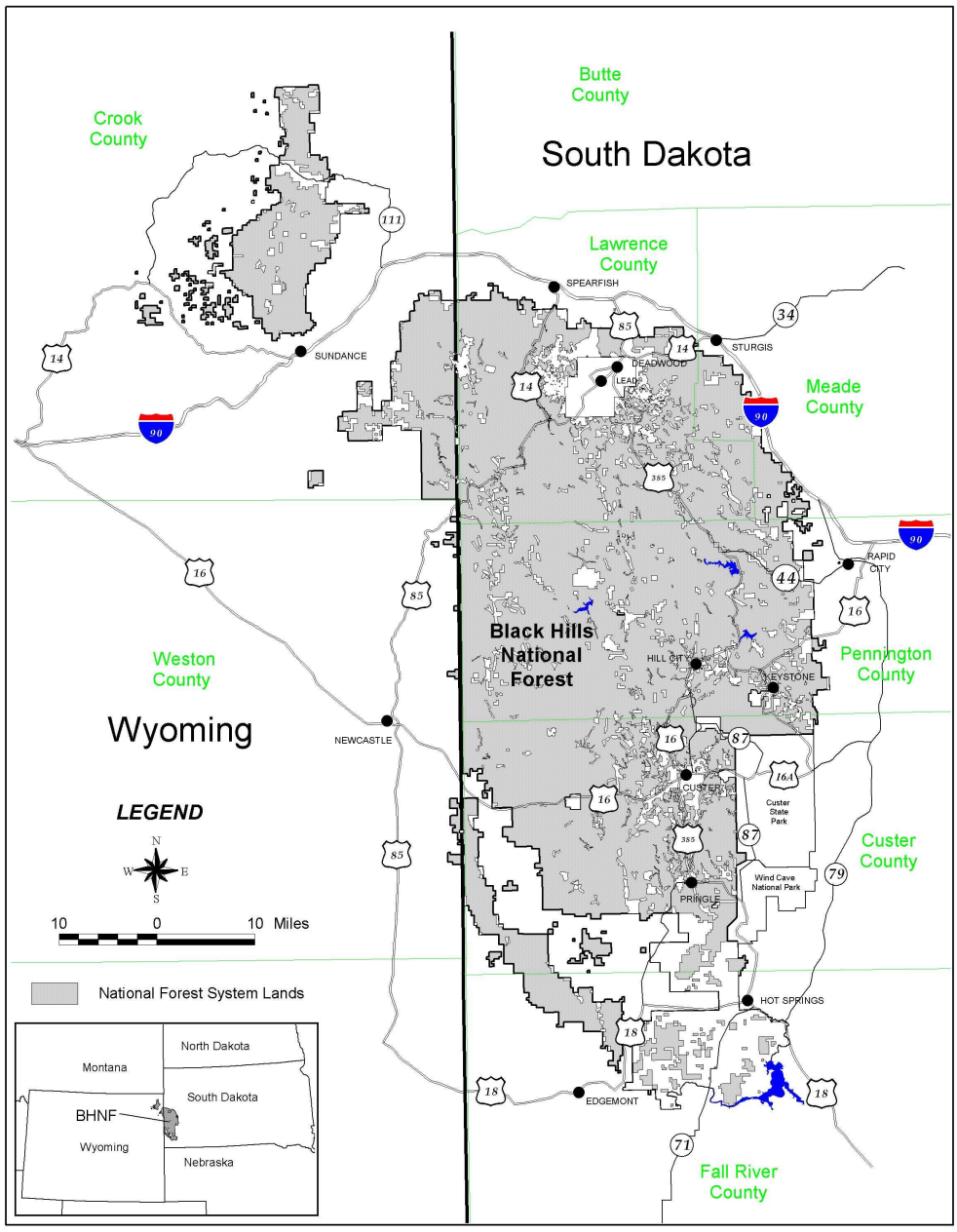
BLACK HILLS NATIONAL FOREST

FOREST-WIDE TRAVEL ANALYSIS REPORT



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ACRONYM/ABBREVIATIONS

ATV	All Terrain Vehicle
BHNF	Black Hills National Forest
CCC	Civilian Conservation Corps
CD	Compact Disk
CDA	Connected Disturbed Area
CFR	Code of Federal Regulations
DEM	Digital Elevation Model
DENR	Department of Environment and Natural Resources
DB(A)	Decibels
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
FHWA	Federal Highway Administration
FLPMA	Federal Land Policy and Management Act
FR	Forest Road
FSH	Forest Service Handbook
FSM	Forest Service Manual
FY	Fiscal Year
GIS	Geographic Information System
GPS	Global Positioning Satellite
IDT	Interdisciplinary Team
INFRA	Infrastructure Database
LRMP	Land and Resource Management Plan
MA	Management Area
ML	Maintenance Level
MOU	Memorandum of Understanding
MVUM	Motor Vehicle Use Map
NEPA	National Environmental Policy Act
NFAB	National Forest Advisory Board
NFMA	National Forest Management Act
NFS	National Forest System
NFSR	National Forest System Road
NHPA	National Historic Preservation Act
NOHVCC	National Off-Highway Vehicle Conservation Council
NRCS	National Resource Conservation Service
NRHP	National Register of Historic Places
NVUM	National Visitor Use Monitoring
OEM	Original Equipment Manufacturer
OHV	Off-Highway Vehicle
PILT	Payment in Lieu of Taxes
R-2	Region 2
R-2 Supplement	Region 2 Roads Analysis Supplement
RAP	Roads Analysis Process

RHV	Risk Hazard Value
RNA	Research Natural Area
ROS	Recreation Opportunity Spectrum
ROW	Right of Way
RVD	Recreation Visitor Day
SAE	Society of Automotive Engineers
SDDOT	South Dakota Department of Transportation
SDOHVC	South Dakota Off-Highway Vehicle Coalition
SOLC	Species of Local Concern
TAP	Travel Analysis Process
TMDL	Total Maximum Daily Loads
USDA	United States Department of Agriculture
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
WGF	Wyoming Game and Fish

BACKGROUND

In August 1999, the Washington Office of the United States Department of Agriculture (USDA) Forest Service published Miscellaneous Report FS-643 titled *Roads Analysis: Informing Decisions about Managing the National Forest Transportation System* (USDA-Forest Service 1999a). The objective of roads analysis is to provide decision makers with critical information to develop road systems that are safe and responsive to public needs and desires, are affordable and efficiently managed, and have minimal negative ecological effects.

In January 2001, the Forest Service published the *Transportation Final Rule and Administrative Policy* authorizing units to use, as appropriate, the road analysis procedure embodied in FS-643 to assist land managers making major road management decisions.

In July 2004, the Rocky Mountain Region 2 published the latest update to the *R2 Roads Analysis Supplement to FS-643*. This supplement ties to Appendix 1 of Misc. Report FS-643 to be used in conjunction with that document. The R2 supplement is intended to provide guidance concerning the appropriate scale for addressing each question and the analysis needed. It has been and will continue to be updated.

In October 2005 the Black Hills National Forest published a Forest-Wide Roads Analysis Report covering Maintenance Level 3, 4, and 5 within the boundaries of the Black Hills National Forest.

In November 2005 the Forest Service published in the Federal Register 36 CFR parts 212, 251, 261, and 295 Travel Management; Designated Routes and Areas for Motor Vehicle Use; Final Rule (the Rule). The Rule requires designation of those roads, trails, and areas that are open to motor vehicle use by class of vehicle and time period, and prohibits the use of motor vehicles off the designated system as well as use of motor vehicles on routes and in areas not consistent with the designations.

In March, 2006, the Forest Service released Forest Service Handbook (FSH) 7709.55 – Travel Analysis Handbook (Draft) which provided guidance for the analysis process to be used in the implementation of the Rule. This handbook modified and expanded the guidance in Miscellaneous Report FS-643 – Road Analysis. The new handbook modified the analysis process somewhat, included trails and areas to the process and changed the intent from roads analysis process (RAP) to travel analysis process (TAP).

PROCESS

Travel analysis is a six-step process. The steps are sequential, with the understanding that the process may require feedback among steps over time as an analysis matures. The amount of time and effort spent on each step differs by project, based on specific situations and available information. The process of progressing through the steps provides framework from which informed decisions can be made about travel system management.

Step 1. Setting up the Analysis

Step 2. Describing the Situation

Step 3. Identifying Issues

Step 4. Assessing Benefits, Problems and Risks

Step 5. Describing Opportunities and Setting Priorities

Step 6. Reporting

PRODUCTS

The products of this travel analysis are:

- A report for decision makers and the public that documents the information and analysis used to identify opportunities and set priorities for future national forest motorized transportation systems.
- Route specific data that identifies estimated relative resource risks and relative public values associated with those routes.
- A summary of roads in nine categories that prioritizes groups of roads for future management decisions based on the relative resource risk and the relative value they provide.
- Maps showing areas of special sensitivity or unique resource value.
- Maps displaying the current inventory of roads and unauthorized routes and the environmental and management risks associated with each.
- Maps showing relative values for each high clearance vehicle (ML 2) road.
- Maps showing public input identifying motorized and non-motorized recreation preferences.
- A map showing the recommended Minimum Road System for the Forest.
- A map showing roads recommended for public motorized travel.
- Maps showing closed roads and user created routes that should be considered for inclusion in the Forest transportation system and designated for motorized use.

STEP 1: SETTING UP THE ANALYSIS

The purpose of Step 1 is to establish the level and type of decision making to be informed by the analysis. Specifically, this step identifies the objectives and scale for the analysis; develops a process plan for conducting the analysis; and clarifies the roles of technical specialists in the team.

1.1 OBJECTIVES OF THE ANALYSIS

This Travel Analysis Process (TAP) addresses the transportation system within the boundaries of the Black Hills National Forest (BHNF or the Forest), evaluating the existing condition of the system and identifying management opportunities. Recommendations for action apply only to those lands that fall within the boundary of the BHNF. This analysis considers social, cultural, economic, and ecosystem components that may overlap jurisdictional boundaries, but that could be affected by the actions taken on National Forest System (NFS) lands.

Specifically, the objectives of the Travel Analysis Process are to:

- Provide basic road information to support project and Forest-level decision making.
- Identify the minimum road system needed for access and administration of the Forest
- Identify changes to current transportation system.
- Identify proposed system designated for pubic motorized use.

1.2 SCALE OF THE ANALYSIS

This travel analysis will be conducted at a National Forest scale. The analysis concentrates on Maintenance Level (ML) 1 and 2 roads, motorized trails, areas and unauthorized routes. Maintenance Level 3, 4, and 5 roads were address in a Forest-Wide Roads Analysis Report in 2005. Existing information is used in conjunction with new significant public input.

1.3 INTERDISCIPLINARY TEAM MEMBERS AND PARTICIPANTS

Black Hills National Forest TAP Interdisciplinary Team (IDT) members (USFS) and/or participants:

Planner	Tom Willems
Engineering/Transportation	Alan Anderson
GIS Specialist	Ken Marchand
GIS Specialist	Lorrie Martinez
GIS Specialist	Todd Mills
GIS Specialist	Aly Oltmanns
District Ranger	Steve Kozel
District Ranger	Mike Lloyd
District Ranger	Bob Thompson
District Ranger	Rhonda O'Byrne

Botanist/Ecologist	Beth Burkhart
Fire/Fuels	Todd Pechota
Fishery/Wildlife Biologist	Steve Hirtzel
Forester	Jeannette Timm
Heritage	Juanita Garcia
Heritage	Donita Carlson
Hydrologist	Les Gonyer
Interdisciplinary	Kaye Olpin
Landscape Architect	Stephen Keegan
Minerals	Rusty Wilder
Range	Craig Beckner
Recreation	Bonnie Jones
Recreation	Amy Ballard
Recreation	Jeramy Rogers
Soils	Deanna Reyher
Timber	Blaine Cook
Wildlife	Kerry Burns
Wildlife	Shirlene Haas
Wildlife	Cara Staab
Writer/Editor	Karen Pinkerton

1.4 IDENTIFICATION OF INFORMATION SOURCES

The following sources of information were identified for use in the analysis:

- Geographic Information System (GIS) database information on the transportation system, Forest resources, heritage data, land ownership, fuels treatments data, fire risk data, perennial streams, wildlife data, botanical data and management area information from the Forest Plan.
- Black Hills National Forest transportation inventory - Infrastructure (INFRA) Roads database.
- Budget information, (e.g., annual maintenance costs, deferred maintenance records, capital improvement costs).
- Data from the EIS (USDA-Forest Service 1996 & 1997) and Forest Plan (USDA-Forest Service 1997) and the Phase II amendment (USDA Forest Service 1997) concerning history, acres, management emphasis, current/future management directions, and location/status of landownership, rights-of-way, easements and leased areas, wildlife, social and economic concerns, and cultural resources.
- Reports that describe the natural resources including climate, soils, geology, and water resources.
- Public comments relating to motorized and non-motorized use.

1.5 STATUS OF CURRENT DATA

Much of the data necessary to this analysis was derived from the roads portion of the Forest INFRA database, existing GIS layers in the Black Hills National Forest GIS database or

available in existing documents. The analysis was conducted on the data as it existed in March 2007. The accuracy and completeness of the data varies in each source. It was not possible to complete and correct all data prior to beginning this work. A certain number of errors can be expected in the final results. The layers will be updated as errors are discovered and the opportunities exist.

Existing GIS coverages include:

- Roads & Trails
- Streams
- Soils
- Cultural Resources
- Wildlife Occurrences and Habitat
- Riparian Areas
- Black Hills Montane Grasslands
- R2 Sensitive Plant Species and BHNF Plant Species of Local Concern Occurrences/Suitable Habitat
- Management Areas
- Ranger District and BHNF Boundaries
- Topographic Quad Sheets
- Land Ownership
- Vegetative Cover
- Fire - Resource Hazard Value (RHV) Areas

1.6 ANALYSIS PLAN

The USFS IDT specialists have conducted the analysis through a multiple stage process: the ranking of relative risk factors by road and route segments (system and non-system roads and trails); the ranking of natural resource management values and identification of social value considerations by segment; the consolidation of road risk and value rankings by road segment to identify opportunities for improvement or modification; the capturing and assigning of social data to each segment; and the identification of unauthorized routes that pass through management and closure areas where roads are currently prohibited or restricted.

The first stage evaluates a complete set of individual ML 1 and 2 roads, inventoried unauthorized roads, and new user created routes. This analysis is based on the potential relative risk that the road or route segment presents to the selected resources. Roads with a National Forest System Road (NFSR) number that are under the jurisdiction of others were also included in the analysis because they are heavily interconnected with roads under Forest Service jurisdiction and the information could be useful if future projects are proposed that include major modifications. Some of the Forest Service roads extend outside the forest boundary, however for the purposes of this analysis the road lengths were cropped at the Forest boundary. If a road or route had more than one jurisdiction, maintenance level, status, system, or user request, it was divided into segments and assigned a unique identifier. This resulted in 13,651 road and route segments representing 8,426 miles. Of these, 4,729 segments or 4,884 miles are system roads under Forest Service jurisdiction. These numbers represent only 53 percent of all miles studied.

The following categories have been identified for risk analysis:

1. **Management Areas** (6 factors)
2. **Hydrology** (3 factors)
3. **Wildlife** (6 factors)
4. **Soils** (2 factors)
5. **Botany** (5 factors)
6. **Heritage** (2 factors)

A detailed description of the individual evaluation factors is presented in Section 5.2.1.

Each category is made up of several individual contributing evaluation factors. For the individual evaluation factors, each road or route segment is analyzed against existing resource data using GIS tools generating a number of risk occurrences per segment. For example, a road crossing a stream would be a sedimentation risk to the stream. The distribution of occurrences for each segment is then reviewed and a relative risk (Low, Moderate, High) and a related risk number (0, 1, 2) is assigned to each. The 0 through 2 numbering system is used to allow mathematically combining the risks presented by different factors. A 0 indicates an estimated lower than average relative risk. A 1 indicates a moderate relative risk, and a 2 indicates a higher than average relative risk. The dividing point between low, moderate, and high risk is determined for each parameter based upon the risk occurrence distribution and input from the individual specialists. An attempt is made to assign this risk based on estimated potential impacts on the resource using the professional judgment of specialists.

Each risk evaluation category is then assigned a relative risk rating after summing the contributing factors. These six category relative risk rating factors are then added together. The distribution of the total risk using all segments is then reviewed and an overall relative risk factor (0, 1, or 2) is assigned to each segment. This process results in a segment risk rating for each factor, for each category, and then an overall risk taking into account all risk categories. An attempt is made to conservatively assign the individual risk numbers such that a final general high relative risk assignment will identify a risk if it is present.

A more detailed description of the above analysis is presented in Section 5.2.1. of this report. A detailed spreadsheet showing the resulting data is located in Appendix B. The spreadsheet size is quite large (13,651 by 172) therefore it has not been printed for the Appendix. The spreadsheet file is copied onto a CD. Color maps showing the risk analysis results are presented in Appendix A. The digital information (spreadsheet and maps) will also be available on a server for internal Forest Service and from the Forest Service website for public access.

The second stage of the analysis evaluates only the individual ML 1 and 2 Nation Forest System (NFS) road segments based only on the relative value that the road provides to Forest Service natural resource managers and forest users. Unauthorized routes were not addressed because the condition of the routes is not documented. A single track or double track, unconstructed unauthorized route may have little value to resource managers if it is not constructed to minimum road standards. The following values have been identified:

1. **Vegetative Management Access**
2. **Range Allotment Access**
3. **Firefighting Access**
4. **Fuels Treatment Access**
5. **Motorized Recreation**

The process used to assign value numbers to roads is identical to the process used to assign risk except that it was not necessary to divide the value categories into sub-factors. An attempt is made to include all important, measurable value categories and to assign values that are realistic.

A more detailed description of the above analysis is presented in Section 5.2.2. of this report. The value data is contained on a CD in the same spreadsheet with the risk data as described above. Color maps showing the value analysis results are presented in Appendix A. The digital information (spreadsheet and maps) will also be available on a server for internal Forest Service and from the Forest Service website for public access.

In the third stage, road segments are consolidated into a matrix table to display the number of segments that fall into each of nine categories based on the rankings for risk and value. Each section of the table is given a category number (1 thru 9). A road with a low value and low risk would be in Category 9. A road with a moderate value and moderate risk would be in Category 5, and a road with a high value rating and high risk rating would be in Category 1. The important categories relative to identifying problem areas and management options to deal with them are the high risk categories (1, 2, and 3). The category that may provide the list of roads with the most realistic possibilities for closure and/or obliteration is Category 3, High Risk / Low Value unless there are other important reasons for keeping those roads open.

Recommendations on how to address these areas of concern are covered in Section 5 of this report. More detailed recommendations could later be determined during the development of applicable project-scale analysis based on more current or more detailed site specific information.

An important value of this analysis lies in the identification of relatively high risk road segments and the presentation of a large amount of detailed information that could be expected to be used as a reference by subsequent project level ID Teams.

The forth stage involves public values input. During the last year, significant public input has been provided by individuals and user groups describing the value they place on areas, roads and routes in the Black Hills. This information is captured in digital files that can be processed in the GIS environment. Data provided in graphic form was loaded into GIS spatial data layers for viewing and mapping. Data provided on forms was summarized and categorized in a report and also loaded into a GIS spatial layer. These value data were digitally attached to each road and route segment that was analyzed, however the nature of the data did not lend itself to ranking as was possible with the resource management data. The information is present in the spreadsheet and can be viewed for each segment by analysts when making value assessments. The GIS spatial layers were used to generate social value thematic maps that can guide decision makers in making large and small scale comparisons. A more detailed description of this data is presented in Section 5.3.

The fifth stage uses GIS software to overlay unauthorized routes on management and closure areas where roads and motorized travel are currently prohibited or restricted and on private land where there is not a recorded right-of-way (ROW). The results allow the identification of routes that could be considered for inclusion in a motorized trail system and the flagging of routes for observation, mitigation or perhaps closure and rehabilitation. A more detailed discussion is presented in Section 5.4.

The above stages provide a significant amount of analysis data in several forms that will aid decision makers in considering changes to the current transportation system.

STEP 2: DESCRIBING THE SITUATION

The purpose of Step 2 is to describe the existing road system in relation to current Forest Plan direction (USDA-Forest Service 1997). Step 2 also provides an overview of the physical, biological, social, cultural, economic, and political environment in relation to the road system.

2.1 GENERAL SETTING

The Black Hills National Forest (BHNF or the Forest) is located in southwest South Dakota and northeast Wyoming. There are approximately 1.5 million acres within the proclaimed National Forest boundary.

The BHNF, with its numerous private, residential, and tourism-related inholdings, is one of the most developed forested areas in the nation (USDA-Forest Service 1996a). Within the proclaimed National Forest boundary, approximately 19 percent of the land is privately owned with entire towns, (e.g., Custer, Hill City, Keystone, Lead, and Deadwood) located within the Forest. Custer State Park, Mount Rushmore National Memorial, Wind Cave National Park, Mickelson Trail, and Jewel Cave National Monument are under other jurisdictions but are located within or are adjacent to the Forest. As a result, Forest roads in the BHNF exist within a network of roads included under the jurisdiction of Federal, State, County and private entities.

2.2 EXISTING TRANSPORTATION SYSTEM

2.2.1 General Description

Beginning in the 1880s, railroads and stagecoach lines were built to accommodate the thousands of people who were coming to the Black Hills in response to the discovery of gold. An extensive rail system was developed to haul mining timbers from the forest to the mines. Large tracts of forest were cut in order to provide timber to the growing mining industry and to provide housing for the people living in the Black Hills. In 1897, the Black Hills Forest Reserve was established, and in 1898 the first timber sale was sold to Homestake Mining Company. By the 1920s, a major highway system was developed and a Forest Road System was initiated. Tourism also justified the construction of a transportation system that was adequate for automobiles, which during the 1930s was augmented by the Civilian Conservation Corps (CCC). Subsequent years have seen further augmentation providing a well spaced, efficient system of roads of all maintenance levels for many different users.

The transportation system currently in place within the Forest is a result of the historic uses described above and the public's expectation that the Forest is available for their use through an extensive road system. The area has since been extensively managed for timber production, livestock grazing, mining activities, big game hunting, wildlife, insect and disease risk, fuels; and for recreational activities along roads and trails that include hiking, horseback riding, mountain bike riding, off-road vehicle use and snowmobile riding.

Most of the BHNF goals within the 1997 Land and Resource Management Plan (LRMP) pertain in some fashion to the transportation system:

Goal 1. Protect basic soil, air, water and cave resources.

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

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

Goal 4. Provide for scenic quality, a range of recreational opportunities, and protection of heritage resources in response to the needs of the BHNF visitors and local communities.

Goal 5. In cooperation with other landowners, strive for improved landownership and access that benefit both public and private landowners.

Goal 6. Improve financial efficiency for all programs and projects.

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

Goal 8. Promote rural development opportunities.

Goal 9. Provide high-quality customer service.

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

Goal 11. Enhance or maintain the natural rate of recovery after significant fire and other natural events while maintaining a mosaic of fuel-loading conditions to facilitate future fire suppression activities.

Objectives designed to achieve these goals involve construction, reconstruction, decommissioning, and maintenance of NFS roads and are discussed throughout this TAP.

There are currently 8,229 miles of inventoried roads within and adjacent to the Forest boundary. These roads fall under multiple systems as listed in Table 2-1. Based on recent observations, it is estimated that there could be another 2,000 miles of new routes that have not been inventoried which would bring the total of system roads and unauthorized routes to over 10,000 miles.

Table 2-1. Miles of Inventoried Road by System for the BHNF

System	Miles of Road	Density (miles/square mile)
National Forest	5,248	2.19
County, State & Federal	348	0.15
Local and Private	22	0.01
Non-System - Unauthorized	2612	1.09
Total	8,229	3.44

* These figures were taken from the Forest Service Infrastructure GIS database. The lengths of these roads were cropped at the Forest boundary. The analysis area encompasses 2,391 square miles within the Forest Boundary.

The 2,612 miles of non-system roads are roads in the Forest that are not maintained by the Forest Service. This statistic represents 32 percent of all inventoried roads within the Forest boundary and is a number equivalent to 50 percent of all NFS roads in the Forest boundary. The nature of these roads varies but they are primarily two track roads that came into being by vehicles leaving NFS roads. The routes were traveled with sufficient frequency to leave an easily noticeable traveled way. Many of these routes are relatively short. Because they are unplanned, they are more likely to be poorly located on the landscape and more likely to have higher erosion potential. The positions of these routes were obtained primarily from interpretation of aerial photographs and they have not all been ground verified. Attempts are made to close these roads when possible however funding and physical location of the routes often limit these efforts. Some of the Non-System routes are also temporary roads that were constructed for vegetation/timber management. They have a road template but they were closed, re-vegetated, and not put on the system.

2.2.2 Regional Connectivity

The Forest is highly connected to the wider region by twelve Forest highways designated under the Public Lands Highways program of the Transportation Equity Act for the 21st Century (TEA21). These roads are owned by the State, County, or Forest Service and qualify for federal funding for improvement or enhancement. A complete list of the Forest highways within the BHNF is provided in Appendix B.

Interstate 90 skirts the periphery of the Forest crossing South Dakota from west to east and passing along the east central and northeastern edges of the Black Hills. I-90 serves as a major access corridor to the Forest.

2.2.3 Forest Roads

The roads that are maintained and used for Forest management and other uses are referred to as Forest roads. These roads are maintained to various standards depending on their function, level of use, and management. Of the approximately 8,229 miles of inventoried roads on the Forest, there are 5,248 miles (64 percent) Forest roads that are within the Forest boundary. These roads fall within multiple jurisdictions, as described in the following paragraphs.

The 5,248 miles of Forest roads are roads that cross primarily Forest land and have an NFSR number. Seven percent of these roads (350 miles) are under the jurisdiction of and are maintained by counties.

Table 2-2. Miles of Roads and Routes by Jurisdiction for the National Forest System and Non-System Roads

Jurisdiction	Miles	Density (miles/square mile)
Forest Service	4,884	2.04
County	350	0.15
Private	14	0.01
Total Forest Roads	**5,248**	**2.19**
Forest Service Non System - Unauthorized	2,612	1.09
Forest Service Non System - Inventoried Public User Input Routes	930	0.39
Total	**8790**	**3.67**

* These lengths are from the Forest Geographic Information System (GIS) and are cropped at the Forest boundary. The analysis area encompasses 2,391 square miles within the Forest Boundary.

The Forest Service has direct maintenance and repair responsibilities for NFS roads. Forest roads under county jurisdiction are maintained and repaired by the county and have county road numbers and names. Several of the longer, cross-forest roads have sections that are Forest jurisdiction and sections that are county jurisdiction. The county sections primarily serve portions of the Forest with high private land density and or high public traffic volumes. Some high speed arterial roads such as Deerfield Road and Sheridan Lake Road (both paved) are entirely under the jurisdiction of the counties. County and Forest Service representatives meet periodically to discuss issues related to county and Forest Service jurisdiction roads that are of joint interest particularly if a major change such as realignment or a surfacing change is planned for a road. Road jurisdictions are periodically transferred as situations change.

Roads within the NFS network are categorized into three functional classes: arterial, collector, and local roads. Arterial roads are the primary roads of the forest, providing connections between human populations, major recreation sites, highways, and collector routes. Collector roads are those that collect and distribute traffic to multiple access points or local roads. Local roads provide access to smaller and specific sites and form a network within the Forest to provide administrative, commercial, and recreation access. The local roads can also be single-purpose roads (e.g., used for timber, recreation or mineral extraction access) that are designed for intermittent use and are generally closed to vehicular traffic when not in use.

There are five Maintenance Levels (ML) used by the Forest Service to determine the work needed to preserve the investment in the road. These ML's are described in FSH 7709.58 – Transportation System Maintenance Handbook (1992) and are briefly defined as follows:

ML 1. Basic Custodial Care (closed to motor vehicle traffic)

ML 2. High Clearance Vehicles

ML 3. Suitable for Passenger Cars

ML 4. Suitable for Passenger Cars, Moderate Degree of User Comfort

ML 5. Suitable for Passenger Cars, High Degree of User Comfort

Maintenance Level 2 roads are primarily one lane, native surface roads for high clearance vehicles. They are usually very low speed with minimal traffic volumes. They are used for hiking, biking, OHV riding, forest management, resource extraction, etc. The ML 1 roads have been closed to traffic for protection of a resource and are usually grassed over.

Maintenance Level 3, 4, and 5 roads are typically crowned, bordered with vegetated ditches, and have cross drains that are generally appropriately spaced for erosion control purposes. Maintenance Level 5 roads provide the highest standard of maintenance and are generally double-laned and paved. Maintenance Level 4 roads provide a moderate level of user comfort, can be single- or double-laned, and have mostly aggregate (gravel) surfacing. Maintenance Level 3 roads are typically single-laned with aggregate surfacing.

Miles of road by Maintenance Level and Functional Class for Forest Service roads are provided in Table 2-3.

Table 2-3. Miles of Road by Maintenance Level for NFS Forest Service Jurisdiction Roads within the BHNF

Maintenance Level	Total	Percentage of Total
1	**1185**	**24.3%**
2	**3045**	**62.3%**
3	**492**	**10.1%**
4	**157**	**3.2%**
5	**5**	**0.1%**
Total	**4884**	

Source: BHNF Roads GIS Coverage

2.2.4 Forest Road Density

Forest Service roads within the BHNF generally display an even distribution with pockets of higher density around cities and major points of interest. Road densities for the NFS roads network have been calculated at several scales (i.e., total forest, ranger district, management area, and 6th -order watershed). Results at the levels of the Management Area, Ranger District, Forest, and Range Allotments are shown in Appendix B.

The density of all Forest roads within the BHNF boundary was calculated to be 2.19 miles/square mile. National Forest System Road density, by comparison, was determined to be 2.04 miles/square mile. When the user-created non-system roads are included, the density rises to 3.67.

2.2.5 Forest Service Trails

The trails that are maintained and used for forest management and other uses are referred to as National Forest System trails. These 35 trails are maintained to various standards depending on their function, level of use, and management. There are 323 miles of inventoried trails on the

Forest, of which 14 miles of the Centennial trail are designated for motorized use. Mountain bikes are prohibited from using trails that are located in the Black Elk Wilderness.

2.2.6 Travel Management Objectives and Standards

Standards for the management of motorized travel in the BHNF are specified in the LRMP (USDA-Forest Service 1997). In general, designated NFS roads are open all year to appropriate motorized vehicle use, unless closed for one or more of the following:

- Motorized use conflicts with Forest Plan objectives;
- Motorized use is incompatible with the Recreation Opportunity Spectrum (ROS) class;
- Motorized use creates user conflicts that result in unsafe conditions;
- Physical characteristics of travelway(s) preclude any form of motorized use;
- Travelways do not serve an existing or identified future public need;
- Financing is not available for maintenance necessary to protect resources; or
- Seasonal travel restrictions are required.

Based upon Management Area (MA) designations and their associated travel standards, unrestricted access is allowed on approximately 55 percent of the BHNF on a year-round basis. Access is either restricted or prohibited on the remaining 45 percent of the Forest. Motorized travel is restricted to designated routes in 11 percent of the Forest to protect sensitive areas. Seasonal restrictions are applied to 32 percent of the Forest to protect wildlife within the Big Game Winter Range Emphasis Area (MA 5.4). Restricted areas are managed to provide high-quality winter and transitional habitat for deer and elk, high-quality turkey habitat, habitat for other species, and a variety of multiple uses. Motorized travel is prohibited in 2 percent of the Forest. Travel opportunity objectives for the BHNF as identified in the LRMP are shown in Table 2-5 (USDA-Forest Service 1997). Travel management standards for each Forest Management Area are shown in Table 2-4.

The Black Hills National Forest Travel Information Map (2005) shows specific closure areas and roads that are closed seasonally and yearlong. There are 1,185 miles of closed NFS roads on the Forest. An additional 611 miles of roads are closed seasonally.

