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BLACK HILLS NATIONAL FOREST

FY 2009 MONITORING AND EVALUATION REPORT

Front Cover Photograph: Bighorn Sheep, Mystic Ranger District.

Black Hills National Forest

Monitoring and Evaluation Report

Fiscal Year 2009

This is the annual monitoring and evaluation report (October 2008 through September 2009) for the Black Hills Land and Resource Management Plan (Forest Plan). A revision of the Forest Plan was completed in June 1997. The first major amendment (Phase I) to this Forest Plan was completed in May 2001, and the second major amendment (Phase II) was completed in October 2005. This report follows the second, five year evaluation of the Forest Plan completed in 2007 as required by the National Forest Management Act (36 CFR 219.10g - … "The Forest Supervisor shall review the conditions on the land covered by the plan at least every 5 years to determine whether conditions or demands of the public have changed significantly"). Some objectives are an outcome of the Phase II amendment completed in 2005. As such, limited data may be available for some of these new objectives.

The basis for the annual monitoring report is in Chapter Four of the Forest Plan. This report does not discuss the entire inventory and monitoring that occurs in the Black Hills but only monitoring information related to the Forest Plan. More detailed studies may occur in association with individual projects that implement the Forest Plan. When relevant to Forest-wide trends, information from these site-specific projects is incorporated into Forest-wide monitoring. The Black Hills Monitoring and Evaluation Report focuses on monitoring effectiveness in meeting or moving toward established objectives set forth in the Forest Plan. Implementation monitoring, or monitoring to insure standards and guidelines are implemented as directed in the Plan, is a minor part of this monitoring report. Monitoring items not included in this report were either not scheduled for reporting or there was insufficient funds to collect relevant data.

The Forest has developed a "Monitoring Implementation Guide 2009" to describe methods to implement the monitoring and evaluation requirements of the Forest Plan; see:

http://go.usa.gov/cUb

Also, see the Sensitive Plant Species and Plant Species of Local Concern Monitoring Implementation Guide 2006 (Addendum to the October 2005 Guide):

http://go.usa.gov/cUb

Supporting documentation for this report is located in the Supervisor's Office, Black Hills National Forest, 1019 North Fifth St., Custer, SD 57730.

/s/ Craig Bobzien — September 30, 2010

CRAIG BOBZIEN — Date
Forest Supervisor

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Monitoring Item 1, Air Quality

Monitoring

The Forest experienced no violations of the Clean Air Act in 2009. There were no formal air quality complaints in 2009 (South Dakota - Administrative Rules - Article 34:10; Wyoming – Air Quality Standards and Regulations - Chapter 10).

The following mitigation actions are implemented on the Black Hills National Forest during prescribed burning to minimize air quality degradation:

- Receptors such as subdivisions, roads, towns, and other air-quality sensitive areas are identified during the prescribed burning planning process.
- Burning prescriptions are identified in the "prescribed burn plan" to ensure that the air quality standards are maintained in receptor areas.
- Prior to implementing a prescribed burn project, weather conditions (predicted and current), including smoke dispersal predictions, are assessed to insure smoke management criteria can be met.
- Air quality is monitored on site and at receptor areas during burn implementation to insure that air quality remains within identified parameters.

The Black Hills region has no non-attainment areas identified at this time (EPA. 2003. Criteria Pollutant Area Summary Report. Green Book. URL: http://www.epa.gov/air/oaqps/greenbk/ancl2.html. February 6). Rapid City, South Dakota remains the key area of concern in that it is close to being designated as a non-attainment area for PM-2.5, which is a pollutant often produced by smoke and dust. The concern for air quality in the Rapid City area has resulted in the Forest working jointly with the Rapid City Air Quality Office on guidelines for all National Forest burning activities. A 1995 guideline places restrictive measures for all forms of open burning planned on National Forest System land in the Rapid City air shed. The Forest continues to work with the Pennington County Air Quality Office and the SD Department of Environment and Natural Resources in mitigating known potential air-quality-impacting activities.

Evaluation

The Black Hills National Forest management activities, primarily prescribed burning, have met state clean air standards over the last year.

Monitoring Item 2, Soil Productivity
Soil Bulk Density

Maintain or enhance watershed conditions to foster favorable soil relationships and water quality.

This monitoring item had previously been included in the 2002 and 2007Monitoring and Five Year Evaluation Reports, and the 2006, 2007 and 2008 Monitoring and Evaluation Reports (USDA Forest Service 2004, 2007a, 2008a, 2009a). From the publishing date, any Forest watershed or soil

reports that address soil bulk density is to tier to the 2009 monitoring report as having the most complete soil bulk density sampling and evaluation information through 2009 for the Black Hills National Forest. The 2009 soil bulk density information has been combined into this report to provide an updated complete source of information that Forest analyses can reference for various projects.

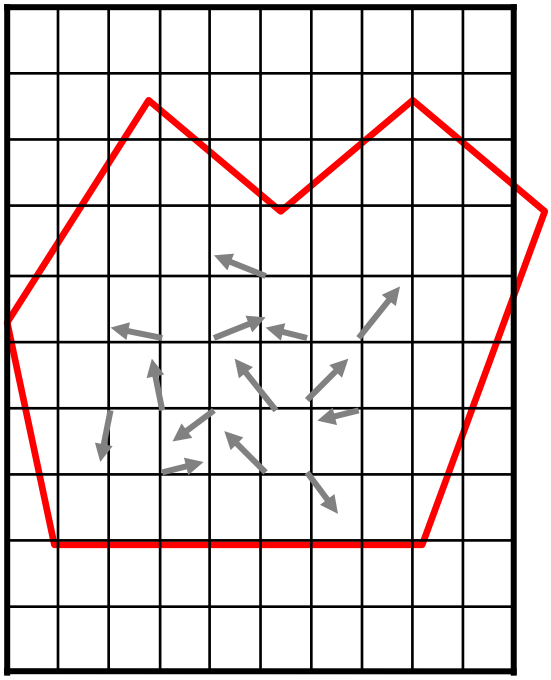
Background and General Soil Bulk Density Sampling Design Description

The Region 2 Supplement to the Forest Service Soil Management Handbook (FSH 2509.18-92-1) (USDA Forest Service 1992) identifies "Guidelines for Sampling Some Physical Conditions of Surface Soils" (USDA Forest Service 1983) as a reference for soil bulk density sampling techniques. The Region 2 Regional Office Soils Program Staff provided training on the use of those techniques in 1997. Building on that training and the sampling design techniques provided in the above mentioned document, soil bulk density data has been collected within the Black Hills at varying frequencies since 1998. This data has been used to periodically reassess the adequacy of monitoring design through consultation with the USFS Rocky Mountain Research Station. The current monitoring design generally utilizes a grid design (see diagram below) for collection of soil core samples (the samples generally collected from an approximate depth of 2-8 cm) along random transects for a selected activity unit. The samples are then processed for the calculation of bulk densities. The average soil bulk density of the disturbed activity areas is compared to the pre-disturbance conditions or adjacent sites that are generally not being disturbed by the specific activity or use.

Selected activity units sampled to date have been targeted at two of the primary activities that occur on the Black Hills National Forest, i.e. timber harvesting and livestock use. In addition, sites with characteristics indicating a greater likelihood of potentially becoming compacted were generally targeted initially for site selection (i.e. clay or loam soils, higher water holding capacity capability, minimal amounts of rock fragments, higher elevations that contribute to longer snow retention and therefore later seasonal moisture retention conditions, within the higher precipitation zones of the Forest). The current timber harvest sampling design includes sampling cutting units prior to and following harvest activities to assess any change in soil bulk densities. The sample design for livestock use areas has included sampling within exclosures (generally ungrazed areas) and adjacent grazed areas within the same soil series and within the same general topographic position. The sampling associated with livestock use has been focused on open grasslands in the Black Hills. Open prairie grasslands and meadows are generally where the soils and site conditions support the most forage production as compared areas with some level of conifer overstory (see various range project analyses). The moist meadows generally occur as concave positions on the landscape and often have deep soils that have higher moisture holding capacities than soils on surrounding slopes that may have a combination of features that limit water holding capacities (such as greater amount of rock fragments in the soil profile, are of a shallower depth, have a higher runoff potential). For similar reasons why open meadows and grasslands receive the majority of vegetation monitoring for forage use (livestock primary use areas of the allotment with the greatest concentration or abundance of palatable forage species) is similar to the reasons for monitoring soils in similar portions of the pastures. In addition to the harvest and livestock use target sampling described above, the Jasper Fire (occurred in 2000) offered opportunities for sampling within burned areas that were salvage harvested.

The Black Hills National Forest Land and Resource Management Plan (Forest Plan) (USDA Forest Service 2006a) and the Region 2 Watershed Conservation Handbook (Forest Service Handbook 2509.25, Rocky Mountain Region Watershed Conservation Practices Handbook, effective April 20, 2006) contain direction to be used to prevent increased soil bulk density conditions to the levels of what is defined as detrimental soil compaction. In addition, the USDA Forest Service Region 2 (Rocky Mountain Region) Rangeland Analysis and Management Training Guide (USDA Forest Service 1996a) provides additional direction targeted directly at grazing implementation activities for conserving or obtaining soil quality conditions on Forest Service administered lands within the Rocky Mountain Region. If there is a physical condition indication (such as platy soil structure), or if there is a measured level that indicates that there has been an average increase of 15% in bulk density associated with Forest Service administered land management activities and uses at specific locations, active measures are to be taken in accordance with the Black Hills National Forest Land and Resource Management Plan, as amended, along with various Forest Service Handbook direction to lower the soil bulk densities to restore productivity and infiltration of impacted sites.

Example of General Grid Placement with Random Transects For Collecting Soil Samples



Timber Harvest Activity Sampling

Monitoring

As documented in the table below, the data collected for timber harvesting activities since this method of soil bulk density sampling began occurred primarily since 2000-2009. It is important to note that most of this period of time (2000-2008) has been documented as having been a period of years either classified as “drought years” or years experiencing lower than average precipitation for

the Black Hills area (see the precipitation graph below developed from information accessed through the High Plains Regional Climate Center at http://hprc.unl.edu; general climatic condition descriptions of abnormally dry to drought conditions for the area can be accessed through http://drought.unl.edu/dm/current.html). Therefore, based on the "drought" or "lower than average precipitation" conditions it can generally be expected that soil conditions were generally dry in association with the below average precipitation patterns during that same period. Therefore, it was expected there would be little to no evidence of increases in soil bulk density for the activity areas sampled from 2000-2008. However, a noticeable increase in soil bulk density was documented at one of the harvest sites sampled during that time period.

Although not at the level of the 15% threshold for soil bulk density increase defined as detrimental compaction in the Region 2 Supplement to the Forest Service Soil Management Handbook (FSH 2509.18-92-1) (USDA Forest Service 1992), an average bulk density increase of greater than 10% was measured in Uncle #16 (central limestone area of the Black Hills). Along with the percentage of bulk density increase measured, the sampling report documented visible rutting associated with equipment within the unit. In reviewing the Black Hills National Forest timber sale inspection reports for activities within this cutting unit area, the soil moisture conditions were described as wet from recent rain events and the sale administrator discontinued harvest operations (end of April 2003). After operations resumed, the area evidently received additional precipitation because documentation indicated that harvest operations were to be shut down again on June 3, 2003 based on wet soil conditions. Inspection sheets documented that the area received more snow the week prior to June 10, 2003, likely contributing to some level of increased site moisture and timber sale activities were taking place on June 10, 2003.

Documentation is available for one site that had been sampled during a prior higher precipitation year as compared to the years described as having climatic conditions described as abnormally dry to drought conditions. Either harvesting or post sale activities that occurred on a Baldman Timber Sale cutting unit (northwestern Black Hills) occurred during soil moisture level conditions when rutting (documented on the soil sampling data sheets) and soil bulk densities could be increased (mean increase of soil bulk densities documented increased to a level of 23% as compared to the pre-harvest soil bulk density measurements for that timber harvest entry).

Evaluation

Although a limited number of sites are available to base conclusions on, there is evidence to support:

1. That sampling results are generally consistent with statements made in the Forest Service Handbook 2509.25 (Rocky Mountain Region), Watershed Conservation Practices Handbook, Chapter 10 – Management Measures and Design Criteria, Amendment 2509.25-2600-2 (effective 4/20/2006) regarding soil compaction. The handbook describes that soil compaction is caused by the weight of vehicles and animals on the ground and soils compact when soil moisture exceeds the plastic limit. Consistent with the Handbook, there is evidence that soils in the Black Hills can compact when some level of timber harvest (or post sale activity) equipment activity occurs when some degree of moist to wet soil conditions exist. Sample sites that provided evidence for this conclusion include Uncle Unit # 16 and the Baldman Cutting Unit (see table below).

2. Also consistent with the same Forest Service Handbook, the data generally collected for sites that were harvested during the below average precipitation years (2000 through 2008) provides evidence that operating timber harvest equipment (not specific to various volumes removed or silviculture prescription applied) during dry soil moisture conditions can be expected to prevent or limit increases in soil bulk densities, or limit the likelihood for increases in soil bulk density effects. Sample sites that provided evidence for this conclusion include the following timber harvest cutting unit areas from the Jasper Fire salvage area: Dumbuk II, Gillette West, Gillette East, Hell Canyon; and other units: Uncle #1 Uncle #2, Mallo, Duck #1, Dumbuk #1 , Hellsgate, Fanny #4 and Burner #3 .

3. While uncertain that soil bulk density levels would decrease or decrease as fast on every soil within the Black Hills, there is evidence that conditions were such that within one geographic area, on one type of soil , and to the depth sampled, that the mean soil bulk density decreased from levels above the threshold classified as "detrimental compaction" to levels below the threshold within the time period of one year. It is unknown what factors may have contributed to this level of decrease, but potentially the decrease may have been associated with soil moisture and temperature conditions that favored active freezing and thawing conditions at the site during that specific year, that the flush of herbaceous growth (and the associated increased root activity) that was observed on site may have contributed to the decline in soil bulk density levels, that water movement on the cutting unit slope may have influenced site conditions within the upper 10 cm (approx. upper 7 inches) of the soil profile, or some other unknown site characteristics The evidence for conclusion was based on sampling of the Baldman Cutting Unit.

Timber Harvest Soil Bulk Density Sampling

Post Harvest Sample Year	Timber Harvest Units Sample Locations	Soil Sampled	Bulk Density Increase from Pre-harvest Sampling to Post-Harvest Sampling
2009	Burner Unit #3	Larson-Lakoa loams	No Increase (2008 was the pre-harvest sample year for this unit)
2009	Fanny Unit #4 T2S, R1E, Sections 8 and 9 Hell Canyon District	Stovho and Citadel loams	No Increase (2007 was the pre-harvest sample year for this unit)
2008	Geranium # 23	Vanocker-Citadel	2008 was the pre-harvest sample year for this unit
2008	Geranium # 32	Lail-Stovho	2008 was the pre-harvest sample year for this unit
2007	Wish Unit #52 T50N, R61W, Sections 14 and 15 Bearlodge District	Larkson and Citadel loams	2007 was the pre-harvest sample year for this unit
2007	Wish Unit #61 T50N, R61W, Section 21 Bearlodge District	Larkson loam	2007 was the pre-harvest sample year for this unit
2004	Uncle #16 T1S, R2E, Section 19 Mystic District	Stovho silt loam	11.6%
2003	Dumbuk II	Stovho	No Increase

	T2S, R1E, Sections 12 and 13 (*Jasper Fire Site*)	loam/sandy loam	
2003	Gillette West T2S, R2E, Section 8 (*Jasper Fire Site*)	Stovho silt loam	3.9%
2003	Gillette East T2S, R2E, Section 9 (*Jasper Fire Site*)	Trebor silt loam/loam	No Increase
2003	Hell Canyon T2S, R2E, Section 14 (*Jasper Fire Site*)	Stovho silt loam	No Increase
2003	Uncle #1 T1S, R2E, Section 35 Mystic District	Stovho silt loam	No Increase
2003	Uncle #2 T2S, R2E, Sections 1 and 2	Stovho silt loam	No Increase
2003	Mallo T1N, R1E, Section 6 Mystic District	Stovho loam	No Increase
2000	Duck (Unit #1) T1S, R2E, Section 9 Mystic District	Stovho silt loam	No Increase
2000	Dumbuk (Unit #1) Hell Canyon District	Stovho silt loam	No Increase
2000	Baldman (cutting unit upper flat area) T50N, R60W, Section 31 Bearlodge District	Citadel loam	3%
1999 and 2000	Baldman (cutting unit slope area) T50N, R60W, Section 31 Bearlodge District	Citadel loam	First year following harvest (1999) – 23% increase; sampling one year later (2000) – 6% increase compared to pre-harvest.
1999	Hellsgate T3N, R1E, Section 1 Northern Hills District	Stovho	No increase

Livestock Use Activity Area Sampling

Monitoring

As displayed in the Range Allotment Soil Bulk Density Sampling table further in this document, data has been collected for livestock use activities since this sampling began in 1998. Sampling has occurred during years that have been documented as having higher than average precipitation for the Black Hills area as well as during years of lower than average precipitation years (see the precipitation graph towards the end of this document). Although soil moisture conditions fluctuate with precipitation and temperature levels throughout the year, soil moisture conditions are generally greater in years with higher precipitation (or immediately following higher precipitation years) and lower soil moisture conditions are generally associated with below average precipitation patterns. Some of the soil data sheets for the sampling period noted dry soil moisture conditions during the below average precipitation years.

The Wolff Range Allotment (located approximately 13 miles south of Lead, SD) was sampled in

1998 during a period of above average precipitation (see precipitation chart at the end of this soil bulk density sampling section). The bulk density calculated in 1998 was 15.5% greater in the grazed area compared to the ungrazed exclosure. A drought started in the Black Hills in 2000 so the Wolff Range allotment was sampled again in 2006 to compare to 1998 bulk densities. The bulk density was slightly lower (approx. 1%) in 2006 as compared to the 1998 results. No single factor can be associated with this approximate 1% change since there were other contributing factors that could have altered soil bulk densities at this site. One factor for example, cattle had been in the exclosure for at least two weeks of the 2005 season, thus potentially increasing the "ungrazed" 2006 bulk densities. Gopher activity was prevalent both within and outside of the exclosure in 2006 and may be contributing to bulk density level changes. Following the 2006 sampling year, cattle were in the Wolff Allotment exclosure for approximately two weeks during the grazing season in 2007. The exclosure fence was apparently repaired in 2008.

The Crows Nest/Upper Beaver Allotment was also sampled in 1998 during the climatic cycle period with above average precipitation. The bulk density calculated for the area from the data collected in 1998 was approximately 18% greater in the grazed area in the vicinity of the exclosure compared to the ungrazed exclosure. The site was re-sampled in 2007 for similar reasons as described for the Wolff Allotment. In addition to sampling similarly to 1998, in 2007 additional transects were sampled further to the east and west of the original grazed 1998 sample site, within the same soil map unit, to gather more information on extent of increased bulk density levels compared to the exclosure. Data from the additional sampling also indicated average bulk density levels were above the 15% threshold level for those soils in the soil map unit.

Range Site Sampling 2008. Based on the previous bulk density information that had been collected on the allotment, 2008 sampling had focused on gathering information from additional primary grazing areas within the the Crows Nest/Upper Beaver Allotment. The existing exclosure (constructed ca. 1940) was sampled as an ungrazed reference comparison site for the grazed areas. A soil map unit of the primary use meadows in this allotment has been sampled over the years in multiple locations. The documented results identify a difference greater than 15% over the existing 1940 exclosure.

Range Site Sampling 2009. The 2009 soil sampling that took place for range occurred on sites located on the Limestone Plateau, above 6200' elevation, in western Pennington and Custer Counties of the Black Hills. The seven range locations were selected by the Forest based on their occurrence within the same soil map unit as the ungrazed exclosure to be used for comparing to the grazed locations. In addition, sites were selected for that soil map unit that had not been previously sampled in 2008, except for a location where an exclosure was constructed in 2009 on the Crows Nest/Upper Beaver Allotment.Based on discussions of multiple years of sampling that document bulk densities above 15% on the primary grazing areas (meadows) of the allotment, Hell Canyon District chose to construct another exclosure near the older established exclosure (, approximately 200' southwest of the existing exclosure) and included sampling of this site as a modification to the 2009 soil sampling contract. This new exclosure (constructed in July 2009) was sampled at the same time as the previously existing exclosure.

The other six range locations were sampled for the first time in 2009. Basic sampling design for most of the previous year's sampling of range sites included sampling grazed conditions in areas adjacent to ungrazed exclosures. Therefore at previous sampling sites, transects occurred under both grazed and ungrazed conditions with results from multiple reference sites. Based on various factors

limiting the use of exclosures (maintenance issues, cattle access, size, length of establishment, etc.) the 2008 and 2009 sampling contract designs had been altered. Instead of sampling ungrazed exclosures in association with grazed range sites in 2008 and 2009, the Crows Nest/Upper Beaver Range Allotment Exclosure (existing) was re-sampled again in 2008 and 2009 as a reference. The soil bulk density data from that exclosure was used in comparing to the bulk densities at the 2008 and 2009 grazed range sites. These sites were not concentrated, but were located at various geographic locations that occurred within the same soil map unit. The nearby newly constructed exclosure (constructed in 2009 and located approximately 200 feet to the southwest) was sampled as an exclosure for the first time in 2009. A total of 640 soil samples were collected during the 2009 range sampling.

Sampling of the grazed range sample locations involved setting up a sampling grid within the selected soil map unit of the meadow. Transect starting points of the grid were selected on a random basis and the 100 foot long transects were laid out on random azimuths. Ten total core soil samples were collected along each individual transect, with samples point locations occurring at ten foot intervals. The collected samples were placed in marked individual plastic bags. In some areas the boundaries of the identified meadow sample site were too narrow for a grid design. At these narrow sites, transect starting points were located on a linear basis and a random azimuth was used to determine the direction of each of transects. In order for some transects to remain within or to remain consistent with the specified soil map unit or soil, some adjustments were made. When sampling, there is a need to have the knowledge and ability to sample the soil described as the major soil within the map unit and avoid various soil inclusions, such as shallow or high rock content soils. The various adjustments can include “sliding” an individual transect in the opposite direction if it would have extended past a soil boundary. These adjustments were consistent throughout the sampling. The top two to three centimeters of the ground surface generally have concentrations of fine roots or duff mixed with soil, therefore, this layer was removed so soil core samples could be collected to be used for the bulk density comparisons.

Evaluation

Based on a relatively limited number of sites there is some evidence to support:

1. Sampling results are generally consistent with statements made in the Forest Service Handbook that soil compaction is caused by the weight of vehicles and animals on the ground and compact when soil moisture exceeds the plastic limit. There is evidence that soils in the Black Hills can compact when some level of livestock use activity occurs when some degree of moist to wet soil conditions exist. Sample sites that provided evidence for this conclusion include the Crows Nest/Upper Beaver, Wolff, Darrow, Murphy, Sixmile, Soholt Lyons, Ditch Creek, Higgins, Castle Creek and Divide Allotments.

2. Soil bulk density changes have been documented to increase to or exceed the Region 2 soil quality standards level on primary grazing areas (usually identified as key areas for monitoring by the range program) of sampled range allotments,with a site on another allotment being near the threshold level. These allotments are located at relatively higher elevations in the Black Hills that have longer snow and soil moisture retention as compared to other lower elevation or lower precipitation zones. Meadow areas within the allotments were sampled during a cycle of higher than average precipitation as well as during a cycle of lower than average precipitation. Both periods of data collection indicated soil bulk density levels at or above the Region 2 Soil Quality

Standard average bulk density increases threshold. The site characteristics and conditions in association with various livestock numbers and management practices at those sites are expected to have contributed to the soil bulk density level changes, although it is not certain when the increases occurred, i.e. recent years or 10-20 or more years ago. Refer to the following table for allotments with primary grazing areas (generally meadow areas of the allotment that are rated as suitable for range forage production; meadow areas are also often identified as "key areas" for monitoring vegetation and use) that document increases in soil bulk density of near, at or greater than 15%.

Range Allotment (Livestock Grazing Areas) Soil Bulk Density Sampling

Year Sampled	Range Sample Site	Soil sampled	Average Difference in Soil Bulk Density in Grazed Compared to Ungrazed Areas
2009	Murphy Allotment T.2S., R.2E., Sectons 1 and 12 (Ditch Creek Road) Mystic Ranger District Elevation:~6,400'	Redbird/Heath silt loams	+11
2009	Ditch Creek Allotment T.1S., R.2E., Sections 9 and 16 (Pole Creek Road) Mystic Ranger District	Redbird/Heath silt loams	+14
2009	Darrow Allotment T.2S., R.2E., Sections 9,10,15,16 (Gillette Canyon) Mystic Ranger District Elevation:~6,200'+	Redbird/Heath silt loams	+16
2009	Darrow Allotment T.2S., R.3E., Sections 30 and 31 (Lemming Draw) Mystic Ranger District Elevation:~6,400'	Redbird/Heath silt loams	+10
2009	Sixmile Allotment T.1S, R.2E., Sections 28, 29 and 32 (Six Mile Draw) Mystic Ranger District Elevation:~6,900'	Redbird/Heath silt loams	+11
2009	Soholt Lyons Allotment T.1N., R.2E., Section 4 (Soholt Draw) Mystic Ranger District Elevation:~6,500'	Redbird/Heath silt loams	+10
2009	Crows Nest/Upper Beaver Allotment * Sample site in 2009 was selected by the District within new exclosure established in 2009 within this allotment to supplement 1998 and 2007 data that identified bulk density increases above 15%.	Redbird/Heath silt loams	+32%
2008	Crows Nest/Upper Beaver Allotment * All range sample sites in 2008 were located within this allotment to supplement 1998 and 2007 data that identified bulk	Redbird/Heath silt loams	+26%, +9%, +31%

	density increases above 15%.		
2007	Crows Nest/Upper Beaver Allotment T1N, R2E, Sections 31 and 32 Hell Canyon District Elevation:~6,600’	Redbird/Heath silt loams	Unit 5: +18.7% at same location sampled in 1998; +16.3% in additional extent. Unit 4: +24.3%
2007	Hell Canyon Allotment T5S, R2E, Section 22 Hell Canyon District Elevation: 4,680’	Paunsaugunt gravelly loam and gravelly silt loam and Gurney loam and silt loam	No difference
2007	Robinson Flats T7S, R2E, Section 14 Hell Canyon District Elevation: 4,300’	Butche and Boneek loams	+5.2%
2006	Wolff Range Allotment (T3N, R3E, Section 26) Northern Hills District, Elev. ~ 5900’	Cordeston loam	+14%*
2002	Baseline Range Allotment (T1N, R2E, Section 23) Mystic District Elevation: 6057’	Vanocker loam	+0.9%
2002	Ditch Creek T1S, R2E, Section 36 (comparison to South Fork Castle Creek exclosure:T1N, R2E, Sec 31) Mystic District Elevation: 6497”	Redbird silt loam	+9.6%
2001	Higgins Gulch Allotment (Sheep Flats Range Exclosure) T5N, R1E Section 21 Northern Hills Ranger District Elevation: 5645’	Citadel loam	+10%
2001	Horsethief Allotment (Deerfield North) T1N, R2E, Sec. 23 - Mystic Dist. Elevation: ~6000 to 6100’	Cordeston loam	+2%
2000	Castle Creek Allotment (Manganese Draw Exclosure) T2N, R1E, Section 35 Hell Canyon District Elevation: 6529’	Redbird loam	+5%
2000	Divide Allotment (Lytle Creek Exclosure) Bearlodge District Elevation: 5583’	Cordeston loam	+6%
1999	Spring Creek Allotment (Negro Creek Exclosure) T2S, R3E, Sec. 1 - Mystic District Elevation: 5935’	Cordeston loam	No difference (limited use of livestock at this exclosure location)
1999	Blacktail Allotment (Blacktail Creek Exclosure) T53N, R64W, Sec. 25 Bearlodge District Elevation: 4864’	Marshbrook Loam	No difference
1998	Crows Nest/Upper Beaver Range Allotment	Cordeston loam	+18%

	(T1N, R2E, Sections 31 and 32) Hell Canyon District, Elev.: ~ 6565'		
1998	Wolff Range Allotment (T3N, R3E, Section 26) Northern Hills District Elevation: ~5900'	Cordeston loam	+15%*

SUMMARY OF 2008 and 2009 SOIL BULK DENSITY RESULTS FOR CROWS NEST/UPPER BEAVER RANGE ALLOTMENT

Sample Locations	Mean Bulk Density (gm/cc)	Exclosure Mean Bulk Density	Difference in Soil Bulk Density in Grazed Compared to Ungrazed Area	Site 29 with ATV sample locations eliminated and sample results recalculated
Section 29 (2008)	1.30	1.02	+27%	+26%
Section 32 (2008)	1.11	1.02	+9%	See column to left
Section 34 (2008)	1.34	1.02	+31%	See column to left
Section 31 (2009)	1.23	.93	+32	NA

Crows Nest/ Upper Beaver Range Allotment 2008 and 2009

Crows Nest/ Upper Beaver Ungrazed Reference Exclosure (referred to on available allotment maps as "South Fork Castle Creek Study Plot Exclosure" (T.1N, R. 2E, Portions of E1/2 of Section 31 and SW ¼ of Section 32) - Transect for sample collections originated on the north side of the exclosure with a 176 degrees heading. The ground cover was 100% along all transects. Vegetation identified this year included a mix of bearded needlegrass, green needlegrass, sedges and forbs. Sedges and forbs seemed to be more dominant this year as compared to years when it was previously sampled. It is unknown but this may have been associated with the amount of precipitation received during the spring of 2008 as compared to that received in 2007. Although samples were collected at a similar time of the year as those collected in 2007 (2007 exclosure sampling dates of July 19-20; 2008 exclosure sampling date of July 24, 2008), small animal disturbances (possibly by gophers) seemed to be less in the exclosure as compared to what was observed in 2007.

Allotment Sample Site in T.1N, R.1E., Section 29 – The results of the sampling at this location documents bulk density levels above the 15% threshold (see Forest Service Handbook 2509.18 – Soil Management Handbook, R2 Supplement No. 2509.18-92-1). The site characteristics of this location include a narrow grassland meadow area with adjacent fairly steep forested side-slopes which may contribute for the cattle to concentrate here. Also, recent logging activity may have contributed as there were a few slash piles located in the meadow. Vegetative ground cover varied from 95 to 100% along transects. The area was a lane for cattle to reach the watering facility on the south end of the meadow. An ATV trail was also noted on the transect forms (see transect data forms included with this report). The vegetation in the area was a mix of vegetation typical of the High Country Silty range site as described in the Custer and Pennington Counties, Black Hills Parts Soil Survey.

Allotment Sample Site T. 1N., R.2E, Section 32 – This sample area had some evidence of prior disturbance from logging activities, however native grass regeneration is happening. Vegetative

ground cover along transects varied from 95 to 100%. No recent slash piles associated with timber vegetation management activities were observed in this area. Prior and current small animal activity disturbance (thought to be gopher activity) were documented on two transects. The vegetation was similar to what was observed at the sample location in Section 29.

Allotment Sample Site T. 1N., R. 1E., Section 34 – The sample area location originally provided by the District was a v-shaped valley with a very narrow area of the Redbird-Heath soils mapping unit. The new sampling area was relocated over the ridge to the East tributary where the map unit valley was of a greater width and provided a greater extent of an area that could be sampled. Vegetative ground cover estimates along transects varied from 90 to 100%. The lab processing results of documented soil bulk density levels above the 15% threshold.

Allotment Sample Site – New 2009 Developed Exclosure T.1N, R. 2E., Section 31) – The only sampling in 2009 on this allotment was the baseline reference and sampling of the new exclosure that had been selected by the District. The lab processing results of document soil bulk density levels within the exclosure was 32% above the established exclosure. Of interest, the soil contractor indicated that while the "visual class" on the transect data collection sheets was noted as "ungrazed" from the time the fence was built until the sampling date, there were some questions as to what had occurred at the site. The vegetation height appeared to be shorter than what had been observed in the same genral area when it had been sampled in previous years so it was the contractor questioned whether it had been grazed very early in the year. In addition to the calculated soil bulk density of the site, the contractor's report noted that at the time the site was sampled, up to seven hits of the slide hammer was required to obtain a sample from the 2009 established exclosure as compared to the three to four hits required for obtaining samples from the adjacent ungrazed reference exclosure.

2009 Range Allotment Soil Bulk Density Sampling Sites

other than the baseline reference site and the newly developed (2009) Crows Nest Upper Beaver exclosure

Range Site # 1 – Murphy Allotment (Mystic Ranger District):T.2S., R.2E., Sections 1 and 12. (Ditch Creek Road) – This area is a fairly wide flat valley that had the remnants of what is thought to have been the former Gillette Canyon Road. The site had several fences separating pastures converging at a watering facility. Two transects (transects number 4 and 8 that were located in a separate pasture) were taken out of the final calculation (removed to avoid mixing pasture unit results). The sampling date was July 21, 2009. The ground cover varied from 50% on a transect that crossed the old Gillette Canyon road to 100% in most of the other transects. The area sampled did not appear to have been grazed at the time it was sampled. The lab processing results of documented soil bulk density levels were below the 15% threshold when compared to the long established ungrazed exclosure mean bulk density.

