TABLE OF CONTENTS

List of Tables

Appendix B Documentation of Analysis

I. Introduction

This appendix describes the analysis process and techniques used by the Interdisciplinary Team during the management plan revision process. It contains the following:

- The framework of the planning process.
- A discussion of the data sources and assumptions made.
- A discussion of the various analytical tools and methods used.

The planning administrative record is an additional source of information used to develop this appendix and is incorporated by reference.

The planning problem is a complex one. This complexity stems from the need to address a variety of interrelated and often conflicting issues by allocating land and scheduling activities in a cost-effective manner for the entire Forest over a long period of time. This appendix describes some of the analytical tools used to reduce the process to manageable proportions.

The size of the analysis area and the number of issues being addressed made the alternative development process and effects analyses complex. The planning area includes parts of 2 Forest Service regions, 3 administrative units, and 10 Ranger Districts on 2.9 million acres spread over four states (Nebraska, South Dakota, North Dakota, and Wyoming) and 28 counties.

A. Framework of the Planning Process

The general planning process (as described in 36 CFR 219.12) guides forest plan revision. This section describes 10 steps, which lead from the completion of a forest plan to the completion of a revised forest plan.

Land and resource management plans (management plans) currently direct management of the national forests and their units. Issuance of these plans occurred June 10, 1987 for the Custer National Forest; November 20, 1985 for the Medicine Bow National Forest, and December 14, 1984 for the Nebraska National Forest. Other National Forest System units (not listed above) under the administration of the Custer and Medicine Bow-Routt National Forests will be addressed in future planning efforts.

Step 10 of the Initial Planning Process - Monitoring and Evaluation

The last step of the initial Forest Plan process is the first step in revising a forest plan. Monitoring and evaluation reports were completed on all three units and summarized in 1995 for the forest plan revision. Essentially, this evaluation summarized monitoring data and reviewed the trends in forest plan implementation.

Revision of management plans is directed by the National Forest Management Act (NFMA), by regulations 35 CFR 219, and by the Forest Service Directives System (FSH 1909.12).

Step 1. Identification of Purpose and Need

Many sources were used to identify the need for change. Some principal sources of information included the following:

- Experiences in implementing the management plans and working with the public.
- Public involvement in implementing projects.
- Need for management plan amendments as a result of implementing projects.
- Monitoring the effects of implementation.
- Understanding cumulative effects from implementing projects.
- Issues raised in appeals and litigation.
- Knowledge gained from research on prairie ecosystems.
- Discussions with employees.
- Coordination and input from other federal agencies, state agencies, county governments, and partners.
- Public feedback on values for these national forest and grassland units.
- Results of assessments.
- Changes in management philosophy for NFS lands.

From those sources, the Forest Service developed the Purpose and Need for Change and defined the major revision topics. In February 1997, the Forest Service published a Notice of Intent to Prepare an Environmental Impact Statement to revise the management plans in the Federal Register. The federal notice initiated the formal public involvement process. In response to the federal notice and many other public outreach efforts, the Forest Service received public comments to help further define the major revision topics.

Step 2. Planning Criteria

During this step, the remainder of the process is outlined. Here the seven major revision topics were developed along with indicators of each. These provided focus for the rest of the analysis.

Step 3. Inventory Data and Information Collection

Numerous data sources were used and stored and analyzed on many different computers and systems. The vast majority of the data used was spatial and was stored on the corporate IBM UNIX system in Arc/Info.

Several non-spatial databases were stored on a personal computer using Paradox or Microsoft Excel as the data management software. This information is primarily non-spatial, wildlife-related information.

Step 4. Analysis of the Management Situation (AMS)

This step determines the ability of the planning area to supply goods and services in response to society's demands. It provides background information for formulating a broad range of reasonable alternatives. The April 1998 Analysis of the Management Situation (AMS) document focused on the revision topics. Much of the work originally completed for the AMS has been incorporated into this FEIS.

Step 5. Formulation of Alternatives

See Chapter 2 of the FEIS.

Step 6. Estimated Effects of Alternatives

The physical, biological, economic, and social effects of implementing each alternative considered in detail were estimated and compared according to NEPA procedures.

Step 7. Evaluation of Alternatives

Significant physical, biological, economic, and social effects of implementing alternatives were evaluated.

Step 8. Preferred Alternative Recommendation

The Forest Supervisors reviewed the interdisciplinary team's evaluation and recommended and identified Alternative 3 as the preferred alternative in the proposed Revised Management Plans and Draft Environmental Impact Statement (DEIS). The DEIS was published and sent out for public review. Following the public review period, the interdisciplinary team evaluated agency and public comments, and revise steps 5-7 as needed to address DEIS comments. The Forest Supervisors then reviewed the interdisciplinary team's evaluation and recommend a preferred alternative for each administrative unit.

Step 9. Plan Approval and Implementation

The Regional Foresters will review the Revised Management Plans and Final Environmental Impact Statement (FEIS) for a final decision.

B. Inventory Data Collection and Storage

Geographic Information System (GIS)

The primary tool for analysis is ARC/INFO[1] on an IBM RS 6000 computer. The IBM is a UNIX-based system. This includes the following types of information:

- Administrative Boundary
- Livestock Grazing Allotments
- Animal Points (Key animal/plant habitat sites)
- Bailey's Ecoregions
- Bighorn Sheep Habitat
- Broad Scale Aquatics
- Campgrounds
- Coal Resources
- Common Land Unit
- Common Vegetation Unit
- Common Water Unit
- DEM (Digital Elevation Model - 30 meter)
- Eligible Wild and Scenic Rivers
- Fences
- Geographic Areas
- Geology Formations
- Growing Degree Days
- Heritage Sites
- Land Status
- Land Type Association
- Landform
- Linear Hydrology (Rivers and Streams)
- Little Missouri River
- Maximum Recorded Prairie Dogs
- Mineral Ownership
- National Wetlands Inventory
- Non-FS Wilderness
- Northern Great Plains Intact Grasslands
- Oil and Gas Leases
- Oil and Gas Potential
- Polygon Hydrology (Lakes, ponds, etc.)
- Present Prairie Dog Distribution
- Public Land Survey System
- Recreation Opportunity Spectrum
- Research Natural Areas
- Roads
- Roadless Area Inventory
- Scenery Management System
- Scenic Integrity Objectives
- Shadehill Reservoir
- Special Interest Areas
- Plant and Animal Species Locations
- US Counties
- US States
- Water Points (Developments)
- Watersheds 1:250,000

[1] ARC/INFO is a product of Environmental Systems Research Institute (ESRI), Inc.

Note: A number of GIS models described in Appendix B and used elsewhere in the Northern Great Plains assessment use Digital Elevation Models (DEMs) as one of the variables. The use of 30-meter DEMs will underestimate the number of acres of steeper slopes in the plains. Topography in the plains breaks quickly in the form of escarpments which may be missed by the 30-meter DEMs. Finer resolution DEMs were not available at the time of this analysis and would have exceeded the capability of the computers used in the analysis.

Non-GIS Information

The Neotropical Migratory Birds database is stored on a PC using Paradox[2]. Vegetation structure is a second database. It is stored on a PC using Microsoft Excel.

The tool for storing timber information is the Rocky Mountain Resource Information System (RMRIS). This database was stored on the Data General computer system. The database uses the ORACLE[3] operating system. Since that analysis was completed, the Data General has been decommissioned and replaced by an IBM RS 6000 Unix system. Timber data has been archived on the IBM system but is not yet loaded into the new version of ORACLE on the IBM.

II. Models and Analyses

A. Alternative Development

Alternatives were developed using GIS as a primary display and analysis tool. Each alternative centered on a theme that used a single management prescription as a background management factor. Then, depending on the emphasis of a given alternative, various special areas were brought in and given a different management prescription. For example, RNAs could be brought in and given a 2.2 management prescription, a Wild and Scenic River segment could be brought in and given a 4.4 management prescription, or a ferret recovery area could be brought in and assigned a 3.63 management prescription. The rules used for each alternative are as follows.

Alternative 1

Alternative 1 reflects current management as defined in the existing Management Plans. Previous management prescriptions were cross-walked to the new national numbering system for management prescriptions. The initial crosswalk is as follows:

[2] PARADOX is a product of Borland International, Inc.

[3] ORACLE is a product of the Oracle Corporation.

Table B-1. Comparison of Management Prescriptions in Existing and Revised Forest Plans.

Dakota Prairie Grasslands	
Old Prescription	**New Prescription**
A (heavy stocking)	6.1
B (intensive mgmt)	6.1
C	3.51
D	3.6
E	8.4
F	8.22 (dev. rec. site in grassland setting)
G	None
J	3.31
L	2.2
M	3.x (riparian / woody draw)
Nebraska National Forest Units	
Old Prescription	**New Prescription**
1A	None
1C	8.6
1D	8.3
3A	1.3
3C	1.3
4A	3.6x
4E	3.x
4F	3.x
4G	3.x
6B	6.x
6C	6.x
6F	6.x
6G	6.11
6H	?
6I	1.33
6J	6.x
6K	?
8C	1.13
9A	3.63
10A	2.2
10C	3.1
10F	8.5
10G (prairie dog mgmt.)	3.63
10H	2.x(?)
Added prescriptions from original plan map:	
Soldier Creek Wilderness	1.13
Remainder Soldier Cr. Unit	6.x or 4.3 or 8.2
Pine Ridge NRA	1.31
Hwy. 385 corridor	7.2
Rest of ridge	5.12

Thunder Basin National Grassland	
Old Prescription	**New Prescription**
1D	8.3
2A	4.3
2B	4.3
4B	3.53
5	3.58
6	6
4C	3.5(?)
4D	5.1x
9A	3.x
12A	8.4
No crosswalk for woody draws and aspen emphasis areas.	

After the initial crosswalk was accomplished, the results were presented to the ranger districts to finalize Alternative 1 management area allocations to represent the current management plans.

Alternatives 2-5

Alternatives 2-5 were initially developed using information in the alternative development matrix below. Many changes occurred between the initial alternatives developed and those analyzed in the DEIS. Some of the highlights are as follows:

- Management Prescription 6.2 was eliminated because it did not provide enough actual difference between Management Prescriptions 6.1 and 3.65.
- Consultation with the US Fish and Wildlife Service increased the number of ferret reintroduction areas.
- The number of roadless areas increased after internal Forest Service reviews were completed.

Table B-2. Alternative Development Matrix.

Revision Areas	Alternative 1	Alternative 2	DEIS Alternative 3	FEIS Alternative 3	Alternative 4	Alternative 5
Theme	No Action	Commodity Emphasis	Developed collaboratively; modify current management by adopting special area designations and placing added emphasis on native plant and animal communities.	Developed collaboratively; modify current management by adopting special area designations and placing added emphasis on native plant and animal communities.	Restoration / Ecological Processes Emphasis	Recreation Emphasis
Composition (seral stage or range condition)	No change	Mid-seral			Increase early and late seral	A mix of composition and structure to meet scenery management and hunting objectives.
Structure (Grassland and Sagebrush Understory)		Moderate to low cover			Increase High and Low Structure	Early and late seral stages are important; shrubs and forbs are important
Background Management Area (MA) Emphasis	Most acres in 6.1, 6.2	Most acres in MA 6.1			Most acres in MA 3.65, 6.2	Look at special recreation emphasis MA
Prairie Dog Colony Acreage	Same (about 3%)	Decrease or no change	5%		Increase to 10% of suitable	Increase to 20% of suitable
		Reduce loss of livestock forage				(Biodiversity and recreation prairie dog shooting)
Thunder-Basin Black-footed Ferret Reintroduction Habitat	No ferrets in Rosecrans	Core ferret reintroduction area at Rosecrans			Core ferret reintroduction area at Rosecrans, plus dispersal area	Core ferret reintroduction area at Rosecrans
TES Habitat	Same	Meet viable pops at a minimum level			Meet viable pops at a high level	Something like alternative 4

Revision Areas	Alternative 1	Alternative 2	DEIS Alternative 3	FEIS Alternative 3	Alternative 4	Alternative 5
Special Plant and Animal Habitat	Meet	Meet			Restoration of guilds of species of concern; restore elk; restore bighorn sheep	Meet
Secondary Range	Same	Decrease secondary range			Increase secondary range (less fence and water for a more natural grazing regime)	Slight increase for better upland bird habitat; maybe less fence and water
Range of Natural Variability - use of fire	No change	No change			Use up to historic frequency of disturbance for each ecological unit	Small disturbance program for wildlife viewing
Herbivory (use of bison and frequency and intensity of use)	No change	No change			Bison introduced in sacred areas, low development areas, some RNAs, some wilderness, and some blocked ownership	Less acres allocated to bison that Alternative 4
Forest Health, Composition, Structure, Fuels, Insects and Disease	No change	Allowable Sale Quantity (ASQ) developed			No ASQ but some harvesting	No ASQ, but some harvesting for forest health to maintain a park-like appearance
Livestock Grazing	No change	Increase fences and water for better forage utilization. Use Bison friendly policy for commodities.			Bison friendly as a commodity	Same as Alternative 4
Animal Damage Control (Prairie Dogs)	No change	Reduce loss of NFS livestock forage with chemical control			Reduce movement to adjacent lands with biological control	Reduce movement to adjacent lands with chemical and biological control

Revision Areas	Alternative 1	Alternative 2	DEIS Alternative 3	FEIS Alternative 3	Alternative 4	Alternative 5
Plant Control (noxious weeds and exotics species)	No change	Moderate program			Moderate program - Alternative 4a	Moderate program
					High program - Alternative 4b	
					Convert poa and brome	
Developed Recreation	No change	No change			No change	Increase to respond to local demand and resource protection (select top sites from each forest)
Dispersed Recreation (ROS)	No change	Increase SPM/RN by 1% or no change			Increase SPNM where erosion and best habitats are located. Less fences; larger pastures for more natural appearance	Diversity of settings (some P/SPNM, some SPM, RN, R), more trail development, at least 1 more OHV area, high productivity site cover, P/SPNM > 25,000 acres (1 site per district), dollars for fish stocking and reservoir renovation, less fences (as dictated by scenery and hunting objectives)
Wild and Scenic River	None	None			All rivers at their present classification level	All rivers at lower than present classification
Proposed Wilderness	None	None			All potential areas	Recommend high recreation opportunity areas and opportunities for solitude.

Revision Areas	Alternative 1	Alternative 2	DEIS Alternative 3	FEIS Alternative 3	Alternative 4	Alternative 5
Proposed RNAs	None	None			All proposed	None
SIAs	None	Some that don't conflict with commodities			Those that maintain natural processes	Most those that add to recreation

All action alternatives assume standards and guidelines are in place to ensure viable populations, noxious weed control, proper functioning riparian conditions, and control of prairie dogs near adjacent landowners.

Alternative 3a was developed as part of a public working group for the Fall River District of the Buffalo Gap National Grassland.

B. Community and Lifestyle Relationships

Economic Analyses

Peer Review

Peer review was used in the DEIS model by consulting with researchers in Wyoming, South Dakota, North Dakota, and Nebraska. That model was further peer reviewed through comments received during the DEIS comment period. Further peer review with researchers in Wyoming occurred after the public comment period.

Jobs and Income

Job and income effects were developed for livestock, timber, recreation, oil and gas production using a computer software program called MicroIMPLAN[4]. The sections below describe the various methods used to determine and analyze job and income effects.

General Criteria

The MicroIMPLAN economic impact model was used to generate economic multipliers and response coefficients for effects analysis and to create economic dependency and diversity information. For this reason the impact areas used for analysis purposes consist of individual counties or more often, groups of counties.

The primary criteria in defining economic impact areas are included in the Social and Economic Analysis Handbook (FSH 1909.17), Chapter 20[5]. This source states, "Impact areas may vary depending on the policy issue being analyzed." It also states that " The impact area should be defined as (1) a functional economic unit of a size appropriate to the policy issue and (2) an area that includes most of the economic factors that are most directly affected by the policy."

The specific criteria stated in FSH 1909.17 includes the following:

- Issues being addressed.
- Location of the counties forming the economic center.
- Trade patterns.
- Forest/county boundaries (PILT and 25% Fund payments).
- Worker places of residence.
- Use of program products from other counties.

---

[4] IMPLAN Professional - Social Accounting and Impact Analysis Software. Minnesota IMPLAN Group, Inc. Feb 97. www.implan.com

[5] See http://www.fs.fed.us/im/directives/html/fsh.html

Impact Areas Selected and Reasons For Selection

Each impact area is centered around the pre-selected Forest Service administrative units in the Northern Great Plains assessment area. The following discussion lists each of the administrative units, the counties included in the impact area, and the reasons for selection.

Oglala National Grassland and Nebraska National Forest - Pine Ridge Unit

State: Nebraska

Counties: Dawes, Sioux

Information Source: Dave Cawrse - Northern Great Plains Assessment Team Leader.

The major part of the Oglala National Grassland is in Sioux County, with the balance in Dawes County. The major part of the Pine Ridge is in Dawes County, while the remainder is in Sioux County. Dawes County, which includes Chadron, Nebraska, is the trade center for the impact area.

Administrative offices for these two units are located in Chadron, and a major part of the indirect and induced spending arising from National Forest System lands occurs in Dawes County. Nonresident tourists incur most of their expenditures in Dawes County, with some in Sioux County. Sioux County does not offer many opportunities for tourist spending. Home ranches for grazing permittees are located in either Sioux or Dawes County. There are no minerals currently being produced from the Oglala National Grassland. The inclusion of Box Butte and Sheridan Counties was considered but dropped because of the insignificant amount of economic activity occurring in those counties arising from the management of the Oglala National Grassland and Pine Ridge Unit of the Nebraska National Forest.

Nebraska National Forest - Bessey Unit and Samuel R. McKelvie National Forest

State: Nebraska

Counties: Blaine, Cherry, Thomas

Information Source: Dave Cawrse - Northern Great Plains Assessment Team Leader.

Grazing and nonresident tourism are the primary products from this area. The above National Forest System lands are located in all of the counties identified above. All of the home ranches of the grazing permittees are also located in these counties. Cattle are trucked from the area. Nonresident tourists, primarily hunters and people using the campground and swimming pool at Bessey, spend their money throughout the small towns in this three-county area. There are no minerals currently being produced from the area.

Fort Pierre National Grassland

State: South Dakota

Counties: Hughes, Jones, Lyman, Stanley

Information Source: Tony Detoy, District Ranger.

Nonresident tourism and grazing are the primary sources of economic activity in the Fort Pierre National Grassland. Nonresident tourism consists primarily of various types of hunting, with some fishing in man-made ponds. Prairie dog shooting is a popular activity. Most of the tourism money is spent in the Pierre area (Hughes County), with some spent in Fort Pierre (Stanley County). Some tourism activity created by the grassland also occurs along I-90 (Jones and Lyman Counties). The primary tourist attraction in the area is the Missouri River and Lake Oahe. Pierre is the major trade center for the area, and much of the indirect and induced spending arising from the management of the grassland occurs here. Pierre is also the major source of labor for economic activities in the area.

Home ranches of grazing permittees are all in Lyman, Jones, and Stanley Counties. There are cattle auction barns in Stanley and Lyman Counties. Most of the cattle are then trucked from the local area.

Buffalo Gap National Grassland

State: South Dakota, Wyoming, Nebraska

Counties: South Dakota - Custer, Fall River, Jackson, Pennington; Wyoming - Niobrara;

Nebraska - Sioux.

Information Sources: Bob Hodorff, Fall River Ranger District; Kathy Simpfenderfer, Wall Ranger District.

The Buffalo Gap National Grassland is located in Fall River, Custer, Pennington, and Jackson Counties, South Dakota. Similar to other grasslands, nonresident tourism and grazing are important forms of economic activity. Grazing is primarily limited to cattle. Nonresident tourism consists of a variety of hunting activities, including upland bird and large game as well as prairie dog shooting. Rock collecting and sight seeing are also popular. Gas and oil production are economically significant activities on the Buffalo Gap National Grassland. The regional center of economic activity is Rapid City, SD (Pennington County). Much of the indirect and induced spending arising from managing the Buffalo Gap National Grassland occurs in the Rapid City area. Nonresident tourist spending is focused in the Rapid City area but occurs in lesser amounts throughout the counties included in the defined impact area. Home ranches of grazing permittees are in Custer, Pennington, and Fall River Counties, South Dakota, Sioux County, Nebraska and Niobrara County, Wyoming. Gas and oil activity also occurs on the grasslands in these counties, with some of the oil going to the refinery in Newcastle, Wyoming (Niobrara County). Much of the oil is trucked from the area.

Grand River National Grassland

State: South Dakota, North Dakota

Counties: South Dakota - Perkins; North Dakota - Adams.

Information Source: Forest Morin, District Ranger.

Grazing and nonresident tourism are the primary economic activities arising from management decisions made on the Grand River National Grassland. Grazing is primarily cattle with some sheep. Nonresident tourism consists of large game and upland bird hunting and prairie dog shooting. The grassland is located in Corson, Ziebach, and Perkins County, South Dakota, with economic activity extending into Adams County, North Dakota. There are no minerals coming from the Grassland at the present time. All of the home ranches of the grazing permittees are located in Perkins County. However, much of their personal and business spending occurs in Adams County, North Dakota. There are also sale barns and feed lots in Lemmon and Bison (Perkins County). Nonresident tourism spending is focused in the Lemmon, South Dakota area. Administrative offices of the Grassland are also located in Lemmon. A small amount of area is located in Corson and Ziebach Counties, but there is no measurable economic impact in those counties other than a small amount of 25% funds.

Cedar River National Grassland

State: North Dakota, South Dakota

Counties: North Dakota - Sioux: South Dakota - Perkins.

Information Source: Forest Morin, District Ranger.

The Cedar River National Grassland is located in Sioux and Grant Counties, North Dakota. The economic effects extend into Lemmon area of South Dakota. The primary economic activities are very similar to the Grand River National Grassland already discussed. These activities consist of nonresident tourism consisting of various forms of hunting and livestock grazing. There is no minerals activity. The area was included in the gas and oil leasing EIS only because it was in North Dakota. Although a small part of the grassland is in Grant County, it has not been included in the economic impact area because of the insignificant amount of economic activity arising from the grassland other than a small amount of 25% funds. Nonresident tourism spending is focused in the Lemmon area (Perkins County), South Dakota. Lemmon serves as a trade center for daily needs, but big-item shopping is done in Bismarck or Dickinson.

Little Missouri National Grassland

State: North Dakota, Montana

Counties: North Dakota - Billings, Bowman, Dunn, Golden Valley, McKenzie, Slope, Stark, Williams; Montana - Fallon, Richland, Wibaux, Dawson.

Information Source: Spike Thompson, District Ranger - McKenzie District; Norm Bishop, Medora District.

Gas and oil leasing, grazing, tourism--the Little Missouri has it all, as well as being the largest of the grasslands. The southern and northern EISs for gas and oil leasing were used as the starting point for determining the impact area. This was discussed with Richard Marshall, Region 1 Minerals Economist. The next step was to determine if any of the other resources created a

need to expand the area already determined for gas and oil effects. With the presence of the Little Missouri River as well as several other smaller streams, the Little Missouri National Grassland offers a wider range of recreational activities than most other grasslands. Its proximity to Roosevelt National Park also enhances its role as a provider of outdoor recreation. However, the economic effects of recreational activities fall well within the geographic area delineated for gas and oil effects. The predominance of tourism spending occurs in Williston, Dickinson, Watford City, Sidney, and along the US 94 corridor. Most of the home ranches of grazing permittees are in McKenzie County, North Dakota with some in Dawson County, Montana. In summary, there was no apparent reason to expand the analysis boundary past the area determined for gas and oil leasing.

Sheyenne National Grassland

State: North Dakota

Counties: Ransom, Richland

Information Source: Bryan Stotts, District Ranger.

The Sheyenne National Grassland is located in Ransom and Richland Counties of South Dakota. Outdoor recreation and grazing are the primary uses. Outdoor recreation generates a certain degree of nonresident tourism for the local economy and consists of activities such as big game, waterfowl, and turkey hunting; ORV use; and sightseeing. Most of the users are from the Fargo area, and most are day users, though there is some overnight camping on the grassland. Nonresident tourists generated little motel and restaurant business in the vicinity, and the economic effect of tourism does not go much beyond Ransom or Richland Counties. For this reason, there was little economic reason to include Cass County in the analysis. The same holds true for grazing. All the home ranches of grazing permit holders are in Richland or Ransom Counties. Sargent County was excluded because there was no apparent economic reason to include it. There is no mineral activity on the Sheyenne National Grassland.

Thunder Basin National Grassland

State: Wyoming

Counties: Campbell, Converse, Crook, Natrona, Niobrara, Weston.

Information Source: Joe Reddick.

The Thunder Basin National Grassland is located in Campbell, Converse, and Weston County, Wyoming. However, the economic effects of mining activity extend to Cook, Natrona, and Niobrara Counties. The major economic centers are Douglas (Converse), Gillette (Campbell) and Casper (Natrona). Much of the work force lives and spends money in these cities. Many businesses in these cities are supported by the mining (coal and oil) industry. Mining headquarters are largely in Gillette. There are oil refineries in Casper and Newcastle. Cattle and sheep grazing exist throughout the grassland, and home ranches are within the minerals impact boundaries. Recreation / nonresident tourism spending follows the same pattern. The exclusion of Natrona County was considered, but further study showed it to be an integral part of the mining economy. Its exclusion would cause the analysis to omit a significant amount of the effects of changes in the mining industry.

Methodology for Determining Economic Response Coefficients for Cattle

Introduction

The economic response coefficients included in this report were calculated to help managers estimate the effects of changes in national grassland management. For example, increases or decreases in the level of livestock grazing could have economic effects on nearby communities. These effects can be measured in terms of employment and income earned by the local population. The following analysis provides coefficients, when multiplied by changes in grazing outputs (AUMs) can produce a reasonable estimate of the change in jobs and income for the selected economic regions.

Methodology

Response coefficients are calculated for each of the economic regions included in cattle and sheep economic work sheets available in the administrative record. The economic impact areas are described above consist of counties or groups of counties which were determined to be in some way economically effected by management of the national grasslands in the Northern Great Plains assessment area.

Livestock Grazing

Livestock grazing was based on cattle production. Sheep grazing is a small part of total grazing in any of the EIAs and for the purposes of this analysis assumed to provide the same level of jobs and income as cattle grazing. The steps in determining jobs and income were as follows:

1. Determine direct jobs and income per AUM.
2. Develop IMPLAN Social Accounting Matrix (SAM)-type multipliers for each EIA.
3. Multiply SAM multipliers by direct jobs and income per AUM determined in step 1 to get total jobs and income from NFS lands. (AUMs x Direct Job or income response coefficient x SAM multiplier).
4. Determine intermingled lands multiplier
5. Multiply total jobs and income from NFS lands by intermingled lands multiplier to get total jobs from NFS pastures.

Step one was determined by David T. Taylor, University of Wyoming Agricultural and Applied Economics professor. The following table shows an example of the first phase in step one. Here ranch level sales, labor costs, average herd size, etc information is obtained and converted to an AUM basis. In this example, Montana was selected for western North Dakota as Montana average herd size more closely matched the herd size normally found on the Little Missouri.

Table B-3. Determining per AUM Job and Income Factors Example.

Little Missouri National Grasslands Livestock Grazing

1997 Census of Agriculture, Montana, Table 51

Beef Cattle Ranching and Farming (NAICS 112111)

	Per Ranch	Per Cow[1]	Per AUM[2]
Total Sales	$72,705	$534.60	$33.41
Hired Labor Expense	$4,433	$32.60	$2.04
Net Cash Returns	$12,834	$94.37	$5.90
Number of Beef Cows	136	1.00	0.06
Cattle and Calves Inventory	207	1.52	0.10
Government Payments	$3,880	$28.53	$1.78
Other Farm Income	$1,639	$12.05	$0.75
Taxes	$3,996	$29.38	$1.84
Depreciation	$5,715	$42.02	$2.63

[1] Based on 136 Beef Cows

[2] Based on 16 AUMs per Cow - Source: Workman, J.P. 1986. Range Economics. Macmillan Publishing, Inc. New York, NY.

Labor Assumptions

1 Full Time Proprietor	1.00	0.007353	0.000460
Hired Labor[3]	0.17	0.001250	0.000078
Total	**1.17**	**0.008603**	**0.000538**

[3] Based on $4,433 of hired labor / $26,401 Ave Earning Per Job for Hired Agr Labor (REIS)

The labor assumptions table gives jobs per AUM (.000538 jobs / AUM). The employee compensation of income is $2.04 / AUM based on the hired labor expense row of Table 1. To get labor earnings employee compensation must be added to proprietor income. Proprietor income is derived from Table 1 as follows:

> Proprietor Income ($5.80) = Net Cash Receipts ($5.90) - Depreciation ($2.63) + Govt Payments ($1.78) + Other Farm Income ($0.75).

Labor Earnings is then $2.04 + $5.80 = $7.84 / AUM which give direct jobs and income multipliers per AUM of .000538 jobs and $7.84 in income.

The above method tended to overestimate jobs and income because the statewide estimates of average herd size per ranch did not agree with local average herd sizes found on the national grasslands and forests, but much of the data used to create the job and income estimates was available only on a statewide basis. Herd size was available by county so regression equations were developed using statewide herd size, jobs, and income REIS data for Montana, Nebraska, North Dakota, South Dakota, and Wyoming. The equations developed are as follows:

> Jobs = .91133739 + .00197568 * beef cows per ranch
>
> Income = -3838.6846 + 183.441098 * beef cows per ranch

Once the regression equations were developed average Economic Impact Area (EIA) herd size estimates were used to estimate jobs and income per ranch, per beef cow, and per AUM. The per AUM job and income factors were then used as multipliers to determine direct jobs and income per EIA and for each alternative.

The second step includes using the MicroIMPLAN economic impact model to determine the local employment and income SAM multipliers ((Direct+Indirect+Induced) / Direct). These can be created automatically in IMPLAN once EIA counties are aggregated into a single model. The multipliers are those obtained for sector 4 (Range Fed Cattle – See "County Profiles and Estimated Impacts.doc" in the Administrative Record). A separate model is created for each EIA, and each EIA will have its own set of SAM income multipliers and SAM employment multipliers.

The third step is to multiply AUMs by direct job or income response coefficients by SAM multipliers for total jobs and income from grazing on National Forest System (NFS) lands. This is done for each of the EIAs for each alternative including the existing condition (see Table 3-7 in FEIS Chapter 3). At this point in the SAM, multipliers could have been adjusted once more by calculating direct income and job accounts in IMPLAN for sector 4, inserting them in the IMPLAN matrix in place of the default values and rerunning the multiplier reports. An initial test with Thunder Basin (See FEIS_direct_rng_tb_tt_modified.xls in the administrative record) indicated the adjusted job multiplier would be 6% less. For this level of adjustment, the SAM multipliers were not readjusted.

The fourth step is to identify the percentage of private lands controlled by commonly fenced pastures (Intermingled Lands). Many Forest Service grazing pastures are mixed ownership pastures--private and state lands fenced in with NFS lands. Private and state landowners have the right to manage grazing as they see fit if they are willing to fence their lands separate from NFS lands. If the private and state lands are not fenced separately from NFS lands, the landowners waive their right to manage grazing as they see fit and must abide by the Land and Resource Management Plan direction. Chapter 3 Community and Lifestyle Relations displays the intermingled lands multipliers.

The fifth step is multiplying total NFS grazing jobs and income by the intermingled lands multipliers and then adding total NFS grazing jobs and income with intermingled lands total jobs and income for total NF pasture jobs and income (see Table 3-9 in FEIS Chapter 3). When grazing jobs and income are reported through the rest of the FEIS (including the NFS dependency tables), it is the NF pasture jobs and income that are used.

Methodology for Determining Economic Response Coefficients for Minerals Production

Introduction

The economic response coefficients used in this analysis were calculated to help managers and planners estimate the effects of changes in national grassland management. For example, increases or decreases in the level of minerals production could have economic effects on communities near national grasslands. These effects can be measured in terms of employment and income earned by the local communities. The following analyses provide a reasonable estimate of the change in jobs and income for the selected economic regions as related to changes in mineral outputs

Methodology

Response coefficients were calculated for each of the gas-, oil-, or coal-producing economic regions included in the "Impact Areas" index in this analysis. The economic impact regions were established as part of the Northern Great Plains assessment and consist of counties or groups of counties which were determined to be in some way economically effected by national grasslands management in the Northern Great Plains assessment area. The reasoning for determining each of the specific impact areas is explained above.

Minerals Mining Activity Categories

The development of response coefficients was limited to two major mineral groups: gas and oil and coal. Other minerals in grassland areas were too minor to merit analysis. Gas and oil are analyzed as a single unit of joint production and the results expressed in "million barrels of oil". The reason for this is that the impact model used for analysis includes natural gas and crude petroleum in a single production function. This means that the current employment and income generated from both activities for each impact area is included in the same account in the impact model and the resulting impacts are also combined. Coal production is measured in "million short tons.

Areas Analyzed

Only 4 national grasslands produced, or will produce in the near future, enough gas, oil, or coal to warrant analysis. Only Thunder Basin National Grassland was analyzed for coal production. Thunder Basin, Buffalo Gap, Oglala, and Little Missouri National Grasslands produce gas and oil.

Determining Impacts

The MicroIMPLAN economic impact model was used to determine the employment and income attributable to the production of gas, oil, and coal in the designated impact areas. The details of MicroIMPLAN will not be explained in this report. It is enough to know that the model predicts changes in employment and income based on predicted changes in final demand. In this case, the change in final demand is represented by the total industry output included in the MicroIMPLAN accounts for the impact areas.

The report shown in this analysis was built from MicroIMPLAN reports. The MicroIMPLAN reports were imported into a spreadsheet (Microsoft Excel) and modified to present the desired information.

Coal

Total coal jobs and income were developed by adding up the direct coal jobs and income obtained from the Oil and Gas IMPLAN model for Campbell, Converse, and Crook counties and multiplying by the coal SAM multiplier for jobs and income.

Oil and Gas

Oil and gas production for the impact area was taken from tables maintained by the Washington Office of the USDA Forest Service. Data was available for each grassland by county and for each total county (Forest Service and non-Forest Service production).

The general approach to calculating response coefficients was to determine direct and total income and employment attributable to the oil and gas industry and then divide it by physical production. This would give a response coefficient that would disclose the income and employment attributable to each million barrels of oil production for the impact area in and around the selected impact area. The assumption is that gas production varies directly and somewhat in proportion to oil production. The joint production function problem is described above. 1997 data was used because this is the most recent year available in impact models.

The total employment and income attributable to gas and oil production was taken from the MicroIMPLAN database. However, this only provides direct employment and income. An impact analysis was necessary to calculate the indirect effects. A scenario was created using the total industry output for the natural gas and crude petroleum sector (Implan sector 38) to represent the total change in final demand attributable to oil and gas production.

Conclusions

The use of these tables is fairly simple. For example, let's say a management alternative the Thunder Basin National Grassland will increase coal production by 30 million short tons per year. The summary table the Thunder Basin shows 18.78 direct and 42.55 total jobs for each million short tons of coal produced in the impact area. This means that approximately 1,280 new jobs would be created in the impact area.

If the decision-maker wants to know in what economic sectors the new jobs will occur, they need to go to the individual detailed table (e.g., Coal Production for the Thunder Basin National Grassland). There they will see the most jobs will be created in the coal mining sector, but a substantial amount will also be created in maintenance and repair, railroads and related services, wholesale trade, eating and drinking establishments, and many other retail and service sectors. Impacts on employee compensation income and total income would be determined the same way.