Table 2-4. Travel Management Standards for the BHNF Management Areas

Management Area #	Management Areas	Motorized Road Travel	Motorized Off-Road Travel	Snowmobile Travel
1.1A	Black Elk Wilderness	Prohibited	Prohibited	Prohibited
3.1	Botanical Areas	Restricted*	Prohibited	Restricted*
3.2A	Inyan Kara Mountain	Prohibited	Prohibited	Prohibited
3.31	Backcountry Motorized Vehicle Recreation Emphasis	Allowed	Restricted **	Allowed

Table 2-4. Travel Management Standards for the BHNF Management Areas

Management Area #	Management Areas	Motorized Road Travel	Motorized Off-Road Travel	Snowmobile Travel
3.32	Backcountry Non-motorized Recreation Emphasis	Prohibited	Prohibited	Restricted*
3.7	Late Successional Forest Landscape	Restricted*	Prohibited	Restricted*
4.1	Limited Motorized Use and Forest Product Emphasis	Restricted*	Prohibited	Restricted*
4.2A	Spearfish Canyon	Restricted*	Prohibited	Restricted*
4.2B	Peter Norbeck Scenic Byway (Section within the Norbeck Wildlife Preserve)	Restricted*	Prohibited	Restricted*
5.1	Resource Production Emphasis	Allowed	Allowed	Allowed
5.1A	Southern Hills Forest and Grassland Areas	Allowed	Allowed	Allowed
5.2A	Fort Meade VA Hospital Watershed	Restricted*	Prohibited	Restricted*
5.3A	Black Hills Experimental Forest	Allowed	Allowed	Allowed
5.3B	Sturgis Experimental Watershed	Restricted*	Prohibited	Restricted*
5.4	Big Game Winter Range Emphasis (Formerly Low-Elevation Wildlife Habitat)	Restricted***	Restricted ***	Restricted*
5.4A	Norbeck Wildlife Preserve	Restricted*	Prohibited	Restricted*
5.43	Big Game and Resource Production	Restricted*	Prohibited	Restricted*
5.6	Forest Products, Recreation and Big Game Emphasis	Allowed	Allowed	Allowed
8.2	Developed Recreation Complexes	Restricted*	Prohibited	Restricted*

* Restricted to Designated Routes ** Restricted to Designated Trails *** Seasonal or yearlong restrictions may apply

Table 2-5. Travel Opportunity Objectives for the BHNF

Category	Percentage of Forest
All Motorized Travel Allowed Yearlong	59.1%
Seasonal Restrictions Apply	22.8%
Seasonal Restrictions – No Off-Road Travel	3.2%
Backcountry Motorized Recreation on Designated Trails	1.0%
Only OHV Travel Prohibited	11.4%
Motorized Travel Prohibited Except Snowmobiles	1.2%
All Motorized Travel Prohibited	1.3%

2.2.7 Use Patterns

While use of the road system by local residents is generally constant throughout the year, recreational road use and road use during hunting season in the Black Hills is both heavy and seasonal. The majority of the estimated 1.7 million site visits per year occur during the tourist season, which generally extends from Memorial Day to Labor Day (USDA-Forest Service 1996a). Winter road use is lighter and allows for seasonal road restrictions to be applied between October and May, as necessary.

In addition to standard recreational use, special events that test the capacity of the road system occur during the tourist season. One example is the Sturgis Motorcycle Rally, which occurs once a year for one to two weeks in August. During this event, more than half a million motorcycle enthusiasts converge in the Black Hills for the rally. The event routes the bikers on a number of different tours through the Northern, Central, and Southern portions of the Black Hills. In addition, the event attracts thousands of vendors to the town of Sturgis where an annual rally is held. Most motorcycle travel is primarily on paved roads.

In recent years, OHV use of Forest Service roads, trails and off road areas has increased significantly. Much of the use is concentrated around urban interface areas and areas that are easy to reach by road. Off-Highway Vehicle travel is present on all levels of forest roads with primary use being on ML 1 and 2 roads and unauthorized roads and trails. The number of user created routes is increasing each year. A percentage of users have ignored road and area closures creating environmental damage, enforcement problems and user conflicts.

2.2.8 National Forest System Roads and Trails Budget

The budget allocation for planning, construction, capital improvement, and maintenance of roads and trails on the Forest has been decreasing noticeably in the last few years. Capital improvement funds acquired to conduct the road and trail improvement work necessary to bring the roads and trails to the desired objective have been minimal. The overall level of federal funding is not sufficient to perform the short and long term maintenance needs identified for the NFS transportation system in general. The long term condition of roads and trails is expected to deteriorate unless new resources become available.

2.2.9 Scenic Byways

The major recreation activity in the BHNF is driving for pleasure and viewing scenery (USDA-Forest Service 1996a). To accommodate this recreational use and recognize scenic and popular routes, two scenic byways were created within the Forest; the Peter Norbeck and Spearfish Canyon Scenic Byways.

The Peter Norbeck Scenic Byway is a 70-mile drive through the heart of the Black Hills granitic core. This byway includes parts of U.S. Highway 16A (the Iron Mountain Road), S.D. Highway 87 (the Needles Highway), S.D. Highway 89 (the Sylvan Lake Road), and S.D. Highway 244 (the Mount Rushmore Highway). It lies adjacent, and provides access to, Mount Rushmore National Memorial and Custer State Park.

The Spearfish Canyon Scenic Byway is an 18 mile drive through a canyon carved into the sedimentary shale and limestone units in the Northern Hills Ranger District. This byway runs along U.S. Highway 14A between the towns of Spearfish and Cheyenne Crossing providing access to waterfalls, wildlife, and numerous recreational activities.

2.3 PHYSICAL ENVIRONMENT

2.3.1 Geographic Features

The Black Hills is an isolated group of rugged mountains that rise high above the surrounding plains. The Black Hills uplift formed about 62 million years ago as an elongated dome that is about 120 miles long by 60 miles wide. An extensive period of erosion occurred during and after the uplift, removing approximately 7,500 feet of sedimentary rocks and exposing the Precambrian crystalline rocks in the central portion of the Black Hills. The exposed igneous and metamorphic Precambrian rocks are referred to as the central core, extending from near Lead, South Dakota to south of Custer, South Dakota.

A layered series of sedimentary rocks is exposed, indicating the presence of roughly concentric rings around the central core. The inner rings of sedimentary rocks are primarily limestone and dolomites, which create the Limestone Plateau or the Minnelusa Foothills, a high altitude area of generally low relief in the western side of the Hills. Due to their karst features, these formations contain the major aquifers for the area and one of the world's largest collections of caves and sinkholes. Most notable is the Jewel Cave (located off of U.S. Highway 16), which extends for more than 105 miles below the surface. Peripheral to these limestone units are the less resistant siltstone and gypsiferous shales, which eroded to create low areas such as the Red Valley in the northern portion of the Hills. The outer ring of sedimentary rocks forms a ridge, known as the "Hogback", which is composed of massive to thinly bedded sandstones, siltstones, and claystones. The ridge forms a general boundary between the Black Hills and the prairie (USDA-Forest Service 1996a).

Road construction and location are often linked to the geologic features of an area. The stability of the roadbed and difficulties in constructing the road (e.g., whether or not blasting is necessary) are both dependant upon the underlying geologic structure of the area.

2.3.2 Climate

The climate of the Black Hills area is continental and, therefore, highly variable. The area as a whole is characterized by hot summers, cold winters, and extreme variations in both precipitation and temperatures (Johnson 1933). These conditions are known to damage the road system. Spring storms, from April to June, account for approximately 50 percent of the yearly precipitation. These storms can be so intense that they wash out entire sections of roads and bridges. Additionally, roads can be damaged by frost heave, whereby the freezing of the ground causes the ground surface to heave and lift pavements. During the spring thaw, the foundation soil once again softens as the ice melts and weakens the structural support for the pavement, leading to cracks (McGee 1996). Roads in higher elevations are often closed by snow accumulation for a portion of the winter.

2.3.3 Soil Conditions

Soils of the Black Hills are generally stable and productive. There are also areas of erosive soils which can be affected by road construction (USDA-Forest Service 1996a). The most erosive soils are derived from igneous rock of the central core and the interbedded siltstones, shales, and gypsum that are found in the Red Valley and the Hogback. There are landscapes located within the Black Hills that are more susceptible to erosion when vegetative cover is removed. Minimizing soil loss associated with disturbance activities on these areas can generally be mitigated by the stabilizing effects of vegetative ground cover.

Mass movement of soils (gravity-induced movement of a portion of the land surface) also occurs on the Black Hills, primarily associated with the steep slopes of the Hogback in the northern and eastern portion of the Forest. Several landslides have also occurred in the Cook Lake area of the Bearlodge Mountains and in the Minnelusa Foothills. Annual precipitation levels in the northern Black Hills that are generally higher than some of the other portions of the Black Hills may contribute to conditions for the mass-movement potential in that area. The central core area of the Black Hills is considered to be generally stable, road cutbanks in the micaceous schist may slump when the cut-slopes are parallel to the layers of bedrock (USDA-Forest Service 1996a).

Roads have the potential to increase soil erosion rates over those generally associated with natural conditions as a result of the land clearing, grading, and surfacing required for their construction. Although roads are to be designed to mitigate many soil loss problems, erosion has been observed or documented to occur on cut-and-fill slopes, road surfaces, and road ditches. The amount of erosion is dependent upon a variety of contributing factors including the road surfacing material, the cross drainage off the road surface, the slope of the road, the road material, and the cut-and fill soil types and slopes, road maintenance, and annual precipitation levels in various areas of the Black Hills. Roads have the potential to increase the likelihood for slumping or slope failure (mass movement) if road alignments cross unstable slopes or create unstable slopes. Revegetation of disturbed soils are various management practices by the Forest Service during road construction that can generally be expected to limit on-site soil loss and water runoff associated with general or higher intensity precipitation events.

2.3.4 Surface Water

Surface water in the Black Hills area is highly influenced by geologic conditions. Numerous headwater springs, originating primarily from the Madison and Minnelusa aquifers, occur in the Limestone Plateau area and provide base flow for many Black Hills streams. These streams flow across the igneous and metamorphic rocks in the central core area, which is relatively impervious to water. As they cross the outcrops of the Madison and Minnekahta limestone formations, however, most of the streams lose all or part of their flow. Large artesian springs occur in many locations down-gradient from the loss zones. These artesian springs provide an important source of base flow in the many streams beyond the periphery of the Black Hills (USDA-Forest Service1996a).

Stream flow varies, coincident with the climate, from the southern to the northern Black Hills. Lack of precipitation between October and April contributes to most streams in the southern Black Hills area to be intermittent or ephemeral, whereas most of the streams in the northern

Black Hills have perennial flow. Underlying porous limestone also promotes ephemeral conditions. All of the streams within the Forest empty into two encircling rivers, the Belle Fourche and the Cheyenne Rivers (USDA-Forest Service 1996a).

2.4 BIOLOGICAL ENVIRONMENT

The physical environment of the Black Hills has shaped the biological environment in unique ways. According to Bailey (1995), the Black Hills comprise an ecoregion distinct from the Southern Rocky Mountains and Great Plains, which contain all other lands administered by Region 2 of the Forest Service.

In many respects, the Black Hills can be thought of as a crossroads between east and west, north and south (USDA-Forest Service 1996a). The area's unique faunal and floral assemblages are primarily a consequence of several invasions and retreats of biotic communities found elsewhere since the Pleistocene glaciation. With four major vegetation complexes and roughly 139 bird, 7 amphibian, 15 reptile, 62 mammalian, and 29 fish species, the Black Hills represent a melting pot of species and habitats. Many of these species are near the edge of their range here, and their population cores are generally located elsewhere in North America (USDA-Forest Service 1996a). Some have estimated that only half a percent of Black Hills species may be considered endemic (McIntosh 1931).

The BHNF is predominately a Rocky Mountain Coniferous Forest Complex dominated by ponderosa pine. As such, it is home to many western species including mule deer, mountain bluebird, and western tanager. Northern species such as white spruce, paper birch, American marten, red-breasted nuthatch, golden-crowned kinglet, and gray jay are also common. Eastern species include bur oak, eastern hophornbeam, white-tailed deer, broad-winged hawk, and ovenbird.

Over 80 percent of the Forest is currently in a forested condition. Meadows or prairie grasslands characterize a small portion of the Forest. Meadows are interspersed among montane forest. Prairie habitat exists primarily at lower elevations, and is considered part of the Grassland Complex of the northern Great Plains.

Roads have the potential to affect the biological environment in a variety of ways. Adverse effects may include habitat loss, habitat fragmentation, sedimentation and/or soil movement, increased mortality from collisions with vehicles, and changes to wildlife behavior patterns. For some species, especially aquatic species, roads may form insurmountable physical barriers to travel, effectively isolating them from other populations and/or habitats. Indirect adverse effects may result from increased human activity, vehicle noise and disturbance during critical periods such as courtship, young-rearing, or winter survival. These indirect effects may alter normal behavior and movements, and can impact reproductive success and survival. In addition, road construction and road maintenance activities may create vectors for the establishment and invasion of noxious weeds and other undesirable species.

In contrast, roads provide a number of benefits for humans including increased access to the Forest by the general public, resource managers, and researchers. By acting as artificial firebreaks, roads may also help to protect important wildlife habitats and botanical communities.

Additionally, scarification from road construction, reconstruction, or maintenance, specifically in ponderosa pine stands, creates opportunities for increased plant diversity and access to forest products.

2.5 SOCIAL, CULTURAL, ECONOMIC, AND POLITICAL ENVIRONMENT

Motorized use of the Forest has a long history, and people are accustomed to utilizing the road system to access the Forest for economic, social, and cultural purposes. Any decisions made regarding the road system, including closures and construction, therefore become a public issue. As a result, Federal land managers operate in a social-economic context, attempting to balance and sustain productive uses with other qualities of the land that are valued in a manner that is expected to best serve the greater public both now and into the future. The following sections describe the social, cultural, economic and political environment in which the road system exists.

2.5.1 Historic Use

For centuries before the present road system was developed, numerous American Indian tribes, including the Arapaho, Cheyenne, Kiowa-Apache, Crow Shoshone, and Sioux, sustained themselves on the natural resources of the area. Hunting, fishing, and gathering of vegetative products provided food and shelter. Later, buffalo, sheep, and cattle were grazed. The spiritual foundation of American Indian tribes is tied to the land and its resources. Many of their cultural practices, (e.g., gathering plants for ceremonial and medicinal purposes) occur on NFS lands and their unique cultures and traditional values add to the richness of the Black Hills social environment.

The influx of immigrants into the area during the late 1800s led to the expansion and improvement of the transportation system in the Black Hills to provide access for mining, grazing, and logging activities. Paths and trails that were likely used for foot or horse travel by American Indians were developed into more formal routes for wagons and wheeled vehicles. Large tracts of forest were cut in order to provide timber to the growing mining industry and to provide housing for the people now residing in the Black Hills. By the 1920s, a major highway system was developed and a Forest Road System was initiated. The Civilian Conservation Corps augmented the system in the 1930s to accommodate tourists traveling in passenger vehicles.

The present road system has evolved largely in response to development within the Black Hills over the past 100 years, particularly from logging and the demand for access to private property. For long-time local residents who depend on these roads, it is important for resources to be managed in a way that sustains economic viability. More recently, the natural beauty and features of the area have prompted increased levels of tourism and recreation, which have also benefited from the road system.

In the past decade, areas have been restricted from motorized use in order to protect soil and water resources or to reduce disturbance to big game in critical winter range. These access restrictions have garnered opposition because closing areas to motorized use can affect traditional access patterns. On the other hand, support for road closures is received from numerous conservation groups, landowners, and other government agencies.

2.5.2 Economic Characteristics

The ease of access to the Forest can generate economic benefits, which are gained at local, regional, and national levels. The local economy benefits from the well-maintained roads that link communities to one another and to the greater region, which in turn fosters community development and facilitates access for fire suppression and emergency response. The NFS roads also provide a route of entry into the Forest for industries that rely on forest products, most notably timber harvest activities. Finally, roads channel tourists, and associated income into the area. A majority of the tourism on the Forest is motorized.

2.5.3 Private Land Development

Private land is an important component of the Black Hills and factors into transportation decisions made for the Forest. Homesteading acts opened the Black Hills to farming during the first decade of the 1900s and, while many of the farms proved unproductive, the homesteads and mining claims created thousands of private in-holdings within the Forest. Today, many of these in-holdings have homes or other developments on them giving the Black Hills the appearance of being one of the most developed forested areas in the nation (USDA-Forest Service 1996a). Applications for private land access under the Federal Land Policy and Management Act of 1976 (FLPMA) are increasing on the Forest. At times the Forest is receiving one to two applications per week. These are generally applications for ML 2 roads. Some applications are to use existing NFS roads and some are for new construction. The new FLPMA roads will contribute to increased traffic on ML 3, 4, and 5 roads.

Development of private land within the Forest boundary is predicted to continue at a constant rate over the next decade, which will place additional demands on the existing road system. The most rapid land development is occurring along the corridors within Boulder Canyon, along U.S. Highway 85 in the northern Hills, the Hill City area, along Sheridan Lake road near Rapid City, and along Highways 385, 44, and 16 (USDA-Forest Service 1996a). Within 10 years, private lands along these corridors could be upwards of 80 percent developed, resulting in increased traffic. The increase in residential traffic is expected to be greatest along the narrow strip adjacent to Interstate 90 where intense residential development is creating an annual growth rate of over 10 percent (USDA-Forest Service 1996a). As communities continue to grow, the level of human interest and activities could be expected to intensify. As a result, differences in social, economic, and cultural values may become more of an issue.

2.6 ROADLESS AREAS

Motorized travel is prohibited in four areas of the Forest to protect soils, wildlife, and other resources. This includes one Wilderness Area (Black Elk) and three inventoried roadless areas (Inyan Kara, Sand Creek, and Beaver Park). Wilderness Areas are designated by US Congress to *"secure for the American people of present and future generations the benefits of an enduring resource of wilderness."* The inventoried Roadless Areas all met the roadless criteria identified under the 1978 RARE II study. Road construction and reconstruction are prohibited in both Wilderness Areas and inventoried Roadless Areas.

The ecological characteristics and social values of these four areas are further described in the following subsections.

2.6.1 Ecological Characteristics

Black Elk Wilderness Area

Black Elk Wilderness Area is located in Pennington and Custer Counties near the eastern boundary of the Forest. Congress first designated it as wilderness in 1980, and recently expanded it with new legislation. Today, Black Elk totals 13,420 acres. The area is managed to allow ecological processes to operate relatively free from the influence of humans.

The Black Elk Wilderness Area contains Harney Peak, the highest point east of the Rocky Mountains. It entirely encompasses the Upper Pine Creek Research Natural Area (RNA). The wilderness also contains 883 acres of the Norbeck Wildlife Preserve. The Black Elk Wilderness, Mt. Rushmore National Monument, and The Needles area of Custer State Park collectively make up an area locally referred to as The High Granite Region. This area is ecologically distinctive from the lower and somewhat drier sites surrounding it (USDA-Forest Service 1996a). Massive granite outcrops rising above mature forest dominate the overall visual landscape. In some areas, however, natural openings occur in the forest canopy due to insect and disease activity, montane meadows, recently burned areas and blowdown. The dominant forest associations of the Black Elk Wilderness are mature ponderosa pine (*Pinus ponderosa*) with areas of white spruce (*Picea glauca*), quaking aspen (*Populus tremuloides*), and other hardwoods.

Inyan Kara

Inyan Kara is a forested dome-like landscape entirely surrounded by prairie, making it a visual and ecological focal point of the surrounding landscape. It is 1,397 acres in size. Areas of steep volcanic rock formations, including columns of laccoliths that rise to near vertical plane, are common.

Ponderosa pine forest is the most conspicuous vegetative element on Inyan Kara; however, stands of Rocky Mountain juniper (*Juniperus scopulorum*), quaking aspen, birch (*Betula spp*.), and bur oak (*Quercus macrocarpa*) are also present. There is a considerable amount of natural dead and down woody material in the area and dead and standing trees due to fire, insect and disease. At some sites, more mature pockets of trees or dense "dog-hair" stands occur.

Wildlife species of both the prairie and forest ecosystems are present. Because of Inyan Kara's isolation, remoteness, and inaccessibility, scant research or documentation exists with respect to specific communities or species present at this site.

Sand Creek

Sand Creek is a 9,948-acre inventoried roadless area located approximately 14 miles east of Sundance, Wyoming. It offers spectacular scenery, with limestone cliffs and steep slopes, and elevation gradients of more than 500 feet. This steepness has kept the Sand Creek area isolated and relatively untouched from past road development and timber management activities.

Evidence of historic mining is present in the form of old shacks and roads, mostly across the creeks and outside the area.

Much of Sand Creek is characterized by Ponderosa Pine Forest and Upland Aspen community types, but some mesic Paper Birch (*Betula papyrifera*)/Hazel (*Corylus spp.)* Forest stands are also present. Finescale dace (*Phoxinus neogaeus*) were introduced into the Sand Creek drainage in 1982, but failed to become established.

Beaver Park

Beaver Park is a 5,109-acre inventoried roadless area on the northeastern flank of the Black Hills, approximately five miles south of Sturgis, South Dakota. Beaver Park is partly defined by steep slopes and an elevation gradient of 1,400 feet. Foothills and upper watersheds of small drainages also occur. Steep-sided slopes of shale-talus, limestone-talus and shallow to moderately deep soils are common. Livestock grazing use is permitted; however, the steep topography of the area and intermittent nature of water in streambeds physically limits grazing use. Recently the area has suffered high mortality of ponderosa pine stands as a result of mountain pine beetle infestation. Motorized access to the area was authorized to treat the beetle infestation and fuel build-up.

Bur Oak /Ironwood (*Ostrya virginiana*) Forests, Creeping Juniper (*Juniperus horizontalis*) Shrublands and Northern Great Plains Little Bluestem (*Schizachyrium scoparium*) Prairie communities are present in the area. Small stands of quaking aspen and birch species may also be present.

2.6.2 Social and Cultural Values

Some people value well-managed access to the forest for multiple-use. Many of these uses tend to generate road construction. Roads allow for pleasure driving and provide access for hunting, camping, and other dispersed recreation. The issue of equity is also important to people with disabilities or limited mobility (e.g., the elderly) who cannot partake in wilderness opportunities without roads. However, roads also reduce the supply of roadless areas that provide for a more primitive recreation experience. Some people greatly value the chance to find solitude in remote and natural settings. Yet others believe that wilderness is essential for ecological reasons, and the slow conversion of landscape by the presence of people has broader implications on the human environment and health.

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STEP 3: IDENTIFYING ISSUES

The primary purpose of Step 3 is to identify and summarize the key issues affecting road-related management. These issues should be considered for analysis in future project level travel analysis. The relevance of these issues may vary depending on the specific analysis area conditions.

3.1 IDENTIFYING ISSUES

Travel-related issues for the BHNF were generated from the following sources: the Forest-wide Roads Analysis Process (RAP), public response to the Phase II Amendment Notice of Intent, public response during public meetings and other outreaches, IDT member input, review of existing documents, discussions with other public agencies, and local knowledge.

Public Involvement

Preliminary public involvement was initiated in 2003 in an effort to familiarize the public and stakeholders throughout the Black Hills region with the objectives of travel management. Between 2003 and 2007, the Black Hills National Forest hosted and participated in numerous public meetings and workshops in Wyoming and South Dakota.

Between 2004 and 2006, the OHV and Travel Management subcommittees of the Black Hills National Forest Advisory Board conducted a number of public meetings to solicit general comments on travel management. The meetings were held in South Dakota and Wyoming to discuss and review Subcommittee objectives and current Forest Service national OHV policy direction, and outline plans for the future. The purpose of these meetings was to gather input to help develop recommendations to assist Forest managers in future OHV and travel management policy planning.

Four "Travelways" Workshops were conducted by the Forest during November of 2006. The purpose of these workshops was to gather public input and ideas for the development of a proposed action. A product from these workshops was a collection of forest site specific information from participants, including organizations, after they completed a mapping exercise.

The issues identified through these sources are as follows:

- Solitude
- Air Quality
- Managing Livestock
- Signing
- Environmental Health
- Wildlife Habitat
- Recreational Opportunities
- Law Enforcement
- User Conflict
- Managed Roads and Trails

- Budget
- Safety
- Economic Stability
- Private Land and the Urban Interface
- Botanical Resources

Issues are described in more detail in the following discussions.

3.1.1 Solitude

- Conflicts arise between motorized users enjoying a ride and non-motorized users seeking quiet of natural surroundings in the forest.
- Trailheads and/or concentrated OHV use near residential areas lead to conflicts between users and homeowners. Designation of trails may increase noise in some areas of the Forest.
- Wildlife may be affected by noise created through OHV use.

3.1.2 Air Quality

- Increased dust caused by OHV use is a concern near communities and subdivisions.
- Increased dust caused by OHV use can cause conflicts between user groups.

3.1.3 Managing Livestock

- An OHV trail system located in permitted range allotments may impact the cattle. Noise, loss of vegetation, interaction with people and open gates may increase due to motorized trail designation through range allotments.

3.1.4 Signing

- Forest Service road and trail markings are numerous and difficult to maintain because of vandalism, cattle, and fire. Increased use and increased need for signs to describe OHV opportunities will make the problem worse and more expensive.

3.1.5 Environmental Health

- User created routes may not be located or engineered properly to sustain OHV traffic, therefore causing environmental damage with continued use (e.g. motorized vehicles in fragile or steep terrain).
- Proliferation of user created routes (parallel trails or roads, illegal travel off designated routes) is causing resource damage.
- Unrestricted seasons of use (routes open to motorized travel too long into the wet or muddy seasons) are causing resource damage.
- Having the trail system adjacent to traditional, cultural, and historic sites in the Forest can lead to vandalism of those sites.
- Use of a motorized trail system may alter wildlife behaviors and movement patterns.

- Roads or trails designated for OHV use located near streams or with unimproved stream crossings may cause or increase erosion, degrade water quality, and /or impede the passage of aquatic organisms.
- Roads or trails use, maintenance and construction may facilitate the spread of noxious weeds.

3.1.6 Wildlife Habitat

- Off-Highway Vehicle use may disturb or harm wildlife when routes are located in important or critical wildlife habitat areas. Too many roads in wildlife habitat areas and disturbance to wildlife during critical lifecycle periods are issues to consider.

3.1.7 Recreational Opportunities

- There are concerns about loss of recreational opportunities when existing routes are closed to motorized travel and loss of semi-primitive and primitive recreational opportunity if more routes or areas are open to motorized travel.

3.1.8 Law Enforcement

- There are concerns whether the agency can enforce decisions on allowed routes and uses for motorized travel.
- Law Enforcement costs and responsibilities may increase due to the influx of motorized users near communities and private landowners.

3.1.9 User Conflict

- Increase interest in our national forests has caused user conflicts across the country. Forest visitors want to recreate in a natural setting in a wide variety of ways. Some enjoy hiking the peace and quiet of a forest. Others enjoy the challenge the terrain provides for OHV riding. The conflict between motorized and non-motorized users is an ongoing issue. The quality of the forest recreation experience may be affected for all users when not prepared for other forest users.
- Private landowners may have issues with trespass or property damage that can occur with concentrated OHV use.
- Various types of motorized vehicles using a multi-use system of roads and trails may have conflicts in regard to speed, noise and dust, and trail conditions. Inexperienced riders may be a hazard to experienced riders (or visa versa) using the same trail.

3.1.10 Managing Roads and Trails

- The National Forest System is experiencing a dramatic rise in use by OHV enthusiast. The Forest Service is struggling to appropriately and reasonably accommodate this need.
- The lack of a well thought out motorized trail system in answer to a growing interest in motorized recreation on the Forest will decrease the quality of the forest visit for all users.

3.1.11 Budget

- The downward trend in federal budgets will limit maintenance of the existing system and opportunities for new trail construction for motorized recreation. The demand for motorized recreation opportunities is growing. A trail system to small to meet the demand of the users may result in user conflicts, increased need for maintenance and law enforcement.

3.1.12 Safety

- Safety issues can arise when forest roads are designated for mixed use. Different sizes of motorized vehicles traveling on the same road at different speeds can cause user conflicts that may lead to increased crash risk. A mix in user experience level can raise these same issues.

- Adapting user created routes for the trail system may raise safety issues if they are not constructed to motorized standards.

3.1.13 Economic Stability

- Tourism has an economic impact on the communities of the Black Hills. The influx of motorized recreation enthusiasts into the small Black Hills communities is felt by local campgrounds, service stations, restaurants and other businesses. Will restrictions on the current use of the Forest land have an effect on the local economy?

3.1.14 Private Land and the Urban Interface

- Communities and subdivisions that border the forest may see an increase in traffic and noise directly related to increase motorized recreation use on the Forest.

- Private residences within the Forest boundary may have trespass issues due to increase motorized recreation traffic.

3.1.15 Botanical Resources

- Roads may destroy or significantly degrade occurrences of sensitive plant species and plant species of local concern, as well as native plant communities.

STEP 4: ASSESSING BENEFITS, PROBLEMS, AND RISKS

The primary purpose of Step 4 is to examine the major uses and effects of the travel system at the forest level to assess the various benefits, problems, and risks of the current travel system and to assess whether or not the objectives of Forest Service policy reform and Forest plans are being met.

4.1 METHOD

For the purpose of this section of the transportation analysis, the Rocky Mountain Region 2 Roads Analysis Supplement (R-2 Supplement) to FS-643 (USDA – Forest Service 2004d) was used in conjunction with FS-643 (USDA-Forest Service 1999a) for an outline of topics to be addressed to assess benefits, problems, and risks. Benefits are defined as the potential uses and socioeconomic gains provided by roads and related access. Problems are conditions for certain environmental, social, and economic attributes that managers deem to be unacceptable related to the road system. Risks are likely future losses in environmental, social, and economic attributes if the road system remains unchanged.

The R-2 Supplement recommends that the following 15 major topics be addressed:

- **Aquatics**
- **Terrestrial Wildlife**
- **Ecosystem Functions**
- **Botany**
- **Economics**
- **Commodity Production**
  - Timber Management
  - Minerals Management
  - Range Management
  - Water Projects
  - Special Products
  - Special Use Permits
- **General Public Transportation**
- **Administrative Use**
- **Protection**
- **Non-Motorized Recreation**
- **Motorized Recreation**
- **Passive Use**
- **Social Issues**
- **Cultural/Historical Issues**
- **Civil Rights and Environmental Justice**

4.2 AQUATICS

Given that this is a forest-wide (i.e., programmatic) TAP, examination of the aquatic questions focuses on identifying roads where there is a higher relative risk of loss of watershed function or health and/or a higher relative risk of aquatic species to be affected by the road system. For this reason, all inventoried roads within the Forest boundary are considered for this portion of the analysis. Examining all roads allows for a more applicable, broad-scale assessment of the risk to watershed function associated with the road system as a whole, rather than just the arterials and

collectors. Further information concerning the relative risk of roads to 6th Order watersheds can be found in the Black Hills National Forest Roads Analysis completed in 2005.

4.2.1 Affects on Surface and Subsurface Hydrology

Ground water and surface water in the Black Hills are closely related. Precipitation reaching the ground may either infiltrate into the soil or, when thunderstorms are very intense, run off slopes into stream channels as overland flow. Water that infiltrates into the soils is held in place until the soil is saturated, when surface and/or subsurface flows begin. Subsurface flows generally percolate deeper into the groundwater zone where they move slowly into aquifers, seeps, springs, and streams (USDA-Forest Service 1996a).

Roads can modify the surface and subsurface hydrologic characteristics in specific locations on the Forest in a number of ways. For example, they can expand the drainage network by altering surface flow routing. Roads also tend to increase the impermeable surfaces in an area, which reduces the amount of precipitation that can directly infiltrate into the soil. If the change in impermeable surfaces is great enough, these reductions in the rate and quantity of infiltration into the subsurface can decrease the rates of groundwater recharge (Dunne and Leopold 1978). This can result in adverse consequences to streams during low flow periods when they are solely supported by groundwater contributions (Dunne and Leopold 1978). Another consequence of decreased infiltration and increased runoff is a decrease in the time of concentration and increased flood magnitudes during storm events (Dunne and Leopold 1978). The increase in flood magnitudes can result in unwanted flooding and adversely affect stream pattern and profile. This is uncommon in the Black Hills due to limited precipitation.