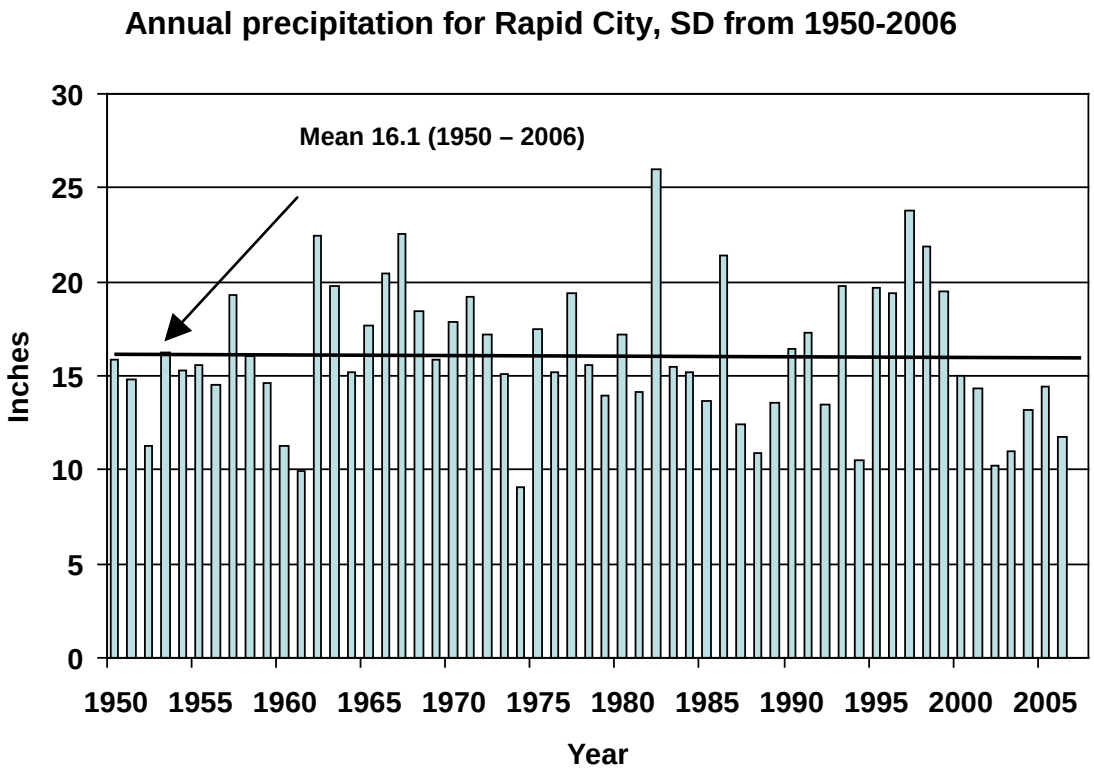
Range Site #2 – Ditch Creek Allotment (Mystic Ranger District): T.1S., R.2E., Sections 9 and 16 (Pole Creek Road) – This area consisted of a long narrow meadow bounded by conifer forest (spruce and pine) to the edge of the soil map unit that was sampled. The sampling date was July 22, 2009. The ground cover varied from 50% (transect location ended up occurring across a cattle trail) to 100% on most of the other transects. Platy soil structure was observed within the cattle trail. This meadow was actively being grazed at the time of sampling. The lab processing results of documented soil bulk density levels while below were close to the 15% threshold (at 14%) when compared to the long established ungrazed exclosure mean bulk density.

Range Site #3 – Darrow Allotment (Mystic Ranger District): T.2S., R.2E., Sections 9, 10, 15, 16 (Gillette Canyon) – This sample area is in the upper reaches of Gillette Canyon within the boundary of the Jasper Fire (occurred in 2000). This is a fairly wide, (approximately 500'), meadow that was apparently burned in the fire. This is also the lowest elevation (just above 6,200 feet) that the soil map unit 'Redbird-Heath silt loams, 2 to 9 percent slopes, were mapped by Natural Resources Conservation Service (NRCS). This area was grazed, however, "lush" vegetation growth was observed; perhaps associated with the amount of precipitation received during the spring of 2009. Percent ground cover varied from 80 to 100%. The calculated mean bulk density for this area, 1.08 gm/cc, was 16% above the reference site and documents bulk density levels above the 15% threshold.

Range Site #4 – Sixmile Allotment (Mystic Ranger District): T.1S., R.2E., Sections 28, 29, 32 (Six Mile Draw) – This area is a long narrow meadow approximately 200' wide and occurs at an elevation of approximately 6900'. The location was not grazed at the date of sampling (July22- 23, 2009). The ground cover varied from 80 to 100%. During sampling, it was noted that the area had soil disturbance at some point in the past. There were several borrow areas in which the topsoil was stripped and the silty clay loam subsoil was exposed at the surface. The sampled unit was divided by a fence between transect 7 and 9, however, at the time the site was sampled the gate was observed to be open. It is unknown if the gate is closed when the area is grazed, therefore, bulk density was also calculated for each pasture portion separately, with both mean soil bulk densities calculated to be lower than that of a 15% increase as compared to the ungrazed exclosure location.

Range Site #5 – DarrowAllotment (Mystic Ranger District) T.2S., R.2E., Section 36; T.2S., R.3E., Sections 30 and 31 (Lemming Draw) – This area is a long narrow meadow around 100 to 200 feet wide at approximately 6400' in elevation. It was grazed at the date of sampling (July 30, 2009). The ground cover varied from 80 to 100%. This site was within the Jasper Fire (occurred in 2000) boundary. An elk herd of a dozen cows and calves were seen in the area at the time that sampling occurred. Evidence of elk using the meadow was obvious. The lab processing results of documented soil bulk density levels were below the 15% threshold when compared to the long established ungrazed exclosure mean bulk density.

Range Site #6 – Soholt Lyons Allotment (Mystic Ranger District): T.1N., R.2E., Section 4; T.2N., R.2E., Sec. 33 (Soholt Draw) – This area is a long very narrow (50 to 100 feet wide) meadow located at approximately 6,500 feet in elevation. It appeared to be ungrazed at the time of sampling (July 27, 2009). The ground cover varied from 90 to 100%. The lab processing results of documented soil bulk density levels were below the 15% threshold when compared to the long established ungrazed exclosure mean bulk density.



Monitoring Item 4d, Watershed Health
Non-point Source Water Pollution Control

Objective 104: Maintain or enhance watershed conditions to foster favorable soil relationships and water quality.

Monitoring

The Forest implements direction from the Regional Watershed Conservation Practices (WCPs) (Forest Service Handbook 2509.25; WCPs) and State Best Management Practices (BMPs) to control nonpoint source water pollution. This monitoring item addresses Objective 104b and the Clean Water Act. While the reporting frequency for this monitoring item is to occur every 2-10 years (refer to Chapter 4 of the Forest Plan), this monitoring item has been reported on a number of times in recent years in the Black Hills National Forest FY 2005, 2006, 2007 and 2008 Monitoring and Evaluation Reports (USDA Forest Service 2006b; 2007a; 2008a; 2009c). District implementation and effectiveness monitoring review for BMPs and WCPs that were provided to for inclusion in the Forest Monitoring and Evaluation Reports in 2009 occurred within sample areas central and southern Hills timber sales: Bluebird, Dumbuk, Fanny, Fossil, Beagle, Crooked and Dark Canyon (USDA Forest Service 2010c, 2010d).

Evaluation:

This evaluation is a summary of the implementation and effectiveness information gathered on BMPs/WCPs applied to silviculture activities. Similar to what had been written in the Black Hills National Forest FY 2005, 2006, 2007 and 2008 Monitoring and Evaluation Reports, the 2009 field season information suggest that the effects of logging activities, through the implementation of BMPs/WCPs, have generally had limited negative impacts on watersheds and/or streams at the sites that were monitored.. Similar to information collected during previous years, the 2009 information collected reveal that BMPs and WCPs are generally being implemented and when implemented are effective in the timber sale units that were inspected. As identified in previous years reports, while BMPs and WCPs are generally being implemented on road systems and are generally effective, there were areas with documented drainage issues such as ruts, rills and gullies on roads and/or more effective road drainage features (such as crowning, drainage dips, etc) or hardening (such as gravel application) need to be incorporated on some of the roads.

The Forest internally actively monitors BMP implementation and effectiveness. Also, various personnel have also participated in Best Management Practices field audits that have been completed in the states of South Dakota and Wyoming in cooperation with the Black Hills Forest Resource Association, Wyoming Timber Industry Association, Wyoming Department of Environmental Quality (WYDEQ), the Wyoming State Forestry Division and non-state and non-federal cooperators (see the audit report for participants). Since initiated, these audits have generally been completed on a 3-year cycle. Audits were completed for both states in 2004, an audit was completed in Wyoming in 2007 (Wyoming State Forestry Division 2007), and an audit was completed in South Dakota in 2009 (Hoxie and Engelskirger 2009). The latest audit included a review of two units within the Black Hills NF sale areas of Thrall (Mystic District) and Jimmy (Northern Hills District) . Based on the process used, the audit indicated that the two Forest locations evaluated in 2009 met the BMPs approximately 90% of the time and were evaluated to approximately89% effective. Review of the audit information for all sites evaluated (federal, state and private) indicate that while BMPs are implemented and generally effective, that road drainage continues to be area that needs greater focus from the standpoint of BMPs. Both states continue to plan for future Best Management Practices Field Audits for harvested areas. Estimated dates for future audits are 2011 for Wyoming and 2012 for South Dakota.

Through this multiple year review and evaluation of BMP and WCP implementation and effectiveness monitoring, and the need for more attention placed on BMPs/WCPs associated with road drainage, the Forest had Resources Staff and Physical Resources Staff (engineering design) personnel meet June 24, 2009 to review the road drainage concerns. Following that a letter was sent to the Forest Supervisor of recommended actions to be taken to address road drainage issues (USDA Forest Service 2009b).

Monitoring Item 5, Water Yield
Water Quantity

Objective 108: Manage for sustained or improved water flows.

Monitoring and Evaluation

Water Quantity or Water Yield has generally been assessed as part of the process for the development of a Land and Resource Management Plan, or a revision of the plan. Water yield was included in the process for the 1997 Revised Black Hills Land and Resource Management plan (see Chapter 3 of the associated Final Environmental Impact Statement). Since it is expected to be assessed again during the next revision process, there has not been additional assessment during the last five years.

Monitoring Item 7, Riparian/Wetlands
Habitat Restoration

Objective 107: Restore degraded wetlands except where exemptions are allowed by a Clean Water Act Section 404 permit.

Objective 214: Restore riparian shrub communities across the forest by 500 acres during the Plan period on sites capable of supporting this community.

Objective 215: Manage for at least 5 stream reaches in a rehabilitated condition during the Plan period. Select reaches where the water table has receded and plant species composition has changed as a result of human activities. Coordinate planning and implementation with state game and fish agencies and downstream private landowners. Use Objective 215a through d in designing the projects.

a. Raise the water table to saturate historically inundated soils.
b. Convert drier-site vegetation to native wet-meadow species.
c. Reintroduce beaver into the drainage once suitable habitat is developed.
d. Design management to maintain wet-meadow conditions.

Monitoring

Projects to restore or enhance riparian and wetland habitat or to rehabilitate stream reaches are generally completed by the following programs; Wildlife, Fish and Rare Plants (NFWF), Vegetation and Watershed Management (NFVW), Range Management/Range Betterment (NFRG/RBRB) or through Knutson-Vandenberg (KV) funds generated from timber sale receipts. The table below shows projects that contributed to riparian/wetland habitat restoration in FY 2009.

Project	District	Funding Source	Target
Beaver Transplant	Bearlodge	NFWF	50 acres
Castle Creek Riparian Fence Repair	Hell Canyon	NFWF	10 acres
Upper Thompson Spring Riparian Protection	Hell Canyon	NFWF	5 acres

The following table summarizes the acres of riparian habitat restored or enhanced from FY2003-2009. Some projects are long-term and restoration activities may occur in multiple years. Subsequently, some project acres may be counted in multiple years.

Activity	2003	2004	2005	2006	2007	2008	2009	TOTAL
Riparian acres restored	53	32	55	3	112	64	65	384

Evaluation

Progress is being made in achieving Objective 214. Efforts to restore beaver to improve riparian areas achieved the most target acres, but the smaller spring/seep protection projects also provide ecological diversity benefits not reflected in their small size.

Monitoring Item 8, Vegetative Diversity, Vegetation Species Composition

Objective 201: Manage for a minimum of 92,000 acres of aspen (double current aspen acres), and 16,000 acres of bur oak (approximately 33 percent increase) in current bur oak during the life of the Plan. The highest priority for hardwood restoration is where conifers (e.g., spruce and pine) have out-competed aspen adjacent to riparian systems that once supported beaver. Increases in bur oak will be focused in other areas than the Bear Lodge Mountains.

The table below shows the 1997 Forest Plan cover types and acreages with the vegetation database outputs since the Phase II Amendment decision for the years 2005, 2006, 2007, 2008 and 2009.

Vegetation database queries were executed in February 2010 for this monitoring item.

Acres Dominated by Aspen or Bur Oak on the Black Hills National Forest, 1997 & 2005-2009

Cover Type	1997	2005	2006	2007	2008	2009
Aspen	48,224	46,172	45,559	45,843	45,111	45,805
Bur Oak	9,243	12,477	12,879	13,021	13,132	13,556

Evaluation

There was a slight increase (694 acres) in aspen acres in 2009, and about a one percent increase as compared to 1997. Forest database stand mapping is more accurate today than the mid-1990s for the 1997 forest plan. Some recent timber harvesting of removing pine from aspen contributes to some increase in the aspen cover type. Over time, prolific pine regeneration is contributes to the decrease of aspen acres. Likewise the pine removal of mixed pine & oak stands are resulting in more oak stands. The increase in aspen or bur oak cover type is achieved generally by removing pine from mixed species stands. Aspen is a disturbance-dependant species. Wild land fire and/or prescribed burning also promote aspen regeneration. Forest land management treatments and natural disturbances will create more acres of hardwoods. Additional time is needed to meet Objective 201.

Objective 202: Conserve and manage existing mountain mahogany stands.

Manage a minimum of 10 percent of the site in cover (mature and over mature shrubs).

Evaluation

There are 4,412 acres of mountain mahogany (SMS) by cover type in the vegetation database. The vegetation database does not track the maturity of mountain mahogany.

Manage a minimum of 40 percent of the site in forage (young shrubs) by treating when root reserves are high or immediately prior to the growing season.

There are 186 acres of shrublands. The vegetation database does not track maturity of shrublands by any variable. Further on-the-ground survey is needed to record shrubland maturity.

Objective 203: Manage 30 to 50 percent of each bur oak stand for 100-plus year old trees.

The age of bur oak is recorded for bur oak stands within the vegetation database. The age is for the stand as a whole. Within each stand, age distribution is not tracked within the vegetation database. Individual stand data printouts displays within stand variations.

Evaluation

The bur oak cover type is 13,556 acres (see cover type chart TBO). There are 8,083 acres of bur oak with stand age determination. Of the 8,606 acres, there are 1,418 acres of bur oak that is 100 years or older.

Objective 204: Conserve and manage birch/hazelnut, Lodgepole pine, Limber pine, and Douglas-fir.

These cover types have the following acres:

Paper birch	3396
Lodgepole pine	103
Limber pine	-0-
Douglas-fir	99

Evaluation

The Forest Health Service Center has documented that "paper birch is in good condition across most of the Black Hills. The stands that are the farthest south in the forest are showing the most decline, generally. This is likely because they are at the edge of their range. Birch regeneration is not abundant. However, there has been little to no management of birch stands that would favor such an occurrence. Most of the birch stands on the forest are reaching a mature state, so there may be increased levels of dieback in coming years."

Lodgepole pine is found primarily on the Northern Hills Ranger District in the Swede Gulch area. Historically, it has been harvested. The Lodgepole pine is regenerating but not prolifically.

Limber pine is found on the north side of Harney Peak. Only a few trees have been discovered.

Douglas-fir is on the Northern Hills and Hell Canyon Ranger Districts. It is not native and its presence is by planting.

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

The table below shows the cover types and acreages for the 1997 Forest Plan and for the vegetation database since the Phase II Amendment decision for the years 2005, 2006, 2007, 2008 and 2009. Meadow acreage for the 1997 Forest Plan was not available.

Acres Dominated by Grassland or Meadow on the Black Hills National Forest, 1997 and 2005-2009.

Cover Type	1997	2005	2006	2007	2008	2009
Grassland	104,174	109,888	109,829	103,026	104,181	107,464
Meadow	n/a	26,089	24,849	6,449	6,876	6,958

Evaluation

The Forest is approximately 14,536 acres short of the grassland objective. The Forest has 3,358 acres more than the objective acres for meadow. For the ten-year period, grassland acreages have shown an increase then a decrease that is likely explained by inconsistencies in what cover types have been queried in the vegetation database. The acres of meadow dropped considerably in 2007 compared to 2005 and 2006. This is explained by the cover types that were queried from the vegetation database. In 2005 and 2006, bluegrass and blue grama represented the meadow habitat. Starting in 2007, cover types more representative of wet meadows were queried.

To insure more consistent future reporting, the following covertypes will represent grassland habitat (both interior and prairie, as defined in the Phase II Amendment Final Environmental Impact Statement) and meadows.

Habitat	Vegetation Database Cover Types
Grassland	GBG (blue grama, buffalo grass), GBL (big and sand bluestems), GEX (planted grassland – exotic species), GLB (little and silver bluestems), GNE (needlegrasses), GOA (oatgrass),GRA (grasslands), GSO (sideoats grama), GWH (wheatgrass)
Meadow	FCA (cattails), GPO (bluegrass), GWE (rush species; wet sedge species)

Objective 239: Manage for 20,000 acres of spruce across the Forest using active management to achieve multiple-use objectives. Treat spruce within 200 feet of buildings where spruce has encroached into hardwoods and for emphasis species management.

The table below shows the acres of spruce for the 1997 Forest Plan and from the vegetation database since the Phase II Amendment decision for the years 2005, 2006, 2007, 2008 and 2009. To increase the acres of spruce cover type is to generally remove pine from a mixed spruce/pine stand.

Acres Dominated by Spruce on the Black Hills National Forest
1997 & 2005-2009

Cover Type	1997	2005	2006	2007	2008	2009
Spruce	21,737	25,462	26,483	26,110	25,724	25,749

Evaluation

The Forest is over 5,749 acres above or 29% greater than the objective of 20,000 acres of spruce.

Monitoring Item 9, Vegetative Diversity, Structural Stages

Monitoring Item 9 displays vegetative diversity using structural stages. Structural stage is a variable for each forested stand on the Forest. The structural stage scheme is a Region Two (Rocky Mountain Region) scheme used by all National Forests in Region Two. The following is the structural stage scheme:

Vegetation database queries were executed in February 2010 for this monitoring item.

Region 2 Structural Stage Descriptions				
Code	**Structural Stage**	**Tree Size Class**	**Diameter Range**	**Crown Cover %**
1	grass-forb	nonstocked		0-10
2	shrub/seedling	established	less than 1 inch	11-100
3A	sapling-pole	small, medium	trees mostly 1-9	11-40
3B				41-70

Region 2 Structural Stage Descriptions				
Code	**Structural Stage**	**Tree Size Class**	**Diameter Range**	**Crown Cover %**
3C				71-100
4A	mature	large, very large	trees mostly 9 inches	11-40
4B			and larger	41-70
4C				71-100
5	Late succesional	large, very large	varies	

Objectives 4.1 – 203, 5.1 – 204, 5.4 – 206, 5.43 – 204, 5.6 – 204: Manage for certain percentages of structural stages in ponderosa pine across the management area in a variety of sizes and shapes.

SS1 – grass-forb 5%
SS2 – shrub/seedling 5%
SS3A – sapling-pole 10%
SS3B – sapling-pole 15%
SS3C – sapling-pole 5%
SS4A – mature 25%
SS4B – mature 25%
SS4C – mature 5%
SS5 – late succesional 5%

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

Late succession is defined in the 1997 Revised Land and Resource Management Plan as Amended by the Phase II Amendment-Glossary Page 38 (USDA Forest Service 2006a). The structural stage 5 within the Regional structural stage code scheme is also used for late succession (old growth).

The Monitoring Implementation Plan identifies tracking acres of structural stage by cover type within 5 selected management areas as identified in the Phase II Amendment.

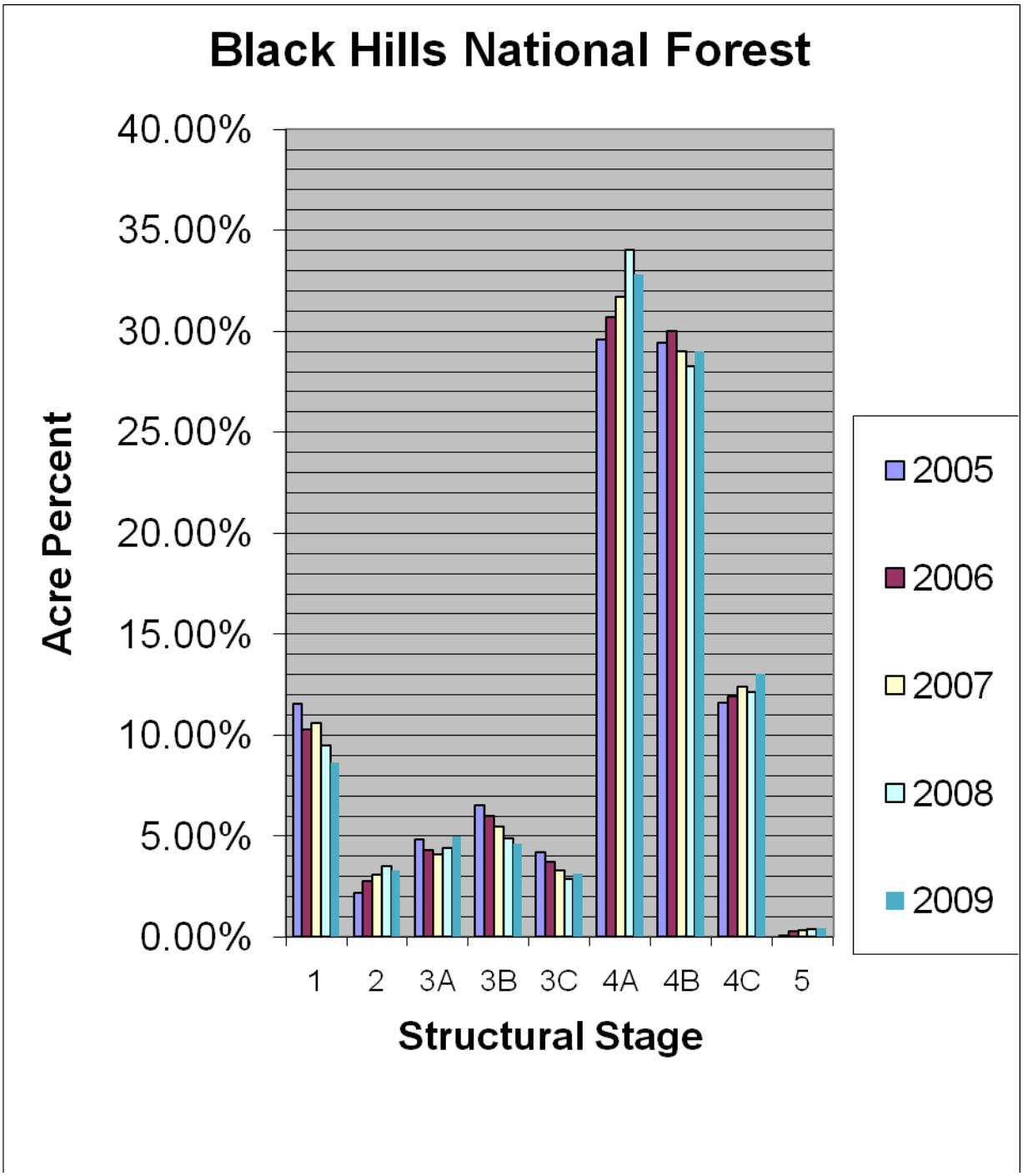
Acres of Structural Stages of Ponderosa Pine within Management Areas 4.1, 5.1, 5.4, 5.43, 5.6												
	VSS >		**1**	**2**	**3A**	**3B**	**3C**	**4A**	**4B**	**4C**	**5**	**Total**
Desired percents >			**5%**	**5%**	**10%**	**15%**	**5%**	**25%**	**25%**	**5%**	**5%**	**100%**
Management												
Area		**Year**										
4.1	acres >	**2005**	427	622	1,586	920	610	11,142	12,539	7,708	232	35,787
	percent >	**2005**	1.20%	1.70%	4.40%	2.60%	1.70%	31.10%	35.00%	21.50%	0.60%	100.00%
	acres >	**2006**	413	548	908	1021	844	9391	14445	8382	204	36156
	percent >	**2006**	1.10%	1.50%	2.50%	2.80%	2.30%	26.00%	40.00%	23.20%	0.60%	100.00%

	acres >	**2007**	393	512	583	1,311	1,033	8,783	14,257	8,982	302	36,156
	percent >	**2007**	1.09%	1.42%	1.61%	3.63%	2.86%	24.29%	39.43%	24.84%	0.84%	100.00%
	acres >	**2008**	388	441	744	1254	981	9060	13831	8984	430	36113
	percent >	**2008**	1.07%	1.22%	2.06%	3.47%	2.72%	25.09%	38.30%	24.88%	1.19%	100.00%
	acres >	**2009**	486	461	975	1253	887	9668	14379	7055	896	36060
	percent >	**2009**	1.35%	1.28%	2.70%	3.47%	2.46%	26.81%	39.88%	19.56%	2.48%	100.00%
5.1	acres >	**2005**	39,499	10,865	16,995	26,632	13,967	167,673	150,591	49,361	467	476,050
	percent >	**2005**	8.30%	2.30%	3.60%	5.60%	2.90%	35.20%	31.60%	10.40%	0.10%	100.00%
	acres >	**2006**	38308	15453	18371	22827	11675	177660	144167	47617	307	476385
	percent >	**2006**	8.00%	3.20%	3.90%	4.80%	2.50%	37.30%	30.30%	10.00%	0.10%	100.00%
	acres >	**2007**	37,468	16,378	18,123	21,319	11,176	181,254	141,541	49,337	798	477,394
	percent >	**2007**	7.85%	3.43%	3.80%	4.47%	2.34%	37.97%	29.65%	10.33%	0.17%	100.00%
	acres >	**2008**	30261	18827	18558	18949	9624	194353	137839	48654	869	477934
	percent >	**2008**	6.33%	3.94%	3.88%	3.96%	2.01%	40.67%	28.84%	10.18%	0.18%	100.00%
	acres >	**2009**	26760	16673	24236	17047	10269	185062	142228	50437	1227	473939
	percent >	**2009**	5.65%	3.52%	5.11%	3.60%	2.17%	39.05%	30.01%	10.64%	0.26%	100.00%
5.4	acres >	**2005**	57,972	7,057	22,789	28,866	21,899	74,688	86,878	40,547	525	341,222
	percent >	**2005**	17.00%	2.10%	6.70%	8.50%	6.40%	21.90%	25.50%	11.90%	0.20%	100.00%
	acres >	**2006**	51861	8469	18045	28974	19926	77761	93782	44154	1137	344109
	percent >	**2006**	15.10%	2.50%	5.20%	8.40%	5.80%	22.60%	27.30%	12.80%	0.30%	100.00%
	acres >	**2007**	52,651	9,183	16,358	24,827	16,303	84,731	90,839	48,084	1,196	344,172
	percent >	**2007**	15.30%	2.67%	4.75%	7.21%	4.74%	24.62%	26.39%	13.97%	0.35%	100.00%
	acres >	**2008**	50491	10621	18947	22263	14450	92131	88796	46638	1299	345636
	percent >	**2008**	14.61%	3.07%	5.48%	6.44%	4.18%	26.66%	25.69%	13.49%	0.38%	100.00%
	acres >	**2009**	45616	10152	17454	22227	15763	86487	87864	52865	1066	339494
	percent >	**2009**	13.44%	2.99%	5.14%	6.55%	4.64%	25.48%	25.88%	15.57%	0.31%	100.00%
5.43	acres >	**2005**	3,743	357	504	761	418	1,665	1,521	539	52	9,559
	percent	**2005**	39.20%	3.70%	5.30%	8.00%	4.40%	17.40%	15.90%	5.60%	0.50%	100.00%

	>											
	acres >	**2006**	448	158	318	285	316	3014	4428	1390	52	10409
	percent >	**2006**	4.30%	1.50%	3.10%	2.70%	3.00%	28.96%	42.54%	13.35%	0.50%	100.00%
	acres >	**2007**	3,217	589	525	743	351	1,079	1,854	1,143	52	9,553
	percent >	**2007**	33.68%	6.17%	5.50%	7.78%	3.67%	11.29%	19.41%	11.96%	0.54%	100.00%
	acres >	**2008**	3217	589	548	795	275	1242	1743	1069	72	9550
	percent >	**2008**	33.69%	6.17%	5.74%	8.32%	2.88%	13.01%	18.25%	11.19%	0.75%	100.00%
	acres >	**2009**	2756	785	319	397	543	1024	1945	1860	0	9629
	percent >	**2009**	28.62%	8.15%	3.31%	4.12%	5.64%	10.63%	20.20%	19.32%	0.00%	100.00%
5.6	acres >	**2005**	132	290	739	244	202	5,888	8,075	3,988	28	19,585
	percent >	**2005**	0.70%	1.50%	3.80%	1.20%	1.00%	30.10%	41.20%	20.40%	0.10%	100.00%
	acres >	**2006**	108	246	630	167	240	4461	9218	4193	507	19770
	percent >	**2006**	0.50%	1.20%	3.20%	0.80%	1.20%	22.60%	46.60%	21.20%	2.60%	100.00%
	acres >	**2007**	122	949	555	250	240	5,759	9,038	2,567	638	20,118
	percent >	**2007**	0.61%	4.72%	2.76%	1.24%	1.19%	28.63%	44.92%	12.76%	3.17%	100.00%
	acres >	**2008**	105	949	555	250	240	5776	9038	2567	638	20118
	percent >	**2008**	0.52%	4.72%	2.76%	1.24%	1.19%	28.71%	44.92%	12.76%	3.17%	100.00%
	acres >	**2009**	703	979	963	239	235	8008	10219	3059	771	25176
	percent >	**2009**	2.79%	3.89%	3.83%	0.95%	0.93%	31.81%	40.59%	12.15%	3.06%	100.00%
Total	acres >	**2005**	**101,773**	**19,191**	**42,613**	**57,423**	**37,096**	**261,056**	**259,604**	**102,143**	**1,304**	**882,203**
	percent >	**2005**	**11.53%**	**2.20%**	**4.83%**	**6.51%**	**4.20%**	**29.60%**	**29.43%**	**11.60%**	**0.10%**	**100.00%**
`												
	acres >	**2006**	**91,138**	**24,874**	**38,272**	**53,274**	**33,001**	**272,287**	**266,040**	**105,736**	**2,933**	**887,555**
	percent >	**2006**	**10.30%**	**2.80%**	**4.30%**	**6.00%**	**3.70%**	**30.70%**	**30.00%**	**11.90%**	**0.30%**	**100.00%**
	acres >	**2007**	**93,851**	**27,611**	**36,144**	**48,450**	**29,103**	**281,606**	**257,529**	**110,113**	**2,986**	**887,393**
	percent >	**2007**	**10.58%**	**3.11%**	**4.07%**	**5.46%**	**3.28%**	**31.73%**	**29.02%**	**12.41%**	**0.34%**	**100.00%**
	acres >	**2008**	**84,462**	**31,427**	**39,352**	**43,511**	**25,570**	**302,562**	**251,247**	**107,912**	**3,308**	**889,351**
	percent >	**2008**	**9.50%**	**3.53%**	**4.42%**	**4.89%**	**2.88%**	**34.02%**	**28.25%**	**12.13%**	**0.37%**	**100.00%**

	acres >	**2009**	**76,321**	**29,050**	**43,947**	**41,163**	**27,697**	**290,249**	**256,635**	**115,276**	**3,960**	**884,298**
	percent >	**2009**	**8.63%**	**3.29%**	**4.97%**	**4.65%**	**3.13%**	**32.82%**	**29.02%**	**13.04%**	**0.45%**	**100.00%**

	Structural Stage							Percent
Year	**1**	**2**	**3A**	**3B**	**3C**	**4A**	**4B**	**4C**
2005	11.53%	2.20%	4.83%	6.51%	4.20%	29.60%	29.43%	11.60%
2006	10.30%	2.80%	4.30%	6.00%	3.70%	30.70%	30.00%	11.90%
2007	10.58%	3.11%	4.07%	5.46%	3.28%	31.73%	29.02%	12.41%
2008	9.50%	3.53%	4.42%	4.89%	2.88%	34.03%	28.25%	12.13%
2009	8.63%	3.29%	4.97%	4.65%	3.13%	32.82%	29.02%	13.04%
Desired Percentages >>	5%	5%	10%	15%	5%	25%	25%	5%



While each of the five management areas is considered individually for the ponderosa pine cover type, there is generally too much structural stage 1, 4A, 4B and 4C, and not enough structural stage 2, 3A, 3B, 3C and 5. Structural stage 1 acres are attributable to the recent large wildfires or stand mortality due to insects. To move a timber stand from one structural stage category to another, and thus move toward Forest Plan objectives, may require growth or several vegetation treatments spanning decades. For example, a 4A stand without an understory may take several decades to transition to a 4B stand. To achieve more structural stage 2 or 3A or 3B, tree harvest methods of overstory removal are used. To implement an overstory removal an understory must be present in a

4A/B/C stand. Overstory removal harvests will change structural stage 4 stands to structural stage 3's, thus increasing the percentage in the structural stage 3 category. Structural stage 1 stands will grow into structural stage 2 and then on into structural stage 3's generally within 20-30 years. Overstory removal and seed cut were the harvest methods most preferred in the last forest planning analysis (USDA Forest Service 1996b Ch.II-36 Table II-6).