Recreation Economic Response Coefficients – General Tourism

Economic response coefficients were developed for general tourism in the Northern Great Plains economic impact areas. Coefficients were developed for each national grassland economic impact area plus the McKelvie Unit of the Nebraska NF (9 economic impact units). The response coefficients were developed for both non-resident and resident tourists. Non-resident tourists are those that reside outside the economic impact area being analyzed. Resident tourists are everyone else. The coefficients are in terms of total jobs and labor income, and each coefficient represents the change for each 1,000 tourist days. Using the Little Missouri National Grassland as an example: on the average, each thousand non-resident tourists spend enough per day in the economic impact area to generate 2.8 direct jobs and 3.4 total jobs (includes subsequent rounds of spending), $46,122 in total labor income. Keep in mind this is “total” jobs and many of them could be part-time. This should not be confused with “full time equivalents” which is another way of expressing job effects.

The distribution of the impacts throughout the economic sectors can be seen on the individual impact reports. Using the Little Missouri National Grassland again: for each thousand non-resident tourists, 8 jobs are created in the hotels sector, .5 jobs in food stores, and .5 jobs in miscellaneous retail. Because of rounding to zero, the jobs report does not disclose the effects of indirect and induced spending. To get this, the unit of impact would have to be increased to at least 10,000 tourist spending days. However, the labor income report can be used to identify

the sectors benefiting from indirect and induced spending. This can be useful to demonstrate what a wide range of sectors / businesses benefit from tourist spending.

The coefficients were developed using the IMPLAN Pro economic impact model with the 1997 county level data sets (this is the latest available from Minnesota Implan Group). Impact models were developed for each of the 9 economic impact areas (EIA). A general tourist spending profile was then subjected to the impact component of the model to generate the reports discussed above and the summary spreadsheets. The spending profile used was for nationwide spending for "mechanized travel," and developed by Don English of the Forest Service Southeast Station in Athens, Georgia. It can be seen on the accompanying spreadsheet (See job_income_rec.xls in the administrative record). It is expressed in 1990 dollars and was converted to 1997 dollars by the IMPLAN model.

Estimated recreation jobs and income did not change by alternative, as it could not be said that one alternative or another would affect overall demand. In estimating jobs and income, it was assumed that 50% of tourists were local EIA residents and the rest were non-resident. Recreation Visitor Days (RVD) estimates were obtained from FEIS Chapter 3, Recreation and Travel Management.

Economic Diversity and Dependency

Introduction

An effort was made to describe economic conditions in Northern Great Plains communities that were associated with the management of the national grasslands and forests of that area. The purpose of this appendix is to generally describe how several of the descriptive variables were determined and measured.

It was felt that economic diversity and dependency needed to be described to the extent practical. This was based on public interest and also developments in other assessments such as the Interior Columbia Basin Ecosystem Management Project. Several units of measure were selected to describe the above variables. Their selection was based as much on data availability as it was on their ability to describe economic conditions.

One of the first decisions was the selection of the geographical unit to be used for measurement and reporting. The first geographic level was that of economic impact areas[6]. These were clusters of counties that bore a significant portion of the effects of management activities from the national grasslands and forests. A comprehensive description of economic conditions at the community level was not done because of a lack of consistent data over the region as a whole. Therefore, descriptions focused at the county or county group level. After economic diversity and dependency were determined at the economic impact area level, there was much demand by local citizens and officials to have the same data available for each individual county. This was also done. In summary, descriptive models have been built at the county, economic impact area, state, and five-state region levels.

[6] See Appendix B (this appendix) "B. Community and Lifestyle Relationships;Economic Analyses; Impact Areas Selected and Reasons For Selection".

Economic Diversity

Several measures were used to demonstrate the diversity of the economies of the economic units of choice. The variables chosen were (1) the number of economic sectors (2) a listing and description of all economic sectors in the economy and (3) the Shannon-Weaver diversity index.

The source of this information is the MicroIMPLAN economic impact system. The single best description of the IMPLAN system is documented in *IMPLAN PRO - A Users Guide* etc. written by the Minnesota IMPLAN Group Inc. More information can be found at their web site http://www.implan.com.

Shannon-Weaver Economic Diversity Indices

The most technical method used to describe economic diversity is the Shannon-Weaver economic indices. Economic diversity indices using the Shannon-Weaver entropy function have been previously computed for all U.S. counties, labor market areas, Bureau of Economic Affairs (BEA) functional economic areas, BEA component economic areas and states using IMPLAN employment data for the years 1977, 1982, 1985, and 1990-1996. These indices have been computed for three levels of industry aggregation: 1-, 2-, and 4-digit Standard Industrial Classification (SIC) groups. For purposes of the NGP assessment only 1996 at the 4-digit level, and the direction of change (1983 through 1996 and 1990 through 1996) were displayed for each county in the NGP economic impact area[7].

Economic diversity is defined as "the presence in an area of a great number of different types of industries" or "the extent to which the economic activity of a region is distributed among a number of categories", then it is useful to have a summary statistic to describe the diversity of an area and compare it to other areas or compare the same area. The entropy method measures diversity of a region against a uniform distribution of employment where the norm is equi-proportional employment in all industries.

1996 is the most recent year for which the Shannon-Weaver indices have been computed.

Economic Dependency

The geographic scale for computing and displaying economic dependency is the same as that used for economic diversity. The question examined in this analysis is “How dependent is an EIA on a particular industry and the indirect and induced jobs and income it creates?” Economic dependency was determined using a two-step process.

In the first step, dependency was estimated for grazing and minerals in total. That is, regardless of Forest Service activities, how dependent is a county or EIA on the grazing industry or the mineral industry in terms of jobs and income? Total livestock grazing dependency was accomplished by estimating direct county and EIA-wide grazing related jobs and income and then multiplying by IMPLAN derived SAM multipliers for a total (direct, indirect, and induced) job and income effect. Total mineral dependency was determined by obtaining IMPLAN mineral sector jobs and income (sectors 37, 38, and 39) and multiplying those values by the appropriate IMPLAN SAM job or income weighted average multiplier. Total jobs and income were then divided into the total grazing or mineral related jobs and income to get percent dependency. This is not a true economic dependency measure, as adjustments were not made to obtain only basic or export (export out of the EIA) related jobs and income. IMPLAN

[7] See www.fs.fed.us/institute/economic_center/spatialdata3.html

supplied this data for both the county and EIA level and both levels of dependency are found in Table 3-2 (FEIS Chapter 3). For example, the table shows that Billings County is 42.4% dependent on the livestock industry for direct, indirect, and induced jobs related to beef cattle. At the same time, the Little Missouri National Grassland EIA is 14.1% dependent on the livestock industry for direct, indirect, and induced jobs related to beef cattle.

In the second step of the dependency analysis, national forest and grassland production of grazing, minerals, and recreation were examined (see Table 3-3 in FEIS Chapter 3). Recreation was added to this level of analysis because a general estimate of RVDs was available all of the grassland and forest units, while similar information was not available at the county or EIA level. The purpose of this table was to examine the dependency of the EIAs on National Forest activities. In this analysis, only jobs and income related to activities occurring on National Forest System lands (in the case of grazing, National Forest pastures) is compared to total EIA jobs and income. The data was not easily disaggregated back down to the county level so as to provide a fair disaggregation and was left at the EIA level. The values in this table are significantly smaller than in the previous industry dependency table (see Table 3-2, FEIS Chapter 3). For example while the Little Missouri National Grassland Economic Impact Area (EIA) is 14.1% dependent on direct, indirect, and induced jobs related to livestock production (see Table 3-2, FEIS Chapter 3), the Little Missouri National Grassland EIA is 1.6% dependent on direct, indirect, and induced jobs related to livestock production on National Forest pastures (see Table 3-3, FEIS Chapter 3).

Indirect Effects On Intermingled Lands

As part of the DEIS comment analysis, it was discovered that significant livestock grazing effects that were indirect in nature were not considered in the DEIS analysis. The primary component of the livestock grazing indirect effects analysis is the intermingled land analysis. This analysis examines the effect of Forest Service control over private and state lands that are fenced in common pastures with National Forest System lands (national forests and grasslands).

Every national grassland or national forest has an administrative boundary that describes the outer limit of the grassland or forest unit in question. Within this boundary, as little as 1/3 of the acres are actually national grassland or national forest acres. The remaining acres are private or state lands. Generally the Forest Service has control only over the national grassland or national forest acres, not the entire area within the administrative boundary. One exception is a Forest Service pasture containing state and or private lands mixed in with National Forest System acres. Within an administrative boundary, there are many pastures with no national grassland or national forest acres in them; these pastures are not considered Forest Service pastures. In the Forest Service pastures with intermingled lands, the state and private land owners have elected not to fence out their lands from federal lands and must abide by the stocking decisions of Forest Service managers. The state and private landowners can fence out their pastures at any time.

The FEIS predominantly discusses effects based only on National Forest System lands, except where there are indirect effects as defined in the National Environmental Policy Act (NEPA) such as the intermingled land livestock grazing effect.

The analysis process was one in which the total acres of Forest Service pastures were compared to the actual acres of National Forest System lands within those pastures to develop a indirect effects multiplier. The equation for the multiplier is:

> *(Non-Forest Service Pasture Acres + Forest Service Pasture National Forest System Acres) / Forest Service Pasture National Forest System Acres*

The smallest this multiplier can be is 1. Within the Northern Great Plains units, no multiplier was greater than 2.3 (on the Thunder Basin).

Using the Thunder Basin as an example, the use of the multiplier will be explained. The multiplier basically says that for every 1 acre of National Forest System land, the Forest Service controls stocking on an additional 1.3 acres of state or private land.

Say the Land and Resource Management Plan decision determines stocking is to be reduced 10%on National Forest System lands resulting a direct, indirect, and induced economic loss of 100 jobs and 1 million in income. The total indirect effect considering federal, state, and private land within Forest Service pastures would be 230 jobs (100 jobs x 2.3) and $2.3 million in income (1 million in income x 2.3).

The indirect effects from the intermingled lands are discretionary in nature because Non-Forest Service landowners have elected to not fence out their land, but it is still an effect to be considered.

Summary

It is important that the methodologies be consistently applied to give comparable results over the planning units. Other regional and more detailed local studies have been conducted. While these studies are usually high quality, they are not comparable to each other due to different methods used and different variables measured. For this reason, national level data, such as that coming from the IMPLAN system, the Regional Economic Information System, and the U.S. Census, was used. Results of the local and regional studies were compared with the IMPLAN results, and where there were differences, the differences could usually be reconciled.

Social Analysis

The study method used was guided discussion groups, also known as focused group interviews or focus groups. Richard Krueger, author of *Focus Groups: A Practical Guide for Applied Research*, explains that focus groups can produce insights into the attitudes, perceptions, and opinions of participants? (1994:19). They are what Krueger describes as a “socially oriented research procedure” (29). The results are qualitative data in which the participants choose how they respond and how they react to the responses of others in the group. Focus groups are made up of people who are similar to each other. Generally, the participants in the groups for this study were homogeneous in their use, interest, orientation, or goals for these public lands.

Each discussion group was led by a trained moderator. Discussion results were entered on a laptop computer by a recorder provided by the Forest Service. The discussions were also audio- tape recorded for later interpretation and report writing.

Subjects of the Study

The subjects were user / interest groups as identified by contact lists, referrals, and self-reports. The intent of the homogeneity among group participants was to promote more free-flowing discussion among group participants and to help analyze different perspectives between groups.

The user / interest groups identified for this study included:

- Industries and related support suppliers.
- Agricultural production (permittee and nonpermittee ranchers, suppliers, wholesalers).
- Oil, gas, minerals industries and suppliers.
- Wood products industry (applies to Nebraska's Pine Ridge region only).
- Consumptive recreationists (hunters, anglers, rock collectors, and suppliers).
- Nonconsumptive recreationists (trail users, sightseers, campers, and suppliers).
- Conservation, preservation, environmental orientations.
- Wildlife production (promotes wildlife conservation and habitat enhancement).
- Government (local, state, federal).
- American Indian government.
- Adjacent landowners.

Participant Criteria

Most participants for the group discussions met the following criteria:

- Lived within 100 miles of public lands in question (local residency was preferred).
- Had some knowledge and / or experience with national forest / grassland management.
- Described themselves as members of a use / interest group category.
- Were willing to participate voluntarily in a 2-hour discussion.

Participant Recruitment

The recorder used a preliminary participant list provided by the District Ranger / manager to recruit participants. This list included people currently on the Forest Service mailing list and names of people not on the list but known to have an association with the user / interest segment. For instance, industrial suppliers and wholesalers, people with an indirect interest, or people who might experience secondary effects. Once a preliminary participant list was developed, the recorder telephoned the potential participants. The target group size was 6 to 12 people.

In most cases, two discussion groups were completed for each user / interest segment. The group discussions were held near the public lands. Public or neutral locations, such as libraries or restaurants, were preferred discussion sites.

Role of Moderator

The moderator encouraged and guided the flow of conversation through a series of sequenced questions. Some situations called for more intervention to keep people on the topic. Other situations allowed the moderator to take a more passive role while the conversation took a natural course to the next question.

The moderator collaborated with the recorder in the report writing. The recorder had the primary responsibility for preparing the report, but the moderator reviewed and corrected the report as necessary.

Role of Recorder

The recorder took comprehensive notes, operated the tape recorder, handled the environmental conditions and logistics, and responded to unexpected interruptions. The recorder prepared the discussion results and incorporated changes offered from participant and moderator reviews. The recorder also recruited and notified participants.

Interview Content and Questions

After introductions, the moderator explained how the information from the discussion would be used. The participants were encouraged to be open and candid in their responses to the study questions. The moderator then posed the first of a series of suggested interview questions. The moderator had flexibility to reword the questions to fit their style and the situation as long as the study objectives were achieved.

Interview Question 1

What is most important to you on the _____ national grassland / forest? How would you like to see it managed? How would you describe your goals for management?

Interview Question 2

Based on how you defined your goals for management, what do you see as opportunities or situations to achieve your goals? In other words, what Forest Service management would further your ability to achieve your goals?

Interview Question 3

Along the same line, what do you see as the obstacles or limitations to achieving those goals?

Interview Question 4

What do you see as some of the interests people have in the _____ national grassland / forest? How do you view your goals in light of these other interests and views?

Interview Question 5

Where the uses and interests of different people conflict, what opportunities do you see for reconciling those conflicting interests?

Optional Questions, if time allowed

Interview Question 6

What has been your experience with the way the Forest Service makes decisions? How open have you found the Forest Service in bringing people into making decisions?

Interview Question 7

What does the term "multiple-use" mean to you?

Interview Question 8

What does the term "ecosystem management" mean to you?

Group Interview Results

In the fall of 1997, the Forest Service conducted interviews with 19 groups of people who identified with a use or interest in the national forests and grasslands in the Northern Great Plains. These group discussions were led by trained moderators who asked a set of standard questions provided by the Forest Service. The questions were designed to explore principal management goals for the public lands. The use or interest groups interviewed for the study are listed below along with some of the key management goals for each segment.

Agriculture Segment

The primary management goals for the public lands identified by this segment are vigorous grass production, available water, and suitable access. There is strong support to manage these federal lands as they believe the Bankhead-Jones Farm Tenant Act intended--to supplement grazing and stabilize local economic conditions. Some people believe that the intent was for local grazing associations and members to have more influence on management decisions than other types of users.

Oil, Gas, Minerals Segment

Access to leased lands and timely responses to applications were among top management goals for this segment. Participants felt the Forest Service could streamline processes and reduce costly delays by better planning and coordination and by anticipating needed information and completing inventories when conditions allow.

Wood Products Segment

This group believes a desired condition for the timber stands is needed, and timber management is an appropriate tool for achieving desired conditions for the forested lands. In their view, timber management could reduce the risk of insects and fire and improve overall forest health. The group believes there are sufficient timber resources to sustain a modest allowable sales quantity on the Nebraska National Forest. The quantity should be a common-sense program based on good inventory data and potential growth and yield.

Consumptive Recreation Segment (hunters, anglers, rock collectors, etc.)

These people have a strong appreciation for public lands where they can pursue their activities. Access is important; however, access doesn't mean driving anywhere but, instead, being able to get to the public lands. The condition of the vegetation, whether trees or grass, is important to providing quality wildlife habitat and recreation experiences.

Nonconsumptive Recreation Segment (trail users, campers, sightseers, etc.)

For this segment, access to the public lands and the experiences they offer is a fundamental management goal. Access could be improved by installing easier-opening gates or cattle guards (instead of gates) and reducing fences overall. Improved visitor information and trail signs would enhance their recreation experience. This group believes that if recreation is encouraged on the public lands, it should be planned for and managed.

Conservation/Preservation/Environmental Segment

The health of the grasslands was considered the primary management goal. People spoke of the need for viable wildlife populations, properly functioning grassland ecosystems, and a healthy mosaic of native vegetation that includes habitat provisions for threatened, endangered, and sensitive plant and animal species. This group believes that a long-term vision for managing the national grasslands should be developed, especially with the involvement of all interested parties.

Wildlife Advocacy/Production Segment

This segment looks to the national grasslands to fill habitat niches that private lands are not providing. They appreciate that the public lands are open to everyone, and citizens have a say in how they are managed. Vegetation condition is considered a critical habitat component. Native grasses are desired, as is grass left to mature instead of being grazed uniformly. Livestock grazing and fire are regarded as tools to achieve vegetation diversity

Government Segment

This group values the natural resources and management opportunities found on the national forest and grassland units. The units represent large tracts of grassland that provide diverse vegetation, recreation sources, wildlife habitat, and economic contributions to communities.

American Indian Community Segment

American Indian communities want to be self-sufficient, and they see the national forests and grasslands as resources that could potentially further their self-sufficiency and improve their economic conditions. They also look to these public lands for spiritual and cultural reasons and uses.

Adjacent Landowners Segment

This segment wants the Forest Service to be a good neighbor by building relationships with their neighbors. As good neighbors, the Forest Service should be accountable and trustworthy. They should respect the opinions of local residents and not try to dominate their neighbors. They should also respect the rights of private property owners and help reduce public trespass on the private lands.

Planning Coordination and Outreach

The Forest Service continually coordinates with scores of state and local governments, associations, tribes, partners, groups, and other entities. This ongoing process is an effort to better identify common goals and visions for the National Forest System lands and adjacent lands on the Northern Great Plains. As part of this effort, the Forest Service tries to keep abreast of the many plans, like county land-use plans, developed by other counties or other entities. Such entities include: county and tribal governments, state wildlife agencies, recreation and tourism agencies, regional economic development groups, state and local transportation departments, and research colleges and universities, to name just a few.

In the fall and winter of 1996-97, Forest Service district rangers and legislative coordinators contacted county, state, and regional agencies in the vicinity of Forest Service units on the Northern Great Plains. The outreach had two goals:

- To assess whether existing local economic development, growth, or other trends or plans could be facilitated by national forest and national grassland management.
- To assess the current and future impact of national forest and national grassland management on local infrastructure, such as police, fire, water, sewer, schools, and roads.

Most agencies expressed a desire to be kept informed of Forest Service planning and management activities. Some presented land-use plans that would require close coordination with Forest Service management. A few expressed a desire that the Forest Service be involved in local land-use plans. Many cases of existing coordination and cooperation in joint ventures were cited. A few opportunities were brought forward for future coordination and cooperation, such as South Dakota's desire to facilitate the permit process on public lands for the motion picture industry. Such a process could facilitate movie productions such as Dances With Wolves, which brought millions of dollars into South Dakota[8].

C. Fire and Fuels Management

Prescribed fire acres were developed utilizing PCHA (Personal Computer Historical Analysis) which is a data storage and retrieval system to determine current acres being burned from the past 20-year period. Historical fire regimes were utilized based on research from *The Role of Fire in Managing for Biological Diversity on native Rangeland of the Northern Great Plains* (Carolyn Hull Sieg) and *Historical Ecology and Ecosystem Variation in Mid-continent Grasslands* (Judy P. von

[8] See Administration Record "Planning Coordination and Outreach with State and Local Entities".

Ahlefeldt). Based on this information, units determined the percent of their unit which should be burned on a yearly basis.

D. Fish, Wildlife and Rare Plants

Potential Black-tailed Prairie Dog Habitat

A habitat model to predict potential habitat for black-tailed prairie dogs was developed and applied using GIS computer technology. The development and use of this model was in response to public comments that frequently addressed the subject of potential prairie dog habitat on NFS lands. Ideally, potential prairie dog habitat would have been determined and defined as the maximum extent of prairie dog colonies known to have occurred historically on those areas that are now part of a national grassland or forest. Of course, historical information on prairie dog colony distributions during the 1800s and early 1900s are not available so a modeling effort appeared to be the next best strategy to quantify and map potential habitat for the species.

Like most modeling efforts, models should be expected to undergo continued modifications and refinements, and this model is no exception. As a means to partially validate and refine model drafts, the maximum distribution of colonies known to occur on each unit over the last 20 to 25 years was compared with habitat predictions of the various model drafts. Refinements in modeling rules (habitat criteria) were made until approximately 85% or more of the maximum recorded colony distribution occurred in habitat predicted to be suitable.

The model criteria (variables) for black-tailed prairie dogs varied between some NFS units depending on the type of soils or vegetation information available. The overall general modeling criteria were as follows:

- Suitable soils.
- Suitable vegetation.
- Suitable slope.
- Suitable hydrology.

Most soils on the NFS lands in the planning area are suitable for prairie dog burrowing. Even some of the sandy soils in the valleys of the Nebraska Sandhills support burrowing activities. Also soils with shallow bedrock are known to support prairie dog colonies. Some soils may be preferred by prairie dogs but few preclude prairie dog burrowing.

Soil type data were not available for the Little Missouri National Grassland, Cedar River National Grassland and Grand River National Grassland. For these units, soil inferences by existing vegetation were used.

Forest and wetland vegetation types were considered unsuitable for prairie dogs. Grassland vegetation types including those with minor shrub components were considered preferred habitat. Since black-tailed prairie dogs also occur in shrublands and modify shrublands by removing shrubs in and around their colonies, shrublands were considered suitable but marginal habitat.

Slopes with suitable soils and vegetation that were less than 10% slope were considered preferred habitat. Slopes ranging from 10 to 30%were classified as suitable but marginal habitat. Areas with average slopes exceeding 30%were identified as unsuitable.

All water and wetlands were classified as unsuitable for prairie dog colonization. Areas with shallow water tables were also classified as unsuitable.

Wet areas were identified in two ways: 1) using US Geological Survey (USGS) data modified by the USDA Forest Service and 2) using National Wetlands Inventory (NWI, www.nwi.fws.gov) data. The first was accomplished by placing a 100-foot buffer (50 feet either side of a stream center) on all USGS perennial and intermittent streams to model the riparian/woody zone. A USGS polygon water layer was also obtained to represent water bodies. Second, the National Wetlands Inventory (NWI), developed by the US Fish and Wildlife Service, was used to identify wet areas with both linear and polygon components in the same manner as the USGS hydrology layer. A data dictionary published by the USFWS entitled "NWI Maps Made Easy, USFWS 2/1993" was used to interpret the codes in the NWI coverages. The water and wetlands part of the analysis used both the USGS and the NWI wetlands systems in the prairie dog potential analysis to ensure maximum identification of wet areas. The Thunder Basin was the exception as the National Wetlands Inventory was not available for it.

The presence of large herbivore (livestock or bison) grazing and/or past soil disturbances was originally considered as criteria for predicting potential prairie dog habitat. Large herbivore grazing was spatially analyzed and mapped using a GIS model for predicting the location and extent of primary, secondary, and ungrazed range. However, other than for steep slopes, almost all rangelands classified as primary, so the presence of large herbivore grazing was dropped as a meaningful criteria. Past soil disturbances in the form of water developments, pipelines, range ripping and furrowing, and past cultivation are also good predictors of suitable prairie dog habitat, but information for this criteria did not exist or was not readily available.

An attempt was made to develop a model for predicting potential prairie dog habitat on the NFS lands in the Nebraska Sandhills, but this effort was unsuccessful.

The Sheyenne National Grassland falls outside of the black-tailed prairie dog habitat range and was not analyzed.

The Pine Ridge is a forest landscape and was not analyzed for black-tailed prairie dog habitat.

In classifying prairie dog habitat suitability, a site was classified as preferred habitat only if all four variables (vegetation, soil, slope, and water) were rated as preferred. If one variable was rated suitable but marginal, the entire site was rated marginal. If one variable was rated unsuitable, the entire site was rated unsuitable.

Analysis differences between different Forest Service administrative units were due to the kinds of soils and vegetation data available and, in the case of the Thunder Basin, the lack of a National Wetlands Inventory.

Dakota Prairie Grasslands

Soil data were not available for the Dakota Prairie units, but the analysis was augmented with a broad-based vegetation classification scheme (see Vegetation Composition for Dakota Prairie Grassland described elsewhere in Appendix B).

The vegetation classifications used for the Grand River, Cedar River, Medora, and McKenzie Analysis Unit are described in the following table. Codes with '**' are preferred vegetation types, codes with '*' are marginal vegetation types, and codes without an asterisk are unsuitable vegetation types.

Table B-4. Code - Existing Vegetation Composition Name.

2010 - Agriculture-Dry	4206 - Ponderosa Pine
2020 - Agriculture-Wet	4214 - Rocky Mountain Juniper
*3111 - Non-native Grass	4300 - Mixed Broadleaf / Conifer Forest
**3130 - Very Low Cover Grasslands	5000 - Water
**3140 - Low Cover Grasslands	6120 - Broadleaf Dominated Riparian
**3150 - Low / Moderate Cover Grasslands	6130 - Mixed Broadleaf / Conifer Riparian
**3160 - Moderate / High Cover Grasslands	6140 - Mixed Forest / Nonforest Riparian
*3210 - Mixed Mesic Shrubs	**6210 - Graminoid / Forb Dominated Riparian
*3309 - Silver Sage	*6310 - Shrub Dominated Riparian
3313 - Creeping Juniper	*6400 - Mixed Shrub / Herbaceous Riparian
*3318 – Shadscale	7301 - Exposed Rock
*3352 - Wyoming Big Sagebrush Steppe	7600 - Badlands
*3510 - Mesic Shrub-Grassland Complex	760 - Shrub Badlands
*3520 - Xeric Shrub-Grassland Complex	**7602 - Grass Badlands
3530 - Tree-Grass Complex	9800 - Clouds
4140 - Mixed Species Broadleaf Forest	9900 - Cloud Shadow
4205 - Limber Pine	

Nebraska National Forest Units

The Nebraska National Forest units had soil survey data and grassland vegetation data, as well as some shrubland and tree data.

Shrub and trees can make a site marginal or unsuitable depending on the species and percent cover. If the shrub species is either sagebrush (ARCA13 and ARTEM types) or rabbitbrush (CHNA2 types) and cover percent is greater than 10% the vegetation is marginal. Otherwise it is preferred. If the shrub species is greasewood (SAVE) the vegetation is not preferred. If greasewood cover is greater than 0 and less than or equal to 10% the vegetation is marginal. If greasewood cover is greater than 10% the vegetation is unsuitable. All other shrubs are preferred vegetation.

Sites are not preferred vegetation if trees were present. If the tree species cover is greater than 0 and less than or equal to 10%, the vegetation is marginal. If tree species cover is greater than 10%, the vegetation is unsuitable.

Soil data was based on range sites[9]. A given soil site can consist of between 1 to 3 different range sites. Each soil site was classed as preferred, marginal, or unsuitable[10].

Thunder Basin National Grassland

The Thunder Basin analysis used vegetation classified from the USDA Forest Service Pueblo IRI (Integrated Resource Inventory) Center, which classified vegetation into the following types. Each type was classified for prairie dog suitability.

Table B-5. Vegetation Habitat Types.

ARTR	Marginal
ARTR-SW	Marginal
NO ACCESS	Unsuitable
NO DATA	Unsuitable
NO RNG SITE	Unsuitable
PIPO JUNIP	Unsuitable
PITS	Unsuitable
PODE	Unsuitable
RIPARIAN	Unsuitable
SAVE-LO	Unsuitable
SAVE-UP	Unsuitable
STCO	Preferred
STCO-PDOG	Preferred
STCO-SW	Preferred
UNKNOWN	Unsuitable
WATER	Unsuitable

Soils were classified using the NRCS sri_muid by looking at the underlying range sites within each sri_muid to determine prairie dog soil suitability[11].

The references consulted in the development of this model are listed at the end of this appendix.

Selection of Management Indicator Species

Regulations in 36 CFR 219.19 and 219.20 (National Forest System Land and Resource Management Planning, September 30, 1982) call for the selection, evaluation, and monitoring of management indicator species (MIS) and their habitat. MIS can be "plant or animal species selected because their population changes are believed to indicate the effects of management activities on other species of selected major biological communities or on water quality." The intent of the regulations is that population trends of the selected species occurring on or in the vicinity of NFS lands would be closely tied to habitat conditions resulting from authorized lands uses on those same NFS lands and that a suite of species would react to the authorized lands uses in a manner similar to the response of the MIS. The regulations do not imply that the population dynamics of management indicator species, as influenced by land uses, directly

[9] See South Dakota and Nebraska USDA - NRCS Technical Guides for a description of range sites.

[10] See Administrative Record "Black-Tailed Prairie Dog Habitat Suitability AML, Nebraska."

[11] See Administrative Record "Black-Tailed Prairie Dog Habitat Suitability AML, Thunder Basin."

represent the population dynamics of other species. Also, the regulations do not require that MIS be selected for all management activities or all biological communities on NFS lands.

Considerable scientific discussion has occurred as a result of the application of the MIS concept by the Forest Service during the development and implementation of the first generation of national grassland and forest Land and Resource Management Plans. Several critical reviews of the MIS concept and its application have been published (Landres et al. 1988, Niemi et al. 1997, U.S. General Accounting Office 1991). Many of the criticisms of the MIS concept and how it has been applied appear to be valid. In response to these critiques and other concerns about the MIS concept and its application, the following criteria were used to help select the best and most credible MIS for the major biological communities and issues:

- Species is indigenous.
- Species is a year-long resident of the vicinity (non-migratory), or population trends of the species in the local or regional vicinity are closely tied to habitat conditions resulting from land uses on NFS lands in the same area.
- Species is considered a keystone species or habitat specialist.
- Species is sensitive to management activities on NFS lands in the local or regional vicinity. Population trends of the species are assumed to be related to changes in habitat composition, structure, ecological processes, and / or human activities.
- Species is appropriate for the scale that best represents the key issues or management concerns.
- Biologically and economically feasible to monitor populations and habitat of the species at similar spatial scales. Populations are of sufficient size or density to be reasonably detected and monitored. Accepted survey protocols exist. Analysis and interpretation of inventory data should produce meaningful and reliable trend information. Species that require high investment for low returns or suspect results should be avoided.
- Species where the scientific literature supports the assumed limiting factors and habitat associations.

Using these selection criteria, suitable MIS could not be identified for some biological communities. Additional evaluation and research may be needed to identify suitable MIS candidates for these communities. It is possible that, based on the selection criteria, credible MIS may not exist for some biological communities.

E. Oil, Gas, Minerals Management

Coal Suitability

Coal suitability for the Thunder Basin National Grassland was accomplished, separate from the Revision effort, jointly by the BLM Casper District Office and FS Douglas Ranger District. The results of this process were used in the analysis.

A coal suitability was done for the remainder of the planning area only on areas where the coal development potential is moderate or high (minerals / geology / paleontology meeting notes, November, 1995). The only area, other than the Thunder Basin National Grassland, that met the criteria is the Little Missouri National Grassland. To determine lands unsuitable for coal mining, ARCView was used to overlay the 20 criterion from 43 CFR 3461.5 on areas of coal

development potential. Where criteria data was not available in GIS (for example federal lands under permit by the Forest Service and being used for scientific study), the information was obtained from Forest Service files in Billings, Montana. There were no areas determined unsuitable for coal mining on the Little Missouri National Grassland.

Oil and Gas Leasing

Stipulation Comparison

The oil and gas leasing alternatives were developed from the stipulation comparison chart shown in Table B-6 . For the current analysis, Alternative 1 (No Action) represents existing leasing decisions (columns 1-4 in the following table). The fifth column represents the stipulations used in Alternatives 2-5 in the DEIS and proposed Revised Management Plans. Alternatives 2, DEIS 3, FEIS 3, 4, and 5 use a consistent set of stipulations (column 6 in the following table). The alternatives vary by acres allocated to management areas and, in most cases, do not vary standards and guidelines except for those associated with management areas. For all alternatives, the lease stipulations used in the FEIS were updated from those used in the DEIS in accordance with new information and as a logical outgrowth of public comment on the DEIS.

To understand the analysis in the FEIS, it is important to know that Alternative DEIS 3 uses the same stipulations as Alternatives 2, FEIS 3, 4 and 5. The difference in alternatives is in the acres allocated to management areas. In the following table, the stipulations used in the DEIS are maintained in column 5 for comparison with the stipulations used in the FEIS, Alternatives 2, DEIS 3, FEIS 3, 4 and 5.

The following abbreviations were used in Table B-6.