In general, roads intercept surface water runoff flowing across the landscape and divert that flow down the road, primarily along vehicle wheel tracks or into road ditches. In each case, concentrated flow reaches the channel faster than water traveling as subsurface flow (Wemple et al. 1996), resulting in an increased volume of surface flows and increases in erosion and sediment delivery to streams or other water bodies. The effects of roads on the hydrology of an area depend largely on local factors, especially the density of roads in a given area, the proximity of roads to streams, road/stream crossings, road grade, erosion potential, and amount of precipitation.

4.2.2 Affects on Surface Erosion

Erosion hazard is the soil's relative susceptibility to sheet and rill erosion when the surface vegetative ground cover is completely removed from the site. Roads can result in more erosion than any other single management activity on the Forest (USDA-Forest Service 1996a). Erosion can occur on the cut-and-fill slopes, the surface of the road, and in the ditch paralleling the road. The amount of erosion depends on the road surfacing, the cross drainage off the road surface, the road material, and cut-and-fill soil types and slopes. Roads also have the potential to induce slumping or slope failure (mass movement) if a road alignment crosses unstable slopes. Once all disturbed areas are adequately revegetated, on-site soil loss, water runoff and sediment movement will generally decrease. Although the soils on the Black Hills generally do not have a high erosion hazard rating, slumping or landslides can occur on steep slopes in a few areas on the Forest. Within the Black Hills, the most erosive soils are typically found on slopes greater than

40 percent and on soils derived from granites and the interbedded siltstones, shales, and gypsum rock types that are found in the Red Valley and the Dakota Hogback (USDA-Forest Service 1996a). Approximately 16 % of the Forest is underlain by soils that are highly erodible in their unvegetated condition.

Key factors in minimizing the volume of surface flow that reaches surface water bodies include the type of drainage structure, targeted and actual function, and spacing. These factors have a direct effect on the degree of surface erosion in an area. The Water Conservation Practices Handbook (FSH 2509.25) provides guidelines for drainage structure spacing. Some, but not all, of the main roads on the Forest have culverts or rolling dips spaced at sufficient intervals to divert the runoff from the road and onto the adjacent land. When implemented correctly, this system of culverts and turnouts is effective in reducing erosion on the road by limiting the amount of area where surface water can concentrate, by limiting the length of surface water flows, and by causing sediment to be deposited in areas with vegetative cover and gentle slopes.

Erosion at culvert outlets is minimized when they are located on flat slopes or in areas with high ground cover and established grasses. Placing rocks at the outlet to dissipate the energy of the discharged water also minimizes erosion. Erosion on adjacent slopes, however, is sometimes increased by the force of water discharged from culverts, especially on steeper slopes, highly erosive soils, or where there is little vegetation.

Construction of roads entails complete removal of vegetation during construction and for a relatively long period of time thereafter. Therefore, when erosion is an issue, erosion rates are typically high unless mitigation measures are used.

4.2.3 Mass Wasting

Mass wasting is a gravity-induced movement of a portion of the land surface, such as a landslide. In general, road-related mass wasting results from a number of factors including:

- Improper placement and construction of road fills and stream crossings
- Inadequate culvert sizes to accommodate peak flows, sediment loads, and woody debris
- Roads located on soils prone to mass wasting
- Water diversion onto unstable hill slopes

The sensitivity of an area to mass wasting depends, in part, on the interaction of the soils and underlying bedrock, slope steepness, and the subsurface hydrology.

Within the Black Hills, there has been some mass wasting associated with the steep slopes of the Dakota Hogback in the northern and eastern portion of the Forest. The Dakota Hogback has interbedded sandstone and shale, which can be unstable on steep slopes. Several landslides have also occurred in the Cook Lake area of the Bearlodge Mountains and in the Deadwood and Opeche Formations. The higher amounts of precipitation in the northern Black Hills may contribute to the mass wasting potential there (USDA-Forest Service 1996a).

A significant factor in determining the potential risk of a road being involved in a mass wasting situation is the steepness of the slope in the area. An analysis was conducted to determine the

number of road miles in high slope areas (slopes greater than 40 %). The analysis was conducted for individual ML 1 and 2 roads and unauthorized roads and user routes. The description of the analysis is presented in Section 5.2.1.and the results are located in the spreadsheet in Appendix B and on Map 20.

4.2.4 Influence on Stream Channel and Water Quality

Roads have often been cited as the major source of sediment addition to streams (USDA-Forest Service 1996a). In general, as the proximity of roads (particularly unpaved roads) to streams and water bodies increases, the potential for degrading water quality also increases. The number of road channel crossings in a watershed is an important factor in evaluating water-quality response to disturbance.

Road-stream crossings have the potential to directly and indirectly affect local stream channels and water quality. Poorly designed crossings directly affect hydrologic function when they constrict the channel, when they are misaligned relative to the natural stream channel, or when improperly sized culverts are installed. Undersized culverts that cannot handle the quantity of surface water runoff from storm events cause stormwater to back up and flow over the road surface. This can cause the roadbed to erode and increase sediment loading to the stream. Downstream of the culvert, water velocities can increase, causing stream headcutting and changes to stream morphology and aquatic habitat. Undersized culverts also frequently become clogged with sedimentation and debris, requiring frequent cleanings to avoid erosion of the road surface. Washouts also occur mainly at stream crossings when flows from the drainage ways overtop the roads, especially on unimproved surfaces, even where there are culverts. Finally, in areas where there are no culverts installed, road traffic across fords loosens bare soil that erodes downstream when there is water in the channel.

Road-stream crossings also act as “connected disturbed” areas where water and sediment are delivered directly to the stream channel. Connected Disturbed Areas (CDAs) are defined as “high runoff areas like roads that discharge surface runoff into a stream or lakes” (USDA-Forest Service 1995). The biggest water quality concern associated with the road system is sediment delivered to the stream system through CDAs.

The road system is hydrologically connected to the stream system where there are CDAs (e.g., road-stream crossings) and areas where roads are adjacent to a stream course and there is an insufficient buffer strip between the road or road drainage structures and the stream system.

An analysis was conducted to estimate the risk from a road because of an insufficient buffer strip between the roads and streams. A buffer width of 119 feet was used as a long term, worst case buffer width for capturing 97 percent of the sediment from a road in an area of highly erosive soils (Williams No Date). The risks were rated for each ML 1 and 2 road and all unauthorized roads and user routes. The analysis is discussed further in Section 5.2.1.and the results are presented in the spreadsheet in Appendix B and on Map 18.

4.2.5 Affects on Water Uses

States assign beneficial or designated uses to their streams and set water quality standards for each use. South Dakota has assigned streams on the Forest, at a minimum, as having the beneficial uses of wildlife propagation, stock watering, and irrigation (USDA-Forest Service 1996a). In addition, major or significant streams have been assigned additional beneficial uses (e.g., domestic water supply or coldwater permanent fish life propagation, recreation) (USDA-Forest Service 1996a). Wyoming has designated all streams on the Forest as Class 2 streams (i.e., surface waters that are determined to currently support game fish; have the hydrologic and natural water quality potential to support game fish; or include nursery areas or food sources for game fish) (USDA-Forest Service 1996a).

With increasing population in the Black Hills area and rapid development of inholdings within the Forest Boundary, stream and lake use for recreation and fishing will likely increase proportionately. Demand for water from stream fed reservoirs and aquifers for municipal and rural water supplies is increasing at a rapid pace. Demand for water for downstream irrigation will likely increase as well unless the increasing cost of the water makes irrigation unprofitable. Periodic droughts have a significant impact on the volumes in many of the streams and lakes with subsequent effects on their use.

The major potential effect of roads on steams and lakes is related to sedimentation. Serious sedimentation in some streams would effect some fish and bird populations. The potential sedimentation risk has been analyzed in other sections of this report.

The 1996 Final Environmental Impact Statement (EIS) indicates that roads may be a contributing factor to surface water quality degradation in Castle Creek, Rapid Creek, and Slate Creek (USDA-Forest Service 1996a). With regards to surface water quality in the Forest, Carter et al. (2002) state that "Most streams generally meet water-quality standards established for designated beneficial uses. The primary exceptions are streams in the exterior setting (outside the Forest), which occasionally fail to meet standards for temperature and dissolved oxygen during low-flow conditions. Standards for suspended sediment have been exceeded in some streams (South Dakota Department of Environment and Natural Resources, 1998)." In most cases those excedences were described as minor and it was not stated if they were road related. Subsequent reports in 2000 and 2002 reported a decreasing number of excedences due to suspended sediments. A review of the 2006 South Dakota (DENR) Integrated Report for Surface Water Quality Assessment and Wyoming's 2006 305(b) State Water Quality Assessment Report and 2006 303(d) List of Waters Requiring Total Maximum Daily Loads (TMDL) revealed no listings for Black Hills streams as impaired in the Black Hills due specifically to road derived pollutants such as sediment.

4.2.6 Affects on Wetlands

The road system may affect wetlands by altering surface water runoff patterns, by contributing sediment and/or other contaminants, by fragmenting or removing wetland habitat, by altering species composition of riparian plant communities, by allowing larger inputs of invasive species (including noxious weeds) that result in greater competition with native species for resources, and by increasing access for humans and livestock (resulting in risks for collection, trampling,

and cropping of riparian plant species). The road system is more likely to affect wetlands in valley bottom locations where wetland sites and road locations are more likely to coincide versus on drier, upland sites.

4.2.7 Affects on Physical Channel Dynamics

Roads can directly affect physical channel dynamics where they encroach on floodplains or restrict channel migration. Floodplains help dissipate excess energy during high flows and recharge soil moisture and groundwater. Floodplain function is compromised when roads encroach on or isolate floodplains. This can increase discharge velocities during peak flows and results in increased bed and/or bank erosion and overall channel in stability. Roads that reduce the storage capacity of floodplains can also affect flood magnitudes downstream of the affected area. Restricting channel migration can cause channel straightening which increases the stream energy available for channel erosion. This can also result in channel instability. Altering channel pattern affects a stream's ability to transport materials, including wood and sediment.

Miles of road within 30 feet of a stream is a good initial indicator of where the road system might be affecting physical channel dynamics (Williams No Date). The potential risk to channels using this 30 foot indicator has been analyzed as a hydrology risk factor for each ML 1 and 2 road and all unauthorized roads and user routes. The analysis is further described in Section 5.2.1.and the results are presented in the spreadsheet in Appendix B and on Map 17.

4.2.8 Affects on Aquatic Organisms

Road-stream crossings can directly restrict the migration and movement of aquatic organisms at crossings containing culverts. Generally, the restriction is on upstream migration, although downstream migration can also be affected, and is due to hanging or perched culverts (i.e., hydraulic jump), high flow velocities, and/or inadequate water depth for fish migration. In some locations, migration barriers may be desirable to protect native species.

Barriers to aquatic species migration/movement are assumed to occur on the Forest. However, an inventory of culverts on perennial streams has not been conducted. These migration/movement barriers likely affect native fish species, as well as several non-native fish species. It is likely that the majority of culverts that do pose migration/movement barriers to fish were originally set to the then-current grade of the stream, and that scour has occurred over time, creating waterfalls at culvert outfalls that are upstream migration/movement barriers.

Native fish species that occur on the Forest and are designated as Region 2 sensitive species include the finescale dace, lake chub, and mountain sucker. Within the Forest, the lake chub is only known to occur in the Deerfield Reservoir (Isaak et al. 2003); its movements are therefore unlikely to be affected by the existing road network. With the exception of one site, all areas where finescale dace have been sampled occur in the Redwater Creek drainage in the Bearlodge Ranger District of the Wyoming Black Hills (Isaak et al. 2003). Isaak et al. (2003) were unable to determine a trend in the current populations because the historic distribution of the finescale dace is largely unknown. However, they concluded that, "Fragmentation will have increasingly negative effects on finescale dace as populations disappear because dispersal of individuals needed to refound extirpated populations will be inhibited" (Isaak et al. 2003).

Mountain suckers are relatively well-distributed in streams throughout the Forest (USDA-Forest Service 2004b). The movement of the mountain sucker could potentially be adversely affected by the road network.

The movement of aquatic mammals and amphibians also needs to be considered. The northern leopard frog is a Region 2 sensitive species and occurs on the Forest in a wide variety of habitats including creeks, lakes, ephemeral wetlands, and ponds (Smith 2003). Northern leopard frogs are considered common in the Black Hills and are found at all elevations. For this species the roads themselves, not culverts, pose a movement barrier, and road-related mortality is one of the risk factors associated with this species (Smith 2003). Due to their widespread use of a variety of habitats, specific road mitigation measures to reduce road-related mortality are difficult to develop and implement effectively. Smith (2003) suggests that frog populations should be considered when siting new roads and that frogs and their habitat be considered when decisions are being made to close or manage existing roads.

None of the sensitive species discussed above have commercial or recreational value and so their persistence is not directly affected by fishing or poaching.

Beaver are semi-aquatic and are a management indicator species on the Forest. Movement of this species is not expected to be substantially affected by the road network. Culverts at road crossings provide convenient locations for beaver to dam in order to create ponds. These dams can result in road damage through overtopping and road fill saturation.

The movement/migration of aquatic macroinvertebrates can also be affected by road culverts, though the specific effects on particular species are largely unknown (Vaugh 2002). An indirect effect of culverts on macroinvertebrate assemblages can be channel degradation or instability, which changes microhabitats and increases sedimentation into the stream (Vaughn 2002).

The road system can contribute to direct habitat loss where mass movements associated with roads directly impact stream channels; where sediment is delivered directly to the stream channel through connected disturbed areas; at road-stream crossings; and where the road system is restricting channel migration and isolating floodplains.

4.2.9 Introduction of Non-Native Species

Roads facilitate access to developed and undeveloped recreation sites along streams and reservoirs found on the Forest. The road network generally follows valley bottoms where multiple access points or stream crossing provide ready access to aquatic habitat for the intentional or unintentional introduction of non-native aquatic species. All game species on the Forest are introduced non-native species whose transplantation was facilitated by the road network.

4.2.10 Affects on Unique Species

Areas of high aquatic diversity or productivity or areas containing rare or unique aquatic species or species of interest are limited to areas containing the lake chub, mountain sucker, finescale dace, northern leopard frog, American dipper, and to walk-in fisheries. The lake chub is

restricted on the Forest to the Deerfield Reservoir and the finescale dace is restricted to the Redwater Drainage in Wyoming. The road system provides a number of access points to Deerfield Reservoir in the form of boat ramps and developed recreation sites. The mountain sucker and northern leopard frog are more widespread on the Forest and a greater degree of overlap occurs with these species.

Spearfish Creek, located in Spearfish Canyon, is home to one of the remaining resident populations of American dipper found in the Black Hills. Walk-in fisheries may also be considered areas of high productivity; these occur on Rapid, Boxelder and Castle Creeks in South Dakota, and on Sand Creek in Wyoming. The degree of overlap with the road system is limited to stream crossings at these locations.

4.3 TERRESTRIAL WILDLIFE

4.3.1 Affects on Habitat

Roads affect habitat quality and quantity in a number of ways, depending on factors such as road placement, vehicle use patterns, width, surface material, and density. Various combinations of these factors can maintain or improve habitat for some species, but are generally thought to degrade it for most (Forman et al. 2003). Typically, negative impacts are greatest to specialized, rare, or declining species.

The amount and composition of vegetation (a major habitat component) is different on and near roads compared to areas away from roads. This affects the amount of cover and food that are available to wildlife. Depending on road surface material and traffic levels, vegetation may be completely absent from roadways. This is less common on ML 1 and 2 roads than those of higher maintenance levels. Noxious weeds and other unpalatable (inedible) plants may dominate roadsides or areas between wheel tracks. Other types of plants that evolved with high levels of sunlight and/or disturbed soils may also be prevalent, and sometimes these are sought by foraging wildlife (e.g., grasses and forbs). Roads may also alter plant species composition by affecting fire frequency or severity. Roads can act as natural fuel breaks, and improve firefighter access; both of these situations contribute to smaller and less frequent fire, which promotes dense forests and later seral species in areas between roads. The abundance of ML 2, unclassified, and user created routes on the Forest very likely has a notable effect to wildlife habitats with regard to fire effects.

Abrupt changes in vegetation along roads create “edges” in habitat. Sometimes these edges are substantial enough to dissect habitat into unused or infrequently used pieces. This is called fragmentation. Species that specialize in a single type of habitat (e.g., closed forests) often avoid edges, and are vulnerable to this type of habitat loss. However, not all species are negatively affected by edges. Some species seek the localized changes provided by edges. Examples include deer feeding in small meadows, or turkey picking up gravel on a roadside.

Roads can act as both barriers and facilitators of animal movement. Barriers can be physical obstructions in habitat, or mental (behavioral) obstructions. Some animals may approach a route, but be deterred from moving across it if traffic or other human activity is present. Generally, the wider the road and the heavier the traffic, the greater the barrier (e.g., ML 3, 4, and 5 are greater

barriers than ML 1 and 2). Roads can also be a barrier in low traffic areas when placed on steep slopes, because large cut and fill segments are required (Thomas and Toweill 1982). Conversely, roads can sometimes facilitate animal movement, particularly when traffic is not present and the roadbed contains fewer obstacles than adjacent areas. This is likely most common on ML 1 roads, which receive little or no traffic.

Habitat degradation occurs adjacent to roads to different degrees due to increased noise, increased pollution (i.e., air pollution, litter, dust) and erosion and sedimentation. Most roads on the Black Hills National Forest are very low traffic volume; 24 percent are closed (ML 1), 62 percent are high clearance with slow moving traffic, and 14 percent are gravel with relatively slow moving traffic. Off-highway vehicles such as ATV's and dirt bikes, which are often louder than other types of vehicles, are most common on ML 2 roads.

An attempt was made to estimate the potential relative risks that roads present to wildlife by road. A detailed discussion of the analysis is in Section 5.2.1. and the results are in a spreadsheet in Appendix B and on Maps 26 thru 31. The analysis included road densities, riparian areas, meadows, and important species for which GIS data was available such as goshawks, snails, American dippers, bats, and martens. This analysis is not all encompassing because it does not include a majority of the species in the Black Hills and the risk rankings could only be set at relative values, as methods of assigning absolute risk were not apparent. These results do indicate that the relative risk from roads for these categories is highest in parts of the northern and central hills.

Roads increase human access into wildlife habitats. Human presence becomes more frequent and far-reaching. Some animals are sensitive to human activity, and habitat that is otherwise suitable may be avoided, used less frequently, or require more energy when humans are present. This is similar to habitat fragmentation discussed earlier. Some animals become accustomed to human presence, and appear unaffected by human activity. This is called habituation.

Habituation is most likely to occur along roads with frequent traffic, especially when vehicles do not slow down, stop, or drop off pedestrians. Major highways and ML 4 and 5 roads fit this category best. Management Level 2 roads present difficult conditions for habituation to occur, because traffic is usually infrequent and unpredictable. The period in which ML 2 roads are used most frequently include the hunting season. For obvious reasons, habituation is not likely to occur at this time. Habituation is not particularly important along ML 1 roads, since these roads are rarely if ever used. Exceptions to this are when frequent closure violations occur.

Non-habituated animals occurring along roads usually flee the area when traffic or other human presence occurs. The long-term effects of this are difficult to measure, because mortality does not instantly occur. However, the increased energy expenditure and potential future avoidance of the area may have an impact on survival or reproduction. This is particularly relevant when habitat quality is low and distance to better habitat is far (Gill et al. 2001).

4.3.2 Affects of Human Activities

Human activities that affect wildlife habitat include management of public lands by Forest Service personnel and their cooperators: commodity production (i.e., livestock, timber, and

mining); off-road vehicle travel; trail use; camping; and hunting and fishing. Wildlife forage, nesting and thermal cover habitat are affected by these activities to varying degrees, depending on the intensity and frequency of use. Commodity production such as tree harvest, forage use, and mining activity have the potential to cause the most influential impacts to wildlife habitat and plant communities due to the extent of these activities on the Forest; and (in the case of logging and mining) ground-disturbing activities, noise, and habitat alteration. Note that logging and livestock use can benefit habitats of some wildlife species.

Off-road vehicle travel on undesignated routes is facilitated from existing roads on gentler terrain. It is estimated that there are approximately 3,550 miles of wheel-track roads most of which have been formed by Forest users driving cross-country (see Section 2.2.3). Off-road vehicle travel affects wildlife habitat through the loss and trampling of vegetation, spread of noxious weeds, soil compaction, increased erosion, and contributing sediment to surface water. Impacts to wildlife habitat within can have either short-term or long-term effects.

Trail use, camping, and hunting and fishing can affect habitat in the same ways as those described for off-road vehicular use. In addition, due to the increased presence of humans in an area, these activities can affect wildlife distribution and use of habitat located near popular trails, fishing areas, and campsites. Hunting, especially in the fall, can influence the movement and distribution of game species, such as elk and deer.

Roads also increase access to private lands, and may promote subdivision development. Increased subdivision development results in habitat loss and increased human presence. Many of the private lands in the Black Hills are in meadows and riparian areas, which are especially important wildlife habitats.

4.3.3 Direct and Indirect Affects on Species

The road system facilitates access to the Forest by humans. Vehicular travel accounted for 1.7 million recreation site visitor days on the Forest in 2004 and was the most popular recreation activity (USDA-Forest Service 2004a). These conditions can lead to higher incidence of vehicle-animal collisions.

In 2002, approximately 45,800 recreation visitor days were estimated for hunting on the Black Hills National Forest (USDA-Forest Service 2004a). As shown in Table 4-1, the number of hunting licenses sold for the South Dakota portion of the Black Hills has increased substantially over the past decade. The most popular Black Hills hunts are for turkeys in the spring and deer in the fall. Wyoming patterns are similar (see Leonard 2004a, 2004b).

Table 4-1. Annual Number of South Dakota Hunting Licenses Sold for Black Hills Hunts, 1997– 2005*

Year	Spring Turkey	Fall Turkey	Elk	Deer
1997	2,574	No data	805	11,824
1998	3,475	No data	752	7,985
1999	3,552	675	1,019	7,849
2000	3,374	628	1,083	7,921

2001	3,998	No season	1,124	6,707
2002	4,761	325	1,229	6,454
2003	5,053	432	1,579	6,438
2004	5,798	750	1,798	7,346
2005	6,397	1,395	2,670	7,814

*Primarily rifle hunts

Source: Huxoll 2004, Huxoll 2006.

Poaching on the Forest is known to occur and is facilitated by improved roads (Sandrini 2005). The majority of poaching violations in the Bearlodge Ranger District in Wyoming are for deer. They typically involve shooting from a public roadway or shooting from inside a vehicle (Sandrini 2005). Mr. Sandrini also reported that poaching violations also occur due to hunters utilizing closed Forest System roads to access private land, such as in the northern portion of the Bearlodge Ranger District (north of Highway 24), in the vicinity of the community of Mosskee, and in the Black Buttes (Sandrini 2005). Turkey and elk are also poached in the Bearlodge District, but to a much lesser extent than deer (Sandrini 2005). Areas in the Bearlodge Ranger District where numerous deer poaching violations have been documented are Blacktail Junction (junction of FR 849 and FR 838), Sand Creek Road (FR 863) just south of the Ranch A boundary and near Thompson Gulch. Spring turkey poaching is also known to occur in these areas as well as around Cook Lake (FR 842) (Sandrini 2005).

Hunting directly effects the populations of the animals involved and is considered the most important method of managing populations of deer, elk and turkeys on the Black Hills. As a result, maintaining a road system that allows efficient access to forest for hunting is an important factor in managing game species of all types. Examples of indirect effects could be a change in game species distribution, increased disturbance (e.g., noise, human presence) to non game wildlife species, and increased disturbance to habitats.

In South Dakota, deer comprise the majority of road kill. Other species such as elk, mountain lion, big horn sheep, turkey, red squirrels and American marten are also killed by motor vehicles. Road kill numbers are generally higher on paved roads than on gravel roads.

Snags (dead standing trees) are special habitat features that provide shelter and foraging substrates for many species of wildlife. Snag harvest on the Forest is not allowed unless snags are plentiful and Forest Plan snag objectives are exceeded in a project area. However, illegal snag harvesting for fuelwood can be a problem, especially where infrequently-used roads (e.g., ML 1 and 2) provide undetected access to snags. Illegal snag harvest has been documented on the Forest, and may result in a loss of nests, roosts and foraging habitat for snag-associated wildlife.

Old growth forests, riparian habitats, meadows, and designated Botanical Areas and Research Natural Areas are some of the unique communities that may be affected by routes and cross-country travel areas. Each of these is discussed below.

As their name implies, old growth habitats require long periods of time to develop, and are not

easily rehabilitated once structural changes occur. They provide essential habitat for many wildlife and plant species. Routes through old growth habitats may create edges if the routes are wide enough to create a gap through closed canopies. Motorized use may introduce a source of disturbance not typically found in this relatively stable environment. Roads through old growth may also facilitate commercial logging, which typically removes key old growth characteristics.

Riparian and meadow habitats are limited in extent but very important to wildlife. Both habitats are typically narrow, making them and their resident wildlife vulnerable to changes. Riparian areas are botanically very diverse, which attracts a corresponding array of wildlife for feeding, reproduction, and shelter. Riparian areas also provide important travel corridors for wildlife moving long distances between other habitats. Meadows provide an abundance of grass for many species of wildlife to feed on, but they often lack hiding cover. Roads and associated human activities in these two important habitats may negatively affect wildlife in the same ways described in the questions above. However, given their small extent and disproportionate use by wildlife, the effects are magnified compared to most other habitats.

4.4 ECOSYSTEM FUNCTIONS

The Black Hills is a relatively well roaded forest. The major unroaded areas are the three areas listed as inventoried roadless areas: Inyan Kara, Sand Creek, an Beaver Park. The ecological attributes of those areas were discussed earlier in this report in Section 2.6.

Interstate road travel may cause future problems with non-native insects on the Forest. Though not currently an issue on the Forest, the gypsy moth has been inadvertently introduced into the Black Hills on numerous occasions since the late 1980s. However, it is not known to have established a breeding population (USDA-Forest Service 1996a, USDA-FS 2004b). Due to the increasing mobility of people and the interstate transport of nursery stock, the likelihood of the gypsy moth becoming established in the Black Hills has increased in the last decade (USDA-Forest Service 1996a).

The degree in which the presence, type, and location of roads contribute to the control of insects, diseases and parasites is most applicable at the local level during project analysis. Maintenance Level 3, 4, and 5 roads are the main access routes to ML 1 and 2 roads, which provide the majority of access to areas of suitable timber. Road access facilitates direct and indirect management and control of insects, diseases and parasites by providing access for crews and equipment to the affected sites. In general, the higher the road density, the more area that is able to be treated. Conversely, the presence of roads can induce stress in vegetation in proximity to a road, which can lead to a higher incidence of insect and parasite infestation (USDA-Forest Service 1996a).

The Black Hills is a well roaded area as described in Section 2 of this report and shown on Maps 1 thru 6. The number, length, maintenance level, and spacing of roads make them well suited for facilitating the control insects, diseases, and parasites.

The types of natural disturbances that have had the most pronounced affect on the Forest include wildland fire, drought, wind, and insects (including the mountain pine beetle and the pine engraver beetle). Of these disturbance types, wildland fire has likely had the most profound

effect on native plant communities and wildlife habitats in the Forest. Roads provide an important management tool in fire management and control, both as fire and fuel breaks and in providing rapid deployment to the burning area, thereby facilitating the initial attack and fire suppression efforts.

Maintenance Level 1, 2, 3, 4, and 5 roads can exacerbate or alleviate local drought conditions by rerouting water flows and by preventing/limiting infiltration of precipitation into the soil. These types of effects occur on the local scale and are beyond the Forest-scale level of analysis covered in this document.

Wind damage can occur anywhere in the Forest if the appropriate conditions exist. However, roads generally increase the amount of forest edge, which can increase the susceptibility of forested areas to wind damage (i.e., windbreak, windthrow) (Kimmins 1987). The specific interactions between a road edge and wind is dependent on-site specific conditions, including the site's topography, aspect, orientation of the road relative to prevailing winds, and type of forest stand (open or dense).

4.5 BOTANY

4.5.1 Affects on Habitat

Roads generally have a negative effect on native plant communities and native plant species of concern (R2 sensitive and BHNF Species of Local Concern (SOLC)). The most direct impact is loss of plant communities and plant occurrences. Unlike wildlife, plants are not able to move to avoid construction or use of a road or trail. Indirect impacts of roads to plant species and plant communities include increased introduction of invasive species leading to increased competition for resources; alteration of hydrology patterns; alteration of habitat condition (such as decrease in canopy cover or change in successional stage); increased access for disturbance vectors (including humans and livestock) which lead to increased disturbances such as trampling, cropping, and collecting; disruption of pollinators; and increased dust (causes increased sediment; also plugs stomata (gas exchange structures) on plant leaves). In some cases, there can be an increase in plant numbers found adjacent to roads and trails from a nearby occurrence, mainly due to increased water availability from concentrated runoff. However, the road-edge habitat is not composed of native species and this and other impacts from the road generally do not support long-term success of these populations.

An attempt was made to estimate the potential relative risks that roads present to R2 sensitive and BHNF SOLC plant species by roads and trails by using a GIS layer of all known plant occurrences and areas of suitable habitat. A detailed discussion of the analysis and the results are in Section 5.2.1. and in Appendix A. The analysis included evaluation of the risk of roads to plant occurrences/habitat and risk from proximity of roads to plant occurrences/habitat - using GIS data available for all thirteen R2 sensitive plant species and all ten BHNF SOLC. The analysis also included evaluation of risk to the eight M.A. 3.1 Botanical Areas; evaluation of risk to riparian habitat (not all riparian areas have been surveyed botanically and they have likelihood to harbor the many R2 sensitive plant and BHNF SOLC occurrences that are associated with riparian areas); and evaluation of risk to Black Hills Montane Grasslands (rare plant community) identified by survey in 2000.

4.5.2 Affects of Human Activities

Human activities that affect plant communities that support R2 sensitive plant species and BHNF SOLC include management of public lands by Forest Service personnel and their cooperators: commodity production (i.e., livestock, timber, and mining); off-road vehicle travel; trail use; camping; and hunting and fishing. Plant communities are affected by these activities to varying degrees, depending on the intensity and frequency of use. Commodity production such as tree harvest, forage use, and mining activity have the potential to cause the most influential impacts to plant communities due to the extent of these activities on the Forest; and (in the case of logging and mining) ground-disturbing activities, noise, and habitat alteration. Some R2 sensitive and BHNF SOLC plant species benefit from low levels of some disturbance types.

Off-road vehicle travel on undesignated routes is facilitated from existing roads on gentler terrain. It is estimated that there are approximately 3,550 miles of inventoried wheel-track roads most of which have been formed by Forest users driving cross-country (see section 2.2.3). It is possible that there is an additional 2,000 miles of such road or routes that have not been inventoried. Off-road vehicle travel affects plant species and communities through the loss and trampling of vegetation, spread of noxious weeds, soil compaction, increased erosion, and contributing sediment to surface water. Impacts to plant communities and the R2 sensitive and BHNF SOLC plant species within can have either short-term or long-term effects.

4.5.3 Affects on Riparian Vegetation

The movement of plant propagules and seeds can also be affected by barriers constructed on streams (culverts, etc.). Populations of some riparian species [such as R2 sensitive species *Carex alopecoidea* (foxtail sedge)] can extend along stream reaches one or two miles in length (or longer) in the Black Hills. Population dynamics include movement of seeds by stream water as well as movement of asexual propagules (e.g. rhizome material) which establish individuals that can then interact sexually with other individuals (Moore et al. 2006).