Evaluation: The Forest is commercially harvesting around 20,000 acres per year, or 2 percent of the suitable forestlands per year. Commercial thin is currently the dominant tree harvest prescription. In order to move towards more structural stage 3's and less structural stage 4's, the Forest should implement more overstory removals or harvest methods which the understory is the dominant structural stage. There is concern of changing the forest landscape by overstory removals which remove all large trees from forest stands. Highways, county roads and gravel roads are areas of high visibility where there is sensitivity to implementation of overstory removals. The residual basal area of the overstory needs to be 10 or below in order to change structural stage 4 to a structural stage 2 or 3. In most cases, sensitive visual areas having a commercial harvest and retaining a large tree component will be a structural stage 4A. Hence, overstory removals with reserve trees, seed cuts, commercial thinning and individual tree selection harvest cuts are significant contributors to structural stage 4A.

The Forest is migrating data from the R2Veg vegetation database to the FSVeg Spatial per national direction and regional database migration schedule. Recent field stand exam data updates the vegetation database with more accurate information. There have been stand boundary re-delineations of which results in more accurate stand information. Project decisions which may have generated many timber sales that are not sold at time of database query extraction are not included in the monitoring results. Therefore, the collective effects of recent stand exams, stand re-delineations and projects with sales not sold after the February 2010 database monitoring queries results in a slight decrease of structural stage 4A and slight increases in structural stages 4B and 4C. Structural stage 1 has a slight decrease due to further large wildfire area(s) new stand delineations.

Monitoring Item 10, Vegetative Diversity, Large Trees

Objectives 4.1 – 203, 5.1 – 204, 5.4 – 206, 5.43 – 204, 5.6 – 204 : 10% of the structural stage 4 ponderosa pine acreage in the management area will have an average tree size of "very large".

Vegetation database queries were executed in February 2010 for this monitoring item.

Very Large tree size is defined as the majority of tree stocking based on basal area is in live trees 9.0 inches in diameter and larger, and within that group, the majority of the basal area is in live trees 16.0 inches and larger in diameter.

The percent of very large trees in structural stage 4 by management area from 2005 to 2009 is shown below. No data is provided prior to 2005 because this is a new objective under the Phase II Amendment. In 1995 the forest database has 28,076 acres of "very large" trees. The management areas have changed labels and boundaries from the 1995 database to today's forest plan scheme. Therefore, it is not possible to determine 1997 acres by today's management areas.

Management Area Percentage of Very Large Trees by Year

Year >	2005	2006	2007	2008	2009
4.1	18.3	17.6	17.5	17.9	19.8
5.1	11.1	11.6	11.8	12.0	12.9
5.4	8.7	8.0	9.5	9.1	8.7
5.43	6.5	3.4	5.5	3.7	3.7
5.6	26.8	25.9	29.1	29.1	31.9

Evaluation: In FY 2009, Management Areas 5.4 and 5.43 were not meeting the objective. However, as for a trend for all 5 management areas there is very little change as a whole. The two large management areas of 5.1 and 5.4 indicate a slight increase in 5.1 and a slight decrease in 5.4 for acres of very large trees. Management Area 5.43 represents 0.8 percent of the Forest. Subsequently, a large tree deficiency in this management area has a minor effect Forestwide.

Monitoring Item 11, Vegetative Diversity and Snag Retention

Reference Forest Plan Objective 211: Within a management area in conifer forested portions of the forest, provide an average of three hard snags greater than 9-inch dbh and 25 feet high per acre, well-dispersed across the forest, 25 percent of which are greater than 14-inch dbh.

Vegetation database queries were executed in February 2010 for this monitoring item.

Number of snags per acre is an output for each forested stand on the forest where there is tree inventory data. Annually, approximately 5-10% of the Forest has field data collected. The table below displays the 2006, 2007, 2008 and 2009 data.

From the vegetation database, the average number of standing dead trees per acre for diameter class 9 inch plus diameter trees by management area on conifer sites with a height 25 feet or greater is 1.7 snags for year 2005. For 2006 the Forest average is 1.3 snags per acre. For year 2007 the Forest average is 3.6 snags per acre. For year 2008 the Forest average is 3.6 snags per acre. For year 2009 the Forest average is 3.5 snags per acre.

Average number of standing dead trees per acre by Management Area for ponderosa pine and white spruce with a height greater than 24.9 feet.

Year >>>	2006	2007	2008	2009

Management Area	# of trees > 9-inch dbh	% trees > 14-inch dbh	# of trees > 9-inch dbh	% trees > 14-inch dbh	# of trees > 9-inch dbh	% trees > 14-inch dbh	# of trees > 9-inch dbh	% trees > 14-inch dbh
1.1A	1.6	37.5%	3.0	43.3%	3.0	43.3%	3.0	43.3%
2.2	2.2	45.5%	4.4	43.2%	4.4	43.2%	7.1	23.9%
3.1	1.6	31.2%	7.3	32.9%	7.2	33.3%	7.1	36.6%
3.31	0.4	25.0%	1.4	14.3%	1.4	14.3%	1.4	14.3%
3.32	2.4	29.2%	5.8	29.3%	5.8	29.3%	5.9	20.3%
3.7	1.4	28.6%	4.9	32.7%	4.6	34.8%	4.6	34.8%
4.1	1.2	25.0%	3.6	27.8%	3.6	30.6%	4.1	26.8%
4.2A	1.1	36.4%	5.6	35.7%	5.6	35.7%	5.4	37.0%
4.2B	2.7	22.2%	5.1	11.8%	5.1	11.8%	5.1	11.8%
5.1	1.2	25.0%	3.7	21.6%	3.7	21.6%	3.6	22.2%
5.1A	1.0	20.0%	1.1	18.2%	1.1	18.2%	1.1	18.2%
5.2A	2.6	26.9%	4.2	28.6%	4.2	28.6%	3.8	21.1%
5.3A	1.1	27.3%	2.3	21.7%	2.3	21.7%	2.3	21.7%
5.3B	5.7	33.3%	14.2	34.5%	14.5	34.5%	6.9	31.9%
5.4	1.5	20.0%	3.1	22.6%	3.0	23.3%	3.0	23.3%
5.43	1.5	20.0%	2.2	31.8%	2.0	25.0%	2.0	25.0%
5.4A	2.7	40.7%	5.2	44.2%	5.3	43.4%	5.4	42.6%
5.6	1.1	27.3%	3.5	28.6%	3.5	28.6%	3.4	29.4%
8.2	2.5	23.1%	3.2	40.6%	3.2	40.6%	3.2	31.3%
Number/Percent	1.3	28.6%	3.6	29.7%	3.6	23.6%	3.5	22.9%

The Forest will continue to monitor data on snag heights and the application of appropriate scientific literature.

FIA (Forest Inventory Analysis) published report data has not been provided to the Forest from the Northern Research Station or the Rocky Mountain Research Station for the re-measurement update for the Black Hills National Forest. There is a FIA report for the State of South Dakota dated for year 2005.

The vegetation database summary numbers continue to be updated for on-the-ground inventory data since recent fires or large tree mortality areas due to insects. Some of the wildfire areas are currently under stand exam contract for updating the vegetation database. Therefore, an estimate of standing dead from recent wildfires and recent tree mortality from insects is appropriate. Wildfires since year 2000 total approximately 175,127 acres. From the Forest vegetation database, a query of average number trees per acre which is 9 inches in diameter or greater resulted in an estimate of 150 trees per acre. Therefore, 150 trees per acre times 175,127 acres of wildfire 26,269,050 trees.

In wildfire areas, due to snag fall down from wind and the cumulative recent past fall downs an estimate is as follows:

Year 2009, 10% of the 2,758,250 trees standing = 275,825

Year 2008, 25% of the 11,033,001 trees standing = 2,758,250

Year 2007, 60% of the 18,388,335 trees standing = 11,033,001

Year 2006, 70% of the 26,269,050 = 18,388,335 trees

For year 2009, the estimated number of wildfire created snags applied across the Forest of 1 million forested acres results in approximately 0.3 snags per acre from wildfire areas (275,825 / 1 million acres). Tree mortality impacted from insects since year 1996-2009 is estimated at 396,000 acres (reference The 2009 Aerial Detection Survey Summary by Forest Health). Likewise, an estimate of 150 trees per acre times 396,000 acres results in 59.4 million snags times 70% fall down rate equals 17.82 million standing snags (396,000 x 150 = 59,400,000 x 0.3 = 17,820,000 standing snags) divided by the Forest of one million forested acres results in 17.8 snags per acre. The 0.3 snags per acre estimate from wildfire and 17.8 snags per acre from insects is an average across the Forest. In reality, the snags are concentrated in the wildfire areas and the insect tree mortality areas. Some areas have been logged where leave trees may have been recently hit by insects. Also, snags are created from prescribed fire, burning of large slash piles and wind-throw snap-offs. Snag density across the Forest ranges from 0-150 snags per acre. There have been no recent very large wildfires. Therefore the number of snags created from wildfires is decreasing due to fall downs. Most snags break down and snap off below 25 feet in height. Strong winds often break the standing snags from 15-25 feet in height or in the case of saturated soils from rain results in blown down trees at the ground level.

Evaluation: Wildfires and insect tree mortality results in above 3 snags per acre for the Forest. The identification of areas for the cutting of standing dead should be annually provided to firewood cutters. The Forest should consider a forest-wide cutting of standing dead for personal use firewood policy.

Monitoring Item 12, Burned Forest Habitat

Objective 11-03: "Following a wildfire, dead trees will be available for value recovery. Retain 50% of the recent (0-5 years) stand-replacing fire acreage up to 10,000 acres Forest-wide." Generally the highest priority areas to retain are those with greater than 70-percent pre-fire canopy closure…"

Following is a summary of the number of fires, total burned acreage, and acreage retained for habitat for the last five years. This objective was effective in 2006 (after the 10/05 Phase II decision), but earlier years are included to indicate available habitat. Relatively large, contiguous blocks of bark beetle killed trees are not included (the geographical analysis tool is yet to be refined).

FISCAL YEAR	NUMBER OF FIRES (NFS lands)	ACRES BURNED (NFS lands)	ACRES (%) RETAINED FOR HABITAT
2003	96	10,773	10,525 (97%)
2004	122	143	143 (100%)
2005	127	6,201	6,201 (100%)
2006	112	866	866 (100%)
2007	108	368	338 (92%)
2008	42	192	192 (100%)
2009	49	45	45 (100%)
Total	656	18,588 acres	18,310 (98%)

Evaluation

A total of 18,588 acres of burned forest habitat was created and largely retained over the last 7 years, exceeding the 10,000 acre objective. Approximately 200 acres in the Red Point Salvage Sale (2003 Fire) and 30 acres in an existing sale within the Boxelder Fire (2007) were salvaged. The total burned acreage does not differentiate stand-replacing fire, and does not include any relatively large (>1,000 acres), contiguous blocks of insect-killed trees which has also created habitat. Ponderosa pine killed in fire loses marketability very quickly due to wood borers and blue stain, thus very little has been salvaged.

Monitoring Item 14, Commodity Production, Regeneration

Regeneration is not specifically referenced Forest Plan objectives 303 – 305.

Vegetation database queries were executed in February 2010 for this monitoring item. Regeneration is measured from field survey or walk through survey on forested lands. When stands are stocked with a minimum of 150 trees per acre then stands are certified as regenerated. Stands are summarized annually by database query for a total number of acres certified for the Forest.

The total certified acres in fiscal year 2009 = 10,396 acres

Monitoring Item 15, Commodity Production, Timber Production

Objective 303: Offer the following allowable sale quantity (ASQ) of timber on suitable and available timberlands in the next decade:

Allowable Sale Quantity From Suitable Lands: (Decade Total)	
Sawtimber	
Million Cubic Feet	181
(Million) Board Feet	838
Roundwood	
Million Cubic Feet	21
(Million) Board Feet	N/A
Total	
Million Cubic Feet	202
(Million) Board Feet	838

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

Objective 305: The ASQ in Objective 303 includes the following non-interchangeable component in the Norbeck Wildlife Preserve. This portion of the ASQ is not interchangeable with the volume outside the Preserve.

Allowable Sale Quantity From Suitable Lands In Norbeck Wildlife Preserve: (Decade Total)	
Sawtimber	
Million Cubic Feet	5.4
(Million) Board Feet	27.0
Roundwood	
Million Cubic Feet	1.0
(Million) Board Feet	N/A
Total	
Million Cubic Feet	6.4
(Million) Board Feet	27.0

The 10-year allowable sale quantity expressed on an average annual basis:

Forest Plan	Million Cubic Feet (MMCF)	Hundred Cubic Feet (ccf)
Sawtimber	18.1	181,000
POL	2.1	21,000
Total ASQ	20.2	202,000

Vegetation database queries were executed in February 2010 for this monitoring item.

The allowable sale quantity (ASQ) in the Forest Plan is from FY 1997 through FY 2006.

There are 865,890 acres suitable and available for timber production (Forest Plan 1997 ROD – 36).

The ASQ is a maximum level of timber that may be sold during the first decade after plan approval. A ceiling on the level of timber that can be sold, the ASQ takes into account available funding, other multiple-use values, and compliance with standards and guidelines that provides environmental protection. ASQ is not an absolute yield that must be achieved (USDA Forest Service 1997b p. ROD-35).

Harvest acreage over the decade in the Forest Plan is an estimated 255,000 acres or average 25,500 acres per year at full funding level. (USDA Forest Service 1996b, Appendix H - 189).

Since ASQ is for one decade and it may be longer before the Plan is again revised, I am establishing guideline 2402 which limits harvest in the decade beginning in fiscal year 2007 to less than 202 million cubic feet. (USDA Forest Service 1996b, p. ROD - 35).

Year 2009 Summary

There were 2 management decisions addressing 108,076 acres in planning areas.

1997 Forest Plan Objective 303

Year 1st Decade	Sold ccf	Cut ccf	Harvested Acres
1997	166,538	119,231	15,307
1998	154,149	116,202	14,307
1999	144,956	140,003	14,238
2000	76,307	131,080	13,567
2001	20,725	157,508	12,442
2002	91,212	123,595	15,123

2003	81,443	135,619	16,500
2004	171,032	149,378	17,795
2005	145,082	165,741	18,200
2006	147,790	154,065	22,430
Decade Total	**1,199,234**	**1,392,422**	**159,909**
Decade Average	**119,923**	**139,242**	**15,991**
2nd Decade			
2007	177,878	180,219	18,286
2008	254,294	192,861	26,844
2009	211,563	228,896	19,270

Evaluation

The first decade average annual sold volume is 119.9 million cubic feet which is below the objective of 181 million cubic feet. The 2nd decade is increasing in volume sold and volume cut due to management efforts of reducing forest mortality from pine beetles. Management's efforts to reduce tree mortality from beetles is predicted to increase the volume sold. This trend is predicted to result in a volume level above the guideline for the 2nd decade.

Norbeck Wildlife Preserve

For the Forest Plan period of 1997-2006 (decade) in the Norbeck Wildlife Preserve, there has been 2 timber sales sold, Needles #2 and Grizzly2. The non-interchangeable component volume is 5.4 million cubic feet (54,000 ccf) of sawtimber (Objective 305). Needles #2 sold 14,379 ccf which is all in Norbeck. Needles #2 harvested 16,385 ccf. Grizzly sold 14,923 ccf. Approximately 61% of Grizzly2 is in Norbeck. Grizzly2 has been harvested at 12,672 ccf. The portion of Grizzly2 in Norbeck is 7,730 ccf (12,672 ccf times 61%). The Needles #2 volume plus Grizzly2 volume within Norbeck is approximately 29,057 ccf (16,385 ccf + 12,672 ccf).

Evaluation

Needles2 completed sawtimber harvest in the 1st decade at 16,385 ccf. Grizzly2 completed sawtimber harvest in the 2nd decade at 12,672 ccf. The objective 303 is for 5.4 million cubic feet per decade. Each timber sale is below the objective for the decade.

Monitoring Item 17, Commodity Production, Forage Utilization/Residual

Objective 301: (This objective did not change with the Phase II Amendment). Produce on a sustained basis and make available up to 233 million pounds of forage for livestock and wildlife use each year (weather permitting). The location and amount of forage produced under the forest canopy will vary with the density of the overstory. This may necessitate changes in where and how both livestock and wildlife grazing takes place on a local basis over the rotation of a stand of timber.

a. Livestock use will be up to 127 million pounds of forage per year or approximately 128,000

AUMs.

b. Wildlife use will be up to 106 million pounds of forage per year or approximate population levels of 70,000 deer and 4,500 elk or other combinations that use the same amount of forage.

Monitoring

This objective relates to annual projected livestock forage use. The Land and Resource Management Plan (Forest Plan) includes Standard 2505 and Guideline 2506 which relate to annual livestock forage, and to proper use or residual levels in riparian and upland forest rangeland settings.

Following these directions the districts continue to develop Allotment Management Plans (AMPs) for allotments that have recently approved environmental assessments. The districts issue Annual Operating Instructions (AOIs) for each allotment on the Forest.

In fiscal year 2009, actual grazing use on the Forest was 117,983 AUMs. This is approximately 92 percent of the annual projected Forest grazing capacity of 128,000 AUMs available for livestock utilization identified in the Forest Plan.

Items Monitored	2003	2004	2005	2006	2007	2008	2009
Livestock AUMs Grazed	122,971	118,919	120,405	115,955	126,186	124,642	117,983

Districts monitored and evaluated approximately 623,571 acres of rangelands on 89 range allotments to determine forage utilization. Following is a breakdown of acres and grazing allotments monitored by ranger district:

Items Monitored	Hell Canyon	Mystic	Northern Hills	Bearlodge
Acres Monitored and Evaluated for Livestock Forage Utilization	250,877	179,016	218,012	101,138
Grazing Allotments Evaluated	19	27	24	10

The monitoring is completed by both Forest Service range staffs and livestock permittees. The districts collected forage utilization data by ocular estimate, photos, and stubble height measurements on key areas throughout the allotments. Utilization and stubble height measurements are and indicator of move times between and off the pastures; it is not to be used as a compliance tool.

Findings and conclusions relevant to the evaluation

1. Forage utilization throughout most of the allotments surveyed were within Forest Plan standards (2505 – Proper Allowable use Guidelines) and allotment management objectives. Measured forage utilization exceeded proper allowable use guidelines on a small amount of areas within certain pastures and some allotments surveyed (less than 10 %). Corrective action was and is being taken as needed; these areas will continue to be monitored to see if management changes

are needed.
2. The Forest continues to promote more permittee assistance in monitoring grazing allotments using the Wyoming Range Guide and Black Hills Range Guide.
3. Following are the more specific information from the Districts with the allotments surveyed and finding.

I. Mystic Ranger District

There were 26,493 AUMs of cattle grazing in 2009 on the Mystic Ranger District. A total of 4,871 cattle (all classes) were grazed on 29 allotments. Range management personnel monitored permitted grazing using the Ocular Estimate Method (R2-2200-OEH). Each method includes photo points to document pre- and post-grazing views.

Forage Utilization/Residual data was collected and evaluated in 2009; this evaluation work covered 27 of 29 allotments. A total of 179,016 acres were surveyed by the Forest Service. Acres monitored by allotment are as follows:

Bald Horse	23,621
Baseline	344
Bitter Creek	10,313
Clinton	6,408
Darrow	9,322
Deerfield	3,064
Ditch Creek	7,948
Dutchman	2,206
Gillette Prairie	3,594
Gordon Points	8,256
Hill City	7,661
Horsethief	2,062
Medicine Mountain	5,137
Murphy	5,737
Newton	2,371
Pactola	4,280
Palmer Gulch	5,968
Porcupine	8,198
Redfern	10,217
Reynold’s Prairie	17,742
Rimmer	2,011
Rockerville	1,964
Silver City	10,873
Six Mile	2,969
Slate Prairie	5,897
Soholt-Lyons	5,105
Tigerville	5,748

Findings

Based on a review of 2009 data, forage utilization percentages for upland vegetation throughout most of the allotments surveyed were within Forest Plan standards (2505 –Proper Allowable use Guidelines) and allotment management objectives. Vegetation responded to abundant moisture (snow and rainfall) and moderate temperatures, and production was qualitatively rated as above normal. Measured forage utilization exceeded proper allowable use guidelines on three allotments surveyed: Redfern, Rimmer, and Slate Prairie. These three allotments are currently being analyzed as part of the Mystic Range Project EIS; a decision is expected by fall, 2010 and is designed to improve resource conditions. Additionally, corrective action for the upcoming season included a discussion of monitoring results and methods to improve livestock distribution during Annual Operating Instruction meetings.

The Mystic District continues to promote increasing permittee assistance in monitoring grazing allotments using the Wyoming Range Guide and Black Hills Range Guide. Offered assistance includes on the ground training with permittees so they can monitor their permitted rangelands, and individual and group monitoring sessions with permittees.

One permittee turned in utilization monitoring data in 2009 – True Ranches for the Ditch Creek Allotment. They survey all pastures for a total of 14, 798 acres using photos and ocular estimates of use documented with the R2-2200-OEH form. Their results find compliance with upland proper allowable use guidelines.

II. Hell Canyon Ranger District

In 2009, 19 allotments covering 250,877 acres were evaluated for utilization using the ocular estimate method. The following table displays the results. Utilization is reported as the arithmetic mean if multiple sites in a particular pasture were assessed.

Allotment	Acres	Pasture	Utilization	
			Date	%
Argyle	363	Argyle	10/7/2009	20
Bull Flats	9697	Brash	10/19/2009	30
		Michaud	10/19/2009	35
		King Tut	10/19/2009	37
		Castle Rock	10/19/2009	54
Castle Creek	5330	East	8/31/2009	28
Central	14210	School House	7/24/2009	23
CNUB	40382	Unit 1	8/31/2009	24
		Unit 4	9/23/2009	30
		Unit 5	9/23/2009	28
		Unit A	8/31/2009	34

		Unit C	9/23/2009	18
		Unit D	7/14/2009	29
		Unit E	8/31/2009	44
		Antelope	9/23/2009	18
Driftwood	4038	West	8/4/2009	21
French Creek	9786	French Creek	6/22/2009	34
		Pope Springs	8/10/2009	33
Hell Canyon	18382	West Gurney	10/21/2009	34
		East Gurney	10/21/2009	26
		South Hell Canyon	10/21/2009	14
Hot Brook	4513	East	10/7/2009	56
Limestone	17742	Bear Springs	7/21/2009	33
Logan Flats	6300	West	8/4/2009	49
Lower Beaver	33035	Summit Ridge	7/14/2009	32
North Custer	13041	Main	10/2/2009	25
		East P2	10/2/2009	39
		Tiltrum	10/2/2009	28
		West	6/22/2009	16
Pass Creek	8559	Putnam Dam	8/4/2009	29
		Freeze Out	6/25/2009	32
Pleasant Valley	24504	Long Draw	8/20/2009	11
Richardson	13396	Roger's Shack	9/29/2009	25
		Pass Creek	9/29/2009	23
Shirttail	3598	North	10/7/2009	38
		South	10/7/2009	51
South Custer	13453	Mayo	9/28/2009	42
Tenderfoot	10548	Case/Paulsen	8/10/2009	3

		South Mile High	8/10/2009	23

III. Bearlodge Ranger District

*Method used was Ocular Estimate.

Allotment	Acres	Utilization	Date
Addition (Mark)	14,244		
Manly Hill Unit (Brimmer)	1,957	70%	8/25/09
Chatfield Unit	1,110	Heavy Use (notes)	8/26/09
Snook Unit	3,674	Heavy – Uplands Light – Riparian (notes)	9/3/09 9/3/09
Beaver Creek (Mark)	12,709		
Fawn Creek Unit – Upper Pasture	1,530	70%	7/20/09
Deer Crk/Cub Crk Unit – Lame Jones		21% enclosure 70% pasture	8/13/09 8/13/09
Divide (Mark)	3,367		
East Pasture	1,630	Moderate/High -Permittee 66% - FS 36% - FS	7/29/09 8/7/09 7/21/09
Riparian Pasture	152	Moderate (notes)	9/10/09
Lost Canyon (Mark)	7,955	Low/Moderate (notes)	7/30/09
North Bearlodge (Mark)	10,057	Low (notes)	8/3/09
Oak Creek (Mark)	5,532	Permittee Monitored, but haven't received documentation yet.	
Ogden (Kati)	8,397	24%	9/24/09
Redwater (Kati)	9,321		
Upper Pasture	2,360	30%	9/24/09
Lower Pasture	2,180	22%	9/24/09
Lower Pasture	2,180	14%	9/24/09
Sandcreek (Mark)	20,794		
Corral Creek Pasture	10,707	70% - Meadow 66% - Upland	7/23/09 8/10/09
Stoney Point (Mark)	8,762		
Blue Ridge Pasture	1,943	24%	8/6/09
Upper East Creek Pasture	1,982	16%	8/6/09

IV. Northern Hills Ranger District

Allotment	Acres	Utilization	
		Date	%
Bear Ridge	5,376		
Needles		9/29	40%
Soldiers Spring		7/22	30%

Boxelder	20,479		
Alpine		7/27	24%
Buskala	11,947		
Ranch		9/1	43%
McCoy		7/13	16%
Rod and Gun		7/13	7%
Cement Ridge	4,178		
Spotted Tail		9/24	30%
Lone Grave		9/24	50%
Corral Creek	6,766		
Corral Creek		10/1	46%
Crook Mountain	5,109		
Crook Mountain		8/19	Light
Custer Peak	4,730		
Lei		7/23	Slight to None
Peak		7/23	20%
Deadman	2,668		
East		7/20	43%
Dumont	2,510		
South		7/21	48%
North		8/26	40%
East Rapid	18,590		
Gimlet		9/1	50%
Griffith	5,685		
West Yearling		7/20	40%
Yellow Jacket		7/21	42%
Gudat	1,223		
East		8/5	33%
Higgins Gulch	15,664		
Citadel		8/12	44%
Hop Creek	5,366		
West		10/7	49%
East		7/23	50%
Middle		8/13	49%
Little Elk	9,479		
West		8/23	Photos
Little Spearfish	9,181		
Shirley		7/20	47%
Tornado		8/12	49%
Pasture	6,061		
Middle		9/16	Photos
Pettigrew	7,504		
Baldy		8/12	50%
Plateau	16,493		
Dry Gulch		9/10	40%

Roubaix	4,539		
Salt		10/1	Light to Moderate
Lake		10/1	Light to Moderate
West		8/5	34%
Tollgate	11,195		
South		8/12	41%
Upper Elk Creek	7,880		
Upper Elk		10/1	Light
Wildcat	13,320		
Clayton		7/20	38%
Wolff	22,069		
Harvey		7/27	37%
Tilson		7/27	29%
Crook Tower		7/27	Very Light
Total	218,012		

Monitoring Item 18a, Emphasis Species, Sensitive Species, Plants

Objective 221: Conserve or enhance habitat for R2 sensitive species and species of local concern (SOLC). Monitoring will be conducted at a Forest-wide level, not at the project level, and will be done for habitats or populations.

General Information

The completion of monitoring is dependent on appropriated funding and availability of personnel. A prioritization strategy was developed to serve as a working guide to prioritize monitoring for Region 2 sensitive plant species and Black Hills Species of Local Concern (SOLC) in the event that funding or personnel are not adequate to complete the full monitoring plan. The strategy was updated in 2008 to reflect knowledge obtained from monitoring data.

The National Weather Service classified 2009 as a normal year for precipitation in the Black Hills (National Weather Service 2010). This is an increase in precipitation after several years of drought conditions.

Noxious weeds and invasive species are discussed below in relation to Region 2 sensitive plant species and plant SOLC. For information regarding the treatment of weeds on the Black Hills National Forest, please refer to Black Hills National Forest Land and Resource Management Plan (1997) as amended by Phase II (2005), Black Hills National Forest Noxious Weed Management Plan (2003), and Monitoring Item 22.

Data used to compile this report is found in the Black Hills National Forest Plant Monitoring Database (2010).

Sensitive Species

Prairie moonwort (Iowa moonwort, *Botrychium campestre*)

Prairie moonwort ranges from the Great Lakes, across Iowa and Nebraska to eastern Colorado and northward to Alberta and Saskatchewan. Rangewide the species occurs primarily on well-drained soils in non-forested habitats, occasionally under shrubs in or at the margins of these habitats. Eleven occurrences are known on the Black Hills National Forest lands (Bearlodge, Hell Canyon, and Mystic Ranger Districts). All occurrences have been confirmed by genetic analysis by Dr. Don Farrar of Iowa State University. Additional sites exist on private land and at Wind Cave National Park. Prairie moonworts are extremely inconspicuous. Rangewide, it is considered a grassland species associated with sandy grassland habitats in prairies, dunes, railroad sidings, and fields over limestone. Black Hills sites occur on substrates with at least some component of limestone and are primarily in open grasslands, usually associated with high forb diversity and sometimes a high proportion of base and rocky soils. Little bluestem (*Schizachyrium scoparium*) and western snowberry (*Symphoricarpos occidentalis*) occur at a majority of sites. Black Hills occurrences range in elevation from 3,870 to 5,640 feet.

2009 Monitoring Design and Results Evaluation

1. **Revisit as many of the known prairie moonwort occurrences on Black Hills National Forest (BOCA5-1, BOCA5-5, BOCA5-6, BOCA5-7, BOCA5-8, BOCA5-9, and BOLI7-1) as possible annually. Document any new disturbances or changed levels of pre-existing disturbances.**
   Four known locations (BOCA5-1, BOCA5-6, BOCA5-8, and BOLI7-1) of prairie moonwort were revisited in 2009. The other sites (BOCA5-5, BOCA5-7, and BOCA5-9) were not revisited because of time constraints.

   At BOCA5-1 an active timber sale was observed 100 meters to the north and runoff from NFSR 117 was visible, however new disturbance to the site was not reported.
   At BOCA5-6, the number of moonworts observed was much less than the previous year's monitoring reported. Dr. Farrar hypothesized that this decrease in aboveground plants was that the 2007 prescribed burn caused a flush of nutrients to the plants which responded by producing spores and now the plants need to rebuild reserves before emerging again. Livestock were observed grazing in the vicinity of the plants, but no damage to prairie moonworts was reported.

   The vicinity of BOCA5-8 was thoroughly searched in 2009 and the site area was increased as new individuals were located. No new disturbances were reported and the impact of the road (pre-existing disturbance) does not seem to be increasing.
   Livestock had not yet accessed the site of BOLI7-1 at the time of monitoring, and no new disturbances were reported.

1. **Gather baseline data on as many of the recently reported (2 in 2009) locations as possible and on any newly located sites. Assess risks to those occurrences.**
   Two new monitoring sites were documented in 2009. BOCA5-10 is located at Hopkins Flat and baseline data was collected in May. Risks to the site were determined to be minor and include

use of the area by livestock and power line maintenance. BOCA5-11 is located at Six Mile Draw and baseline data was collected in June. Risks to the site include livestock use, timber harvest, and the presence of invasive species (Canada thistle and smooth brome).

2. **Document any noxious weeds or invasive plant species. Document if weeds are co-located with prairie moonwort or what distance they are located from occurrences if they occupy the same ecological type. Use this information to update a weed strategy with prioritization for all Region 2 sensitive and SOLC plant. Document if any weed treatment activity has affected occurrences.**

3. At BOCA5-1 smooth brome was the dominant vegetation along the roadside. The site boundary at BOCA5-6 was extended in 2009, and the newly discovered area contains hounds tongue (*Cynoglossum officinale*) and Canada thistle in the same ecotype, but not co-located with prairie moonwort. No non-native or invasive species were reported at BOCA5-8 or BOLI7-1. None of the prairie moonwort sites had evidence of weed treatment activity affecting these occurrences.

Narrowleaf grapefern (slender moonwort, *Botrychium lineare*)

Narrowleaf grapefern is historically known from California and Utah and currently from Colorado to Washington, Montana, Alaska, and the Yukon Territory. Western populations of the species occur primarily on limestone substrates in a variety of habitats including heavily forested sites, meadows, fen-like seeps, and gravelly roadsides. Seven occurrences are known from the Black Hills National Forest (Bearlodge, Hell Canyon, and Mystic Ranger Districts) as well as Wind Cave National Park. All occurrences have been genetically confirmed by Dr. Don Farrar of Iowa State University. All sites occur in openings on soils with some component of limestone. Rangewide, this species has often been documented in areas of natural and anthropomorphic disturbance. Black Hills occurrences range in elevation from 4,200 to 6,160 feet.