TBNG	Thunder Basin National Grassland
NLMNG	Northern Little Missouri National Grassland
SLMNG	Southern Little Missouri National Grassland
NNF	Nebraska National Forest
NAA	Not administratively available for leasing
NCA	Administratively available but not currently authorized for leasing
CSU	Controlled Surface Use
LN	Lease Notice
NSO	No Surface Occupancy
TL	Timing Limitation
G	goshawk
P	prairie falcon
S	Swainson's hawk
F	ferruginous hawk
EIS	Environmental Impact Statement
SIO	Scenic Integrity Objective
LM	Little Missouri
TRNP	Theodore Roosevelt National Park
NFS	National Forest Service
MA	Management area
DPG	Dakota Prairie Grasslands
CRNG	Cedar River National Grassland

Table B-6. Stipulation Comparison Chart

Resource, Use, Issue	TBNG	NLMNG	SLMNG	NNF	DEIS Standards and Guidelines	FEIS Standards and Guidelines
Surface - Physical					CSU for riparian areas, woody draws, wetlands, and floodplains over 200 meters from edge.	CSU for water, wetlands, woody draws, riparian areas, and floodplains; all units.
Floodplains	CSU	LN	LN	NSO w/i 1/8 mi		
Riparian	CSU		CSU			
Wetland	CSU	LN	LN	NSO w/i 1/8 mi		
River Bottom		NSO				
Playa	CSU					
High soil and water hazard	CSU			NSO>15%		
Moderate soil and water hazard				CSU		
Soil productivity permanent impairment to soil productivity	CSU					
Slopes 34-60%	CSU					
Slopes>60%	NSO					
Slopes >40% and mass failure		NSO	NSO			
Slopes > 40%					CSU	NSO; all units
Soils susceptible to mass failure					CSU slopes 25 to 40%	CSU slopes 25 to 40% w/soils susceptible to mass failure; TBNG, NNF only
Water Quality Monitoring	LN					
Wooded Draw		NSO	NSO			

Resource, Use, Issue	TBNG	NLMNG	SLMNG	NNF	DEIS Standards and Guidelines	FEIS Standards and Guidelines
Wildlife						
T and E species / habitat	LN	LN	LN	LN		
Bald eagle and peregrine falcon nests	NSO, TL - 2 / 1-7 / 31w / i 1 mi, CSU w / i ½-mi				TL w / i 1 mi 2 / 1-7 / 31 CSU w / in 1 / 2 mi	NSO w / i 1mi line of sight; DPG. NSO w / i 1mi line of sight bald eagle only, not peregrine falcon on TBNG and NNF.
Bald eagle winter roost	TL-11 / 1-4 / 1 w / i 1 mi				TL w / i 1 mi 11 / 15-2 / 29	NSO w / i 1mi; all units
goshawk, osprey, Swainson's hawk, prairie falcon	TL -3 / 1-7 / 31 w / i ¼-mi CSU w / i 300 ft	NSO w / i ¼-mi (P) TL-3 / 15-7 / 20 (P)	TL-3 / 1-8 / 1 w / i 1 mi NSO w / i 1 / 2 mi (P)	TL-3 / 1-8 / 1 w / i 1 / 2 mi	CSU w / i ½-mi (G,P,S)	TL w / i ½-mi 3 / 1-7 / 31(S) NSO ¼-mi (S); TBNG, NNF. NSO w / i ¼ mi (P) NLMNG, SLMGNG
ferruginous hawk	TL -3 / 1-7 / 31 w / i ¼-mi CSU w / i 300 ft	NSO w / i ¼-mi (P, F) TL-3 / 15-7 / 20	TL-3 / 1-8 / 1 w / i 1 mi NSO w / i 1 / 2 mi	TL-3 / 1-8 / 1 w / i 1 / - mi NSO w / i 1 / 4 mi	TL w / i 1 mi from 3 / 1-7 / 31 CSU w / i ½-mi	TL w / i ½-mi 3 / 1-7 / 31; NSO w / i ¼ mi; TBNG, NNF. NSO w / i ½ mi; NLMNG, SLMNG.
merlin				TL-3 / 1-8 / 1 w / i 1 / 2 mi	TL w / i 1 / 2 mi from 3 / 15-7 / 15;	TL w / i ½-mi 4 / 1-8 / 15 NSO w / i ¼ mi; TBNG, NNF. NSO w / i ½ mi; NLMNG, SLMNG.
golden eagle	TL -2 / 1-7 / 31 w / i ¼-mi CSU w / i 300 ft	NSO w / i ¼-mi TL-3 / 15-7 / 15 w / i ½-mi	NSO w / i ½-mi	TL-3 / 1-8 / 1 w / i 1 / 2 mi NSO w / i ¼-mi	CSU w / i in ½-mi	TL w / i in ½-mi 2 / 1 to 7 / 31 NSO w / i ¼ mi; TBNG, NNF NSO w / i ½ mi; NLMNG, SLMNG.

Resource, Use, Issue	TBNG	NLMNG	SLMNG	NNF	DEIS Standards and Guidelines	FEIS Standards and Guidelines
Wildlife, cont.						
burrowing owl					TL w/i ¼-mi from 5/1-7/31	NSO w/i ¼ mi; all units.
sharp-tailed grouse	CSU w/i ¼-mi	NSO w/i 200 ft TL-3/1-4/15 w/i ¼-mi	NSO w/i 1/4 mi TL-3/1-6/15 w/i 1 mi	NSO w/i ¼-mi TL-3/1-6/15 w/i 1 mi	CSU w/i ¼-mi TL w/i 1 mi from 3/1-6/15	TL w/i 1 mi from 3/1-6/15 NSO w/i ¼ mi; all units.
sage grouse	CSU w/i ¼-mi		NSO w/i ¼-mi; TL- w/i 2 mi 3/1-6/15	NSO w/i ¼-mi, TL-3/1-6/15 w/i 1 mi	TL w/i 2 mi from 3/1-6/15; CSU w/i ¼-mi	TL w/i 2 mi from 3/1-6/15 NSO w/i ¼ mi; all units.
Rookery	TL-3/1-7/31 w/i ¼-mi					
Mountain plover					TL w/i plover use area or rookery or w/i ¼-mi of nest from 3/1-7/31	TL w/i ¼-mi 3/15-7/31 CSU brooding habitat NSO nesting areas; TBNG, NNF
Black-footed ferret occupied habitat outside MA 3.63						TL w/i 1/8 mi 3/1-8/31 CSU; all units
Big game crucial range		CSU or NSO in canyonlands				
Deer winter range	TL-12/1-4/30 CSU, NSO					
bighorn sheep		NSO-Mgmt Area C	NSO habitat		Lambing areas TL w/i 1 mi 4/1-6/15 CSU w/i 1 mi sight distance	Lambing areas TL w/i 1 mi 4/1-6/15 CSU w/i 1 mi sight distance; NLMNG, SLMNG only
mule deer			CSU			

Resource, Use, Issue	TBNG	NLMNG	SLMNG	NNF	DEIS Standards and Guidelines	FEIS Standards and Guidelines
Wildlife, cont.						
Antelope winter range		NSO w/i 900 ft TL-1/1-3/31				TL w/i mapped areas 1/1-3/31 only on NLMNG and SLMNG
prairie dogs		NSO w/i 100 ft	NSO w/i 100 ft	CSU w/i 1/4 mi		
swift fox					TL - w/i 1/4 mi of swift fox dens from 3/1-7/30	TL - w/i 1/4 mi of swift fox dens from 3/1-7/31; all units
Sensitive and Watch Plants			CSU known populations		CSU known populations - bring forward from SLMNG EIS	Carried forward in Botanical SIAs
Visual Resources						
Retention visual quality				NSO	CSU - High SIO area surface occupancy subject to operational constraints	CSU - High SIO area surface occupancy subject to operational constraints; all units
Scenery – Theodore Roosevelt NP						CSU - High SIO w/i 1 mi of TRNP; NLMNG, SLMNG
Retention foreground		NSO w/i seen area of LM River TL-5/15-9/15 next to TRNP	NSO w/i foregrd retention of LM River			
Partial retention foreground				CSU	CSU - Moderate SIO area surface occupancy subject to operational constraints	CSU - Moderate SIO area surface occupancy subject to operational constraints; all units
Middle and background			CSU w/i mid and background of LM and NFS access routes			

Resource, Use, Issue	TBNG	NLMNG	SLMNG	NNF	DEIS Standards and Guidelines	FEIS Standards and Guidelines
Visual Resources, cont.						
Cultural Resources	LN	LN	LN, NSO Traditional use	LN	NSO areas in NLMNG and SLMNG greater than 400 meters in width	NSO w/i National Register eligible sites; NLMNG, SLMNG
Other	NSO Buffalo Divide	CSU Elkhorn; NSO Blue Butte; NSO Graves		NSO Fiddle Cr	Bring forward stips from SLMNG where larger than 400 meters in width, Blue Buttes is not administratively available for leasing TBNG area is covered by MA 2.1, NNF- NSO on Fiddle Creek, bring forward.	Blue Buttes is not administratively available for leasing; Elkhorn is in MA 2.1 TBNG area is covered by MA 2.1, NNF- NSO on Fiddle Creek, bring forward.
Special Value Areas	NSO and CSU Biological diversity and rec. values		NSO Ponderosa Pine		Will only show in Alternative 1 for both units. They are handled by MAs in other alternatives	Will only show in Alternative 1 for both units. They are handled by MAs in other alternatives
Paleontology Area	LN	LN	LN, CSU	LN, CSU Potential, NSO All known	CSU on geologic formations classed 3,4 and 5 for fossils	CSU on geologic formations classed 3,4 and 5 for fossils TBNG, NNF only On DPG a LN is used.
Uses, Special Designations						
Recommended for Wilderness						NSO, MA 1.2; TBNG, NNF
Suitable for Wilderness						NAA, MA 1.2A; NLMNG, SLMNG
Backcountry Recreation Nonmotorized						NSO, MA 1.31; all units

Resource, Use, Issue	TBNG	NLMNG	SLMNG	NNF	DEIS Standards and Guidelines	FEIS Standards and Guidelines
Uses, Special Designations, cont.						
Wild and Scenic Classification			TL-5/15-9/15 Little Missouri		NSO, MA 1.5 Wild	NSO, MA 1.5 Wild; NLMNG, SLMNG
Research Natural Areas		NSO	NSO		NSO, MA 2.2	NSO, MA 2.2; all units
Special Interest Areas			NSO candidate areas, CSU Nominated areas		CSU -DPG - Slope Type Formation, Cannonball/Slope Contact, Bullion Creek Formation Type TBNG - Paleontological, Cheyenne River Zoological NNF - Edgemont Shark Locality, Marietta South, One-Mile Hill, and Wallace Ranch Localities;	CSU -DPG - Slope Type Formation, Cannonball/Slope Contact, Bullion Creek Formation Type Section TBNG - Paleontological, Cheyenne River Zoological NNF - Edgemont Shark Locality, Marietta South, One-Mile Hill, and Wallace Ranch Localities
Special Interest Areas - Botanical						NSO – DPG - Aspen Stand, The Bog, Grand River Sand Dunes, Black Butte, Black Cottonwood, Riparian Pools, and Roundtop Butte
Special Interest Areas - Geologic						NSO – DPG –White Buttes, Burning Coal Vein/ Columnar Juniper, and Ice Caves. NSO-TBNG-Lance Geologic site
Special Interest Areas - Historic						NSO – DPG – Battle of the Badlands, Custer Trail/Davis Creek, and Square Buttes. NSO-TBNG-Cow Creek Rangelands

Resource, Use, Issue	TBNG	NLMNG	SLMNG	NNF	DEIS Standards and Guidelines	FEIS Standards and Guidelines
Uses, Special Designations, cont.						
Special Interest Areas					NSO - TBNG- Cellars and Buffalo Divide Archeological sites NNF-Toadstool Park, Hudson Meng Bison Bonebed, and Warbonnet/Yellowhand	NSO - TBNG- Cellars and Buffalo Divide Archeological sites NSO-NNF-Toadstool Park, Hudson Meng Bison Bonebed, and Warbonnet/Yellowhand
Roadless Areas Inventoried Roadless Areas (IRAs)		NSO Low Development Areas	NSO			
Developed Sites						
Designated dispersed recreation sites						TL w/i ¼ mi 5/1-12/1 Burning Coal Vein, Buffalo Gap, Sather Lake CCC, Campgrounds and Summit, White tail Picnic Areas, and 6 Maa Daa Hey Trail overnight camps, Wannagan, Magpie, Roosevelt, Elkhorn, Beicegel, Bennett; NLMNG, SLMNG
Designated dispersed rec use site (fisheries)	CSU w/i 400 mtr for noise				Bring forward from TBNG	CSU w/i 400 mtr for noise for TBNG: Weston Reservoir, Upton Cent. No. 2, Kellog Dam, Upton Bass Pond, Turner Reservoir, East Iron Creek Reservoir TBNG
Dispersed			TL-5/15-9/15 Foreground LM River			NSO, w/I ¼ mi of Little Missouri River MA 4.22; NLMNG, SLMNG

Resource, Use, Issue	TBNG	NLMNG	SLMNG	NNF	DEIS Standards and Guidelines	FEIS Standards and Guidelines
Developed Sites, cont.						
Campgrounds		NSO, TL-5/15-9/15 w/i ¼-mile CSU w/i ¼-mi	NSO, TL-5/1-12/1 w/i ¼-mi		NSO	NSO
Mgmt. Prescriptions						
Mgmt Area C (wildlife)		NSO	NSO		Bring forward for CRNG, Knispel T130,R85 SW Sec 21 and North Community T129, R89 NWSENE Sec 15	Bring forward for CRNG, Knispel T130,R85 SW Sec 21 and North Community T129, R89 NWSENE Sec 15
MA 1.2 Recommended for wilderness					NSO	NSO, MA 1.2; TBNG, NNF
MA 1.2A Suitable for Wilderness					NSO	NAA, MA 1.2A; NLMNG, SLMNG
MA 1.31 Back country nonmotorized					NSO	NSO
MA 2.4 American Indian traditional use areas					Not administratively available for leasing	Not administratively available for leasing
MA 3.51 Bighorn Sheep					NSO w/i MA 3.51	NSO w/i MA 3.51;
MA 3.51A Bighorn Sheep						Not currently authorized; CSU under specified conditions
MA 3.63 Black-footed ferret reintroduction					CSU	CSU w/i reintroduction habitat; DPG TBNG, NNF. NSO w/i reintroduction habitat/roadless; DPG only.

Resource, Use, Issue	TBNG	NLMNG	SLMNG	NNF	DEIS Standards and Guidelines	FEIS Standards and Guidelines
Mgmt. Prescriptions, cont.						
MA 3.68 Big game range					TL w/i winter range 12/15-3/15 TL w/i elk calving areas 5/1-6/31 CSU over whole area	TL w/i winter range 12/15-3/15 TL w/i elk calving areas 5/1-6/31; TBNG only
MA 4.22 Little Missouri River Corridor						NSO, w/I ¼ mi of Little Missouri River MA 4.22; NLMNG, SLMNG
Amidon Admin. Site LMNG			NSO		Not mapped on unit maps so will not bring forward	Not mapped on unit maps so will not bring forward
Cedar River NG			CSU entire area		Bring forward CSU	SLT only entire area
Areas Not Administratively Available		4 areas _ Blue Buttes; Long X Divide; Twin Buttes; Dutchman's Barn			Bring forward areas as not administratively available	Bring forward Blue Buttes; Long X Divide; Twin Buttes and add Bullion Buttes and Kinley Plateau, not administratively available; NLMNG, SLMNG

Analysis Process

The oil and gas leasing analysis was only done on those Northern Great Plains administrative units analyzed in previous oil and gas leasing decisions or presently under analysis:

- The Little Missouri National Grassland and Cedar River National Grasslands.
- The southern portion of the Fall River District of the Buffalo Gap National Grassland.
- The Oglala National Grassland.
- The Thunder Basin National Grassland.

The basic process of the analysis was to put all factors that resulted in a stipulation in a single Arc/Info file. This resulted in very large files, but placed all the information in a single location to facilitate future use of the information when deciding on an application to drill.

The information inside each file was tracked in two ways. First information about each factor was stored separately in as many as three different fields. One field defined the constraint (NSO, CSU, SLT, NCA, NAA etc.) another defined the reason (burrowing owl, High Scenic Integrity Objective, etc.) and a third defined whether or not a timing limitation was in affect. Timing limitations were separate from other stipulations as they can occupy the same space as a NSO, CSU, SLT, NCA, or NAA stipulation.

Second, the information was tracked by stipulation and timing limitation for mapping purposes. By tracking information in these two ways, one can produce a map of each unit showing the dominant stipulation and whether or not a timing limitation exists. At the same time, one can look at the individual stipulations. It also provides future information on what other stipulations might apply if on-site analysis determines the reason for the dominating stipulation does not, in fact, exist.

A key point of the oil and gas analysis is that it is a subsurface ownership analysis and the patterns depicted on a map will not resemble a normal surface ownership pattern. Only those tracts with federal subsurface ownership were included in the analysis. In many cases, there is National Forest System surface ownership and private ownership of the subsurface minerals. In these cases, there isn't a leasing decision to be made as there is no federal ownership of the minerals. In the case of private surface ownership and federal mineral ownership, a leasing decision will be made.

Alternative 1 for each unit was developed from each of the existing oil and gas decisions. If updated information was appropriate to use, such as current wildlife points, these locations were included in Alternative 1. New wildlife species points not addressed in the original analyses were not included. Several sites in the original analyses that have leasing stipulations were found not to have federal minerals under them upon further analysis, and therefore these sites do not appear in Alternative 1.

Alternatives 2-5 were developed from Table B-6 displayed above. This chart was reduced to a list of 44 resources, uses, or issues (variables). If a variable exists on a given unit, an oil and gas leasing stipulation was developed for it. The following table displays the variables analyzed in each unit.

Table B-7. Stipulation Analysis Chart.

Resource, Use, or Issue (variables)	Cedar River NG	Medora District Little Missouri NG	McKenzie District Little Missouri NG	Thunder Basin NG	Fall River District Buffalo Gap NG	Oglala NG
Riparian, Woody Draws, Wetlands, and Floodplains[12]		X	X	X		
Slopes > 40%	X	X	X	X	X	X
Soils susceptible to mass failure	X	X	X	X	X	X
Bald Eagle Nest				X		
Bald Eagle Winter Roost				X		
goshawk			X			
Swainson's hawk			X	X	X	X
prairie falcon		X	X	X		X
ferruginous hawk		X	X	X	X	X
merlin			X	X		
golden eagle		X	X	X	X	X
burrowing owl		X	X	X	X	X
sharp-tailed grouse		X	X	X		X
sage grouse		X		X	X	
mountain plover				X		
Pronghorn antelope		X	X			
swift fox					X	
Sensitive and Watch Plants	X					
Scenic Integrity Objectives	X	X	X	X	X	X
Cultural Resources / Heritage Sites		X	X		X	
Not Administratively Available		X	X			
Paleontology Area	X	X	X	X	X	X
Wild River Classification		X				
Special Interest Areas		X		X	X	X
Developed Recreation Sites (Campgrounds)		X	X			

[12] Although all units have wet or woody draw areas, only those areas greater than 400 feet wide were included. This is because standard lease terms allow Forest Service managers to move any operator selected drilling location 200 feet without needing a special leasing stipulation.

Resource, Use, or Issue (variables)	Cedar River NG	Medora District Little Missouri NG	McKenzie District Little Missouri NG	Thunder Basin NG	Fall River District Buffalo Gap NG	Oglala NG
Designated dispersed recreation Site				X		
Mgmt Area C (wildlife)	No Federal Minerals					
MA 1.2 Recommended for wilderness		X	X		X	X
MA 1.2A Suitable for wilderness		X	X			
MA 1.31 Back country nonmotorized			X	X		X
MA 2.2 Research Natural Areas		X	X	X		
MA 2.4 American Indian traditional use areas			X			
MA 3.51 Bighorn Sheep		X	X			
MA 3.51A Bighorn Sheep		X	X			
MA 3.63 Black-footed ferret reintroduction			X	X		
MA 3.63 Black-footed ferret reintroduction roadless			X			
MA 3.68 Big game range				X		
MA 4.22 River and Travel Corridor		X	X			
Not Currently Authorized for Leasing-Coal bed methane				X		
Amidon Admin. Site LMNG	No Federal Minerals					
Cedar River NGL CSU	CSU entire area - X					
Standard Lease Terms	X	X	X	X	X	X
Federal mineral status	X	X	X	X	X	X
Federal lease status	X	X	X	X	X	X

F. Plant and Animal Damage Control

As their part of the Northern Great Plains Interagency Steering Committee agreement, the National Park Service developed a presence or absence report of noxious weeds. This report was completed in April 1998 and can be viewed on an Internet sit located at http://www.calmit.unl.edu/ngp. The following information sources were used:

- State of Montana, Department Of Agriculture, Helena, Montana. Data only reported at statewide level.
- *Nebraska Department of Agriculture, Bureau of Plant Industry, County Infestation Report*, 1995.
- *North Dakota Department of Agriculture, County Weed Board Annual Report*, 1995.
- *Annual Report, South Dakota Weed and Pest Program*, 1995.
- Wyoming Weed and Pest Program Coordinator, 1995.

G. Range Management and Livestock Grazing

The following describes the components used in the range analysis. It includes

- Process used to determine existing capable rangelands.
- Process used to determine suitable rangelands.
- Process used to determine vegetation structure.
- Process used to determine vegetation composition.
- Process used to determine desired upland herbaceous vegetation conditions.
- Process used to determine herbage productivity.
- Process used to determine forage outputs.

Decisions made in the revised management plans will not determine the number of livestock (animal unit months or stocking levels) allowed to graze on the national grassland and forest units. Instead, the revised management plan will describe desired conditions for vegetation that fit within the context of rangeland health and multiple uses. The revised management plans focus on the conditions desired on the landscape to ensure sustainable rangeland health. The desired conditions are defined by the species of grass (composition) and height and density of the grass (structure). Estimates were then made for analysis purposes of likely grazing levels given the assumption of season-long grazing and varying (by alternative) season-long rest (absence of livestock grazing) levels.

Primary, Secondary, and Inaccessible/Ungrazed Rangelands

Biotic and abiotic factors interact with animal behavior at various spatial and temporal scales to determine livestock grazing patterns across landscapes (Bailey et al. 1996, Cook 1966, Senft et al. 1987). Forage quality and quantity are the primary biotic factors, while slope and distance from water are the primary abiotic factors. The animal behavior factor is the ability of livestock to recall the location of preferred foraging and shelter sites.

This model uses only abiotic factors to predict and map broad grazing distribution patterns. These patterns are classified and mapped as primary, secondary, and inaccessible / ungrazed range. Primary ranges are usually grazed first and heavier by livestock. Secondary ranges are those usually grazed last and to a lesser degree (Society for Range Management 1989). Models using the abiotic factors of slope and distance to water are usually more reliable that those that include biotic variables because the abiotic factors are the overriding determinants of large-scale grazing patterns. They also act as constraints within which the mechanisms involving the biotic factors operate (Bailey et al. 1996, McInnis et al. 1990). Because of this, inclusions resulting from biotic and animal behavior factors can be expected to occur within the broad map units derived from this model.

Information on livestock grazing distribution is key in helping to assess livestock forage availability and to predict effects of grazing on wildlife. Results of this GIS model will not be used for determining actual livestock grazing capacities. It is recognized that actual use data would be best for mapping livestock grazing distribution patterns across each planning area, but this information is not uniformly available across all areas. It's also recognized that type of livestock will also influence grazing distribution; the abiotic factors in this model are based on cattle. Computer model results may be modified in areas grazed by sheep or other livestock. The GIS analysis also includes information on the distribution of existing range developments (fences and water) and current grazing management strategies.

Livestock Distribution Criteria

Following are the criteria to classify primary, secondary and inaccessible / ungrazed rangeland.

Primary Range

Criteria (All must be met)

1. Grazed by livestock.
2. Classified as "capable rangelands" (USDA Forest Service 1996).
3. Natural or developed water sources within 1 mile (Holechek et al. 1989, Mackie 1970).
4. Less than 10% slope (Holechek et al. 1989, Mackie 1970).
5. No barriers to livestock (including fences).

Secondary Range

Criteria (Numbers 1 and 2 have to be met plus one or more of the remaining criteria)

1. Grazed by livestock.
2. Classified as "capable rangelands" (USDA Forest Service 1996).
3. 1 to 1.75 miles from water (Holechek et al. 1989, Mackie 1970).
4. 11% to 40% slope (Holechek et al. 1989, Mackie 1970, USDA Forest Service 1996).
5. No barriers to livestock (including fences).

Inaccessible/Ungrazed Rangeland

Criteria (Number 1 must be met plus one or more of the remaining criteria)

1. Classified as rangeland including grasslands, shrublands, savannah, and wet meadows but excluding other wetlands, aquatic areas, barren lands, and ungrazable woodlands / forests.
2. Greater than 1.75 miles from water (Holechek et al. 1989, Mackie 1970).
3. Greater than 40% slope (Holechek et al. 1989, Mackie 1970, USDA Forest Service 1996).
4. Barriers (including fences) exclude livestock.
5. Administratively excluded or withdrawn from livestock grazing.

References are listed at the end of Appendix B.

Spatial data used for modeling included fences, water developments, natural water, slope, and range capability using the criteria described above. A draft map depicting the modeling results was sent to District staff for review. This review identified many water sources that were missed by the water developments layer. Many intermittent streams that are used early in the year by livestock where also not included on the layer. These additions were made on a polygon-by-polygon basis for the Nebraska units and Thunder Basin National Grassland. The Little Missouri National Grassland indicated there were no unwatered places on the national grassland due to an extensive watering system and the use of intermittent streams early in the season. Secondary range on the Little Missouri was due to slopes above 10%[13].

Capable Lands for Livestock Grazing

A capability analysis identifies areas on the national grasslands and forests with the physical characteristics capable of supporting livestock grazing. Generally, this includes areas that are accessible to livestock and producing adequate forage. The results are displayed in Table B-19 through Table B-21.

Criteria to Determine Existing Capable Rangelands

Areas considered physically capable of supporting livestock grazing must contain the following features as addressed in the Forest Service Manual:

- Occur in areas with slopes less than 40 percent;
- Soils producing more than 200 pounds of forage per acre;
- Be accessible to livestock;
- Have water or the potential to have water. (Areas where there is no water can be made capable by providing water and therefore are considered to be capable)

[13] See also "Primary / Secondary Range AMLs" in the Administrative Record.

Information Used to Determine Existing Capable Lands

The following information was gathered or developed to determine capable rangelands and maps developed which displayed the information:

- Ownership from CFFs (Cartographic Feature Files).
- Slope by 10 percent breaks from DEMs (USGS 30-meter Digital Elevation Model).
- Soils with a potential for producing more than 200 pound of forage per acre.
- Location of areas that don't produce forage: rock, roads, water bodies, bare ground, etc.
- Areas inaccessible to livestock (determined by District personnel).

Process

Use GIS to identify areas that meet the following criteria:

- Begin with lands that are National Forest System lands.
- Subtract areas with slopes greater than 40%.
- Subtract areas with the potential of producing less than 200 lbs forage / acre.
- Subtract areas that are dominated by a large percentage of rock, bare ground, roads, and water bodies.
- Subtract areas that are currently inaccessible (such as railroad rights-of-way) to livestock.

Slope was determined from 30-meter USGS digital elevation model (DEM) grids. Each grid was run through a process in Arctools to define slope, percent slope and finally slope in 10% increments.

The wetness of a site was determined in two ways. First linear features (streams) from Forest-maintained USGS-based hydrology layers were buffered three feet either side of the centerline to model average stream width. Second the polygon features, lakes, ponds, etc. were identified as standing water bodies from the forest hydrology layers. These two features defined wet areas and standing water. The forest hydrology information, in conjunction with the water site classification of the potential productivity step below, provided a more thorough classification of water than either cover coverage, independently.

Similar to streams, roads and train tracks were buffered and classified as noncapable rangeland. Roads were buffered 8 feet either side of the centerline to allow for the road bed. Train tracks were buffered 100 feet either side of the centerline to model an average corridor where livestock are fenced out.

The GIS methods used to identify the above five criteria differed between units due to the type of soil productivity information available. Different soil surveys use slightly different soil classifications. The Dakota Prairie Grasslands and the Spring Creek area of the Thunder Basin National Grassland did not have a GIS-compatible soil survey. The processes used by the different units are as follows:

Dakota Prairie Analysis Units

- Grand River and Cedar River National Grasslands.
- McKenzie District of the Little Missouri National Grassland.
- Medora District of the Little Missouri National Grassland.
- Sheyenne National Grassland.

Cedar River, Grand River, Little Missouri, and Sheyenne National Grasslands

Ecological classification of potential site productivity was used to classify range capability. Sites on the Dakota Prairie Grassland were classified using the process described in "Determination of Herbage Productivity - Dakota Prairie Grassland" in this chapter as follows:

200 lbs production / acre	Crested Wheatgrass
201-400 lbs production / acre	Badlands
401-600 lbs production / acre	Coniferous trees / forest
601-800 lbs production / acre	Water
801-1000 lbs production / acre	Deciduous Forest / Woodland
1001-1200 lbs production / acre	Cropland
1201+ lbs production / acre	

Of the site-types listed above, those with 200 lbs production / acre, Coniferous trees / forest, and water were considered not capable.

Nebraska Analysis Units

- Bessey unit of the Nebraska National Forest.
- Fall River District of the Buffalo Gap National Grassland.
- Fort Pierre National Grassland.
- McKelvie National Forest.
- Pine Ridge unit of the Nebraska National Forest and the Oglala National Grassland.
- Wall District of the Buffalo Gap National Grassland.

The Nebraska units had an extensive GIS land resource information system available provided by the Integrated Resource Inventory Center (IRI) in Pueblo, CO. A key piece of information provided was the NRCS (Natural Resource Conservation Service) SRI_MUIDs which link to a rather extensive soils data base. One component of the database is potential soil productivity. Using the data base tools of Info soil types were selected for a potential productivity below 200 lbs of production.[14],[15]

[14] See /fsfiles/office/plan/data/ngp/land_cover_type/sri_muid.txt

Medicine Bow-Routt Analysis Unit

- Thunder Basin National Grassland.

Thunder Basin Analysis Unit Low productivity SRI_MUIDs

The Thunder Basin Range Capability Analysis was different from the one done for the Nebraska units because the soil survey was incomplete and somewhat inaccurate, the Spring Creek soil survey had not been completed, and because of active coal leases and strip mining on the Thunder Basin[16].

The first analysis of range capability used a soil productivity table[17] similar to the one used for the Nebraska units above and found all sri_muids with a zero NRCS production value and classified them as noncapable rangeland. District review of the resulting map indicated the first analysis overestimated the acres of noncapable rangelands because some of the sri_muids with zero NRCS values were actually productive lands that were inaccurately characterized by the soil survey. The problem sri_muids with zero value were identified for District review on a map. George Wiggins of the Douglas Ranger District indicated the four sri_muids listed below were in fact capable rangelands:

- sri_muid 45045 is 75% capable * avg production of 1097 lb / acre = 822.75 lb / acre
- sri_muid 605233 is 20% capable * avg production of 1097 lb / acre = 219.4 lb / acre
- sri_muid 605234 is 65% capable * avg production of 1097 lb / acre = 713.05 lb / acre
- sri_muid 709119 is 80% capable * avg production of 1097 lb / acre = 877.6 lb / acre

The above sri_muids were removed from the list of noncapable sri_muids.

The percent capable determination was based on Douglas District professional interpretation of soil map unit description, comparable field data, and general field experience by Forest Service rangeland management professionals familiar with the area.

The average production value of 1097 lb / acre was determined by Virginia Emly, GIS coordinator Nebraska NF. This production value was based on an acre-weighted average from sri_muid polygons having NRCS production values on the Thunder Basin.

Noncapable rangelands due to soils for the Spring Creek portion of the Thunder Basin were determined on a prorated basis[18] from noncapable rangelands on the rest of the Thunder Basin. The prorated process estimated the acres of noncapable rangeland due to soils but did not identify the location of those noncapable rangelands.

Rangelands on which an existing coal mining lease existed were classified as noncapable rangelands. This was because these lands could be taken out of production for a coal strip mine depending on the needs of the coal mining company. The US Forest Service can permit grazing those lands on an annual basis. Due to the temporary forage availability on coal leased lands, these lands were not considered capable rangelands.

---

[15] See Administrative Record "Range Capability AML - Bessey, Fall River, Fort Pierre, McKelvie, Pine Ridge, Wall"

[16] See Administrative Record "Range Capability AML - Thunder Basin"

[17] See Paper - "Thunder Basin Range Production Table"

[18] See paper - "Thunder Basin Incapable Soils Worksheet"

Suitable Lands for Livestock Grazing

Suitability is defined as the appropriateness of applying certain resource management practices to a particular land area based on economic and environmental consequences and considerations for other uses that may be affected. A unit of land may be suitable for a variety of individual or combined management practices.

Each management area has a specific set of standards and guidelines used in determining suitable lands. Alternatives vary in the allocation of management areas to achieve the goals and objectives for that alternative.

Information Used to Determine Suitable Lands

- Rangeland capability (see Capable section).
- Management Area Prescription allocation for each alternative.
- Areas closed to grazing or not in an allotment.
- Areas that are determined by the District to be environmentally sensitive with no forage value assigned.
- Fenced recreation areas and / or sites.
- Administrative sites.
- Special areas (wildlife, plant species, etc.).

Process

Use GIS to identify areas that meet the following criteria:

- Start with capable rangelands generated from the Capable section.
- Develop alternatives with different range management prescriptions as defined in the management areas to meet goals and objectives of the alternatives.
- Analyze alternative uses foregone. Perform the following:
    a. Subtract areas with management area prescriptions that have standards and guidelines that do not allow livestock grazing.
    b. Subtract fenced recreation sites, developed recreation sites, administrative sites, and special use sites.
    c. Subtract areas that are closed to grazing.

A District interdisciplinary team identifies site-specific areas within each management area based on the goals and objectives for each alternative and areas where conflicts occur between livestock and other resources. The team then determines if these areas are unsuitable, and if so, they are subtracted from suitable rangelands.

Results of Inventory and Analysis

The determination of both rangeland capability and suitability may be reviewed and updated if it becomes an issue at the site-specific project level. For instance, rangelands identified as capable and suitable for domestic livestock grazing in the land and resource management plan may include areas that are not appropriate for domestic livestock grazing when analyzed at the site-specific level (i.e., wetlands or some dispersed recreation sites). In determining alternative uses forgone, the only criteria utilized applied to the management area prescriptions that contain standards and guideline that do not allow grazing. These management areas prescriptions also included administrative sites. The results of the analysis are displayed in Table B-20 through Table B-22. Due to the small difference between capable and suitable rangeland, the cost of administration does not differ between alternatives due to suitability.

In some situations, domestic livestock need not be prohibited from areas identified in the plan as unsuitable. For example, a forested or riparian area with sufficient forage to support domestic livestock may not be identified as suitable, but the presence of domestic livestock drifting in from an adjacent suitable area may not conflict with other uses. In this situation, it would not be necessary to physically prevent access to the forested or riparian area by domestic livestock, but there would be no allocation of forage.

Grassland Vegetation Structure

Grassland structure, as used in this document, refers to the vertical structure of vegetation types dominated by grasses, sedges and forbs and where shrubs are absent or a minor component. The vertical structure of grassland vegetation, in combination with other vegetation characteristics, influences the diversity of plants and animals that occurs across grassland landscapes. The visual obstruction method (Robel et al. 1970) has been selected for monitoring and analyzing vertical vegetation structure. Visual obstruction readings (VOR) are commonly used to measure vertical structure[19] and represent the height that vegetation totally (100%) screens a calibrated pole when viewed from a standard height (39 inches) and distance (156 inches).

The pole used by the Forest Service in the planning area is modified from that described by Robel et al. (1970) and is painted with alternating 1-inch gray and white bands. Robel et al. used a pole graduated in half decimeters. The narrower 1-inch graduations on the modified pole provide a finer level of resolution to detect changes in grassland structure.

VORs are taken from 4 directions around stations systematically located every 10 paces along a linear paced transect. In steep (>15% slope) topography, readings are taken at each station from 2 directions on the contour. The number of the last band partially or totally visible is recorded as the VOR, and mean VOR is calculated for each station and transect. The number of stations per transect and the number of transects per unit area is predetermined based on variability observed during initial sampling and a desired level of precision (1/2 inch) and confidence (80%). Transect locations were random and commonly stratified by sites with similar levels of

[19] Robel et al. 1970, Sousa 1987, Duebbert and Lokemoen 1977, Grosz and Kirby 1986, Manske et al. 1988, Mattise et al. 1981, Sedivec et al. 1995, Benkobi et al. 2000, Benkobi 1999, U.S. Fish and Wildlife Service 1999

potential productivity. Sampling was random across an entire unit or within a contiguous block.

Uplands were prioritized for monitoring. It should not be assumed that this distinction implies that structure along drainages and overflow sites is any less important. In fact, on the more arid grasslands located in the western part of the planning area, these sites can be major contributors to grassland structure because they are more conducive to the establishment and growth of mid- and tall-grass species. Also, vegetation along drainages also serves as a filter strip--an important ecological function related to enhancing soil stability and water quality.

Most VOR transects were measured in the fall after killing frost and livestock grazing and prior to the influence of winter winds and snowpack. The primary reason for monitoring the vegetation left after livestock grazing in the fall is that spring nesting cover (before spring green-up) is critical to some grassland wildlife species, especially during droughts. Winter cover is also important to some resident wildlife species on the open plains.