Mitigation to re-establish aquatic connections at migration barriers would involve either re-setting a culvert below the current grade and with the orientation of the stream, or replacing the culvert with a bridge, bottomless culvert, or hardened low-water ford.

The road network may alter, remove, or impede normal growth of riparian vegetation – including herbaceous, shrub, and tree vegetation. This can cause changes in riparian plant communities or alter the successional stages/pathways of riparian plant communities. While direct impacts of sediment impact from roads are one affect to riparian plant communities, changes to riparian plant communities can also be caused directly by changes in hydrology patterns and increased introduction of weed seeds/propagules,. Changes to riparian plant communities may also be caused indirectly by roads facilitating increased entry by humans into riparian areas leading to collection or trampling of plants and introduction of invasive plant species. Roads and trails can also facilitate increased entry of livestock into riparian areas, leading to trampling, grazing, and introduction of invasive plant species.

The road network may remove or impede the growth of overstory vegetation adjacent to stream channels that would provide shade. Riparian plant communities may be removed where roads

cross streams or encroach on riparian areas. An analysis was conducted to estimate the potential risk of roads to riparian areas in the Forest using the potential for sediment being transported into and affecting the riparian habitat, road mortality of riparian area inhabitants, riparian habitat fragmentation and the risk of resource damage from OHV access. A buffer width of 400 feet from a riparian area was used as a long term, worst case buffer based on Forest Plan Guideline 9204 which states that if topography allows, roads should not be constructed within 400 feet of a meadow. The risks were rated by ML 1 and 2 roads and all unauthorized roads and user routes. The analysis is discussed Section 5.2.1. and the results are presented on the spreadsheet in Appendix B and on Map 18.

There are a number of R2 sensitive and BHNF SOLC plant species found in riparian and floodplain habitat. These species include: foxtail sedge (*Carex alopecoidea*), leathery grapefern (*Botrychium multifidum*), yellow lady's slipper (*Cypripedium parviflorum*), northern gentian (*Gentiana affinis*), broadlipped twayblade (*Listera convallarioides*), arrowleaf sweet coltsfoot (*Petasites sagittatus*), autumn willow (*Salix serissima*), hoary willow (*Salix candida*), shining willow (*Salix lucida* spp.*caudata*), bloodroot (*Sanguinaria canadensis*), and American cranberry bush (*Viburnum opulus* var. *americanum*). Several of these species have been impacted by collection in other parts of the country (most notably yellow lady's slipper and bloodroot.) The plant monitoring program on the Forest has not documented any collection pressure for these species to the current time, but collection/poaching remains a risk. Increased travel on an increasing density of roads and trails on the Forest leads to increased opportunity for people to access R2 sensitive and BHNF SOLC plant occurrences.

The road system can contribute to loss of occurrences of plant species of concern where roads directly impact stream channels and associated riparian vegetation; where hydrology patterns (including water and sediment flow) are changed by roads; where roads restrict seed/propagule movement; and where roads allow increased access by people (leading to effects such as trampling, collecting, and increased introduction of invasive plant species (including noxious weeds). New roads and trails can also increase access to riparian areas by livestock (leading to effects including trampling, grazing, and increased introduction of invasive species (including noxious weeds).

Roads and trails facilitate access to riparian plant communities on the Forest by humans and other vectors such as livestock. These vectors transport seeds and propagules of invasive plant species (both native and non-native, including noxious weeds) into riparian areas that alter species composition, cause greater competition with native plant species for resources, and lower condition of native riparian plant communities.

Based on occurrences documented in the Forest plant database, there are approximately 150 recently visited (2000-2006) locations of R2 sensitive and BHNF SOLC plant species in riparian areas across the Black Hills. The vast majority of these occurrences are found in multiple use areas spread across the forest (with larger number in the northern Black Hills than southern due to the larger number of riparian areas in the northern vs. southern Black Hills). A few areas have been recognized for the plant communities and plant species they contain through designation as M.A. 3.1 Botanical Areas. Of the eight M.A. Botanical Areas, all eight include riparian areas (Bear/Beaver Gulches, Black Fox, Dugout Gulch, Englewood Springs, Higgins Gulch, McIntosh Fen, North Fork Castle Creek, Upper Sand Creek). Three of the four Research Natural Areas

(M.A. 2.2) on the Forest include or are adjacent to riparian areas (Canyon City, Hay Creek, and North Fork Castle Creek). Spearfish Canyon and Botany Canyon are two additional notable riparian areas on the Forest that harbor high quality riparian plant communities and significant R2 sensitive and BHNF SOLC plant occurrences.

4.5.4 Affects on Unique Communities

A number of unique or high quality plant communities found in the Forest are managed under Management Area (MA) 3.1 – Botanical Areas. The number of miles for ML 1, 2, 3, 4, and 5 roads found in Botanical Areas are 31.4, 39.7, 2.7, .1, and 0 miles, respectively; for a total of approximately 75 miles. The specific number of road miles found within each of the eight botanical areas is provided in Table 4-2.

Table 4-2. Number of Road Miles in Each Botanical Area

Botanical Area	Road Miles	Road Maintenance Level	Unauthorized Route Miles
Bear/Beaver Gulches	27.6	1, 2	5.5
Black Fox Valley	3.64	1, 2, 3	6.9
Dugout Gulch	9.16	1, 2	1.4
Englewood Springs	5.98	1, 2	1.3
Higgins Gulch	7.10	1, 2, 3	.8
McIntosh Fen	9.78	1, 2, 4	4.5
North Fork Castle Creek	2.72	1, 2	1.7
Upper Sand Creek	9.13	1, 2	13.2

Roads in the botanical areas facilitate recreational use of these areas, and so could be expected to increase the likelihood of noxious weed establishment in these areas. Due to the facilitated access provided by the ML 3 and 4 roads in the Black Fox Valley, Higgins Gulch, and McIntosh Fen Botanical Areas, these Botanical Areas are likely the most susceptible to noxious weed establishment associated with roads. However, there is access by ML 1 and 2 roads to all Botanical Areas.

Maintenance Level 1 and 2 roads and non system routes were analyzed for there potential relative risk to botanical areas. The analysis description is in section 5.2.1. and the results are in the overall risk analysis in Appendix B and on Map 23. The potential relative risk to botanical areas was estimated by considering the lengths of segments within a 300 foot buffer and within the Botanical Areas.

The Black Hills Montane Grassland rare plant community type is endemic to the Black Hills (i.e. this plant association does not occur anywhere else outside the Black Hills) (Marriott et al. 1999). A survey was completed in 2000 (Marriott 2000) identifying montane grassland sites and providing condition class ranking. Putting any new roads or trails into this rare plant community type with limited known sites could lead to concerns for persistence of this community type on the Black Hills landscape.

One of the primary concerns regarding exotic organisms is the introduction and establishment of invasive, non-native plant species (including noxious weeds). Currently, there are a total of twenty-one noxious weeds species targeted for control (USDA-Forest Service 2003a). Of these twenty-one species, ten are a high priority for control on the Forest, three are considered to be of medium priority, and eight are low priority noxious weed species (USDA-Forest Service 2003a). Throughout the Forest, ML 1, 2, 3, 4, and 5 roads may facilitate the spread of noxious weeds directly through vehicular transportation of the organisms (seeds or propagules) and/or indirectly through habitat alteration/disturbance (i.e., bare soil or patchy ground cover) that favors the establishment of noxious weeds. Invasive species and noxious weeds can compete with native plant species or replace them (R2 sensitive, BHNF SOLC, and all other native plant species), thus degrading native plant communities which are the foundation for ecosystem function. Noxious weeds degrade the quality and quantity of forage available to livestock and wildlife and can adversely impact other components of habitat quality and quantity (e.g., percent cover, dominant species, species richness and diversity) and thereby degrade ecosystem function.

According to the BHNF Noxious Weed Management Plan (USDA-Forest Service 2003a), *"Consistent implementation of road construction/maintenance mitigation and control measures is needed to prevent establishment and spread of approximately 2,315 acres of weed infestation predicted to occur in the absence of elevated management over the next ten years on the Forest from scheduled road construction/maintenance activities."*

4.6 ECONOMICS

The monetary costs associated with the road system in the Black Hills are substantial to the Forest Service, the counties and the state & federal highway organizations. The estimated costs to the Forest Service to manage NFS roads to standard, for the long term, are calculated using the Forest Service Infrastructure (INFRA) database. The INFRA database summarizes annual and deferred maintenance costs and overhead. Annual maintenance costs include such things as routine road surface blading and culvert cleaning and the annualized cost of replacing signs, and road surfaces, mostly gravel. Deferred maintenance costs reflect maintenance that was not performed when it was scheduled and was delayed for a future period. These costs could include aggregate replacement, and culvert & sign replacement. The estimated costs for ML 1, 2, 3, 4, and 5 roads for annual and deferred maintenance are shown below.

Table 4-3. Annual and Deferred Maintenance Costs for System Roads on the Black Hills with Forest Service Jurisdiction

Maintenance Level	Total Miles*	Annual Maintenance Cost	Deferred Maintenance Cost
1	1,159	$372,370	$82,717
2	3,076	$3,743,535	$11,635,985
3	504	$5,916,769	$10,317,221
4	160	$1,455,367	$3,892,797
5	5	$68,294	$696,540
Total	**4,904**	**$11,556,335**	**$26,625,260**

* INFRA miles of roads and trails reflect current inventories measured on the ground and they are not cropped at the Forest boundary. They do not, therefore, coincide directly with GIS miles used in other tables.

GIS Geographic Information System

The historical resources expended to perform the reconstruction, maintenance and repair of all Forest Service roads and trails are shown in Table 4-5.

Table 4-5. Road and Trail Management Funding Sources

Funding Source	Type	FY 2003	FY 2004	FY-2005	FY 2006	2007
FS – Congressional Appropriations	Road Construction / Maintenance Fund	$3,244,000	$2,934,600	$2,324,784	$2,132,596	$3,085,900
	Trail Construction / Maintenance Fund	$270,900	$236,700	$209,700	$148,000	$174,000
Road & Trail Deposits(Timber Receipts)	10 % Fund	$400,000	$77,100	$45,000	$243,733	$211,800
	Forest Service Total	**$4,033,400**	**$3,248,400**	**$2,579,484**	**$2,524,329**	**$3,645,000**
Timber Sale (TS) Purchasers Direct	TS Road Reconstruction	$496,265	$839,280	$182,560	$413,308	*
	TS Road Maintenance	$67,200	$55,055	$72,124	$115,884	*
	Maintenance Deposits	$4,928	$6,111	$8,068	$0	*
	Surface Rock Replacement	$120,169	$75,491	$89,464	$42,175	*
	Reconstruction Deposits	$201,358	$100,834	$141,372	$95,682	*
	Timber Purchasers Total	**$889,920**	**$1,076,771**	**$493,588**	**$667,049**	*
Total Funding		**$4,923,320**	**$4,325,171**	**$3,073,072**	**$3,191,378**	*

*These figures not currently available.

The congressional forest budget appropriation for planning, construction, capital improvement, and maintenance of forest roads and trails on the Black Hills had been decreasing noticeably until FY 07. The road funding decreased from 3.2 million dollars in 2003 to 2.1 million in 2006, a 34 percent decrease. The Final allocation for FY 07 for road maintenance reflected a temporary increased recovering to near FY 03 levels not counting inflation. Current information indicates that these funds can be expected to remain in the 2.0 to 2.5 million dollar range in the near future. Trail funding followed a similar trend but did not recover substantially. Future allocations are expected to remain in the FY 07 range in the near term.

Road and Trail Deposits (10% Fund) are 10 percent of Black Hills National Forest Timber receipts that are returned to the Forest Service. The amount of this fund that is available for road and trail maintenance varies directly with the amount of timber sold and with internal Forest allocation priorities. Yearly fluctuations in this fund are not expected to have a significant long term impact on overall road and trail maintenance budgets.

Capital improvement funds acquired to conduct trail and road improvement work necessary to bring the system up to the desired objective have been sporadic and minimal in past years. However, the Forest has benefited from a regional bridge program which has funded eleven bridge replacements in the last seven years.

A portion of the road maintenance on Forest roads is performed by timber purchasers and fuels treatment contractors on roads where timber products are being transported. The cost of road maintenance work performed by the purchasers is shown in Table 4-5. The level of expenditure

is linked to the volume of timber, number of sales, and the miles of road needed to remove the timber from the Forest. Timber sale impact road maintenance is funded by the purchasers in two ways. The first is road maintenance work performed by the purchasers directly. The second is payments for maintenance and surface rock replacement that are made to the Forest Service who then contracts or performs the work. In addition, timber sale receipts are used for road reconstruction deposits which fund engineering services necessary to design the reconstruction elements of the timber sale road specifications. These road reconstruction funds are collected based on the actual cost to the Forest Service for these services.

The Forest encompasses 418 miles of county roads. These roads are integral to the Forest transportation system. In some cases, the Forest Service and the counties have jurisdiction over different sections of the same road. The counties receive payments from the Forest Service that can be used to support these roads under two programs, Payment in Lieu of Taxes (PILT) and 25% funds. The PILT funds are based on the acres of Forest Land in the county and are intended to help compensate for the loss of taxable base. The expenditure of PILT funds is at the discretion of the counties. In 2006, the counties with boundaries within the Forest received PILT funs of $1,394,606. The 25% funds are that portion of receipts the Forest Service receives each year primarily from the sale of timber. The 25% Fund Act provided for 25% of actual receipts to be paid to the counties. The Secure Rural Schools and Community Self-Determination Act of 2000 provided the option for counties to receive the average of the three highest 25% payments made annually from 1986 to 1999. All counties within the Black Hills elected to receive payments by this leveled method. Therefore, the impact of fluctuating timber receipts is minimized. The use of these funds is limited to roads and schools. In 2006, the counties received $4,318,198 which is a figure that has been adjusted for inflation since 2001.

The overall level of federal funding and timber purchaser expenditures is not sufficient to perform the short and long term maintenance needs identified for NFS roads in general. The annual road maintenance funding is approximately 25 percent of what is needed based on the INFRA Database. The deferred maintenance funds are less than 5 percent. The federal portion of that funding cannot be expected to increase significantly. As a result, without new resources, the long term condition of NFS roads is expected to deteriorate. The increased use of ML 2 roads subsequent to the implementation of the Rule could put increased pressure on limited maintenance resources.

This analysis considers ML 1 and 2 roads. Most of these roads were developed over the years for a variety of access needs, and considerable capital investments were incurred to construct and maintain these roads. They are a very significant part of the Forest transportation system. They comprise 85 percent of the total miles and receive approximately 25 percent of the total maintenance funds. A Road Value versus Risk matrix was developed for existing ML 1 and 2 system roads to determine where possibilities might exist to change the road system to reduce risk, reduce costs or modify motorized transportation opportunities. The detailed analysis can be found in Section 5.2.1. The maps and data can be found in Appendix A and B. The results of the risk/value analysis are presented in Section 5.3 – Road System Management Options – Setting Priorities.

The current trail system on the Forest is made up of 35 trails for a total of 323 miles. Fourteen miles of the Centennial Trail are designated as motorized. The section of motorized trail is

heavily traveled resulting in significant maintenance costs every one or two years. A one mile reconstruction contract in 2006 cost $17,000. The condition of the trails varies widely depending on the type of trail (Forest, National, Wilderness, Motorized, etc.), the volume of use, the terrain, and the type of soil. Current maintenance funds are not sufficient to maintain the trail system to standard. An increase in the number of miles of motorized trail would not be environmentally sustainable in the long term without an appropriate increase in the trail construction and maintenance resources.

4.7 COMMODITY PRODUCTION

4.7.1 Timber Management

Maintenance Level 1 and 2 roads provide the majority of access to areas of suitable timber. Overall road density of system roads throughout the Forest is 2.19 miles/square mile. This density generally provides adequate access to suitable timber areas for management and treatment activities.

The affect of road spacing and location on logging system feasibility is an important consideration when determining timber suitability, management area allocations, and economic efficiency.

The Black Hills region is home to a modern, efficient wood-product industry. Approximately two-thirds of the industry's needs are supplied by the Black Hills National Forest, with the remainder being supplied from private lands, State lands, or other National Forests (USDA-Forest Service 1996a). During the past century, virtually all suitably operative forest acres have been entered for harvest at least once (USDA-Forest Service 1996a). This translates into approximately five billion board feet that have been harvested since the completion of the first Federal timber sale (called Case No. 1) in 1899 on the Black Hills Forest Reserve (now the Black Hills National Forest) (USDA-Forest Service 2004a).

In general, close road spacing (i.e., higher road densities) results in more efficient timber production because it permits more rapid turn-around times and higher production that reduces yarding cost and increases stumpage value. Closer road spacing can increase the total cost for road building due to a higher number of road miles. This can be reduced with the use of temporary roads. The road system in the Black Hills has developed over the years into an efficient transportation system for all uses including timber management. The basic grid of ML 3, 4, and 5 (arterials and collectors) is well spaced to access most general areas of the Forest. From this basic system, there is another well spaced grid of ML 1 and 2 roads that reach areas in between. The number of ML 1 and 2 roads fluctuates yearly based on their need and risk. Most timber sales result in closing and/or decommissioning some roads after the timber is removed for resource protection or if they are no longer needed. Some sales also result in the construction of new ML 2 roads to areas that could not be treated efficiently with the existing system. They are usually short roads and few in number.

As shown in Table 4-5, the road densities of Forest Service roads found in the four resource production management areas on the Forest are higher than the mean road density found on the Forest. In keeping with its management objective, Management Area 5.43, Big Game Winter

Range Emphasis has a low road density for these road types in the winter however the density is still above the winter objective of 1 mile per square mile.

Table 4-6. Road Densities Found in Resource Production Management Areas

National Forest Service System Roads that are under Forest Service Jurisdiction	Maintenance Level 1, 2, 3, 4, and 5 Roads	
	Amount of Roads (miles)	Density (miles/square mile)
Forest-Wide Mean Road Density Forest Service System Roads	4,884	2.04
Management Area		
4.1 - Limited Motorized Use and Forest Product Emphasis	160	2.31
5.1 - Resource Production Emphasis	1,835	2.08
5.4 – Big Game Winter Range Emphasis	1,537	2.52 1.27 in Winter
5.43 - Big Game and Resource Production	40	2.5
5.6 - Forest Products, Recreation, and Big Game Emphasis	161	3.03

4.7.2 Minerals Management

Mineral resources on National Forest System lands are managed in three categories: locatable, leasable, and saleable minerals. The public has different rights to access an area dependant on the category of mineral being developed.

The Forest Service does not manage the mineral resources on NFS lands. That authority resides with the Secretary of the Interior. Forest Service authority is directed at the use of the surface of NFS lands, including the development of roads in connection to the operations authorized under the United States mining laws (30 U.S.C. 21-54).

Locatable minerals are those deposits subject to location and development under the General Mining Law of 1872 (as amended). An individual or a company may locate a mining claim, and thus establish a property right to minerals on that claim, and the right to reasonable access to that claim. With the exception of public lands withdrawn from mineral entry (Forest land purchased as acquired land rather than public domain), the Forest is open under the general mining laws. Locatable minerals important to the history and economy of the Black Hills include gold, silver, iron, feldspar, uranium, tin and mica.

Leasable minerals are federally owned fossil fuels (e.g., oil, gas, coal, and oil shale), geothermal resources, sulfur, and phosphates. These minerals are subject to exploration and development under leases, permits, or licenses issued by the Secretary of the Interior with Forest Service consent. The 1920 Mineral Leasing Act (as amended) together with the 1989 Federal Onshore

Oil and Gas Leasing Reform Act provide the authority and management direction for Federal leasable minerals on NFS lands. Road construction to locate drill pads and for access by service vehicles is a common activity in an oil or gas field.

Currently there is no leasable minerals activity on the Black Hills National Forest.

Salable minerals include mineral materials such as deposits of sand, gravel, clay, rock, or stone. There are a number of mineral material sales on the Black Hills every year, with access generally provided by the existing Forest road system. The Forest Service also develops quarries to provide crushed stone for Forest Service and public roads projects, which require access by the Forest Service road system.

Mining in national forests is governed by the General Mining Law of 1872 and subsequent amendments ("General Mining Law"). These laws confer a statutory right upon citizens to enter certain public lands for the purpose of prospecting. Pursuant to the General Mining Law, *"Except as otherwise provided, all valuable mineral deposits in lands belonging to the United States . . . shall be free and open to exploration and purchase."* The application of the General Mining Law to national forests was specifically affirmed by Congress in the Organic Act, 16 U.S.C. §§ 478, which makes the national forests *"subject to entry under the existing mining law of the United States and the rules and regulations applying thereto."* The Organic Act allows the Secretary of Agriculture to make rules regulating the *"occupancy and use [of national forest land] and to preserve the forests thereon from destruction."* 16 U.S.C. § 551. However, the Organic Act also expressly states that it *"shall [not] be construed as prohibiting . . . any person from entering upon such national forests for all proper and lawful purposes, including that of prospecting, locating, and developing the mineral resources thereof."* 16 U.S.C. § 478.

In response, the Forest Service stated that it *"recognized that prospectors and miners have a statutory right, not mere privilege, under the 1872 mining law and the Act of June 4, 1897, to go upon and use the open public domain lands of the National Forest System for the purposes of mineral exploration, development and production."* 39 Fed. Reg. 31317. The Forest Service also acknowledged that *"exercise of that right may not be unreasonably restricted."*

The current regulations governing access to National Forest system lands for the purposes of mining are now set forth at 36 CFR. Part 228, subpart A.

Forest Service policy is stated in Forest Service Manual (FSM) 2800: *"The availability of mineral and energy resources within the national forests and grasslands significantly affects the development, economic growth, and defense of the Nation. The mission of the Forest Service in minerals management is to encourage, facilitate, and administer the orderly exploration, development, and production of mineral and energy resources on National Forest System lands to help meet the present and future needs of the Nation."*

Forest Service policy regarding access to NFS lands is further clarified in FSM 2813.4: *"The right of reasonable access for purposes of prospecting, locating, and mining is provided by statute. Such access must be in accordance with the rules and regulations of the Forest Service. However, the rules and regulations may not be applied so as to prevent lawful mineral activities or to cause undue hardship on bona fide prospectors and miners."*

4.7.3 Range Management

Maintenance Level 3, 4, and 5 roads in the Forest facilitate the management of range allotments by BHNF range management specialists and facilitate access by allotment permittees. Maintenance Level 1 and 2 roads provide the majority of access to allotments and also facilitate access and management activities. The affect of roads on rangeland health is generally thought to be detrimental due to an increased likelihood for noxious weed introduction and potential erosion.

Roads of all jurisdictions in the Black Hills frequently cross range allotment fences resulting in cattleguard and or gate installations depending on the location of the road. Funding to manage cattleguards is currently being provided from range and road program funds and permittees as the situation and funding levels allow. Declining budgets will make adequate levels of maintenance and repair of these features difficult. Gates left open are an issue on ML 1 and 2 roads. The severity of the problem is related to the road's proximity to population centers and the area's popularity for dispersed recreation and hunting.

The value of ML 1 and 2 roads for range management access was included in the risk/value analysis in Section 5. The analysis description is located in Section 5.2.1. and the results are presented in Appendix B and on Map 17.

4.7.4 Water Projects

The existing road system is sufficient to access existing water diversions, impoundments, and distribution canals and pipes. The larger structures tend to be accessible by ML 3, 4, and 5 roads. These roads, in turn, provide connectivity to local roads required for some maintenance activities.

Since 1917, Homestake Mining Company has diverted stream flows from Little Spearfish Creek and Spearfish Creek into pipelines for hydroelectric power generation at the facility. Power lines, water transmission conduits and aqueducts all cross Forest Service lands. Homestake Mine/Barrick has recently shut down and reclaimed one of the power plants and sold the other to the city of Spearfish. Access to the area has been sufficient in the past and is not expected to be an issue in the future.

4.7.5 Special Products

The current road system provides adequate access to the Forest for collecting special forest products. Accessibility for special forest product collection may be considered in project specific analysis for road closures (permanent or seasonal).

4.7.6 Special Use Permits

Special use authorizations and road easements are required for all instances of commercial uses of the Forest road system, including utility corridors, power lines, pipelines, water transmission lines, minerals, range use, and water production sites. Road systems located on National Forest System (NFS) lands directly influence the management of all special use authorizations to

access, construct, and maintain privately owned lands and facilities within or adjacent to the Black Hills National Forest proclamation boundary.

According to the 2004 data representing special uses from the USFS SUDS INFRA database, there are currently 762 special use authorizations issued on the Black Hills National Forest. Table 4-6 provides a breakdown of these authorizations for non-federal use of NFS lands:

Table 4-7 Breakdown of Special Use Authorizations

Special Use Type	Number of authorizations
Communication Sites	**7**
Concession Recreation Permits	**1**
Marinas	**2**
Organization Camps	**2**
Outfitter Guide Permits	**43**
Road Easements / Permits	**320**
Recreation Residences	**164**
Other (utilities, water lines, misc.)	**198**
TOTAL AUTHORIZATIONS	762

There are currently several utility corridors crossing portions of the Black Hills National Forest in both Wyoming and South Dakota. The NFS roads provide the majority of the access required for power line maintenance. Together, the county and NFS roads (all maintenance levels and jurisdictions) provide sufficient access to utility corridors throughout the Forest.

Special use authorizations or other formal written instruments (easements) are required for private land owners that have need for use of NFS roads and use of NFS land for private roads to provide access to their property. Despite this requirement, there are numerous private land inholdings (private lands surrounded by NFS lands) scattered throughout the Forest that do not have documented access or easements across NFS lands. While use of open NFS roads is allowed, any additional road work needed to provide and maintain year-round access to private lands would require a permit for the individuals to do this work. Many landowners find they need an easement when transferring property or establishing title. There have not been any instances of the Forest Service taking action against any adjacent or intermingled landowners using the NFS roads.

There is a commercial traffic restriction on NFS roads. This results in a permit being required for commercial use of the system. The Forest Service enforces this restriction whenever possible.

Outfitter guide use on the Forest is authorized for a variety of activities including hunting, fishing, trail riding, rock climbing, and snowmobiling. The road system is used to disperse these varied uses throughout the Forest. In general, most recreation special use proposals and authorizations are designed around the existing road system as guides are often attracted to the easy access provided to the Forest.

4.8 GENERAL PUBLIC TRANSPORTATION

Most access points into the Black Hills National Forest originate from the twelve Forest Highways that traverse into or through the Forest. These highways provide connectivity to the NFS roads, which, in turn, connect numerous public roads managed and operated by federal, state, county and local governments. Many of the ML 3, 4, and 5 system roads on the Forest serve as the primary through routes that connect communities and allow local residents, tourists, and industries access to the Forest. These roads connect to arterial, collector, and some local roads where traffic is dispersed into the Forest for a variety of uses.

A number of communities are directly served by Forest roads as are a large number of private land inholdings. Table 4-7 lists several of the key communities within the Forest and the primary routes of access into those communities.

Table 4-8. Primary Public and Forest System Access to Larger Communities within the Forest

Community, Town, or City	Public Roads	National Forest System Roads
Deadwood/Lead	US 385 US 85 Forest Highway 17	False Bottom Mt. Roosevelt
Hill City	US 385 US 16 Forest Highway 17	Rochford Rd
Keystone	US 16A SD 40	
Custer	US 16A SD 89 US 385	Sidney Park Hazelrodt Cutoff Lower French Creek Marble Quarry Iron Creek Pleasant Valley Stagg
Pringle	US 385 SD 89	Carroll Creek South Rifle Pit Beaver Creek

Source: BHNF GIS Roads Coverage

These roads and others on the Forest are important to and are used by numerous smaller communities in and around the Forest as well. Many people in these smaller communities rely on access to the Forest for their livelihood as well as for recreation.

The Black Hills area is widely intermingled between developed areas, Forest administrated lands, towns, and national and state park system lands. There are a number of private and other inholdings dispersed within the Forest. The amount and dispersion of these lands as well as their development vary across the forest. Most of these lands are accessed by arterial and collector roads (ML 3, 4, and 5). Additional access needs to inholdings are addressed on an individual basis as requests are received. Forest Service policy dictates that access is to be provided to a level that is reasonable and suitable for the uses occurring on the land. When landowners desire access, they must apply for a special use or road use permit if new construction or reconstruction is needed. The application is analyzed through the National Environmental Policy Act (NEPA) process to determine possible environmental effects and the level of reasonable access required. If access is provided by a public road agency such as the County or State, the Forest Service may not be obligated to provide any additional access over NFS lands. Furthermore, when larger developments or subdivisions are built and inholding traffic is expected to exceed that generated by the users of the National Forest, agency policy is to pursue transferring jurisdiction of the Forest road to another public road authority such as the county or state.

Numerous roads crossing the Forest fall under the jurisdiction of agencies other than the Forest Service. When mutually beneficial and desirable, cooperative agreements can be established to share road improvement and maintenance responsibilities.

A Memorandum of Understanding (MOU) has been entered into between the Black Hills National Forest (the Rocky Mountain Region and Northern Region), the South Dakota Department of Transportation (SDDOT), and the Federal Highway Administration (FHWA-South Dakota Division [MOU – R-2 Supplement 1500-96-1]). The MOU establishes procedures for coordinating transportation activities on NFS lands within the State of South Dakota. Under the MOU, the SDDOT is responsible for the planning, location, design, construction and perpetuation of a safe and efficient public highway system needed for the benefit of the using public (R-2 supplement). The FHWA administers Federal highway funding to the states. The Forest is charged with the protection, occupancy, and multiple use management of Forest lands and resources for the use and benefit of the public and for the development of a Forest Transportation System needed to accomplish these purposes.

Since many public highways traverse Forest lands, the SDDOT needs authorization to occupy those lands for rights-of-way, waste areas, material sources, and highway construction and maintenance operations. Similarly, since elements of the Forest Transportation System and other improvements are connected or adjacent to public highways, the Forest needs approval for development and improvements, which may have an effect on highway administration. The MOU grants those authorities and establishes procedures for consultation and project activities. Formal agreements also exist between the BHNF and the counties within which the Forest is located to share operations or maintenance for those roads that are part of both the County and Forest system road network

Rights-of-way, reciprocal rights, and easements are recorded in the Forest files and county courthouse documents and are too numerous to list in this document. The Forest recognizes these rights and works with the owners to maintain access while protecting the natural resources and facilities on adjacent National Forest lands.

Maintenance Level 1 and 2 roads and unauthorized routes for which the Forest does not have a recorded easement across private property represent a potential risk for increased costs to the Forest or for possible restriction of public access. That risk was analyzed by determining which road & route segments lack easements across private land. The analysis description is located in Section 5.2.1. and results are presented in Appendix B and on Map 10.

Design, maintenance, and traffic control on ML 3, 4, and 5 roads generally emphasize user safety and economic efficiency. The largest proportion (approximately 75 percent) of road maintenance and improvement funds available to the Forest is spent on these higher standard roads. Maintenance, roadside clearing, and installation and maintenance of warning and regulatory signs are performed on an annual basis. Seasonal restrictions are imposed when necessary for the protection of resources and road users.

Maintenance funding for existing roads is inadequate to perform all necessary projects and a deferred funding backlog exists. As budget allocations continue to decrease, it is expected that road condition will deteriorate causing further safety concerns.

4.9 ADMINISTRATIVE USE

The road system on the Black Hills National Forest appears to provide adequate access for research, inventory, and monitoring.

The road system generally provides adequate access for investigative and enforcement activities. These roads provide access to developed and dispersed recreation sites where many common violations occur. These roads also provide adequate access to the many developed trailhead-parking areas. While the road system provides access to perform investigative and enforcement activities, it also provides access for increasing public use of the National Forest system lands, which can lead to increased crime and, consequently, increased enforcement activity. Known problems include unauthorized off-road travel, poaching of wildlife, illegal campfires, arson, and timber theft.