2009 Monitoring Design and Results Evaluation

1. **Revisit as many of the known narrowleaf grapefern occurrences on Black Hills National Forest (BOLI7-1, BOLI7-2, BOLI7-3, BOCA5-1, BOCA5-6) as possible annually. Document any new disturbances or changed levels of pre-existing disturbances.**

   The five known locations of narrowleaf grapefern were revisited in 2009. There were no new disturbances or recent livestock impacts reported at BOLI7-1.

   At BOLI7-2, livestock were noted at the bottom of the drainage on NFSR 868, near the hybrid portion of the site. Light trailing through the narrowleaf grapefern population; however, there was no discernable utilization in either portion of the site.
   There was no sign of recent grazing or logging at the narrowleaf grapefern population or in the immediate surrounding area at BOLI7-3; however, livestock were observed in Hughes Draw, approximately a mile upstream.

   At BOCA5-1, an active timber sale was observed 100 meters to the north and runoff from NFSR 117 was visible, however new disturbance to the site was not reported.

At BOCA5-6, the number of moonworts observed was much less than the previous year's monitoring reported. Dr. Farrar hypothesized that this decrease in aboveground plants was that the 2007 prescribed burn caused a flush of nutrients to the plants which responded by producing spores and now the plants need to rebuild reserves before emerging again. Livestock were observed grazing in the vicinity of the plants, but no damage to prairie moonworts was reported.

2. **Gather baseline data on the two recently reported (2008) locations and any newly located sites. Assess risks to those occurrences.**

   BOLI7-4 and BOLI7-5 were located during 2008 survey. BOLI7-4 appeared secure with no immediate threats to the occurrence except for the possibility of off road vehicle (OHV) and livestock use of the site. BOLI7-5 also appeared secure with similar threats. Livestock were observed within the same watershed on the day of monitoring; however the actual site had not been grazed.

3. **Document any noxious weeds or invasive plant species. Document if weeds are co-located with narrowleaf grapefern or what distance they are located from occurrences if they occupy the same ecological type. Use this information to update a weed strategy with prioritization for all Region 2 sensitive and SOLC plant species. Document if any weed treatment activity has affected occurrences.**

   Monitoring in 2009 revealed neither new populations of invasive plant species nor treatment effects at BOLI7-1 or BOLI7-5.

   At BOLI7-2 no new non-native or invasive plant populations were reported in 2009; however a small patch of cheatgrass (*Bromus tectorum*) was reported within ten feet of the site. Hounds tongue (*Cynoglossum officinale*) and field pennycress (*Thlaspi arvense*) were observed on the nearby roadbed. Musk thistle (*Carduus nutans*) was observed in a different ecotype than narrowleaf grapefern, but was common along the main road.

   No invasive species other than smooth brome (*Bromus inermis*) were reported from BOLI7-4.

   At BOCA5-1, smooth brome was the dominant vegetation along the roadside. The site boundary at BOCA5-6 was extended in 2009, and the newly discovered area contains hounds tongue (*Cynoglossum officinale*) and Canada thistle in the same ecotype, but not co-located with narrowleaf grapefern.

Foxtail sedge (*Carex alopecoidea*)

Foxtail sedge was confirmed on the Black Hills National Forest in 2000. Currently, more than 30 occurrences have been documented between the Bearlodge and Northern Hills Ranger Districts (3,840-5,900 feet). These occurrences are located in the Cement Ridge area (along the South Dakota and Wyoming border) and the Bearlodge Mountains of Wyoming. Foxtail sedge is usually located along open, perennial streams and is often associated with historic beaver dams or ponds. Occurrences have also been documented in riparian corridors dominated by white spruce (*Picea glauca*) and in drainages with dense shrub cover. No matter, the dominant vegetation, foxtail sedge

is usually found in the transition between saturated and mesic soils.

2009 Monitoring Design and Results Evaluation

1. **Annually monitor presence/absence at sites CAAL8-16, CAAL8-19, CAAL8-20, CAAL8-22, CAAL8-30 and CAAL8-31. Document site endpoints with a GPS (if changes in site extent are observed). If a contraction of the occurrence is noted, document the reason if it can be determined. Observe density of concentration areas and compare to previous years. Assess habitat condition.**

   All five core foxtail sedge sites were monitored in 2009.

   Foxtail sedge was present at CAAL8-12 and individuals appeared healthy with many reproductive stalks. OHV tracks were observed on the closed road adjacent to the site; however foxtail sedge was not directly impacted. A contraction in the size of the site was not reported.

   Monitoring of site CAAL8-16 revealed that foxtail sedge was still present. It was scattered among thick brush in some areas, as well as in openings along the creek margins and among other graminoids. A contraction in the size of the site was not reported.

   A late September visit to CAAL8-19 revealed recent ATV tracks in the drainage bottom as well as in the side drainage. Recent livestock use resulted in trampling to bare mud, hummocking, and stream bank alteration near foxtail sedge and in adjacent suitable habitat. There was recent livestock trailing along creek margins and a few heavily used and trampled stream crossings. Overall utilization along riparian area is light however, and utilization is heavier in adjacent upland areas. In addition to use of the site by livestock, monitoring reported evidence of wildlife use of the area (elk tracks). Foxtail sedge was reported from the east end of the gulch on both sides of the fence (Forest Service and private lands), as well as from the west end of the site. No contraction of the site was reported.

   The exclosure at CAAL8-20 showed evidence of light livestock use (minor stream bank alteration, trampled grass, trailing, and manure) most likely caused by a calf observed in the exclosure at the time of survey. Some direct grazing had occurred on foxtail sedge outside the exclosure, but the impact was not severe. Grazing was more evident on upland species at the bottom of the site. Foxtail sedge within the exclosure appeared robust and healthy with many seed heads. In general, the vegetation excluded from grazing appeared thick and lush. Foxtail sedge was dense and with many fruiting culms north of the exclosure. Elk scat, tracks, and wallows were also observed in the area.

   Overall the site condition and habitat quality of the Pole Cabin site (CAAL8-22) were comparable to previous years. All sub-populations of foxtail sedge are present and occur in comparable densities to previous years. Foxtail sedge occurs in open areas as well as scattered under willows and hawthorn cover in the drainage bottom. Many individuals had finished dispersing seed by late September. Very minor grazing on foxtail sedge was observed and is not anticipated to negatively impact the browsed plants. In general individual plants appeared larger, more robust, and had more seed heads at the west end of the site. Plants at this end of the site are more sheltered by rocks and logs along the stream bank and thicker shrubs. By contrast, the east end of the site is more accessible to livestock and elk and shows signs of

extended livestock use (stream bank alteration (estimated >50%) and unstable stream banks (sloughing and shearing)). Upland vegetation surrounding the site was grazed to less than two inches in many areas and had common dandelion (*Taraxacum officinale*), clover (*Trifolium spp*.), timothy, Kentucky bluegrass (*Poa pratensis*), plantains (*Plantago sp*.), yarrow (*Achillea millefolium*), and other species that increase with grazing as dominant species.

Monitoring of CAAL8-30 in 2009 reported that seed head production appeared to be good this year (estimate of 70% of plants in mature fruit), with several seed heads on some clumps. Evidence of current livestock use including fresh manure, stream bank alteration, trailing, and hummocking at crossings was also reported. Light grazing of foxtail sedge was observed and several individuals had been trampled by livestock, including plants found directly in livestock trails. Overall livestock utilization in the site area was moderate. Use appeared heavier than 2008, but not as heavy as previous years.

Livestock was present when botanists surveyed CAAL8-31. The stretch of Beaver Creek associated with subpopulation A appeared much healthier than it did when visited in 2008. Grazing use by cattle was much lighter and appeared to have occurred earlier in the season. However, fresh cow tracks were observed and two cows were seen in the area of subpopulation B. More foxtail sedge was observed this year than last and it could be positively identified because it still had seed heads. Even though the livestock situation was somewhat improved this year, the condition of the creek is still degraded. There were a couple of downcut areas noted, and generally the elevation of the stream is so far below the banks that moisture requirements for riparian vegetation cannot be met. A 6" tall hand stacked rock dam that blocked the width of the channel was observed. It wasn't there in 2008 and the purpose could not be determined. Very few sedges of any kind were growing on the flood plains. Foxtail sedge was limited to small depressions where moisture gathers. Most of the foxtail sedge seen were wispy and had shriveled and pale perigynia.

Little evidence of livestock access was observed in subpopulation B, just light trailing and utilization. The drainage had good diversity with very few weeds with the exception of hound's tongue that was growing on the slopes at the edge of the drainage. Vegetation is dominated by sedges and rushes in wetter areas and creeping bentgrass and Kentucky bluegrass in the drier areas. Much of the vegetation was waist high. Foxtail sedge was patchy and scattered along the drainage bottom. A few of the plants had been trampled or lightly grazed. There was a concentration of foxtail sedge in and around a hawthorn thicket where cattle have been bedding. Approximately 30% of the foxtail sedge at this subpopulation had produced fruit this year. This part of the site was more stable than the population in the main drainage.

Foxtail sedge in subpopulation C had a patchy distribution. The stream flows water intermittently and foxtail sedge occurs in both moist and dry areas. Overall the population appeared healthy and robust with most plants producing fruiting heads. Monitoring reported evidence of last year's high water and bank scouring. Some evidence of livestock trailing was reported, but it does not appear that livestock had been at the site long. Hummocking and stream bank alteration from previous years was still evident with the most evidence of trampling and bedding in shadier areas under aspen.

Foxtail sedge in subpopulation D was also distributed patchily with about 20-30 clumps observed. Overall the population appears healthy and robust with most clumps having several

fruiting heads. Evidence of livestock access and use was only slight with only little if any direct grazing or trampling of foxtail sedge observed.

2. **Implement monitoring using transects at CAAL8-19, CAAL8-20, CAAL8-22, CAAL8-30, and CAAL8-31 regarding the effects of restricting livestock grazing on all or portions of these occurrences to assess whether Standard 2505f has been met. At a minimum, establish photo-point monitoring. Implement monitoring before exclosures are built when possible to generate baseline data for comparison to data collected after exclosures are built.**

   The small exclosure constructed in 2007 at CAAL8-19 was present and in good repair when visited in 2009. Dense patches of foxtail sedge inside the exclosure are robust and healthy with many fruiting heads. Some vegetation inside the exclosure appeared to be lightly grazed (not foxtail sedge) and a few cow hoof-prints were seen inside the exclosure, but appeared to be from a few stray animals. The grazing was likely the result of a combination of wildlife and livestock. The west fence of the exclosure bisects a dense patch of foxtail sedge. Foxtail sedge in the exclosure is very dense and robust with many fruiting heads, whereas foxtail sedge outside the exclosure (near the fence) had been trampled to the point of exposing bare soil with only a few tufts of vegetation remaining. Botanists pulled brush next to the fence in this area in an attempt to discourage further trampling.

   A large new exclosure was constructed at the Pettigrew Gulch foxtail sedge population (CAAL8-20) in 2008 (to meet FP standard 2505f). Four line-intercept transects for foxtail sedge were established in 2009 (two inside and two outside the exclosure). Monitoring of the site revealed stream bank alteration, trampling, trailing, and bank shear from livestock along the north exclosure fence. New trails and stream crossings were likely caused by changes in travel patterns caused by the new exclosure fence. The livestock watering tank (at Emerald Spring) above the new exclosure was empty and not functioning at time of survey. This improvement was also non-functional in 2008. A tree had fallen and broken the intake pipe and water from the broken pipe was running across the hillside. Livestock access to the saturated soils caused trampling and hummocking surrounding and down-slope of the tank. Northern Hills District range personnel were notified about the situation.

   Two Line Intercept transects were established at CAAL8-22 in 2008, one inside and one outside the exclosure. These transects were re-read in 2009 and two additional transects were established. Photos were taken at established photo points were re-taken on 8/28/2009. Grass within the new exclosure was much thicker and more robust than outside exclosure and was dominated by creeping bentgrass (*Agrostis stolonifera*) and timothy (average height 2.5-3.5 feet tall). Foxtail sedge was present and robust within the new exclosure (2.5-3.5 feet tall) and exhibited healthy foliage and reproduction.
   The exclosure boundary fence at CAAL8-30 was finalized in 2009 with construction expected to be completed by late fall 2009. Potential exclosure sites at CAAL8-31 were mapped in August of 2009.

3. **Document observations regarding whether foxtail sedge sites in Dugout Gulch Botanical Area (CAAL8-16) and Upper Sand Creek Botanical Area (CAAL8-12) are accessed by livestock to assess the status of Forest Plan Standard 3.1-2503.**
4.

When the foxtail sedge population at Upper Sand Creek was visited on August 24, 2009, ten head of livestock were observed in the site. Vegetation was matted from livestock bedding and there was recent trailing in the area. More trailing (to bare mud) was observed at the northern end of site where the drainage is narrow and the road follows the drainage bottom. Bedding and trampling occurred in and around foxtail sedge, directly impacting the plants. Some recent hummocking from livestock also observed in wetter areas of the habitat. Evidence of grazing on foxtail sedge was observed, and reproductive structures had been removed; however, overall utilization of the area was light to moderate. It did not appear that livestock had been in the pasture long.

Livestock was present in Dugout Gulch Botanical Area (CAAL8-16) site on September 16, 2009 (time of monitoring). Seven head were observed in the drainage east of the green gate. Manure and faint livestock trailing were observed on both the east and west sides of the green gate. Recent stream bank alteration from livestock had occurred in site area (more prevalent east of the green gate). A few deep cow tracks (more than 4 inches deep) were observed directly on and adjacent to foxtail sedge. A fence crosses the creek twice toward the west end of the site (outside the botanical area). Livestock utilize the south side of the fence and stream bank alteration was estimated at more than 90%.

5. Document any noxious weeds or invasive plant species. Document if weeds are co-located with foxtail sedge and, if appropriate, at what distance from foxtail sedge individuals the weeds occur. Use this information to update a weed strategy with prioritization for all Region 2 sensitive and Black Hills National Forest SOLC plant species. Document if any weed treatment activity has affected individuals within an occurrence.

The Upper Sand Creek site (CAAL8-12) is dominated by non-native and invasive species. Canada thistle is co-located with foxtail sedge and occurs in dense stands throughout the site. Musk thistle and Common tansy (*Tanacetum vulgare*) occur in dense patches in the same ecotype as foxtail sedge. Absinthium (*Artemisia absinthium*), common St. John's wort (*Hypericum perforatum*), and cheatgrass were all common along the adjacent road, in drier soil. Timothy was common in the site area and hounds tongue was observed occasionally in the same ecotype as foxtail sedge.

The Dugout Gulch site (CAAL8-16) also has a high concentration of non-native and invasive plant species, both within the site and along the trail. Lesser burdock (*Arctium minus*), hound's tongue, and Canada thistle are all dense in areas of the drainage bottom, especially at the west end. Bull thistle and timothy are scattered in the drainage bottom. St. John's wort, sulfur cinquefoil (*Potentilla recta*), and crownvetch (*Securigera varia*) occurred in scattered patches along the adjacent road. Common buckthorn (*Rhamnus cathartica*) was dense in areas of the drainage with many seedlings and young plants. It is even a dominant component of the overstory in some areas.

At Ladyfinger Gulch (CAAL8-19), Canada and bull thistle were scattered along the drainage and were observed within ten feet of foxtail sedge in the same ecotype. Timothy, oxeye daisy (*Leucanthemum vulgare*), and yellow rocket (*Barbarea sp.*) grow along the drainage in the same ecotype as foxtail sedge. It appears that the species composition here is shifting toward non-natives.

Dense patches of non-native and invasive species occur at CAAL8-20. Canada thistle occurs in patches throughout drainage and co-occurs with foxtail sedge. It is particularly thick in the exclosure. Bull thistle, musk thistle, hound's tongue, smooth brome occur occasionally throughout the drainage bottom and are often co-located with foxtail sedge. Oxeye daisy, common tansy, and sulfur cinquefoil occur infrequently along the drainage, but do not co-occur with foxtail sedge at this site.

At CAAL8-22 non-native and invasive species had a similar density both inside and outside the exclosure fence; however inside the exclosure more plants were successful in producing seed heads and were larger overall. Canada thistle, musk thistle, hound's tongue, and timothy were all present inside exclosure. Monitoring reported evidence of treatment of non-native and invasive species took place earlier in the season, both in and out of the exclosure. Musk thistle and hound's tongue were co-located with foxtail sedge, occurring frequently within the site. Common tansy, bull thistle, and absinthium were occasionally co-located with foxtail sedge, but were most abundant along the roadsides in patches. Canada thistle was found within one meter of foxtail sedge and occurred in dense patches both in and out of the exclosure.

The Deer Creek population of foxtail sedge (CAAL8-30) is co-located with Canada thistle, hound's tongue, bull thistle, musk thistle, and timothy. Canada thistle occurs consistently in the draw bottom; however several galls were observed on Canada thistle individuals and many had their seed heads browsed.

The Beaver Creek population of foxtail sedge (CAAL8-31) occurs in the same ecotype as timothy, bull thistle, Canada thistle, musk thistle, and hound's tongue. Common tansy and oxeye daisy occur in the same drainage as foxtail sedge.

Lesser yellow lady's slipper (*Cypripedium parviflorum*)

Lesser yellow lady's slipper is primarily circumboreal in distribution and rangewide is generally found in shady deciduous and mixed woodlands near streams, shrublands, swamps, bogs, and wet forests. Habitat in the Black Hills includes stream banks under both spruce and deciduous overstories, moist cliffs (usually north-facing), and moist areas/seeps under white spruce or mixed conifer forest. Black Hills occurrences range in elevation from 3,500 to 6,500. An estimated 4,000 individuals exist in over 50 different locations across the Forest (Bearlodge, Mystic, and Northern Hills Ranger Districts).

2009 Monitoring Design and Results Evaluation

1. **Relocate as many geographically spaced occurrences as possible of previously reported locations (or a combination of previously located sites and newly located sites) when the plant is most identifiable (primarily during the flowering period) and gather baseline data. If possible include reported occurrences in M.A. 3.1 Botanical Areas. Assess risks to those occurrences.**

   In 2009, monitoring and baseline data collection occurred at CYPA19-29, CYPA19-44, and CYPA19-46. More sites were not visited because of lack of time and resources.

The yellow lady slipper site in Waite Gulch (CYPA19-29) was discovered in 2007 during botanical survey. The site consisted of undisturbed habitat with no recent logging in the area; however there were some very old stumps on the slopes indicating that the area had been logged historically.

The yellow lady slipper population at Dalton Lake (CYPA19-44) was discovered during botanical monitoring in 2007. The site consisted of three plants in excellent habitat with good species diversity and lacking ground disturbing activities. There was a great deal of downed woody material and litter cover at the site was approximately 30%. There was a closed road that skirted the upper part of the drainage. This population is not far from the open road, yet access was difficult due to slope, downed trees, and other woody debris.

The yellow lady slipper population at South Stagebarn Canyon (CYPA19-45) was discovered during botanical monitoring in 2007. The bottom of Stagebarn Canyon is degraded due to historic OHV use. It is likely that some habitat was affected by this use. The population itself was not accessible for off-road traffic due to cliffs and steep walls and foot access was marginal. Overall, the habitat was in good shape and no current management activities were apparent.

Another population of yellow lady slipper that occurs in South Stagebarn Canyon (CYPA19-46) was visited in 2009. In spite of the closure to off road use, impacts by OHV use are still evident in the population area. Recent motorcycle tracks were seen in the adjacent area and many of the rocks in the area had scratches from low clearance off-road vehicles. Also there were tracks going around the rockiest areas on the north side of the existing trail through potential yellow lady slipper habitat. In spite of the habitat being altered, the plants on the bank appeared healthy. Shrub cover was fairly dense on the slope with smaller amounts of herbaceous vegetation. The steep slope protects the plants from OHV use. Insect activity was evident on the yellow lady slipper and surrounding vegetation in this area.

2. **Document any evidence of plant collection at any of the sites.**

   There was no evidence of plant collection at CYPA19-29, CYPA19-44, CYPA19-45, or CYPA19-46.

3. **Document any evidence of livestock access to occurrences in botanical areas.**
   CYPA19-29, CYPA19-44, CYPA19-45, and CYPA19-46 do not occur within botanical areas.

4. **Document any noxious weeds or invasive plant species. Document if weeds are co-located with lesser yellow lady's slipper or what distance weeds are located from occurrences if they occupy the same ecological type. Use this information to update a weed strategy with prioritization for all Region 2 sensitive and SOLC plant species. Document if any weed treatment activity has affected occurrences.**

   No noxious or invasive plant species were reported at CYPA19-29, CYPA19-44, CYPA19-45, or CYPA19-46.

Giant helleborine (stream orchid, *Epipactis gigantea*)

Giant helleborine occurs in western North America from British Columbia to California and east to Texas. Rangewide, it occurs in wet meadows, seepage slopes, and the base of cliffs along streams and rivers. In the Black Hills it has only been located at Cascade Springs in Fall River County, South Dakota. It is likely dependent upon the constant moisture and warmth associated with these springs. No other warm springs have been documented on Black Hills National Forest.

The confinement of giant helleborine to one watershed in the Black Hills makes the South Dakota population vulnerable to random event such as extreme drought, disease, fire, or flooding. However, the existence of multiple sub-occurrences of the species in the watershed may help buffer against catastrophic disturbances in the area.

Effects of the Alabaugh Wildfire (July 2007) were monitored in 2009 as were effects associated with ongoing recreational use and the presence of invasive plant species. Canada thistle (*Cirsium arvense*) is a South Dakota state-listed noxious weed. Russian olive (*Elaeagnus angustifolia*) and salt cedar (*Tamarix sp.*) are non-native invasive species of concern. All of these species occur near Cascade Creek and are being treated by Hell Canyon Ranger District. In 2009, Hell Canyon Ranger District personnel began treatment and removal of Russian olive from the Cascade Drainage. The results of this treatment will be monitored during future visits.

2009 Monitoring Design and Results Evaluation

1. **Monitor presence/absence of giant helleborine concentration areas along stream transects on an annual basis. If individual plants or subpopulations are observed to decline, consult with the Rocky Mountain Research Station to design a more rigorous monitoring plan.**

   As was the case in 2008, botanists observed far fewer giant helleborine plants at Cascade Springs than have been observed in previous years. Prior to 2008, the Cascade Springs population size was recorded as 501-1,000 or 1,001-10,000. In 2008 botanists estimated that fewer than 500 plants were observed. In 2009 there were so few individuals that individuals could be counted (this was not practical in previous years because of the high density of plants). Several stems were likely overlooked due to the thick vegetation and inaccessibility of some areas; however the decline in numbers from previous years was dramatic. A total of 49 giant helleborine stems were counted (44 vegetative and 4 in flower). This decline in population has been observed since 2007. Accordingly a new, more intense, monitoring strategy was developed in consultation with the Rocky Mountain Research Station and will be used in 2010. A usually dense population of giant helleborine located on a point bar was absent in 2009. This area is now dominated by poison ivy (*Toxicodendron rydbergii*) and Canada thistle. Similarly a mound at the confluence of channels once covered in giant helleborine, was covered in goldenrod (*Solidago sp.*) with southern maidenhair fern (*Adiantum capillus-veneris*) along edges.

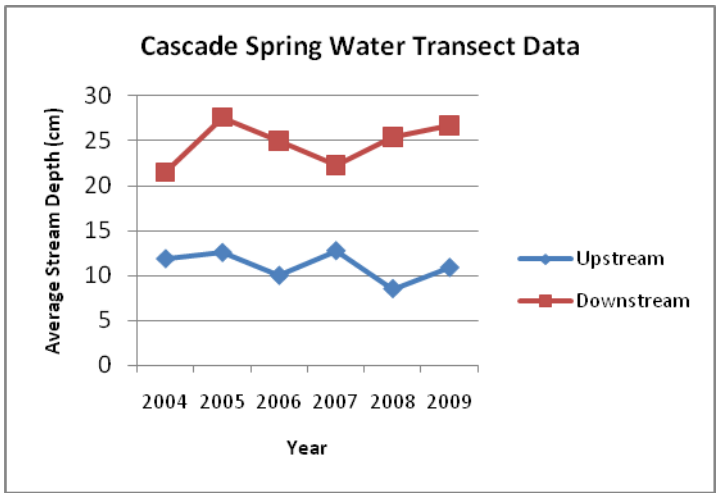
   In addition to the loss of individuals, a few giant helleborine plants were observed with bright yellow fungus and brown spots of unknown cause. At this time, we are unsure as to the cause in decline of the population, but records of previous years (2000-2008) indicate that the giant helleborine population declines in drought years, only to recover after a few wet years.

2. **Document recreation nick point trails that extend into giant helleborine concentration areas and record impacts.**

Previously noted nick points are still present; however no significant new use or trails were observed.

3. **Monitor water levels at the two permanent transect locations on an annual basis at the time of appropriate phenology for monitoring giant helleborine each year.**
Two permanent water transects along Cascade Creek at J.H. Keith Picnic Ground were established in 2004. Water level measurements have been recorded annually since then to coarsely document changes in water levels. As part of the established monitoring protocol, these transects were read on July 13, 2010. The mean of measured reading at each transect were calculated to obtain the average stream depth and are reported in the table below.

	2004 (July 2)	2005 (July 5)	2006 (July 14)	2007 (July 2)	2008 (July 28)	2009 (July 13)
Upstream Transect Average Stream Depth (cm)	**11.9**	**12.6**	**10**	**12.8**	**8.5**	**10.9**
Downstream Transect Average Stream Depth (cm)	**21.5**	**27.6**	**25**	**22.3**	**25.4**	**26.7**



Because of concern about impacts to groundwater from the Alabaugh Fire and expected future water development, the USGS reactivated the gauging station at the southern end of the picnic area. Data from this gauging station is available at http://waterdata.usgs.gov/sd/nwis/measurements/?site_no=432012103331100

5. **Document any noxious weeds and the following invasive species: Russian olive and salt cedar. Document if any weeds are co-located with giant helleborine or what distance they are located from the occurrence if they occupy the same ecological type. Use this information to update a weed strategy with prioritization for all Region 2 sensitive and Black Hills National Forest SOLC plant species. Document if any weed treatment activity**

has affected the occurrence.

Canada and bull thistle were co-located giant helleborine in places. Yellow sweet clover (*Melilotus officinalis*) and smooth brome (*Bromus inermis*) are also present and seem more rubust than previous years. Grape vines (*Parthenocissus vitacea* & *Vitis riparia*) were observed climbing over most vegetation. Field bindweed (*Convolvulus arvensis*) was reported to be thriving in the drier upland areas. Anticdotal evidence reports a decline in the presence of invasive and noxious weed species in the last two to three years. This is prehaps a result of consistent weed treatment efforts over the last several years. A more robust invasive species monitoring strategy was developed and will be tested in 2010.

6. **Document erosion occurring at any giant helleborine concentration area.**

The Alabaugh Fire of July 2007 burned the timbered lands adjacent to Cascade Creek. Heavy rain events were recorded in 2007 and 2008. As a result of this change in sediment regime, it is expected that erosion will occur along Cascade Creek. In 2009, monitoring revealed some fresh bank under-cutting and scouring on cutbanks. At the time of monitoring, these sites did not show signs of revegetation.

7. **Document any verifiable unauthorized collections of giant helleborine.**

No evidence of collection of giant helleborine was reported.

Groundcedar (trailing clubmoss, *Lycopodium complanatum*)

Groundcedar is circumboreal and common across northern latitudes but disjunct or sparse at the southern limits of the species' distribution, such as in the Black Hills. Rangewide, it is restricted to moist microhabitats within boreal plant communities in ravines, steep drainages, and on moist streamside benches. There are ten occurrences of groundcedar reported from the Black Hills National Forest. These occurrences are located in the northern Black Hills (Bearlodge and Northern Hills Ranger Districts) on shaded, north-facing, white spruce dominated slopes often associated with paper birch (*Betula papyrifera*) or quaking aspen (*Populus tremuloides*). Black Hills occurrences range in elevation from 4,960 to 6,340 feet.

The persistence of groundcedar in the Black Hills is currently known to be contingent on conserving occurrences on public land. Over the past several years, the monitoring design has been modified based on discovery of new occurrences and to minimize site disturbance associated with monitoring. The number of occurrences, geographic distribution, elevation, occurrence size, and assessment of risks were of primary consideration in the design. A subset of five occurrences has been selected as core sites and plans are to monitor them on an annual basis.

2009 Monitoring Design and Results Evaluation

1. **Monitor the following groundcedar sites for presence/absence on an annual basis: LYCO3-1, LYCO3-4, LYCO3-5, LYCO3-8, and LYCO3-9.**

The Sand Creek population of groundcedar (LYCO3-1) appeared to be stable even though approximately 30% of individuals showed browning of leaves. Some of the plants that were brown may have died in 2008 and have not yet decayed. In addition to the die-off of older plants, replacement growth that had bright green and healthy color was also observed. Competing vegetation seemed to have increased this year across much of the site. Some of the groundcedar were barely visible due to the increase in low shrub canopy. It seems as though the groundcedar is thicker in open areas. An estimated five percent of the plants had strobili with immature fruit. Due to the stability and the fragile nature of this site, Black Hills botanists and Rocky Mountain Research Station personnel agreed that unless there is an event (management, fire, etc.) that opens up the canopy or threatens the stability of the site, it would be sufficient to monitor this site every 3 years. This would reduce the amount of impacts that the monitoring itself may be causing.

The Butcher Gulch population of groundcedar (LYCO3-4) was re-visited in 2009. The surrounding habitat appears to be recovering from the Grizzly Gulch fire of 2002. The Lycopodium complanatum in the burned area looked healthier than it did in 2008; however, the thick vegetation on the site made the groundcedar much harder to see. The plants had deep green color within both the burned and unburned areas. There was very little yellowing of the plants. One patch of groundcedar in the unburned area had excellent strobili production this year. Strobilli were more abundant than on any of the other populations monitored across the Forest in 2009. The site seems as stable as possible considering how recently the fire occurred.

The Tillson Creek groundcedar population (LYCO3-5) was visited in 2009. All six of the known subpopulations were relocated and the slope was surveyed for previously undocumented plants, but none were found. Each year the site has more downed woody material and continues to become more open. The plants in the furthest west subpopulation were fairly sparse but healthy appearing. No strobili were noted on the plants and only a small amount of browning of the plants. Moderate to heavy duff covered the area and some of the plants were actually growing out of a duff-covered log. Much of the overstory of spruce was dying or down. There was a moderate to dense cover of spruce regeneration; however, there also was a moderate amount of mortality of the seedlings and saplings.

The second patch was denser than the first; however there was an increased amount of yellowed groundcedar and few strobili were seen. The third subpopulation examined was a large, densely grouped bunch of plants growing in an area with moderate ground vegetation and a lighter litter layer than the first two. Only 4 strobili were observed on these plants.

The fourth group of plants were located in a more shaded location and were dense and deep green in color with very little yellowing. The fifth group of groundcedar had up to a third of the population yellowed or brown and was showing very little replacement or sprouting. Green and healthy looking plants were interspersed between the yellow and brown plants. There was heavier cover of competing vegetation at that location than at any of the other groundcedar subpopulation on the same slope.

The sixth subpopulation was the easternmost, and had healthy deep green plants with minimal yellowing. The plants had new growth and appeared vigorous even though they had no strobili.

Once again, no groundcedar were found of the previously existing population along a tributary

to the North Fork of Rapid Creek (LYCO3-8). Stiff clubmoss was found at the site (LYAN2-4). Some groundcedar may have been destroyed in 2007 by livestock trailing through the site. There was also a new spruce downfall (natural) in the site area that may have partially covered some plants with bark and debris. In addition, much of the overstory has been removed (both naturally and anthropomorphically) making the site more open than it was in the past.

A meeting of botany and range staff (from the SO and the Northern Hills District) was convened to determine if the trees that were felled at LYAN2-4 in late 2007 were effectively stopping livestock from trailing through the population. During the winter of 2008, an additional natural downfall occurred within the site that effectively blocked the area where livestock were trailing in 2008. Livestock and elk have been effectively routed to cross the creek upstream from the site. After viewing the site the group determined that the trailing impacts were mitigated for now; however, the site will continue to be monitored to ensure that the new livestock trail remains unobstructed.

The groundcedar population at Chicago Gulch was revisited in 2009. The population was concentrated into a small densely occupied microsite. No strobili were observed in 2009, but plants appeared green and healthy, with only a few browning individuals. Suitable habitat in the vicinity of the site was surveyed, but no new individuals were reported.

2. Once every five years, revisit all known groundcedar occurrences. All sites are scheduled to be revisited in 2009.

All eight known locations of groundcedar were visited in 2009. The status of the five core sites are discussed in item 1.

At LYCO3-2, most of the groundcedar had light green color and healthy new growth. Some small dead patches were observed; however there is three times as much light green as there is brown. The plants were so dense in areas that they created groundcover. The groundcedar was contained by two game trails. The population appeared to be stable.

The groundcedar population at Buskala Creek (LYCO3-7) was revisited in 2009. Two new subpopulations of groundcedar were found west of the original location. These patches were about 75 meters apart on the same contour level but upslope of the original location. The original location was the largest, most extensive, subpopulation at this site. The habitat was lush and mossy with thick twinflower (*Linnaea borealis*) and grouse whortleberry (*Vaccinium scoparium*). Most pants at this microsite were green and very healthy looking with lots of fresh growth. Monitoring reported an increase in slash and downed spruce in the site area. Mountain pine beetle kill was observed in the vicinity and will likely spread closer to the vicinity of the site and open up the canopy in the future. Currently only moderate pine beetle kill observed in site area. Overall, groundcedar plants appeared within the normal range of healthy variability observed for this species in the Black Hills. Only a few stems were observed with strobili and those found were very small and immature (it is possible that strobili may have still been emerging).