Knowing the full range of cover levels that can occur in an area is key to understanding and managing grassland structural diversity. Like any vegetation measurement, the range of values that can be expected for a particular measurement needs to be known if management direction and effectiveness are to be fully and accurately established and assessed. Since livestock grazing can directly reduce vegetation structure by removing forage, managing vegetation structure on grasslands is largely a program of managing livestock grazing intensity. The frequency and intensity of grazing can also influence plant species composition and vigor, thereby indirectly increasing or decreasing the amount of structure a site can produce. For example, a site dominated by mid-grass species can produce more vertical structure than a comparable site where multiple years of heavy livestock grazing have reduced mid-grass composition and increased the amount of short-grass species.

Theoretically, the lowest VOR that can be expected for any grassland site is limited only to the extent that livestock can physically remove above-ground vegetation. This typically results in mean transect VORs less than 1 or 2 inches. The maximum VOR (long-term biological potential) for a particular site occurs where forage from the last 1 or 2 growing seasons has not been removed by livestock and where the current successional stage of a site maximizes mid and tall grass species composition and vigor (Sousa 1987). The ability to measure and monitor the long-term biological potential to provide vegetation structure is frequently limited by having sites or reference areas with those characteristics. Areas on NFS lands or other jurisdictions where specific management techniques can be applied to help determine the long-term biological site potential for structure are scarce to non-existent. The need for sufficiently sized reference areas for monitoring and experimentation will be addressed as part of this planning effort. Some of the currently ungrazed sites have been rested from livestock grazing too long and do not reflect maximum structure.

An average VOR by itself is not a perfect or complete descriptor of grassland structure because the variability of the cover, or patchiness, may be important to many wildlife species that depend on grassland cover for various life functions. Size and shape of cover patches and their distribution across the landscape can also influence the use of grasslands by wildlife. The amount of litter can also be important but seldom contributes to VORs. Although other structure measurements would have been useful, this analysis was limited to VORs.

Monitoring results were available for most of the NFS units in the planning area. However, structure levels on the Cedar River and Thunder Basin National Grasslands were not monitored. Because of its proximity and similar management to the Grand River National Grassland, we are assuming that grassland structure conditions on the Cedar River unit are similar to those found on the Grand River National Grassland. The Thunder Basin National Grassland was not monitored because this unit is more representative of short-grass prairie and shrublands and typically does not produce a wide range of grassland cover levels. Monitoring grassland structure on the Nebraska National Forest's Pine Ridge Ranger District was not a management priority, so monitoring on that unit was minimal, and the results are not summarized. Analysis results are presented as frequency distributions using 1-inch class increments.

This monitoring program was limited solely to public lands, and none of the analysis results apply to other land jurisdictions in or near the National Forest System lands. Although it would be desirable from an ecosystem management standpoint to put the results of this monitoring into the context of structure levels at a broader scale, it is highly unlikely that monitoring of other land jurisdictions will occur.

Information on precipitation is also presented because precipitation and the resulting growing conditions, along with livestock grazing, have a significant effect on potential and existing vegetation structure.

Plant Species Composition

Several analysis methods were utilized to determine a mix of vegetation composition on the Dakota Prairie Grassland units, Nebraska National Forest and associated grassland units and the Thunder Basin National Grassland. The Nebraska National Forest utilized the Natural Resource Conservation Service analysis methodology and an ecological site description process developed by the Rocky Mountain Experiment Station. The Thunder Basin National Grassland utilized an ecological site description process developed by the Rocky Mountain Experiment Station. These processes measure existing species composition on a range site or ecological site and compare it with the expected climax plant community for the same range or ecological site. Since each state office of the NRCS establishes criteria for range sites, these vary from state to state. In North Dakota, range sites established by the state NRCS office included more than one vegetation type and were not specific for habitat type classification. In the 1980s, it was determined by Region 1 of the Forest Service to utilize habitat types in determining vegetation community types which were smaller in scale than that of the NRCS range sites.

The following descriptions and tables should be used to compare existing mix of vegetation composition with the potential mix of vegetation composition at climax condition. The potential vegetation composition is not to be used for what the desired mix of vegetation composition should be since field managers should try to achieve a mix of vegetational ecological conditions. This information is used as a guideline in determining a desired mix of dominant vegetation as displayed in the desired upland herbaceous vegetation condition to achieve resource goals and objectives for each alternative in the Management Plans. This was also used in the effects analysis of the Environmental Impact Statement.

Dakota Prairie Grassland Units

Vegetation composition for the Dakota Prairie Grasslands units was derived using several data sources, including the following:

- Two GIS themes.
- Existing vegetation and land cover classes and potential vegetation environments.
- Field plots.
- Habitat type and ecological classifications completed for the Little Missouri and Sheyenne National Grasslands.

The ecological classifications describe both potential vegetation (climax or reference plant associations) and seral or alternative vegetation states associated with each habitat type. Development of the classifications followed protocols outlined in Forest Service Handbook direction (2090.11)[20] and recommendations of the Range Inventory and Standardization Committee Report (RISC 1988) for developing and using classifications for rangeland assessments.

Field sampling methods followed plot layout and sampling protocols outlined in the Northern Region Ecosystem Inventory and Analysis Guide (USDA Forest Service 1992). Information collected at the plot included production by life-form, species composition, dominance type, habitat type, ground cover values, vegetation and cover class, and physical characteristics of the site. This data provides ancillary information attached to each existing vegetation and land cover class and potential vegetation map unit. The ancillary information can be used to summarize composition, production, and other characteristics of the cover class and potential vegetation map unit.

Existing Vegetation

Existing vegetation and land cover classes were derived from LANDSAT Thematic Mapper (TM) imagery through a contract with the Wildlife Spatial Analysis Lab, University of Montana (Redmond et al 1997). Three and a half LANDSAT images, ground truth plots, and expert knowledge about vegetation cover types and patterns were used to generate the existing vegetation and land cover theme.

The following table is a summary of LANDSAT images and ground truth plots used to generate the existing vegetation and land cover GIS theme.

[20] www.fs.fed.us/im/directives/html/fsh.html

Table B-8. Summary of Information Used to Generate Vegetation and Land Cover.

Dakota Prairie Grassland Unit	LANDSAT Scene	LANDSAT Scene Date	Number of Ground Truth Plots	Yrs. represented by ground truth plots
Sheyenne NG	Path30/Row27 (1/2 scene)	August 10, 1992	377	1992-1996
Grand/Cedar River NG	Path33/Row28	June 12, 1992	686	1994-1996
Little Missouri River NG	Path33/Row28	June 12, 1992	686	1987-1996
	Path34/Row28	August 9, 1993	875	1987-1996
	Path34/Row27	July 11, 1994	1351	1987-1996

The vegetation and land cover classes represent a broader classification of existing vegetation than typically used for allotment management planning and are based on spectral differences between classes rather than direct measures of species composition and dominance. They are most similar to cover type maps or vegetation type maps. Dominance types are typically finer scale vegetation descriptions used for project and allotment level planning that are nested within the vegetation and land cover classes.

Six grassland vegetation cover classes were used to describe vegetation composition for grassland-dominated vegetation:

1. 3111, non-native grass (crested wheatgrass).
2. 3130, very low cover and production grass.
3. 3140, low cover and production grass.
4. 3150, low/moderate cover and production grass.
5. 3160, moderate/high cover and production grass.
6. 3170, high cover and production grass.

The five cover and production classes were derived from measures of Modified Normalized Vegetation Index (MNDVI), which is correlated to biomass. To associate the six cover classes to dominance types, assumptions about production and foliar and ground cover properties relationships between dominance types and the cover classes were used. These correlations are based on knowledge about spectral relationships to foliar cover (represented by dominance types), bare soil, and biomass. These assumptions will be validated at a later date against the data by comparing the frequency of plots representing the dominance types and their occurrence within each grass cover class.

The following table displays the assumed relationships between grass cover classes and dominance types and associated vegetation and bare soil attributes.

Table B-9. Attributes for Cover Classes and Dominance Types.

Grass Cover Class	Assumed Cover Class Attributes	Dominance Type Correlations	Assumed Dominance Type Attributes
3111	Moderate to high production and cover	crested wheatgrass	Production > 1000 lb / ac; bare ground < 10%
3130	Very low production and low foliar cover and high bare soil.	Short grass species are dominant and co-dominant. 1. blue grama-threadleaf sedge 2. clubmoss-blue grama 3. blue grama-clubmoss	Production < 500 lb / ac; bare ground > 10%.
3140	Low foliar cover and low production, moderate to high bare soil.	Short grass species are dominant and mid grass species are co-dominant. 1. blue grama-western wheatgrass 2. threadleaf sedge-needle and thread 3. blue grama-needle and thread	Production < 500 lb / ac. bare ground < 10%
3150	Low to moderate foliar cover, low bare soil, low / moderate production.	Mid grass species dominant and short grass species are co-dominant. 1. western wheatgrass-blue grama 2. needle and thread-blue grama 3. green needle grass-needle leaf sedge 4. needle and thread-threadleaf sedge	Production 500-1000 lb / ac; bare ground < 10%
3160	Moderate to high foliar cover and production, low to no bare soil.	Mid grass species dominant and co-dominant except warm season species where a short grass species is co-dominant 1. western wheatgrass-green needlegrass 2. green needlegrass-western wheatgrass 3. western wheatgrass-needle and thread 4. plains reedgrass-threadleaf sedge 5. little bluestem-threadleaf sedge 6. sand bluestem-sideoats grama	Production > 1000 lb / ac; bare ground < 10%
3170*****	High cover and production low to no bare soil	Tall grass species dominant and co-dominant. 1. big bluestem-little bluestem	Production > 1500 lb / ac; no bare soil

***** Applies to Sheyenne NG only.

Potential Vegetation Composition

This is a derived GIS layer used to predict the spatial distribution of biophysical environments associated with habitat types across the three grassland units. It is not a vegetation map in the traditional sense. It represents biophysical settings associated with a habitat type based on moisture / temperature gradients across the landscape, which are a function of soil properties, climate, and vegetation. The potential vegetation environment layer is used with the existing vegetation layer to identify the capability of the land to support the desired vegetation and

make comparisons between existing vegetation and desired vegetation for planning and monitoring purposes. The map is based on 23 soil, climate, terrain and spectral variables that were associated to geo-referenced field data representing habitat types of the three grassland units (Jensen et al 1998). The habitat types used for development of this layer have been described by USDA-FS (1992), Hirsch (1985), Girard (1985), Hanson et al (1984), Hanson and Hoffman (1985), Nelson et al (1985) and USDA-FS (1996). The number of plots used to generate the predicted potential vegetation environment GIS layer are as follows:

Grassland Unit	**No. of Field Plots**
Sheyenne NG	316
Grand / Cedar River NG	324
Little Missouri NG	1285

Nebraska National Forest and Thunder Basin National Grassland

Existing Vegetation Composition

On the Nebraska National Forest units, Natural Resource Conservation Service range analysis methods and ecological site classification methodology (Uresk 1990) has been conducted since 1987 to determine current range condition and composition by vegetation type. Plot data has been collected using these methodologies on the national forest and national grassland units. The plot data is associated with range and ecological sites are stored in a tabular database. On the Thunder Basin National Grassland, an ecological site classification methodology developed by Benkobi and Uresk (1996) was used to determine current conditions on ecological sites.

Potential Vegetation Composition

Potential vegetation composition was derived by utilizing the NRCS technical guide. This guide describes the expected range site vegetation dominance type given the biological site potential and normal moisture year.

Desired Upland Herbaceous Vegetation

The purpose of this document is to give a thorough explanation of how we arrived at our desired future condition for vegetation composition and our rationale for selection of seral stages.

A Forest Service team of wildlife biologists and range conservationists decided to use seral stages as a descriptor for desired and existing vegetation composition. The team included the following individuals: Dan Uresk, Dave Wheeler, Bob Mountain, Clarke McClung, Mike McNeill, Jim Wickel, Dan Svingen, Greg Schenbeck, Tim Byer, Virginia Emly, and Joe Alexander. The group agreed to use the Natural Resource Conservation Service's Handbook for describing seral stages on all of the units except the Bessey and McKelvie Units and the Thunder Basin National Grassland which has peer reviewed and published work on ecological sites .

An interdisciplinary team also established vegetation structure objectives for grassland, sagebrush, and ponderosa pine vegetation types. The amount and diversity of quality habitats for game species, management indicator species, threatened, endangered, and sensitive plant and animal species were the primary factors considered in developing the vegetation structure objectives.

After deciding to use the above listed methodologies, the team worked with a GIS specialist to obtain the breakdown of range sites for each of the national forests and grasslands on the Nebraska National Forest. This data showed the number of acres classified into each specific range site for every unit.

Upon examining this data, it became evident that there were only three to five major range sites for each unit. The rest of the acreages fell into range sites which were a minor component of the landscape (less than 5%). It was assumed at this point that for management purposes at the geographic area scale only the major range sites would be described and therefore would be where we focused our monitoring efforts in the future.

Once the major range sites had been identified for each unit, the Natural Resource Conservation Service range site descriptions were used to extrapolate what we could expect to see in terms of species composition across the landscape. The range site descriptions along with professional knowledge of the transitional states within these range sites were used to break out the seral stages for each unit. Descriptions were then written in a narrative format for each geographic area (GA).

After descriptions had been written for each geographic area, we looked at the structure objectives for each GA. We then related the structure objectives with the seral stage write-ups to determine what would be needed at the GA scale to achieve our structure objectives. Using professional judgment, structure objectives and the knowledge of the management in the areas surrounding these grassland units, we selected the numbers listed in the GA write-ups for desired future condition.

Following the above listed analysis, the write-ups for each GA were sent to the respective Ranger Districts for an interdisciplinary review. The Districts then modified the write-ups using the professional knowledge and expertise of their staffs. Once the desired future condition was determined for each unit, they were forwarded on to the writer/editor for final edits and insertion into the Forest Plan.

Existing condition for the Nebraska National Forest units were determined by using existing data. The data already delineated by range sites was then sent back to the District staff. The staff members then took the definitions of Late, Late Intermediate, Early Intermediate and Early seral stages for each of the GA and applied them to the data sets.

Information used in the development of the matrices came from data already gathered for potential vegetation productivity, structure and composition to provide guidelines or sideboards in determining a mix of upland herbaceous vegetation conditions. In general in the Draft EIS, Matrix A was used with Alternative 1, which would continue the present mix and level of multiple-use activities. Matrix A was also used with Alternative 2 which places emphasis on commodity outputs. Matrices B and C were used with Alternatives 3 and 5, which would place greater emphasis on wildlife habitats, recreation opportunities, and noncommodity services. Matrix D was used with Alternative 4, which would emphasize natural processes and restoration of impaired native ecosystems. The objectives of the matrices were to meet multiple-use objectives and habitat requirements as outlined in Appendix H of the Land and Resource Management Plan. In the Final EIS, other matrices were developed through further analysis and public involvement.

It is not possible to display the percentage of vegetative mix for each vegetation community type as it relates to plant succession. Plant succession is defined as the progressive replacement of plant communities on an ecological site that leads to the climax plant community. The transition pathway of succession is not necessarily linear and may follow alternative pathways rather than follow a single pathway. The field manager must monitor existing vegetation composition and structure conditions to establish the seral stage in relation to the path of succession.

Dakota Prairies National Grassland

The following tables, developed for the DEIS display the desired mix of dominant vegetation types (expressed as a seral stage) and structure based on a management area average potential:

Table B-10. Desired Mix of Vegetation Types for Grand River/Cedar River National Grasslands.

		Structure		
Matrix	**Composition**	**High**	**Moderate**	**Low**
a.	80% late to mid seral stage	10% - 30%	55% - 75%	10% - 20%
b.	85% late to mid seral stage	20% - 30%	50% - 70%	10% - 20%
c.	90% late to mid seral stage	30% - 40%	40% - 60%	10% - 20%
d.	90% late to mid seral stage	35% - 45%	35% - 55%	10% - 20%

For the Grand River / Cedar River National Grasslands, Matrix B is the preferred matrix for this geographic area in the FEIS for desired structure.

Desired seral stages (plant species composition) and vegetation structure across the geographic area are as follows:

Desired Seral Stages - Objective		
Early	Mid	Late
10 to 15%	65 to 75%	15 to 20%

The potential mix of seral conditions within this geographic area (GA) is very diverse due to the influences of precipitation, soil types, and disturbances such as grazing and fire. Descriptions of species dominance / co-dominance associated with early, mid and late seral conditions follow below. Seral stages are aggregated into sites having similar soil texture and / or topographic features; together they provide an overview of the entire GA. Although dune and badland soils / topography are present within this GA, they are not of significant size and would not be discussed further. The following descriptions incorporate information from NRCS Range Site descriptions and Rangeland Cover Types of the United States, Society for Range Management (1994).

Early seral: This seral condition would most commonly occur in and around prairie dog towns, and in isolated areas of high livestock use such as around water developments or concentration areas near fences or natural barriers. This seral condition is important in providing habitat for

prairie dogs and low structure obligate species. These sites often contain large areas where club moss is a dominant floristic feature.

- Sandy soil sites – Dominated by blue grama, sedge, and annual forbs. Mid and tall grass species such as prairie sandreed, needle-and-thread grass, western wheatgrass, and little bluestem are conspicuously absent. Many areas of bare soil can be present.
- Silty soil sites – Dominated by blue grama, annual forbs, fringed sage, and broom snakeweed. Mid and tall grass species such as western wheatgrass, needle-and-thread grass and green needlegrass are conspicuously absent. Many areas of bare soil can be present.
- Clay soil sites – Dominated by blue grama, annual forbs and annual grasses. Mid and tall grass species such as green needlegrass, needle-and-thread grass, western wheatgrass, and little bluestem are conspicuously absent. Many areas of bare soil can be present.
- Shallow soil sites – Dominated by blue grama, annual forbs, and annual grasses. Mid and tall grass species such as little bluestem and western wheatgrass are conspicuously absent. Many areas of bare soil can be present.
- Overflow sites – Dominated by blue grama, annual forbs, and Kentucky bluegrass. Tall and mid grass species such as big bluestem, needle-and-thread grass, and prairie sandreed are conspicuously absent. Water tables are usually lowered and some bare soil can be present.

Mid seral*:* This seral expression can provide opportunities for achieving high structure as it moves toward late seral conditions and mid / tall grass species begin to increase. The species mix found in mid seral conditions is highly variable.

- Sandy soil sites – Blue grama, upland sedges, and Kentucky bluegrass primarily dominate in earlier mid seral conditions although sand dropseed and sideoats grama may be present in limited quantities. Blue grama continues to dominate as movement begins toward the latter stages of mid seral condition where prairie sandreed, needle-and-thread grass, and western wheatgrass begins to replace it as a dominant in the later mid seral condition. High structure can be achieved as this habitat type moves toward late seral conditions.
- Silty soil sites – Blue grama and sedge are primarily dominant in earlier mid seral conditions. These species continue to be present in large amounts as movement begins toward a higher seral condition where little bluestem and prairie junegrass become more prominent in mid seral conditions. Western wheatgrass, needle-and-thread grass, and green needlegrass begin to replace these species as this habitat type moves toward late seral conditions. High structure can be achieved as this habitat type moves toward late seral conditions.
- Clay soil sites – Blue grama and upland sedges primarily dominate in earlier mid seral conditions although buffalo grass, inland saltgrass, and needle grasses can be present in limited quantities. Blue grama continues to be present in large amounts as movement begins toward a higher seral condition where western wheatgrass and green needlegrass begin to appear in the composition. These two species begin to become co-dominant as these sites move toward late seral conditions. High structure can be achieved as this habitat type moves toward late seral conditions.

Mid seral, cont.

- Shallow soil sites – Blue grama dominates early mid seral conditions, with limited occurrences of green needlegrass and needle-and-thread grass. Blue grama continues to be present in large amounts as movement begins toward a higher seral condition with associated increases of green needlegrass and needle-and-thread grass in mid seral conditions. Western wheatgrass, needle-and-thread grass, green needlegrass, and sideoats grama begin to replace blue grama as this habitat type moves toward late seral conditions. High structure can be achieved as this habitat type moves toward late seral conditions.
- Overflow sites – Blue grama and Kentucky bluegrass tend to be more dominant in earlier mid seral conditions. As this type moves to the latter mid seral condition, switchgrass, sideoats grama, prairie sandreed and green needlegrass increase and becomes more prominent. Big bluestem and western wheatgrass begin to replace these species as this habitat type moves toward late seral conditions. High structure can be achieved as this habitat type moves toward late seral conditions.

Late seral: This seral expression provides the best opportunity for achieving high structure objectives on all habitat types.

- Sandy soil sites – Dominated by prairie sandreed, needle-and-thread grass, and little bluestem. Associated species include lesser amounts of sand bluestem, sideoats grama, western wheatgrass, and sand dropseed. In some areas big bluestem can be an important component and blue grama may be present in limited (less than 10% by composition) quantities.
- Silty soil sites – Dominated by western wheatgrass, needle-and-thread grass, and green needle grass. Associated species include lesser amounts of little bluestem, sedge and prairie junegrass. This seral condition also may contain limited (less than 10% by composition) occurrence of blue grama.
- Clay soil sites – Dominated by western wheatgrass, needle-and-thread grass, and green needlegrass. Contains lesser amounts of buffalo grass, needleleaf sedge, and inland saltgrass. On thinner clay sites this seral condition may also contain limited (10-15% by composition) occurrence of blue grama.
- Shallow soil sites – Dominated by little bluestem. Associated species include lesser amounts of western wheatgrass, sideoats grama, needle-and-thread grass, and green needlegrass. On very shallow soils, blue grama and needle-and-thread grass dominate. This seral condition may also contain limited (less than 10% by composition) occurrence of blue grama.
- Overflow sites – Dominated by big bluestem and western wheatgrass. Associated species include lesser amounts of prairie sandreed, green needlegrass, sideoats grama, and switchgrass.

Desired Structure Objectives		
Low	Moderate	High
10 to 20%	50 to 70%	20 to 30%

High vegetation structure can be achieved on moderate and highly productive grasslands dominated by mid and / or tall grasses (late or moderate-late seral stages). Grasslands on

moderate to highly productive soils but in a low seral condition and dominated by short-stature plant species generally do not have the capability to provide high vegetation structure. Management changes would be necessary to move some existing seral conditions toward a higher seral condition to meet structure objectives.

Prairie dog colonies provide low structure, as do grassland areas grazed by livestock at high intensities. Low vegetation structure can result from a dominance of low stature plant species in an early seral condition or from heavy utilization of mid and tall grasses typical of high mid to high seral conditions.

Table B-11. Desired Mix of Vegetation Types for Little Missouri National Grassland.

		Structure		
Matrix	**Composition**	**High**	**Moderate**	**Low**
a.	80% late to mid seral stage	10% - 20%	60% - 80%	10% - 20%
b.	85% late to mid seral stage	20% - 35%	45% - 70%	10% - 20%
d.	90% late to mid seral stage	40% - 60%	25% - 45%	10% - 20%
g.	80% late to mid seral stage	20% - 30%	50% - 70%	10% - 20%

For the Little Missouri National Grassland, matrix g is the preferred matrix for the Badlands and Rolling Prairie Geographic areas in the FEIS .

For the Badlands Geographic area, the desired seral stages (plant species composition) and vegetation structure across the geographic area are as follows:

Desired Seral Stages - Objective		
Early	Mid	Late
10-15%	65-75%	15-20%

The potential mix of seral conditions within this Geographic Area (GA) is very diverse, due to the influence of precipitation, soil types, and disturbances such as grazing and fire. Descriptions of species dominance / co- dominance associated with early, mid, and late seral conditions follow below. Seral stages are aggregated into sites having similar soil texture and / or topographic features. Together they provide an overview of the entire GA. These descriptions incorporate information from the NRCS Range Site descriptions and *Rangeland Cover Types of the United States* (Society for Range Management 1994).

Early seral: This seral condition would most commonly occur in and around prairie dog towns, and in areas of intensive livestock use such as around water developments or concentration areas near fences or natural barriers. This seral condition is important in providing habitat for prairie dogs and low structure obligate species.

- Steep south and west aspect slopes (all soil types) – Primarily short grasses such as blue grama and buffalo grass along with upland sedges, fringed sage, annual forbs and shrubs. Mid and tall grass species such as western wheatgrass, needle-and-thread grass, and prairie sandreed are conspicuously absent.

Early seral, cont.

- Moderate slopes (less than 35% on all soil types) – Primarily short grasses such as blue grama and buffalo grass along with upland sedges, fringed sage, annual forbs and shrubs. Mid and tall grass species such as western wheatgrass, needle-and-thread grass, and green needlegrass, are conspicuously absent. Occurrences of bare soil can increase significantly from late or mid seral conditions.
- Saline lowland sites (fine textured soils) – Primarily large increases of inland saltgrass, with varying amounts of foxtail barley, mat muhly, silverweed cinquefoil, and other annual forbs. Mid and tall grass species such as Nuttall alkaligrass, western wheatgrass, and slender wheatgrass are conspicuously absent.

Mid seral: This seral expression can provide opportunity for achieving high structure as it moves toward late seral conditions and mid/tall grass species begin to increase. The species mix found in mid seral conditions is highly variable.

- Steep south and west aspect slopes (all soil types) – Species composition is highly variable with blue grama, Sandberg bluegrass, and upland sedges dominating in the early mid seral condition. In the early mid seral condition, blue grama dominates on these sites. As the seral condition improves, blue grama would decrease and western wheatgrass along with needle-and-thread begins to dominate this seral condition.
- Moderate slopes (less than 35% on all soil types) – Species composition is highly variable with blue grama, buffalo grass, Sandberg bluegrass, and upland sedges dominating the early mid seral conditions on clay soils and blue grama, sand dropseed, and upland sedges dominating the early mid seral condition on sandy soils. As the seral condition improves, those species decrease and western wheatgrass and needle-and-thread grass begin to dominate this seral condition.
- Saline lowland sites (fine textured soils) – Inland saltgrass increases as seral condition moves downward to the point where it is very dominant in early seral conditions. Inland saltgrass begins to decrease while Nuttall alkaligrass, alkali cordgrass, western wheatgrass and slender wheatgrass begin to increase and gradually dominate these sites as movement is made toward a higher seral condition.

Late seral: This seral expression provides the best opportunity for achieving high structure objectives especially on the moderate slopes.

- Steep south and west aspect slopes (all soil types) – Primarily western wheatgrass, needle-and-thread grass, little bluestem, and blue grama. Important associated species include plains muhly, red threeawn, sideoats grama, and upland sedges. For this seral condition, western wheatgrass and needle-and-thread grass are the dominant/co-dominant species on these sites.
- Moderate slopes (less than 35% on all soil types) – Primarily western wheatgrass, needle-and-thread grass, prairie sandreed, and sand bluestem. Important associated species include Sandberg bluegrass, sand dropseed, needleleaf sedge, and buffalograss on clay sites and Canada wild rye, prairie junegrass, and upland sedges on sandy sites. For this seral condition, western wheatgrass and needle-and-thread grass are the dominant/co-dominant species on these sites.

- Saline lowland sites (fine textured soil types) – Primarily Nuttall alkaligrass, slender wheatgrass, alkali cordgrass, western wheatgrass, and very limited amounts of inland saltgrass. Important associated species include plains bluegrass, alkali sacaton, and mat muhly.

Desired Structure Objectives

Low	Moderate	High
10-20%	50-70%	20-30%

High vegetation structure can be achieved on moderate and highly productive grasslands dominated by mid and/or tall grasses (latter stages of mid seral and late seral stages). Grasslands on moderate to highly productive soils but in a low seral condition and dominated by short-stature plant species generally do not have the capability to provide high vegetation structure. Management actions may be necessary to improve some existing seral conditions to meet structure objectives.

Prairie dog colonies provide low structure, as do grassland areas intensively grazed by livestock. Low vegetation structure can result from a dominance of low stature plant species in an early seral condition or from heavy utilization of mid and tall grasses typical of high mid to high seral conditions.

For the Rolling Prairie Geographic area in the Little Missouri National Grasslands, the desired seral stages (plant species composition) and vegetation structure across the Geographic area are as follows:

Desired Seral Stages Objectives

Early	Mid	Late
10-15%	65-75%	15-20%

The potential mix of seral conditions within this geographic area is very diverse due to the influences of precipitation, soil types, and disturbances such as grazing and fire. Descriptions of species dominance/co-dominance associated with early, mid and late seral conditions follow below. Seral stages are aggregated into sites having similar soil texture and/or topographic features; together they provide an overview of the entire GA. These descriptions incorporate information from the NRCS Range Site descriptions and Rangeland Cover Types of the United States, Society for Range Management (1994).

Early seral: This seral condition would most commonly occur in and around prairie dog towns, and in areas of intensive livestock use such as around water developments or concentration areas near fences or natural barriers. This seral condition is important in providing habitat for prairie dogs and low structure obligate species. These sites often contain large areas where club moss is a dominant floristic feature.

- Sandy soil sites (deeper soil development) - Dominated by blue grama, threadleaf sedge, sun sedge, and gray sagewort. Mid and tall grass species such as western wheatgrass, needle-and-thread grass, sand bluestem, and little bluestem are conspicuously absent. Many areas of bare soil can be present.

Early seral, cont.

- Clay soil sites (deeper soil development) - Dominated by blue grama, threadleaf sedge, fringed sage, and broom snakeweed. Mid and tall grass species such as western wheatgrass, needle-and-thread grass, and prairie junegrass are conspicuously absent. Many areas of bare soil can be present.
- Shallow soil sites (primarily loam and sandy loam soil textures) – Dominated by blue grama, threadleaf sedge, fringed sage, cactus and red threeawn. Mid and tall grass species such as western wheatgrass, needle-and-thread grass, plains muhly, and sideoats grama are conspicuously absent. Many areas of bare soil can be present.
- Overflow sites (primarily clay and clay loam soil textures) – Dominated by blue grama, sedges, annual forbs, and Kentucky bluegrass. Tall and mid grass species such as big bluestem, needle-and-thread grass, and green needlegrass are conspicuously absent. Many areas of bare soil can be present.

Mid seral: This seral expression can provide opportunity for achieving high structure as it moves toward late seral conditions and mid / tall grass species begin to increase. The species mix found in mid seral conditions is highly variable.

- Sandy soil sites (deeper soil development) – Blue grama, upland sedges, and Kentucky bluegrass primarily dominate in earlier mid seral conditions. These species continue to be present in large amounts as movement begins toward a higher seral condition where big bluestem, green needlegrass, and western wheatgrass begin to replace those species. High structure can be achieved as this habitat type moves toward late seral conditions.
- Clay soil sites (deeper soil development) – Blue grama, threadleaf sedge, sun sedge and hairy grama primarily dominate in earlier mid seral conditions. These species continue to be present in large amounts as movement begins toward a higher seral condition where Sandberg bluegrass and upland sedges become a co-dominant in mid seral conditions. Western wheatgrass, needle-and-thread grass, green needlegrass begin to dominate as this habitat type moves toward late seral conditions. High structure can be achieved as this habitat type moves toward late seral conditions.
- Shallow soil sites (primarily loam and sandy loam soil textures) – Blue grama and threadleaf sedge primarily dominate in earlier mid seral conditions. These species continue to be present in large amounts as movement begins toward a higher seral condition where Sandberg bluegrass becomes a co-dominant in mid seral conditions. Western wheatgrass, needle-and-thread grass, plains muhly, and sideoats grama begin to replace these species as this habitat type moves toward late seral conditions. High structure can be achieved as this habitat type moves toward late seral conditions.
- Overflow sites (primarily clay and clay loam soil textures) – Blue grama and fescue sedge tend to be more dominant in earlier mid seral conditions. As this type moves to the latter mid seral condition, western wheatgrass increases and becomes a co-dominant. Big bluestem, needle-and-thread grass, and green needlegrass begin to replace these species as this habitat type moves toward late seral conditions. High structure can be achieved as this habitat type moves toward late seral conditions.

Late seral: This seral expression provides the best opportunity for achieving high structure on all habitat types.

- Sandy soil sites (deeper soil development) – Primarily prairie sandreed, needle-and-thread grass, sand bluestem, and little bluestem. Associated species include lesser amounts of prairie junegrass, western wheatgrass, and sand dropseed.
- Clay soil sites (deeper soil development) – Primarily western wheatgrass, needle-and-thread grass, green needle grass, and prairie junegrass. Associated species include lesser amounts of inland saltgrass, Sandberg bluegrass, and buffalo grass.
- Shallow soil sites (primarily loam and sandy loam soil textures) – Primarily western wheatgrass, needle-and-thread grass, and plains muhly. Associated species include lesser amounts of prairie junegrass, little bluestem, upland sedges, and sideoats grama.
- Overflow sites (primarily clay and clay loam soil textures) – Primarily big bluestem, needle-and-thread grass, and green needlegrass. Associated species include lesser amounts of western wheatgrass, porcupine grass, bearded wheatgrass, and thickspike wheatgrass. Forbs comprise approximately 10% of this habitat type in late seral condition. Typical species include Rydberg's sunflower, tall goldenrod, and tall white aster.

Desired Structure Objectives

Low	Moderate	High
10-20%	50-70%	20-30%

High vegetation structure can be achieved on moderate and highly productive grasslands dominated by mid and / or tall grasses (latter mid seral or late seral stages). Grasslands on moderate to highly productive soils but in a low seral condition and dominated by short-stature plant species generally do not have the capability to provide high vegetation structure. Management actions may be necessary to improve some existing seral conditions to meet structure objectives.

Prairie dog colonies provide low structure, as do grassland areas intensively grazed by livestock. Low vegetation structure can result from a dominance of low stature plant species in an early seral condition or from heavy utilization of mid and tall grasses typical of high mid to high seral conditions.

The height and density of grasses, forbs and sedges in the understory of sagebrush stands are important factors influencing structure for several wildlife species. The relationship of structure to quality nesting habitat for sage grouse is described in Appendix H.

Table B-12. Desired Mix of Vegetation Types for Sheyenne National Grassland.

Matrix	Composition	Structure High	Structure Moderate	Structure Low
a.	80% late to mid seral stage	10% - 20%	60% - 80%	10% - 20%
b.	85% late to mid seral stage	10% - 30%	55% - 75%	10% - 20%
c.	90% late to mid seral stage	20% - 30%	50% - 70%	10% - 20%
d.	90% late to mid seral stage	50% - 70%	20% - 40%	0% - 20%
g.	80% late to mid seral stage	30% - 40%	50% - 65%	5% - 10%

For the Sheyenne National Grassland, Matrix G is the preferred matrix for this Geographic area in the FEIS

For the Sheyenne Geographic area, the desired seral stages (plant species composition) and vegetation structure across the GA are as follows:

Desired Seral Stages Objectives		
Early	Mid	Late
5-10%	50-65%	30-40%

The potential mix of seral conditions within this GA is very diverse. Although topographic relief is minimal, the extremes in available moisture in the predominately sandy soils of this GA provide distinct vegetation changes within short distances. Although management such as prescribed fire and livestock grazing can have a significant influence on vegetation composition, hydrologic and topographic features such as sand dunes and depressions are the primary influence on floristic composition within the GA.

Blowout areas may be present in the sandy and sand soil sites during any of the seral conditions described below, but are generally more extensive in early seral stages.

Descriptions of species dominance/co-dominance associated with early, mid and late seral conditions are as follows below. Seral stages are aggregated into sites having similar soil texture and/or topographic features; together they provide an overview of the entire GA. These descriptions incorporate information from NRCS Range Site descriptions and Rangeland Cover Types of the United States, Society for Range Management, 1994. It is important to note that the species composition and characterization of wetlands represents ecological condition as opposed to classic seral condition descriptions.