4.10 PROTECTION

Fuels management is a primary topic of concern for the Black Hills National Forest. The extensive road system provides a means to access most parts of the Forest to conduct fuels management activities. The ML 3, 4, and 5 roads provide connectivity to ML 1 and 2 roads to access more remote areas of the Forest.

The Forest recently initiated several major fuel reduction projects, and more projects are likely during the next several years in response to public concern and reduce fire hazard. The focus of much of this fuel reduction planning is the Wildland Urban Interface, particularly the issue of public safety in these areas.

Roads can also function as fuel breaks during fuel hazard reduction projects such as prescribed burning. Firewood removal helps to meet fuel reduction goals and is facilitated by the road system.

The value of ML 1 and 2 road segments for fuels management was analyzed in Section 5.2.1. The results are presented in Appendix B and on Map 39.

Air quality impacts from Forest System roads are associated with vehicle emissions and dust from traffic on unpaved roads. These effects typically are localized and temporary, and their extent depends on the moisture levels and the amount of traffic. Most of the unpaved ML 3, 4, and 5 roads in the Forest under Forest jurisdiction are located in unpopulated areas with low traffic volumes. Dust issues on ML 1 and 2 roads typically are less severe; however there are issues on some ML 2 roads and unauthorized routes that have high traffic levels. Dust abatement is a relatively expensive activity and is dependent on budget levels and priorities. Historical budgets have not been sufficient to support other than minimal suppression activities. Dust abatement activities have been required primarily when project level analysis for timber harvest identifies needs near residential areas. In most cases, the abatement efforts are made the responsibility of the timber purchaser under the timber sale contract.

4.11 RECREATION

The Black Hills economy depends heavily on recreation and tourism. The Forest is important as both a primary destination and as a backdrop for other destinations (e.g., the region's two National Parks, two National Monuments, a National Memorial, Custer and Bear Butte State Parks, Bureau of Land Management lands, and historic towns). The Forest road system links all of these sites through the Forest.

The "Recreation Corridor" centered along Highway 16 is specifically tourist-oriented. Such tourist attractions as Custer State Park, Wind Cave National Park, Jewel Cave National Monument, Mount Rushmore National Memorial, Crazy Horse Monument, Keystone, Hill City, and Reptile Gardens are in the area. The heaviest use occurs between Memorial Day and Labor Day.

The principal recreation activities on the Forest are driving for pleasure and viewing scenery (63 percent), camping and picnicking (9 percent), hunting and fishing (7 percent), hiking and horseback riding (7 percent), and snowmobiling (4 percent). These uses occur in dispersed areas and at developed sites. The remaining 10 percent is comprised of nearly 50 other activities.

Generally, recreational users of the Forest are very attached to the area as a place to go for a "drive in the country", find peace and quiet, enjoy the scenery and outdoor experiences, to gather forest products, and enjoy the many national attractions contained within the Forest boundary. Multiple opportunities exist for the variety of recreation uses throughout the Forest. When planning for future construction, maintenance, and decommissioning of roads, impacts to recreational use of those particular areas are generally considered on a project-by-project basis.

A National Visitor Use Monitoring (NVUM) sample was conducted in 2003 and determined that recreation use on the forest for fiscal year 2003 was 1,252,175 national forest visits. The 80

percent confidence interval width was +/- 18.1 percent. There were 1,684,885 site visits, an average of 1.22 site visits per national forest visit. Included in the site visit estimate are 55,436 Wilderness visits.(USDA Forest Service BHNF NVUM Report June 2004).

There was an average of 2.43 people per vehicle with an average of 2.03 axles per vehicle. This information in conjunction with traffic counts was used to expand observations from individual interviews to the full forest population of recreation visitors.

A description of visitor activity during their national forest visit was developed. This basic information includes participation in various recreation activities, length of stay on the national forest and at recreation sites, visitor satisfaction with national forest facilities and services, and economic expenditures.

The average length of stay on the BHNF was 27.9 hours. Thirty-four percent of visitors stayed overnight on the Forest. During their visit to the Forest, the top five recreation activities of the visitors were viewing wildlife, relaxing, viewing natural features, driving for pleasure and fishing. Each visitor also picked one of these activities as their primary activity for their current recreation visit to the Forest. The top primary activities were fishing, relaxing, hiking/walking, driving for pleasure and motorized water activities. One-third of the recreation visitors interviewed were asked about the types of constructed facilities and special designated areas they used during their visit. The five most used facilities/areas were: picnic area, scenic byway, forest roads, forest trails, and developed campground.

Vehicular travel is one of the most popular recreation activities on the Forest (USDA-Forest Service 2004a). With the exception of OHV's, the high demand for vehicular travel opportunities is currently being met by the road system. Feedback from OHV operators indicate a desire for an expanded motorized trail system.

Over time, the amount of recreation use is expected to increase. Where demand for motorized recreation stays constant or increases, and the area where that opportunity is allowed stays constant or decreases, crowding and a reduction in the quality of the recreation experience can be expected. The same holds true for areas where the demand is for non-motorized recreation.

Recreation on the Forest is managed in compliance with the requirements of the adopted Recreation Opportunity Spectrum (ROS) classes. The classes are summarized in Table 4-8 below by Management Area.

Table 4-9. Recreation Opportunity Spectrum Classes by Management Area

Management Area	Name	Acres	P	SPNM	SPM	RN	RNNM	R
1.1A	Black Elk Wilderness	13,542	X					
2.2	Natural Research Areas	3126		X				
3.1	Botanical Areas	8,120		X		X		
3.2A	Inyan Kara Mountain	1,345	X					
3.31	Back Country Motorized Recreation Emphasis	11,865			X			

Table 4-9. Recreation Opportunity Spectrum Classes by Management Area

Management Area	Name	Acres	P	SPNM	SPM	RN	RNNM	R
3.32	Back Country Non-Motorized Recreation Emphasis	11,532		X				
3.7	Late Successional Forest Landscapes	25,026					X	
4.1	Limited Motorized Use and Forest Product Emphasis	43,647					X	
4.2A	Spearfish Canyon	9,399				X		
4.2B	Peter Norbeck Scenic Byway	1,695				X		
5.1	Resource Production Emphasis	536,869				X		
5.1A	Southern Hills Forest and Grassland Areas	89,685				X		
5.2A	Fort Meade VA Hospital Watershed	3,308		X		X		
5.3A	Black Hills Experimental Forest	3,393				X		
5.3B	Sturgis Experimental Watershed	1,079		X				
5.4	Big Game Winter Range Emphasis	396,289				X		
5.4A	Norbeck Wildlife Preserve	10,074		X				
5.43	Big Game and Resource Production	12,174				X		
5.6	Forest Products, Recreation, Big Game Emphasis	27,173				X		
8.2	Developed Recreation Complexes	11,395				X		

P=Primitive; SPNM=Semi-primitive non-motorized; SPM=Semi-primitive motorized; RN=Roaded Natural; RNNM=Roaded natural non-motorized; R=Rural.

Non-motorized areas make up 10 percent of the Forest with the other 90 percent being open to motorized use. The Primitive class (1 percent) is managed to be essentially free from evidence of humans and on-site controls. Motor vehicle use within the area is not permitted. The Semi-Primitive Non-motorized class (3 percent) is important for nonmotorized recreation in a predominantly unroaded context. All non-motorized activities are allowed in these areas. Semi-Primitive Motorized (1 percent) offers access on ML 1 and 2 roads. There are no restrictions on the type of vehicles that can use these roads, so they provide opportunities for recreational off-road travel, as well as access for hunting. Management Level 3, 4, and 5 roads are used to access the roads to these areas. The Roaded Natural areas (89 percent) tend to have more of the arterial and collector roads, but may still have qualities of naturalness that are conducive to sightseeing.

Roaded Natural Non-motorized areas (6 percent) are managed to provide a natural-appearing environment with moderate evidence of humans.

Given the abundance of roaded recreation opportunities in the Forest, building roads into currently unroaded areas, road maintenance and road decommissioning, except on a large scale, would have a small effect on the quality or quantity of roaded recreation opportunities. However, developing new roads into unroaded areas could have an affect on unroaded recreation opportunities because of the limited amount of unroaded areas currently available (4 percent).

When travel is limited, as when roads are decommissioned or the maintenance level is reduced such that travel is no longer possible for a portion of users, some users will gain and others will lose. For example, when an area is closed to motorized travel to protect wildlife, there is a secondary effect on people: the closure not only shuts off motorized travel, but it also restricts access for persons with disabilities, limits firewood gathering, and may reduce some forms of recreation, such as hunting. On the other hand, a closure to motorized travel provides increased solitude for hikers and cross-country skiers.

In general, decommissioning or reducing the maintenance level of existing roads would be expected to indirectly benefit people who prefer non-motorized recreation while developing new roads would be expected to benefit those users who prefer motorized recreation.

New roads can affect scenic integrity by detracting from the natural form, line, and color of the surroundings. Improperly designed roads, specifically those with fresh cut-and-fill slopes, would especially reduce scenic quality. Decommissioning roads, by contrast, would, in the long-term, likely restore scenic integrity as the unused road is returned to its natural state. Scenic integrity will be addressed as new road construction, reconstruction, or decommissioning is proposed. Inability to perform maintenance on roads can result in visible erosion damage, which decreases scenic integrity. Increasing road maintenance can improve protection and conservation of the scenic integrity within the road corridor.

Two scenic byways are located on the Forest. The 70-mile Peter Norbeck Scenic Byway traverses portions of Highways 87, 89 and 16A and enters into Custer State Park for a portion of the route. Mount Rushmore, the Norbeck Overlook, the Gordon Stockade, Cathedral Spires, Needles Eye, the Norbeck Wildlife Preserve, and Sylvan and Horsethief lakes are a few of the points of interest along the route. The Spearfish Canyon Scenic Byway, which also functions as a commercial highway (US 14A) connects I-90 to US 85. The steep, high Paha Sapa Limestone walls, which surround the Canyon, are a constant, dominant feature.

The scenic integrity value of ML 1 and 2 roads was analyzed. The analysis is described in Section 5.2.1. The results are presented in the spreadsheet in Appendix B of this report however the data was not presented on a map.

Primitive recreation opportunities on the Forest are limited to the Black Elk Wilderness and Inyan Kara Mountain (no public access to Inyan Kara). Motorized use in these areas is prohibited thereby protecting the natural integrity, natural appearance, and opportunities for solitude at these sites. Unroaded recreational experiences can be had in other areas of the Forest. Should currently unroaded areas become roaded, visitors may be displaced to other undeveloped

areas, including Black Elk Wilderness and Inyan Kara Mountain, which could result in crowding of these areas.

The current policy for off road recreation in the Forest is an open unless closed policy. In the last five years, the demand for all types of OHV recreation on the Forest has increased significantly and indications are that this trend will continue. Many of the Forest roads have been constructed for timber removal, mining or other forest product access and they currently provide the majority of the opportunities for OHV recreation. They are not always best suited for the recreation needs of OHV enthusiasts. Currently there are only fourteen miles of trail designated for motorized use on the BHNF. Off-road enthusiasts have become accustom to riding their OHV on any road, trail or area that is not posted or gated as closed. A portion of these riders have chosen to ignore restriction and prohibitions. These actions have resulted in a large and growing system of undeveloped trails. Many of these trails are located such that they present risks to natural resources including soils and water. As the number of visitors to the forest increases, so do the incidences of environmental damage and user conflict.

Public comments by recreationists and private land owners during the past three years have identified excessive OHV noise as a major concern within the Forest. Forest visitors and nearby residents enjoy the peace, solitude and wildlife viewing opportunities the forest setting offers. The noise of OHV's can interfere with the recreation experience that they are seeking. Motorized recreationists also enjoy the sounds of nature when they turn off their machines. Excess noise disturbs wildlife. Noise can disturb eating habits, interfere with important travel routes, scare animals off nests to expose offspring to predators, and cause the loss of important energy reserves.

The 2005 Travel Management Final Rule (the Rule) published by the US Forest Service in December of 2005 has directed the Forest to look at new ways of managing OHV use on the Forest. The Rule directs the Forest to restrict motorized recreation to designated roads, trails, and areas. This will require changes in the way the Black Hills National Forest is managing motorized recreation. The recent discussion is focused primarily on summer OHV use.

4.12 SOCIAL ISSUES

The road system provides access for use of the Forest, including access for developed and dispersed recreation, timber production, livestock and rangeland management, mineral production, access to historical sites, management of fire and fuels, wildlife needs, and insect and disease risk. In addition, the road system provides access to private land holdings within the Forest boundary and provides a throughway for the transport of goods and services to the human communities within and near the Black Hills region. Because the Black Hills region is an area of national tourist destinations, users of the road system include residents of many states and other countries, as well as communities within the region.

Motorized use of the NFS lands in the Black Hills has a long history and people are accustomed to utilizing the road system to access the Forest for economic, social, and cultural purposes. The Black Hills has a strong tradition of multiple use of resources, with many people tied to the way the Forest is managed either by employment, or people looking to enjoy the outdoor recreation

opportunities that the Forest has to offer, or people who value the heritage resources or spiritual values provided by the Black Hills.

Access is important for the management of NFS lands as well as non Forest-owned lands within the proclaimed Forest boundary. Road closures or maintenance level modifications may impact access to traditional, cultural, historical, residential, and commercial sites. Such closures or maintenance level modifications may also impact access by Forest Service permittees or cooperators, as well as private owners and other land management agencies (e.g., the National Park Service) for management activities.

Seven counties contain parts of the Black Hills National Forest and, overall, about 12 percent of the land area in those counties is NFS land (USDA-Forest Service 2004a). Thus, road system management decisions impact social and economic conditions in communities in these counties. Access to lands within the Forest boundary is essential for the economic health of the region and access also has important social benefits outside the region since the Black Hills region is a national tourist destination. The local economy generally benefits from the well-maintained roads that link communities to one another and to the greater region, which in turn fosters community development and facilitates access for fire and emergency response. Also, roads channel tourists, and associated economic benefits, into the area.

Timber is a recognized commodity of the NFS lands and roads, and provides substantial job opportunities for local residents. The wood products industry directly employs about 1,600 people in the seven-county region; about 1.5 percent of total jobs in the area (USDA-Forest Service 2004a). Recreational use of the road network and surrounding lands also provides employment opportunities for industries that support tourism. It is difficult to measure employment related to recreational activity, because that employment occurs in many sectors (USDA-Forest Service 2004a). However, it is important to note that many tourism-related jobs are seasonal and do not pay a wage or have benefits that would attract families (USDA-Forest Service 2004a).

The influx of immigrants into the area during the late 1800s led to the expansion of the transportation system in the Black Hills for accessing mining, grazing, and logging activities. Paths and trails were developed into more formal routes for wagons and wheeled vehicles. Large tracts of forest were cut in order to provide timber to the growing mining industry and to provide housing for the people now residing in the Black Hills. By the 1920s, a major highway system was developed and a Forest Road System was initiated. The Civilian Conservation Corps augmented the system in the 1930s to accommodate tourists traveling in passenger vehicles. The present road system has evolved largely in response to resource production on the Forest over the last 100 years, particularly from logging and the demand for access to private property.

Area residents typically value rural or small-town life, family-oriented recreational use, and scenery-related quality of life, as well as valuing the commodities production that provides essential employment and income for the region. Many residents, particularly in the western portion of the region, are descended from original pioneer families who settled the land a century or more ago. These residents in particular tend to have a close tie to the public land, including the need to use it economically to make a living (USDA-Forest Service 1996a).

The population also enjoys the diverse recreational opportunities and fairly easy access to the Forest. The 2004 Draft EIS for the Forest LRMP Phase II Amendment found that generally, residents of the area favor continued timber production and management on the Forest. They enjoy the benefits of the timber road network for recreation and would prefer to have the roads maintained and open (USDA-Forest Service 2004a).

For some residents, the existence of roadless areas in the Forest, which comprise approximately 26,000 acres, or roughly 2 percent of the Forest, provides an important value for their sense of place. Like other natural attributes of the forest, people have different values about the need for or desirability of preserving roadless and pristine areas. Some people value well-managed access to the forest for multiple use. Many of these uses tend to generate road construction. For recreation, roads provide access for pleasure driving, hunting, camping, and other dispersed recreation, although they reduce the supply of roadless areas that provide for a more primitive recreation experience. The issue of equity is also important to some people, since persons with disabilities or limited mobility (such as the elderly) cannot partake in certain wilderness opportunities. Some people greatly value the chance to find solitude in remote and natural settings. Others believe that wilderness is essential for ecological reasons, and the slow development of natural landscape has broader implications on the human environment and health.

There is a conflict regarding the use of the Forest and NFS roads for consumptive versus non-consumptive uses, depending on the area. Some areas, such as those around Newcastle and Sundance, are generally more commodities oriented, while others, such as the Highway 16 corridor, are generally more recreation oriented. This conflict is reflected in the recent concern over Forest management by some environmental organizations, and emphasized by the number of appeals to Forest projects, which have gained wide media attention. The diversity of opinion may reflect a growing change in local attitudes towards Forest management.

For long-time local residents who depend on logging and other commodity production, the general objective is for resources to be managed in a way that sustains economic viability. More recently, the natural beauty and features of the area have prompted tourism and recreation, which have also benefited from the road system. Thus, although there may be some trends toward an increased awareness of the outdoors and non consumptive resources, there is still a strong component that relies on consumptive uses (USDA-Forest Service 1996a). Especially as the population around the Forest increases, the desire among some residents to have unroaded areas may conflict with the desire of other residents to use the Forest for either commodity production and/or more developed recreation.

Another conflict associated with the road system and its management is related to the development of private land within the Forest boundary. Roads and driveways serving residential areas and business that intersect with Forest roads create vehicle speed and turning movement conflicts that can increase the potential for accidents, resulting in both damaged vehicles and personal injury. Additionally, the mix of vehicles (large trucks, high- and low-clearance personal vehicles, all terrain vehicles, motorcycles, snowmobiles) traveling at different traffic speeds on roads can create conflicts that can lead to traffic accidents and congestion.

Another conflict is related to the issue of access to traditional and heritage sites. Roads that are adjacent to traditional, cultural, and historic sites in the Forest can lead to vandalism of those sites. On the other hand, road closures or maintenance level modifications may impact access to traditional and heritage sites, which can reduce opportunities for protection, interpretation, and visitor access.

In general, conflicts associated with multiple use and the development of private land can be expected to increase as communities in and near the area continue to grow and change. Manufacturing employment in the area has generally declined, spurred in part by recent declines in timber supply and the closing of Homestake gold mine. However, other industry has been increasing and is being promoted. At the same time, retiree populations have increased, and overall the population has increased in the last decade (USDA-Forest Service 2004a). As communities continue to grow, the level of human interest and activities can be expected to intensify. Differences in social, economic and cultural values may become more of an issue as a result.

4.13 CULTURAL/HISTORICAL ISSUES

Access to heritage resources (e.g., archaeological, historical and paleontological sites) is a multi-faceted subject with the opportunity both to benefit and to adversely affect the resource. Whether or not access is a desirable condition depends on how access can be expected to affect a resource, and in specific cases competing interests may even come to different conclusions (USDA-Forest Service 1996a). With over 6,000 archaeological and historical resources identified to date on the Forest, and an estimated 11,000 projected resources present (of which as many as 1300 or more are eligible for the National Register of Historic Places [NRHP] [USDA-Forest Service 1996a]) examples of every possible scenario can be found on the Forest. Fewer paleontological resource sites have been recorded, but they are subject to the same effects as heritage resources.

Access to cultural resources provides an opportunity for study, learning, preservation, protection from fire (USDA-Forest Service 1996a), monitoring, and traditional use. Balancing the benefits of reaching cultural resources more easily are the deleterious effects possible from over-use, vandalism or looting, and other physical effects both intended and unintended. Effects harder to identify in advance include the effects to the NRHP integrity of a resource as a result of changes in setting due to traffic or visitors.

In contrast to good or improved access, lack of access to cultural resources also may have both a beneficial and deleterious effect. Archaeological and paleontological sites usually retain greater integrity when they are not visited for any purpose, particularly when isolation results in protection from looting. However, lack of access can result in unrecognized physical deterioration from natural causes such as erosion. Similarly, isolated structural resources such as buildings, bridges, or mining features are generally protected from vandalism or overuse when they are not readily accessible, but can lose NRHP integrity when neglect results in their collapse, other deterioration, or fire (36CFR800.5(a)(2)(vi)).

Traditional cultural resources are subject to the same complex mix of conditions as archaeological, architectural, and paleontological resources. Although difficulty in reaching

traditional use areas can have the effect of conserving the resource from overuse or unwanted intrusion from cultural outsiders, lack of access has the same effect as removing the resource. On the other hand, traditional resources are particularly sensitive to overcrowding and usage conflicts.

American Indians, particularly the Oglala and Standing Rock Sioux, have expressed concerns about access to traditional resource use areas on the Forest (USDA-Forest Service 1999b). However, these concerns center more on the availability of the resources, such as medicinal plants, and the ability of traditional users to harvest them or use the locations for ceremonial purposes than around roadways to the traditional use areas.

The construction, maintenance, and use of road systems has the potential to result in ground disturbance and cause adverse effects to significant archaeological, cultural, and paleontological sites. A common mitigation measure used by the Forest is to "cap" or cover significant resources with gravel or earth fill and fabric cover. A major risk to significant heritage or paleontological resources is the use of native surface roads. Continued use can result in rutting, erosion and disturbance of intact artifact deposits and paleontological resources.

The Forest seeks to balance the needs of its various constituencies and its own mission when considering specific road projects; both improvements and closures. The Forest already conducts consultation with interested groups, including government-to-government consultation with American Indians. Because of the extent of the road system, the effect of each proposal is evaluated in the context of complying with Section 106 of the National Historic Preservation Act (NHPA).

Management of the road system in Forest is of concern to American Indians, particularly as it relates to other development activities on the Forest. American Indian issues related to management of Forest include: (1) recognition of traditional American Indian values, (2) protection of sacred areas, (3) access to practice traditional ceremonies, (4) appropriate reburial of human remains, (5) greater involvement in land management decisions, and (6) employment and training opportunities (USDA-Forest Service 1996a).

Access to traditional resource use areas on the Forest is a concern for the American Indians. This includes resource gathering areas, general historic use areas, and sacred sites. The Forest continues to consult with American Indians to resolve issues of resource protection, access and use.

The Forest road system provides access for traditional uses (e.g., harvesting of resource materials such as tipi poles and native plants), and for religious ceremonies. Tribes will be able to continue to harvest tipi poles and traditional and medicinal plants. Negative impacts from road closures that can result if traditional users are unable to access traditional resources could be balanced by the increased access provided by reconstructed or otherwise improved or new roads. However, increased access can also create conflicts between traditional uses and recreation or extractive uses (USDA-Forest Service 2000a).

Historic roads and trails meeting the NRHP criteria are considered historic properties; even such resources that are not eligible for the NRHP on a national level may have local or state

significance. Included in this resource type are bridges, culverts, and or other structural elements of the transportation system. Roads having historic value are often still used as routes throughout the Forest, adding another layer to their heritage value (USDA Forest Service 2000a).

A number of historic heritage resources that are part of the current road system in the Forest have been listed on the NRHP or are considered eligible (USDA-Forest Service 1996b). The NRHP-eligible sites listed below are representative of the various site types.

- Portions of the Cheyenne-Deadwood Trail
- Cheyenne-Deadwood Trail
- Belle Fourche Bridge
- Iron Mountain Road and Pigtail Bridges
- Forest Roads associated with Civilian Conservation Corps (CCC) activities and facilities: Pactola; Rochford; Hill City; Rockerville; Custer; Tigerville and Deerfield; Savoy and Summit; and Park Creek
- CCC features associated with roads
- McLaughlin Tie 7 Timber Railroad

Effects on historic roads and trails are considered on a project-specific level, to comply with Section 106 of the NHPA. Projects could include reconstruction of roads that are or follow historic routes, replacement or repair of historic features such as bridges or CCC-related structures, construction of new roads that follow historic routes, or decommissioning of historic roads. While most of these projects could affect the historic character of a resource by modifying or demolishing it, decommissioning roads with historic features could result in the deterioration of these features through neglect ((36CFR800.5(a)(2)(vi)).

4.14 CIVIL RIGHTS AND ENVIRONMENTAL JUSTICE

Users of Forest System roads include people with disabilities and people of all racial backgrounds and income levels. None of the counties in the Black Hills contain low-income or minority populations as defined by Executive Order 12898 (USDA-Forest Service 2004a). In general, changes in road management, including closing or decommissioning of roads, would have similar effects on all people, including minorities and low-income populations. Closing or decommissioning roads would have somewhat greater impact on people with disabilities.

However, for project-level decisions, particular attention is generally paid to roads that provide access to recreation areas that are accessible to people with disabilities or with limited mobility (e.g., the elderly) since they generally have difficulty with or cannot partake in certain wilderness opportunities.

In addition, project-level decisions should consider the particular needs of American Indians. Among other purposes, American Indians use the road system for gathering traditional plants and accessing sites of particular spiritual importance. However, road system planning and management is essential, because road construction, maintenance, and public access can disturb such sites.

Finally, it should be noted that minorities hold jobs in the wood-products industry in a much higher proportion than the population of minorities represented in the region (USDA-Forest Service 2004a). Thus, road management decisions that affect access to timber-producing areas, or increase costs of timber production, could have indirect adverse effects on minority populations.

STEP 5: SETTING PRIORITIES AND DESCRIBING OPPORTUNITIES

5.1 SETTING PRIORITIES - ROADS

Step 5 involves focusing on setting priorities and describing opportunities to improve the transportation system on the BHNF. This section concentrates on setting priorities for the roads portion of the transportation system. Roads in this analysis were categorized based on the key values and identified risks associated with each road. The methods used to assign values and risks and then priorities are described below.

5.1.1 Method

Maintenance Level 1 and 2 system roads, non-system roads and unauthorized routes on the BHNF were evaluated to assess the risks and values associated with their use using the following tools: GIS assessment, matrix spreadsheets, and a road management table.

GIS Assessment. The estimated potential relative risks and values presented by roads and routes were evaluated at the road segment scale. The analysis used GIS software combined with the current NFS inventories and cartographic feature files. The analysis at the road segment scale analyzed risks and values associated with ML 1 and 2 system roads, non-system roads and unauthorized routes. Maps were produced to illustrate the spatial aspects of the road and route parameters analyzed.

The Road Analysis Spreadsheet. The Road Analysis Spreadsheet lists all selected road and route segments, the assigned low, moderate, or high relative risk/value ratings for each, and the data values that were used to determine those ratings. Since this road analysis is an overview assessment, the detail and accuracy for relative road risk and values contain a degree of subjectivity and potential for value changes. The road analysis spreadsheet does, however, provide specific information on roads and routes that may pose a higher than average risks to resources and can be used in conjunction with road value assessments to assist with prioritizing future local-level analysis or projects. As more information becomes available or is updated, the road analysis information should be validated and updated accordingly.

A more detailed description of the individual factors is presented below. The detailed spreadsheet showing the resulting data is located in Appendix B. The spreadsheet size is quite large (13,651 by 172) therefore it has not been printed for the Appendix. The spreadsheet file is copied onto a CD. Color maps showing the risk analysis results are presented in Appendix A. The digital information (spreadsheet and maps) will also be available on a server for internal Forest Service use and on the Forest Service website for public access.

The Road Management Table. The Road Management Table was developed following procedures outlined by the Allegheny National Forest Roads Analysis Report (USDA-Forest Service 2003), and in other National Forest road analysis reports, to summarize the information in the road matrix spreadsheets. The table categorizes the relative values and risks of the current road system, helps identify opportunities for managing the road system, and prioritizing

expenditures of Forest road maintenance and improvement funds. This table is strictly a management guide and is not to be considered firm direction as it combines many of the road matrix risk and value variables.

The table is a 3 x 3 matrix table constructed to display the number of segments that fall into each of nine categories based on the three rankings each for risk and value. Each section of the table is given a category number (1 thru 9). A road with a low value and low risk would be in Category 9. A road with a moderate value and moderate risk would be in Category 5, and a road with a high value rating and high risk rating would be in Category 1. The important categories relative to identifying problem areas and management options to deal with them are the high risk categories (1, 2, and 3). The category that may provide the list of roads with the most realistic possibilities for closure and/or obliteration is Category 3, High Risk/Low Value unless there are other important reasons for keeping those roads open.

5.1.2 Criteria for Assigning Values and Risks

To assess the impact of roads on the BHNF and to identify opportunities and priorities for road management, a ranking system of relative risks and values was developed based on the issues, problems, risks, and benefits identified in the previous steps. Six road-related risk categories and five road-related value criteria were developed for this process. The risk-related categories were further divided into more specific risk factors related to the category.

If a road or route had more than one jurisdiction, maintenance level, status, system, or user request, it was divided into segments based on those different labels that allowed the assignment of a unique identifier. This resulted in 13,651 road and route segments representing 8,475 miles.

For the individual evaluation factors, each road or route segment was analyzed against existing resource data using GIS tools generating a number of risk occurrences per segment. An example would be a road crossing a stream would be an occurrence of a sedimentation risk to the stream. The distribution of occurrences for each segment was then reviewed and a relative risk (Low, Moderate, High) and a related risk number (0, 1, 2) was assigned to each. The 0 through 2 numbering system was used to allow mathematically combining the risks presented by different factors. A 0 indicates an estimated lower than average relative risk. A 1 indicates a moderate relative risk, and a 2 indicates a higher than average relative risk. The dividing point between low, moderate, and high risk is determined for each parameter based upon the risk occurrence distribution and input from the individual specialists. An attempt is made to assign this risk based on estimated potential impacts on the resource using the professional judgment of specialists.

Each risk evaluation category is then assigned a relative risk rating after summing the contributing factors. These six category relative risk rating factors are then further added together. The distribution of the total risk using all segments is then reviewed and an overall relative risk factor (0, 1, or 2) is assigned to each segment. This process results in a segment risk rating for each factor, for each category, and then an overall risk taking into account all risk categories.

5.1.3 Road and Route Related Risks

In all cases, the individual risk indicators are based on relative amounts of a parameter found on the Black Hills National Forest. The actual or 'absolute' risk that roads pose to the selected parameters could not be determined within the scope of this analysis. An attempt was made to be conservative in assigning risk conditions to increase the likelihood that high risk areas would be identified. The assigning of these risk conditions and the relative ranking of the results is based, in most cases, on the professional judgment of the specialists involved. It is important to note therefore that the relative risk rankings should only be used as an indicator of the road or route's potential for impact and as a flag for project level analysis teams to look at a road in more detail.

In combining the individual risk factors into the overall relative road risk rating, the factors were weighted equally. It is likely that certain risks would contribute more or less to the overall risk of a particular road or route, but a valid method of weighting them could not be determined.

General relative risk categories were assigned as follows:

0 - There are no or relatively low potential risks.
1 - There are relatively moderate potential risks.
2 - There are relatively high potential risks.

Relative road risk was evaluated using the following relative risk categories and component risk factors. The detailed discussion of these overall relative risk factors and the results are presented below.

1. **Management Areas** (6 factors)
   - Existence in prohibited management area
   - Miles within .5 miles of a non-motorized trail
   - Miles within 300 feet of private land
   - Miles within restricted management area 5.4 Big Game Winter Emphasis
   - Miles within a seasonal closure area
   - Miles within high road density areas
2. **Hydrology** (3 factors)
   - Number of stream crossings per segment
   - Miles within 300 feet of perennial streams
   - Miles within 119 feet of perennial streams
3. **Wildlife** (6 factors)
   - Feet within 100 feet of documented bat cave/mine
   - Feet within snail occurrence site
   - Feet within 1,000 feet of a wildlife guzzler (watering) location
   - Miles within .5 miles of a Goshawk location
   - Feet within 119 feet of an American Dipper stream
   - Miles with marten habitat
4. **Soils** (2 factors)

- Miles on topographic slopes > 40%
- Miles in severe erosion risk locations

5. **Botany** (5 factors)
   - Miles within weed infestation areas
   - Miles within 400 feet of riparian areas
   - Feet within 500 feet of sensitive and species of local concern plant habitat
   - Feet within 300 feet of Botanical areas
   - Feet within 300 feet of Montane grasslands
6. **Heritage** (2 factors)
   - Feet within areas un-surveyed for heritage sites
   - Feet within 30 feet of areas eligible or unevaluated for addition to the National Register of Historic Places

Management Area Risk (6 Factors)

The Management Area relative risk category above was further divided into six individual Management Area related factors.