Baseline data was collected from the groundcedar population at Custer Crossing (LYCO3-10) in 2009. The site was open with a lot of downed woody debris, and moderate to heavy non-persistent litter. Seedling and sapling sized spruce was common in the site; however, no

regeneration of paper birch (*Betula papyrifera*) was observed. The paper birch trees were all mature, tall and spindly in shape, borderline decadent. Some of the ponderosa pine (*Pinus ponderosa*) was also decadent. In the immediate area of the groundcedar population, there was minimal herbaceous vegetation. The groundcedar was concentrated in a ten square meter area, where the slope was steeper and more open. There was much less of the other herbaceous ground cover where the groundcedar was dense. Past and present management activities in the vicinity appeared to be minimal. Cattle were heard in the meadow below, but there was no sign that they ever come up the slope.

3. **Review the series of permanent markers (placed in 2005) at points along the boundary edges of the Sand Creek groundcedar occurrence (site number LYCO3-1). Document presence/absence of groundcedar in the vicinity of each stake. Retake photos at each marker at least every five years and compare extent and condition of groundcedar to the last set of photos. (Photos were last retaken in 2008.)**

   Photos were taken at the established photo points; however many groundcedar plants were blocked from view by vegetation. Groundcedar was present at each marker and the population did not appear to be expanding or contracting.

4. **Document any noxious weeds or invasive plant species. Document if weeds are co-located with groundcedar or what distance they are located from occurrences if they occupy the same ecological type. Use this information to update a weed strategy with prioritization for all Region 2 sensitive and SOLC plant species. Document if any weed treatment activity has affected occurrences.**

   Noxious and invasive plant species were abundant in the drainage below LYCO3-1; however no weeds were found co-located with groundcedar. These species included common tansy, hound's tongue, common St. John's wort (*Hypericum perforatum*), and Canada thistle. Absinth wormwood was noted in the drainage bottom approximately one half mile upstream from the site. It was well established and appeared to be spreading down the drainage. Evidence of weed treatment was observed along the road, but this treatment was far enough away that it is unlikely to impact the site.

   Canada thistle, bull thistle, and hound's tongue were reported in the dry pine slope above LYCO3-2; however no noxious or invasive species were reported in the site.

   No weeds were noted within LYCO3-4; however, Tyrol knapweed (*Centaurea nigrescens*), Canada thistle, oxeye daisy, and hound's tongue were present in the drainage bottom and the opposing pine slope.

   No noxious or invasive plant species were reported from LYCO3-5 or LYCO3-7.

   No noxious or invasive plant species were reported from within LYCO3-8, but bull thistle, oxeye daisy, and hound's tongue were reported from the drainage bottom and along nearby road.

   No noxious or invasive plant species were observed in the immediate vicinity of LYCO3-9; however bull thistle, musk thistle, Canada thistle, common St. John's wort, and hound's tongue

were abundant in old skid trails (where site was logged in 2004).

Musk thistle, clover, and timothy were all found on the slope above LYCO3-10; however, no weeds were co-located with the groundcedar.

5. **Document if there are any impacts from livestock grazing (particularly, trails through the sites) in sites visited annually, and in all groundcedar sites when revisited every five years.**

   No evidence of impacts from livestock was observed at LYCO3-1, LYCO3-4, or LYCO3-5. No evidence of livestock use of the area was reported from LYCO3-2; however game trails pass through site on two edges of the population.

   No evidence of impact from livestock was observed in LYCO3-7; however occasional livestock and game trails occur across slope in the vicinity of the site. Most grazing occurs in the drainage bottom below the groundcedar population.

   Livestock seem to have been effectively prevented from accessing LYCO3-8. See discussion in item 1 for more details.

   Livestock access appears to be increased at LYCO3-9. This was most likely an effect of opening an adjacent area by logging. Light livestock use was observed on the trail adjacent to LYCO3-9. No damage to groundcedar individuals was reported, but remains a potential threat. Heavier recent livestock activity has occurred on the slope in the logged area of site (hoofprints, grazing, manure). Livestock use appears to be heavier on skid trails and in the drainage bottom, but some use was observed in unlogged suitable habitat as well (trailing, manure).

   There was no evidence of livestock use at LYCO3-10; however a wildlife trail was observed and some groundcedar were uprooted by the traffic.

Lesser roundleaved orchid (large roundleaved orchid, *Platanthera orbiculata*)

Lesser roundleaved orchid is endemic to the boreal regions of northern North America, with the distribution dipping further south on the eastern portion of the continent. Black Hills occurrences are found primarily on shady, north-facing slopes in paper birch/hardwood or white spruce forests on moist, rich, humus soils. Black Hills occurrences are found on three ranger districts (Bearlodge, Hell Canyon, and Northern Hills Ranger Districts) and range in elevation from 4,350 to 6,150 feet.

Lesser roundleaved orchid is relatively secure in the Black Hills based on the large number of occurrences (greater than 30) that are distributed in three geographically separated regions of the Forest (Bearlodge Mountains, northwestern Black Hills, and Black Elk Wilderness). In the Black Hills, the species is primarily limited by the small extent of cool, moist boreal habitat. Long-term droughts or dramatic climate changes characterized by drier, warmer conditions may present the greatest risk to lesser roundleaved orchid and its habitat.

The nine core occurrences were identified using two criteria: size (estimated number of individuals) and geographic distribution of the occurrences. Three occurrences from each of the three primary geographic areas were designated as core occurrences for annual monitoring. Although monitoring

focuses on the presence or absence of a given occurrence, a count of the total number of individuals observed at each site is collected (if time permits). If any of the core occurrences are extirpated, then the probable reason will be documented and new sites will be selected to keep a total of nine core sites.

The second purpose of monitoring, as originally designed, is to provide baseline data on the persistence of lesser roundleaved orchid during dry conditions. During a drought and during the first and second consecutive non-drought years, the design includes monitoring three additional sites (PLOR4-4, PLOR4-21, and PLOR4-22) for presence/absence and counting the total number of individuals observed at all 12 sites. The assumption was that the high numbers of lesser roundleaved orchid observed in 2000 were partially reflective of several years of above average precipitation. Additional drought year monitoring has taken place from 2002-2009. These data on lesser roundleaved orchid population persistence and numbers in both wet and dry years are important for reassessing the species and for annually re-examining the monitoring design. It remains unknown whether absence of lesser roundleaved orchid indicates dormancy or mortality.

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1. **Annually monitor presence/absence of known core site locations in the Bearlodge Mountains: site numbers PLOR4-1, PLOR4-2 and PLOR4-3. If any of the core monitoring sites is not present (refer to discussion above regarding climatic ties), document reason if it can be determined (i.e. drought, fire, noxious weeds).**

   The lesser roundleaf orchid at the upper fork of North Redwater drainage (PLOR4-1) was visited in August of 2009. Monitoring efforts reported a few faint game trails through site area and a well used livestock trail traversing the lower slope of the site area. The livestock trail at the lower portion of the site did not appear to be used recently, but received considerable use earlier in season or last fall. The site and habitat seemed moist and healthy, however only 4 PLOR4 individuals were found (same as in 2008).

   The lesser roundleaf orchid population at Fawn Creek (PLOR4-2) was visited and 23 plants found in 2009 (same as 2008). All of the individuals had some insect damage ranging from minor to enough to kill the plant. In general the plants in this population were chlorotic and unhealthy. Manure and trampling of vegetation was observed in the drainage below the site, but the steep and brushy nature of the site makes direct impacts to the plants unlikely.

   The lesser roundleaf orchid population at Cub Creek (PLOR4-3) was visited and four plants were counted (same as 2008). All of the plants had moderate browning and insect damage along with slight chlorosis. A livestock/wildlife trail was observed in a shallow drainage to the west of the site. There is no risk of impact to the site because it is too steep and lined with rock ledges that would impede livestock. No evidence of livestock use has been reported from the area.

2. **Annually monitor presence/absence of the Black Elk Wilderness core site locations: site numbers PLOR4-23, PLOR4-24 and PLOR4–25. If any of the core monitoring sites is not present (refer to discussion above regarding climatic ties), document reason if it can be determined (i.e. drought, fire, noxious weeds).**

The lesser roundleaf orchid population at Grizzly Creek (PLOR4-23) was visited and 26 individuals were observed. All plants found had at least some insect damage, holes, browning or leaf tissue missing (with as much as 20% of leaf tissue gone in most severe cases). Despite this, the population appeared to be healthy overall, and within the normal range of damage seen in previous years at the site. No plants were found in trailside subpopulation in 2009; however forb cover is very thick in this area and plants could have been overlooked.

Another lesser roundleaf orchid population at Grizzly Creek (PLOR4-24) was visited and thirteen individuals were counted. All lesser roundleaf orchids had at least some insect damage (holes, brown spots, leaf tissue missing). Damage ranges from a few scattered holes to 40% of tissue missing with the plants closest to the trail and a downed spruce tree the most impacted. Plants do not appear to be healthy; however, four produced flowering stalks. Monitors recorded fresh slash and down trees in the vicinity of lesser roundleaf orchids. Some plants were among the slash, especially at the western part of the site. Branches directly on and around plants were removed. Mountain pine beetle have infected ponderosa near the site.

Yet another lesser roundleaf orchid population at Grizzly Creek (PLOR4-25) was visited in 2009 and sixteen individuals were counted. Again, all plants had at least some insect damage with up to 30% of leaf tissue missing. And again, the damage seems to be within normal observed range for this species on the forest. Despite insect damage, plants seem to be fairly healthy overall; several had flowering stalks. All plants found within twelve meters of a hiking trail and are therefore susceptible to tramping and collection by recreationalists.

3. **Annually monitor presence/absence of three core monitoring occurrence sites in the northwestern Black Hills: site numbers PLOR4-6, PLOR4-12 and PLOR4-19. If any of the core monitoring occurrence sites are not present (refer to discussion above regarding climatic ties), document reason if it can be determined (i.e. drought, fire, noxious weeds). Continue to record site changes at PLOR4-6 relative to 2004 hardwood restoration treatment.**

A population of lesser roundleaf orchid at Chicago Gulch (PLOR4-6) was visited and ten plants were counted. An orchid was found in an area that had not had individuals present since 2004; however the plant had browning/yellowing on the leaf and did not look healthy. The majority of lesser roundleaf orchids appeared healthy, with only minor insect damage. Fresh manure was observed on the slope in the same habitat near the plants location (about 10 meters from lesser roundleaf orchids) and recent livestock activity had occurred on the slope in the logged area of site. Livestock use is heavier on skid trails and in the drainage bottom, but some impacts were observed in unlogged suitable habitat as well. Livestock access appears have increased since opening the adjacent area by logging. Trampling by livestock continues to be a threat to this population.

The lesser roundleaf orchid population at Robinson Gulch (PLOR4-12) was visited and eight individuals were counted, the highest number of observed individuals since 2004. These plants appeared healthy with only minor insect damage on some foliage. Monitoring reported fresh manure in the site and trailing through suitable, but unoccupied habitat.

The other lesser roundleaf orchid population at Robinson Gulch (PLOR4-13) was visited and thirteen individuals were counted, the highest number of observed individuals since 2000.

Some of the plants had a small amount of insect damage, but overall the population looked healthy. No livestock traffic was observed on the slope, but there had been minimal use in the drainage bottom.

The lesser roundleaf orchid population at Higgins Gulch (PLOR4-19) was visited and 142 individuals were counted, the highest number observed at this site. The individuals appeared to be healthy with less insect damage than had been observed in previous years. The leaves were shiny, green, and healthy, but still showed evidence of insect damage. No new or current livestock use or trailing was observed; however across the fence livestock utilization fairly heavy (60-70%). Several faint game trails were observed in the vicinity of lesser roundleaf orchids.

4. **If drought conditions persist, continue to monitor the three additional sites: PLOR4-4, PLOR4-21 and PLOR4-22 (these sites were chosen for variation in geographic distribution) and count individuals at all 12 locations. During the 2nd non-drought year, count individuals at the 12 sites. After the 2nd non-drought year reassess the monitoring design to determine future needs.**

   2009 marked the second non-drought year in a row, so these three sites were visited.

   The lesser roundleaf orchid population at Beaver Creek (PLOR4-4) was visited and five plants were observed. Condition of the vegetative plants varied widely in condition and amounts of damage from insects. Some lesser roundleaf orchids were pale in color.

   The lesser roundleaf orchid site at Seamore Gulch was visited and 20 plants were reported, the largest number recorded at this site. The shrub canopy on this site was patchy, either fairly open or closed. Numerous old trails traversed the slope suggesting that at one time livestock heavily used this site but are not using it now. In spite of some past heavy disturbances it was still good habitat. Plants appeared healthy with good color and a small amount of insect damage. There were a lot of small white aphid-like insects flying around or sitting on the vegetation.

   The lesser roundleaf orchid site at Higgins Gulch (PLOR4-22) was visited and three plants were observed. Individuals were observed to have minor insect damage and slightly chlorotic appearance, but did not appear unhealthy looking. No livestock use was reported from this site.

5. **Document observations for at least one occurrence in Bear/Beaver Gulches Botanical Area regarding whether the occurrence is grazed by livestock (PLOR4-4 or PLOR4-5) to assess the status of meeting Forest Plan Standard 3.1-2503 (Restrict access of domestic livestock use to protect the Region 2 sensitive and species of local concern plant occurrences in designated botanical areas). In drought years, PLOR4-4 will be monitored as per item 4 above. In non-drought years, either PLOR4-4 or PLOR4-5 may be monitored.**

   Livestock were observed in the pasture near PLOR4-4 and heard lowing in the distance. No evidence of livestock use of the site was reported.

6. **Document any noxious weeds or invasive plant species. Document if weeds are co-located with lesser roundleaved orchid or what distance they are located from occurrences if they occupy the same ecological type. Use this information to update a weed strategy with**

prioritization for all Region 2 sensitive and SOLC plant species. Document if any weed treatment activity has affected occurrences.

Canada thistle, musk thistle, and timothy occurred commonly along road bed below PLOR4-1. Hound's tongue was located sporadically along the drainage bottom in the same ecotype as lesser roundleaf orchid, but not within the orchid population.

No noxious or invasive plant species were observed at PLOR4-2.

Bull thistle and timothy were reported from PLOR4-3.

At PLOR4-4, hound's tongue was reported from within the site, approximately 50 ft from lesser roundleaf orchids. Bull thistle and common St. John's wort were observed near the road.

Bull thistle, musk thistle, Canada thistle, common St. John's wort, and hound's tongue were abundant along old skid trails at PLOR4-6.

Not many noxious or invasive plant species were reported from directly within PLOR4-12. Timothy was found infrequently within the site and musk thistle, hound's tongue, common tansy, sulfur cinquefoil, and oxeye daisy were found along the road in the main Robison Gulch area.

No noxious or invasive plant species were seen in the vicinity of PLOR4-13; however, the nearby drainage bottom has a robust population of sulfur cinquefoil which appears to be spreading rapidly.

Hound's tongue was observed infrequently throughout PLOR4-19, but was dense in the drainage bottom below the site. Timothy and clover were observed occasionally growing within the site.

No noxious or invasive species were observed within PLOR4-21; however Canada thistle and hound's tongue were observed along the road below the site and timothy was found within the site.

No noxious or invasive plant species were reported from within PLOR4-22.

At PLOR4-23 Canada thistle was reported from a similar ecotype along Trail #7, but not from the site itself. Clover and timothy were also recorded along the trail in the vicinity of the population.

Canada thistle was located in a similar ecotype as lesser roundleaf orchid at PLOR4-24, but not in the site itself.

No noxious or invasive plant species were reported from within PLOR4-25.

Sageleaf willow (hoary willow, *Salix candida*)

Sageleaf willow is a wetland obligate species known to occur from eastern Canada to Alaska and across the northern United States. In the Black Hills, it is limited to one verified extant occurrence west of Deerfield (McIntosh Fen Botanical Area, 6,000 feet). The persistence of the species in the Black Hills is dependent on conserving this single occurrence. Habitat includes cold seep or spring-fed saturated substrates produced by unusual hydrologic conditions where sedimentary layers of the Limestone Plateau intersect impermeable schist of the crystalline Central Core. Sageleaf willow is found in wet meadows and associated fens.

As an obligate wetland species, the primary risk to sageleaf willow's persistence and reproductive success is lowering of the local water table. Noxious weeds, insects, and fungal infestations have also been identified as potential risks for this species. In 2007, Region 2 Forest Health scientists completed a willow health assessment at McIntosh Fen. Their final conclusion was that weevils, rust, and several other diseases and insects were present at McIntosh Fen, but were not causing widespread damage to the willows. It was noted that the biggest reason for the suspected rise in insect and disease activity at McIntosh Fen is the relatively dry conditions the willows have been experiencing for several years. Improving the site hydrology would help restore environmental conditions for willow and result in fewer insect and disease problems.

In an effort to restore the local water table, Mystic Ranger District personnel have tried several methods to slow the loss of water from the wetland caused by drainage ditches dug in the 1960s when the fen area was used to produce hay. In 1996 several bales of straw were placed in the ditches with moderate effectiveness. In 2007, thirty stainless steel plates were installed perpendicular to one of the larger ditches. Results were instantaneous and have resulted in the return of rushes and sedges into the drainage ditch and presence of a higher water table around the artificial ditch.

Fishing occurs along Castle Creek (near the fen) in the McIntosh Fen Botanical Area, and a designated snowmobile trail crosses the Botanical Area but does not extend into either subpopulation of sageleaf willow. No impacts to sageleaf willow have been documented from either activity. Minimal impacts from wildlife use and no impacts from livestock use have been observed since McIntosh Fen was designated a Botanical Area in 1997. Impacts from use by either wildlife or livestock could pose a threat to the persistence of sageleaf willow on the Black Hills National Forest.

2009 Monitoring Design and Results Evaluation

1. **At McIntosh Fen, GPS new endpoints of the occurrence if site size has changed. Revisit markers placed in 2005 around the largest dense patches of sageleaf willow.**
   - **Collect data on the two to six plants near each marker that were tagged in 2005 and note whether they are reproductive or vegetative. Tags should be on live branches. Replace tag on live branch if branch is dead when monitored and document that the tag was moved from dead to live branch.**
   - **Estimate height and assess the condition of each tagged plant and document whether it is affected by some agent (e.g. rust, willow borer, livestock grazing, wildlife grazing, etc.). Specify the agent that is observed. Document observations regarding whether sageleaf willow occurrence at McIntosh Fen Botanical Area is grazed by livestock.**

In 2009, there was no expansion or contraction of sageleaf willow detected at McIntosh Fen. The twelve large plastic stakes installed at McIntosh Fen in 2005 (ten at the southern subpopulation and two at the northern subpopulation) were revisited on June 25, 2009. The five tagged individuals near each stake were relocated, and the condition of each plant was documented. Plants had appropriate structures for differentiating male individuals from female individuals. Observations were taken on 48 tagged sageleaf willow plants: 13 female, 17 male, 18 vegetative. Four of the tagged plants were not relocated in 2009, and 21 tags were found on dead branches that were moved to live branches (eight tags were moved from dead to live branches in 2008). The 2005 protocol states that tags would be placed on live branches, so it is known that the branches were alive when originally tagged. The data (43% of plants with new dead branches in 2009 [15% in 2008, 28% in 2007]) supports monitoring observations that willow borer is effecting willow species at McIntosh Fen. Evidence of willow borer activity was noted on the bases of most dead branches observed. A few sageleaf willow individuals were observed that had been browsed by wildlife, and some rust (but not severe) was observed on sageleaf willow at the time of monitoring.

There was no evidence of livestock grazing on sageleaf willow at the occurrence and no evidence that livestock had entered the fenced McIntosh Fen Botanical Area. The site is meeting Forest Plan Standard 3.1-2503.

2. Measure aboveground water levels along the permanent water transects at McIntosh Fen described under monitoring design for autumn willow (*Salix serissima*). Transects should be read at the same time sageleaf willow is in good phenological stage for monitoring.

Two permanent water transects were installed at McIntosh Fen in 2004 and data has been collected from a one-time reading each in 2004, 2005, 2006, 2007, 2008, and 2009 when the phenology of sageleaf willow is appropriate for monitoring. This protocol is not rigorous enough to determine cause and affect relationships relative to changes in water level. It is only intended to coarsely document changes in water levels. A summary of the data (2004-2009) from the three water transects (McIntosh Fen – North, McIntosh Fen – South, and Middle Fork Boxelder Creek) are presented in the tables below.

McIntosh Fen – South Water Transect Data Summary (Transect length = 109 m)				
Year	**# positive measurements**	**# of "Trace" measurements**	**# of "Zero" measurements**	**Total # of measurements**
2004	**7**	**4**	**115**	**126**
2005	**7**	**5**	**114**	**126**
2006	**6**	**4**	**116**	**126**
2007	**5**	**6**	**115**	**126**
2008	**13**	**41**	**72**	**126**
2009	**0**	**17**	**109**	**126**

McIntosh Fen – North Water Transect Data Summary (Transect length = 61 m)				
Year	**# positive measurements**	**# of "Trace" measurements**	**# of "Zero" measurements**	**Total # of measurements**
2004	**3**	**0**	**59**	**62**
2005	**9**	**4**	**49**	**62**
2006	**2**	**1**	**59**	**62**
2007	**5**	**3**	**54**	**62**
2008	**13**	**3**	**46**	**62**
2009	**1**	**2**	**59**	**62**

Most notable from the data presented above is the decrease in the number of "positive" and "trace" measurements recorded in 2009 as compared to 2008. 2008 and 2009 were not designated drought years (http://www.drought.unl.edu/dm/monitor.html), yet the measurements of the transect data in 2009 are more similar to data prior to 2008 than 2008 data was. This discrepancy in the data could be attributed a difference in personnel who read the transects.

3. Collect baseline data at the experimental site planted on Heely Creek. Assess risks to site and record observations on overall health of sageleaf willow.

The willow transplant site at Heely Creek (SACA4-2) was visited on July 2, 2009. There was some doubt in the species identification of the autumn willow because the plants are young and the variability in the growth patterns and traits of the willow family members.

The willow transplants are protected from disturbance using two exclosures. Exclosure #1 is fenced with a buck and pole fence, thus only keeping cattle out of the planting area. Exclosure #2 is fenced with eight-foot plastic web fencing and mostly likely will keep not only livestock, but also deer and elk out of the planted area.

Given the difficulty in identifying young willows, it was determined that 37 of the planted willows were autumn willow, 14 were sageleaf willow, 17 were false mountain willow (*Salix pseudomonticola*), 21 were diamondleaf willow (*S. planifolia*) or pussy willow (*S. discolor*), and one was Bebb willow (*S. bebbiana*) in exclosure #1.

Within exclosure #2 there were eighteen planted willows with fourteen of them thought to be autumn willow, two diamondleaf willows, and two were unidentifiable because they were dead. No sageleaf willows were found within exclosure #2.

Canada thistle co-occurred with the planted willows. There was much trailing and trampling from livestock in the wet areas adjacent to the exclosure at the time of monitoring. There were a lot of dandelions throughout the site. It was clear that wildlife access the inside of this exclosure on a regular basis. One vexar tube was found hanging in a small spruce tree. There were quite a few tubes tipped over or laying down nowhere near a living or dead willow. There are residual livestock impacts within the fence. A small amount of hummocking remains, yet the damage is healing. Outside then fence there was quite a bit of disturbance from trampling and bedding. On the drier ground yarrow (*Achillea millefolium*) was the dominant forb, suggesting historic heavy livestock use. Generally, the landscape outside the fence was much drier than that inside.

The planted cuttings were in varying stages of growth. Some were just a couple of little suckers from a dead twig while on others the original cutting was elongating.

4. **Document any noxious weeds or invasive plant species. Document if weeds are co-located with sageleaf willow or what distance they are from occurrences if they occupy the same ecological type. Use this information to update a weed strategy with prioritization for all Region 2 sensitive and SOLC plant. Document if any weed treatment activity has affected the occurrence.**

   At McIntosh Fen (SACA4-1) Canada thistle co-occurs with sageleaf willow and in the same ecotype in northern subpopulation. Canada thistle also occurs in very dense stands in slightly drier areas. Smooth brome is scattered in drier areas and also co-occurs with sageleaf willow. Weeds at SACA4-2 are discussed in item #3.

Autumn willow (*Salix serissima*)

Autumn willow occurs primarily in northern boreal bogs throughout its range and is a disjunct relic in the Black Hills. There are four known occurrences on Black Hills National Forest lands in fens and wet meadows often dominated by sedges and other willow species. Autumn willow is known to occur in McIntosh Fen, Middle Fork of Boxelder Creek, Nahant and Silver Creeks and appears to occur in the same unique hydrological conditions as sageleaf willow. Black Hills occurrences range in elevation from 5,620 to 6,000 feet.

Since autumn willow has similar habitat requirements as sageleaf willow, it follows that the primary risks to the persistence and reproductive success of the two species is also similar. Refer to the sageleaf willow discussion for a more detailed discussion of threats.

2009 Monitoring Design and Results Evaluation

1. At McIntosh Fen, GPS new endpoints of the occurrence if site size has changed. Revisit stakes (or other landmark (electric pole) in the northern subpopulation) placed in 2005 near the margins of the largest dense patches of autumn willow.

- **Collect data on the two to six nearby plants to each marker that were tagged in 2005 and note whether they are reproductive or vegetative. Tags should be on live branches. Replace tag on live branch if branch is dead when monitored and document that the tag was moved from dead to live branch.**
- **Estimate the height and assess the condition of each tagged plant and document whether it is affected by some agent (e.g. rust, willow borer, livestock grazing, wildlife grazing, etc.). Specify the agent that is observed. Document observations regarding whether autumn willow occurrence at McIntosh Fen Botanical Area is grazed by livestock.**

In 2009, there was no expansion or contraction of autumn willow populations detected at McIntosh Fen (SASE2-1).

The twelve large plastic stakes installed at McIntosh Fen in 2005 (ten at the southern subpopulation and two at the northern subpopulation) were revisited on June 25, 2009. The five tagged individuals near each stake were relocated, and the condition of each plant was documented. Plants had appropriate structures for differentiating male individuals from female individuals. Observations were taken on 56 tagged sageleaf willow plants: 35 female, 19 male, 2 vegetative. Six of the tagged plants were not relocated in 2009, and 24 tags were found on dead branches that were moved to live branches (eight tags were moved from dead to live branches in 2008). The 2005 protocol states that tags would be placed on live branches, so it is known that the branches were alive when originally tagged. The data (42% of plants with new dead branches in 2009 [15% in 2008, 28% in 2007]) supports monitoring observations that willow borer is effecting willow species at McIntosh Fen. Evidence of willow borer activity was noted on the bases of most dead branches observed. A lot of the larger plants had been flattened, either bedding elk or snow load perhaps. The flattened plants didn't seem largely affected and were still producing new branches this year in spite of the heavy disturbance. Less rust (red bumps) was observed on autumn willows in 2009 than in previous years, but this may have changed as the season progressed. There was no evidence of livestock grazing on sageleaf willow at the occurrence and no evidence that livestock had entered the fenced McIntosh Fen Botanical Area. The site is meeting Forest Plan Standard 3.1-2503.

2.At Middle Boxelder Creek, Nahant, and Silver Creek (sites SASE2-2, SASE2-3, SASE2-4), GPS new endpoints if autumn willow site boundaries have changed. Count individuals during the blooming period (documenting total number of individuals and total number of reproductive individuals). Document the number of plants observed to be affected by some agent (e.g. rust, willow borer, wildlife grazing, etc.). Document observations regarding if autumn willow plants are grazed by livestock to assess the status of meeting Standard 2505 e.

In 2009, there was no expansion or contraction of autumn willow populations detected at Middle Boxelder Creek, Nahant, or Silver Creek (SASE2-2, SASE2-3, or SASE2-4).

At the Middle Boxelder Creek population of autumn willows (SASE2-2), most of the willow borer evidence was old, and no larvae were found. Observers reported small amounts of insect and disease damage in the form of leaf spots and galls. The soils in the site were wetter than previous years and the autumn willow appeared to be healthier than in the past several years. The soil was saturated in most areas where the autumn willow occurs with occasional standing water (see water transect data in item #3). In general the population appeared to be healthy with vigorous sucker growth observed on several autumn willows. Catkin production on the seven female plants ranged from very few small catkins to many dense catkins. Evidence of previous year's browsing on autumn willows was present, and recent browsing appears to be light to moderate.

At the Nahant population (SASE2-3), both autumn willows appeared healthy and vigorous. Several fresh, healthy sucker branches were present on both plants. Only a few dead branches were observed and are most likely caused by willow borer activity. Observers reported no evidence of browsing and the soils in the vicinity of the population were saturated with areas of standing water.

The Silver Creek population of autumn willow (SASE2-4) did not appear healthy when visited in 2009; however the surrounding wetland habitat appeared to be prospering. Other willow species in the wetland do not appear to be as negatively impacted as the autumn willow. Evidence of willow borer activity in past years was present; however no live borers were observed during monitoring efforts. Six individuals were counted (five female, one male), but one of the female plants had only one living branch remaining. No evidence of livestock was observed in the surrounding pasture and none of the plants showed signs of livestock browsing. The autumn willows did show sign of continued wildlife browsing.

3.Measure aboveground water levels along the permanent depth point water measurement transects at McIntosh Fen (two permanent transects: one transect at each subpopulation) and at Middle Fork Boxelder Creek (one permanent transect). This monitoring should occur when the willow species are in good phenological stage for monitoring.

See item #3 for sageleaf willow for water transect data from McIntosh Fen.

Middle Fork Boxelder Creek (SASE2-2) – Water Transect Data Summary (Transect length = 19.5 m)				
Year	# of Positive measurements	# of "Trace" measurements	# of "Zero" measurements	Total # of measurements
2004	5	0	36	41
2005	3	0	38	41
2006	5	8	28	41
2007	6	9	26	41
2008	17	15	9	41
2009	**6**	**11**	**24**	**41**

The water transect data from 2009 more closely matches data from 2006 and 2007 than 2008. The data indicates a gradual increase in surface moisture which follows the precipitation reported for the past few years. 2008 and 2009 were not designated drought years (http://www.drought.unl.edu/dm/monitor.html), indicating that conditions were wetter than previous years. Wetter conditions lead to an increase in the local water table, which in turn suggests that the soils in the site are once again saturated.

5. **Collect baseline data at the experimental site planted on Heely Creek and the reported site in the Canyon City RNA. Assess risks and record observations on overall health of autumn willow.**

The willow transplant site at Heely Creek (SASE2-5) was visited on July 2, 2009. There was some doubt in the species identification of the autumn willow because the plants are young and the variability in the growth patterns and traits of the willow family members.

The willow transplants are protected from disturbance using two exclosures. Exclosure #1 is fenced with a buck and pole fence, thus only keeping cattle out of the planting area. Exclosure #2 is fenced with eight-foot plastic web fencing and mostly likely will keep not only livestock, but also deer and elk out of the planted area.

Given the difficulty in identifying young willows, it was determined that 37 of the planted willows were autumn willow; 14 were sageleaf willow; 17 were false mountain willow (*Salix pseudomonticola*); 21 were diamondleaf willow (*S. planifolia*) or pussy willow (*S. discolor*); 1 was Bebb willow (*S. bebbiana*) in exclosure #1.

Within exclosure #2 there were eighteen planted willows with fourteen of them thought to be autumn willow, two diamondleaf willows, and two were unidentifiable because they were dead. No sageleaf willows were found within exclosure #2.

Canada thistle co-occurred with the planted willows. There was much trailing and trampling from livestock in the wet areas adjacent to the exclosure at the time of monitoring. There were a lot of dandelions throughout the site. It was clear that wildlife access the inside of this exclosure on a regular basis. One vexar tube was found hanging in a small spruce tree. There were quite a few tubes tipped over or laying down nowhere near a living or dead willow. There are residual livestock impacts within the fence. A small amount of hummocking remains, yet the damage is healing. Outside then fence there was quite a bit of disturbance from trampling and bedding. On the drier ground yarrow (*Achillea millefolium*) was the dominant forb, suggesting historic heavy livestock use. Generally, the landscape outside the fence was much drier than that inside.

The planted cuttings were in varying stages of growth. Some were just a couple of little suckers from a dead twig while on others the original cutting was elongating.

The site reported to be in the Canyon City RNA was relocated and confirmed to be strapleaf willow (*Salix eriocephala* var. *ligulifolia*) by Robert Dorn.

6. **Document any noxious weeds or invasive plant species. Document if weeds are co-located**

with autumn willow or what distance they are located from occurrences if they occupy the same ecological type. Use this information to update a weed strategy with prioritization for all Region 2 sensitive and SOLC plant species. Document if any weed treatment activity has affected occurrences.

At McIntosh Fen (SASE2-1) Canada thistle co-occurs with autumn willow and in the same ecotype in northern subpopulation. Canada thistle also occurs in very dense stands in slightly drier areas. Smooth brome is scattered in drier areas and also co-occurs with sageleaf willow.