Early seral: Early seral conditions are a natural component of these highly erodible sandhills. Sparsely vegetated dunes in healthy condition provide important habitat for species dependent on early seral conditions. This seral condition would most commonly occur in and around areas of intensive livestock use such as around water developments or concentration areas near fences or natural barriers. This seral condition is important in providing habitat for Richardson's ground squirrel and other low structure obligate species.

- Sandy and sand soil sites in undulating prairie topography – In early seral conditions, blue grama, and annual forbs dominate. Mid and tall grass species are conspicuously absent. Blowout areas are common and would increase in size without changes in management to move them toward a higher seral condition.
- Sandy and sand soil sites in choppy sandhills topography – In early seral conditions Kentucky bluegrass, blue grama, sun sedge, and annual forbs such as western ragweed dominate. Mid and tall grass species are conspicuously absent. Western snowberry can be dominate in early seral conditions. Blowout areas are common and would increase in size without management actions to move them toward a higher seral condition.
- Midsites in all topographies – In early seral condition Kentucky bluegrass, sun sedge and blue grama dominate the composition. Forbs such as ragweed, goldenrod, and hoary vervain are prevalent. Blowout areas may occur and would increase in size without management actions to move them toward a higher seral condition.
- Wet meadows (sub irrigated but can be seasonably flooded) – In the early seral condition, Kentucky bluegrass, foxtail barley and Baltic rush dominate. The water table drops in early seral condition creating areas of bare soil dominated by annual forbs.
- Wetlands (water tables at the soil surface with portions continually flooded) – In early seral conditions, Kentucky bluegrass, fowl bluegrass, foxtail barley, and Baltic rush dominate. Water tables drop earlier in the season and there are large areas of bare soil dominated by annual forbs for most of the year.

Mid seral: This seral expression can provide opportunity for achieving high structure as it moves toward late seral conditions and mid / tall grass species begin to increase. The species mix found in mid seral conditions is highly variable.

- Sandy and sand soil sites in undulating prairie topography – In the early stages of this seral condition blue grama, Kentucky bluegrass, western yarrow, western ragweed and goldenrod can be present with very limited occurrences of sand dropseed, sun sedge, and prairie junegrass. As this type moves toward late seral conditions, sand dropseed and blue grama can increase while prairie sandreed, needle-and-thread grass, and little bluestem begin to reappear. In the latter stages of mid seral condition, sand dropseed and hairy grama begin to decrease while prairie sandreed, needle-and-thread grass, little bluestem, and porcupine grass increase. Kentucky bluegrass and blue grama may still be present in moderate amounts in the latter stages of mid seral conditions.
- Sandy and sand soil sites in choppy sandhills topography – In the earlier stages of mid seral condition, Kentucky bluegrass, sun sedge, and hairy grama can dominate. Curlycup gumweed may also dominate in the early stages of mid seral condition. As this type moves toward late seral conditions sideoats grama and needle-and-thread grass begin to reappear through the latter stages of mid seral condition, when prairie sandreed and sand bluestem also begin to reappear and become more visually prominent. Kentucky bluegrass and blue grama can still be present in moderate amounts.

Mid seral, cont.

- Midsites in all topographies – In the earlier stages of mid seral condition Kentucky bluegrass, sun sedge, and blue grama mostly dominate the composition. As this type moves toward late seral conditions these species decrease and tall grass species such as big bluestem, indiangrass and switchgrass begin to reappear. In the latter stages of mid seral conditions, those species become a more conspicuous part of the composition and sun sedge and blue grama begin to disappear although they still can be a dominant portion of the composition.
- Wet meadows (sub irrigated but can be seasonally flooded) – In the earlier stages of mid seral conditions, fowl bluegrass, fescue sedge, common spike sedge, Baltic rush, and Kentucky bluegrass dominate. As this type moves toward late seral conditions northern reedgrass and switchgrass begin to reappear. In the latter stages of mid seral conditions, those species begin to dominate and Kentucky bluegrass, fowl bluegrass, and Baltic rush begin to become less evident and northern reedgrass, switchgrass, and woolly sedge begin to dominate.
- Wetlands (water tables at the soil surface with intermingled open water) – In the earlier stages of mid seral conditions, fowl bluegrass, common spike sedge, Baltic rush, and Kentucky grass dominate. As this type moves toward late seral conditions prairie cordgrass and slough sedge begin to become more evident. In latter stages of mid seral conditions, those species begin to dominate and Kentucky bluegrass, fowl bluegrass, and Baltic rush begin to become less evident.

Late seral: This seral expression provides the best opportunity for achieving high structure objectives on all habitat types.

- Sandy and sand soil sites in undulating prairie topography – This type is dominated by prairie sandreed, needle-and-thread grass, and prairie Junegrass. Associated species include little bluestem, porcupine grass, sand lovegrass, and blue grama. On less coarse sandy sites, forbs can be an important component (up to 15% by composition) including purple prairie clover, penstemon, and dotted gayfeather. On coarser sand sites, shrubs can also be an important component (up to 10% by composition) including western snowberry, leadplant, and prairie rose.
- Sandy and sand soil sites in choppy sandhills topography – This type is dominated by sand bluestem, prairie sandreed, and needle-and-thread grass. Associated species include sideoats grama, Canada wild rye, and little bluestem. This type also supports a diverse forb life form in late seral conditions including penstemon, stiff sunflower, and prairie spiderwort. Shrubs and tree may be visually conspicuous across the landscape including western snowberry, sumac, leadplant, chokecherry, scattered bur oak, and small clumps of aspen in favored sites.
- Midsites in all topographies – This type is dominated by big bluestem, switchgrass, northern reedgrass, indiangrass, and to a lesser extent, little bluestem. Scattered forbs can include penstemon, large gayfeather, and white prairie clover. This site in late seral conditions provides excellent opportunity for quality prairie chicken nesting habitat.
- Wet meadows (sub irrigated but can be seasonally flooded) –This type is dominated by switchgrass, northern reedgrass, and wooly sedge. This site in late seral conditions can also contain a diverse number of forbs including the western prairie fringed orchid, a federally listed species. Willows can be a component of this type.

- Wetlands (water tables at the soil surface with portions continually flooded) – Extreme yearly and seasonal fluctuations in water depth are characteristic of wetlands. These water fluctuations result in plant composition shifts that may be beyond the influence of specific management activities. Typically, this type can be dominated by prairie cordgrass and several sedge species. Associated species include cattails and bulrushes along the edge of open flooded depressions. Baltic rush can be found in limited quantities, associated primarily with the edge of open water.

Desired Structure Objectives

Low	Moderate	High
5-10%	50-65%	30-40%

High vegetation structure can be achieved on those portions of the GA that are dominated by mid and / or tall grasses (late or the latter stages of mid seral condition). Grasslands on moderate to highly productive soils but in a low seral or ecological condition and dominated by short-stature plant species generally do not have the capability to provide high vegetation structure. Management actions may be necessary to move some existing seral conditions toward a higher seral condition to meet structure objectives. In many cases, this change may be fairly rapid and easy to achieve (mid seral conditions), while for other cases, it may take years or decades to accomplish (low and early mid seral conditions).

Grassland areas intensively grazed by livestock over extended time periods, provide low structure. Low vegetation structure can result from a dominance of low stature plant species in an early seral or low ecological condition or from heavy utilization of mid and tall grasses typical of high mid to high seral conditions. These sites are especially important for Richardson's ground squirrel and other low structure obligate species.

Eliminate non-native trees outside developed and identified high-use dispersed recreation areas within 20 years.

Thunder Basin National Grasslands

Table B-13. Desired Mix of Vegetation Types for Thunder Basin National Grassland, Mixed-grass Prairie.

		Structure		
Matrix	**Composition**	**High**	**Moderate**	**Low**
a.	80% late to mid seral stage	10% - 20%	50% - 70%	20% - 30%
b.	85% late to mid seral stage	15% - 25%	55% - 75%	15% - 25%
c.	90% late to mid seral stage	30% - 40%	40% - 60%	10% - 20%
d.	90% late to mid seral stage	40% - 60%	30% - 50%	5% - 15%
g.	70% late thru early intermediate seral stage	30% - 40%	40% - 50%	15% - 25%
h.	55% late thru early intermediate seral stage	30% - 40%	25% - 35%	30% - 40%

Matrix	Composition	Structure High	Moderate	Low
i.	70% late thru early intermediate seral stage	25% - 35%	45% - 55%	15% - 25%
j.	70% late thru early intermediate seral stage	35% - 45%	35% - 45%	15% - 25%
k.	70% late thru early intermediate seral stage	30% - 40%	45% - 55%	10% - 20%

In the DEIS, late to mid seral stage is a combination of these dominant vegetation types 1) green needlegrass, western wheatgrass, 2) western wheatgrass, blue grama, 3) western wheatgrass, buffalo grass, blue grama.

In the FEIS, the seral stages on the Thunder Basin National Grasslands were expanded from early, mid and late seral stages to early, early intermediate, late intermediate, and late seral stage.

On the Thunder Basin National Grassland, the preferred matrix in the FEIS for each Geographic Area is as follows:

- Broken Hills GA matrix g
- Cellars Rosecrans GA matrix h
- Fairview Clareton GA matrix i
- Hilight Bill GA matrix i
- Spring Creek GA matrix j
- Upton Osage GA matrix k

Desired seral stages (plant species composition) and vegetation structure (Plan Appendix I) across the Broken Hills geographic area of the Thunder Basin National Grassland are as follows:

Desired Seral Stages - Objective

Late	Late Intermediate	Early Intermediate	Early
15 to 25%	30 to 40%	25 to 35%	10 to 30%

Across the landscape, grass and sagebrush are intermingled. In some areas, grasses are the dominant species; in other areas, sagebrush is the dominant species. The vegetation composition varies depending on seral stage.

In grass-dominated communities in mid to late seral stages, the dominant native grass species are western wheatgrass, needle and thread grass, green needlegrass, and little bluestem. In grass-dominated sites in early to mid seral stages, grasses such as blue grama often dominate. Threeawn and blue grama are commonly the dominant grasses on prairie dog colonies in early seral stage.

In sagebrush-dominated communities, there is more sagebrush in the mid to late seral stages than in early to mid seral stages. As the community moves from early to late seral stage, the percentage of grasses declines. In the understory, the dominant native plant species are western wheatgrass and green needlegrass.

Desired Vegetation Structure (Objective)

High	Moderate	Low
30 to 40%	40 to 50%	15 to 25%

High vegetation structure can be achieved on moderate and highly productive grasslands dominated by mid grasses (late or late intermediate seral stages). Grasslands on moderate to highly productive soils but in an early seral condition and dominated by short-stature plant species generally do not have the capability to provide high vegetation structure. Management changes may be necessary to move some existing seral conditions toward a higher seral condition to meet structure objectives.

Prairie dog colonies provide low structure, as do grassland areas grazed by livestock at high intensities. Low vegetation structure can result from a dominance of low stature plant species or from heavy utilization of mid grasses.

The height and density of grasses, forbs and sedges in the understory of sagebrush stands are important factors influencing structure for several wildlife species. The relationship of structure to quality nesting habitat for sage grouse is described in Appendix H. Appendix H describes quality nesting as sagebrush understories with residual herbaceous cover averaging at least 7 inches in height. This objective is primarily provided when sagebrush habitat types are in a late seral condition.

Desired seral stages (plant species composition) and vegetation structure (Plan Appendix I) across the Cellars Rosecrans geographic area of the Thunder Basin National Grassland are as follows:

Desired Seral Stages - Objective

Late	Late Intermediate	Early Intermediate	Early
10 to 20%	20 to 30%	25 to 35%	25 to 35%

Across the landscape, grass and sagebrush are intermingled. In some areas, grasses are the dominant species; in other areas, sagebrush is the dominant species. The vegetation composition varies depending on seral stage.

In grass-dominated communities in mid to late seral stages, the dominant native grass species are western wheatgrass, needle and thread grass, green needlegrass, and little bluestem. In grass-dominated sites in early to mid seral stages, grasses such as blue grama often dominate. Threeawn and blue grama are commonly the dominant grasses on prairie dog colonies in early seral stage.

In sagebrush-dominated communities, there is more sagebrush in the mid to late seral stages than in early to mid seral stages. As the community moves from early to late seral stage, the percentage of grasses declines. In the understory, the dominant native plant species are western wheatgrass and green needlegrass.

Desired Vegetation Structure - Objective

High	Moderate	Low
30 to 40%	25 to 35%	30 to 40%

High vegetation structure can be achieved on moderate and highly productive grasslands dominated by mid grasses (late or late intermediate seral stages). Grasslands on moderate to highly productive soils but in an early seral condition and dominated by short-stature plant species generally do not have the capability to provide high vegetation structure. Management changes may be necessary to move some existing seral conditions toward a higher seral condition to meet structure objectives.

Prairie dog colonies provide low structure, as do grassland areas grazed by livestock at high intensities. Low vegetation structure can result from a dominance of low stature plant species or from heavy utilization of mid grasses.

The height and density of grasses, forbs and sedges in the understory of sagebrush stands are important factors influencing structure for several wildlife species. The relationship of structure to quality nesting habitat for sage grouse is described in Appendix H. Appendix H describes quality nesting as sagebrush understories with residual herbaceous cover averaging at least 7 inches in height. This objective is primarily provided when sagebrush habitat types are in a late seral condition.

Desired seral stages (plant species composition) and vegetation structure (Plan Appendix I) across the Fairview Clareton geographic area of the Thunder Basin National Grassland are as follows:

Desired Seral Stages - Objective

Late	Late Intermediate	Early Intermediate	Early
10 to 20%	30 to 40%	30 to 40%	10 to 20%

Across the landscape, grass and sagebrush are intermingled. In some areas, grasses are the dominant species; in other areas, sagebrush is the dominant species. The vegetation composition varies depending on seral stage.

In grass-dominated communities in mid to late seral stages, the dominant native grass species are western wheatgrass, needle and thread grass, green needlegrass, and little bluestem. In grass-dominated sites in early to mid seral stages, grasses such as blue grama often dominate. Threeawn and blue grama are commonly the dominant grasses on prairie dog colonies in early seral stage.

In sagebrush-dominated communities, there is more sagebrush in the mid to late seral stages than in early to mid seral stages. As the community moves from early to late seral stage, the percentage of grasses declines. In the understory, the dominant native plant species are western wheatgrass and green needlegrass.

Desired Vegetation Structure - Objective

High	Moderate	Low
25 to 35%	45 to 55%	15 to 25%

High vegetation structure can be achieved on moderate and highly productive grasslands dominated by mid grasses (late or late intermediate seral stages). Grasslands on moderate to highly productive soils but in an early seral condition and dominated by short-stature plant species generally do not have the capability to provide high vegetation structure. Management changes may be necessary to move some existing seral conditions toward a higher seral condition to meet structure objectives.

Prairie dog colonies provide low structure, as do grassland areas grazed by livestock at high intensities. Low vegetation structure can result from a dominance of low stature plant species or from heavy utilization of mid grasses.

The height and density of grasses, forbs and sedges in the understory of sagebrush stands are important factors influencing structure for several wildlife species. The relationship of structure to quality nesting habitat for sage grouse is described in Appendix H. Appendix H describes quality nesting as sagebrush understories with residual herbaceous cover averaging at least 7 inches in height. This objective is primarily provided when sagebrush habitat types are in a late seral condition.

Desired seral stages (plant species composition) and vegetation structure (Plan Appendix I) across the Hilight Bill geographic area of the Thunder Basin National Grassland are as follows:

Desired Seral Stages - Objective

Late	Late Intermediate	Early Intermediate	Early
10 to 20%	30 to 40%	30 to 40%	10 to 20%

Across the landscape, grass and sagebrush are intermingled. In some areas, grasses are the dominant species; in other areas, sagebrush is the dominant species. The vegetation composition varies depending on seral stage.

In grass-dominated communities in mid to late seral stages, the dominant native grass species are western wheatgrass, needle and thread grass, green needlegrass, and little bluestem. In grass-dominated sites in early to mid seral stages, grasses such as blue grama often dominate. Threeawn and blue grama are commonly the dominant grasses on prairie dog colonies in early seral stage.

In sagebrush-dominated communities, there is more sagebrush in the mid to late seral stages than in early to mid seral stages. As the community moves from early to late seral stage, the percentage of grasses declines. In the understory, the dominant native plant species are western wheatgrass and green needlegrass.

Desired Vegetation Structure (Objective)

High	Moderate	Low
25 to 35%	45 to 55%	15 to 25%

High vegetation structure can be achieved on moderate and highly productive grasslands dominated by mid grasses (late or late intermediate seral stages). Grasslands on moderate to highly productive soils but in an early seral condition and dominated by short-stature plant species generally do not have the capability to provide high vegetation structure. Management changes may be necessary to move some existing seral conditions toward a higher seral condition to meet structure objectives.

Prairie dog colonies provide low structure, as do grassland areas grazed by livestock at high intensities. Low vegetation structure can result from a dominance of low stature plant species or from heavy utilization of mid grasses.

The height and density of grasses, forbs and sedges in the understory of sagebrush stands are important factors influencing structure for several wildlife species. The relationship of structure to quality nesting habitat for sage grouse is described in Appendix H. Appendix H describes quality nesting as sagebrush understories with residual herbaceous cover averaging at least 7 inches in height. This objective is primarily provided when sagebrush habitat types are in a late seral condition.

Desired seral stages (plant species composition) and vegetation structure (Plan Appendix I) across the Spring Creek geographic area of the Thunder Basin National Grassland are as follows:

Desired Seral Stages - Objective

Late	Late Intermediate	Early Intermediate	Early
10 to 20%	30 to 40%	30 to 40%	10 to 20%

Across the landscape, grass and sagebrush are intermingled. In some areas, grasses are the dominant species; in other areas, sagebrush is the dominant species. The vegetation composition varies depending on seral stage.

In grass-dominated communities in mid to late seral stages, the dominant native grass species are western wheatgrass, needle and thread grass, green needlegrass, and little bluestem. In grass-dominated sites in early to mid seral stages, grasses such as blue grama often dominate. Threeawn and blue grama are commonly the dominant grasses on prairie dog colonies in early seral stage.

In sagebrush-dominated communities, there is more sagebrush in the mid to late seral stages than in early to mid seral stages. As the community moves from early to late seral stage, the percentage of grasses declines. In the understory, the dominant native plant species are western wheatgrass and green needlegrass.

Desired Vegetation Structure (Objective)

High	Moderate	Low
35 to 45%	35 to 45%	15 to 25%

High vegetation structure can be achieved on moderate and highly productive grasslands dominated by mid grasses (late or late intermediate seral stages). Grasslands on moderate to highly productive soils but in an early seral condition and dominated by short-stature plant species generally do not have the capability to provide high vegetation structure. Management changes may be necessary to move some existing seral conditions toward a higher seral condition to meet structure objectives.

Prairie dog colonies provide low structure, as do grassland areas grazed by livestock at high intensities. Low vegetation structure can result from a dominance of low stature plant species or from heavy utilization of mid grasses.

The height and density of grasses, forbs and sedges in the understory of sagebrush stands are important factors influencing structure for several wildlife species. The relationship of structure to quality nesting habitat for sage grouse is described in Appendix H. Appendix H describes quality nesting as sagebrush understories with residual herbaceous cover averaging at least 7 inches in height. This objective is primarily provided when sagebrush habitat types are in a late seral condition.

Desired seral stages (plant species composition) and vegetation structure (Plan Appendix I) across the Upton Osage geographic area of the Thunder Basin National Grassland are as follows:

Desired Seral Stages - Objective

Late	Late Intermediate	Early Intermediate	Early
15 to 25%	30 to 40%	25 to 35%	10 to 20%

Across the landscape, grass and sagebrush are intermingled. In some areas, grasses are the dominant species; in other areas, sagebrush is the dominant species. The vegetation composition varies depending on seral stage.

In grass-dominated communities in mid to late seral stages, the dominant native grass species are western wheatgrass, needle and thread grass, green needlegrass, and little bluestem. In grass-dominated sites in early to mid seral stages, grasses such as blue grama often dominate. Threeawn and blue grama are commonly the dominant grasses on prairie dog colonies in early seral stage.

In sagebrush-dominated communities, there is more sagebrush in the mid to late seral stages than in early to mid seral stages. As the community moves from early to late seral stage, the percentage of grasses declines. In the understory, the dominant native plant species are western wheatgrass and green needlegrass.

Desired Vegetation Structure (Objective)

High	Moderate	Low
30 to 40%	45 to 55%	10 to 20%

High vegetation structure can be achieved on moderate and highly productive grasslands dominated by mid grasses (late or late intermediate seral stages). Grasslands on moderate to highly productive soils but in an early seral condition and dominated by short-stature plant species generally do not have the capability to provide high vegetation structure. Management changes may be necessary to move some existing seral conditions toward a higher seral condition to meet structure objectives.

Prairie dog colonies provide low structure, as do grassland areas grazed by livestock at high intensities. Low vegetation structure can result from a dominance of low stature plant species or from heavy utilization of mid grasses.

The height and density of grasses, forbs and sedges in the understory of sagebrush stands are important factors influencing structure for several wildlife species. The relationship of structure to quality nesting habitat for sage grouse is described in Appendix H. Appendix H describes quality nesting as sagebrush understories with residual herbaceous cover averaging at least 7 inches in height. This objective is primarily provided when sagebrush habitat types are in a late seral condition.

Nebraska National Forest And Grassland Units

The major range sites for each of the Nebraska units is as follows:

Unit	Range sites	Acres/Range Site
Bessey	Sands/Choppy Sands	85,700
	Dry Valley	100
McKelvie	Sands/Choppy Sands	107,970
	Dry Valley	6,370
Fall River	Clayey	56,630
	Silty	14,600
	Thin Upland	15,460
Wall	Clayey	15,380
	Silty	24,240
	Dense Clay	9,210
	Shallow Clay	6,860
	Thin Claypan	14,970
Fort Pierre	Clayey	58,590
	Silty	5,430
	Shallow Clay	4,940
	Thin Claypan	3,870
Oglala	Clayey	35,230
	Limy Upland	13,680
	Silty	2,900
	Shallow Clay	20,030
Pine Ridge	Silty	8,970
	Savanna	31,720

Table B-14. Desired Mix of Vegetation Types for Nebraska National Forest Units Ft. Pierre, Buffalo Gap and Oglala National Grasslands, Pine Ridge Unit.*

		Structure		
Matrix	**Composition**	**High**	**Moderate**	**Low**
a.	80% late to mid seral stage	10% - 20%	50% - 70%	20% - 30%
b.	85% late to mid seral stage	20% - 30%	50% - 70%	10% - 20%
c.	90% late to mid seral stage	30% - 40%	40% - 60%	10% - 20%
d.	90% late to mid seral stage	40% - 60%	30% - 50%	0% - 20%
g.	65% late thru early intermediate seral stage	25% - 45%	45% - 65%	1% - 20%
h.	75% late thru early intermediate seral stage	15% - 35%	40% - 60%	15% - 35%

Matrix	Composition	Structure High	Moderate	Low
i.	70% late thru early intermediate seral stage	10% - 30%	50% - 70%	10% - 30%
j.	60% late thru early intermediate seral stage	35% - 45%	35% - 45%	15% - 25%
k.	60% late thru early intermediate seral stage	30% - 40%	35% - 45%	20% - 30%
l.	50% late thru early intermediate seral stage	25% - 35%	35% - 45%	25% - 35%
m.	60% late thru early intermediate seral stage	30% - 50%	30% - 50%	10% - 30%
n.	60% late thru early intermediate seral stage	10% - 20%	65% - 85%	5% - 15%

***** The Pine Ridge Unit and Oglala National Grassland were evaluated the same, as they are one administrative unit.

In the DEIS, late to mid seral stage is a combination of these dominant vegetation types 1) western wheatgrass, green needlegrass, 2) western wheatgrass, green needlegrass, little bluestem, big bluestem, 3) needle-and-thread, buffalo grass, blue grama, 4) western wheatgrass, needle-and-thread, sedge, 5) needle-and-thread, sedge.

In the FEIS, the seral stages for the units on the Nebraska National Forest were expanded from early, mid and late seral stages to early, early intermediate, late intermediate, and late seral stage.

On the Nebraska National Forest and Grassland Units, the preferred matrix in the FEIS for each Geographic Area is as follows:

- Fall River Northeast GA matrix g
- Fall River Southeast GA matrix h
- Fall River West GA matrix i
- Wall North GA matrix j
- Wall Southeast GA matrix k
- Wall Southwest GA matrix l
- Fort Pierre GA matrix m
- Oglala GA matrix i
- Pine Ridge GA matrix m

The following section describes the specific vegetative compositional and structural objectives for the Fall River Northeast Geographic Area:

Composition

The desired plant species composition objective across the geographic area is as follows:

Late Seral	Late Intermediate Seral	Early Intermediate Seral	Early Seral
20 to 40%	40 to 60%	5 to 15%	5 to 10%

The description of the dominant native plant species in the late seral stage is as follows: The more productive soils (clayey, silty, and thin upland soils) should be comprised mainly of midgrasses and to a lesser extent tall grasses. On clayey, silty, and thin upland range sites western wheatgrass, green needlegrass, porcupine grass, sideoats grama, and little bluestem are the primary mid grasses and big bluestem should make up the majority of the tall grass. Tallgrasses such as big bluestem, switchgrass, and prairie sandreed should be expressed in the overflow or run-in sites.

The description of the dominant native plant species in the late intermediate seral stage is as follows: The more productive soils (clayey, silty, and thin upland soils) should be comprised mainly of midgrasses and to a lesser extent shortgrasses. The dominant grass species in the late intermediate seral stage should be western wheatgrass with the codominance made up of needle and thread, porcupine grass, blue grama, and sedges. The mix of grasses making up the codominance in the late intermediate seral stages will fluctuate according to precipitation and / or grazing intensities. Overflow sites will be made up of midgrasses, mainly western wheatgrass and green needlegrass.

The description of the dominant native plant species in the early intermediate seral stage is as follows: The more productive soils (clayey, silty, and thin upland soils) should be comprised mainly of shortgrasses and to a lesser extent midgrasses. The dominant grass species in the early intermediate seral stage should be blue grama, buffalo grass, western wheatgrass, needle and threadgrass, and sedges. The mix of grasses making up the codominance in the early intermediate seral stages will fluctuate according to precipitation and / or grazing intensities. Overflow sites will be made up of midgrasses and shortgrasses; mainly western wheatgrass, needle and thread, and blue grama.

The description of the dominant native plant species in the early seral stage is as follows: The more productive soils (clayey, silty, and thin upland soils) should be comprised mainly of shortgrasses with little if any presence of midgrasses. The early seral stage will be dominated by sedges, and short grasses such as blue grama and buffalograss on all range sites. Overflow sites will be dominated by shortgrasses and to a lesser extent midgrasses. The early seral stage should be emphasized on the less productive claypan soil types, in and around prairie dog towns, and in isolated areas of high livestock use.

Structure

Manage the geographic area to meet the vegetation structure objectives identified below:

High	Moderate	Low
25 to 45%	45 to 65%	1 to 20%

High vegetation structure can be achieved on moderate and highly productive soils dominated by mid and / or tall grasses (late or late intermediate seral stage composition). Grasslands on moderate to highly productive soils but dominated by short statured species generally do not have the capability to provide high vegetation structure unless management is changed to increase the composition of mid to tall grass species over a period of years or decades.

Moderate structure can be achieved on moderate to highly productive soils dominated by mid and / or tall grasses depending on grazing use levels. Grasslands within this geographic area receiving light to moderate levels of livestock use should be in the late or late intermediate seral stage to achieve moderate structure. Grasslands dominated by shortgrass species in the early intermediate or early seral stage will not achieve moderate structure under even light grazing levels.

Low productivity soils, prairie dog colonies, and grassland areas grazed by livestock at high intensities provide low structure. Low vegetation structure can result from a dominance of low stature plant species or from heavy utilization of mid and tall grasses.

See Plan Appendix I for more information on grassland structure.

The following section describes the specific vegetative compositional and structural objectives for the Fall River Southeast Geographic Area:

Composition

The desired plant species composition objective across the geographic area is as follows:

Late Seral	Late Intermediate Seral	Early Intermediate Seral	Early Seral
20 to 30%	40 to 60%	15 to 25%	1 to 10%

The description of the dominant native plant species in the late seral stage is as follows: The more productive soils (clayey, silty, and thin upland soils) should be comprised mainly of midgrasses and to a lesser extent tall grasses. On clayey, silty, and thin upland range sites western wheatgrass, green needlegrass, porcupinegrass, sideoats grama, and little bluestem are the primary mid grasses and big bluestem should make up the majority of the tall grass. Tallgrasses such as big bluestem, switchgrass, and prairie sandreed should be expressed in the overflow or run-in sites.

The description of the dominant native plant species in the late intermediate seral stage is as follows: The more productive soils (clayey, silty, and thin upland soils) should be comprised mainly of midgrasses and to a lesser extent shortgrasses. The dominant grass species in the late intermediate seral stage should be western wheatgrass with the codominance made up of needle and thread, porcupine grass, blue grama, and sedges. The mix of grasses making up the codominance in the late intermediate seral stages will fluctuate according to precipitation and / or grazing intensities. Overflow sites will be made up of midgrasses, mainly western wheatgrass and green needlegrass.

The description of the dominant native plant species in the early intermediate seral stage is as follows: The more productive soils (clayey, silty, and thin upland soils) should be comprised mainly of shortgrasses and to a lesser extent midgrasses. The dominant grass species in the early intermediate seral stage should be blue grama, buffalo grass, western wheatgrass, needle and threadgrass, and sedges. The mix of grasses making up the codominance in the early intermediate seral stages will fluctuate according to precipitation and / or grazing intensities. Overflow sites will be made up of midgrasses and shortgrasses; mainly western wheatgrass,

needle and thread, and blue grama.

The description of the dominant native plant species in the early seral stage is as follows: The more productive soils (clayey, silty, and thin upland soils) should be comprised mainly of shortgrasses with little if any presence of midgrasses. The early seral stage will be dominated by sedges, and short grasses such as blue grama and buffalograss on all range sites. Overflow sites will be dominated by shortgrasses and to a lesser extent midgrasses. The early seral stage should be emphasized on the less productive claypan soil types, in and around prairie dog towns, and in isolated areas of high livestock use.

Structure

Manage the geographic area to meet the vegetation structure objectives identified below:

High	Moderate	Low
15 to 35%	40 to 60%	15 to 35%

High vegetation structure can be achieved on moderate and highly productive soils dominated by mid and / or tall grasses (late or late intermediate seral stage composition). Grasslands on moderate to highly productive soils but dominated by short statured species generally do not have the capability to provide high vegetation structure unless management is changed to increase the composition of mid to tall grass species over a period of years or decades.

Moderate structure can be achieved on moderate to highly productive soils dominated by mid and / or tall grasses depending on grazing use levels. Grasslands within this geographic area receiving light to moderate levels of livestock use should be in the late or late intermediate seral stage to achieve moderate structure. Grasslands dominated by shortgrass species in the early intermediate or early seral stage will not achieve moderate structure under even light grazing levels.

Low productivity soils, prairie dog colonies, and grassland areas grazed by livestock at high intensities provide low structure. Low vegetation structure can result from a dominance of low stature plant species or from heavy utilization of mid and tall grasses.

See Plan Appendix I for more information on grassland structure.

The following section describes the specific vegetative compositional and structural objectives for the Fall River West Geographic Area:

Composition

The desired plant species composition objective across the geographic area is as follows:

Late Seral	Late Intermediate Seral	Early Intermediate Seral	Early Seral
10 to 30%	50 to 70%	10 to 20%	1 to 10%

Grasses: The description of the dominant native plant species in the late seral stage is as follows: The more productive soils (clayey, silty, and thin upland soils) should be comprised mainly of midgrasses and to a lesser extent tall grasses. On clayey, silty, and thin upland range sites western wheatgrass, green needlegrass, porcupine grass, sideoats grama, and little bluestem are the primary mid grasses and big bluestem should make up the majority of the tall grass. Tallgrasses such as big bluestem, switchgrass, and prairie sandreed should be expressed in the overflow or run-in sites.

The description of the dominant native plant species in the late intermediate seral stage is as follows: The more productive soils (clayey, silty, and thin upland soils) should be comprised mainly of midgrasses and to a lesser extent shortgrasses. The dominant grass species in the late intermediate seral stage should be western wheatgrass with the codominance made up of needle and thread, porcupine grass, blue grama, and sedges. The mix of grasses making up the codominance in the late intermediate seral stages will fluctuate according to precipitation and / or grazing intensities. Overflow sites will be made up of midgrasses, mainly western wheatgrass and green needlegrass.

The description of the dominant native plant species in the early intermediate seral stage is as follows: The more productive soils (clayey, silty, and thin upland soils) should be comprised mainly of shortgrasses and to a lesser extent midgrasses. The dominant grass species in the early intermediate seral stage should be blue grama, buffalo grass, western wheatgrass, needle and threadgrass, and sedges. The mix of grasses making up the codominance in the early intermediate seral stages will fluctuate according to precipitation and / or grazing intensities. Overflow sites will be made up of midgrasses and shortgrasses; mainly western wheatgrass, needle and thread, and blue grama.

The description of the dominant native plant species in the early seral stage is as follows: The more productive soils (clayey, silty, and thin upland soils) should be comprised mainly of shortgrasses with little if any presence of midgrasses. The early seral stage will be dominated by sedges, and short grasses such as blue grama and buffalograss on all range sites. Overflow sites will be dominated by shortgrasses and to a lesser extent midgrasses. The early seral stage should be emphasized on the less productive claypan soil types, in and around prairie dog towns, and in isolated areas of high livestock use.

Sagebrush Stands: The dominant native plant species in the understory of big sagebrush stands in the late seral stage is as follows: The late seral stage is dominated by midgrasses such as western wheatgrass, green needlegrass, and needle and thread with shortgrasses especially blue grama and buffalograss being a minor part of the understory component.

The dominant native plant species in the understory of big sagebrush stands in the late intermediate seral stage is as follows: Western wheatgrass is the dominant grass species in the understory with blue grama and buffalograss being the two codominant species.

The dominant native plant species in the understory of big sagebrush stands in the early intermediate seral stage is as follows: The early intermediate seral stage has an understory dominance of blue grama and buffalo grass while western wheatgrass is a lesser component of the understory.

The dominant native plant species in the understory of big sagebrush stands in the early seral stage is as follows: The early seral stage is dominated by shortgrasses such as buffalograss and blue grama. There is also a considerable amount of annual forbs, broom snakeweed, and plains cactus making up the understory of the sagebrush communities in the early seral stage.

Structure

Manage the geographic area to meet the vegetation structure objectives identified below:

High	Moderate	Low
10 to 30%	50 to 70%	10 to 30%

High vegetation structure can be achieved on moderate and highly productive soils dominated by mid and / or tall grasses (late or late intermediate seral stage composition). Grasslands on moderate to highly productive soils but dominated by short statured species generally do not have the capability to provide high vegetation structure unless management is changed to increase the composition of mid to tall grass species over a period of years or decades.

Moderate structure can be achieved on moderate to highly productive soils dominated by mid and / or tall grasses depending on grazing use levels. Grasslands within this geographic area receiving light to moderate levels of livestock use should be in the late or late intermediate seral stage to achieve moderate structure. Grasslands dominated by shortgrass species in the early intermediate or early seral stage will not achieve moderate structure under even light grazing levels.