MA 1 - Existence in prohibited management area

The prohibited management area indicator assigns a risk based on whether a road segment is located in a management area where on-road motorized use is currently prohibited, limited, or intermittent. These Management Areas are1.1A – Black Elk Wilderness; 2.2 – Research Natural Areas; 3.1 – Botanical Areas; 3.2A – Inyan Kara; 3.32 – Backcountry Non-Motorized; and 5.4A Norbeck Wildlife Preserve. A limited number of roads exist in some of these management areas. Although limited motorized use is necessary for administration, motorized used of these roads in general can present a risk to their resources and provide opportunities for unauthorized use. The existence of a segment within a management area was used to measure the relative risk. This analysis was not conducted on routes that are currently listed as unauthorized, which includes the user routes that were recently submitted, because the use of those routes under current management area direction is prohibited. The relative risk ratings for road segment existence in prohibited management areas were set as follows:

1 - Relatively Moderate Risk: Road exists but is closed
2 - Relatively Higher Risk: Road exists and is open

MA 2 - Miles within .5 miles of a non-motorized trail

This indicator assigns a risk to a road or route segment based on its proximity to an existing non-motorized trail. The risk is based primarily on visual and noise disturbance to users of trails that were designed and located primarily for the enjoyment of non-motorized users. Those users value quiet and natural landscapes and close proximity of motorized users would present a risk of user conflict. A secondary risk would be presented by the opportunity close proximity would present for unauthorized motorized use of the non-motorized trail. The distance of .5 mile was selected because it is the approximate distance at which the sound emitted from a motorized

vehicle at a noise level of 96 DB(A) would attenuate to approximately 30 DB(A) which is the noise level of a whisper. This ending noise level assumes normal attenuation based on distance with some limited attenuation from topography and vegetation.

The 96 DB(A) noise level was selected for this analysis because it is the maximum level currently mandated by five states and is regarded as an adequate limit by the EPA and motorcycle manufacturers (American Motorcyclist Association 2005). This noise level is based on the Society of Automotive Engineers (SAE) stationary test standard J1287. The actual noise levels generated by OHVs in the Black Hills are quite varied. It is common practice for motorcyclists, in particular, to replace Original Equipment Manufacturer (OEM) mufflers with noisier ones resulting in levels much high than 96 DB(A). The Forest Service has not set a stationary sound limit for the Black Hills however it is being considered.

The relative risk ratings for the miles of individual road and route segments that are within .5 miles of non-motorized trails are were set as follows:

0 - Relatively Lower Risk: 0 to < .25 mile
1 - Relatively Moderate Risk: .25 to < .5 mile
2 - Relatively Higher Risk: >= .5 to 11.2 miles

MA 3 - Miles within 300 feet of private land

This indicator assigns a risk to a road or route segment based on its proximity to private land. The risk is based primarily on visual and noise disturbance to private landowners. Private landowners value quiet, natural landscapes and privacy, and close proximity would present a risk of conflict with those values. In general, noise annoys. A secondary risk would be presented by the opportunity close proximity would present for unauthorized incursion onto private land. The distance of 300 feet was selected because it is the approximate distance at which the sound emitted from a motorized vehicle at a noise level of 96 DB(A) would attenuate to approximately 50 DB(A) which is the noise level of an average office. This ending noise level assumes normal attenuation based on distance only however it is probable that there would be additional attenuation in most situations base on interference from topography and vegetation.

The selection of 96 DB(A) as the originating noise level is discussed in the previous risk factor.

The relative risk ratings for the miles of individual road and route segments that are within 300 feet of private land were set as follows:

0 - Relatively Lower Risk: 0 to < .25 mile
1 - Relatively Moderate Risk: .25 to < .5 mile
2 - Relatively Higher Risk: >= .5 to 2.2 miles

MA 4 - Miles within restricted Management Area 5.4 Big Game Winter Emphasis

This risk indicator is based on the number of miles of individual road or route segments that are located in MA 5.4 Big Game Winter Emphasis. This is the only management area that is managed for a specific road density. The goal for open Forest Service road density in the winter is 1.0 miles per square mile. This is the second largest MA at 610 square miles which are

scattered in large areas primarily in the central and eastern hills. The current winter open road density has been calculated at 1.27 with a summer open road density of 2.52. The estimated summer open route density using all roads from all systems and all inventoried unauthorized roads including recently submitted user defined roads is 4.56. The management intent of setting aside this large area in the winter is to provide areas for wildlife to escape from the disruption of motorized traffic. The more miles a segment has in MA 5.4, the more general risk it poses to wildlife through noise, harassment, habitat disruption, etc.

The relative risk ratings for the miles of individual road and route segments that are MA 5.4 were set as follows:

0 - Relatively Lower Risk: 0 to < .25 mile
1 - Relatively Moderate Risk: .25 to < .5 mile
2 - Relatively Higher Risk: >= .5 to 13.8 miles

MA 5 - Miles within a seasonal closure area

This risk indicator is based on the number of miles of individual road or route segments that are located in an area that has been seasonally closed with a closure order. These areas, with two exceptions, are closed from December 15th to May 15th. These closure areas are Wild Irishman, Blackhawk Wildlife Winter Area, Pleasant Valley, Beaver Creek, Roby (Nov1 – May 15), Cicero Peak, Bismark, Willow Creek, TeePee, Thrall Winter Area, and Deerfield lake Eagle Nest (May 21 – September 1). The more miles a segment has in a seasonal closure area, the more general risk it poses to resource constraint that generated the closure order.

The relative risk ratings for the miles of individual road and route segments that are management area 5.4 were set as follows:

0 - Relatively Lower Risk: 0 to < .25 mile
1 - Relatively Moderate Risk: .25 to < .5 mile
2 - Relatively Higher Risk: >= .5 to 8.7 miles

MA 6 - Miles within high road density areas

Road density is a simple indicator of the concentration of roads in an area and, in general, is calculated by dividing the length of roads found within the Forest and within a selected area by the selected area. For this analysis, the Forest was divided into 100 meter square sections. To get a more accurate representation of the density in that general area, all of the road sections within a radius of .56 mile of the center of the square (which results in one square mile) are used to compute the density of the circle. That density is then assigned to the 100 meter square. This was repeated for every 100 meter square within the boundary of the Forest. Road densities were calculated using all roads (all systems, Forest Service, County, State, Federal & private). All roads were used for this calculation because the potential effect of the road density does not really depend on who has jurisdiction or for what reason it was created. The unauthorized routes were not included because in general they tend to have a smaller footprint, light traffic and smaller impact. The distribution of the 100 meter square densities was evaluated and the sections were divided into three categories based on a logical break in the distribution. These

break points also correlate to a statement in the Forest Plan that a majority of the resource production areas have road densities between 2.5 and 4.5.

Relatively Lower Road Density: 0 to 2.5 miles per square mile
Relatively Moderate Road Density: 2.5 to 4.5 miles per square mile
Relatively Higher Road Density: > 4.5 miles per square mile

The number of miles that each individual road or route segment spent in density squares greater than 2.5 was then calculated. The distribution of the results was reviewed and roads were divided into three ratings:

0 - Relatively Lower Road Density Risk: 0 to < .5 mile
1 - Relatively Moderate Road Density Risk: >= .5 to <1.0 mile
2 - Relatively Higher Road Density Risk: >= 1.0 to 12.6 miles

The potential effects of high density road areas on the hydrology of the area primarily relate to the increased opportunities for the road to transport sediment or hydrocarbon or salt based pollutants to sensitive areas such as streams, lakes, riparian areas, and botanical areas. The real effect of a road on these areas depends on such variables as the size of the road, the road surfacing, traffic levels, the proximity to sensitive areas, the erosion potential of the soils, the steepness of the surrounding topography, the grade of the road, the amount and type of precipitation, and effectiveness of the road drainage structures. This risk factor is a general way of taking into account all of these conditions. The other hydrology risk factors represent some of these conditions more accurately.

This risk factor also measures the risk of roads to wildlife in general terms. The general assumption is that the higher the road density, the more risk there is to wildlife. Although all roads can affect the various wildlife species found on the Forest in a variety of ways, when compared to more primitive roads (i.e., ML 1 and 2 roads), ML 3, 4, and 5 roads generally have a disproportionate affect on wildlife due to their larger 'footprints', increased vehicle speeds, and traffic volumes. These effects are in the form of habitat alteration, wildlife mortality, disturbance, and habitat fragmentation.

Road density also measures a risk to botanical resources. Roads can result in the actual destruction of sensitive plants, the modification of habitat for sensitive species, and they can aid in the introduction of invasive species that crowd out sensitive species.

Because of the importance of road density, densities were calculated and maps were prepared showing road density within the Forest Boundary in three ways. One map shows the relative road density of all roads in all systems and all unauthorized routes using three shades of blue. A second map shows the relative density of just NFS roads that have Forest Service jurisdiction. A third map shows the relative densities of all unauthorized roads including the recently provided user routes. A comparison of these three maps shows the influence of non-NFS roads and unauthorized routes on the overall route densities within the Forest Boundaries. These maps are located in Appendix A.

Overall Management Area Relative Risk

The risk rating for each of the above management area risk factors was added for each segment. The distribution of these sums was reviewed and a cumulative management area relative risk factor was assigned. This factor is used in the overall road risk computation. There is a possible total of 12 points. The cumulative ratings are as follows:

0 - Relatively Lower Overall Risk: 0 Overall Segment Risk Points
1 - Relatively Moderate Overall Risk: 1 to 5 Overall Segment Risk Points
2 - Relatively Higher Overall Risk: 6 to 10 Overall Segment Risk Points

See Appendix A for maps showing each management area risk by segment.

Hydrology Risk (3 Factors)

The hydrology relative risk category above was further divided into three individual hydrology related factors. These factors are related to the risk to stream health from sedimentation and to fisheries habitat and connectivity.

H 1 - Number of stream crossings per segment

Road or route stream crossing density is an indicator of the degree of direct effects related to aquatic habitat loss, sediment input into streams and the potential for aquatic habitat fragmentation due to in-stream structures, e.g. culverts. Stream crossings are the points where roads and streams intersect. The accuracy and currency of the roads and stream data is critical to producing a useful stream-crossing coverage. For this analysis, the BHNF perennial streams GIS coverage (updated for currency using field surveys {2000 to 2007} by Les Gonyer and Steve Hertzel, BHNF and the South Dakota School of Mines & Technology) was used. The overall number of stream crossings may be inflated using this stream layer because the source document is old and the positions accuracies of the streams are not comparable to the more current road position data. The method of relative ranking the results tends to reduce the effect of the poor stream position accuracies. This indicator is reported as the number of road-stream crossings per road. Relative risk ratings used for the stream crossing density indicator are:

0 - Relatively Lower Risk: 1 & 2 stream crossings
1 - Relatively Moderate Risk: 3 & 4 stream crossings
2 - Relatively Higher Risk: > 4 to 34 stream crossings

The value of this risk indicator is related to the nature of the stream crossing and the type of road. A native surface road in steep topography and highly erosive soils crossing a stream at an unimproved/wet crossing will likely have significantly more impact on the stream than a paved road in a flat, vegetated area crossing over a bridge. This analysis did not provide such detailed information however the number and nature of crossings would be a major point in a project level analysis.

H 2 - Miles within 30 feet of perennial streams – stream proximity risk

The 30 foot stream channel proximity indicator is used to address encroachment into floodplains, channel restrictions, and as another indicator of hydrologic connectivity between roads and streams. A hydrologically connected road can be defined as *"any road segment that has a*

continuous surface flowpath to a stream channel" (Williams no date). Inboard ditches that drain to road-stream crossings are the most obvious road segments that are connected. Other situations that connect roads to streams are cross drains that create overland flow to stream channels, roads with fill slopes that encroach on stream channels, and landslide scars that create a surface flowpath to a channel. For this factor, connectivity was addressed using a 30-foot buffer of the updated BHNF perennial streams GIS coverage. Thirty feet was selected as the distance generally observed on the Black Hills between the centerline of roads and streams where the road template appears to modify the hydraulics of the stream under normal flood conditions (Williams, no date).

Using a buffer of stream channels to determine the length of road hydrologically connected to streams is only an approximation of connectivity. This risk indicator does not account for variations in hydrologic connectivity resulting from slope position, hill slope gradient, road type, precipitation, soil type or bedrock geology, vegetative buffers, all of which may significantly influence the degree of connectivity. Further development of this indicator would involve field sampling to determine how well the indicator represents actual connectivity. Relative risk ratings for road proximity (30 feet) to stream channels are as follows:

0 - Relatively Lower Risk: 0 to .01 mile
1 - Relatively Moderate Risk: > 01 to .1 mile
2 - Relatively Higher Risk: > .1 to 1.21 miles

H 3 - Miles within 119 feet of perennial streams

The 119 foot stream channel proximity indicator is used to address general sediment delivery into streams and other sensitive areas. The 119 foot buffer distance is the estimated distance in the Black Hills at which the buffer zone is 97 percent effective in trapping sediment from roads in highly erosive soils, evaluated at large scale for long time periods (Williams no date). Roads within 119 feet of a stream would therefore pose some risk of delivering sediment. The risk would increase as the road gets closer to the stream. The relative risk ratings for stream channel proximity (119 feet) are as follows.

0 - Relatively Lower Risk: 0 to .5 mile
1 - Relatively Moderate Risk: >.5 to 1 mile
2 - Relatively Higher Risk: > 1 to 3.11 miles

Overall Hydrology Relative Risk

The risk rating for each of the above hydrology risk factors was added for each road. The distribution of these sums was reviewed and a cumulative hydrology relative risk factor was assigned. This factor is used in the overall road risk computation. There is a possible total of 6 points. The cumulative ratings are as follows:

0 - Relatively Lower Overall Risk: 0 Overall Segment Risk Points
1 - Relatively Moderate Overall Risk: 1 to 3 Segment Road Risk Points
2 - Relatively Higher Overall Risk: 4 to 6 Overall Segment Risk Points

See Appendix A for maps showing each hydrology risk by segment.

Wildlife Risk (6 Factors)

The wildlife relative risk category above was further divided into six individual wildlife related factors.

W 1 - Feet within 100 feet of documented bat cave/mine

The bat risk factor represents a risk to existing bat roost populations. The more linear feet of a road or route segment within 100 feet of roosts, the more likely the route will pass close to the roost. Segments that are closer to bat roosts have more potential for users to see the cave/mine roost and enter the site to explore. The more human use the site receives, the higher the risk of disturbing roosting, hibernating, or lactating bats.

Routes outside the 100 foot zone have some risk because people may still discover and disturb the roosts/hibernacula, but the likelihood of disturbance is lower. Routes with greater than 100 linear feet within the 100 foot zone are given a high relative risk because they are more likely to pass next to the roost/hibernacula, thereby increasing the likelihood that users will stop and visit. The relative risk ratings for bat roost proximity (100 feet) are as follows.

0 - Relatively Lower Risk: 0 feet
1 - Relatively Moderate Risk: > 0 to 100 feet
2 - Relatively Higher Risk: > 100 to 233 feet

W 2 - Feet within snail occurrence site

The snail colony risk factor is displayed as the number of feet a road or route segment is within selected snail occurrence sites. The more linear feet within snail occurrence sites, the more likely recreational activities associated with that segment will impact snail colonies.

Segments outside snail occurrence sites are given a low risk because they are unlikely to impact known snail colonies. There is some risk that they may impact undiscovered snail colonies. The break between medium and high relative risk is based on a natural break in the data. This results in about half of the segments within snail colonies having a relatively moderate risk and about half having a relatively higher risk. The relative risk ratings for snail colonies are as follows:

0 - Relatively Lower Risk: 0 feet
1 - Relatively Moderate Risk: > 0 to 150 feet
2 - Relatively Higher Risk: > 150 to 983 feet

W 3 - Feet within 1,000 feet of a wildlife guzzler (watering) location

The guzzler location risk factor is displayed as the number of feet a road or route segment is within 1,000 feet of a wildlife watering structure (guzzler). The more distance a segment has within 1,000 feet of a guzzler, the more likely it will pass closer to the guzzler. The closer a segment is to the guzzler, the more risk there is of chasing wildlife off the water source.

Segments that have 1,000 feet or less within 1,000 feet of a guzzler are expected to be either short routes or are on the periphery of the 1,000 foot zone. Segments with over 1,000 feet within this zone are more likely to pass closer to the guzzler. Segments with over 2,000 feet in this zone are given a higher relative risk because they are likely to pass through the center of the zone right next to the guzzler or are very curvy routes that potentially curve around the guzzler on more than one side.

0 - Relatively Lower Risk: 0 to 1,000 feet
1 - Relatively Moderate Risk: > 1,000 to 2,000 feet
2 - Relatively Higher Risk: > 2,000 to 10,289 feet

W 4 - Miles within .5 miles of a Goshawk location

Road noise and other activities such as road maintenance and road reconstruction may present some disturbance risk to goshawks, especially during nesting season. Segments that are not within .5 mile of a goshawk nest have a relatively low risk of adversely affecting goshawks because they are at a sufficient distance to avoid disturbances during the nesting period (similar to USFWS guidance and WGF guidance on raptor protection). There is still some risk that these routes may affect some undiscovered nest on the Forest. Segments with more than .5 mile within .5 mile of a nest are classified as high risk because at this point it is more likely that the route passes close to he nest (within .25 mile of the nest) which creates a higher likelihood that the nest would be disturbed during the nesting period. Routes with between 0 and .5 mile within .5 mile of a nest are given a moderate relative risk.

0 - Relatively Lower Risk: 0 miles
1 - Relatively Moderate Risk: > 0 to .5 mile
2 - Relatively Higher Risk: > .5 to 2.7 miles

W 5 - Feet within 119 feet of an American Dipper stream

A recent survey showed American Dipper populations along eight streams in the Black Hills (Blacklund no date). Those streams are Rapid Creek, Bear Butte Creek, Whitewood Creek, Spearfish Creek, Beaver Creak, Spring Creek, Sand Creek, and Crow Creek. This risk factor is displayed as the miles of the road that is within 119 feet of the streams listed above. Dippers are present only on portions of the streams but the analysis uses the entire length of the stream to be conservative. The 119 foot distance is used to represent an approximate risk due to sedimentation and pollution (Williams no date). Routes that have more length within the 119 foot zone are more likely to be closer to the stream or parallel the stream. Segments that are closer to the stream or parallel the stream have more risk of supplying sediment to the stream (affects dipper food source) and more risk of disturbing the dipper nests (always close to water, the farthest recorded distance from water is about 25 feet).

Segments greater than 119 feet from a dipper stream (0 feet within the 119 foot zone) have a relatively lower risk of affecting dippers because the zone helps trap sediment and nests are always close to the streams. Segments that have between 0 and 300 feet within the zone are likely to have no or fewer stream crossings and the crossings are likely to be at near right angles to the stream. While there is some risk of sediment and disturbance with these segments, there is

not as much risk as segments that parallel the stream or cross the stream numerous times. Segments greater than 300 feet within the 119 foot zone are given a relative risk of high because they are more likely to parallel the stream and/or cross the stream multiple times.

0 - Relatively Lower Risk: 0 feet
1 - Relatively Moderate Risk: > 0 to 300 feet
2 - Relatively Higher Risk: > 300 to 14,474 feet

W 6 - Miles within marten habitat

Risks to marten from roads and route segments include habitat alteration, habitat fragmentation, and road mortality. The risk factor is displayed as the miles of the segment within high quality marten habitat as defined by Fecske (2003). Segments outside the high quality marten habitat are given a low relative risk because marten are expected to be absent or occur at low densities in these areas. Dispersing individuals may occur in these areas. There is no biological information that helps differentiate between medium and high relative risk. There is a natural break in the data at one mile. Routes with one mile or less in marten habitat are given a moderate relative risk because they are likely to be shorter segments and/or occur on the periphery of marten habitat polygons or cross small isolated habitat patches. Segments with greater than one mile in marten habitat are given a high relative risk because they are more likely to be longer segments and pass deeper into marten habitat or cross multiple smaller habitat patches.

0 - Relatively Lower Risk: 0 miles
1 - Relatively Moderate Risk: > 0 to 1 mile
2 - Relatively Higher Risk: >1 to 8.2 miles

Overall Wildlife Relative Risk

The risk rating for each of the above wildlife risk factors was added for each segment. The distribution of these sums was reviewed and a cumulative wildlife relative risk factor was assigned. This factor is used in the overall road risk computation. There is a possible total of 12 points. The cumulative ratings are as follows:

0 - Relatively Lower Overall Risk: 0 Overall Segment Risk Points
1 - Relatively Moderate Overall Risk: 1 to 6 Overall Segment Risk Points
2 - Relatively Higher Overall Risk: > 6 Overall Segment Risk Points (none)

See Appendix A for maps showing each wildlife risk by segment.

Soils Risk (Two Factors)

The soils relative risk category above was further divided into two individual soils related factors.

S 1 - Miles on topographic slopes > 40%

Hill slope gradient, or slope, is one of the primary driving forces in mass-wasting failures, erosion, and non-point source pollution, including sediment delivery to streams and other surface water bodies. Steep slope areas tend to contribute more sediment onto a road and water carries it downslope once it leaves the road. Steep slope areas can also have a correlation to grade of the road in that area. Roads with steep grades transport sediment more readily and are at greater risk to erosion damage. For this analysis, a ten meter Digital Elevation Model (DEM) was processed using GIS to generate percent slope gradients throughout the BHNF. The slope classes are, therefore, subject to the accuracy of the DEM. High slope areas were defined as having a slope (in percent) greater than 40 percent. This figure is based on specialist professional judgment and is for the Black Hills. The risk factor is based on the length of a road or route segment that is within a 40 percent slope area. The greater the length of the segment that is on a 40 percent side slope, the greater the risk. The relative risk ratings for high slope areas are as follows:

0 - Relatively Lower Risk: 0 to .1 mile
1 - Relatively Moderate Risk: > .1 to .25 mile
2 - Relatively Higher Risk: > .25 to 2.4 miles

S 2 - Miles in severe erosion risk locations

The severe erosive risk location indicator is used to address potential for road or route damage due to erosion of the road surface and for sediment transport into environmentally sensitive areas. The Black Hills has numerous different soil types at the surface. Some of them have characteristics that contribute to higher potential for erosion and material can move quite readily during rain events particularly if soils are without vegetative cover and are in steep areas. The potential risk is also related to proximity to sensitive areas. The stream and environmentally sensitive proximity risk and high slope risk are covered by other factors.

This indicator was developed in consultation with the National Resources Conservation Service (NRCS) and is based on the idea that the erosive risk of a road or route segment is related to the combination of the erosive nature (erodibility represented by the 'Kw' factor) of the soil that the road occurs on and the grade (percent) of the road. It is possible for a road in lower erodibility soils but steep grades to present an erosive risk equal to a road with higher erodibility but a relatively lower grade. It was determined, based on NRCS data that a severe erosion potential area could be described as one having a higher erodibility (Kw > .22) plus a road grade greater than 8 percent or having a lower erodibility (Kw < .22) plus a road grade of greater than 15 percent.

To identify road locations with severe erosion risk, the most recent NRCS soil data was processed to develop a GIS layer that divided the Forest into areas with a Kw factor less than .22 and areas greater than .22. The Kw factor varies with depth. The depth of 8 inches was selected as the most representative for the surface of a mature high clearance Forest Service road. Another GIS process was used to compute the grade of every road and route segment in 100 meter segments. These erodibility and road grade layers were then combined to compute the number of miles for each segment that met one of the two severe erosion risk criteria. The more miles in a severe erosion location, the more risk for road damage and the more possibility of damage to environmentally sensitive areas. The distribution of miles for each segment was reviewed and the following relative risk ratings were selected:

0 - Relatively Lower Risk: < .25 mile
1 - Relatively Moderate Risk: >= .25 to < .50 mile
2 - Relatively Higher Risk: >= .50 mile to 5.29 miles

Overall Soils Relative Risk

The risk rating for each of the above soil risk factors was added for each segment. The distribution of these sums was reviewed and a cumulative soil relative risk factor was assigned. This factor is used in the overall road risk computation. There is a possible total of 4 points. The cumulative ratings are as follows:

0 - Relatively Lower Overall Risk: 0 Overall Risk Points
1 - Relatively Moderate Overall Risk: 1 and 2 Overall Risk Points
2 - Relatively Higher Overall Risk: 3 and 4 Overall Risk Points

See Appendix A for maps showing each soils risk by segment.

Botany Risk (Five Factors)

The Botany relative risk category above was further divided into five individual Botany related factors.

B 1 - Miles within weed infestation areas

Noxious weeds generally represent a growing risk to the natural distribution and occurrences of plant species in the Black Hills as in other areas of the country. The risk posed by roads is primarily related to ground disturbance and transportation of seeds. Road maintenance, reconstruction and construction activities can expose a dormant seed bed or provide fertile, open ground for new noxious weed seeds brought in by other means. Roads allow vehicle traffic that can spread seeds brought from other parts of the forest or country. Treatment occurs along roads and seeding of road construction areas occurs with Black Hills seed mixes however the risk remains. All roads present a risk associated with weeds however the roads with known weed infestations pose a much higher risk of weed re-growth and spreading of seeds to other areas. The current Black Hills GIS weed layer was used to determine the miles of each road or route that is in a known weed infested area. The results showed higher risks associated with existing system roads than with newer unauthorized routes. Probable causes of this result are that many of weed occurrence areas are currently mapped along existing roads and have been in place longer allowing more time for weeds to develop. Continued use of unauthorized routes will eventually result in the increase of weeds occurrences on those routes also. The distribution of these results was evaluated and the following risk ratings were assigned.

0 - Relatively Lower Risk: < .25 mile
1 - Relatively Moderate Risk: >= .25 to < 1 mile
2 - Relatively Higher Risk: >= 1 to 6.58 miles

B 2 - Miles within 400 feet of riparian areas

The riparian area risk factor is displayed as the miles of road or route segment that is within 400 feet of a riparian area. The 400 foot distance was based on Forest Plan Guideline 9204 that states, if topography allows, roads should not be constructed within 400 feet of a meadow. Riparian areas include meadows although not all riparian area is classified as meadow. Riparian areas are an important habitat for a majority of plant species of concern on the Black Hills National Forest. A road/trail network may alter, remove, or impeded normal growth of riparian vegetation, including herbaceous shrub, and tree vegetation. This can cause changes in riparian plant communities or alter the successional stages/pathways of riparian plant communities. Direct impacts of sediment from roads are one affect to riparian plant communities. Other direct impacts include changes to riparian plant communities caused by changes in hydrology patterns and increased introduction of weed seeds/propagules. Changes to riparian plant communities may also be caused indirectly by roads facilitating increased entry by humans into riparian areas leading to collection or trampling of plants and introduction of invasive plant species. Roads and trails can also facilitate increased entry of livestock into riparian areas, leading to trampling, grazing, and introduction of invasive plant species. Because there is still a large part of BHNF landbase that has not been botanically surveyed, being conservative of riparian areas will support persistence of R2 sensitive and BHNF SOLC plant species. To perform this analysis, the current Black Hills riparian area layer was buffered by 400 feet. The miles of each segment that are located within this total area was determined and the distribution was reviewed. The relative risk ratings for riparian area proximity are as follows:

0 - Relatively Lower Risk: < .25 mile
1 - Relatively Moderate Risk: >= .25 to < .5 mile
2 - Relatively Higher Risk: >= .5 to 8.0 miles

B 3 - Feet within 500 feet of sensitive and species of local concern plant habitat

Roads and trails generally have a negative effect on native plant communities and native plant species of concern (R2 sensitive and BHNF SOLC). The direct impact of roads and trails is loss of plant individuals, plant occurrences, and plant communities. Unlike wildlife, plants are not able to move to avoid construction or use of a road or trail. Indirect impacts to plant species and plant communities include increased introduction of invasive species leading to increased competition for resources; alteration of hydrology patterns; alteration of habitat condition (such as decrease in canopy cover or change in successional stage); increased access for disturbance vectors (including humans and livestock) which lead to increased disturbances such as trampling, cropping, and collecting; disruption of pollinators; and increased dust (causes increased sediment, also plugs stomata (gas exchange structures) on plant leaves). In some cases, there can be an increase in plant numbers found adjacent to roads and trails from a nearby occurrence, mainly due to increased water availability from concentrated runoff. However, the road-edge habitat in not composed of native species and is not stable. These and other impact from roads and trails generally do not support long-term success of road/trail-side populations.

In areas where suitable habitat has been previously determined (on a project-by-project basis, by district botanists), most known plant occurrences fall within suitable habitat polygons. The plant occurrences/habitat polygon is the best estimation of occurrence extent that could be made for

any plant occurrence because it has been ground-truthed by a botanist. For the travel analysis process, the plant occurrence/habitat polygon was used as a basis for determining potential impact from roads or trails. Where plant occurrence point data was not included in previously determined suitable habitat polygon, a plant occurrence/habitat polygon was created by a botanist after examining site characteristics in the vicinity of a plant occurrence point through aerial photography, GIS hillshade command, and other tools.

The determination of risk is based on the assumption made by botanical specialist that any road or trail within a plant occurrence/habitat polygon has a high potential for the direct impact of destroying individuals of R2 sensitive plant species or BHNF SOLC. A buffer of 500 feet was chosen to consider relative risk from roads/ and trails in the vicinity of plant occurrences causing indirect impact and to ensure that a road or trail does not cross into a plant occurrence/habitat polygon. The relative risk ratings for plant habitat polygon proximity are as follows:

0 - Relatively Lower Risk: < 250 feet
1 - Relatively Moderate Risk: >= 250 to < 500 feet
2 - Relatively Higher Risk: >= 500 to 17,155 feet

B 4 – Feet within 300 feet of Botanical areas

The Black Hills has a number of areas that are designated as botanical areas, Management Area (MA 3.1). Botanical areas and other high quality natural communities are located in a number of places throughout the Forest. The common thread to all of them is that they exhibit plant communities, associations and/or individual species of particular interest. High quality MA 3.1 areas, which comprise about 1 percent of the Black Hills National Forest, are generally managed to maintain their botanical features. Management Area 3.1 areas can provide habitat for threatened, endangered or sensitive species, and other elements of biological diversity, or for their scenic and/or public property values. Various disturbances of these areas can cause changes to their environment and/or damage that could take a long time to restore or may never be restored. A variety of risks are associated with roads, however a highly visual risk is that roads can provide easy access to the area by OHVs. If a road passes through or near a botanical area, it could also potentially contribute to the introduction of invasive species (including noxious weeds); alteration of hydrology patterns; alteration of habitat condition (such as decrease in canopy cover or change in successional stage); increased access for disturbance vectors (including humans and livestock) leading to increased disturbances such as vegetation trampling, cropping, and colleting; disruption of pollinators; and increased dust/sedimentation. If a road or trail segment passes within 300 feet of one of these areas, it was determined by botany specialists to be a high potential risk. A GIS accuracy factor of 10 feet was assumed allowing a segment to have up to 10 feet of length computed to be within a buffer zone before it was determined to be relatively higher risk. The relative risk ratings for botanical area proximity are as follows:

0 - Relatively Lower Risk: 0 feet
1 - Relatively Moderate Risk: > 0 to < 10 feet
2 - Relatively Higher Risk: >= 10 to 11,582 feet

B 5 - Miles within 300 feet of Montane grasslands

Black Hills montane grasslands are endemic to the Black Hills (i.e. this plant community does not occur anywhere else outside of the Black Hills) and are found at higher elevation on the limestone plateau and adjacent central core of the Black Hills. They are dominated by grasses and other graminoids but typically forb-rich and known locally for spectacular season wildflower displays. Surveys were undertaken in 1998 and 1999 to identify locations of this plant community and evaluate condition. Twenty-six-sites surveyed in depth were ranked moderate to good quality. Disturbances from roads and trails to locations of Black Hills montane grassland community can cause direct impacts by destroying plants and thus altering the extent or species composition of stands. Indirect impacts from roads and trails include degradation by introduction of invasive species (including noxious weeds); alteration of hydrology patterns; alteration of habitat condition (such as decrease in canopy coverage or change in successional state); increased access for disturbance vectors including humans and livestock leading to increased disturbances to vegetation such as trampling, cropping, and collecting; disruption of pollinators; and increased dust/sedimentation. If a road or trail passes within 300 feet of an identified Black Hills montane grassland community, it was determined by botany specialist to be a high potential risk. All other roads were determined to have a relatively lower risk. The relative risk ratings for montane grassland proximity are as follows:

0 - Relatively Lower Risk: 0 feet
1 - Relatively Moderate Risk: > 0 to < 10 feet
2 - Relatively Higher Risk: >= 10 to 18,569 feet

Overall Botany Relative Risk

The risk rating for each of the above botany risk factors was added for each segment. The distribution of these sums was reviewed and a cumulative botany relative risk factor was assigned. This factor is used in the overall road risk computation. There is a possible total of 10 points. The cumulative ratings are as follows:

0 - Relatively Lower Overall Risk: 0 Overall Risk Points
1 - Relatively Moderate Overall Risk: > 0 to 5 Overall Risk Points
2 - Relatively Higher Overall Risk: 6 to 10 Overall Risk Points

See Appendix A for maps showing each botany risk by segment.

