka	Noxious Weed Coordinator - 26 years with the United States Air Force as a Life Support Superintendent. Started as a seasonal employee in June 1991 as a group leader for the Pactola RD Youth Conservation Corps (YCC). Worked as a Forestry Technician on the Recreation Team through 1995. Range Technician in 1996 as a seasonal until accepting a Range Term position in Weeds in the Year 2000. Accepted a permanent Range Technician job with the Forest Service in 2004. Representing the Forest Service in the Deerfield/Hill City and Doty Springs Noxious Weed Management Areas. Fire experience includes working as a Retardant loader at the Rapid City Airport Tanker Base, Information Officer, Driver, trailer towing, fuels truck and ATV operator for prescribed burns and local fires. Crew Liaison Officer for Severity and Native American Fire Crews.
David Slepnikoff	Resource Assistant – Master of Science, Recreation, San Francisco State University, 1973; Bachelor of Science, Natural Resources/Forestry, Humboldt

	State University, 1971; Additional graduate studies: Forestry, Humboldt State University; Logging Engineering, Oregon State University; Outdoor Recreation, Utah State University; and Lands Management, George Mason University. Twenty-nine years of Forest Service experience at the district and forest level in timber sale preparation, silviculture, lands management, minerals, fire/fuels management, range management, travel management, and recreation management. Fire experience as a division supervisor; fifteen years as a Fire Information Office Type 2 and six years as a Training Specialist.
Steve Keegan	Landscape Architect - Bachelor of Science, Landscape Architecture & Environmental Studies, State University of New York - College of Environmental Science and Forestry (ESF), 1980; Bachelor of Science, (dual degree with ESF), Syracuse University 1980; Associates of Arts, Humanities, State University of New York - Onondaga Community College, 1978. Twenty-two years of Forest Service experience at the forest and zone level in Oregon, South Dakota, Montana, Idaho conducting Scenic Resource Assessments for: vegetation and fuels management, watershed analyses, recreation construction and reconstruction, and burned area emergency rehab. Fire experience in Type 1-4 incidents with USFS; experience as chief and assistant fire chief for City and Rural Fire Departments in New York, Idaho, Oregon and South Dakota.
Kurt Allen	Entomologist - BA-Biology, University of Northern Iowa, MS – Forestry / Entomology, Iowa State University. Thirteen years as an entomologist with the US Forest Service in Durham, NH and Rapid City, SD working on defoliators, exotics and bark beetles.
Mark Vedder	Assistant Fuels Management Officer - Bachelor of Science, Range Resources, University of Idaho 1978. Range Technician Challis NF 1978-79; Range Conservationist 1979-1992 Caribou NF & Black Hills NF; 1990 to date Assistant Fire/Fuels Management Officer for Twenty-six years experience with Forest Service in Idaho and South Dakota in Fire Preparedness & Suppression, Fire Planning including NFMAS Analysis, NEPA analysis, Fuels Management, Brush Disposal, Range / Wildlife / Watershed Management, Noxious Weed Control (chemical & biological), Trail Construction, Road Maintenance, Travel Management, & Contract Prep with Administration. Fire experience and qualifications include Incident Commander Type 4, Dozer Boss, Engine Boss, Strike Team Leader Crew, Prescribed Fire Effects Monitor, Duty Officer, Initial Attack Dispatcher, Fixed Wing Base Manager, Mixmaster, Parking Tender, and Air Tanker Base Manager.