Low productivity soils, prairie dog colonies, and grassland areas grazed by livestock at high intensities provide low structure. Low vegetation structure can result from a dominance of low stature plant species or from heavy utilization of mid and tall grasses.

The following section describes the specific vegetative compositional and structural objectives for the Wall North Geographic Area:

Composition

The desired plant species composition objective across the geographic area is as follows:

Late Seral	Late Intermediate Seral	Early Intermediate Seral	Early Seral
20 to 40%	30 to 50%	10 to 30%	1 to 20%

The description of the dominant native plant species in the late seral stage is as follows: The more productive soils (clayey and silty range sites) should be comprised mainly of midgrasses and to a lesser extent tall grasses, the moderate productive soils (dense clay and shallow clay range sites) should be comprised of midgrasses, while the less productive thin claypan and claypan range sites should be comprised of midgrasses and shortgrasses. On clayey and silty range sites western wheatgrass, green needlegrass, needle and thread, sideoats grama, and little bluestem are the primary mid grasses and big bluestem should make up the majority of the tall grass. The dense clay range sites are comprised of mainly western wheatgrass and green needlegrass to a lesser extent. On shallow clay range sites, found primarily on the slopes, western wheatgrass, and green needlegrass occur in amounts approximately equal to big bluestem, little bluestem, and sideoats grama. Western wheatgrass, blue grama, and buffalograss should dominate the less productive thin claypan and claypan range site. The mix of grasses making up the codominance on all range sites in the late seral stage will fluctuate according to precipitation and / or grazing intensities. Tallgrasses such as big bluestem, switchgrass, and prairie sandreed should be expressed in the overflow or run-in sites.

The description of the dominant native plant species in the late intermediate seral stage is as follows: The more productive soils (clayey and silty range sites) should be comprised mainly of midgrasses and to a lesser extent shortgrasses and tall grasses, the moderate productive soils (dense clay and shallow clay range sites) should be comprised of midgrasses and short grasses, while the less productive thin claypan and claypan range sites should be comprised of shortgrasses and to a lesser extent midgrasses. The dominant grass species on clayey and silty range sites in the late intermediate seral stage should be western wheatgrass with the codominance made up of needle and thread, blue grama, and sedges. The dense clay range sites are comprised of mainly western wheatgrass. On shallow clay range sites little bluestem,

western wheatgrass, and sideoats grama are the dominant species while blue grama and sedges become more abundant. Blue grama, buffalograss and to a lesser extent western wheatgrass will dominate the less productive thin claypan and claypan range sites. The mix of grasses making up the codominance on all range sites in the late intermediate seral stage will fluctuate according to precipitation and / or grazing intensities. Overflow sites will be made up of midgrasses, mainly western wheatgrass and green needlegrass.

The description of the dominant native plant species in the early intermediate seral stage is as follows: The more productive soils (clayey and silty range sites) should be comprised mainly of shortgrasses and to a lesser extent midgrasses, the moderate productive soils (dense clay and shallow clay range sites) should be comprised of midgrasses and short grasses, while the less productive thin claypan and claypan range sites should be comprised of shortgrasses. The dominant grass species on clayey and silty range sites in the early intermediate seral stage should be blue grama, buffalograss, western wheatgrass, needle and thread, and sedges. The dense clay range sites are comprised of mainly western wheatgrass and an increasing amount of forbs. On shallow clay range sites blue grama and threadleaf sedge dominate the site while little bluestem is the remaining midgrass component. The less productive thin claypan and claypan range sites will be dominated by annual grasses and cactus. The mix of grasses making up the codominance in the early intermediate seral stages will fluctuate according to precipitation and / or grazing intensities. Overflow sites will be made up of midgrasses and shortgrasses; mainly western wheatgrass, needle and thread, and blue grama.

The description of the dominant native plant species in the early seral stage is as follows: The more productive soils (clayey and silty range sites) should be comprised mainly of shortgrasses with little if any presence of midgrasses, the moderate productive soils (dense clay and shallow clay range sites) should be comprised of short grasses with little presence of midgrasses, while the less productive thin claypan and claypan range sites should be comprised of shortgrasses. The early seral stage will be dominated by sedges, and short grasses such as blue grama, buffalograss and annual grasses on all range sites. The mix of grasses making up the codominance in the early seral stages will fluctuate according to precipitation and / or grazing intensities. Overflow sites will be dominated by shortgrasses and to a lesser extent midgrasses.

Structure

Manage the geographic area to meet the vegetation structure objectives identified below:

High	Moderate	Low
35 to 45%	35 to 45%	15 to 25%

High vegetation structure can be achieved on moderate and highly productive soils dominated by mid and / or tall grasses (late or late intermediate seral stage composition). Grasslands on moderate to highly productive soils but dominated by short statured species generally do not have the capability to provide high vegetation structure unless management is changed to increase the composition of mid to tall grass species over a period of years or decades.

Moderate structure can be achieved on moderate to highly productive soils dominated by mid and / or tall grasses depending on grazing use levels. Grasslands within this geographic area receiving light to moderate levels of livestock use should be in the late or late intermediate seral stage to achieve moderate structure. Grasslands dominated by shortgrass species in the early intermediate or early seral stage will probably not achieve moderate structure under even light grazing levels.

Low productivity soils, prairie dog colonies, and grassland areas grazed by livestock at high intensities provide low structure. Low vegetation structure can result from a dominance of low stature plant species or from heavy utilization of mid and tall grasses.

The following section describes the specific vegetative compositional and structural objectives for the Wall Southeast Geographic Area:

Composition

The desired plant species composition objective across the geographic area is as follows:

Late Seral	Late Intermediate Seral	Early Intermediate Seral	Early Seral
20 to 40%	30 to 50%	10 to 30%	1 to 20%

The description of the dominant native plant species in the late seral stage is as follows: The more productive soils (clayey and silty range sites) should be comprised mainly of midgrasses and to a lesser extent tall grasses, the moderate productive soils (dense clay and shallow clay range sites) should be comprised of midgrasses, while the less productive thin claypan and claypan range sites should be comprised of midgrasses and shortgrasses. On clayey and silty range sites western wheatgrass, green needlegrass, needle and thread, sideoats grama, and little bluestem are the primary mid grasses and big bluestem should make up the majority of the tall grass. The dense clay range sites are comprised of mainly western wheatgrass and green needlegrass to a lesser extent. On shallow clay range sites, found primarily on the slopes, western wheatgrass, and green needlegrass occur in amounts approximately equal to big bluestem, little bluestem, and sideoats grama. Western wheatgrass, blue grama, and buffalograss should dominate the less productive thin claypan and claypan range site. The mix of grasses making up the codominance on all range sites in the late seral stage will fluctuate according to precipitation and / or grazing intensities. Tallgrasses such as big bluestem, switchgrass, and prairie sandreed should be expressed in the overflow or run-in sites.

The description of the dominant native plant species in the late intermediate seral stage is as follows: The more productive soils (clayey and silty range sites) should be comprised mainly of midgrasses and to a lesser extent shortgrasses and tall grasses, the moderate productive soils (dense clay and shallow clay range sites) should be comprised of midgrasses and short grasses, while the less productive thin claypan and claypan range sites should be comprised of shortgrasses and to a lesser extent midgrasses. The dominant grass species on clayey and silty range sites in the late intermediate seral stage should be western wheatgrass with the codominance made up of needle and thread, blue grama, and sedges. The dense clay range sites are comprised of mainly western wheatgrass. On shallow clay range sites little bluestem, western wheatgrass, and sideoats grama are the dominant species while blue grama and sedges become more abundant. Blue grama, buffalograss and to a lesser extent western wheatgrass will dominate the less productive thin claypan and claypan range sites. The mix of grasses making up the codominance on all range sites in the late intermediate seral stage will fluctuate according to precipitation and / or grazing intensities. Overflow sites will be made up of midgrasses, mainly western wheatgrass and green needlegrass.

The description of the dominant native plant species in the early intermediate seral stage is as follows: The more productive soils (clayey and silty range sites) should be comprised mainly of shortgrasses and to a lesser extent midgrasses, the moderate productive soils (dense clay and shallow clay range sites) should be comprised of midgrasses and short grasses, while the less productive thin claypan and claypan range sites should be comprised of shortgrasses. The dominant grass species on clayey and silty range sites in the early intermediate seral stage

should be blue grama, buffalograss, western wheatgrass, needle and thread, and sedges. The dense clay range sites are comprised of mainly western wheatgrass and an increasing amount of forbs. On shallow clay range sites blue grama and threadleaf sedge dominate the site while little bluestem is the remaining midgrass component. The less productive thin claypan and claypan range sites will be dominated by annual grasses and cactus. The mix of grasses making up the codominance in the early intermediate seral stages will fluctuate according to precipitation and / or grazing intensities. Overflow sites will be made up of midgrasses and shortgrasses; mainly western wheatgrass, needle and thread, and blue grama.

The description of the dominant native plant species in the early seral stage is as follows: The more productive soils (clayey and silty range sites) should be comprised mainly of shortgrasses with little if any presence of midgrasses, the moderate productive soils (dense clay and shallow clay range sites) should be comprised of short grasses with little presence of midgrasses, while the less productive thin claypan and claypan range sites should be comprised of shortgrasses. The early seral stage will be dominated by sedges, and short grasses such as blue grama, buffalograss and annual grasses on all range sites. The mix of grasses making up the codominance in the early seral stages will fluctuate according to precipitation and / or grazing intensities. Overflow sites will be dominated by shortgrasses and to a lesser extent midgrasses.

Structure

Manage the geographic area to meet the vegetation structure objectives identified below:

High	Moderate	Low
30 to 40%	35 to 45%	20 to 30%

High vegetation structure can be achieved on moderate and highly productive soils dominated by mid and / or tall grasses (late or late intermediate seral stage composition). Grasslands on moderate to highly productive soils but dominated by short statured species generally do not have the capability to provide high vegetation structure unless management is changed to increase the composition of mid to tall grass species over a period of years or decades.

Moderate structure can be achieved on moderate to highly productive soils dominated by mid and / or tall grasses depending on grazing use levels. Grasslands within this geographic area receiving light to moderate levels of livestock use should be in the late or late intermediate seral stage to achieve moderate structure. Grasslands dominated by shortgrass species in the early intermediate or early seral stage will not achieve moderate structure under even light grazing levels.

Low productivity soils, prairie dog colonies, and grassland areas grazed by livestock at high intensities provide low structure. Low vegetation structure can result from a dominance of low stature plant species or from heavy utilization of mid and tall grasses.

The following section describes the specific vegetative compositional and structural objectives for the Wall Southwest Geographic Area:

Composition

The desired plant species composition objective across the geographic area is as follows:

Late Seral	Late Intermediate Seral	Early Intermediate Seral	Early Seral
20 to 40%	20 to 40%	10 to 30%	10 to 30%

The description of the dominant native plant species in the late seral stage is as follows: The more productive soils (clayey and silty range sites) should be comprised mainly of midgrasses and to a lesser extent tall grasses, the moderate productive soils (dense clay and shallow clay range sites) should be comprised of midgrasses, while the less productive thin claypan and claypan range sites should be comprised of midgrasses and shortgrasses. On clayey and silty range sites western wheatgrass, green needlegrass, needle and thread, sideoats grama, and little bluestem are the primary mid grasses and big bluestem should make up the majority of the tall grass. The dense clay range sites are comprised of mainly western wheatgrass and green needlegrass to a lesser extent. On shallow clay range sites, found primarily on the slopes, western wheatgrass, and green needlegrass occur in amounts approximately equal to big bluestem, little bluestem, and sideoats grama. Western wheatgrass, blue grama, and buffalograss should dominate the less productive thin claypan and claypan range site. The mix of grasses making up the codominance on all range sites in the late seral stage will fluctuate according to precipitation and/or grazing intensities. Tallgrasses such as big bluestem, switchgrass, and prairie sandreed should be expressed in the overflow or run-in sites.

The description of the dominant native plant species in the late intermediate seral stage is as follows: The more productive soils (clayey and silty range sites) should be comprised mainly of midgrasses and to a lesser extent shortgrasses and tall grasses, the moderate productive soils (dense clay and shallow clay range sites) should be comprised of midgrasses and short grasses, while the less productive thin claypan and claypan range sites should be comprised of shortgrasses and to a lesser extent midgrasses. The dominant grass species on clayey and silty range sites in the late intermediate seral stage should be western wheatgrass with the codominance made up of needle and thread, blue grama, and sedges. The dense clay range sites are comprised of mainly western wheatgrass. On shallow clay range sites little bluestem, western wheatgrass, and sideoats grama are the dominant species while blue grama and sedges become more abundant. Blue grama, buffalograss and to a lesser extent western wheatgrass will dominate the less productive thin claypan and claypan range sites. The mix of grasses making up the codominance on all range sites in the late intermediate seral stage will fluctuate according to precipitation and/or grazing intensities. Overflow sites will be made up of midgrasses, mainly western wheatgrass and green needlegrass.

The description of the dominant native plant species in the early intermediate seral stage is as follows: The more productive soils (clayey and silty range sites) should be comprised mainly of shortgrasses and to a lesser extent midgrasses, the moderate productive soils (dense clay and shallow clay range sites) should be comprised of midgrasses and short grasses, while the less productive thin claypan and claypan range sites should be comprised of shortgrasses. The dominant grass species on clayey and silty range sites in the early intermediate seral stage should be blue grama, buffalograss, western wheatgrass, needle and thread, and sedges. The dense clay range sites are comprised of mainly western wheatgrass and an increasing amount of forbs. On shallow clay range sites blue grama and threadleaf sedge dominate the site while little bluestem is the remaining midgrass component. The less productive thin claypan and claypan range sites will be dominated by annual grasses and cactus. The mix of grasses making up the codominance in the early intermediate seral stages will fluctuate according to precipitation and/or grazing intensities. Overflow sites will be made up of midgrasses and shortgrasses; mainly western wheatgrass, needle and thread, and blue grama.

The description of the dominant native plant species in the early seral stage is as follows: The more productive soils (clayey and silty range sites) should be comprised mainly of shortgrasses

with little if any presence of midgrasses, the moderate productive soils (dense clay and shallow clay range sites) should be comprised of short grasses with little presence of midgrasses, while the less productive thin claypan and claypan range sites should be comprised of shortgrasses. The early seral stage will be dominated by sedges, and short grasses such as blue grama, buffalograss and annual grasses on all range sites. The mix of grasses making up the codominance in the early seral stages will fluctuate according to precipitation and / or grazing intensities. Overflow sites will be dominated by shortgrasses and to a lesser extent midgrasses.

Structure

Manage the geographic area to meet the vegetation structure objectives identified below:

High	Moderate	Low
25 to 35%	35 to 45%	25 to 35%

High vegetation structure can be achieved on moderate and highly productive soils dominated by mid and / or tall grasses (late or late intermediate seral stage composition). Grasslands on moderate to highly productive soils but dominated by short statured species generally do not have the capability to provide high vegetation structure unless management is changed to increase the composition of mid to tall grass species over a period of years or decades.

Moderate structure can be achieved on moderate to highly productive soils dominated by mid and / or tall grasses depending on grazing use levels. Grasslands within this geographic area receiving light to moderate levels of livestock use should be in the late or late intermediate seral stage to achieve moderate structure. Grasslands dominated by shortgrass species in the early intermediate or early seral stage will not achieve moderate structure under even light grazing levels.

Low productivity soils, prairie dog colonies, and grassland areas grazed by livestock at high intensities provide low structure. Low vegetation structure can result from a dominance of low stature plant species or from heavy utilization of mid and tall grasses.

The following section describes the specific vegetative compositional and structural objectives for the Fort Pierre Geographic Area:

Composition

The desired plant species composition objective across the geographic area is as follows:

Late Seral	Late Intermediate Seral	Early Intermediate Seral	Early Seral
20 to 40%	30 to 50%	10 to 30%	1 to 20%

The description of the dominant native plant species in the late seral stage is as follows: The more productive soils (clayey, silty, and thin upland soils) should be comprised mainly of midgrasses and to a lesser extent tall grasses. On clayey, silty, and thin upland soils western wheatgrass, green needlegrass, porcupinegrass, sideoats grama, and little bluestem are the primary mid grasses and big bluestem should make up the majority of the tall grass. Western wheatgrass, blue grama, and buffalograss should dominate the less productive claypan soil types. Tallgrasses such as big bluestem, switchgrass, and prairie sandreed should be expressed in the overflow or run-in sites.

The description of the dominant native plant species in the late intermediate seral stage is as follows: The more productive soils (clayey, silty, and thin upland soils) should be comprised mainly of midgrasses and to a lesser extent shortgrasses, while the less productive claypan soils should be comprised of shortgrasses and to a lesser extent midgrasses. The dominant grass species in the late intermediate seral should be western wheatgrass with the codominance made up of needle and threadgrass, porcupinegrass, blue grama, and sedges. The mix of grasses making up the codominance in both the late intermediate seral stages will fluctuate according to precipitation and / or grazing intensities. Overflow sites will be made up of midgrasses, mainly western wheatgrass and green needlegrass.

The description of the dominant native plant species in the early intermediate seral stage is as follows: The more productive soils (clayey, silty, and thin upland soils) should be comprised mainly of shortgrasses and to a lesser extent midgrasses, while the less productive claypan soils should be comprised of shortgrasses. The dominant grass species in the early intermediate seral stage should be blue grama, buffalo grass, western wheatgrass, needle and threadgrass, and sedges The mix of grasses making up the codominance in the early intermediate seral stages will fluctuate according to precipitation and / or grazing intensities. Overflow sites will be made up of midgrasses and shortgrasses; mainly western wheatgrass, needle and threadgrass, and blue grama.

The description of the dominant native plant species in the early seral stage is as follows: The more productive soils (clayey, silty, and thin upland soils) should be comprised mainly of shortgrasses with little if any presence of midgrasses, while the less productive claypan soils should be comprised of shortgrasses. The early seral stage will be dominated by sedges, clubmoss, and short grasses such as blue grama and buffalograss on all soil types. Overflow sites will be dominated by shortgrasses and to a lesser extent midgrasses. The early seral stage should be emphasized on the less productive claypan soil types, in and around prairie dog towns, and in isolated areas of high livestock use.

Structure

Manage the geographic area to meet the vegetation structure objectives identified below:

High	Moderate	Low
30 to 50%	30 to 50%	10 to 30%

High vegetation structure can be achieved on moderate and highly productive soils dominated by mid and / or tall grasses (late or late intermediate seral stage composition). Grasslands on moderate to highly productive soils but dominated by short statured species generally do not have the capability to provide high vegetation structure unless management is changed to increase the composition of mid to tall grass species over a period of years or decades.

Moderate structure can be achieved on moderate to highly productive soils dominated by mid and / or tall grasses depending on grazing use levels. Grasslands within this geographic area receiving light to moderate levels of livestock use should be in the late or late intermediate seral stage to achieve moderate structure. Grasslands dominated by shortgrass species in the early intermediate or early seral stage will not achieve moderate structure under even light grazing levels.

Low productivity soils, prairie dog colonies, and grassland areas grazed by livestock at high intensities provide low structure. Low vegetation structure can result from a dominance of low stature plant species or from heavy utilization of mid and tall grasses.

The following section describes the specific vegetative compositional and structural objectives for the Oglala Geographic Area:

Composition

The desired plant species composition objectives across the geographic area is as follows:

Late Seral	Late Intermediate Seral	Early Intermediate Seral	Early Seral
10 to 30%	50 to 70%	10 to 20%	1 to 10%

The description of the dominant native plant species in the late seral stage is as follows: The more productive soils (clayey, shallow clay, limy upland, and silty range sites) should be comprised mainly of midgrasses and to a lesser extent tall grasses, while the less productive claypan soils should be comprised of midgrasses and shortgrasses. On clayey and silty range sites western wheatgrass, green needlegrass, sideoats grama, and little bluestem are the primary mid grasses and big bluestem should make up the majority of the tall grass. On shallow clay range sites, found primarily on the slopes of the river breaks, western wheatgrass, ricegrass, and green needlegrass occur in amounts approximately equal to big bluestem, little bluestem, and sideoats grama. Leadplant should also be a common part of the grassland community on the above mentioned range sites in the late seral stage. Western wheatgrass, blue grama, and buffalograss should dominate the less productive claypan range site. Tallgrasses such as big bluestem, switchgrass, and prairie sandreed should be expressed in the overflow or run-in sites.

The description of the dominant native plant species in the late intermediate seral stage is as follows: The more productive soils (clayey, shallow clay, limy upland, and silty range sites) should be comprised mainly of midgrasses and to a lesser extent shortgrasses, while the less productive claypan soils should be comprised of shortgrasses and to a lesser extent midgrasses. The dominant grass species on clayey and silty range sites in the late intermediate seral stage should be western wheatgrass with the codominance made up of needle and thread, blue grama, and sedges. On shallow clay range sites little bluestem, western wheatgrass, and sideoats grama are the dominant species while blue grama and sedges become more abundant. The mix of grasses making up the codominance on all range sites in the late intermediate seral stage will fluctuate according to precipitation and/or grazing intensities. Overflow sites will be made up of midgrasses, mainly western wheatgrass and green needlegrass.

The description of the dominant native plant species in the early intermediate seral stage is as follows: The more productive soils (clayey, shallow clay, limy upland, and silty range sites) should be comprised mainly of shortgrasses and to a lesser extent midgrasses, while the less productive claypan soils should be comprised of shortgrasses. The dominant grass species on clayey and silty range sites in the early intermediate seral stage should be blue grama, buffalograss, western wheatgrass, needle and thread, and sedges. On shallow clay range sites blue grama and threadleaf sedge dominate the site while little bluestem is the remaining midgrass component. The mix of grasses making up the codominance in the early intermediate seral stages will fluctuate according to precipitation and/or grazing intensities. Overflow sites will be made up of midgrasses and shortgrasses; mainly western wheatgrass, needle and thread, and blue grama.

The description of the dominant native plant species in the early seral stage is as follows: The more productive soils (clayey, shallow clay, limy upland and silty range sites) should be comprised mainly of shortgrasses with little if any presence of midgrasses, while the less productive claypan soils should be comprised of shortgrasses. The early seral stage will be dominated by sedges, and short grasses such as blue grama and buffalograss on all range sites.

Overflow sites will be dominated by shortgrasses and to a lesser extent midgrasses. The early seral stage should be emphasized on the less productive claypan range sites, in and around prairie dog towns, and in isolated areas of high livestock use or other persistent disturbances.

Structure

Manage the geographic area to meet the vegetation structure objectives identified below:

High	Moderate	Low
10 to 30%	50 to 70%	10 to 30%

High vegetation structure can be achieved on moderate and highly productive soils dominated by mid and / or tall grasses (late or late intermediate seral stage composition). Grasslands on moderate to highly productive soils but dominated by short stature species generally do not have the capability to provide high vegetation structure unless management is changed to increase the composition of mid to tall grass species over a period of years or decades.

Moderate structure can be achieved on moderate to highly productive soils dominated by mid and / or tall grasses depending on grazing use levels. Grasslands within this geographic area receiving light to moderate levels of livestock use should be in the late or late intermediate seral stage to achieve moderate structure. Grasslands dominated by shortgrass species in the early intermediate or early seral stage will not achieve moderate structure under even light grazing levels.

Low productivity soils, prairie dog colonies, and grassland areas grazed by livestock at high intensities for an extended season of use provide low structure. Low vegetation structure can result from a dominance of low stature plant species or from heavy utilization of mid and tall grasses.

The following section describes the specific vegetative compositional and structural objectives for the Pine Ridge Geographic Area:

Composition

The desired plant species composition objectives across the geographic area is as follows:

Late Seral	Late Intermediate Seral	Early Intermediate Seral	Early Seral
15 to 25%	40 to 70%	5 to 15%	1 to 20%

The description of the dominant native plant species in the late seral stage is as follows: The more productive soils (silty and savannah range sites) should be comprised mainly of midgrasses and to a lesser extent tall grasses. On silty range sites western wheatgrass, green needlegrass, sideoats grama, and little bluestem are the primary mid grasses and big bluestem should make up the majority of the tall grass. Savannah range sites should be made up of little bluestem, sideoats grama, green needlegrass, and slender wheatgrass for midgrass species and big bluestem, prairie sandreed, and sand bluestem will make up the tallgrass species.

The description of the dominant native plant species in the late intermediate seral stage is as follows: The more productive soils (silty and savannah range sites) should be comprised mainly of midgrasses and to a lesser extent shortgrasses and tallgrasses. The dominant grass species in the late intermediate seral stage on silty range sites should be western wheatgrass with the codominance made up of needle and threadgrass, blue grama, and sedges. The dominant grass species in the late intermediate seral stage on savannah range sites should be little bluestem, prairie sandreed, slender wheatgrass, sideoats grama, and blue grama. The mix

of grasses making up the codominance in the late intermediate seral stages will fluctuate according to precipitation and / or grazing intensities.

The description of the dominant native plant species in the early intermediate seral stage is as follows: The more productive soils (silty and savannah range sites) should be comprised mainly of shortgrasses and to a lesser extent midgrasses. The dominant grass species in the early intermediate seral stage on silty range sites should be blue grama, buffalo grass, western wheatgrass, needle and threadgrass, and sedges. The dominant grass species in the early intermediate seral stage on savannah range sites should be little bluestem, prairie junegrass, prairie sandreed, blue grama, hairy grama, and plains muhly. The mix of grasses making up the codominance in the early intermediate seral stages will fluctuate according to precipitation and / or grazing intensities.

The description of the dominant native plant species in the early seral stage is as follows: The savannah range sites in an early seral stage will be dominated by broadleaf weeds such as annual ragweed, green sagewort, and lupine, sedges, and annual grasses like downy brome. Other species common to the early seral stage on savannah range sites are short stature grass species such as red threeawn, hairy grama, and blue grama. The silty range sites should be comprised mainly of shortgrasses with little if any presence of midgrasses. Sedges will dominate the early seral stage on silty range sites and short grasses such as blue grama and buffalograss. The early seral stage should be emphasized on the less productive saline upland range sites and in isolated areas of high livestock use or other persistent disturbances.

Structure

Manage the geographic area to meet the vegetation structure objectives identified below:

High	Moderate	Low
10 to 20%	65 to 85%	5 to 15%

High vegetation structure can be achieved on moderate and highly productive soils dominated by mid and / or tall grasses (late or late intermediate seral stage composition). Grasslands on moderate to highly productive soils but dominated by short stature species generally do not have the capability to provide high vegetation structure unless management is changed to increase the composition of mid to tall grass species over a period of years or decades.

Moderate structure can be achieved on moderate to highly productive soils dominated by mid and / or tall grasses depending on grazing use levels. Grasslands within this geographic area receiving light to moderate levels of livestock use should be in the late or late intermediate seral stage to achieve moderate structure. Grasslands dominated by shortgrass species in the early intermediate or early seral stage will not achieve moderate structure under even light grazing levels.

Low productivity soils, and grassland areas grazed by livestock at high intensities for an extended season on use provide low structure. Low vegetation structure can result from a dominance of low stature plant species or from heavy utilization of mid and tall grasses.

Forest Vegetation

Manage for a 40-60% forest cover (silvicultural structural stages 2-5; see glossary) across the geographic area.

Manage timber stands to do the following:

- Improve forest health.
- Prevent potentially damaging forest pest populations.
- Reduce fuel loading and risk of catastrophic wildfire.
- Enhance wildlife and TES habitats.
- Provide national forest timber to support local economies.
- Recover or enhance rangeland vegetation from Ponderosa pine encroachment.
- Improve riparian habitat.
- Enhance recreation experiences or visuals.

Manage forest cover to achieve a 60-80 sq. ft. basal area on 10% of the forest cover. Manage to achieve silvicultural structural stages 4 and 5, with emphasis on structural stages 4a (mature open) and 5 (old growth/late successional).

Manage forest cover to create stands with four structural stages in the forest cover as follows:

- 15-25% in structural stage 2.
- 15-25% in structural stage 3.
- 40% in structural stage 4.
- 20% in structural stage 5.

Achieve forest structural diversity by maintaining or enhancing hardwood trees, shrub inclusions and other beneficial plant communities and openings.

Table B-15. Desired Mix of Vegetation Types for Nebraska National Forest, Bessey Unit, Samuel R. McKelvie National Forest.

		Structure		
Matrix	**Composition**	**High**	**Moderate**	**Low**
a.	80% late to mid seral stage	20% - 30%	70% - 80%	0
c.	85% late to mid seral stage	40% - 60%	40% - 60%	0
d.	90% late to mid seral stage	70% - 80%	20% - 30%	0
g.	61% late thru early intermediate seral stage	40% - 60%	40% - 60%	0%-5%

In the DEIS, late to mid seral stage is a combination of these dominant vegetation types 1) sand bluestem, prairie sandreed, 2) little bluestem, switchgrass, sedge, and 3) blue grama, sedge

In the FEIS, the seral stages for the units on the Bessey and Samuel R. McKelvie Units were expanded from early, mid and late seral stages to early, early intermediate, late intermediate, and late seral stage.

On the Bessey and McKelvie Units, the preferred matrix in the FEIS for each Geographic Area is matrix g.

The following section describes the specific vegetative compositional and structural objectives for the Bessey Geographic Area:

Composition

The desired plant species composition objective across the geographic area is as follows:

Late Seral	Late Intermediate Seral	Early Intermediate Seral	Early Seral
30-50%	30-50%	1-20%	1-20%

The description of the dominant native plant species in the late seral stage is as follows: The sands and choppy sands ecological type will be dominated by sand bluestem while little bluestem will be the codominant species. Prairie sandreed, hairy grama, switchgrass, sedges and sand lovegrass are also important grasses in the late seral stage on this ecological type. On the more productive dry valley ecological type blue grama will be the dominant species while sedges will be the codominant species. Prairie sandreed, sand bluestem, switchgrass, sand lovegrass, and little bluestem are also important grasses on dry valley sites in the late seral stage.

The description of the dominant native plant species in the late intermediate seral stage is as follows: The sands and choppy sands ecological type will be dominated by little bluestem while sand lovegrass will be the codominant species. Sand bluestem, sedges, prairie sandreed, hairy grama, and switchgrass, are also important grasses in the late intermediate seral stage of the sands and choppy sands ecological type. On the more productive dry valley ecological type little bluestem will be the dominant species while sedges will be the codominant species. Switchgrass, blue grama, sand bluestem, hairy grama, and needle and thread are also important grasses on dry valley sites in the late intermediate seral stage.

The description of the dominant native plant species in the early intermediate seral stage is as follows: The sands and choppy sands ecological type will be dominated by hairy grama while little bluestem will be the codominant species. Sand bluestem, sedges, prairie sandreed, switchgrass, and sand lovegrass, are also important species in the early intermediate seral stage of the sands and choppy sands ecological type. On the more productive dry valley ecological type sedges will be the dominant species while blue grama will be the codominant species. Little bluestem, switchgrass, prairie sandreed, sand bluestem, and hairy grama are also important grasses on dry valley sites in the early intermediate seral stage.

The description of the dominant native plant species in the early seral stage is as follows: The sands and choppy sands ecological type will be dominated by sand bluestem while switchgrass will be the codominant species. Sand lovegrass, sedges, little bluestem, prairie sandreed, and blue grama are also important species in the early seral stage of this ecological type. On the more productive dry valley ecological type switchgrass will be the dominant species while sand bluestem will be the codominant species. Little bluestem, prairie sandreed, needle and thread, blue grama, and sedges are also important species on dry valley sites in the early seral stage

Structure

Manage the geographic area to meet the vegetation structure objectives identified below:

High	Moderate	Low
40 to 60%	40 to 60%	0 to 5%

High vegetation structure can be achieved on moderate and highly productive soils dominated by mid and / or tall grasses (early or early intermediate seral stage composition). Grasslands on moderate to highly productive soils but dominated by shortgrass species generally do not have the capability to provide high vegetation structure unless management is changed to increase the composition of mid to tall grass species over a period of years or decades.

Moderate structure can be achieved on moderate to highly productive soils dominated by mid and / or tall grasses depending on grazing use levels. Grasslands within this geographic area receiving light to moderate levels of livestock use will need to be in the early or early intermediate seral stage to achieve moderate structure. Grasslands dominated by shortgrass species in the late intermediate or late seral stage will not achieve moderate structure regardless of grazing levels.

Low productivity soils, prairie dog colonies, and grassland areas grazed by livestock at high intensities provide low structure. Low vegetation structure can result from a dominance of low stature plant species or from heavy utilization of mid and tall grasses.

The following section describes the specific vegetative compositional and structural objectives for the McKelvie Geographic Area:

Composition

The desired plant species composition objective across the geographic area is as follows:

Late Seral	Late Intermediate Seral	Early Intermediate Seral	Early Seral
30 to 50%	30 to 50%	1 to 20%	1 to 20%

The description of the dominant native plant species in the late seral stage is as follows: On the more productive dry valley ecological type blue grama will be the dominant species while sedges will be the codominant species. Prairie sandreed, sand bluestem, switchgrass, sand lovegrass, and little bluestem are also important grasses on dry valley sites in the late seral stage. The sands and choppy sands ecological type will be dominated by sand bluestem while little bluestem will be the codominant species. Prairie sandreed, hairy grama, switchgrass, sedges and sand lovegrass are also important grasses in the late seral stage on this ecological type.

The description of the dominant native plant species in the late intermediate seral stage is as follows: On the more productive dry valley ecological type little bluestem will be the dominant species while sedges will be the codominant species. Switchgrass, blue grama, sand bluestem, hairy grama, and needle and thread are also important grasses on dry valley sites in the late intermediate seral stage. The sands and choppy sands ecological type will be dominated by little bluestem while sand lovegrass will be the codominant species. Sand bluestem, sedges, prairie sandreed, hairy grama, and switchgrass, are also important grasses in the late intermediate seral stage of the sands and choppy sands ecological type.

The description of the dominant native plant species in the early intermediate seral stage is as follows: On the more productive dry valley ecological type sedges will be the dominant species while blue grama will be the codominant species. Little bluestem, switchgrass, prairie sandreed, sand bluestem, and hairy grama are also important grasses on dry valley sites in the early intermediate seral stage. The sands and choppy sands ecological type will be dominated by hairy grama while little bluestem will be the codominant species. Sand bluestem, sedges, prairie sandreed, switchgrass, and sand lovegrass, are also important species in the early intermediate seral stage of the sands and choppy sands ecological type.

The description of the dominant native plant species in the early seral stage is as follows: On the more productive dry valley ecological type switchgrass will be the dominant species while sand bluestem will be the codominant species. Little bluestem, prairie sandreed, needle and thread, blue grama, and sedges are also important species on dry valley sites in the early seral stage. The sands and choppy sands ecological type will be dominated by sand bluestem while switchgrass will be the codominant species. Sand lovegrass, sedges, little bluestem, prairie sandreed, and blue grama are also important species in the early seral stage of this ecological type.

Structure

Manage the geographic area to meet the vegetation structure objectives identified below:

High	Moderate	Low
40 to 60%	40 to 60%	0 to 5%

High vegetation structure can be achieved on moderate and highly productive soils dominated by mid and / or tall grasses (early or early intermediate seral stage composition). Grasslands on moderate to highly productive soils but dominated by shortgrass species generally do not have the capability to provide high vegetation structure unless management is changed to increase the composition of mid to tall grass species over a period of years or decades.