Heritage Risk (Two Factors)

The Heritage relative risk category above was further divided into two individual heritage related factors.

H 1 - Feet within areas un-surveyed for heritage sites

The Black Hills has a large number of heritage sites, many of them resulting from the historical use of this area by several American Indian tribes. Many of these sites have been identified to be protected. The risk posed by road or route segments is the easy access they provide to historical

sites with potential resulting damage. The roads themselves can also disturb sites during construction and maintenance activities. Not all of the Forest has been surveyed. Areas that were used for this risk factor were areas that have not been surveyed. The risk factor chosen for this parameter is the number of feet of a segment that passes through an area which has not been surveyed. The risk is that unidentified sites exist and are currently being damage. Addition of new official routes is not possible until an area is surveyed. The risk for a proposed route is the significant cost to survey the area and the possibility that a site could be identified which would prohibit a new route or require mitigation. Relative risk ratings used for heritage indicator are:

0 - Relatively Lower Heritage Risk: 0 to < 500 feet
1 - Relatively Moderate Heritage Risk: >= 500 to < 1,000 feet
2 - Relatively Higher Heritage Risk: >= 1,000 to 67,200 feet

H 2 - Feet within 30 meters of areas eligible or unevaluated for addition to the National Register of Historic Places

Many of the heritage sites within the Black Hills that have been identified to be protected have been identified through systematic surveys. Not all of the Forest has been surveyed but in areas that have been surveyed, a record exists. Sites that were used for this analysis were either eligible for listing on the national registry, were unevaluated, or of unknown status. Sites that were "not eligible" for listing were not analyzed. The risk posed by roads is the easy access they provide to historical sites with potential resulting damage. The roads themselves can also disturb sites during construction and maintenance activities. The risk factor chosen for this parameter is if a road passes within 30 meters of an archeology site that fell into the above categories for consideration. Segments that are located within this area represent a risk for damage to the heritage resource. The more of a segment that is within this proximity, the greater the risk. Relative risk ratings used for heritage indicator are:

0 - Relatively Lower Heritage Risk: 0 to < 10 feet
1 - Relatively Moderate Heritage Risk: >= 10 to < 50 feet
2 - Relatively Higher Heritage Risk: >= 50 to 16,597 feet

Overall Heritage Relative Risk

The risk rating for each of the above heritage risk factors was added for each segment. The distribution of these sums was reviewed and a cumulative heritage relative risk factor was assigned. This factor is used in the overall road risk computation. There is a possible total of 4 points. The cumulative ratings are as follows:

0 - Relatively Lower Overall Risk: 0 Overall Risk Points
1 - Relatively Moderate Overall Risk: 1 & 2 Overall Risk Points
2 - Relatively Higher Overall Risk: 3 & 4 Overall Risk Points

See Appendix A for maps showing each heritage risk by segment.

Final Overall Relative Risk For Each Segment

The risk rating for each of the above risk categories was added for each segment. The distribution of these sums was reviewed and a cumulative segment relative risk factor was assigned. This risk is a combination all of the individual risk factors. The individual risk factors were combined using two methods. The first was adding each individual risk rating together and assigning ratings based on the distribution of the total. The second was adding the ratings of each of the six categories and assigning ratings based on that distribution. The methods yield different results because the second method gives more weight to the categories that have more factors. To get a final risk of each segment the point totals determined from the two methods were averaged and the averages were given relative risk ratings. There was a possibility of 30 total points once the numbers were averaged. The cumulative ratings are as follows:

0 - Relatively Lower Overall Risk: 0 to 2 Overall Average Risk Points
1 - Relatively Moderate Overall Risk: 2.5 to 4.0 Overall Average Risk Points
2 - Relatively Higher Overall Risk: 7.5 to 21.0 Overall Average Risk Points

5.1.4 Road-Related Values

Baseline road value information is important in transportation planning, as road management activities need to consider the current relative value of roads to the efficient management of the forest and to the public in general. The result of this analysis is a relative road value rating that approximates the value of roads for the five different parameters studied. It could be expected that the value of these roads be high in general because they were constructed for a specific purpose and significant financial resources were invested in them.

In all cases, the individual value indicators are based on relative amounts of a parameter found on the Black Hills National Forest. The actual or 'absolute' value that roads provide to the selected parameters could not be determined within the scope of this analysis. An attempt was made to be conservative in assigning value conditions to increase the likelihood that high value areas would be identified. The assigning of these value conditions and the relative ranking of the results is based, in most cases, on the professional judgment of the specialists involved. It is important to note therefore that the relative value rankings should only be used as an indicator of the road's value and as a flag for project level analysis teams to look at a road in more detail if necessary.

In combining the individual value indicators into the overall relative road segment value rating, the indicators were weighted equally. It is likely that certain risks would contribute more or less to the overall value of a particular road but a valid method of weighting them could not be determined.

General relative value categories were assigned as follows:

0 - There is no or relatively low potential value
1 - There is relatively moderate potential value
2 - There is relatively high potential value

Relative road value was evaluated using the following relative value indicators:

1. **Vegetative Management Access**
2. **Range Allotment Access**
3. **Firefighting Access**
4. **Fuels Treatment Access**
5. **Motorized Recreation**

Relative value ratings were selected, analyzed, rated and compiled using the same method described for relative risks. The detailed discussion and the results are presented below.

1 - Vegetative Management Access

Access to suitable timber was chosen as a value parameter. The vegetation management of the forest requires efficient access by personnel and equipment to suitable timber over well spaced high and low clearance vehicles. The rating factor that was chosen is the number of acres of timber that is within .25 miles of a road. The ML 1 and 2 roads have value because they pass through timber areas allowing direct access for timber extraction. The distance of .25 miles was felt to be an appropriate maxim distance for access to timber without constructing additional roads. In many cases the actual distance could be much longer or shorter. The number of acres of suitable timber within .25 miles of each road was determined and relative values were assigned to each based on the following distribution.

0 - Relatively Lower Timber Access Value: 0 to 20 acres
1 - Relatively Moderate Timber Access Value: >= 20 to 150 acres
2 - Relatively Higher Timber Access Value: >= 150 to 3,058 acres

2 - Range Allotment Access

The Black Hills is divided into 133 areas known as range allotments. Many of these areas are leased to cattle ranchers for cattle grazing for a period of each year. The primary working access to these range allotments by permittees for managing cattle herds is across ML 1 and 2 roads. The rating factor that was chosen is the number of range allotments that a road accesses. The number of allotments was determined and relative values were assigned to each based on the following distribution.

0 - Relatively Lower Range Access Value: 0 allotments
1 - Relatively Moderate Range Access Value: 1 allotment
2 - Relatively Higher Range Access Value: 2 to 4 allotments

3 - Firefighting Access

Access to timber for wildland fire suppression activities is another important road value. A key factor in preventing most fire starts from becoming escaped fires is getting appropriate resources to the fires quickly. The well developed matrix of higher speed and low speed roads throughout the Black Hills is a big factor in historically successful fire suppression activities. Another major value of roads is their use as a natural fire break. Maintenance Level 1 roads are an ideal anchor

point for setting backfires in advance of the flame front of an escaped fire. Most of the large fires in the Forest are contained, at least in part by using roads as fire lines.

To establish a firefighting access value, the Black Hills fire Risk, Hazard, Value (RHV) analysis layer was used. For the RHV analysis, the Forest was divided into a series of polygons. Each polygon was rated for the relative risk (low, moderate, and high) of fire starts, the hazard present once the fire starts, and the values at risk in the polygon. To estimate the firefighting access value, low, moderate and high ratings were assigned the numbers 0, 1, and 2 respectively and the numbers were totaled for each polygon. The resulting totals (RHV Rating) ranged from 1 through 6. The firefighting access value rating for each road was then calculated from the number of acres with a high RHV rating (4, 5, or 6) that are within .25 miles of a ML 1 or 2 road. The distance of .25 miles was felt to be an appropriate average distance for quick access by a fire crew or brush truck across an un-roaded area from a ML 1 or 2 road. In many cases the actual distance could be much longer or shorter. The distribution of the acres within .25 miles of each ML 1 and 2 road was reviewed and the following ratings were assigned.

0 - Relatively Lower Firefighting Access Value: 0 to 125 acres with a high RHV rating
1 - Relatively Moderate Firefighting Access Value: >= 125 to 250 acres with a high RHV rating
2- Relatively Higher Firefighting Access Value: >= 250 to 3,938 acres with a high RHV rating

4 - Fuels Treatment Access

Access to the forest for the treatment of fuels is another very important road value. For the purposes of this analysis, the high priority fuels treatment areas were chosen to be areas in the Black Hills Fire Hazard Layer that were rated High Hazard in ponderosa pine, white spruce, aspen, birch, oak, and grass. These hazard ratings were previously determined using cover type, structural stage, elevation, slope, and aspect. Maintenance Level 1 and 2 roads have value because they pass through areas that are high priority for fuels treatment and they also have value when they get near these areas where access to fuels can be gained directly. As with suitable timber and firefighting access, the distance of .25 miles was felt to be an appropriate average distance for access across un-roaded land for fuels treatment personnel and equipment. The acres of high hazard areas within .25 miles of each road were determined and relative values were assigned to each based on the following distribution.

0 - Relatively Lower Fuels Access Value: 0 to 125 acres of high hazard area
1 - Relatively Moderate Fuels Access Value: >= 125 to 250 acres of high hazard area
2 - Relatively Higher Fuels Access Value: >= 250 to 2,788 acres of high hazard area

5 - Motorized Recreation

All Forest Service roads represent an opportunity for motorized recreation of one form or another. The open roads have current value in this category. Roads and routes that were specifically requested for OHV use in the most current round of Forest user inputs were given additional emphasis. Current value for motorized recreation was estimated as follows:

0 - Relatively Lower Motorized Recreation Value: Road is currently closed
1 - Relatively Moderate Motorized Recreation Value: Road is currently open
2 - Relatively Higher Motorized Recreation Value: >= Road or Route has been specifically requested for motorized use.

Overall Relative Value for Each Road Segment.

The value rating for each of the above value factors was added for each road with 10 being the highest sum. The distribution of these sums was reviewed and an overall relative road value factor was assigned. The cumulative ratings are as follows:

0 - Relatively Lower Overall Road Value: 0 to 3 points
1 - Relatively Moderate Overall Road Value: 4 to 6 points
2 - Relatively High Overall Road Value: 7 to 10 points.

Map 41 in Appendix A shows the overall road value by segment.

5.1.5 Public Input (Social Values)

Public Involvement

Preliminary public involvement was initiated in 2003 in an effort to familiarize the public and stakeholders throughout the Black Hills region with the objectives of travel management. Between 2003 and 2007, the Black Hills National Forest hosted and participated in numerous public meetings and workshops in Wyoming and South Dakota.

Between 2004 and 2006, the OHV and Travel Management subcommittees of the Black Hills National Forest Advisory Board (NFAB) conducted a number of public meetings to solicit general comments on travel management. The meetings were held in South Dakota and Wyoming to discuss and review Subcommittee objectives and the current Forest Service national OHV policy direction, and outline plans for the future. The purpose of these meetings was to gather input to help develop recommendations to assist Forest managers in future OHV policy planning.

The Travel Management subcommittee also distributed a *User Needs Assessment Questionaire* to solicit comments from both OHV and non-OHV users to evaluate the potential for establishing a designated OHV trail system on the Black Hills National Forest. The 559 comments submitted helped the Subcommittee define opportunities for an OHV trail system and understand potential conflicts with other users.

Four "Travelways" Workshops were conducted by the Forest during November 2006. The purpose of these workshops was to gather public input and ideas for the development of a proposed action. A product from these workshops was a collection of forest site specific information from participants after they completed a mapping exercise.

The public was also asked to provide input to the Forest Service on routes wanted for motorized use and/or routes that may be in conflict with other desired conditions sought by the public on Forest lands. This initial public involvement ended in 2007 with the agency receiving numerous comments on individual routes, a large number of general comments, and some area-wide comments on travel.

During the last year, significant public input has been provided by individuals and user groups describing the value they place on areas, roads and routes in the Black Hills. Significant effort was also expended by the Forest Service to capture this information in digital files that could be processed in the GIS environment. Data provided in graphic form was loaded into GIS spatial data layers for viewing and mapping. Data provided on forms was summarized and categorized in a report from which data was loaded into a GIS spatial layer. These value data were successfully digitally attached to each road and route segment that was analyzed, however the nature of the data did not lend itself to ranking as was possible with the resource management data. The information is present in the spreadsheet and can be viewed for each segment by analysts when making decisions. The GIS spatial layers were used to generate social value thematic maps that can guide decision makers in making large and small scale comparisons. Roads and unauthorized routes that were requested for motorized use in this process were also used in the GIS system when doing value computations for roads and identifying potential trails. Thematic maps showing the data are presented in Appendix A (Maps 42 thru 45). The Excel data spreadsheet that shows these social values attached to each road or route segment is found in Appendix B. The following list represents the types of data processed in this manner.

1. GPS data (930 miles) provided by users reflecting which roads and routes were desired for motorized use (by vehicle type).

2. Motorized and non-motorized values based on (DOT Matrix) forms submitted at public meetings in 2006.

3. Motorized and non-motorized values based on area mapping (Crayon Exercises) developed at public meetings in 2006.

4. Motorized and non-motorized values based on area and line input from groups, including the Norbeck Society, the Rocky Mountain Elk Foundation, and the South Dakota Off-Highway Vehicle Coalition (SDOHVC).

5.1.6 Management Options/Recommendations - Roads

By characterizing the road values and risks on a low, moderate, and high scale, a three by three matrix of road priorities (Categories) can be constructed. The categories can be assigned numbers that relate to the priority that the roads in that category should have when allocating maintenance, repair, and mitigation funds and when making forest wide transportation management decisions. The relatively high risk categories are assigned the high priority numbers starting with High Value/High Risk as a 1 or Highest Priority, followed by Moderate Value/High Risk with a 2, etc. In a similar manner, the Moderate Risk Categories are priority 4 thru 6 with 4 being High Value/Moderate risk. The Low Risk Categories are priority 7 thru 9.

Table 5-1 shows the Category Matrix and the number of miles of road that falls within each category/priority. The matrix discussion also shows some recommendations for future road maintenance and transportation management decisions. These recommendations are general recommendations. Project level analysis teams would have to look at these roads, particularly the relatively high risk roads, in their project area in the context of the current budget levels and many other issues relevant to the road at the time.

Table 5–1. Value/Risk Analysis Priority Matrix – Road Management Categories

	VALUES				
RISKS	**Scores**	**High (7-10)**	**Moderate (4-6)**	**Low (0-3)**	**Totals**
	High (7.5-21)	**Category 1** Mitigate, Maintain 441 Segments (1,084 miles)	**Category 2** Mitigate, Maintain 193 Segments (353 Miles)	**Category 3** Mitigate, Restrict, Close, Decommission 0 Segments (0 miles)	1,437 Miles
	Moderate (2.5-7.0)	**Category 4** Mitigate, Maintain 1,052 Segments (1,217 miles)	**Category 5** Mitigate, Maintain 1,324 Segments (1,061 miles)	**Category 6** Mitigate, Restrict? 123 Segments (57 miles)	2,335 miles
	Low (0-2.0)	**Category 7** Maintain 207 Segments (109 miles)	**Category 8** Maintain 980 Segments (295 miles)	**Category 9** Evaluate Need 254 Segments (54 miles)	458 miles
	Totals	2,410 miles	1,709 miles	111 miles	4,230 miles

Roads with a relative risk rating of 7.5 or more represent those roads that may be causing resource impacts, while those with a risk rating less than 7.5 are not as much of a resource impact concern. Roads with relative value ratings of greater than 0 represent roads that have access value either to resource managers or the recreational public. They represent a financial investment; have value in at least one of the value categories, and in the absence of an unacceptable environmental or management risk that cannot be mitigated, it is reasonable to retain them.

Within each category, there are possible management actions for roads as follows:

Category 7. High Value/Low Risk—Ideal Situation - 109 road miles

- Maintain to standard by focusing road maintenance funds on these roads.
- Review for potential resource concerns.
- These roads form an important part of the minimum road system for the Forest.

Category 1. High Value/High Risk—Priorities for Capital Improvement – 1,084 road miles

- These roads are a high priority for local-level roads analysis to identify high-risk reduction needs.

- These roads are a high priority for capital improvement funding.
- Increase maintenance funding to these roads to keep resource risks from increasing.

Category 3. **Low Value/High Risk—Priorities for Risk Analysis -0 road miles**

- These roads are moderate priority for local-level scale roads analysis to identify high-risk reduction needs and to confirm low road use value.
- These roads have potential for reducing maintenance level.
- Consider decommissioning if not needed for other purposes.

Category 9. **Low Value/Low Risk—Priorities for Reducing Maintenance Level/Decommissioning - 54 road miles**

- These roads are lowest priority for expending annual road maintenance funds.
- These roads are moderate potential for decommissioning or reducing maintenance level.
- Consider for conversion to trail or linear wildlife opening depending on need.

5.1.7 Minimum Road System

The minimum road system needed for safe and efficient travel and for administration, utilization, and protection of NFS land (the minimum road system, 36 CFR 212.5(b)) strikes a balance between the benefits of public access to NFS lands and the costs of road-associated effects on ecosystem values, taking into account public safety, affordability, and management efficiency.

One of the major objectives of travel analysis is to identify a minimum road system as described above. The broad based, Forest-scale analysis of roads discussed in previous sections estimated the risks and values associated with each road in the current road system. The existence and status of these roads were determined under previous management decisions and it is not the intent of the 2005 Travel Management Final Rule to make changes to the existing inventory without taking into account past decisions. Recommendations for future management decisions concerning roads were summarized in Section 5.1.6. That summary did not recommend closure or decommissioning of any specific roads currently on the system without a detailed project level consideration of the information presented in this analysis and any information outside the scope of this analysis.

The analysis for ML 3, 4, and 5 roads was completed in a Forest-Wide Roads Analysis in 2005. It identified risks and values for these higher speed gravel and asphalt (ML 3, 4, and 5) roads. It did not identify any roads for closure. A portion of these roads are under county jurisdiction but they are listed as part of the Forest Service System. The Forest Service and the counties jointly manage these roads under cooperative agreements but the majority of the maintenance responsibility rests with the counties. These roads are an integral part of the collector and arterial roads that are the backbone of the Forest transportation system. In some cases, the Forest Service and a county will have jurisdiction of different portions of the same road.

The recommended minimum road system is the current transportation system which includes all ML 1, 2, 3, 4, and 5 NFS roads. The ML 1 (closed/stored) roads are included. They are not currently open to motorized travel but they are needed for future use. As noted in Tables 2-2 and

2-3 of this analysis, the total Forest Service System as of March 2007 was made up of 5,248 miles of roads. Of those, 4,884 were under Forest Service jurisdiction. This total changes frequently based on decisions made after project level analysis, primarily timber sales. Roads are added when needed and others are removed when it is determined that they are no longer necessary or there is a management area or environmental issue that cannot be mitigated. This minimum recommended road system and the detailed travel analysis presented here is intended to serve as the baseline information to be used in conjunction with more site specific information to aid in making future decisions such as vegetation management Environmental Analysis (EA) and the Environmental Impact Statement (EIS) analysis necessary for the implementation of 2005 Travel Management Final Rule.

The recommended minimum road system is shown on Map 47.

5.1.8 Roads Recommended for Public Motorized Travel

The second major objective of travel analysis is to identify a system of roads, trails, and areas that are designated for motorized travel. Trails are discussed in Section 5.2 and areas in 5.3. The recommended minimum roads system from Section 5.1.7 is includes a number of roads that are currently closed (ML 1) and roads that cross private land.

The ML 1 roads have been closed to motorized use based on previous management decisions and this analysis was not intended to change those decisions. The recommendation would be to not include them in a public motorized system without further project level consideration.

The public comment and department responses section of the Rule in the Federal Register addressed access to motorized vehicles across private property. *"Some user-created roads and trails on NFS lands cross private property. The agency generally will not consider a road or trail on NFS lands for designation unless there is legal public access to that road or trail. Where access to NFS lands from private property is needed, the Forest Service will seek rights-of-way from willing sellers. If public access cannot be secured, these routes generally will be closed to motor vehicles under the final rule."* This analysis identified 275 road segments that may cross private land without a right-of-way. This number is likely high because the Right-Of-Way (ROW) database used is not complete. Many conflicts could have been resolved in recent decisions and the data may not have reached the centralized ROW database. It is also possible that some roads were erroneously identified because of the accuracy and precision of GIS land ownership and road special data. These ROW roads were flagged as having a potential ROW issue and were not included in the roads recommended for public motorized travel. Additional research during upcoming analysis will be necessary to determine their status. An additional 242 road segments were identified as passing within 150 feet of private property. It is possible that a few of these segments could be across private property because of inaccurate property line or road location data.

The existing condition is that roads are open to motorized traffic unless specifically closed. With the exception of roads with possible ROW issues, this broad based, Forest-scale analysis does not recommend a change without additional information considered in a future EA or EIS process.

Map 47 shows the roads recommended for public motorized travel. Map 10 shows the roads and unauthorized routes that were identified as possibly crossing non Forest Service land without a recorded ROW.

5.2 SETTING PRIORITIES - TRAILS

The current motorized trail system is a 14 mile section of the Centennial Trail. Current management direction allows OHV use of all of the Forest road system and off road areas except for roads and areas where motorized use is expressly prohibited. A more comprehensive trail system is needed to allow successful implementation of the Rule and help fill motorized and non-motorized user needs. This section concentrates on setting priorities for expanding a motorized trail portion of the Forest transportation system.

5.2.1 Method

Sources of new motorized trails could be converting existing ML 1 and 2 roads, unauthorized routes, newly inventoried user created routes or establishing new trails with no existing footprint. A decision to convert an existing road to a trail should be accompanied by a more detailed, site specific analysis. It may also be possible to coincidently manage a road as a road and a trail at the some time. To aid in setting priorities in determining locations for new trails, the existing roads and routes were analyzed for environmental and management area risk. Public motorized and non-motorized values were added to the individual segments in the spreadsheet data and the user input files were used to create thematic maps that summarized how users valued roads and areas. Unauthorized and user created route locations were also filtered against existing management and closure areas where motorized road and off-road use is currently prohibited or restricted.

5.2.2 Potential Trail Risks and Values

This portion of the analysis discusses the risks associated with developing trails from existing roads and routes. The risks and values of ML 1 and 2 roads were considered in Section 5.1. The same GIS risk analysis that was completed for roads in Section 5.1. was also completed for all previously inventoried unauthorized routes and new user created routes. The values that were associated with potential motorized trails were based largely on whether the roads or routes were requested by motorized users. This data is stored in the spreadsheet in Appendix B and in numerous risk maps in Appendix A. Two of the more important maps are Map 3 which shows the overall unauthorized route density on the forest and Map 35 which shows the over relative risk represented by each unauthorized route segment.

5.2.3 Public Input

The description of what motorized trail related public input was collected and how it was used is the same as the description in Section 5.1.5.

5.2.4 Management Area Filters

The proliferation of new unauthorized routes across the forest is widespread and includes routes in areas where new roads and/or motorized travel is prohibited or restricted by the Forest Plan or closure orders. It also includes routes across private land where there are no recorded ROWs. The GIS software was used to overlay unauthorized routes over these areas to identify which routes could be considered for inclusion in a motorized trail system and to flag routes for observation, mitigation or perhaps closure and rehabilitation. The results are presented in the spreadsheet in Appendix B and on Maps 7, 8, 10, and 49 in Appendix A. The Forest ROW layer was used for the comparison with roads and routes across private land. This layer is likely to be incomplete in some areas resulting in the possibility of identifying some roads without ROWs incorrectly. The following lists show the management areas and closure areas that were considered.

Management Areas where Forest Plan prohibits or limits motorized travel on and off roads and infers or states "no new routes".

- **1.1A – Black Elk**; Prohibit motorized use & new routes. Obliterate existing roads or unneeded trails.
- **2.2 – RNA's**; Prohibit motorized use on & off roads except for research or emergencies. Close or obliterate existing roads.
- **3.1 – Botanical**; Motorized allowed on roads. Prohibited off roads except for administrative use. No new roads. New trails only for interpretive, educational, or correct environmental damage.
- **3.2A – Inyan Kara**, Motorized prohibited on & off road. No new roads.
- **3.32 – Backcountry Non Motorized**; Motorized prohibited on & off road. Exceptions for main roads and administrative use. Motorized trails will not be developed.
- **3.7 – Late Successional** (Sand Creek only) – Motorized travel restricted to designated routes. Off road is prohibited. Nothing new in Sand Creek only,
- **5.1A – Southern Hills Forest & Grass land Areas** (Pilger Mountain only), On & Off permitted but "no new roads on Pilger Mountain only";
- **5.4A – Norbeck Wildlife Preserve**; No new trails.

Existing Closure Areas where motorized travel is prohibited on and off roads and the area is not already covered by a Management Area restriction.

0 – Spring Creek Headwater
11 – Box Elder Forks Walk in Fishery
11 – Elk Creek Walk in Fishery
11 – Fort Meade Admin. Watershed
11 – Sturgis Experimental Watershed
24 – Spokane Mine
34 – Bighorn Sheep Area
79 – Craven Canyon

Management Area where the Forest Plan restricts motorized use to designated routes and prohibits off road motorized use.

3.7 – Late Successional
4.1 – Limited Motorized & Forest Products
4.2A – Spearfish Canyon
4.2B – Peter Norbeck Scenic Byway
5.2A – Fort Meade VA Watershed
5.3B – Sturgis Experimental Watershed
5.43 - Big Game & Resource Production

Existing Closure Areas where motorized travel is restricted to designated routes and off-road motorized use is prohibited and the area is not already covered by a Management Area restriction.

0 - Blank Fox / North Castle Creek
0 – Botany Canyon
0 – Pactola Extension
11 – McVey Wildlife Area
11 - Pactola Rapid Creek
11 – Beaver Creek Walk in Fishery
11 – Pactola Lake Recreation Area
11 – Sheridan Lake Recreation Area
11 – Roubaix Lake
11 - Castle Creek Walk in Fishery
11 – Deerfield Lake
31 – Polo Peak - Is Motorized Rec. MA 3.31
32 – Shanks Quarry
35 – Victoria Creek
36 – Victoria Creek Management Area
37 – Buzzards Roost
58 – Jasper Fire Area
68 – Battle Creek Fire Area
69 – Elk Mountain & Rogers Shack Fire Area
81 – Red Nose
82 – Beaver & Bear Gulches
82 – McIntosh Fen
82 – Englewood Springs
82 – Higgens Gulch
93 - Ricco Fire Area
94 – Crook Mountain
95 – Red Point Fire Area

The identification of unauthorized route segments as being located in management and closure areas where they are currently prohibited or restricted does not mean that they could not be considered for inclusion in a future trail system. Managers may find that the relative importance

of a specific trail may lead to mitigating or accepting risks in some cases. Some closure areas such as fire areas are temporary. The future termination of a closure order could free up trails that are currently prohibited.

5.2.5 Management Options

The management options for the design of a motorized trail system for the Forest are quite varied. The potential for conflicts between the many different users groups is quite real. The financial resources necessary to develop and maintain a new motorized trail system are currently not identified. The legal and natural resource management issues are complex.

A successful motorized trail system has been described as one that is:

- Socially Acceptable
- Economically Feasible
- Environmentally Sustainable

Tom M. Crimmins, in a National Off-Highway Vehicle Conservation Council (NOHVCC) publication Management Guidelines for OHV Recreation stated *"Virtually all successful OHV programs include many of the same elements and have managers that can visualize and apply the concept of the '4 E's of management"*. The 4 E's are:

1. **Engineering** – Designing the facilities to address issues.
2. **Education** – Telling participants what is expected, important, and interesting.
3. **Enforcement** – Identifying and dealing with problems.
4. **Evaluation** – Making sure your actions are accomplishing your goals.

Selecting a successful option that will aid managers in the application of the 4 E's will be a complex task. It will require significant resources, patience and time by all of the parties involved when considering the detailed natural resource management data represented in this report. Sources of new motorized trails could be the conversion of existing ML 1 and 2 roads, coincidently managing some ML 1 roads as trails, conversion of unauthorized and newly inventoried user created routes, or construction of new trails with no existing footprint. The existing roads and routes have been analyzed for the environmental risks they may present if incorporated into a trail system. Public input has been collected, processed, mapped and recorded in a spreadsheet, and roads and routes have been evaluated for compliance with existing management area direction. The results are discussed in more detail in the next section. This data can now be used in developing alternatives and making a decision.

5.2.6 Potential Trails

The analysis discussed above has resulted in the construction of several maps that are presented in the Appendix A. Maps 1 thru 3 show the density of roads and unauthorized routes on the forest. Maps 7 and 8 identify unauthorized routes that cross prohibited or restricted management and closure areas. Map 10 shows roads and unauthorized routes that cross private land without a recorded right-of-way. Maps 11 thru 33 show the estimated relative environmental risk for each

road and unauthorized route. Map 35 shows the overall relative risk data for the unauthorized routes. Maps 42 thru 45 show the motorized and non-motorized user input data. Maps 48 and 49 show the ML 1 (closed) roads and unauthorized routes that have potential to be developed as part of a motorized trail system based on the fact that they do not violate a management area or cross private land without a right-of-way. These two maps do not take into account the severity of the environmental risk described on Map 35.

5.3 SETTING PRIORITIES - AREAS

Yearlong off-road motorized travel is currently authorized over approximately 59 percent of the Forest. Seasonal off-road travel is authorized over an additional 23 percent. The general intent of the 2005 Travel Management Final Rule is to close forests to general off-road motorized travel and manage motorized travel by restricting it to a system of designated roads, trails, and areas. Responsible officials are not required to establish areas for motorized vehicle use but may do so after appropriate environmental analysis.

5.3.1 Area Related Risks and Values

The Rule states that for trails and areas, the responsible official shall consider issues with the objective of minimizing:

1. Damage to soil, watershed, vegetation, and other forest resources.
2. Harassment of wildlife and significant disruption of wildlife habitats.
3. Conflicts between motor vehicle use and existing or proposed recreational uses.
4. Conflicts among different classes of motor vehicle uses.