At the Middle Boxelder Creek population (SASE2-2) noxious and invasive plant species are abundant and dense along drainage and along road. Canada thistle and garden yellowrocket (*Barbarea vulgaris*) co-occur with autumn willow. Canada thistle, butter and eggs, hound's tongue, musk thistle, oxeye daisy, dandelion, smooth brome, timothy, Kentucky bluegrass, cheatgrass, and common tansy occur in drier areas surrounding the site.

Canada thistle, oxeye daisy, butter and eggs, and hound's tongue are present in drier area above SASE2-3 and below road (approximately fifteen meters from the wetland area). Smooth brome is the dominant grass on the road margin. Common tansy and musk thistle were reported at the site in 2008, but were not observed in 2009.

Canada thistle occurs in patches on the edge of the wetland at SASE2-4. Garden yellowrocket dominated the vegetation along the edges of the wetland and bull thistle was occasionally observed throughout the site.

Weeds at SASE2-5 are discussed in item #3.

Bloodroot (*Sanguinaria canadensis*)

Bloodroot occurs in moist forests form Nova Scotia to Florida and west to Manitoba and Kansas. In the Black Hills, it occupies floodplains, forested terraces, drainage bottoms, and north-facing foot slopes in open, rich hardwood plant communities. There are over twenty known occurrences of bloodroot on the Black Hills National Forest. The known populations are limited to the northeast portion of the Forest (Northern Hills Ranger District), from the east side of Spearfish Canyon to west of Tilford. Black Hills occurrences range in elevation from 3,940 to 5,000 feet.

The eight core bloodroot sites were selected using four criteria: size (estimated number of individuals), geographic distribution of the occurrence, potential risk from livestock grazing, and community type. The largest estimated number of individuals observed at a given site was a primary factor used in delineating potential core occurrences. Of these eight core occurrences, four were designated as key because they contain over 1,000 individuals and are deemed critical to maintaining the metapopulation of bloodroot on the Black Hills National Forest. According to the current protocol, the four key occurrences are to be monitored annually and the additional four remaining core occurrences are to be monitored during drought years.

2009 Monitoring Design and Results Evaluation

1. Annually monitor presence/absence of the four core monitoring sites considered key due to large population size. If occurrence extent has changed from the previous year, gather GPS data at the endpoints if the site is long (e.g. some sites are ½ mi to 1 ½ mi long in drainages) or collect GPS points around the entire occurrence if the site is small (less than ½ acre).

The portion of the site that is located under the power lines (approximately 0. 5 acre) at the bloodroot population at False Bottom (SACA13-1), both east and west of NFSR 195 had the brush and trees cleared sometime earlier this spring. Prior to the power line maintenance the bloodroot occurred in a scattered and patchy distribution within the treatment area. The power line maintenance appeared to involve hand-cutting of spruce that were 14-15 feet tall. The trees were bucked up after they were fallen. It was not apparent whether the shorter shrub layer was cut with a piece of lightweight equipment or by a hand crew because very little soil disturbance resulted. The power line maintenance resulted in a deep layer of slash covering the bloodroot population. The stumps and stobs left from cutting were on average 4-6 inches tall and at the time of survey some of the taller beaked hazelnut (*Corylus cornuta*) stobs were beginning to leaf out. Forest Plan monitoring of this population took place on May 18, 2009. At that time of that visit the choke cherry (*Prunus virgininiana*) and beaked hazelnut were beginning to sprout back in the cleared area. Seventy-two bloodroots were counted in the affected area and surrounding habitat. Most of the surviving plants were under the beaked hazelnut that was still standing at the edge of the brushed area. Most of them were past bloom and had aborted seed heads. Tansy and St. John's wort were densely concentrated under the power line and in the brushed area. Monitoring will continue to document how the removal of the canopy cover and increase in woody debris affects the bloodroot in this small area.

Outside of the small area affected by the power line maintenance the bloodroot occurred in a scattered distribution and was limited to known suitable habitat, all of the areas were east of both the road and creek. In the area by the old trash dump, abandoned trailer, and campsite the plants were more abundant than downstream, but still a patchy. A few of the areas where the bloodroot was found had less canopy cover than most of the population, yet these plants still appeared to be viable and healthy. In the northernmost end of the population the plants were a bit more patchy and scattered with most of them being in late bloom or having immature fruit.

The bloodroot population at Lost Gulch (SACA13-2) appeared stable and healthy. It was comparable to previous years, with no new human-caused disturbances observed. There was, however, evidence of early season high water (which does not appear to have affected bloodroots) and light wildlife use (deer) in site area. The ruts caused by OHV use in the riparian area near SACA13-2 (2006) appear to be more vegetated than in previous years. No bloodroots were observed in the burned area (from 2005 Camp5 Fire) this year, but individuals may have been overlooked.

The bloodroot population at Meadow Creek (SACA13-3) appeared healthy despite the severely degraded habitat. The shrub canopy that supports the population is in major decline. Generally the hawthorne did not look healthy and appears to be in decline. The chokecherry was the only shrub that looked healthy. Riverbank grape (*Vitis riparia*) was growing on many of the shrubs. Bloodroot appeared to be densest in the areas of heavy shrub cover where they were protected. Scattered individual plants were growing upslope from the main population, in the aspen stand and also under slash left after logging.

Habitat has been degraded by various human and animal uses. There was a trail (human, livestock, or both) through the biggest part of the population with bloodroots growing in the middle of it. Garbage is common and scattered throughout the site. Livestock flops are abundant in and around the site. Gophers or moles have moved into the site and were doing a lot of burrowing. The beaver dam that is in the creek adjacent to the site blew out sometime last winter or spring. At that location, bloodroot grows up to the edge of a steep and unstable bank above the creek. There is potential for losing some of the plants in future high water events.

The bloodroot population at Park Creek (SACA13-14) was visited in May 2009. Plants are consistently present in known concentration areas. Bloodroots are often concentrated in protected areas in thickets, under down debris, or at the base of shrubs (area less susceptible to trampling. Some plants were observed to have emerged through slash from the 2006 hardwood enhancement project. Slash and debris is still deep on the north facing slope, and only a couple bloodroots were observed growing in this area (bloodroot occurred in a dense stand here in years prior to the 2006 thinning). The population appeared to be healthy; however weeds are becoming a treat. Historic and recent livestock use was evident (hummocking and trailing along creek and beaver dam area); however the area had not been accessed for the season at the time of monitoring. In addition to livestock use of the site, there was evidence that the site was also used by wildlife. OHV use occurs on NFSR 541.1 adjacent to the site and on user created trails on the hillside above the road.

2. During a drought year, monitor presence/absence of all eight core sites. If any core sites are absent, select another known site to monitor presence/absence.

2009 was not a drought year; therefore only four monitoring sites were visited.

3. Document any noxious weeds or invasive plant species at the core sites considered key due to large population size. Document if weeds are co-located with bloodroot or what distance they are located from occurrences if they occupy the same ecological type. Use this information to update a weed strategy with prioritization for all Region 2 sensitive and SOLC plant species. Document if any weed treatment activity has affected occurrences.

In the southernmost portion of the population at SACA13-1, where the bloodroots are most dense, tansy and hound's tongue co-occur.

Hound's tongue, smooth brome, and Canada thistle were reported to co-occur with bloodroot at SACA13-2. Bull thistle occurs occasionally along the drainage in the same ecotype as bloodroot, but is not co-located with it. Common tansy, spotted knapweed (*Centaurea stoebe* ssp. *micranthos*), Dalmatian toadflax (*Linaria dalmatica*), and common burdock have all been reported from this site, but were not observed in 2009. No evidence of weed treatment affecting bloodroot was reported.

Non-native and invasive plant species still occur in dense stands in disturbed areas around SACA13-3. Common tansy, black henbane (*Hyoscyamus niger*), and butter and eggs are all present in the area adjacent to the population that was disturbed during recent logging activities. Common tansy is abundant in the drainage bottom and extends onto the bench where bloodroot often co-occurs. Hound's tongue, black henbane, and butter and eggs co-occur with bloodroot.

Bull thistle was reported in 2007 but not observed in 2008 or 2009. This species could have been present, but not observed because of the early season visit date.
Canada thistle, hound's tongue, common dandelion, and clover co-occur with bloodroots at SAVA13-14. Bull thistle and smooth brome occur in the same ecotype as bloodroot, but do not co-occur. Spotted knapweed was observed in patches along NFSR 541.1 and its presence reported to Northern Hills District personnel.

4. **Document any evidence of bloodroot collection at the four core monitoring sites considered key due to large population size.**

   There was no evidence of bloodroot collection reported during monitoring of the core sites.

Lanceleaf peatmoss (*Sphagnum angustifolium*)

Lanceleaf peatmoss was recently confirmed to exist on the Mystic Ranger District of the Black Hills National Forest. This species was added to the Regional Forester's list of Sensitive plant species in April 2007 (USDA Forest Service 2007b) and was included in the most recent update (USDA Forest Service 2009a).

Lanceleaf peatmoss is scattered across northern North America. In the United States, it is known to occur in Alaska and Maine, south to California and across the north-central portion of the country to North Carolina (NatureServe 2009, McQueen & Andrus 2007). It has also been widely reported across Canada (from Yukon south to British Columbia and east to Greenland and Newfoundland; McQueen & Andrus 2007).

Lanceleaf peatmoss is currently only known to occur in the Rochford Cemetery Fen (RCU_001) on the Mystic Ranger District (USDA Forest Service 2010b); however efforts are now underway to inventory other wetlands with potential habitat. This site is found at 5,500 feet in Management Area 5.1, resource production emphasis.

1. Relocate the 1986 collection site. If lanceleaf peatmoss is present, collect baseline data and assess risks to site.

   The 1986 collection site (SPAN11-1) was revisited and baseline data collected on November 6, 2009. Observers searched for sporophytes, but did not see any. The site was damaged during a high volume flow following a heavy rain event in 2008. Risks to the site include livestock impacts, damage from illegal OHV use, alterations in site hydrology, and impacts associated with the upcoming paving of Rochford Road.

2. **Collect baseline data on any additional sites that are discovered. Assess risks.**

   No additional confirmed sites for lanceleaf peatmoss were discovered in 2009.

3. **Document any noxious weeds or invasive plant species. Document if weeds are co-located with Sphagnum angustifolium or what distance they are located from occurrences if they occupy the same ecological type. Use this information to update a weed strategy with**

prioritization for all Region 2 sensitive and SOLC plant species. Document if any weed treatment activity has affected occurrences.

Canada thistle was observed in the vicinity of the site, but did not co-occur with lanceleaf peatmoss.

American cranberrybush

highbush cranberry, *Viburnum opulus* var. *americanum*

American cranberrybush is widely distributed across North America. In the Black Hills it occurs at mid-elevations in wet, shaded habitats along streams, springs, and canyon bottoms. There are more than 30 occurrences of American cranberrybush reported on the Black Hills National Forest (Bearlodge and Northern Hills Ranger Districts). Most Black Hills occurrences are in drainage bottoms or lower slopes with moist soil conditions and partial shading. Currently known sites are primarily associated with paper birch/ironwood (*Ostrya virginiana*) and paper birch/hazelnut (*Corylus cornuta*) communities, with or without white spruce or quaking aspen. A few sites are in ponderosa/oak (*Quercus macrocarpa*). Paper birch is present at almost all currently documented sites. Black Hills occurrences range in elevation from 3,800 to 5,700 feet.

2009 Monitoring Design and Results Evaluation

1. **Relocate as many geographically spaced occurrences as possible of previously reported locations (or a combination of previously located sites and newly located sites) and gather baseline data. Try to include reported occurrences MA. 3.1 Botanical Area. Assess risks to those sites.**

   The American cranberry bush population at Pettigrew Gulch (VIOPA2-6) had minimal insect damage to the leaves including a few aphids and evidence of chewing insects. There was again some browning and spots on the leaves and shriveling of a few of the terminal leaves that could signify disease; however, the plant appeared to be healthy. There were several new suckers and stems that emerged this year. The population produced fruit this year, but the fruit was widely scattered and not that abundant.

   There were many livestock trails upstream of the American cranberrybush, but a large pine had fallen and blocked the drainage bottom 70 feet upstream from the site. The blockage offers some protection for the population because livestock cannot pass it and thus they were rerouted out of the drainage onto the slope. An estimated twenty to thirty percent of the leaves had been browsed by either livestock or wildlife.

   The American cranberrybush population in Dugout Gulch Botanical Area (VIOPA2-16) has to compete for light with a dense overstory of shrubs. This makes the plants grow in a spindly pattern. Other than odd growth form, the population appeared healthy with good color and vigor. There was no sign recent grazing by livestock.

   The population at West Strawberry Creek (VIOPA2-27) appeared to be healthy without any predation by insects. They did show signs of moderate browsing by wildlife. The clumps were quite dense and there was plenty of suckering occurring.

The American cranberry bush population on a tributary to Beaver Gulch (VIOPA2-32) occurs in a drainage bottom in a rocky area between the drainage bottom and a livestock trail. The American cranberrybush here had severe insect damage on its leaves (more than half of the leaf tissue gone). Several stems were stripped of leaves by insects, leaving only leaf veins. Livestock trailing had recently taken place directly down the drainage, in the vicinity of American cranberrybush.

2. **Document any noxious weeds or invasive plant species. Document if weeds are co-located with American cranberrybush or what distance they are located from occurrences if they occupy the same ecological type. Use this information to update a weed strategy with prioritization for all Region 2 sensitive and SOLC plant species. Document if any weed treatment activity has affected occurrences.**

   No noxious or invasive plant species occurred in the vicinity of VIOPA2-6; however Canada thistle, musk thistle, bull thistle, and hound's tongue grew in the drainage adjacent to the American cranberrybush.

   Hound's tongue, sweet clover, black medic, and timothy were reported from the vicinity of VIOPA2-16.

   The broad fill slope down above VIOPA2-27 is choked with non-native species including oxeye daisy, alfalfa, common tansy, sweet clover, and Canada thistle. As with many other locations in the Black Hills this year, the clover species have produced abundant vegetative growth and bloom. In some places on the slope down to the creek the alfalfa and yellow sweet clover were three to four feet tall.

   Bull thistle grew in the same ecotype as American cranberry bush at VIOPA2-32, but did not occur at the site itself.

Great-spurred violet

Selkirk's violet, *Viola selkirkii*

Great-spurred violet is a circumboreal herbaceous species, and rangewide it is locally abundant in specialized microsites in coniferous and deciduous forests. There are nineteen known occurrences on Black Hills National Forest lands with additional occurrences documented from Custer State Park and Mount Rushmore National Monument. Black Hills occurrences are restricted to a concentrated area (approximately 36 square miles) of the central core on igneous or metamorphic bedrock. Microhabitats are often moist, cold air drainages, in shaded to open areas, and often in the vicinity of granitic rock outcrops. White spruce is usually the dominant overstory with a variable understory. All currently known occurrences on Forest Service lands are located within the Black Elk Wilderness and/or the Norbeck Wildlife Preserve. Black Hills occurrences range in elevation from 5,240 to 7,000 feet.

On Black Hills National Forest, great-spurred violet is relatively secure from risks, with the exception of extreme climate change. Most of the known occurrences on Black Hills National Forest lands are not considered to be at risk from management activities. Some occurrences may be

vulnerable to impacts form hikers and rock climbers in the future. In addition, invasion by noxious weeds or other invasive plant species and efforts to control them, trampling or browsing by elk or mountain goats, and future fire suppression efforts are potential risks at some sites. Naturally occurring periodic flooding may reduce the size and extent of some occurrences, but may also create habitat.

The current monitoring protocol includes annual monitoring of sites VISE2-2 ("Violet Valley") and VISE2-11 (Sunday Gulch). These sites were selected because they have a relatively large number of plants, they have a greater combined potential risks than other sites, and they are two of the lowest elevation sites. It is likely that any declines associated with drought conditions and climate change would affect lower elevation sites first. VISE2-1 and VISE2-11 are used as triggers for determining if additional occurrences should be monitored.

2009 Monitoring Design and Results Evaluation

1. **On an annual basis, monitor presence/absence of the four largest sub-occurrences at site number VISE2-2 ("Violet Valley"), and site number VISE2-11 (Sunday Gulch). If one or more of the four largest sub-occurrences at "Violet Valley" or the Sunday Gulch occurrence is not present, document the reason (i.e. drought, elk, noxious weeds) if it can be determined and select two other sites in other drainages to monitor presence/absence to determine if other occurrences are being affected in the same way.**

   The four largest subpopulations of great-spurred violet at Violet Valley (VISE2-2) were present. A new user created trail was constructed sometime in the last year. It traverses the edge of subpopulation 4. It did not appear that there had been substantial use of the trail, but the effort that went into constructing it indicates that use may be imminent.

   All of the main concentration areas were relocated at the great-spurred violet population at Sunday Gulch (VISE2-11); however the population does not seem as dense as it was in previous years. Violets were observed emerging from slash produced during thinning along the power line in 2008. Violets were also present along the margins of burnt pile areas.

   Six new sites of great-spurred violet were located in 2009 and baseline data was collected.

2. **Every five years, monitor all locations within the same year.**

   All known locations of great-spurred violet were visited in 2008 and are scheduled to be revisited in 2013.

3. **Document any noxious weeds or invasive plant species. Document if weeds are co-located with great-spurred violet or what distance they are located from occurrences if they occur in the same ecological type. Use this information to update a weed strategy with prioritization for all Region 2 sensitive and SOLC plant species. Document if any weed treatment activity has affected occurrences.**

   Bull thistle occurred within two feet of great-spurred violets at VISE2-2. Canada thistle was co-located with great-spurred violet. The Siberian peashrub (*Caragana aborescens*) is spreading

and is now located within two meters of great-spurred violet.

Bull thistle occurs in patches scattered along drainage (within 10 feet of great-spurred violets) at VISE2-11. Smooth brome occurs on mossy benches with great-spurred violet and hound's tongue occurs along the road, adjacent to riparian area.

Noxious or invasive plant species extend from the burned area into the great-spurred violet site at VISE2-13. Canada and bull thistle co-occur with great-spurred violet. Weeds were not pulled at VISE2-13 in 2009.

4. **On any currently known great-spurred violet site that is affected by a flood or fire event, monitor for presence/absence. Monitor presence/absence of VISE2-13 (Pine Creek Research Natural Area (RNA)/Elkhorn Mountain 2003 Fire area).**

   No great-spurred violet sites were affected by flood or fire.

   The population of great-spurred violet in the Upper Pine Creek RNA (VISE2-13) was present and appears healthy in concentration areas noted in previous years. Observers noted burned trees have been falling in the vicinity of the great-spurred violets. The stream channel above the site was dry at the time of monitoring, but had been scoured and eroded by recent rain events. Erosion has not affected the great-spurred violets.

Species of Local Concern

Southern maidenhair fern

Adiantum capillus-veneris

Southern maidenhair fern occurs primarily in tropical and warm temperate regions of the world. In North America, it is mainly distributed across the southern third of the United States with disjunct northern occurrences (such as the Black Hills). The northern occurrences are restricted to moist, calcareous substrates closely associated with warm or hot springs. The single documented Black Hills occurrence is associated with warm springs at Cascade Creek (3,150-3,450 feet) in Fall River County, South Dakota. Plants at Cascade Creek are found in moist to saturated areas on the stream bank and in depressions and old channels on the adjacent floodplain. No other warm springs are known on Forest Service administered land in the Black Hills.

Developed picnic grounds are located at both ends of the southern maidenhair fern occurrence at Cascade Falls. The majority of the population is located along Cascade Creek on the Whitney Preserve managed by The Nature Conservancy. Monitoring conducted annually since 2000 documents an increase in occurrence size on Forest Service administered lands as compared to previous reports. At this time, the population appears to be stable, but there is insufficient data to demonstrate trend.

The Alabaugh Wildfire of July 7-13, 2007 burned approximately 10,300 acres, including hillsides adjacent to Cascade Creek. Monitoring in 2008 and 2009 documented the effects of the fire on southern maidenhair fern populations. While no southern maidenhair fern or associated riparian vegetation were burned during the Alabaugh Fire, several high precipitation events after the fire resulted in increased sediment and ash input into the creek. Since this landscape is naturally highly erosive, the plant communities present are adapted to occasional large-scale disturbance events. Long term negative impacts are not expected but the site will continue to be monitored.

Ongoing recreational use, noxious weed and invasive plant presence, and treatment of associated vegetation with herbicide are considered the greatest ongoing risks to southern maidenhair fern and its habitat on the Black Hills National Forest. Canada thistle (*Cirsium arvense*) is listed as a noxious weed by the State of South Dakota. Russian olive (*Elaeagnus angustifolia*) occurs in the Cascade Creek valley. In 2008 the Hell Canyon Ranger District initiated a restoration program with the goal of replacing non-native tree and shrub species with native shrubs (e.g. green ash (*Fraxinus pennsylvanica*), boxelder (*Acer negundo*), and American elm (*Ulmus americana*)).

2009 Monitoring Design and Results Evaluation

1. **Monitor presence/absence of southern maidenhair fern along Cascade Creek (ADCA-1, ADCA-2) on an annual basis. If the extent of concentration areas changes from one year to the next, consult on a more rigorous design with the Rocky Mountain Research Station.**

   Southern maidenhair fern persisted in most known patches in 2009. It occurred in patches along creek margins and occasionally in rocky area around the falls. The patch that occurs on the

rocks near Cascade Falls was present, but was not robust (some individuals buried in the grass and surrounding vegetation) and the patch recorded in a depression near willows was not relocated this year. At Cascade Springs, individuals appeared robust and healthy in the rockwork near the gazebo and in meanders where high flows did not scour as much. Observers noted some bare ground along the stream bank in areas where scouring may have occurred previously, but southern maidenhair fern persists in these areas. Overall the population appears stable and similar to previous years. A new monitoring protocol was developed and will be tested in 2010.

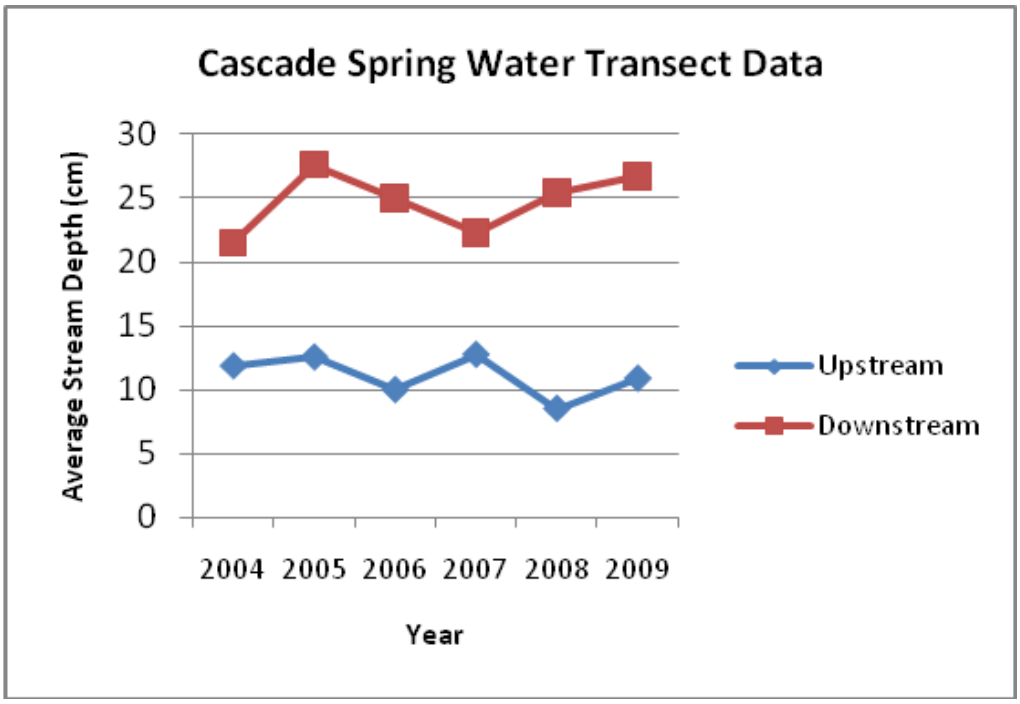
2. **Document recreation nick point trails that extend into concentration areas of southern maidenhair fern and record impacts.**

   Previously noted nick points are still present and no significant new use or trails were observed. However, a new dam was built in 2008 to create a new swimming area at Cascade Falls.

3. **Monitor water levels at the two permanent transect locations on an annual basis at a time of appropriate phenology for monitoring giant helleborne each year.**

   Two permanent water transects along Cascade Creek at J.H. Keith Picnic Ground were established in 2004. Water level measurements have been recorded annually since then to coarsely document changes in water levels. As part of the established monitoring protocol, these transects were read on July 13, 2010. The mean of measured reading at each transect were calculated to obtain the average stream depth and are reported in the table below.

	2004 (July 2)	2005 (July 5)	2006 (July 14)	2007 (July 2)	2008 (July 28)	2009 (July 13)
Upstream Transect Average Stream Depth (cm)	**11.9**	**12.6**	**10**	**12.8**	**8.5**	**10.9**
Downstream Transect Average Stream Depth (cm)	**21.5**	**27.6**	**25**	**22.3**	**25.4**	**26.7**



Because of concern about impacts to groundwater from the Alabaugh Fire and expected future water development, the USGS reactivated the gauging station at the southern end of the picnic area. Data from this gauging station is available at http://waterdata.usgs.gov/sd/nwis/measurements/?site_no=432012103331100

4. **Document any noxious weeds and the following invasive species of concern: Russian olive (*Elaeagnus angustifolia*) and salt cedar (*Tamarix sp.*). Document if weeds are co-located with southern maidenhair fern or what distance weeds are located from concentration areas if weeds are occupying the same ecological type. Use this information to update a weed strategy with prioritization for all Region 2 sensitive and SOLC plant species. Document if any weed treatment activity has affected the occurrences.**

   Canada and bull thistle were co-located with fern in places. Yellow sweet clover (*Melilotus officinalis*) and smooth brome (*Bromus inermis*) are also present and seem more rubust than previous years. Grape vines (*Parthenocissus vitacea* & *Vitis riparia*) were observed climbing over most vegetation. Field bindweed (*Convolvulus arvensis*) was reported to be thriving in the drier upland areas. Anticdotal evidence reports a decline in the presence of invasive and noxious weed species in the last two to three years. This is prehaps a result of consistent weed treatment efforts over the last several years. A more robust invasive species monitoring strategy was developed and will be tested in 2010.

5. **Document erosion patches occurring at any concentration area of southern maidenhair fern.**

   The Alabaugh Fire of July 2007 burned the timbered lands adjacent to Cascade Creek. Heavy rain events were recorded in 2007 and 2008. As a result of this change in sediment regime, it is expected that erosion will occur along Cascade Creek. In 2009, monitoring revealed some fresh bank under-cutting and scouring on cutbanks. At the time of monitoring, these sites did not

show signs of revegetation.

6. **Document any verifiable unauthorized collections of southern maidenhair fern.**
   No evidence of collection of southern maidenhair fern was reported.

Leathery grapefern (*Botrychium multifidum*)

Leathery grapefern is nearly circumboreal in distribution, occurring across North America, Europe, and northwest Asia. Rangewide, it grows in moist, open or shaded areas, including old pastures, meadows, woodland margins, riverbanks, and bottom lands. There are eight known occurrences of leathery grapefern on the Black Hills National Forest. Most of these occurrences (seven out of eight) are found in a concentrated area within the Black Elk Wilderness and Norbeck Wildlife Preserve. These populations occur in soils derived from igneous or metamorphic parent material. A single population in the Bear Lodge Mountains occurs in a steep, narrow, sandstone drainage with paper birch, and hazelnut. Most occurrences in the Black Hills are characterized by moss, mesic soil, perennial streams, and coniferous woodlands. Individuals often occur in open to shady areas, often in or near old stream channels where water is no longer flowing on a permanent basis. Black Hills occurrences range in elevation from 4,620 to 6,450 feet.

2009 Monitoring Design and Results Evaluation

1. **Annually monitor presence/absence and count individuals at the five annual monitoring sites: BOMU-1, BOMU-4, BOMU-5, BOMU-7, and BOMU-8.**

   The number of individual plants observed at BOMU-1 was greater than any previous years this site had been visited. No new disturbances were observed.

   The location of one of the sub-populations at BOMU-2 was covered in logging slash at the time of monitoring. The slash was removed from the area, however no individuals were re-located. Individuals were re-located at the second sub-population at BOMU-2.

   A revisit of BOMU-3 revealed that the population was still intact and the area showed few management impacts.

   At BOMU-4, few plants were relocated and those that were located did not look robust; however a healthy individual was discovered in a new area of the site. These results could be a result of changes in the surrounding vegetation and the progression of the site into a later seral stage.

   The population of leathery grapefern at BOMU-5 appeared robust when visited in 2009. Forb cover and white spruce recruitment are increasing at the site and could eventually impact the suitability of the site for leathery grapefern.

   At BOMU-6, only one sub-population was relocated; however the same number of individuals was observed in 2009 as was observed in 2004, just in different locations.

   The leathery grapefern population at BOMU-7 appeared comparable to observations made in

2008. Almost all plants were relocated and appeared to be vigorous. Threats to the population were mostly natural (beaver activity, forest succession) with the exception of encroachment of Canada and bull thistle.

BOMU-9 looked vigorous in 2009. Most individuals were relocated and the site appeared to be unaffected by livestock in the last year. No non-native or invasive species were observed.

2. **Gather baseline data on any new occurrences that may be discovered. Assess risks to those sites.**

No new occurrences of leathery grapefern were located in 2008. All known sites have baseline data gathered.

3. **Every five years, re-inventory all locations within the same year.**

All eight known locations of leathery grapefern were revisited in 2009. See protocol number one for details of the sites.

4. **Document any noxious weeds or invasive plant species. Document if weeds are co-located with leathery grapefern or what distance they are from occurrences if they occupy the same ecological type. Use this information to update a weed treatment strategy with prioritization for all Region 2 sensitive and BHNF SOLC plant species. Document if any weed treatment activity has affected occurrences.**

In 2008, Canada thistle in the vicinity of BOMU-1 had been sprayed (blue dye and withered thistles had been observed in area and some spraying had occurred within a few meters of leathery grapeferns). No evidence of weed spraying was observed in 2009. The number of leathery grapeferns in the area appears stable and no negative effects from the 2008 weed treatment were observed.

Canada thistle continues to co-occur with leathery grapefern at BOMU-2, BOMU-3, and BOMU-6; however neither the presence nor the treatment of this species has resulted in negative effects on the populations. In fact, treatment of Canada thistle near BOMU-6 has drastically decreased the number of thistles observed in the area.

Canada and bull thistle along with timothy continue to persist in the vicinity of BOMU-4 and BOMU-7; however neither the presence nor the treatment of these species has resulted in negative effects on the population. At BOMU-7, treatment of Canada thistle seems to be having minor effects on the thistle population.

Canada and musk thistle continue to persist in the vicinity of BOMU-5, but do not directly impact the population. Negative impacts resulting from treatment of these invasive species was not reported at this site.

Neither noxious weeds or invasive plant species, nor effects of treatment of these species were observed at BOMU-8.

Southwestern showy sedge

Carex bella

The primary range of southwestern showy sedge is the southwest United States and Mexico. Rangewide, this species typically inhabits stream banks, meadows, moist woods, and open slopes, frequently above timberline. Black Hills occurrences (eight documented, three on the Black Hills and five in Custer State Park) are found in high elevations of the granitic core in cool, moist, shaded white spruce forests often with paper birch and usually associated with granite outcrops. The occurrences on Black Hills National Forest are concentrated in the Black Elk Wilderness between 6,600 and 7,100 feet.

2009 Monitoring Design and Results Evaluation

1. **Annually monitor presence/absence of the three known occurrences (CABE3-1, CABE3-2, and CABE3-3) and assess risks. Document if any occurrence is affected by a flood or fire event.**

   CABE3-1, CABE3-2, and CABE3-3 were visited in 2009. None of the sites had been affected by flood or fire events.

   The southwestern showy sedge located at the headwaters of Nelson Creek (CABE3-1) was monitored in August of 2009. Southwestern showy sedge was present in both subpopulations; however the number of individuals recorded was less than in previous years. This was most likely because the visit occurred later in the season when southwestern showy sedge is less identifiable. In general, both the site and the individuals appear healthy and robust when compared to previous years.

   Individuals in the main concentration of southwestern showy sedge at CABE3-2 were covered with cottony matter which appears to be associated with an insect infestation. Aphid-like insects were observed in cottony mass as well as small winged insects. One infested seed head was collected for closer inspection by an entomologist. The "wooliness" was concentrated on the seed heads on most infested plants but also on the leaves and stems of some plants. A few Sprengel's sedge (*Carex sprengelii*) plants were observed with the wooly infestation but it seemed to be targeting southwestern showy sedge. Botanists estimated that 80% of fruiting heads in the main concentration were infested with the insects.

   Kurt Allen confirmed that the insect was a native species that tends to infest an area for a season and would not negatively impact the host plant. Other than the insect presence, most individuals appeared healthy.

   The Harney Peak population of southwestern showy sedge (CABE3-3) was similar in appearance to previous years with the same level of disturbance associated with its proximity to a highly used recreational trail. Individuals appeared slightly smaller than in previous years, but still produced reproductive structures.