Moderate structure can be achieved on moderate to highly productive soils dominated by mid and / or tall grasses depending on grazing use levels. Grasslands within this geographic area receiving light to moderate levels of livestock use will need to be in the early or early intermediate seral stage to achieve moderate structure. Grasslands dominated by shortgrass species in the late intermediate or late seral stage will not achieve moderate structure regardless of grazing levels.

Low productivity soils, prairie dog colonies, and grassland areas grazed by livestock at high intensities provide low structure. Low vegetation structure can result from a dominance of low stature plant species or from heavy utilization of mid and tall grasses.

For all units an emphasis (Matrix a through d) was then assigned to each management area by alternative dependent on what the desired condition should be to achieve resource goals and objectives based on structural stage classes. Not all units have all four matrices, a through d. The reason was that in the original development of the matrices there were overlaps of only 5%. It was decided to combine those matrices that overlapped. Further analysis and public input derived several other matrices for different geographic areas. For monitoring purposes, structural stages would be monitored based on the local site potentials to determine if the desired conditions are being met.

Herbage Productivity

Several methods were used in determining existing and potential graminoid herbage production on the Northern Great Plains planning units.

Dakota Prairie Grasslands

Existing Production

Herbage production for the Dakota Prairie Grasslands were derived from two sources: the Natural Resources Conservation Service (NRCS) and North Dakota State University (NDSU). Average production for rolling prairie and badlands types on the Little Missouri were provided by NRCS personnel (Froemke 2000) based on their recommended stocking for those types. The NRCS web site (http://plants.usda.gov) was consulted with regard to production on the Grand River National Grassland (GRNG). Twenty-three plots of clipped data were available for Perkins County, which contains most of the GRNG. The data was available for five separate range sites. Production values for each range site were averaged before arriving at an average production value with which to characterize the GRNG. Because of the proximity of the Cedar River National Grassland (CRNG), the average production value used for the GRNG was also used for the CRNG.

The NRCS did not feel that production data for the Sheyenne National Grassland (SNG) was as reliable as that found for the western side of the state, and NDSU was consulted in the attempt to find research specific to the SNG. Several graduate theses dealing with vegetation resources on the SNG were provided and reviewed. Two of those efforts contained production data that was specific to the SNG. One study (Nelson 1986) was conducted during one year (1982) while the other (Hopkins, 1996) gathered production data from the period of 1991 – 1994. The average production values from these two studies were within .3% of each other and the data covering multiple years was selected to characterize production on the SNG.

Potential Production

Vegetation production within the Northern Great Plains is highly variable due to annual and seasonal fluctuations in precipitation, affecting available moisture for vegetation growth. Production data was compared to that of other studies (Bjugstad 1965, Uresk and Bjugstad 1996) and Natural Resource Conservation Service (NRCS) production data. Dakota Prairie Grassland data was found to fall within the production range of these other studies. The following table displays the range in production data for selected North Dakota counties associated with the grassland units from NRCS soil survey data tables.

The Natural Resource Conservation Service technical guide was used to determine potential productivity for range site based on biological site potential and normal moisture year. The following table displays the range in production data for selected North Dakota counties associated with the grassland units from NRCS soil survey data tables.

Table B-16. Range of Production for Select North Dakota Counties.

County	Grassland Unit	Production Range lbs/acre	Mean lbs/acre
Ranson	Sheyenne NG	1000 - 6600	3167
Golden Valley	Little Missouri NG, Medora Dist	700 - 6600	2223
Billings	Little Missouri NG, Medora Dist.	500 - 2600	1506
McKenzie	Little Missouri NG, McKenzie Dist.	500 - 6600	1685
Corson	Grand River NG	1362-2185	1834
Perkins	Grand River NG	1401-2257	1893

The following table summarizes the average existing production to the average potential production based on the mean value from the Natural Resource Conservation Service.

Table B-17. Existing vs. Potential Productivity.

Planning Unit	Existing Average pounds/acre	NRCS Potential Average pounds/acre	Existing Percent of Potential
Grand River National Grasslands	1427	1,893	75%
Cedar River National Grasslands	1427	1,834	78%
Little Missouri National Grassland	908	1,685	57%
Sheyenne National Grassland	2127	3,167	67%

Nebraska National Forest Units and Thunder Basin National Grassland

Existing Production

On the majority of the Nebraska National Forest units, the Natural Resource Conservation Service (NRCS) range analysis methodology was used to determine current range condition from which existing herbage productivity was derived from the average NRCS productivity values. Plot data was collected from 1987 to present using this methodology on the Buffalo Gap, Ft. Pierre and Oglala National Grasslands and on the Pine Ridge portion of the Nebraska National Forest. The range site plot data was put into a geographical information system for analysis. On the Thunder Basin National Grassland, the Bessey Division of the Nebraska National Forest, and the Samuel R. McKelvie National forest, an ecological inventory was used to determine current range condition (seral stage). However, existing productivity was derived using a similar methodology as to the other Nebraska National Forest units.

Potential Production

The Natural Resource Conservation Service technical guide was used to determine potential productivity for range site based on biological site potential and normal moisture year.

The following table shows the average existing productivity as compared to the average potential productivity.

Table B-18. Existing vs. Potential Productivity.

Planning Unit	Existing Average pounds/acre	Potential Average pounds/acre	Existing Percent of Potential
Thunder Basin National Grassland	564	1,007	56%
Bessey unit, Nebraska National Forest	1,480	2,540	58%
Samuel R. McKelvie National Forest	1,430	2,610	55%
Buffalo Gap National Grassland / Fall River	960	1,480	65%
Buffalo Gap National Grassland / Wall	920	1,410	65%
Fort Pierre National Grassland	1,450	2,050	70%
Pine Ridge unit, Nebraska National Forest	920	1,460	63%
Oglala National Grassland	1,080	1,550	70%

Process to Determine Forage Outputs

Decisions made in the revised management plans will not determine the number of livestock (animal unit months) allowed to graze on the national grassland and forest units. Instead, the revised management plan will describe desired conditions for vegetation that fit within the context of rangeland health and multiple uses. The desired conditions are defined by the species of grass (composition) and height and density of the grass (structure). Forage outputs were determined only to compare the effects and desired condition for each of the alternatives. The analysis process that was utilized to determine estimated available forage and corresponding animal unit months (AUMs) are based on a fixed set of planning assumptions only to show differences among the management alternatives.

Rangeland managers must ensure that the resources under their care are used in a sustainable manner. Standard estimates of utilization or the quantity of biomass removed by grazing have been calculated by previous research. These estimates have been categorized into three basic livestock forage use levels: light, moderate, and high. This information is crucial to ensuring that grazing does not result in damage to plants or the soil. Utilization estimates help determine the carrying capacity of a site in terms of use over space and time (Orr 1998).

There is a relationship between structure and the allocation of forage to livestock based on continuous season-long grazing. A guide to determine the appropriate allocation of forage use was developed that incorporated the desired structure levels. This forage use, however, does not consider forage losses from trampling, waste, and other herbivory uses. The following table displays the appropriate allocation of forage for livestock under a continuous season-long grazing system and to maintain the desired structure levels:

Table B-19. Forage Allocation Under Continuous, Season-long Grazing.

	High Structure Class	Moderate Structure Class	Low Structure Class
Livestock Forage Use	8 - 10% (light use)	25 - 35% (mod. use)	35 - 40% (heavy use)
Total Utilization level	30 - 35%	35 - 55%	55 - 65%

(Orr 1998; Nebraska Cooperative Extension 1986; Holecheck, Pieper, Herbel 1989)

Calculations to Determine Total Available Forage

Calculations were made on suitable rangeland using existing herbage production by range site or habitat type on the Thunder Basin National Grassland and on the Nebraska National Forest and associated units and at the vegetative zone level on the Dakota Prairie National Grasslands.

On the Dakota Prairie National Grasslands, total available forage was calculated using the following process:

Step 1

Management Area Acres from Plan	X	Structure Class Percent from Desired Upland Herbaceous Matrix Determination	=	Acres by Structure Class

Step 2

Acres by Structure Class	X	Herbage Production of Site	=	Total Herbage Production by Structure Class

Step 3

Total Herbage Production by Structure Class	X	Allocated Use by Structure Class from Forage Use Guidelines	=	Forage Available by Structure Class

Step 4

Available Forage Production by Structure Class for all Structure Classes Added Together	=	Total Available Forage

Total available forage was calculated using a GIS analysis on the Thunder Basin National Grassland and Nebraska National Forest and associated units. Spatial and tabular data used for modeling included range capability, existing herbage production, management area allocations, structure classes, utilization levels per structure class and percentage rested acres. [21] A simplistic explanation of the analysis steps is as follows:

[21] See Administrative Record "Availabe Forage AMLs and matrix.aws for Thunder Basin , Bessey Unit, Samuel R. McKelvie, Pine Ridge Unit / Oglala NG, Fall River RD, Wall RD and Ft. Pierre RD "

Explanation of analysis steps, cont.

- Determined the allowable forage factor to use for each desired mix of vegetation type matrix (See Table B-13/B-1 4) by alternative. This calculation is based on the midpoint percentage of each structure lass, the range of forage allocated per structure class (see Table B-19) and the percentage of rested acres.
- Assigned the matrix class to each management area by alternative.
- Assigned the allowable forage factor to each matrix class.
- Subtracted all nonsuitable rangeland areas.
- Determined total amount of forage allocated to livestock. (Allowable forage factor x existing herbage production on suitable acres = allocated forage).

Calculation of Forage Use

To calculate the number of AUMs of grazing, the total available forage should be divided by the forage requirements of the animal unit. Forage requirement is the forage needed to sustain an animal (e.g., cow, horse) or pairs of animals (e.g., cow and calf) for one month, based on the size, type, and class of the animal.

These calculations are based on a continuous season-long grazing system and assume an animal unit forage intake requirement of 780 lbs per month (intake requirements for a 1,000-lb. cow with calf up to 6 months of age). Factors, such as management systems, timing of use, and livestock size were not taken into consideration in order to provide a consistent comparison of effects for each alternative. The information used is an expression of the information currently known at a landscape level but does not reflect the site-specific conditions of all areas. This information was developed as an aggregation of existing data from the planning area. Site-specific variation in available forage and AUMs may occur as a result of adaptive resource management, vegetation condition differences, or acres of prairie dog colonies desired.

The following tables show estimated forage outputs on capable and suitable lands based on alternative resource emphasis. Although Alternative 1 is described as representing current management direction, it should be noted that the estimated allowable AUMs may not match what is currently permitted or authorized. This is due to the fact that current management has implemented a variety of grazing systems, timing of use, and special conditions. As already stated, the values shown are based on a continuous season-long grazing system, the least intensive management of any that might be used. Also, the current actual use could be 20% less than the authorized use level because actual use can vary considerable on a yearly basis. The column entitled “Existing Condition” reflects average use for the 20-year period on the Dakota Prairie National Grasslands and a 5-year period on the Nebraska National Forest and Thunder Basin National Grassland ending in 1999.

Table B-20. Summary Table for the Dakota Prairie Grasslands

Planning Unit	Capable Acres	Existing Condition	Alt. 1	Alt. 2	DEIS Alt. 3	FEIS Alt. 3	Alt. 4	Alt. 5
Grand River National Grassland	152,600							
Suitable Acres		152,600	152,600	152,390	153,380	152,360	152,390	152,350
Estimated Total Available Forage (M pounds)		46,370	48,996 to 53,351	48,929 to 53,278	42,331 to 51,737	43,375 to 47,506	32,520 to 36,098	38,154 to 42,068
midpoint		46,370	51,174	51,103	47,034	45,440	34,359	40,111
Estimated AUMs		57,501	62,815 to 68,399	62,729 to 68,305	54,270 to 66,330	54,270 to 66,330	41,819 to 46,280	48,916 to 53,933
midpoint		57,501	65,607	65,517	60,300	58,257	44,050	51,424
(Acres / AUM)		2.7	2.4 – 2.2	2.4 – 2.2	2.8 – 2.3	2.8 – 2.5	3.6 – 3.3	3.1 – 2.8
midpoint		2.7	2.3	2.3	2.5	2.6	3.5	3.0
Cedar River National Grassland	6,650							
Suitable Acres		6,650	6,650	6,650	6,580	6,650	6,650	6,650
Estimated Total Available Forage (M pounds)		1,930	2,894 to 3,179	2,894 to 3,179	1,615 to 1,973	2,524 to 2,795	1,840 to 2,069	2,178 to 2,434
midpoint		1,930	3,037	3,037	1,794	2,659	1,955	2,306
Estimated AUMs		3,401	3,111 to 4,076	3,111 to 4,076	2,070 to 2,530	3,326 to 3,583	2,360 to 2,652	2,792 to 3,121
midpoint		3,401	3,893	3,893	2,300	3,410	2,506	2,956
(Acres / AUM)		2.0	1.8 – 1.6	1.8 – 1.6	3.2 - 2.6	2.1 – 1.9	2.8 – 2.5	2.4 – 2.1
midpoint		2.0	1.7	1.7	2.9	2.0	2.7	2.3
Little Missouri National Grassland McKenzie and Medora units	884,730							
Suitable Acres		884,620	884,620	884,460	823,910	884,460	884,530	884,530
Estimated Total Available Forage (M pounds)		246,405	244,987 to 269,084	244,942 to 269,035	201,113 to 245,817	213,622 to 236,510	154,954 to 174,123	184,324 to 206,009
midpoint		246,405	257,035	256,989	223,456	225,066	164,539	195,167
Estimated AUMs		315,900	314,085 to 344,979	314,029 to 344,917	257,850 to 315,150	273,874 to 303,218	198,659 to 223,235	236,312 to 264,114
midpoint		315,900	329,532	329,473	286,500	288,546	210,947	250,213
(Acres / AUM)		2.8	2.8 – 2.6	2.8 – 2.6	3.2 - 2.6	3.2 – 2.9	4.5 – 4.0	3.7 – 3.4
midpoint		2.8	2.7	2.7	2.9	3.2	4.2	3.5
Sheyenne National Grassland	69,500							
Suitable Acres		69,200	69,200	69,500	67,925	69,500	67,840	69,500
Estimated Total Available Forage (M pounds)		44,970	44,892 to 49,308	45,087 to 49,522	19,094 to 23,338	35,460 to 39,322	20,490 to 26,550	33,594 to 37,252
midpoint		44,970	47,100	47,304	21,216	37,391	23,520	35,423

Planning Unit	Capable Acres	Existing Condition	Alt. 1	Alt. 2	DEIS Alt. 3	FEIS Alt. 3	Alt. 4	Alt. 5
Sheyenne National Grassland, cont.								
Estimated AUMs		57,650	57,554 to 63,216	57,804 to 63,490	24,480 to 29,920	45,416 to 49,866	26,269 to 34,039	45,069 to 47,759
midpoint		57,650	60,385	60,647	27,200	47,937	30,154	45,414
(Acres / AUM)		1.2	1.2 – 1.1	1.2 – 1.1	2.8 - 2.3	1.5 – 1.4	2.6 – 2.0	1.6 – 1.5
midpoint		1.2	1.2	1.2	2.5	1.5	2.3	1.5

Table B-21. Summary Table for the Thunder Basin National Grassland

Planning Unit	Capable Acres	Existing Condition	Alt. 1	Alt. 2	DEIS Alt. 3	FEIS Alt. 3	Alt. 4	Alt. 5
Thunder Basin National Grassland	532,100							
Suitable Acres		532,100	532,100	532,100	532,100	532,060	531,060	532,100
Estimated Total Available Forage (M pounds)		87,900	80,005 to 118,943	79,543 to 118,482	84,731 to 103,561	70,146 to 106,112	61,201 to 96,888	73,360 to 110,463
midpoint		87,900	99,474	99,012	94,146	90,038	79,044	91,911
Estimated AUMs		112,700	102,570 to 152,492	101,978 to 151,900	108,630 to 132,770	89,932 to 136,042	78,462 to 124,216	94,052 to 141,620
midpoint		112,700	127,530	126,939	120,700	115,434	101,340	117,836
(Acres / AUM)		4.7	5.2- 3.5	5.2 – 3.4	4.9 – 4.0	5.9 – 3.9	6.6 – 4.3	5.6 – 3.8
midpoint		4.7	4.4	4.3	4.5	4.9	5.5	4.7

Table B-22. Summary Table for the Nebraska National Forest Units.

Planning Unit	Capable Acres	Existing Condition	Alt. 1	Alt. 2	DEIS Alt. 3 *Alt 3a*	FEIS Alt. 3	Alt. 4	Alt. 5
Bessey unit, Nebraska National Forest	89,580							
Suitable Acres		88,500	88,500	88,480	88,770	89,010	88,490	88,480
Estimated Total Available Forage (M pounds)		27,245	16,830 to 28,012	19,683 to 30,883	24,710 to 30,202	17,072 to 27,885	11,883 to 20,936	13,010 to 23,191
midpoint		27,245	22,421	25,283	27,456	22.382	16,409	18,100
Estimated AUMs		34,930	21,577 to 35,913	25,235 to 39,593	31,680 to 38,720	21,887 to 35,749	15,234 to 26,841	16,679 to 29,732
midpoint		34,930	28,745	32,414	35,200	28,696	21,037	23,206
Stocking Level (Acres / AUM)		2.5	4.1 – 2.5	3.5 – 2.2	2.8- 2.3	4.0 – 2.5	5.8 – 3.3	5.3 – 3.0
midpoint		2.5	3.3	2.8	2.5	3.2	4.5	4.1
Samuel R. McKelvie National Forest	114,190							
Suitable Acres		112,270	112,270	112,240	111,680	112,470	112,070	111,670

Planning Unit	Capable Acres	Existing Condition	Alt. 1	Alt. 2	DEIS Alt. 3 *Alt 3a*	FEIS Alt. 3	Alt. 4	Alt. 5
Estimated Total Available Forage (M pounds)		33,560	23,290 to 38,880	27,041 to 42,623	28,782 to 35,178	23,615 to 38,571	16,514 to 29,096	18,014 to 32,112
midpoint		33,560	31,085	34,831	31,980	31,093	22,084	25,063
Estimated AUMs		43,020	29,859 to 49,846	34,668 to 54,644	36,900 to 45,100	30,276 to 49,450	21,172 to 37,302	23,095 to 41,170
midpoint		43,020	39,853	44,656	41,000	39,862	29,237	32,132
(Acres / AUM)		2.6	3.8 – 2.3	3.2 – 2.0	3.0 - 2.5	3.7 – 2.8	5.3 – 3.0	4.8 – 2.7
midpoint		2.6	3.0	2.6	2.8	3.2	4.1	3.7
Buffalo Gap National Grassland/Fall River	306,430							
Suitable Acres		306,430	306,430	306,400	313,420	306,400	306,400	306,400
Estimated Total Available Forage (M pounds)		76,050	51,369 to 78,146	56,194 to 83,195	69,849 to 85,371 *68,726 to 83,998*	51,552 to 77,505 51,863 to 76,816	42,302 to 67,075	46,999 to 71,826
midpoint		76,050	64,757	70,128	77,610 *76,362*	64,528 *64,358*	54,699	59,412
Estimated Allowable AUMs		97,500	65,858 to 100,187	72,044 to 106,661	89,550 to 109,450 *88,110 to 107,690*	66,093 to 99,366 66,490 to 98,482	54,234 to 85,992	60,256 to 92,084
midpoint		97,500	83,021	89,909	99,500 *97,900*	82,729 *82,510*	70,127	76,170
(Acres / AUM)		3.1	4.6 – 3.0	4.3 – 2.9	3.5 - 2.9 *3.6 - 2.9*	4.6 – 3.0 4.6 – 3.1	5.6 – 3.6	5.0 – 3.3
midpoint		3.1	3.8	3.6	3.2	3.8	4.6	4.1
Buffalo Gap National Grassland/Wall	238,650							
Suitable Acres		237,450	237,450	238,650	239,235	238,650	238,650	238,650
Estimated Total Available Forage (M pounds)		62,230	40,083 to 61,148	42,289 to 64,496	50,474 to 61,690	40,127 to 60,699	33,074 to 54,551	35,871 to 56,713
midpoint		62,230	50,615	53,392	56,082	50,413	43,812	32,106
Estimated Allowable AUMs		79,780	51,388 to 78,395	54,217 to 82,687	64,710 to 79,090	51,447 to 73,303	42,404 to 69,936	45,990 to 72,708
midpoint		79,780	64,891	68,450	71,900	64,632	56,169	59,349
(Acres / AUM)		2.9	4.6 – 3.0	4.4 – 2.9	3.7 - 3.0	4.1 – 3.2	5.6 – 3.4	5.0 – 3.3
midpoint		2.9	3.8	3.6	3.3	3.6	4.5	4.1
Ft. Pierre National Grassland	113,360							
Suitable Acres		112,550	112,550	112,550	113,390	112,550	112,550	112,550
Estimated Total Available Forage (M pounds)		52,460	30,448 to 46,567	37,616 to 55,528	32,152 to 39,296	27,957 to 43,289	25,077 to 39,407	25,077 to 39,407
midpoint		52,460	38,507	46,571	35,724	38,511	32,242	32,242

Planning Unit	Capable Acres	Existing Condition	Alt. 1	Alt. 2	DEIS Alt. 3 *Alt 3a*	FEIS Alt. 3	Alt. 4	Alt. 5
Estimated AUMs		67,255	39,036 to 59,701	48,225 to 71,190	41,220 to 50,380	35,842 to 55,499	32,150 to 50,522	32,150 to 50,522
midpoint		67,255	49,368	59,708	45,800	49,375	41,337	41,337
(Acres / AUM)		1.7	2.9 – 1.9	2.3 – 1.6	2.8 - 2.3	3.1 – 2.0	3.5 – 2.2	3.5 – 2.2
midpoint		1.7	2.4	1.9	2.5	2.5	2.8	2.8
Pine Ridge unit, Nebraska National Forest	31,560							
Suitable Acres		31,200	31,200	31,490	48,545	31,490	31,520	30,350
Estimated Total Available Forage (M pounds)		10,690	5,411 to 8,304	5,699 to 8,620	8,775 to 10,725	5,554 to 8,331	4,993 to 7,624	4,723 to 7,277
midpoint		10,690	6,857	7,159	9,750	6,942	6,308	5,999
Estimated AUMs		13,700	6,937 to 10,646	7,307 to 11, 050	11,250 to 13,750	7,120 to 10,680	6,402 to 9,774	6,055 to 9,329
midpoint		13,700	8,792	9,178	12,500	8,901	8,087	7,691
(Acres / AUM)		2.3	4.5 – 2.9	4.3 – 3.5	4.3 - 3.5	4.4 – 2.9	4.9 – 3.2	5.0 – 3.2
midpoint		2.3	3.7	3.9	3.9	3.6	4.0	4.1
Oglala National Grassland	79,390							
Suitable Acres		79,370	79,370	79,370	88,200	79,340	79,370	79,370
Estimated Total Available Forage (M pounds)		21,600	16,425 to 25,071	18,146 to 26,791	19,586 to 23,938	16,852 to 25,062	13,019 to 20,800	14,489 to 22,269
midpoint		21,600	20,748	22,469	21,762	20,957	16,909	18,378
Estimated AUMs		27,700	21,059 t0 32,142	23,265 to 34,348	25,110 to 30,690	21,606 to 32,132	16,691 to 26,665	18,575 to 28,500
midpoint		27,700	26,601	28,806	27,900	26,869	21,679	23,563
(Acres / AUM)		2.9	3.8 – 2.5	3.4 – 2.3	3.5 - 2.9	3.7 – 2.5	3.7 – 2.9	4.3 – 2.8
		2.9	3.1	2.8	3.2	3.1	3.3	3.5

References consulted or cited for this analysis are listed at the end of the appendix.

Benchmark Analysis

The maximum livestock production capability is based on the assumptions in the section above "Calculation of Forage Use", all capable rangeland being suitable and all rangelands being in good condition. An assumption of all rangeland being in excellent condition was considered, but rangeland managers indicated an excellent range condition cannot be sustained with continual grazing use.

Alternative 2, depicted in the Summary Tables for the Dakota Prairie Grassland, the Thunder Basin National Grasslands, and the Nebraska National Forest Units, represents the maximum livestock forage benchmark. As a comparison, the following table depicts the midpoint of NRCS recommended initial livestock forage stock guidelines.

Table B-23. NRCS Initial Stocking Levels

Maximum Livestock Production Using or Approximating Standard NRCS Initial Stock Guidelines Forage Allocation = 50% for plant vigor, 25% for Wildlife and Trampling, 25% For Livestock 780 pounds of forage per AUM		
Unit	**Annual M Pounds of Forage Allocated to Livestock**	**Annual AUMs**
Grand River National Grassland	54,440	69,795
Cedar River National Grassland	3,321	4,258
Little Missouri National Grassland, McKenzie District	140,694	180,380
Little Missouri National Grassland, Medora District	140,436	180,046
Sheyenne National Grassland	51,516	66,046
Thunder Basin National Grassland	75,026	96,187
Nebraska National Forest, Bessey Unit	32,745	41,981
Samuel R. McKelvie National Forest	40,137	51,458
Buffalo Gap National Grassland, Fall River District	73,543	94,286
Buffalo Gap National Grassland, Wall District	54,614	70,017
Fort Pierre National Grassland	40,799	52,307
Nebraska National Forest, Pine Ridge Unit	7,176	9,200
Oglala National Grassland	21,430	27,374

This table depicts what initial stocking levels would be using NRCS guidelines. These values compare with the midpoint of the range of values presented in Table B-20 through Table B-22 above. There are significant differences between the Summary tables and the NRCS table. The reason for this is NRCS allocates a 25% use value for livestock whereas the predictive model varies use levels to meet vegetative desired conditions.

H. Recreation Management and Use

Demand Assessment

Information for the demand assessment through the Selected Activity Trends subsection was taken from the Northern Great Plains Plan Revision Recreation Assessment, dated September 3, 1997 (3-4, 9-12). Please refer to this document (on file in Chadron, Nebraska) for more detailed demand information. Many of the management area designations in the next plans will meet recreational demand. Such designations as Special Interest Areas, backcountry nonmotorized recreation, dispersed recreation areas, developed sites, and scenic corridors can fill the varying recreation demands of people.

Perceptions of benefits are based upon personal and societal values, and evidence exists that public values may be shifting. Newspaper coverage of national forests and grasslands has indicated more interest in ecological, aesthetic, and moral/spiritual values relative to economic values. One study revealed that recreation benefits and values were discussed more frequently than any other categories of benefits and values in an analysis of more than 30,000 on-line media news stories between 1992 and 1996. There is also evidence that, while the recreation-customer metaphor does encourage managers to identify recreationists' preferences and to

provide activities and facilities to meet those preferences, some shortcomings remain. For instance, some members of the public see themselves not as "customers," but as "owners" of the public lands, because tax dollars collected from all citizens support public lands.

More importantly, the customer metaphor may imply that recreation settings are viewed similarly to mass-produced consumer products. It ignores the fact that many people form strong personal attachments to specific places that hold unique values to them. Values associated with the experience of being in an environment rather than the value of products or services taken from an environment are known as "experiential values" and contain elements of three broad categories:

- **Emotional Values** - place-based experiences that elicit strong feelings such as a traditional family camping spot or hunting area.
- **Symbolic Values** - places that carry meanings beyond their immediate physical presence such as locations of important events such as General George Custer's travel route across the Little Missouri National Grassland or the Warbonnet Memorial on the Oglala National Grassland.
- **Spiritual Values** - people's experiences that link them to deeper meanings and connections with a greater reality can be, but may not be, associated with a specific place.

The "typical" public lands recreator may be a white male, 25-40 years old, living in a city of 50,000 or less, who has children in a multiple-career home, and is likely to load the family into a sport utility vehicle and travel less than a hundred miles to a wildland setting to recreate for an average 3-4 hours.

The results of several survey instruments that have attempted to capture the essence of outdoor recreation participants are now available. Some surveys such as the National Survey on Recreation and the Environment (NSRE) and the US Fish and Wildlife Service (USFWS) sponsored National Survey of Fishing, Hunting and Wildlife Associated Recreation (FHWAR) have been conducted on a somewhat regular basis for up to 40 years. They offer some of the most comprehensive information about national outdoor recreation participation and trends.

For more site-specific recreation information, the Custer National Forest, in 1992, contracted with a private firm to conduct a random telephone survey to determine perceptions and desires relative to forest and grassland management. The Nebraska National Forest during the summer and fall of 1994 contracted with the Southeastern Forest Experiment Station to conduct on-site surveys of recreationists at sites on each of the Forest's administrative units. In 1995-96, Thunder Basin National Grassland and the Custer National Forest grasslands conducted brief customer satisfaction surveys. In addition, the recreation use figures for each management unit within the planning area are available for 1992-96, and most of the units also collected written recreation information request data for several months in 1995-96. Wyoming updated the State Comprehensive Outdoor Recreation Plan in 1995 in part by conducting county-by-county random telephone surveys and by surveying county recreation directors or county elected officials.

Trends and Projections

Public lands management and planning depends upon accurate information from a variety of sources. "Snap-shot" information isn't as useful as trend information that charts changes over

time and is comparable in methodology, context, and content. To look at trends in recreation, the 1996 survey of Fishing, Hunting, and Wildlife-Associated Recreation sponsored by the USFWS, and the 1994-95 National Survey of Recreation and Environment (NSRE) offer the two best sources of national trend information. As the names imply, one is more narrowly focused on wildlife-related recreation, while the other includes a wider array of primarily outdoor recreation activities.

Rather than attempt to recreate or repeat the findings in these and other references, the following are highlights that apply to the issues, activities, and resources most closely associated with the Northern Great Plains units.

General Trends

Though opinions are divided, most seem to agree that available leisure time is shrinking. The number one reason for not participating in leisure activities is reported as "lack of time." In order to compensate, people are becoming more discriminating about leisure time choices and are seeking ways to easily and precisely locate information leading them to the benefits and leisure time activities they seek. Adventure travel businesses including outfitters and guiding businesses rely increasingly upon electronic marketing and business transactions. Many national forests and grasslands have developed Internet homepages that are available on the national website, but many have not.

The two most significant broad-scale changes that will likely influence how people recreate over the next 50 years relate to anticipated increases both in the population and real income. U.S. Census projections are for population increases ranging from 30 percent in the North to 60 percent in the Pacific region coupled with an 88 percent increase in average real income.

Demographic changes are expected to play an important role in outdoor recreation trends in the coming years. The number of people over 16 has grown by 65 percent since 1960, the percentage of Caucasians, who currently make up over 80 percent of outdoor recreationists, is falling, and the country is becoming more urban. Since recreation participation differs among demographic groups, there will likely be shifts that reflect the country's changing make-up. With increasing age, activities generally switch from active to passive activities. Racial distinctions are also reflected in outdoor recreation preferences, and people with rural backgrounds tend to prefer dispersed recreation activities.

Most activities for which survey information has been collected are projected to continue long-term moderate growth, while more rapid growth is expected for new, risky, technology-driven activities such as mountain biking and jet skiing. Interestingly, the current fastest growing activities include bird watching, hiking, backpacking, primitive area camping, and off-highway driving.

Fishing participation is expected to increase nationally by 36 percent over the next 55 years, with the Rocky Mountain / Great Plains Region seeing as much as a 55 percent increase. Fishing currently accounts for twice as many "primary purpose trips" as nonconsumptive wildlife activities and nearly three times as many as all forms of hunting combined. Nationally, hunting is projected to continue to decline over time. However, the 12 Rocky Mountain / Great Plains states from Nevada east to Kansas are projected to see a 20 percent increase in hunting participation.

Participation in nonconsumptive wildlife activities is expected to increase 64% over the next 55 years, while days spent participating are projected to double. The most prominent factor contributing to this increase appears to be the increasing age of the population.

The following tables illustrate the changes in wildlife-related recreation participation in Northern Great Plain states from 1980-1990 (1980-1990 FHWAR Trends, Rpt 91-2).

Table B-24. Recreation Related to Fish and Wildlife by State (1980-1985)

State	Hunting 1980-1990	Fishing 1980-1990	Non-consumptive, non-residential wildlife 1980-1990
North Dakota	+10%	+5%	+53%
Nebraska	-13%	+30%	+127%
South Dakota	-10%	+17%	+71%
Wyoming	-16%	+1%	+29%

However, the same information for the 1985-1990 period gives a somewhat different impression in some cases.

Table B-25. Recreation Related to Fish and Wildlife by State (1985-1990)

State	Hunting 1985-1990	Fishing 1985-1990	Non-consumptive, non-residential wildlife 1985-1990
North Dakota	-6%	-8%	-12%
Nebraska	-1%	+10%	+20%
South Dakota	-1%	+9%	-26%
Wyoming	-16%	-6%	-27%

Two noticeable changes in the 1985-1990 time-frame were the resurgence of hunting in Nebraska and South Dakota accompanied by a precipitous decline in non-residential (over a 15-minute drive from home), non-consumptive wildlife activities. Hunting is gradually, but steadily, declining as a part of the outdoor recreation menu overall, and several reasons have been suggested.

Hunting is a space-intensive activity requiring large area settings compared to most other activities, and changing attitudes of private landowners has resulted in fewer private lands open to hunting. Many comments received during initial scoping for the plan revision alluded to the increase in fee hunting that reduces the private land available. Another possibility is that, with the continued shift to an urban life-style, fewer young people are exposed to hunting during the time when they are making recreation life-style choices. Finally, hunting participation is higher among Caucasians and American Indians than other groups (Asians, Hispanics, and African-Americans), and Caucasians are becoming a smaller percentage of the population.

The following table indicates the changes in both the numbers of hunters using public lands in the Northern Great Plains states and the percentage of time spent hunting on public lands. Since the 1991 FHWAR failed to distinguish between federal and state public lands as the 1985 version did, all public lands were used for this comparison. It may be important to note that while the figures indicate a general decline both in the number and percent of hunters using public lands (except Wyoming), they may not accurately reflect the use on a specific Northern Great Plains unit. Anecdotal evidence indicates that, for some units, hunting pressure has intensified significantly during this time period. In addition, as private lands become less available to public hunting and as more private landowners convert to fee hunting only, increased use of public lands for hunting can be expected in the future.

Table B-26. Hunters' Use of Public Lands

State	1985 Hunters Using Public Lands	% of Total Hunters Using Public Lands	1991 Hunters Using Public Lands	% of Total Hunters Using Public Lands
North Dakota	56,900	55%	46,900	48%
Nebraska	61,500	32%	44,300	48%
South Dakota	99,900	60%	73,000	50%
Wyoming	121,000	68%	99,700	74%

Only Wyoming saw an increase in the percentage of hunting days on public lands, while all experienced declines in the numbers of hunters using public lands.

Selected Activity Trends

The 1994-95 NSRE noted a 155 percent increase in birdwatching since the 1982-83 survey, the largest increase of any activity, representing 32 million additional participants. Figures indicate that nationally approximately 123,500 dedicated birders spend an average of $2000 a year, half on travel. "Avitourism" is beginning to be appreciated as a source of found money in some areas that have, or have promoted, birding attractions. In Grand Island, Nebraska, crane watching draws 80,000 birders who spend $15 million annually.

Following birdwatching were hiking, backpacking, primitive area camping, and off-highway driving as measured by the percentage growth rate.

Backpacking participation is expected to increase by about 23 percent over the next 50 years while hiking, which currently accounts for nearly 50 million participants and over 800 million days annually, is expected to also grow by between 30 and 80 percent.