And to consider:

5. Compatibility of motor vehicle use with populated areas (sound, emissions, other factors).

The risk and value data described under Setting Road and Trail Priorities was gathered for use in the above considerations. The data is valuable in evaluating roads, trails, and areas. Additional information related to the estimated relative environmental risks of the forest road system on the Forest by 6th order watersheds is presented in the Black Hills National Forest, Forest Wide Roads Analysis (RAP) conducted and reported in 2005.

5.3.2 Management Options

General guidance concerning designation of off-road motorized areas is derived from FSM 7715.63.

1. Responsible officials are not required to establish areas on NFS land for motor vehicle use but may do so after appropriate environmental analysis.
2. Areas are not intended to be large or numerous.
3. Areas should have natural resource characteristics that are suitable for motor vehicle

use or should be so significantly altered by past actions that motor vehicle use might be appropriate. Examples could include sand dunes, quarries, and lands within the pool area and below the high water level of reservoirs.

4. Avoid designating areas that are adjacent to private property or that do not have easily identifiable geographical features as boundaries.

5.4 OPPORTUNITIES FOR ADDRESSING PROBLEMS AND RISKS

This section provides a discussion on how to mitigate problem and risk areas. The topics are centered on the issues developed in Section 3 of this report.

1. Solitude
2. Air Quality
3. Managing Livestock
4. Signing
5. Environmental Health
6. Wildlife Habitat
7. Recreational Opportunities
8. Law Enforcement
9. User Conflict
10. Managed Roads and Trails
11. Budget
12. Safety
13. Economic Stability
14. Private Land and the Urban Interface

5.4.1 Solitude

Conflicts arise between motorized users enjoying a ride and non-motorized users seeking quiet of natural surroundings in the forest.

Trailheads and/or concentrated OHV use near residential areas lead to conflicts between users and homeowners. Designation of trails may increase noise in some areas of the Forest.

Wildlife may be affected by noise created through OHV use.

There is an industry standard applied to OHV's for noise level produced by the machines when manufactured. However, because of aftermarket changes, some of these machines exceed these levels in a forest setting. The noise level of some machines has produced a negative attitude toward OHV recreation and has resulted in the loss of OHV riding areas across the country. Limiting the allowable noise to a standard level (96 DB(A)) for OHV's may mitigate some of the user conflicts on the forest. Enforcement of the noise level would be key to the success of such a limit. A simple, standard noise-measuring instrument is available at a reasonable cost. Noise limits and noise measurements are being used successfully in other forests and natural resource areas. Locating trails and trailheads away from residential areas should also reduce the

opportunity for conflict. Establishing a noise standard and designating motorized roads and trails away from sensitive wildlife areas should reduce the effects on wildlife.

5.4.2 Air Quality

Increased dust caused by OHV use is a concern near communities and subdivisions.

Increased dust caused by OHV use can cause conflicts between user groups.

Air quality impacts from NFS roads are associated with vehicle emissions and dust from traffic on unpaved roads. These effects typically are localized and temporary, and their extent depends on the moisture levels and the amount of traffic. Most of the unpaved ML 3, 4, and 5 roads in the Forest under Forest jurisdiction are located in unpopulated areas with relatively low traffic volumes. Dust issues on ML 1 and 2 roads typically are less severe; however there are issues on some ML 2 roads that have high traffic levels. Dust abatement is a relatively expensive activity and is dependent on budget levels and priorities. Historical budgets have not been sufficient to support other than minimal abatement activities. Dust abatement activities have been required primarily when project level analysis for timber harvest identifies needs near residential areas. In those cases, the abatement efforts are made the responsibility of the timber purchaser under the timber sale contract.

Concentrating motorized use on roads and trails can potentially increase the amount of dust created in some areas. Converting roads to trails or otherwise creating new motorized trails will create an opportunity to route trails through materials that are less likely to give off dust; to bring in stable, low dust, surfacing materials; and to try new surface stabilization chemicals. A new or increased source of trail related funding would likely have to be found to do this.

5.4.3 Managing Livestock

An OHV trail system located in permitted range allotments may impact the cattle. Noise, loss of vegetation, interaction with people and open gates may increase due to motorized trail designation through range allotments.

An opportunity exists when designating roads and trails for motorized use to designate them in areas where cattle do not typically forage for food such as areas with steep ground, little grass or no water sources. Where funding allows, it may be possible install gates engineered for ease of use by OHV users including ones that close automatically.

5.4.4 Signing

Forest Service road and trail markings are numerous and difficult to maintain because of vandalism, cattle, and fire. Increased use and increased need for signs to describe OHV opportunities will likely make the problem larger and more expensive.

Clearly marked roads and trails aid all users in knowing what to expect on the route ahead. Trails can be signed for user restrictions, difficulty levels, distance, connections, etc. A properly

signed trail is important to the success of the trail system. Installation and maintenance costs for trail signing must be considered when designing the sign plan for a trail system.

It is possible that vandalism of Forest signs will decrease after implementation of the Rule if Forest users recognize that destroying a sign that locates a route that is open to motorized travel will reduce the usability of the system overall. A road and trail system map will be available but the loss of signs will make it more difficult for users to determine where travel in legal. New or increased funding sources will likely be necessary to provide signs for a new trail system. Sign locations such as route markers that have experienced "cattle damage" could be considered for a more cattle resistant sign. Preventing sign damage due to wildland fire may be possible but consideration would have to be given to the potential increased costs versus just replacing route markers in a fire area with an inexpensive one as the damage occurs. Future signing efforts will likely reflect a selective process based on monitoring and evaluation of need.

The 2005 Travel Management Final Rule reduces reliance on signing on the ground somewhat with the requirement of the production and use of a Motor Vehicle Use Map (MVUM). The MVUM describes the vehicle types and time periods that are legal on designated roads and trails.

5.4.5 Environmental Health

User created routes often are not located or engineered properly to sustain OHV traffic, therefore, causing environmental damage with continued use (e.g. motorized vehicles in fragile or steep terrain).

Proliferation of user created routes (parallel trails or roads, illegal travel off designated routes) is causing resource damage.

Unrestricted seasons of use (routes open to motorized travel too long into the wet or muddy seasons) is causing resource damage.

Having the trail system adjacent to traditional, cultural, and historic sites in the Forest can lead to vandalism of those sites.

Use of a motorized trail system may alter wildlife behaviors and movement patterns.

Roads or trails designated for OHV use located near streams or with unimproved stream crossings may cause or increase erosion, degrade water quality, and /or impede the passage of aquatic organisms.

Roads or trails use, maintenance and construction may facilitate the spread of noxious weeds.

The reason for the development of the Rule by the Forest Service was to manage the proliferation of user created routes, illegal travel off designated routes and uncontrolled cross country motorized travel. The successful implementation of the Rule is intended to significantly reduce environmental damage, undesirable effects on cultural and historic sites, and wildlife disturbance. Trails that are properly constructed and maintained, are logically located in relation to user wants and needs, and are clearly identified for specific uses, will aid in long term

sustainability. Monitoring the designated road and trail system and making adjustments as conditions change will aid in maintaining environmental quality of the area.

The damage caused to roads and trails because of unrestricted seasons of use is primarily the result of motorized travel on ML 2 roads when they are wet and soft. A majority of this damage seems to occur in the spring and fall when large numbers of vehicles enter the Forest for different hunting seasons. The roads can become deeply rutted in some areas creating drainage and erosions problems that in some cases can become significant. Currently, funding levels restrict the maintenance of these roads to once every five years unless special conditions require more frequent maintenance or repair. One opportunity to reduce some of this damage would be to temporarily close ML 2 roads when they are too soft by placing closure notifications and maps on the Forest Service web site. This would require a public information program to inform the public in advance that the system exists and that they should check the web site when they plan to travel on those roads. This system is in place on other forests.

5.4.6 Wildlife Habitat

> *Off-Highway Vehicle use may disturb or harm wildlife when routes are located in important or critical wildlife habitat areas. Too many roads in wildlife habitat areas, and disturbance to wildlife during critical lifecycle periods are issues to consider.*

The current Forest Management Plan has guidance for the protection of wildlife and wildlife habitat. Areas of the forest are set aside permanently and seasonally that have restrictions on motorized use for the purpose preserving habitat, reducing road densities, and giving wildlife a place where they will not be disturbed. Implementation of the Rule will further increase the area of the Forest where wildlife can live undisturbed.

5.4.7 Recreational Opportunities

> *There are concerns about loss of recreational opportunities when existing routes are closed to motorized travel and loss of semi-primitive and primitive recreational opportunity if more routes or areas are open to motorized travel.*

The most noticeable loss of motorized recreational opportunities because of implementation of the Rule will be the loss of the ability to travel off designated roads and trails. That change is mandated by the Rule. Any further loss of motorized opportunities will depend on the final designation of roads and trails. The possible combinations of roads and trails that could be designated is quite large but the ultimate solution will depend largely on how large a system can be built and maintained, how the system conforms to environmental protection requirements, and how well the many different user groups work with the Forest Service to designate a system that address the needs of all. One of the possible outcomes is that there will be more roads and routes available for motorized travel. The current management restrictions placed on primitive and semi-primitive areas are to preserve the primitive nature of those areas. These restrictions under normal circumstances, would severely limit additional motorized routes in most of these areas

5.4.8 Law Enforcement

There are concerns whether the agency can enforce decisions on allowed routes and uses for motorized travel.

Law Enforcement costs and responsibilities may increase due to the influx of motorized users near communities and private landowners.

The enforcement of motorized travel restrictions is an extremely important part of the successful implementation of the Rule. Current law enforcement resources are limited and the prospect of those increasing is not good.

In some respects, compliance under the new Rule may be easier. Route identification signs corresponding to the MVUM should be on the ground and off-route motorized travel will be prohibited. There are a large percentage of motorized users, including individuals, motorized and non-motorized groups, landowners and businesses that are knowledgeable and concerned that the Forest is protected and that access to the Forest be preserved. The conscious efforts of this large group may aid significantly in informing the relatively small group that is either uninformed or unwilling to recreate in a manner that is legal and responsible.

Additional opportunities to improve the effectiveness of limited law enforcement would be to design a system that is logical and easy for both local and out of state users to understand; to design a system that addresses the needs of the motorized users; and to form partnerships with groups, businesses and other agencies that will help build, maintain and manage portions of the motorized trail system.

5.4.9 User Conflict

Increase interest in our national forests has caused user conflicts across the country. Forest visitors want to recreate in a natural setting in a wide variety of ways. Some enjoy hiking the peace and quiet of a forest. Others enjoy the challenge the terrain provides for OHV riding. The conflict between motorized and non-motorized users is an ongoing issue. The quality of the forest recreation experience may be affected for all users when not prepared for other forest users.

Private landowners may have issues with trespass or property damage that can occur with concentrated OHV use.

Various types of motorized vehicles using a multi-use system of roads and trails may have conflicts in regard to speed, noise and dust, and trail conditions. Inexperienced riders may be a hazard to experienced riders (or visa versa) using the same trail.

The opportunity to address these and many other potential user conflict issues is in the design and implementation of a comprehensive trail system that addresses these issues. There are written guidelines generated by public and private organizations that describe motorized trail systems that attempt to minimize these conflicts. It is a very large task but the raw materials are

there. The Forest area is large, with a wide variety of scenery and terrain and a well developed system of roads to work with.

5.4.10 Managing Roads and Trails

The National Forest System is experiencing a dramatic rise in use by OHV enthusiast. The Forest Service is struggling to appropriately and reasonably accommodate this need.

The lack of a well thought out motorized trail system in answer to a growing interest n motorized recreation on the Forest will decrease the quality of the forest visit for all users.

The opportunity to deal with these issues is presented in part by the successful implementation of motorized trail system in the Forest as discussed in the User Conflict issue above. Long-term success in providing a satisfactory recreational experience to Forest users will depend to a certain extent on the size of the demand. If the popularity of OHV recreation continues its rapid growth, even a large, well-designed trail system could be overwhelmed.

5.4.11 Budget

The downward trend in federal budgets will limit maintenance of the existing system and opportunities for new trail construction for motorized recreation. The demand for motorized recreation opportunities is growing. A trail system too small to meet the demand of the users may result in user conflicts, and increased need for maintenance and law enforcement.

Section 4.5 clearly demonstrates that annual maintenance funding is inadequate to maintain the current road and trail system on the Forest. Over time, road and trail conditions can be expected to continue to incur additional deferred maintenance costs and degrade unless maintenance funding increases and significant road reconstruction/improvement funding becomes available or the number of roads is reduced. The challenge for the Forest Service is to identify ways to more efficiently spend the limited road maintenance dollars allocated to the Forest, to identify ways to reduce costs, or to identify new revenue sources.

One approach is to reduce or eliminate expenditures on roads that are of low value and/or of low risk. Because of the nature of the roads analyzed, there are few low value roads. Other management options include reducing overall maintenance efforts and concentrating on road segments in poor condition. This would not be a desirable long-term approach. A joint Forest Service/County review of roads could be conducted to identify roads that could realistically be shifted to county jurisdiction or could be jointly maintained. This would be conducted in an environment when county budgets also are inadequate.

Surface rock replacement rates charged timber purchasers for use of gravel roads could be reviewed to determine if the current rate being charged is appropriate for the amount of gravel lost during timber haul. Increased volumes of timber sold could be expected to increase the number of miles of road maintained periodically by timber purchasers. These miles include blading of ML 3, and 4 roads and reconstruction and maintenance of ML 1 and 2 roads. A proportional amount of reconstruction/improvements to ML 3, 4, and 5, roads could be added to

timber sale road packages when resource and user safety issues are significant. Some roads for which year round access is not required could be identified for temporary or permanent closure. Roads across private land without a recorded ROW could be closed if not required for access, if appropriate.

The development and maintenance of a large motorized trail system in this funding environment would be quite difficult. A recent motorized trail reconstruction contract was completed at a cost of $20,000 per mile. It is estimated that annual maintenance for each mile of a motorized trail could cost between $250 and $500 per mile. Construction and maintenance costs will vary widely based on the level of use, the terrain and the type of soil. Near term implementation of a trail system will be unlikely without the large-scale use of current NFS roads. Many of these roads will not meet the level of difficulty and excitement requested by motorized users and will likely result on a large percentage of the traffic on a small percentage of roads. This situation will increase the maintenance requirements for those roads especially if the are in softer soils. The well designed system that attempts to address all user needs will, by necessity, be a long term solution. Motorized trails will take time to design and build if funding sources or cooperators can be identified.

Opportunities for obtaining help in implementing a motorized system are numerous. Outside funding sources, volunteers and partnerships will play an important part. Some states have implemented OHV registration/permitting programs that collect funds to put toward trails. A trail use charge could be implemented similar to those implemented to help maintain hiking and biking trails in some areas. In some Forests, user organizations have constructed and adopted motorized trails. Public and private organizations that would benefit from a healthy motorized trail system could become partners in funding or maintaining trails. The size of a support structure that includes the above participants will determine to a large degree the size and quality of a future motorized trail system for the Black Hills National Forest.

5.4.12 Safety

Safety issues can arise when forest trails, roads, and areas are designated for mixed use. Different sizes of motorized vehicles traveling on the same motorized system at different speeds can cause user conflicts that may lead to accidents. A mix in user experience level can raise these same issues.

Adapting user created routes for the trail system may raise safety issues if they are not constructed to motorized standards.

The designation of a trail system will be accompanied by a mixed-use analysis which considers the safety aspects of highway legal and non-highway legal vehicles on the same roads. The detail of the analysis will be determined by many things including the types of vehicles and riders that are expected to use the system, the type of road, the speed of traffic, and crash history. The analysis on the Forest roads in South Dakota will be complicated by a state law that permits properly outfitted ATVs to be registered as highway legal motorcycles and allows them to use highways (except the interstate) regardless of the speed and type of traffic. A designation on Forest roads that departs from state law is possible however it creates a more difficult law enforcement issue.

5.4.13 Economic Stability

Tourism has an economic impact on the communities of the Black Hills. The influx of motorized recreation enthusiasts into the small Black Hills communities is felt by local campgrounds, service stations, restaurants and other businesses. Will restrictions on the current use of the Forest land have an effect on the local economy?

Cross-country motorized travel will be prohibited when the Rule is implemented in 2008 or 2009. Motorized users who travel here solely for that purpose will be affected. The subsequent effect on the economy would be hard to predict. However the demand for recreational opportunities, motorized and non-motorized, in the Black Hills appears to be quite strong and growing in many different aspects. A large, well-designed road and trail system open to OHVs can be expected to be well used. A well designed motorized system should also increase opportunities for non-motorized users to find appropriate areas to recreate.

5.4.14 Private Land and the Urban Interface

Communities and subdivisions that border the forest may see an increase in traffic and noise directly related to increase motorized recreation use on the Forest.

Private residences within the Forest boundary may have trespass issues due to increase motorized recreation traffic.

Communities and subdivisions have seen an increase in traffic and noise related to the rapid, unregulated expansion of OHV recreational use. A motorized trail system that provides opportunities in appropriate locations along with properly enforced regulations, that prohibit cross-county use should help reduce the traffic and noise in these areas.

The analysis in this report generated to aid in the road and route designation process includes information to help in designating routes away from private property. This effort coupled with the prohibition of cross-country travel and a future well signed and mapped trail system should help reduce trespass issues. Trespass occurrences from individuals who refuse to comply with rules and disregard the wishes of private landowners will be difficult to control without the imposition of meaningful penalties.

5.4.15 Botanical Resources

Roads may destroy or significantly degrade occurrences of sensitive plant species and plant species of local concern, as well as native plant communities.

The Forest road system currently in place may have some affect on plant communities. The relative risks of existing roads and unauthorized routes are estimated in this report. Any new roads are constructed only after a biological evaluation of the area concerned. The implementation of the Rule should significantly decrease the risk of degradation of plant communities overall as unmanaged cross-country motorized travel will be prohibited. The development of new trails or conversion of roads to trails will be informed by the analysis in this report and perhaps more site specific review.

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STEP 6: REPORTING

6.1 REPORT

This report describes the existing condition, the travel analysis, results and opportunities, including maps and a CD containing the analysis data. The digital information (report, spreadsheet and maps) will also be available on a server for internal Forest Service use and on the Forest Service website for public access.

6.2 MAPS

Color maps showing existing condition, public input data, risk and value analysis data, and results are presented in Appendix A.

Map Index

1. Existing Conditions Map All Roads & Routes
2. Existing Conditions Map USFS System Roads
3. Existing Condition Map All Non-System Routes
4. Density Polygons of All Roads & Routes
5. Density Polygons of All FS Roads With FS Jurisdiction
6. Density Polygons of All Unauthorized Routes
7. Routes in Prohibited Management and Closure Areas
8. Routes in Restricted Management and Closure Areas
9. Routes and Roads in High and Very High Scenic Integrity Areas
10. Roads and Routes Across Private Land with no ROW
11. Management Risk, Prohibited Management Areas Risk
12. Management Risk Big Game Winter Range Risk
13. Management Risk, Miles within .5 Miles of a Non-Motorized Trail Risk
14. Management Risk, Feet within 300 ‘ of Private Land Risk
15. Management Risk, Miles within High Road Density Area Risk
16. Hydrology Risk, Perennial Stream Crossings
17. Hydrology Risk, Miles within 30’ of Perennial Stream
18. Hydrology Risk, Miles within 119’ of Perennial Stream
19. Soils Risk, Miles in Severe Erosion Risk Locations
20. Soils Risk, Miles in High Slope Areas
21. Botanical Risk, Feet within 500’ of Plant Occurrence Habitat
22. Botanical Risk, Miles within 400’ of Riparian Areas
23. Botanical Risk, Miles within 300’ of Botanical Areas
24. Botanical Risk, Miles within 300’ of Montane Grassland Areas
25. Botanical Risk, Miles within Weed Infested Areas
26. Wildlife Risk, Feet within 100’ of Bat Sites
27. Wildlife Risk, Miles within .5 miles of Active Goshawk Sites
28. Wildlife Risk, Feet within 1000’ of Wildlife Guzzler Locations
29. Wildlife Risk, Miles within Marten Habitat Areas
30. Wildlife Risk, Feet within Snails Occurrence Sites
31. Wildlife Risk, Feet within 119’ of Dipper Streams

32. Heritage Risk, Feet within Areas Un-Surveyed
33. Heritage Risk, Feet within 30 Meters of Heritage Site
34. Overall Relative Road Risk
35. Overall Relative Risk Factor - Unauthorized Routes
36. Resource Value, Timber Access
37. Resource Value, Range Access
38. Resource Value, Fire Fighting Access
39. Resource Value, Fuels Treatment Access
40. Resource Value, Motorized Recreation
41. Overall Relative Road Value
42. Public Input, Meetings
43. Public Input, Not Meetings
44. Non-Motorized, Total Public Input
45. Motorized, Total Public Input
46. Recommended Minimum Transportation System
47. Roads Currently Open to Motorized Travel
48. Closed Roads with Motorized Trail Potential
49. Unauthorized Routes with Motorized Trail Potential

6.3 ANALYSIS DATA

The analysis data generated during this process is located in one Excel spreadsheet file and is identified as Appendix B. The spreadsheet size is quite large (approximately 35 MB). It is 13,651 by 172 cells representing data for approximately 8,500 miles of roads and unauthorized routes. It has not been printed for the Appendix but has been copied onto a CD which is included.

6.4 FOREST SERVICE GIS ANALYSIS MODEL

The scope of this analysis process is quite large. It covers literally all of the relevant authorized and unauthorized road and route data in the Black Hills GIS database (approximately 8,500 miles). It does not include county and Forest Service high speed roads which were analyzed in a Forest Wide Roads Analysis in 2005. Manual manipulation of all of the associated management and environmental risk data and natural resource and social value data across four Ranger Districts in a timely and efficient manner was not realistic. To aid in this analysis and future decisions, the GIS spatial data and the spreadsheet data were linked in a GIS model that allows analysts and decision makers rapid access to resource layer information and analysis results data on a segment by segment basis. An analyst can bring up a screen with a resource layer in the background and a road or route layer in the foreground. The analyst can then select a road segment on the screen and view all of analysis data from the final spreadsheet for that segment. This model is very platform and software specific so it would not be easily reproduced elsewhere. It is primarily an in-house analysis aid. The model is currently available to Forest Service personnel at the Forest Service District offices for reviewing this travel analysis data and for near future project level travel analysis. The GIS algorithms that performed the data analysis have been preserved. The data layers that were used for this analysis were current as of March 2007. As those source

layers are changed to remain current, the GIS analysis algorithms would have to be used on the updated layers for the final model to remain current.

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REFERENCES

Bailey, R.G. 1995. *Descriptions of the Ecoregions of the United States.* United States Department of Agriculture, Forest Service. Miscellaneous Publication 1391.

Backlund, D. 2005 *The American Dipper, Cinclus mexicanus, in the Black Hills of South Dakota: Past and Present,* South Dakota Game Fish and Parks. Online at http://www.sdgfp.info/Wildlife/Diversity/dipper/index.htm

Carter, J.M., D.G. Driscoll, J.E. Williamson and V.A. Lindquist. 2002. Atlas of Water Resources in the Black Hills Area, SD. Hydrologic Investigations Atlas HA-747. Online at http://water.usgs.gov/pubs/ha/ha747/index.html.

Chatwin, S. C., D. E. Howes, J. W. Schwab, and D. N. Swanston. 1994. *A Guide for Management of the Landslide-Prone Terrain in the Pacific Northwest*, Second Ed. Department of Agriculture, Forest Service. Land Management Handbook 18.

Fecske, D. M. 2003. *Distribution and abundance of American martens and cougars in the Black Hills of South Dakota and Wyoming*. PhD Dissertation, South Dakota State University. 171p.

Forman, R.T.T., D. Sperling, J.A. Bissonette, A.R. Clevenger, C.D. Cutshall, V.H. Dale, L. Fahrig, R. France, C.R. Goldman, K. Heanue, J.A. Jones, F.J. Swanson, T. Turrentine, and T.C. Winter. 2003. *Road Ecology: Science and Solutions.* Island Press. Covelo, WA.

Gill, J. A., K. Norris, and W. J. Sutherland. 2001. Why behavioral responses may not reflect the population consequences of human disturbance. Biological Conservation 97: 265-268.

Huxoll, C. 2004. 2003 Annual Report , Big Game Harvest Projections. South Dakota Game Report No. 2004-01. South Dakota Department of Game, Fish and Parks. Pierre, SD. Online at: http://www.sdgfp.info/Wildlife/hunting/Harvest/2003BGSummary.pdf

Huxoll, C. 2006. 2005 annual report, big game harvest projections. South Dakota Game Report No. 2006-04. South Dakota Dept. Game, Fish and Parks. Pierre, SD. http://www.sdgfp.info/Wildlife/hunting/Harvest/2005BGSummary.pdf

Isaak, D.J., W.A. Hubert, 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. U.S. Forest Service, Rocky Mountain Region, Black Hills National Forest.* Available on the world wide web at: http://www.fs.fed.us/r2/blackhills/projects/planning/assessments/chub_sucker_dace.pdf

Johnson, B.N. 1933. A climatological review of the Black Hills. *The Black Hills Engineer.* Rapid City, South Dakota School of Mines and Technology. Unpublished M.S. thesis.

Kimmins, J.P. 1987. *Forest Ecology*. Macmillan Publishing Company. New York, NY.

Leonard, C. 2004a. Annual Report of Big and Trophy Game Harvest, 2003. Wyoming Game and Fish Department, WY. July 28. Online at: http://gf.state.wy.us/downloads/pdf/04biggameharvest.pdf

_____2004b. Annual Report of Small and Upland Game Harvest 2003. Wyoming Game and Fish Department, WY. September 9. Available online at: http://gf.state.wy.us/downloads/pdf/04uplandharvest.pdf

Marriott, H. 2000. Survey of Black Hills Montane Grasslands. Unpublished report for Black Hills National Forest, Custer, SD.

Marriott, H., D. Faber-Langendoen, A. McAdams, D. Stutzman, and B. Burkhart. 1999. The Black Hills Community Inventory – Final Report. The Nature Conservancy, Midwest Conservation Science Center, Midwestern Resource Office. Minneapolis, MN.

McGee, D. 1996. The Mechanisms and Effects of Frost Heave. Online at: http://www.acad.carleton.edu/curricular/GEOL/classes/geo258/studentwork/McGee.html.

McIntosh, C. 1931. A botanical survey of the Black Hills of South Dakota. *The Black Hills Engineer*. Vol. XIX, No. 3. Rapid City, SD.

Moore, L., S. Friedley, and D.L. Hazlett. (2006, July 31). *Carex alopecoidea* Tuckerman (foxtail sedge): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http:// www.fs.fed.us/r2/projects/scp/assessments/carexalopecoidea.pdf [April 20, 2007].

Motorcycle Sound Working Group. 2005. Sound Advice. American Motorcyclist Association

Packer, P.E., and G.F. Christiansen. 1964. Guides for controlling sediment from logging roads. USDA Intermountain Forest and Range Exp. Station Misc. Pub. 42.

Parrish, J.B., D.J. Herman, and D.J. Reyher. 1996. A Century of Change in Black Hills Forest and Riparian Ecosystems. United States Forest Service Agricultural Experiment Station, United States Department of Agriculture, South Dakota State University.

Sandrini, J. 2005. Telephone conversation between Joe Sandrini, Game Biologist, Wyoming Game and Fish Department, Newcastle, WY, and Richard McEldowney, Ecologist, Science Applications International Corporation. January 18.

Smith, B. E. 2003. Conservation Assessment for the Northern Leopard Frog in the Black Hills National Forest South Dakota and Wyoming. Black Hills National Forest. Custer, SD. Online at http://www.fs.fed.us/r2/blackhills/projects/planning/ assessments/leopard_frog.pdf.

Thomas, J. W. and D. E. Toweill. 1982. Elk of North America, ecology and management. Stackpole Books. Harrisburg, PA. Pp. 453-456.

USDA – Forest Service. 2005 Black Hills National Forest Forest-Wide Roads Analysis Report. October 2005. United States Department of Agriculture-Forest Service, Rocky Mountain Region. Custer, SD

_____2004a. Black Hills National Forest Draft Environmental Impact Statement for the Phase II Amendment to the 1997 Land and Resource Management Plan. August 2004. United States Department of Agriculture-Forest Service, Rocky Mountain Region. Custer, SD.

_____2004b. Black Hills National Forest 2003 Monitoring and Evaluation Report. United States Department of Agriculture-Forest Service. Custer, SD. Online at http://www.fs.fed.us/r2/blackhills/projects/planning/2003Monitor/all.pdf.

_____2004c. Black Hills National Forest 2004 National Visitor Use Monitoring Results. United States Department of Agriculture-Forest Service. Black Hills National Forest. Custer, SD

_____2004d. R2 Roads Analysis, Supplement to FS-643. United States Department of Agriculture, Forest Service, Rocky Mountain Region 2, Lakewood, CO.

_____2003a. Decision Notice and Finding of No Significant Impact for the Black Hills National Forest Noxious Weed Management Plan. United States Department of Agriculture-Forest Service, Rocky Mountain Region. Custer, SD.

_____2003b. Deferred Maintenance Cost for Roads Analysis Summary. Excel table provided by Craig Kjar.

_____2001. Medicine Bow National Forest Roads Analysis Report. United States Department of Agriculture-Forest Service. Laramie, WY.

_____2000a. Forest Roads: A Synthesis of Scientific Information. General Technical Report. PNW_GTR_509.

_____2000b. Schedule A Summaries for Pennington, Lawrence, Meade, Crook, and Custer Counties (Database query). United States Department of Agriculture-Forest Service, Rocky Mountain Region. Custer, SD.

_____1999a. Roads Analysis: Informing Decisions About Managing the National Forest Transportation System. United States Department of Agriculture, Forest Service. Miscellaneous Report, FS–643.

_____1999b. Decision for Appeals of the Black Hills National Forest Land and Resource Management Plan. #97-13-00-0085, Oglala Sioux Tribe; #97-13-00-0120 , Biodiversity Associates/Friends of the Bow, Standing Rock Sioux Tribe, Sierra Club, Prairie Hills Audubon Society, Oglala Sioux Tribe, Biodiversity Legal Foundation, The Wilderness Society, Donald J. Duerr, Leila Stanfield; #97-13-00-0125 , Lionel P. Trepanier, The Greens/Green Party USA, Wildlands and Forest Issues Direct Action Network.

_____1997a. Black Hills National Forest Land and Resources Management Plan. United States Department of Agriculture-Forest Service, Rocky Mountain Region. Custer, SD.

_____1997b. Forest Service National Resource Guide to American Indian and Alaska Native Relations. Online at http://www.fs.fed.us/people/tribal/.

_____1996a. Revised Land and Resource Management Plan Final Environmental Impact Statement. United States Department of Agriculture-Forest Service, Black Hills National Forest. Custer, SD.

_____1996b. Cultural Resources Overview, Synthetic & Management Summaries. Volume 2, Management Summary. United States Department of Agriculture-Forest Service, Rocky Mountain Region. Custer, SD.

_____1993. Water Resources Inventory Handbook. FSH 2509.16 United States Department of Agriculture-Forest Service.

USFWS. 1999. Utah Field Office Guidelines for Raptor Protection from Human and Land Use Disturbances, US Fish and Wildlife Service, Utah Field Office, Salt Lake City, UT. January 1999.

Vaughan, D.M. 2002. Potential Impact of Road-Stream Crossings (Culverts) on the Upstream Passage of Aquatic Macroinvertebrates. U.S. Forest Service Report. San Dimas Technology and Development Center. March 21, 2002.

Wemple, B.C., Jones, J.A., Grant, G.E. 1996. Channel Network Extension by Logging Roads in Two Basins, Western Cascades, Oregon. *Water Resources Research*, 32.

Williams, M. No Date. Draft Watershed Component of the Forest Plan Roads Analysis Process. United States Department of Agriculture-Forest Service, Rocky Mountain Region. Custer, SD.

Wrede, J. 2005. Telephone conversation between John Wrede, Regional Biologist, South Dakota Game, Fish, and Parks Department, Rapid City, SD, and Richard McEldowney, Ecologist, Science Applications International Corporation. January 19.

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