2. **Gather baseline data on any new occurrences that may be discovered. Assess risks to those sites.**

Baseline data was collected from CABE3-4 and CABE3-5. Neither of these sites had been affected by fire or flood events.

A new population of southwestern showy sedge was located during a floristic inventory or Upper Pine Creek Research Natural Area (CABE3-4) in 2009. The population co-occurs with Selkirk's violet (*Viola selkirkii*) and Sprengel's sedge. When baseline monitoring data was collected, the sedges were almost finished flowering making distinction between Sprengel's sedge and southwestern showy sedge difficult. No disturbance was reported at this site and threats to the population appear to be those associated with climate change.

A second population of southwestern showy sedge was located while conducting botanical monitoring in the Black Elk Wilderness (CABE3-5) in 2009. The population was located in a small, localized microsite. Approximately half of the observed individuals had fruiting heads, some had more than one. The site is quite remote and no disturbances associated with recreation or management were reported. The greatest threat to the population appears to be those associated with climate change

3. **Document any noxious weeds or invasive plant species. Document if weeds are co-located with southwestern showy sedge or what distance they are located from occurrences if they occur in the same ecological type. Use this information to update a weed strategy with prioritization for all Region 2 sensitive and SOLC plant species. Document if any weed treatment activity has affected occurrences.**

   Smooth brome was found in a different ecotype in the vicinity of the southwestern showy sedge population at CABE3-1. No noxious or invasive plant species were reported at CABE3-2, CABE3-3, CABE3-4, or CABE3-5.

4. **On any currently known southwestern showy sedge site that is affected by a flood or fire event, monitor for presence/absence.**

   None of the sites had been affected by flood or fire events.

Beaked spikerush (*Eleocharis rostellata*)

Beaked spikerush is an obligate wetland species which occurs in saturated to inundated conditions. Rangewide this species occurs in coastal salt marshes and inland saline, alkaline, or strongly calcareous wetland habitats (e.g. around hot springs). The single documented occurrence of beaked spikerush in the Black Hills is on the calcareous substrates associated with the warm springs at Cascade Creek which perennially warm waters may be an important component of beaked spikerush's survival. The species occurs on Black Hills National Forest, The Nature Conservancy, and other privately held lands along Cascade Creek, with only ten percent of the total population occurring on Black Hills National Forest land (3,150-3,450 feet).

The Alabaugh Wildfire of July 7-13, 2007 burned approximately 10,300 acres, including hillsides adjacent to Cascade Creek. Monitoring in 2008 and 2009 documented the effects of the fire on beaked spikerush populations. While no beaked spikerush or associated riparian vegetation were

burned during the Alabaugh Fire, several high precipitation events after the fire resulted in increased sediment and ash input into the creek. Since this landscape is naturally highly erosive, the plant communities present are adapted to occasional large-scale disturbance events. Long term negative impacts are not expected but the site will continue to be monitored.

Ongoing recreational use, noxious weed and invasive plant presence, and treatment of associated vegetation with herbicide are considered the greatest ongoing risks to beaked spikerush and its habitat on the Black Hills National Forest. Canada thistle (designated noxious by the State of South Dakota) and Russian olive occur in the Cascade Creek valley. In 2008 the Hell Canyon Ranger District initiated a restoration program with the goal of replacing non-native tree and shrub species with native shrubs (e.g. green ash, boxelder, and American elm).

2009 Monitoring Design and Results Evaluation

1. **Monitor presence/absence of beaked spikerush along Cascade Creek on an annual basis. If the extent of concentration areas changes from one year to the next, consult on a more rigorous design with the Rocky Mountain Research Station.**

   The beaked spikerush populations at Cascade Springs and Cascade Falls appeared robust in 2009; however some individuals were flattened by recent high water events. Beaked spikerush grows in dense clusters in open areas along the creek but is absent from thickets and shaded areas.

   At Cascade Falls, beaked spikerush occurs along most of the stream bank at the west end (all but ~10-20%). It also occurs in depressions away from the stream in the northern end, close to the property boundary. In the eastern side of Cascade Falls, approximately 50% of the banks are covered with beaked spikerush between the falls and the private boundary. Over most of the area, beaked spikerush populations are connected in large patches (see overview photos). Large patches in the low areas along creek were present. Beaked spikerush is often co-located with narrowleaf willow (*Salix exigua*).

2. **Document recreation nick point trails that extend into concentration areas of beaked spikerush and record impacts.**

   Previously noted nick points are still present and no significant new use or trails were observed. However, a new dam was built in 2008 to create a new swimming area at Cascade Falls.

3. **Monitor water levels at the two permanent transect locations on an annual basis at a time of appropriate phenology for monitoring beaked spikerush each year.**

   Two permanent water transects along Cascade Creek at J.H. Keith Picnic Ground were established in 2004. Water level measurements have been recorded annually since then to coarsely document changes in water levels. As part of the established monitoring protocol, these transects were read on July 13, 2010. The mean of measured reading at each transect were calculated to obtain the average stream depth and are reported in the section on southern maidenhair fern.

Because of concern about impacts to groundwater from the Alabaugh Fire and expected future water development, the USGS reactivated the gauging station at the southern end of the picnic area. Data from this gauging station is available at http://waterdata.usgs.gov/sd/nwis/measurements/?site_no=432012103331100

4. **Document any noxious weeds and the following invasive species of concern: Russian olive, and salt cedar. Document if weeds are co-located with beaked spikerush or what distance weeds are located from concentration areas if they occupy the same ecological type. Use this information to update a weed strategy with prioritization for all Region 2 sensitive and SOLC plant species. Document if any weed treatment activity has affected the occurrences.**

   Canada and bull thistle were co-located with beaked spikerush in places. Yellow sweet clover (*Melilotus officinalis*) and smooth brome (*Bromus inermis*) are also present and seem more rubust than previous years. Grape vines (*Parthenocissus vitacea* & *Vitis riparia*) were observed climbing over most vegetation. Field bindweed (*Convolvulus arvensis*) was reported to be thriving in the drier upland areas. Anticdotal evidence reports a decline in the presence of invasive and noxious weed species in the last two to three years. This is prehaps a result of consistent weed treatment efforts over the last several years. A more robust invasive species monitoring strategy was developed and will be tested in 2010.

5. **Document erosion patches occurring at any concentration area of beaked spikerush.**
   The Alabaugh Fire of July 2007 burned the timbered lands adjacent to Cascade Creek. Heavy rain events were recorded in 2007 and 2008. As a result of this change in sediment regime, it is expected that erosion will occur along Cascade Creek. In 2009, monitoring revealed some fresh bank under-cutting and scouring on cutbanks. At the time of monitoring, these sites did not show signs of revegetation.

6. **Document any verifiable unauthorized collections of beaked spikerush.**
   No evidence of collection of beaked spikerush was reported.

Northern gentian (*Gentiana affinis)*

Northern gentian is known from western North America. There are many Black Hills National Forest occurrences (Hell Canyon, Mystic, and Northern Hills Ranger Districts) primarily from the central to western Black Hills in a wide range of habitats. Northern gentian is considered a facultative upland species in South Dakota and eastern Wyoming. Black Hills occurrences have been documented in moist areas near stream margins, springs, fens, montane grasslands, vegetated drainages with cobbles, and conifer dominated slopes and range in elevation from 4,960 to 6,620 feet.

2009 Monitoring Design and Results Evaluation

1. **Relocate as many occurrences as possible of previously reported locations of northern gentian (or a combination of previously located sites and newly located sites) and gather baseline data. Assess risks to those sites.**

Eight known locations of northern gentian were re-visited in 2009. Seven of the eight sites did not have baseline data collected previously.

GEAF-7 had baseline data collected in 2006 and was revisited in 2009. A two day effort was required to survey the Castle Creek corridor and revealed several thousand individuals. Impacts to individuals included direct impact by livestock, competition from invasive and non-native plant species, OHV trails, recreation-related foot trails, and a squater camp.

The norther gentian population at McIntosh Fen Botanical Area (GEAF-9) was reported in 2005 and baseline data was collected in 2009. At the site, northern gentian appeared healthy with good vegetative growth. None of the observed individuals had flowers; however, a couple plants had immature buds. Northern gentian co-occurs with tall cottongrass (*Eriophorum angustifolium* ssp. *angustifolium* (09SO01B)). The area surrounding the northern gentian was moist but not saturated and the fen area in the vicinity seems drier this year than previous years.

The northern gentian population at Heely Creek (GEAF-12) was discovered during botanical surveys in 2002. In 2009, SO botanists revisted the site to collect baseline data. The northern gentian was co-located with autumn willow and sageleaf willow plantings. Exclosures were built to protect the willows from livestock impacts and therefore serve to prevent livestock impact on the northern gentian within the exclosure as well. Impacts from livestock were observed outside the exclosure in the form of hoof prints, trailing, and hummocking in the saturated soil.

The northern gentian population at Procunier Spring (GEAF-13) was discovered during botanical surveys in 2007 and baseline data was collected in 2009. The plants occurred in scattered patches along the drainage. Most of the northern gentian at this site was small and spindly, but had good, dark green color. Some of the plants were eaten or trampled and area appears to be a congregation area for livestock. There were fairly large patches of bare ground over much of the habitat as well as an old road and many cow trails through the area. The meadow is open enough that OHV traffic could drive anywhere on it, including through the gentian habitat.

The northern gentian population at Cold Creek (GEAF-14) was discovered in 2006 during botanical survey and was visited in 2009 to collect baseline data. The site suggested heavy historic livestock use, but appeared to be recovering. Overall, the area was weedy, yet still exibited fairly diverse species compostion, even though the grasses were dominated by invasive or introduced species. There was good native forb diversity and recent heavy disturbance appeared minimal. The plants themselves appeared healthy except 10 per cent of the population browning along the leaf margins.
The northern gentian population in the Black Fox Botanical Area (GEAF-15) had baseline data collected in 2009. The northern gentian were of good size and had a deep-green, glossy color. They had abundant buds and blooms. The habitat consisted of diverse species composition including native species despite moderate numbers of noxious and non-native species.

A second population of northern gentian in Cold Creek (GEAF-16) was located during botanical surveys in 2006 and baseline data was collected in 2009. Northern gentian was scattered along a dry drainage. Individuals in areas with drier soil appeared more stressed than those gowing in moist soil. In dry areas, buds on northern gentian were shriveled and starting to dry, so they

probably did not bloom or set seed.

The northern gentian population at the Parmlee exclosure (GEAF-17) was discovered during botanical survery in 2006. The northern gentian is concentrated in the open spaces where there were no trees, primarily in the southwest corner of the fenced area. Individuals appeared robust and healthy. Livestock were grazing the meadow adjacent to the exclosure at the time of monitoring; however utilization by livestock appeared minimal. Outside of the exclosure, the vegetation was much weedier, less diverse, and had reduced forb cover. Red clover, yarrow, and Kentucky bluegrass dominated the vegetation outside of the exclosure.

2. **Document any noxious weeds or other invasive plant species. Document if weeds are co-located with northern gentian or what distance they are located from occurrences if they occupy the same ecological type. Use this information to update a weed strategy with prioritization for all Region 2 sensitive and SOLC plant species. Document if any weed treatment activity has affected occurrences.**

Noxious or invasive species are common and well established along Castle Creek (GEAF-7). Canada thistle co-occurs with northern gentian and is consistently scattered along the drainage. Butter-and-Eggs (*Linaria vulgare*) was scattered in patches near one of the bridges. Musk thistle occurred in dense patches in the area of the campground. Bull thistle was scattered throughout the drainage. Oxeye daisy was located adjacent to the road and in the meadows where the cutleaf coneflower (*Rudbeckia laciniata*) wasn't as dense. Hound's tongue was scattered throughout the drainage. Creeping or rover bellflower (*Campanula rapunculoides*), an invasive, escaped garden plant, was found along the roadside near private land.

Canada thistle is common in the vicinity and in the same ecotype as northern gentian at GEAF-9; however thistle is not co-located with the gentian.

Canada and bull thistle were co-located with northern gentian at GEAF-12.

No noxious or invasive plant species were reported from GEAF-13.

Musk thistle, Canada thistle, hound's tongue, oxeye daisy, Kentucky bluegrass, smooth brome, and timothy were all abundant at GEAF-14.

Canada thistle occurred in dense patches in and around northern gentian at GEAF-15. Oxeye daisy and hound's tongue were not co-located with northern gentian; however they were observed in the surrounding habitat.

The only noxious or invasive plant species reported at GEAF-16 was a trace amount of cheatgrass. This population should be treated before it has a chance to expand.

Scattered patches of smooth brome and Canada thistle grew along the road near GEAF-17, but neither was noted within the fenced area. Musk thistle was observed within five feet of the exclosure but not within it.

Broadlipped twayblade

Listera convallarioides

Broadlipped twayblade occurs across northern North America and extends south only at high elevations. Rangewide it occurs on rich humus in open woods and boggy meadows and is most often associated with cool soil. It is considered a facultative wetland species in South Dakota and eastern Wyoming and has a high tolerance for anaerobic conditions. There are four known occurrences on the Black Hills National Forest with one site extending onto Bureau of Land Management land. Occurrences are restricted to a 20 square-mile area in the northern Black Hills (Northern Hills Ranger District), south of Lead. Elevations range from 5,120 to 6,080 feet. Individuals are growing in saturated soil conditions adjacent to creeks and springs in white spruce woodlands.

2009 Monitoring Design and Results Evaluation

1. **Annually monitor presence/absence of the four broadlipped twayblade occurrences on Black Hills National Forest (LICO5-1, LICO5-2, LICO5-3, LICO5-4). If any new sites are discovered, gather baseline data and assess risks.**
   LICO5-1, LICO5-2, LICO5-3, and LICO5-4 were revisited in 2009. No new populations of broadlipped twayblade were discovered.

   The broadlipped twayblade population at West Strawberry Creek (LICO5-1) was visited in July 2009. The population appeared to be thriving in the wet, boggy seep areas, particularly where there is deep shade for most of the day. In general the stream banks were well vegetated and stable. The birch and aspen within the site were suckering so there is potential for more shade in the future. There also were quite a few small seedling spruce scattered throughout the riparian area. This year broadlipped twayblade was seen further up the creek than what was reported in 2008. Some of the habitat where it was noted this year could be considered marginal, as it was growing in a boulder strewn stretch of creek where the drainage bottom narrowed. Plants at that location were much smaller and pale with moderate amounts of insect damage.

   The upper portion of the broadlipped twayblade population at Englewood Springs Botanical Area (LICO5-2) is found near the springs. In this area, broadlipped twayblade was often found under thick fowl mannagrass (*Glyceria striata*). Most twayblade in this area was vegetative, but some had mature fruit. Many individuals were starting to turn yellow through natural senescence. Another concentration of broadlipped twayblade on the upper slope appeared to be flourishing under the cutleaf coneflower. More broadlipped twayblade in this area was in fruit than lower on slope.

   The subpopulation of broadlipped twayblade found along the creek near NFSR 288 is discussed under item 2.

   The population of broadlipped twayblade at the Bear Butte Creek headwaters (LICO5-3) was visited in July of 2009. The individuals found under downed spruce appeared to be of appropriate size, density, and color with healthy flowers. By contrast, most of the broadlipped twayblade found at the seep area were chlorotic, small in size, and had brown spots. More investigation is needed, but botanists suspect the cause is disease or water quality issues. This site is in the Upper Elk Allotment but does not appear to have been grazed yet this season (2009). This site is also a monitoring site for the North Zone Range 08 Project. Deep elk tracks were observed in the saturated soils of the boggy area and deer were observed bedded in nearby

oxeye daisies.

The broadlipped twayblade population found near a tributary to Elk Creek (LICO5-4) was also visited in July 2009. This site contained relatively undisturbed habitat and the population is currently estimated at over 1,000 individual plants. The broadlipped twayblade were large and appeared healthy. Intermediately sized trees are replacing many of the older trees in the overstory that are dying and falling over. The surrounding uplands and riparian area have suffered from disturbance and degradation. The surrounding uplands were incredibly weedy and at the time of monitoring the oxeye daisy was blooming. No livestock were in the area at the time of survey; however, there were cattle in the pasture to the west. There was evidence of OHV traffic and related damage in the riparian zone adjacent to the nearby private land. In particular, the closed stream crossing approximately 0.25 miles upstream from the broadlipped twayblade still shows evidence of recent OHV use as well as a spring adjacent to the crossing that has been converted to an unstable mud pit by OHV crossings.

2. **Document whether the occurrence (LICO5-2) in Englewood Springs Botanical Area is accessed by livestock to assess the status of meeting Forest Plan Standard 3.1-2503 (Restrict access of domestic livestock use to protect the R2 sensitive and species of local concern plant occurrences in designated botanical areas).**

   North Zone Range 08 Project addressed the portion of the broadlipped twayblade population at Englewood Springs that occurs along the creek. In 2008 a photo point was established to assist in monitoring impacts. In 2009 the monitoring trigger point was exceeded and a temporary electric fence was installed and was in place at the time of survey.

   Monitoring of this lower site revealed that earlier season livestock trampling was evident, but appeared to be less than last year). No recent livestock use within exclosure was reported; therefore the fence appears to be effective. Broadlipped twayblade was present in both known areas within the exclosure. Plants appeared to be healthy (most had fruiting stalks) with some leaves beginning to yellow (normal senescence). Some recent human trampling adjacent to the population, near the established photo point was noted, but impacts not appear to be severe.

3. **Document any noxious weeds or other invasive plant species. Document if weeds are co-located with broadlipped twayblade or what distance they are located from occurrences if they occupy the same ecological type. Use this information to update a weed strategy with prioritization for all Region 2 sensitive and SOLC plant species. Document if any weed treatment activity has affected occurrences.**

   The steep fill slope that lies between the highway and LICO5-1 is densely covered with weedy species including oxeye daisy, white clover, red clover, black medic (*Medicago lupulina*), alfalfa (*Medicago spp.*), common tansy, sweet clover (*Melilotus officianale*), and Canada thistle and very few native species persist. Oxeye daisy, common tansy, and Canada thistle are well established along the creek and co-located with broadlipped twayblade.

   The lower portion of LICO5-2 (near NFSR 288) contains many non-native and invasive plant species within the vicinity. Northern Hills weed personnel treated the area earlier in the season. Canada thistle was found in same ecotype as broadlipped twayblade and was occasionally co-located with the twayblade. Bull thistle and oxeye daisy were found in the same ecotype as

broadlipped twayblade.

At the upper site, the small patch of oxeye daisy observed and pulled last year in the cutleaf coneflower area was present and all plants observed were again pulled. Canada thistle, hound's tongue, and bull thistle were growing within the broadlipped twayblade population. The thistle test plot established in 2005 was read and three people spent over two hours pulling weeds. Time was focused in habitat where broadlipped twayblade occurs, both up and downstream of the test plot. Seed heads were clipped and removed from the site, and vegetation was pulled and left on site to compost (USDA Forest Service 2009d).

Canada thistle was dense in the drainage bottom near broadlipped twayblade at LICO5-3. Canada thistle, bull thistle, and timothy were found co-located with broadlipped twayblade. Butter and eggs, hound's tongue, oxeye daisy, and common dandelion were found infrequently in the same ecotype as broadlipped twayblade.

Bull thistle was co-located with broadlipped twayblade at LICO5-4. Hound's tongue, musk thistle, and oxeye daisy are located in the vicinity.

Stiff clubmoss

Lycopodium annotinum

Stiff clubmoss is widely distributed in boreal habitats of North America. In most places, it occurs in swampy or moist coniferous forests, mountain forests, or exposed grassy or rocky sites. In the Black Hills, stiff clubmoss occurs in moist microhabitats within remnant boreal white spruce and paper birch/hazelnut communities (5,100 to 6,300 feet). There are ten occurrences of stiff clubmoss documented on the Black Hills (Bearlodge, Mystic, and Northern Hills Ranger Districts), three of which co-occur with groundcedar.

2009 Monitoring Design and Results Evaluation

1. **Revisit the three sites of stiff clubmoss that co-occur with groundcedar (LYAN2-1, LYAN2-3, LYAN2-4), monitor presence/absence and assess risks.**

   Monitoring occurred at LYAN2-1, LYAN2-3, and LYAN2-4 in 2009.

   Once again LYAN2-1 appeared to be stable with only an estimated ten percent of the plants having browned. The rest of the individuals were large and robust. Photos were retaken at the established photo points. As was the case in 2008, most of the plants that had strobili were in the center of the co-occurrence of the groundcedar and stiff clubmoss. An estimated five percent of the plants had strobili, and of those plants that had strobili, ten percent still had immature fruit and had not released spores yet. The area surrounding LYAN2-1 appeared to be suffering from the damage caused by monitoring visits. Botanists decided to visit this site only if management activities were planned or had occurred in the vicinity, otherwise the site would be visited every five years. The next planned monitoring visit will occur in 2014.

   The population of stiff clubmoss at Tillson Creek (LYAN2-3) co-occurs with groundcedar. Overall, the site appeared stable in 2009 with no major changes since the last monitoring visit in

2008. There are three subpopulation of stiff clubmoss found at this site. At subpopulation A, some stems were brown and dried or dead, but overall the population appears healthy and mostly green; approximately ten percent of plants were observed to have strobili. At subpopulation B, botanists observed a faint game trail forming through site, but not causing much disturbance to site. This subpopulation appears healthy with fewer brown stems than subpopulation A. Approximately five percent of individuals were observed with strobili. At subpopulation C, individuals showed browning around the edges but appeared healthy overall. Only a few individuals were observed with strobili. No additional concentration areas of stiff clubmoss or groundcedar were located, despite efforts to survey the surrounding suitable habitat. Elk droppings were found in the site area. No evidence of recent livestock use was observed; however, grazing occurs in the drainage bottom below site. This slope is not favorable for grazing due to lack of forage species and large amounts of blow down.

The stiff clubmoss site located along a tributary to the north fork of Rapid Creek (LYAN2-4) was visited in 2009. Fewer stiff clubmoss individuals were observed at the site than in previous years and again, groundcedar was not relocated. New spruce downfall (natural) in the site area may have partially covered some plants with bark and debris. In addition, much of the overstory of the site has been removed (both naturally and anthropomorphically) making the site more open than it was in the past.

A meeting of botany and range staff (from the SO and the Northern Hills District) was convened to determine if the trees that were felled at LYAN2-4 in late 2007 were effectively stopping livestock from trailing through the population. During the winter of 2008, an additional natural downfall occurred within the site that effectively blocked the area where livestock were trailing in 2008. Livestock and elk have been effectively routed to cross the creek upstream from the site. After viewing the site the group determined that the trailing impacts were mitigated for now; however, the site will continue to be monitored to ensure that the new livestock trail remains unobstructed.

2. **Relocate as many occurrences as possible of previously reported locations of stiff clubmoss (or a combination of previously located sites and newly located sites) and gather baseline data. Assess risks to those sites.**

   Three established monitoring sites for stiff clubmoss were visited; however due to lack of time and resources new monitoring sites were not established and other known stiff clubmoss sites were visited in 2009.

3. **Document any noxious weeds or invasive plant species. Document if weeds are co-located with stiff clubmoss or what distance they are located from occurrences if they occupy the same ecological type. Use this information to update a weed strategy with prioritization for all Region 2 sensitive and SOLC plant species. Document if any weed treatment activity has affected occurrences.**

   Timothy was observed in the same ecotype as stiff clubmoss at LYAN2-3. No noxious or invasive plant species were reported from within the site at LYAN2-4; however bull thistle, oxeye daisy, and hound's tongue were located in the drainage bottom and along the nearby road.

   Absinth wormwood was noted in the drainage bottom approximately one half mile upstream

from LYAN2-1. It was well established and appeared to be spreading downstream. Evidence of weed treatment along the road leading to the site was observed, but no treatment in the vicinity of the stiff clubmoss. The area surrounding stiff clubmoss at this site appears to be free of noxious and invasive plant species at this time.

Alpine mountainsorrel

Oxyria digyna

Alpine mountainsorrel is widely distributed in arctic and alpine habitats in North America. It is usually associated with rocky areas (especially near streams) and moist ground in alpine or subalpine habitats. The six known occurrences on Black Hills National Forest lands are restricted to two square miles within the Black Elk Wilderness. An additional occurrence has been reported form Custer State Park. Alpine mountainsorrel grows on course textured soils in rocky gullies near steep, granite rock outcrops (6,000 to 7,240 feet). It is often associated with southwest showy sedge and great-spurred violet.

2009 Monitoring Design and Results Evaluation

1. Annually monitor presence/absence of the four documented sites (OXDI3-1, OXDI3-2, OXDI3-3, and OXDI3-4) and assess risks.

The alpine mountainsorrel population at the headwaters of Nelson Creek (OXDI3-1) was monitored in August of 2009. Alpine mountainsorrel is found on a flat ledge with soil built up over rocks and in large crack between spires. The population was present and appeared to be healthy and stable with only a small amount of yellow/brown tattering on leaves. The tattering was most likely natural senescence because of the late date. But site and plants appear overall healthy and stable.

One of the alpine mountainsorrel populations at Harney Peak (OXDI3-2) was visited in August of 2009. This site is divided into two subpopulations. The alpine mountainsorrel at subpopulation A appeared to have had a successful reproductive season (40% of the plants displayed mature fruit). Some individuals displayed brown speckling and tattering of leaves but plants looked very healthy. Nearby vegetation showed evidence of grazing (most likely from mountain goats); however the alpine mountainsorrel did not appear to be affected. This stonework area is directly below the tower, but does not receive much direct traffic from visitors. The subpopulation is estimated to be approximately 200 plants.

The second subpopulation occurs along base of a north-northeast facing wall. Here alpine mountainsorrel co-occurs with southwestern showy sedge and great-spurred violet (*Viola selkirkii*). Subpopulation B has fewer plants than at A (approximately 150 plants). Plants appear healthy overall, but only ten percent displayed mature fruit.

Plants look healthy and are locally abundant in the gully. This is a densely populated site. Site with the second greatest number of individuals recorded. (OXDI3-6 site in vicinity of Grizzly Creek headwaters has greatest # of individuals).

The alpine mountainsorrel population at Elkhorn Mountain was visited in August of 2009. This

population occurs in a dry drainage that most likely holds water during spring runoff and heavy rain events. Rocks falling or talus sliding are possible threats to the site, but the area seems relatively stable. Some individuals at the site have brown speckles on their leaves, but the population appears healthy and stable overall.

Another alpine mountainsorrel population in the Harney Peak area (OXDI3-4) occurs in the bottom of a gully below the Harney Peak summit. This drainage holds a large volume of water during heavy rain events due to the large surface area of exposed rock above. Alpine mountainsorrel occurs directly in the scour zone, but site appears relatively stable overall. The area did not show evidence of recreational or mountain goat use. Some individuals in the population displayed brown speckling on one or two leaves, but the population appears healthy and stable. Alpine mountainsorrel co-occurs with great-spurred violet (VISE2-10) at this site.

2. **Gather baseline data on any new occurrences that may be discovered. Assess risks to those sites.**

   Baseline data was collected on two newly discovered occurrences. OXDI3-5 was discovered during a floristic inventory of the Upper Pine Creek Research Natural Area. The population did not appear to have a very successful reproductive season (only 15% of plants bore fruit). The leaves of some individuals had speckled and tattered leaves. This damage could have been caused by hail or water movement during recent heavy rain events. This population occurs in a relatively undisturbed area. Trail #9 is not very far from the site; however the area shows little to no evidence of recreational use. Ponderosa pines down slope from the alpine mountainsorrel have been killed by mountain pine beetle. If beetle damage spreads, the canopy cover of the site could decrease making the habitat unsuitable for alpine mountainsorrel. Great-spurred violet co-occurs with alpine mountainsorrel at this site.

   Alpine mountainsorrel was discovered at Grizzly Creek during a monitoring visit. Plants were found in the main drainage and in the lower part of a rocky, northwest facing side gully above the main drainage. The area channels runoff during spring melt and heavy rain events. Plants occur in dense patches in rocky area along drainage, some right along the water's edge. Some individuals exhibited brown spots on their leaves, but the population appears to be healthy. Alpine mountainsorrel is co-located with great-spurred violet in areas (VISE2-17).

3. **Document any noxious weeds or invasive plant species. Document if weeds are co-located with alpine mountainsorrel or what distance they are located from occurrences if they occupy the same ecological type. Use this information to update a weed strategy with prioritization for all R2 sensitive and SOLC plant species. Document if any weed treatment activity affected occurrences.**

   No noxious or invasive plant species were reported from OXDI3-1, OXDI3-2, OXDI3-3, OXDI3-4, or OXDI3-5. A few Canada thistle were found in the same ecotype as the alpine mountainsorrel at OXDI3-6. These were pulled.

4. **On any currently known alpine mountainsorrel site that is affected by a flood or fire event, monitor for presence/absence.**

   No known alpine mountainsorrel populations were affected by flood or fire events.

Arrowleaf sweet coltsfoot

Petasites sagittatus

Arrowleaf sweet coltsfoot occurs in Alaska, Canada, and the northern continental United States from Washington to Michigan and south to Colorado and Utah. Rangewide, it is associated with cold, wet, marshy conditions and is a facultative wetland species. In the Black Hills, it is often found in moist to saturated meadows and spruce/paper birch/aspen forests (5,120-6,600 feet). There are ten reported arrowleaf sweet coltsfoot occurrences on the Black Hills National Forest (Hell Canyon, Mystic, and Northern Hills Ranger Districts).

2009 Monitoring Design and Results Evaluation

1. **Relocate as many occurrences as possible of previously reported locations of arrowleaf sweet coltsfoot (or a combination of previously located sites and newly located sites) and gather baseline data. Assess risks to those sites.**

   Two arrowleaf sweet coltsfoot sites were visited in 2009, including the site at Black Fox Botanical Area (PESA5-5). Arrowleaf sweet coltsfoot was found at all of the locations where it had been previously mapped within Black Fox botanical area. No new subpopulations were found within the botanical area. Also, the survey was continued outside of the botanical area for one mile up the Rhoads Fork and 1.2 miles up the South Fork of Rapid Creek. Only one new population of arrowleaf sweet coltsfoot was found just upstream from the summer homes on the South Fork (PESA5-8) and none was found on Rhoads Fork. One vegetative component that was consistently present with arrowleaf sweet coltsfoot was field horsetail (*Equisetum arvense*). Where the field horsetail was more prevalent, it seemed the arrowleaf sweet coltsfoot was also denser. The arrowleaf sweet coltsfoot that were overtopped by field horsetail generally had smaller leaves that were starting to curl at the time of survey. A small percentage had large and healthy looking leaves. The arrowleaf sweet coltsfoot was also found in heavy cover of Kentucky bluegrass, timothy, and Canada thistle, not surprisingly those plants did not look as healthy as those found in the more native species assemblages. The leaves tended to be undersized and slightly necrotic in the weedier areas. The healthiest appearing arrowleaf sweet coltsfoot occurred in partial canopy of spruce with light to moderate amounts of field horsetail. In those areas, the plants had large leaves with much less necrosis and less insect damage.

   The arrowleaf sweet coltsfoot that occurs along the South Fork of Rapid Creek (PESA5-8) had baseline data collected in August of 2009. Arrowleaf sweet coltsfoot occurred in partially open riparian habitat with moderate amounts of down woody material. The species assemblage tended to be diverse and native with moderate abundance of Canada thistle, bull thistle, and timothy. The small population was found less than less than 100 yards upstream from the summer homes. The plants were in a localized area that was 30 x 50 feet square and there were 150-200 plants.

2. **Document any noxious weeds or invasive plant species. Document if weeds are co-located with arrowleaf sweet coltsfoot or what distance they are located from occurrences if they occupy the same ecological type. Use this information to update a weed strategy with prioritization for all Region 2 sensitive and SOLC plant species. Document if any weed**

treatment activity has affected occurrences.

Noxious and invasive plant species found both within the botanical area (PESA5-5) and along Rhoads Fork included Canada thistle, musk thistle, hound's tongue, oxeye daisy, and bull thistle. Dense patches of Canada thistle and hound's tongue were observed throughout the riparian zone and uplands within the botanical area.

At PESA5-8, Canada thistle occurred at moderate densities, while bull thistle and timothy occurred at lesser densities.

3. **Document whether the occurrence (PESA5-5) in Black Fox Botanical Area is impacted by livestock to assess the status of meeting Forest Plan Standard 3.1-2503 (Restrict access of domestic livestock use to protect the Region 2 sensitive and species of local concern plant occurrences in designated botanical areas).**

   The fence to exclude cattle and offroad vehicles from the botanical area was completed in late July 2009. On the dates of survey there was no sign that livestock had been in the botanical area this year; however, there was some hummocking of wet areas that resulted from past use by livestock. These areas appear to be healing. There were many deer trails and bedding areas throughout the fen area causing light disturbance.

Northern hollyfern

Polystichum lonchitis

Northen hollyfern is a circumboreal fern that occurs in rock crevices and at the base of boulders, primarily in boreal and subalpine coniferous forests or alpine regions. Northern hollyfern is disjunct in the Black Hills with the closest occurrence in western Wyoming. Over twenty occurrences have been documented in the Black Hills National Forest (Bearlodge and Northern Hills Ranger Districts). These occurrences are associated with moist, mossy, shaded, north-facing slopes, ravines, or gulches in limestone. Usually the overstory consists of paper birch and hazelnut with the occational white spruce, ironwood, or aspen. Black Hills occurrences range in elevation from 4,280 to 6,040 feet.