Horseback riding accounts for about the same number of participants as backpacking, 15 million, but falls behind only hiking and off-highway driving in the number of primary purpose trips and days spent participating. It is expected to increase primarily based upon projected growth in real income. However, at least in Nebraska, it has received a legislative boost. The 1997 state legislature passed a law designed to limit liability and offer some measure of protection for those engaged in horse-related businesses.

Off-highway driving is expected to grow by 37 percent in the Rocky Mountain / Great Plains region, over twice the national average.

Primitive camping, which in most cases seems to decrease as income increases and draws its following from rural white males, is projected to decline by about 6 percent nationally, while growing by about 20 percent in the Rocky Mountain / Great Plains region.

Days spent biking are expected to increase by 50 percent in the region over the next 50 years compared to developed camping, which will likely double. A recent study by the University of Wisconsin Center for Community Economic Development of 280 mountain bikers revealed that 94 percent felt that "natural surroundings were very or extremely important." The overwhelming majority agreed upon the importance of quiet settings, limiting motorized vehicles, a variety in trail types, and single-track trails. Over 90 percent had household incomes over $30,000 and 31 percent had advanced degrees.

Trends on Specific Units

Note: The numbers in parenthesis at the end of each paragraph refer to page numbers in the Montoring and Evaluation Reports.

Dakota Prairie Grasslands

The *Fiscal Year 1995 Monitoring and Evaluation Report* for the grassland units of the Custer National Forest stated developed recreation use has decreased on the Little Missouri National Grassland due to budget constraints. Several loops in the Buffalo Gap Campground have been closed because of lack of sufficient funding to complete needed repairs. The grassland has seen an increase in horseback and mountain bike use (12).

The Sheyenne National Grassland has experienced a steady rise in use of the North Country Trail, resulting in increased conflicts between horseback riders and hikers (5).

The report contained no recreation trend information for the Grand River and Cedar River National Grasslands.

Medicine Bow-Routt National Forest (TBNG)

The *Thunder Basin National Grassland Fiscal Year 1995 Monitoring Evaluation Report and Ten-year Review* does not indicate there is any recreation demand exceeding available supply, although plans have been developed for at least one small, minimal-service campground. The grassland is experiencing localized damage from off highway vehicles (4, 6)

Nebraska National Forest Units

According to the *Fiscal Year 1995 Monitoring and Evaluation Report*, developed recreation use has exceeded the anticipated management plan accomplishment. Dispersed recreation use as well as off highway vehicle use is less than anticipated accomplishment, although dispersed recreation use has been increasing (11).

Table B-27. Recreation and Management Plan Accomplishment Percentages

Activity Monitored	% Anticipated Management Plan Accomplishment 1992-95
Developed Recreation Use RVDs	155
Dispersed Recreation Use RVDs	86
Off-Highway Vehicle use RVDs	12

There are appears to be a need for additional developed facilities, particularly on the Wall District of the Buffalo Gap National Grassland, which offers no developed recreation facilities, and the Bessey Ranger District, where demand exceeds available facilities (13).

Public Comments

The Public Scoping Comments Summary provides further information on recreation and travel management demand. Some commentors have requested more recreation facilities such as campground, picnic sites, trails, interpretive stations, whereas others discouraged additional facilities (5). Results of the full CUSTOMER survey on the Nebraska National Forest indicate that visitors found the recreation sites and their recreation experience met or exceeded their expectations (v).

Public scoping comments related to hunting included concern over wildlife habitat requirements; access for hunters; concern that number of hunters is reducing the hunting experience; and request for walk-in hunting areas (6). In addition, results from "Customer Report Card" surveys conducted in the autumns of 1994-6 show that hunters across all units rated feeling uncrowded as one of the most important attributes of their outdoor experience. In all cases the number of hunters completely satisfied with having an uncrowded recreation experience was lower than the number who considered it important. This was especially true on the Grand River Ranger District, Sheyenne National Grassland, Pine Ridge Ranger District, and Fall River Ranger District.

Comments received during the scoping period regarding travel management had two themes. Many people stated that the negative effects of uncontrolled off-road travel out weight the rights of people to pursue those activities. Many of the same people promoted more control and enforcement of restrictions. The other theme emphasized that national forests and grasslands are among the few, if not only places for OHV enthusiasts to ride. Some commentors, supporting this theme, suggested segregating OHV activities to specific trails and areas to reduce conflicts with other recreation users (5).

Developed Recreation

To determine the people at one time (PAOT) capacity for developed recreation sites the following assumptions were made:

- Campgrounds and picnic grounds - each individual site has a capacity of 5 PAOTs.
- Boat / canoe launch - 10 PAOTS each at the put in and take out site.
- Hardened dispersed recreation sites - 25 PAOTs.

In Alternatives DEIS 3 and 5, with objectives to construct new recreation facilities, it was assumed that each new campground would have 15 campsites and new picnic grounds would have 10 picnic sites. All alternatives for the Nebraska National Forest assumed the Prehistoric Prairies Discovery Center would be built and would have a 350 PAOT capacity.

Trails

For the Dakota Prairie and Nebraska units any trails now under construction were assumed to be completed for all alternatives.

Dispersed Recreation

The following processes were used to determine the changes in dispersed recreation opportunities. The change in opportunity for quality deer habitat was taken directly from the percent riparian / woody draw regeneration occurring by alternative. Alternative 1 is the base level. Each plus sign equals a 50% increase over base. Therefore, if the increase was close to double of the base percentage, two "+" signs were applied. To determine change in upland bird habitat the percentage of the unit in a high vegetative structure was used. Again Alternative 1 served as the base and the amount of change was based on how much different the structure varied by alternative from the base. Two "+" signs indicate a close to double percentage increase from the base. This information is displayed in the Comparison Tables in FEIS Chapter 2.

Recreation Opportunity Spectrum

The Recreation Opportunity Spectrum (ROS) inventory was conducted according to the direction in the 1996 ROS book (IV-4 -IV-14). The mapped ROS classifications were then entered into GIS. Appropriate ROS classes were selected for each management area based on the intent of the management area prescription. Table B-29 displays the ROS classes assigned to each management area. The ROS classification acronyms are defined as follows:

- SPNM - semi-primitive nonmotorized.
- SPM - semi-primitive motorized.
- RNNM - roaded natural nonmotorized.
- RN - roaded natural.
- RM - roaded modified.
- R – rural.
- U – urban.

Table B-28. Management Areas - Recreation Opportunity Spectrum (ROS)*

Management Area	ROS Classification
1.1 Wilderness: Soldier Creek	SPNM
1.2 Recommended for Wilderness	SPNM
1.2 A Suitable for Wilderness	SPNM
1.31 Backcountry Recreation Nonmotorized	SPNM
1.31A Pine Ridge National Recreation Area	SPNM
1.5 National River System: Wild Rivers Designated and Eligible	RNNM
2.1 Special Interest Areas: Red Shirt Black Cottonwood Rest	 SPNM RNNM Same as existing ROS
2. 2 Research Natural Areas	SPNM for areas over 2,500 acres RNNM for the rest
2.4 American Indian Traditional Use Areas	SPM and RN

Management Area	ROS Classification
3.4 National River System: Scenic Rivers Designated and Eligible	SPM, RN and R
3.51 Bighorn Sheep	SPM, RN, RM and R
3.51A Bighorn Sheep with Nearby Non-federal Mineral Ownership	SPM, RN, RM and R
3.63 Black-footed Ferret Reintroduction Habitat	SPM and RN
3.64 Special Plant and Wildlife Habitat	SPM, RN, and R
3.65 Rangelands with Diverse Natural –Appearing Landscapes	SPM, RN, RM, and R
3.66 Ecosystem Restoration (Tallgrass Prairie)	SPM, RN, and R
3.68 Big Game Range	SPNM (seasonal), SPM, and RN
4.22 Scenic Areas, Vistas or Travel Corridors:	SPM and RN
4.32 Dispersed Recreation: High Use	RN
4.33 Dispersed Recreation	SPM, RN, and RM
4.4 National River System: Recreation Rivers Designated and Eligible	RN and R
5.12 General Forest and Rangelands: Range Vegetation Emphasis	SPM and RN
5.13 Forest Products	SPM and RN
5.31A Experimental Forests (Denbigh)	RN
5.31B Experimental Forests (Souris Purchase Unit)	RN
6.1 Rangeland Resource Production	SPM, RN, RM, and R
6.2 Rangeland with Broad Resource Emphasis	SPM, RN, RM, and R
7.1 Residential/Forest Intermix	RN and R
8.3 Designated Utility Corridors: Existing and Potential	SPM, RN, RM, and R
8.4 Mineral Production and Development	U
8.5 Nursery	R
8.6 Administrative Sites	R, U

*Any Management Area with more than one ROS classification listed used the existing ROS classifications for the adopted classifications.

Scenic Integrity Levels

All the planning units have been inventoried under the new Scenery Management System, following the process outlined in *Landscape Aesthetics A Handbook for Scenery Management*. The mapped landscape values were then entered into GIS. Appropriate scenic integrity levels (SIL) were selected for each management area based on the intent of the management area prescription. The table below displays the SIL classes assigned to each management area.

Table B-29. Management Areas - Scenic Integrity Level.

Management Area	Scenic Integrity Level
1.1 Wilderness: Soldier Creek	Very High
1.2 Recommended for Wilderness	High
1.2 A Suitable for Wilderness	High
1.31 Backcountry Recreation Nonmotorized	High
1.31A Pine Ridge National Recreation Area	High

Management Area	Scenic Integrity Level
1.5 National River System: Wild Rivers Designated and Eligible	High
2.1 Special Interest Areas	High
2. 2 Research Natural Areas	High
2.4 American Indian Traditional Use Areas	High
3.4 National River System: Scenic Rivers Designated and Eligible	Moderate
3.51 Bighorn Sheep	Moderate in FG and MG, Low in BG of scenic classes 1-2; Low in all areas scenic classes 3-7
3.51A Bighorn Sheep with Nearby Non-federal Mineral Ownership	Moderate in FG and MG, Low in BG of scenic classes 1-2; Low in all areas scenic classes 3-7
3.63 Black-footed Ferret Reintroduction Habitat	Low
3.64 Special Plant and Wildlife Habitat	Moderate
3.65 Rangelands with Diverse Natural -Appearing Landscapes	Moderate in FG and MG, Low in BG of scenic classes 1-2; Low in all areas scenic classes 3-7
3.66 Ecosystem Restoration (Tallgrass Prairie)	Moderate in FG and MG, Low in BG of scenic classes 1-2; Low in all areas scenic classes 3-7
3.68 Big Game Range	Moderate in FG and MG, Low in BG of scenic classes 1-2; Low in all areas scenic classes 3-7
4.22 Scenic Areas, Vistas or Travel Corridors:	Moderate
4.32 Dispersed Recreation: High Use	Moderate
4.33 Dispersed Recreation	Moderate in FG and MG, Low in BG of scenic classes 1-2; Low in all areas scenic classes 3-7
4.4 National River System: Recreation Rivers Designated and Eligible	Moderate
5.12 General Forest and Rangelands: Range Vegetation Emphasis	Moderate in FG and MG, Low in BG of scenic classes 1-2; Low in all areas scenic classes 3-7
5.13 Forest Products	Moderate in FG and MG, Low in BG of scenic classes 1-2; Low in all areas scenic classes 3-7
5.31A Experimental Forests (Denbigh)	Moderate
5.31B Experimental Forests (Souris Purchase Unit)	Moderate
6.1 Rangeland Resource Production	Low
6.2 Rangeland with Broad Resource Emphasis	Low
7.1 Residential/Forest Intermix	Moderate
8.3 Designated Utility Corridors: Existing and Potential	Low
8.4 Mineral Production and Development	Low
8.5 Nursery	Low
8.6 Administrative Sites	Low

FG - foreground; MG - middleground; and BG - background.

Travel Management

To determine travel effects by alternative, the management area designation with the corresponding standards and guidelines was used, as well as district travel management plans to determine acres with restrictions. The calculation used for designated route areas is: Designated route areas = total unit acres - (nonmotorized areas - seasonal restriction areas).

The existing miles of road per square mile on each unit was calculated by dividing the acres of the unit by 640 acres to get square miles on the unit. The number of miles of road on each unit was then divided by the number of sq. miles on the unit to determine number of miles of existing road per square mile (mi/sq mi).

K. Special Area Designations

Research Natural Areas

See Appendix E.

Roadless Areas

See Appendix C.

Special Interest Areas

See Appendix F.

Wild and Scenic Rivers

See Appendix G.

J. Timber Management

Tentatively Suited Timber Lands

Tentatively suited timber lands are displayed in Chapter 3 of the DEIS in table TR-1 and the narrative which follows the table.

Tentatively suited timber lands on the Pine Ridge Unit of the Nebraska National Forest were determined in part by soil timber productivity as classified by the NRCS[22],[23].

[22] Soil Survey of Dawes County, Nebraska; USDA Soil Conservation Service, February 1977 pp 79-81 and Consultation with USDA NRCS.

[23] See Administrative Record "Tentatively Suited Timberland AML.

Lands Appropriate for Timber Production

The Little Missouri National Grassland and the Sheyenne National Grassland contain 940 acres and 5,110 acres of tentatively suited timber lands, respectively, that were not considered appropriate for timber production. These lands were considered inappropriate because minimum management requirements, as stated in Forest Service Handbook 2409.13-23, cannot be met[24].

The approximately 26,000 acres of forested type on the Samuel R. McKelvie National Forest and Bessey unit were not considered tentatively suitable based on irreversibility due to soils, questions on restocking within five years, and the inadequate response information available.

Timber discussions from this point on will be limited to the Pine Ridge Unit of the Nebraska National Forest because it is the only planning unit has lands that can be allocated as suited timber lands.

Timber Suitability Analysis

The first step in determining timber suitability was to identify forest lands available for timber harvest. District input and GIS was utilized to determine and identify National Forest System lands that were forested and nonforested.

The Pine Ridge Ranger District evaluated tentatively suitable forestland by utilizing polygons based on soils capable of producing timber as determined by the Natural Resources Conservation Service (NRCS). Based on this, the evaluation shows more lands capable of producing timber than are actually forested. This is due to fire events that have occurred on this unit and the loss of forest cover. It is expected that these areas will become forested and capable of producing timber and, therefore, should be considered in the evaluation.

The next step was to determine unsuitable timberland based on the following criteria:

- Areas not within a Management Area 5.13.
- Areas that cannot be reforested within 5 years of final harvest (on south or west slopes or slopes greater than 40%).
- Areas that are not forested due to fire and other reasons (reforestation costs are significantly higher than the future value of the timber).

The Pine Ridge Ranger District was the only unit that contained the management area prescription 5.13. Therefore, it was the only unit that could contain suitable timber and further analysis on the other units is not necessary. Also, the Pine Ridge Ranger District only used the management area prescription 5.13 in Alternative 2. Based on the GIS layers for the above listed criteria, following is a table indicating suitable timber for the Pine Ridge Ranger District:

[24] See Forest Service Handbook 2409.13-23 - www.fs.fed.us/im/directives/html/fsh.html.

Table B-30. Suitable Timber, Pine Ridge Ranger District.

Criteria	Acres
Tentatively Suitable Timberland	39,800
Areas not within MA 5.13 (NRA and timber sites on Grassland)	2,720
Areas that can not be reforested (south and west slopes, greater than 40 percent slopes)	15,740
Areas not forested but listed as tentatively suitable (fire and other)	11,200
Suitable Timberland	10,140

The following tables describe desired conditions for timber stands both over the long term (100 years) and short term (10 - 15 years). Alternative 1 is not shown because it would continue the current management direction.

Table B-31. Short- and Long-term Desired Conditions for Alternative 2.

10 - 15 year Desired Conditions	100 year Desired Conditions
Dense Timber Stands: Management Area 5.13 One third of suitable timber stands would have 2 stories with 60 - 80 sq/ft basal area of the sawtimber overstory and a seed/sap understory.	**Dense Timber Stands:** Management Area 5.13 All of the suitable timber lands would be uneven-aged stands containing 3 size classes consisting of the following: 10% of the basal area in seed/sap 20% of the basal area in post/pole 70% of the basal area in sawtimber 65% of the total acres in Management Areas 6.1 and 7.1 are unmanaged
Open Savanna Timber Stands: Management Area 6.1 Management Area 7.1 Ten percent of the unsuitable timber land acres would have 20 - 40 sq/ft basal area in sawtimber with no understory.	**Open Savanna Timber Stands:** Management Area 5.13 (100% of the unsuitable acres) Management Area 6.1 (35% of the acres) Management Area 7.1 (35% of the acres) Open, park-like ponderosa pine stands with scattered mature sawtimber. Low fuel loadings and no understory with 100% of the timber being a sawtimber size class.

Table B-32. Short- and Long-term Desired Conditions for Alternative 3.

10 - 15 year Desired Conditions	100 year Desired Conditions
Dense Timber Stands: Management Area 5.12 Management Area 7.1 Ten percent of the unregulated timber land would have 2 stories with 60 - 80 sq/ft basal area in sawtimber and a seed/sap understory.	**Dense Timber Stands:** Management Area 5.12 (75% of the acres) Management Area 7.1 (65% of the acres) Timber lands would be un-even aged stands containing 3 size classes consisting of the following: 10% of the basal area in seed/sap 20% of the basal area in post/pole 70% of the basal area in sawtimber
Open Savanna Timber Stands: Management Area 5.12 Management Area 3.51 Management Area 7.1 Ten percent of the unregulated timber land acres would have 20 - 40 sq/ft basal area in sawtimber with no understory.	**Open Savanna Timber Stands:** Management Area 5.12 (25% of the acres) Management Area 3.51 (100% of the acres) Management Area 7.1 (35% of the acres) Open, park-like ponderosa pine stands with scattered mature sawtimber. Low fuel loadings and no understory with 100% of the timber being a sawtimber size class.

Table B-33. Short- and Long-term Desired Conditions for Alternative 4.

10 - 15 year Desired Conditions	100 year Desired Conditions
Dense Timber Stands: Management Area 6.1 Management Area 7.1 Ten percent of the unregulated timber land would have 2 stories with 60 - 80 sq/ft basal area in sawtimber with a seed/sap understory.	**Dense Timber Stands:** Management Area 6.1 (65% of the acres) Management Area 7.1 (65% of the acres) Timber lands would be un-even aged stands containing 3 size classes consisting of the following: 10% of the basal area in seed/sap 20% of the basal area in post/pole 70% of the basal area in sawtimber
Open Savanna Timber Stands: Management Area 5.12 Management Area 3.51 Management Area 6.1 Management Area 7.1 Ten percent of the unregulated timber land acres would have 20 - 40 sq/ft basal area in sawtimber with no understory	**Open Savanna Timber Stands:** Management Area 5.12 (100% of the acres) Management Area 3.51 (100% of the acres) Management Area 6.1 (35% of the acres) Management Area 7.1 (35% of the acres) Open, park-like ponderosa pine stands with scattered mature sawtimber. Low fuel loadings and no understory with 100% of the timber being a sawtimber size class.

Table B-34. Short- and Long-term Desired Conditions for Alternative 5.

10 - 15 year Desired Conditions	100 year Desired Conditions
Dense Timber Stands: Management Area 6.1 Management Area 7.1 Ten percent of the unregulated timber land would have 2 stories, with 60-80 sq/ft basal area in sawtimber with a seed/sap understory.	**Dense Timber Stands:** Management Area 6.1 (65% of the acres) Management Area 7.1 (65% of the acres) Timber lands would be un-even aged stands containing 3 size classes consisting of the following: 10% of the basal area in seed/sap 20% of the basal area in post/pole 70% of the basal area in sawtimber
Open Savanna Timber Stands: Management Area 3.51 Management Area 6.1 Management Area 7.1 Ten percent of the unregulated timber land acres would have 20-40 sq/ft basal area in sawtimber with no understory.	**Open Savanna Timber Stands:** Management Area 3.51 (100% of the acres) Management Area 6.1 (35% of the acres) Management Area 7.1 (35% of the acres) Open, park-like ponderosa pine stands with scattered mature sawtimber. Low fuel loadings and no understory with 100% of the timber being a sawtimber-size class.

Timber Benchmark Analysis

Maximum timber production was estimated from the tentatively suited timber lands using all Forested acres assuming they could be hand planted if needed to meet the five year regeneration requirement.

A selection harvest system was used with a yield determined by an expert panel[25]. The estimated yield was 2.5 MBF/acre with a reentry and similar yield every 30 years on 29,600 acres (39,800 tentatively suited acres - 11,200 non-forested acres). This gives a maximum annual sustained production (long term sustained yield) of 2.383 MMBF (28,600/30*2.5) in the foreseeable future (next 120 years). Once current nonstocked acres were hand planted and grew into merchantable timber annual timber production (long tern sustained yield) would be 3.316 MMBF (39,800/30*2.5).

Maximum present net value of Pine Ridge timber would be $0.00. Timber on the Pine Ridge currently costs $160/MBF to prepare and sell, while timber prices are $116/MBF, making these sales below cost.

Timber Demand

Ponderosa pine is the primary sawtimber species in the Pine Ridge area. In Nebraska, it is found in the Pine Ridge, eastward along the Niobrara and Snake Rivers and in other scattered pockets in western Nebraska. With control of fire, ponderosa pine which used to exist in presettlement days only in sites protected from fire, has spread across the landscape and this expansion is continuing today. Nebraska's forests have increased from 718,000 acres in 1983 to 948,000 acres in 1994. This reversed a 30% decline from 1955 to 1983. Ponderosa pine in Nebraska increased from 157,000 acres to 174,000 acres from 1983 to 1994. Likewise Nebraska

[25] See timber_effects_mtg_100298.aw

ponderosa pine sawtimber volume increased 23% from 1983 to 1994 although only 14% of the harvest volume was in the higher grade trees with a DBH greater than 19".[26]

The Pine Ridge District, as is the remainder of the Nebraska National Forest, is currently unregulated and has no Allowable Sale Quantity. The timber sales which have occurred on the Pine Ridge District since 1990 are as follows[27:]

Sale Name	Year Sold	Sale Vol.	Product Sold
Homestead	1990	1,161 MBF	Sawtimber
Rocky Buttes	1994	1,018 MBF	Sawtimber

The timber sales listed above were both completed by Pope and Talbot out of Spearfish, South Dakota. All milling was done in Spearfish, SD.

The recently completed Final Environmental Impact Statement for the Black Hills National Forest (BHNF) states (III-447) "A modern efficient wood products industry exists today with a capacity to process more than 200 MMBF annually." The total sale program quantity projected from the BHNF for the next decade is less than or equal to 85 MMBF if the forest receives full funding for the program. The BHNF used industry data on mill capacities, since mill capacity was well above any supply they could produce. Excess milling capacity is evidenced by firms buying BHNF sales from as far away as 300 miles into Montana.[28]

The timber benchmark analysis indicates the long-term sustained yield from Pine Ridge District is less than 4 MMBF annually, which is well within the excess milling capacity of the Black Hills area. Estimated timber production under all alternatives is well within the milling capacity of the Black Hills.

[26] Schmidt, Thomas L and Wardle, Tom D. 1998. The Forest Resources of Nebraska. USDA Forest Service North Central Research Station.

[27] Nebraska National Forest Management Attainment Reports 1985-1995.

[28] USDA Forest Service. 1996. Black Hill National Forest, 1996 Revised Land and Resource Management Plan, Final Environmental Impact Statement. pIII-447.

References Consulted

Potential Prairie Dog Habitat Model

Campbell, T. M., III, and T. W. Clark. 1981. "Colony Characteristics and Vertebrate Associates of White-tailed and Black-tailed Prairie Dogs in Wyoming." Am. Midl. Nat. 105:269-276.

Carlson, D. C. and E. M. White. 1987. "Effects of Prairie Dogs on Mound Soils." Soil Sci. Soc. Am. J. 51:389-393.

Cincotta, R. P., D. W. Uresk, and R. M. Hansen. 1987. "Demography of Black-tailed Prairie Dog Populations Reoccupying Sites Treated with Rodenticide." Great Basin Nat. 49:339-343.

Clippinger, N. W. 1989. Habitat Suitability Index Model: Black-tailed Prairie Dog. USDI Fish and Wildlife Service, Biol. Rep. 82(10). 21pp.

Dahlsted, K. J., S. Sather-Blair, B. K. Worcester, and R. Klukas. 1981. "Application of Remote Sensing to Prairie Dog Management." J. Range Manage. 34:218-223.

Knowles, C. J. 1982. "Habitat Affinity, Populations, and Control of Black-tailed Prairie Dogs on the Charles M. Russell National Wildlife Refuge." Ph.D. Dissertation. Univ. of Montana, Missoula. 171pp.

Knowles, C. J. 1986. "Some Relationships of Black-tailed Prairie Dogs to Livestock Grazing." Great Basin Nat. 46:198-203.

Knowles, C. J. 1994. A Review of Black-tailed Prairie Dog Literature in Relation to Rangelands Administered by the Custer National Forest. Rep. to USDA Forest Service. 61pp.

Koford, C. B. 1958. "Prairie Dogs, White Faces, and Blue Grama." Wildl. Monogr. No. 3. 78pp.

Munn, L. C. 1993. "Effects of Prairie Dogs on Physical and Chemical Properties of Soils." Pages 11-17 in Oldemeyer, J. L., D. E. Biggins and B. J. Miller, eds. In Proceedings: Management of Prairie Dog Complexes for the Reintroduction of the Black-footed Ferret. USDI Fish and Wildlife Service, Biol. Rep. 13. 96pp.

Powell, K. L. 1992. "Prairie Dog Distribution, Habitat Characteristics, and Population Monitoring in Kansas: Implications for Black-footed Ferret Recovery." M.S. Thesis, Kansas State Univ., Manhattan. 131pp.

Reading, R. P. and R. Matchett. 1997. "Attributes of Black-tailed Prairie Dog colonies in North Central Montana." J. Wildl. Manage. 61(3):664-673.

Reid, N. J. 1954. "The Distribution of the Black-tailed Prairie Dog in the Badlands of Southwestern North Dakota." M.S. Thesis. State Univ. Iowa, Iowa City. 30pp.

Snell, G. P., and B. D. Hlavachick. 1980. "Control Prairie Dogs -- The Easy Way." Rangelands 2:239-240.

Stromberg, M. R. 1975. "Habitat Relationships of the Black-tailed Prairie Dog: Vegetation, Soils, Comparative Burrow Structure and Spatial Patterns." M.S. Thesis, Univ. of Wisc., Madison. 175pp.

Uresk, D. W., J. G. McCracken, and A. J. Bjugstad. 1981. "Prairie Dog Density and Cattle Grazing Relationships." Pages 199-201 in R. M. Timm and R. J. Johnson, eds. In Proceedings: 5th Great Plains Wildlife Damage Control Workshop. Univ. of Nebraska, Lincoln.

Uresk, D. W. 1987. "Relation of Black-tailed Prairie Dogs and Control Programs to Vegetation, Livestock, and Wildlife." In: Integrated Pest Management on Rangelands: A Short-grass Prairie Perspective. Ed. J. L. Capinera. Westview Press, Boulder, Colo. pp. 312-323.

Selection of Management Indicator Species

Landres, P.B., J. Verner, and J.W. Thomas. 1988. Ecological Uses of Vertebrate Indicator Species: a Critique. Conservation Biology 2(4):316-328.

Niemi, G.J., J.M. Hanowski, A.R. Lima, T. Nicholls, N. Weiland. 1997. A Critical Analysis on the Use of Indicator Species in Management. J. Wildl. Manage. 61(4):1240-1252.

U.S. General Accounting Office. 1991. Wildlife Management: Problems Being Experienced With Current Monitoring Approach. Report to Secretary of Agriculture, RCED-91-123. 8pp.

Primary, Secondary, and Inaccessible/Ungrazed Rangelands Model

Bailey, D.W., J.E. Gross, E.A. Laca, L.R. Rittenhouse, M.B. Coughenour, D.M. Swoft, and P.L. Sims. 1996. "Invited Synthesis Paper: Mechanisms that Result in Large Herbivore Grazing Distribution Patterns." J. Range Management 49(5):386-400.

Cook, C.W. 1996. "Factors Affecting Utilization of Mountain Slopes by Cattle." J. Range Management 19:200-204.

Mackie, R.J. 1970. "Range Ecology and Relations of Mule Deer, Elk, and Cattle in the Missouri River Breaks, Montana." Wildl. Monogr. 20. 79pp.

McInnes, M.L., T.M. Quigley, M. Vavra, and H.R. Sanderson. 1990. "Predicting Beef Cattle Stocking Rates and Live Weight Gains on Eastern Oregon Rangelands: Description of a Model". Simulation: 137-145

Range Term Glossary Committee. 1989. A Glossary of Terms Used in Range Management. Society for Range Management. Denver, Colorado. 20pp.

Senft, R.L., M.B. Coughenour, D.W. Bailey, L.R. Ritterhouse, O.E. Sala, and D.M. Swift. 1987. "Large Herbivore Foraging and Ecological Hierarchies." Bioscience 37:789-799.

USDA Forest Service. 1996. Determination of Rangeland Capability and Suitability: Northern Great Plains Management Plans Revisions. Unpublished file document. 3 pp.

Forage Use Calculation

Committee on Rangeland Classification. 1994. Rangeland Health, New Methods to Classify, Inventory, and Monitor Rangelands. National Academy Press.

Holechek, Jerry L., Pieper, Rex D., Herbel, Carlton H. 1989. Range Management Principles and Practices. Prentice-Hall, Inc.

Jensen, Mark E., Dibenedetto, Jeff P., Bourgeron, Patrick S., Brewer, C. Kenneth. 1998. Biophysical Modeling of Rangeland Potential Vegetation at a Landscape Scale (Draft).

Manske, Llewellyn L. 1998. Animal Unit Equivalent for Beef Cattle Based on Metabolic Weight. North Dakota State University, Dickinson Research Extension Center. DREC 98-1020.

Nebraska Cooperative Extension Service. 1986. A Guide for Planning and Analyzing a Year Round Forage Program. EC-86-113.

Orr, Barron. 1997. Estimating Utilization. Office of Arid Lands Studies, The University of Arizona. Tucson, AZ.

Robel, R.J., J.N. Briggs, A.D. Dayton, and L.C. Julbert. 1970. "Relationship between Visual Obstruction Measurements and Weight of Grassland Vegetation." Journal of Range Management 23(4):295 - 297.

Visual Obstruction Method

Arnold, T.W., and K.F. Higgins. 1986. Effects of shrub coverages on birds of North Dakota mixed-grass prairie. The Canadian Field-Naturalist 100:10-14.

Benkobi, L. 1999. Sampling of residual cover on Fort Pierre National Grassland. Final Report to Nebraska National Forest, Chadron, Nebraska. 10pp.

Benkobi, L., D.W. Uresk, G. Schenbeck, and R.M. King. 2000. Protocol for monitoring standing crop in grasslands using visual obstruction. J. Range Management. 53(6):627-633.

Duebbert, H.F., and J.T. Lokemoen. 1977. Upland nesting of American bitterns, marsh hawks, and short-eared owls. The Prairie Naturalist 9:33-40.

Duebbert, H.F., J.T. Lokemoen, and D.E. Sharp. 1986. Nest sites of ducks in grazed mixed-grass prairie in North Dakota. The Prairie Naturalist 18:99-108.

Grosz, K.L. 1988. Sharp-tailed grouse nesting and brood rearing habitat in grazed and nongrazed treatments in southcentral North Dakota. MS Thesis, North Dakota State University, Fargo. 72pp.

Grosz, K.L. and D.R. Kirby. 1986. The nesting and brood-rearing ecology of sharp-tailed grouse in relation to specialized grazing systems. North Dakota Farm Research Bull., 44(2):22-24.

Hertel, D.R. 1987. Effects of grazing systems on habitats used by upland nesting waterfowl in south central North Dakota. MS Thesis, North Dakota State University, Fargo. 93pp.

Higgins, K.F. 1986. A comparison of burn season effects on nesting birds in North Dakota mixed-grass prairie. The Prairie Naturalist 18:219-228.

Higgins, K.F., and W.T. Barker. 1982. Changes in vegetation structure in seeded nesting cover in the prairie pothole region. USDI Fish and Wildlife Service, Special Scientific Report – Wildlife No. 242. 26pp.

Kirsch, L.M. 1979. Instructions for use of height-density pole for evaluating wildlife habitats on grasslands. U.S. Fish and Wildlife Service, Unpublished File Report. 3pp.

Kobriger, J. 1981. Habitat use by nesting and brooding sharp-tailed grouse in southwestern North Dakota. North Dakota Outdoors 43(1):2-7.

Luttschwager, K. A., K. F. Higgins, and J. A. Jenks. 1994. Effects of emergency haying on duck nesting in conservation reserve program fields, South Dakota. Wildl. Soc. Bull. 22:403-408.

Kohn, S. C. 1976. Sharp-tailed grouse nesting and brooding habitat in southwestern North Dakota. M.S. Thesis. South Dakota State Univ., Brookings. 41pp.

Manske, L., and W.T. Barker. 1981. The prairie grouse on the Sheyenne National Grassland, North Dakota. Rep. To USDA Forest Service. 238 pp.

Manske, L.L., and W. T. Barker. 1988. Habitat usage by prairie grouse on the Sheyenne National Grassland. p. 8-20 in A. J. Bjugstad (Tech. Coord.). Prairie chickens on the Sheyenne National Grassland. USDA Forest Service, Gen. Tech. Rep. RM-159. 73pp.

Manske, L. L., W. T. Barker and M. E. Biodini. 1988. Effects of grazing management treatment on grassland plant communities and prairie grouse habitat. p. 58-72. *in* A. J. Bjugstad (Tech. Coord.). Prairie chickens on the Sheyenne National Grassland. USDA Forest Service, Gen. Tech. Rep. RM-159. 73 pp.

Mattise, S. N., R. L. Linder and G. D. Kobringer. 1981. Effects of grazing systems on sharp-tailed grouse habitat. p. 124—132 *in* Proceedings of the Wildlife-Livestock Relationships Symposium. April 20-22, 1981. Coeur d'Alene, Idaho.

Messmer, T. A. 1990. Influence of grazing treatments on nongame birds and vegetation structure in South Central North Dakota. PhD. Dissertation. North Dakota State Univ., Fargo. 147 pp.

Robel, R. J., J. N. Briggs, A. D. Dayton, and L. C. Hulbert. 1970. Relationships between visual obstruction measurements and weight of grassland vegetation. J. Range Management 23(4):295-297.

Sedivec, K. K., W. T. Barker, T. A. Messmer, D. R. Hertel, and K. F. Higgins. 1995. Effects of grazing management on sharp-tailed grouse in North Dakota. p. 20-22 *in* Proceedings of the Prairie Grouse Technical Council. August 28-31, 1995. Medora, North Dakota.

Sousa, P. J. 1987. Habitat management models for selected wildlife management practices in the Northern Great Plains. U.S. Fish and Wildlife Service, Rep. No. REC-ERC 87-11.

Toepfer, J. E. and R. L. Eng. 1988. Winter ecology of the greater prairie chicken on the Sheyenne National Grassland, North Dakota. p. 32-48 *in* A. J. Bjugstad (Tech. Coord.). Prairie chickens on the Sheyenne National Grassland. Gen. Tech. Rep. RM-159.

U.S. Fish and Wildlife Service. 1999. Valentine National Wildlife Refuge comprehensive conservation plan. Ft. Niobrara / Valentine National Wildlife Refuge Complex, Valentine, Nebraska. 138pp.