2009 Monitoring Design and Results Evaluation

1. **Relocate as many occurrences as possible of previously reported locations of northern hollyfern (or a combination of previously located sites and newly located sites) and gather baseline data. Assess risks to those sites.**

   POLO4-2, POLO4-8, and POLO4-13 were visited in 2009. More sites were not visited due to limitations in time and resources.

   The northern hollyfern population located along Beaver Creek (POLO4-2) was visited in 2009. The single observed plant looks healthy with a combination of new and older fronds. No evidence of disturbance was observed in the main drainage (where the population is located); however evidence of grazing was observed in side drainages.

The northern hollyfern population in the Bear/Beaver Gulches Botanical Area was visited in 2009. Extensive livestock trailing and related disturbance was observed in the drainage bottom adjacent to the northern hollyfern; however, the plants were situated far enough out of the drainage bottom that they are most likely unaffected. The slope where the plants are located is steep enough that livestock likely will not access. Four cows were seen adjacent to the site the day of survey. The stream below the population is unstable and will most likely continue to cut a deeper channel up the drainage. The plants themselves appeared healthy with a few curled and dried fronds which were assumed to be natural dieback and replacement.

The northern hollyfern population at Strawberry Ridge (POLO4-8) was visited in 2009. All of the plants looked healthy with deep green color. They were in the process of releasing spores on the day of the survey. They were growing in microsites formed by shallow depressions that likely collect extra moisture. Even though the Butch Gulch fire (2003) killed many of the trees in the area, the northern hollyfern are still getting some shade from herbaceous vegetation. The slopes and drainage bottom were very weedy. There was no sign of recent grazing activity in the area. At this point development on adjacent private lands seems to be the greatest risk to this population.

2. **Document any noxious weeds or invasive plant species. Document if weeds are co-located with northern hollyfern or what distance they are located from occurrences if they occupy the same ecological type. Use this information to update a weed strategy with prioritization for all Region 2 sensitive and SOLC plant species. Document if any weed treatment activity has affected occurrences.**

   No noxious or invasive plant species were reported from within the site itself; however common tansy occurred frequently in the drainage bottom along the creek. Common St. John's wort and lesser burdock (*Arctium minus*) occurred occasionally in the drainage bottom.

   At POLO4-8 Canada thistle and hound's tongue were co-located with northern hollyfern. Timothy was fairly thick in the drainage bottom.
   Hound's tongue and musk thistle were observed in the drainage bottom, but were not co-located with northern hollyfern at POLO4-13.

Shining willow

Salix lucida ssp. *caudata*

Shining willow is widely distributed in the western and northern continental United States and Canada. The easternmost limit to shining willow is in South Dakota. Rangewide, it is commonly associated with stream banks, shores, wet meadows, and seeps. It is considered a facultative wetland plant in South Dakota and eastern Wyoming. Two Black Hills occurrences were relocated and confirmed in 2006 while a third historical record was not relocated. A fourth occurrence was planted from cuttings in 2007.

2009 Monitoring Design and Results Evaluation

1. **Annually monitor presence/absence of the Spearfish Creek and N. Redwater sites (SALU-2, SALU-3) and if time permits, the experimental planting site on Redwater Creek (SALU-**

4). Count shining willow individuals at each site. Document any new disturbances or changed levels of pre-existing disturbances.

The majority of individuals at the shining willow population on the tributary to North Redwater Creek (SALU-2) had some minor insect damage and varying degrees of yellowing and brown mottling on leaves. Browsing on plants ranged from 20-40% of current years leaders browsed. This browsing is most likely from wildlife since all plants are within the exclosure. The willows that were transplanted in 2007 appeared healthy and exceeded six feet in height in the western exclosure and four feet in the eastern exclosure. The westernmost transplant had impressive growth in spite of the scouring at the base of the plant. A few suckers were beginning to sprout at the bases of the plants and branches are outgrowing the cages.

Monitoring reported new suckers from the root system of the parent plant that were four to six inches tall. Browse on young suckers was a problem in 2008, but this year's growth are somewhat protected by the fence. The plants in the eastern exclosure showed minor amounts of damage from leaf rolling insects. The non-sensitive willow species were also healthy with little to no browse. There were a few suckers coming from the base but not many. It is possible that the plants are dedicating energy to root development.

The shining willow population that grows in Spearfish Canyon (SALU-3) was visited in August of 2009. The population showed evidence of leaf miner, chewing insects, and black spots (disease) on the leaves. Observers reported a newly removed (by beaver) live branch from the female plant. The female plant looks to be in decadent and declining condition. Several of the lower branches are dead and overhang the creek. Other problems noted were many black spots on the leaves, insect egg galls, leaf rolling insects, shriveled leaves, and aphids. One of the larger branches was newly dead from what appeared to be different disease than what is causing the black spots on the leaves. The entire branch had very shriveled and reddish leaves. The male plant has had all of the larger, woody branches removed by beaver. There were four 1-2 inch diameter stumps left with the only active growth coming from suckers. It looked better than the female but also had the black spots and insect herbivory on the terminal leaves. Some of the new leaves, if they were not eaten, were shriveled or stunted.

In August of 2009, the transplanted shining willow population at Redwater Creek was visited to assess the condition of the site. Five of the plants were very small (on to two feet) with small leaves that were few in number. Eight of the plants were large (six feet tall) and robust with good growth this year and very little evidence of browsing. Another eight of the plants fell into an intermediate category measuring three to four feet tall with moderate vigor. Only one catkin was found on the plants and it was past its prime. It looked like the plant might be a female, but observers could not be certain. Some of the twigs had buds that never opened. There was some brown/yellow mottling on some of the leaves, a few dead twigs, and dieback of twig tips above the beaver dam. It is uncertain if this was due to disease or changes in the available water. The surviving transplants that were planted on the top of the beaver dam were crowded by hound's tongue, Canada thistle, cow parsnip, and mullein. Those species are sharing the cages with the transplanted willows. Most of the empty cages located on the dam are filled with weeds.

2. Gather baseline data on any new occurrences that may be discovered. Assess risks. If time permits:

- **Survey Spearfish Creek for additional plants/occurrences.**
- **Attempt to relocate the second Bearlodge site for shining willow that was not found in 2006, 2007, or 2008.**

No new shining willow sites were discovered in 2009. Botanists surveyed Spearfish Creek for additional occurrences, but none were located. The Bearlodge site was not relocated in 2009 either.

3. **Document observations regarding if shining willow plants are grazed by livestock to assess the status of meeting Forest Plan standard 2505 e.**

When monitoring occurred at SALU-2 in August of 2009, livestock were immediately upstream of the western exclosure; however no evidence of livestock browsing on the shining willow was observed. Wildlife appears to have been browsing the willows within the exclosures, including shining willow. The shining willows at SALU-3 and SALU-4 do not show signs of browsing by livestock. Forest Plan Standard 2505e has been met with regards to shining willow.

4. **Document any noxious weeds or invasive plant species. Document if weeds are co-located with shining willow or what distance they are located from occurrences if they occupy the same ecological type. Use this information to update a weed strategy with prioritization for all Region 2 sensitive and SOLC plant species. Document if any weed treatment activity has affected occurrences.**

At SALU-2, Canada thistle occurred within the exclosures, some of it within two meters of the transplants. There were patches of musk thistle within the exclosure as well as timothy and Kentucky bluegrass. Some Canada thistle in the site area had been hand-pulled earlier this season. Hound's tongue, black medic, and bull thistle occur in the drainage near the shining willow.

Common tansy and oxeye daisy co-occur with the shining willows at SALU-3. Canada thistle grows in the same ecotype as the willows, but is not co-located.

Houndstongue, Canada thistle, and musk thistle compete with shining willow for resources at SALU-4.

Monitoring Item 18b-m, Emphasis Species, Sensitive Species, Wildlife

Emphasis Species

Sensitive Species (Wildlife)

Objective 221: Conserve or enhance habitat for R2 sensitive species and species of local concern (SOLC). Monitoring will be conducted at a Forest-wide level, not at the project level, and will be done for habitats or populations.

Objective 221 is applicable to all sensitive species. There are two other types of objectives that are relevant to some, but not all, sensitive species. The first type is species-specific objectives that are

directly applicable to one or more species (e.g., Objective 237 for prairie dogs). These are evaluated below under the appropriate species headings. The second type of objectives are not specific to or in direct reference to sensitive species but are relevant habitat considerations for some sensitive species (including objectives related to landscape vegetative diversity (LVD) such as vegetation Objectives 201 and 239-LVD). Full evaluations of this last type of objectives are found under other monitoring items, but a summary may be provided below when appropriate. A summary of monitoring information and evaluation of that information presented for each sensitive species.

Monitoring Item 18b, Emphasis Species, American Marten

Emphasis Species
Sensitive Animals
American marten

The American marten monitoring protocol focuses on the amount of preferred habitat. In the Black Hills, marten are highly associated with white spruce forests, and this is considered preferred habitat.

Amount of Preferred Habitat: As disclosed in Monitoring Item 8, the spruce cover type was 25,749 acres of the Forest. This is 29% greater than what is called for in Objective 239-LVD (20,000 acres). Fire suppression during the last century has allowed spruce to increase in abundance and density in the Black Hills. Relative to ponderosa pine, spruce is patchily distributed.

The Forest is conserving habitat for the American marten.

Monitoring Item 18c, Emphasis Species, Bats

Emphasis Species
Sensitive Animals
Bats (Townsend's big-eared bat, Fringe-tailed myotis)

The sensitive bats monitoring protocol focuses on three items: protective measures, disturbance, and snags. Roost protection measures stem from Standards 3208 and 3209. Snag data are found in Monitoring Item 11, and correspond to Objective 211.

Protective Measures: There are three types of protective measures that are reported here: pre-closure mine evaluations, bat passage devices installed, and bat passage devices maintained. In 2009, one mine was evaluated for bat habitat and bat use. The table below shows the number of bat passage devices installed in caves and mines across the Forest in the past. One gate was installed in FY2009.

Number of Bat Passage Devices Installed in Caves and Mines						
	Prior to 2005	2005	2006	2007	2008	2009
Caves	6	0	0	0	0	0
Mines	6	5	2	2	1	1

Disturbance: Personnel monitored mines, caves and/or bat passage devices for signs of vandalism, incompatible uses, and non-compliance with established closure dates. All monitored caves and mines and closure devices were in good condition.

Snags: Monitoring Item 11 displays that in FY 2009, there were 3.5 snags per acre >9" dbh and greater than 25 feet tall across conifer forested portions of the Forest. The percent of snags greater than 14 inches dbh was 23%. This was a decrease from 30% in FY 2007 and 24% in 2008. The number of snags greater that 9 inches DBH exceeds Objective 211 and the percent greater than 14 inches dbh is slightly under (2%) Objective 211 (excluding large burned areas and mortality from insects). Wildfires and insect tree mortality results in more than 3 snags per acre across the Forest.

The Forest is conserving and enhancing habitat for the Townsend's big-eared bat and fringe-tailed myotis.

Monitoring Item 18d, Emphasis Species, Black-tailed Priairie Dog

Sensitive Animals

Black-tailed Prairie Dog

Objective 237: This objective prompts the Forest to manage for 200-300 acres of prairie dog towns in at least 3 separate towns. This species was not monitored in FY 2009. The best available information is shown in the table below and indicates the Forest is exceeding Objective 237.

Prairie Dogs	**2002**	**2003**	**2005**
# of towns	6	5	10
acres	246	264	400

Monitoring Item 18e, Emphasis Species, American Three-toed Woodpecker

Sensitive Birds

American Three-toed Woodpecker

There are two components to the three-toed woodpecker monitoring protocol: relative density of woodpeckers in white spruce (preferred habitat), and the amount of white spruce.

Relative Density in Preferred Habitat: Relative density of this species is monitored through the Monitoring Birds of the Black Hills (MBBH) program. See Monitoring Item 21 (Emphasis Species – MIS, Non-game Birds section) for more information on the MBBH program. White spruce habitat was monitored in 2009. Estimated woodpecker densities have ranged from 0.7 to 3.9 birds/km^2 (White et al. 2010) (see table below). The species has also been detected in several of the remaining habitats sampled by MBBH, but spruce trees were either present or in close proximity. Detections were too infrequent in these habitats to allow density estimates to be calculated.

Relative density (birds/km^2) of American three-toed woodpecker in white spruce habitat, 2001-2009 (White et al. 2010).

2001	2002	2003	2005	2007	2009
0.7	3.1	3.9	3.9	1.4	1.3

Amount of Preferred Habitat: As disclosed in Monitoring Item 8, the spruce cover type was 25,749 acres of the Forest. This is greater than what is called for in Objective 239-LVD (20,000 acres). In 1995, there were 21,737 acres of spruce, and in 1899, it was estimated at 15,000 acres (USDA Forest Service 1996b). This indicates a long-term increase in spruce. Fire suppression during the last century has allowed spruce to increase in abundance and density in the Black Hills. Relative to ponderosa pine, spruce is patchily distributed (USDA Forest Service 2005b p. III-24).

The Forest is conserving habitat (white spruce) for the American three-toed woodpecker. It is unclear why the relative density has dropped over the last two sample cycles.

Monitoring Item 18f, Emphasis Species, Northern Goshawk

Sensitive Birds

Northern Goshawk

There are three components to the goshawk monitoring protocol: nest stand habitat, overall habitat diversity, and territory occupancy.

Nest Stand Habitat: This monitoring component measures the amount and trend of structural stages 4B, 4C, and 5 within designated goshawk nest stands. It will not be evaluated in this

monitoring report, because designated nest stands have not been entered into the corporate wildlife database yet, and are therefore not available in a format necessary for this type of analysis. When funding becomes available, nest stand boundaries will be obtained from the administrative records of district-level projects, and entered into the corporate wildlife database. A GIS analysis can then be performed to provide information for this monitoring component.

Habitat Diversity: Habitat diversity is provided through the Forest Plan Structural Stage Objectives (Objectives 4.1-203, 5.1-204, 5.4-206, 5.43-204, and 5.6-204). Monitoring Item 9 (Vegetative Diversity – Structural Stages) provides a structural stage comparison between the current condition and the desired condition in ponderosa pine forests. Monitoring Item 9 discusses the Forest's progress towards the structural stage objectives. Habitat diversity is being provided consistent with Objective 221, though it may take some time to achieve the desired amounts of some structural stages.

Territory Occupancy: This component measures the presence of territorial goshawks within known territories. If a territory has territorial birds within it, it is said to be occupied. Some signs of territorial behavior are aggressiveness (e.g., vocalizations and physical movement toward surveyors), prey remains around nest sites, and molted feathers around nests. Territoriality is a good indicator that an established (capable of breeding) pair exists in an area, and is easier to detect than breeding status or nest success (Woodbridge and Hargis 2005). Therefore, territory occupancy is what the Forest evaluates to demonstrate persistence of breeding goshawks on the Forest.

The SDGFP has funded goshawk monitoring on the Black Hills from 2003 to 2009 (Knowles and Knowles 2008). During the 7 years of surveys, 30 active nest territories were studied. Fifty-three nesting attempts were monitored of which 35 fledged young (66% successful) (Knowles and Knowles 2009).

In 2009, 42 goshawk territories were monitored. Of these, 14 (33%) were active. This territory occupancy rate is consistent with data since 2000 (see table below). The rate was not determined in 2004. Woodbridge and Hargis (2005) disclose territory occupancy rates between 39% and 100% in two Western study areas from 1992 to 1996. This may suggest that the recent rates on Black Hills NF may be relatively low. However, the frequency and intensity of monitoring in those studies were much higher than what is performed in the Black Hills, which would lead to higher (and more accurate) occupancy rates. Forest Service monitoring in the Black Hills is typified by only one or two visits to a subsample of nests each season, with each visit lasting less than one full person-day. Furthermore, goshawk territoriality and nest attempts show high annual variation, and may be closely tied to annual precipitation fluxes that affect prey abundance (Salafsky et al. 2005). Therefore, drought conditions over the past several years may also be affecting goshawks.

Goshawk Territories Monitored & Occupied, 2000-2009									
	2000	2001	2002	2003	2005	2006	2007	2008	2009
Territories Monitored	42	46	84	74	56	34	49	32	42
Territories Occupied	12	9	20	25	23	9	18	13	14
% of Territories Occupied	29%	20%	24%	34%	41%	26%	37%	41%	33%

The Forest is conserving habitat for the northern goshawk, but additional time is needed to achieve the desired structural stage percentages.

Monitoring Item 18g, Emphasis Species, Bald Eagle

Sensitive Birds

Bald Eagle

Historically, bald eagles wintered in and migrated through the Black Hills. Eagles are frequently seen from October through March feeding on road-killed animals (carrion), perched near unfrozen lakes or streams, or soaring in the sky.

The first nesting attempt on the Forest was confirmed in FY 2007 at Deerfield Reservoir. This nest was monitored for the second year in FY 2008 and one eagle was fledged. In 2009, a nesting attempt was made in March and April. The nest was abandoned in early May and did not fledge any young.

Deerfield Bald Eagle Nest Status and Fledging History		
Year	**Status**	**No. of Young Fledged**
2008	Active	1
2009	Initiated, Abandoned	0

Prior to FY 2006, there were no known traditional (repeated use) or communal roost sites in the Black Hills. In 2006, a night roosting area was discovered at Pactola Reservoir. Approximately 18 to 22 eagles were observed at the roost on four separate occasions between late December 2005 and late January 2006.

Bald eagles are also known to use transitory roost sites on the Forest. These are roosts that are not used repeatedly or on a consistent basis, and may be chosen based on proximity to a temporary food supply (e.g., carrion). Mature ponderosa pine trees provide suitable roost sites, and they are abundant across the landscape. Therefore, transitory roost sites do not appear to be a limiting factor on the Forest.

The Forest is conserving habitat for the bald eagle consistent with Objective 221.

Monitoring Item 18h, Emphasis Species, Birds

Rare Birds

Peregrine Falcon, Burrowing Owl, Flammulated Owl, Lewis's Woodpecker, Loggerhead Shrike, Northern Harrier, Yellow-billed Cuckoo, Long-billed Curlew

Each of the species included in this monitoring item are considered uncommon, rare, casual or accidental to the Black Hills (Tallman et al. 2002). The Forest uses detection data collected through the MBBH program to track these species (White et al. 2010). See Monitoring Item 21 (Emphasis Species – MIS, Non-game Birds section) for more information on MBBH.

Rare Bird MBBH Observations, 2001-2008

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009
Burrowing Owl	0	0	0	1	0	7	0	0	0
Flammulated Owl	0	1	0	0	0	0	0	0	0
Lewis's Woodpecker	3	4	9	4	8	7	9	1	34
Loggerhead Shrike	1	0	0	0	0	0	0	0	0
Long-billed Curlew	0	0	0	0	0	7	0	3	0
Northern Harrier	1	0	0	0	0	1	0	0	0
Peregrine Falcon	0	0	0	0	0	0	0	0	0
Yellow-billed Cuckoo	0	0	0	0	0	0	0	0	0

Of the species listed above, the Lewis's woodpecker is the most frequently detected. Over three times as many were seen in 2009 as the next highest year (2007). As discussed in Monitoring Items 9 and 11, the snag objectives are being met and the structural stage objectives provide habitat diversity for forest dwelling species such as Lewis's woodpeckers.

Since the MBBH Program started in 2001, the first observations of long-billed curlew occurred in 2006. All observations occurred in grassland habitat in the Southern Black Hills. No long-billed curlews were recorded in 2009.

None of the other rare sensitive birds (flammulated owl, northern harrier, loggerhead shrike, peregrine falcon, or yellow-billed cuckoo) were recorded on the Forest in 2009. Only the flammulated owl, loggerhead shrike and northern harrier have been detected and in very limited numbers in the recent history of the MBBH program.

The Forest is conserving habitat for these rare species, consistent with Objective 221, even though some species are absent or so rare that they are not detected. Burrowing owls, long-billed curlews, northern harriers, and loggerhead shrikes are more typically found on the plains surrounding the Black Hills and occurrence is expected to be infrequent or rare in the Black Hills.

Monitoring Item 18i, Emphasis Species, Black Hills Redbelly Snake

Reptiles

Black Hills Redbelly Snake

There are two indicators for the redbelly snake: trend of riparian habitat condition, and amount of hardwood habitats on the Forest. These indicators are in direct reference to Monitoring Items 6 and 8, respectively.

No Forest-wide data on riparian resource condition or trend (Monitoring Item 6) was collected in FY 2009. The implementation of Forest Plan standards and guidelines, Regional watershed conservation practices and best management practices maintain riparian habitat Forest-wide, but probably at a level less than its full capability. Monitoring item 7 identifies projects to restore riparian and wetland habitat or to rehabilitate stream reaches. This data can be used to partially indicate trend of redbelly snake habitat. According to Monitoring Item 7, progress is being made to restore 500 acres of riparian shrub communities (Objective 214) and to enhance streams. These projects, though not directly targeted for the red-bellied snake, likely have a small positive influence on the habitat trend for this species.

According to Monitoring Item 8, stands dominated by aspen currently occupy approximately 45,805 acres on the Forest. This is an increase of 694 acres from 2008, and about a one percent increase since 1997. Aspen stands have been replaced by pine and spruce in many areas of the Forest, and likely have declined since pre-settlement times (USDA Forest Service 2005b p. 111-28). This may have resulted in a net loss of redbelly snake habitat.

Overall, the Forest appears to be conserving habitat for the redbelly snake, but additional effort is needed to improve riparian condition and increase the acres of aspen.

Monitoring Item 18j, Emphasis Species, Northern Leopard Frog

Emphasis Species

Amphibians

Northern Leopard Frog

The leopard frog monitoring protocol calls for determining continued persistence at a rotating sample of 8 known occupied habitats (index sites) annually. Monitoring efforts should be done in July and August and should be rotated annually among index cites so that all 40 sites are monitored over a five year period. The data is to be compiled annually with a summary of the previous five years.

The largest leopard frog monitoring effort to date occurred in 2009. Monitoring occurred during late August and mostly during September. Thirty-one index sites were visited in 2009. Leopard frogs were found at 18 of the 31 sites visited (58%). Four index sites that previously had leopard frogs did not have leopard frog observations in 2009. Eight sites were monitored for the first time in 2009 and 5 of them had leopard frogs present. District Biologists anecdotally noticed fewer

leopard frogs in 2009 than in previous years.

Over the last five years, 43 index sites have been visited. Of the 43 sites visited over the last five years, 28 (65%) of them had leopard frogs present. A summary of past monitoring is shown in the table below. A lower percentage of monitored sites had leopard frogs in 2005-2009, but that could have been due to the late season monitoring in 2009. Still, this coupled with the anecdotal observations of fewer leopard frogs indicates a possible decline in leopard frogs. Additional future monitoring is needed to determine of this is a long-term downward trend.

Five Year Summary Compilation of Leopard Frog Index Sites monitored.				
	2002-2006	2003-2007	2004-2008	2005-2009
# of sites monitored	31	29	30	43
# of sites with leopard frogs	22	21	24	28
% of sites with leopard frogs	71%	72%	80%	65%

Leopard frog index sites are not distributed well across the Forest. Most of the index sites are in the central and southern Black Hills. There are very few index sites in the northern Black Hills and Bear Lodge Mountains. Additional effort and funding is needed to establish additional sites in these areas.

Projects implemented in 2009 that improved habitat conditions for leopard frogs by protecting stream or lake shorelines and upland vegetation are reported in Monitoring Item 7. These projects move the Forest towards achieving Forest Plan Objectives 213, 214, 215 and 221.

Forest Plan standards and guidelines, Regional watershed conservation practices and best management practices maintain riparian habitat condition. Small-scale riparian enhancement projects are likely to provide some positive incremental benefit to the leopard frog. Limited data suggest that the Forest is conserving habitat for the leopard frog. However, monitoring of index sites and anecdotal observations indicate possibly fewer leopard frogs than in the past. Additional index site monitoring is needed to determine if this is a long-term trend.

Monitoring Item 18k, Emphasis Species, Cooper's Rocky Mountain Snail

Invertebrates

Cooper's Rocky Mountain Snail

The Cooper's Rocky Mountain snail (*Oreohelix strigosa cooperi*) monitoring protocol calls for monitoring 20% of all known (Frest and Johannes 2002) mountain snail sites annually and tracking newly discovered sites. Results are to be reported annually with a five-year summary compilation.

No snail colonies were visited in 2009. The Forest developed an agreement with Wyoming Natural Diversity Database (WYNDD) to conduct monitoring at a random sample of the known snail sites. WYNDD began monitoring in the spring of 2010 and results will be available in the fall of 2010.

Over the past five years, 10 Frest sites that had mountain snails have been monitored. Of the sites monitored, seven (70%) continue to have mountain snails present.

Over the past five years, mountain snails have been discovered at six new sites. In 2007, mountain snails were discovered at two new sites. In 2008, mountain snails were discovered at 4 new sites, including two of Frest's sites that previously had no record of mountain snails.

It appears the Forest is conserving snail habitat consistent with Objective 221 through the implementation of Standard 3103. Continued monitoring of known sites is needed. In particular, sites where the Cooper's Rocky Mountain snail was not resampled in 1999 should be revisited to verify species absence and additional inventory should be done to determine the distribution and abundance of this species.

Monitoring Item 18l, Emphasis Species, Regal Fritillary

Invertebrates

Regal Fritillary

The monitoring indicator for the regal fritillary is the amount of grassland habitat on the Forest. It is unlikely that all of the prairie grassland cover types offer suitable habitat for the regal fritillary, but refined habitat associations are not known in the Black Hills. As disclosed in Monitoring Item 8, grassland acres are less than the objective, but that is to be expected given the limited amount of time this objective has been in place. The current acres of meadow exceed the objective. Projects across the Forest have been emphasizing meadow and grassland restoration through removal of pine encroachment. Some of this, particularly pine removal on the periphery of prairies, may contribute to habitat enhancement for the regal fritillary.

It appears the Forest is conserving and enhancing habitat for the regal fritillary through meadow and grassland restoration projects, but additional time will be needed to achieve the grassland acre objective. The meadow acreage is being achieved.

Monitoring Item 18m, Emphasis Species, Fish
Fish
Finescale Dace and Lake Chub

Finescale Dace

The Wyoming Game and Fish Department conducted limited fish surveys on the Bearlodge Ranger District in 2009. Waterbodies sampled included Hemler Reservoir, Beaver, Cow, Ogden and Richardson creeks. Approximately 75 finescale dace were collected in Hemler Reservoir (Moan 2009 pers. comm.). Most of the fish showed signs of the parasitic yellow grub, a trematode. This reservoir is privately owned and its operation is authorized under a Forest Service Special Use Permit. Finescale dace were not collected at any of the creek sites that were sampled.

Current finescale dace distribution is sporadic and has been influenced by past transplantation efforts primarily in the Redwater River Drainage. No finescale dace populations occur on the South Dakota portion of the Forest (Isaak et al. 2003). This species' distribution *and abundance may be improved by management efforts that enhance or create standing water habitat, such as beaver ponds. A comprehensive stream inventory of the Bearlodge Ranger District would provide useful information on this species' current distribution. For additional information on this species, see the Fiscal Year 2005 Monitoring Report available online at:*
http://fs.usda.gov/Internet/FSE_DOCUMENTS/fsm9_011879.pdf

Lake Chub

Historic accounts suggest the lake chub was more widely distributed across the Black Hills (Isaak et al. 2003). The only population of lake chub currently known to occur on the Forest is in Deerfield Reservoir (Isaak et al. 2003), which is on upper Castle Creek on the Mystic Ranger District. Deerfield Dam/Reservoir is a U.S. Bureau of Reclamation facility. The Forest Service manages the recreational facilities around the lake.

The table below shows the number of lake chub collected during fish population surveys done by the South Dakota Department of Game, Fish and Parks on Deerfield Reservoir.

Gillnet sampling	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
# caught	N/A	N/A	N/A	15	155	55	11	6	4	3	1	2	1	0	0	0
CPUE*	114.3	105.5	109.0	3.8	38.8	13.8	2.8	1.5	0.6	0.8	0.3	0.5	0.25	0	0	0

*Catch Per Unit Effort equals the number of fish caught per gillnet set overnight.
Source: SDGFP 2001, SDGFP 2006 and SDGFP unpublished data

The lake chub population in Deerfield Reservoir is in a downward trend. Lake chub numbers declined substantially in 2000 and continue to remain low (SDGFP 2006). No lake chub were collected during standardized fish population surveys in 2009, but one lake chub was captured during white sucker removal efforts conducted by the South Dakota Department of Game, Fish and

Parks in May 2009. Sampling gear and surveys specifically targeted at capturing lake chub may need to be used in order to monitor lake chub at these reduced population levels.

Low dissolved oxygen levels in late summer near the bottom of the reservoir effectively reduces the amount of habitat available (Isaak et al. 2003). In 2010, Deerfield Reservoir was newly listed as not meeting its assigned beneficial use of coldwater permanent fish life propagation due to temperature (SD DENR 2010). Temperature violations on Deerfield Reservoir are most likely not the result of pollution or degradation (Lorenzen 2010 pers. comm.). All of the water temperature violations occurred near the lake surface probably as a result of summer ambient air temperatures.

The downward population trend may be due to non-habitat related conditions, such as the interaction with other native or non-native aquatic species. The removal of white suckers to reduce its population may have a positive effect if white suckers are adversely affecting the lake chub. The increasing abundance of non-native predatory fish, such as yellow perch and rock bass, which are fairly recent illegal introductions into the reservoir, may also be having a detrimental effect on lake chub numbers.

Efforts to better understand the status of lake chub in Deerfield Reservoir and activities to increase their abundance and distribution on the Forest will be done in coordination with the South Dakota Department of Game, Fish and Parks and the U.S. Bureau of Reclamation.

Monitoring Item 19a, c-e, Emphasis Species, Species of Local Concern

Objective 221: Conserve or enhance habitat for R2 sensitive species and species of local concern (SOLC). Monitoring will be conducted at a Forest-wide level, not at the project level, and will be done for habitats or populations.

Monitoring Item 19a, Emphasis Species, Bats

Species of Local Concern

Mammals, Bats (Long-eared Myotis, Long-Legged Myotis, Northern Myotis, Small-Footed Myotis)

There are two monitoring indicators for the SOLC bats: roost protection measures, and availability of snags. Roost protection measures stem from Standards 3208 and 3209. Snag data are found in Monitoring Item 11, and correspond to Objective 211.

Protective Measures: There are three types of protective measures that are reported here: pre-closure mine evaluations, bat passage devices installed, and bat passage devices maintained. In 2009, one mine was evaluated for bat habitat and bat use. The table below shows the number of bat passage devices installed in caves and mines across the Forest in the past. One gate was installed in FY2009.

Number of Bat Passage Devices Installed in Caves and Mines						
	Prior to 2005	2005	2006	2007	2008	2009
Caves	6	0	0	0	0	0
Mines	6	5	2	2	1	1

Disturbance: Personnel monitored mines, caves and/or bat passage devices for signs of vandalism, incompatible uses, and non-compliance with established closure dates. All monitored caves and mines and closure devices were in good condition.

Snags: Monitoring Item 11 displays that in FY 2009, there were 3.5 snags per acre >9" dbh and greater than 25 feet tall across conifer forested portions of the Forest. The percent of snags greater than 14 inches dbh was 23%. This was a decrease from 30% in FY 2007 and 24% in 2008. The number of snags greater that 9 inches DBH exceeds Objective 211 and the percent greater than 14 inches dbh is slightly under (2%) Objective 211 (excluding large burned areas and mortality from insects). Wildfires and insect tree mortality results in more than 3 snags per acre across the Forest.

The Forest is conserving and enhancing habitat for the SOLC bats.

Monitoring Item 19c, Emphasis Species, Northern Flying Squirrel

Species of Local Concern

Mammals, Northern Flying Squirrel

The monitoring indicator for the northern flying squirrel is the amount of preferred habitat. Preferred habitat is quantified in three ways: acres of spruce cover type; acres of ponderosa pine in structural stage 5; and acres of ponderosa pine with very large tree size in structural stage 4. These components tier directly to Monitoring Items 8, 9, and 10, respectively.

Acres of Spruce Covertype: As disclosed in Monitoring Item 8, the spruce cover type was 27,749 acres. This is greater than what is called for in Objective 239-LVD (20,000 acres). In 1995, there were 21,737 acres of spruce, and in 1899, it was estimated at 15,000 acres (USDA Forest Service 1996b). This indicates a long-term increase in spruce. Fire suppression during the last century has allowed spruce to increase in abundance and density in the Black Hills.

Acres of Structural Stage 5 Pine Stands: The table below shows the acres of Structural Stage 5 Forest-wide. Structural stage 5 has increased over the past five years, but has shown an 80% decline over the ten-year evaluation period.

Acres of Ponderosa Pine Structural Stage 5 Forest-wide, 1997-2009						
	1997	2005	2006	2007	2008	2009
Structural Stage 5	22,409	2,677	3,445	4,494	4,579	5,422

Acres of Structural Stage 4 Pine Stands with a Tree Size of Very Large: Forest Plan Objectives by management area (Management Area 4.1- Objective 203; 5.1-204; 5.4-206; 5.43-204; and 5.6-204) guide the Forest to provide 10% of the structural stage 4 pine acreage (i.e., 4A, 4B and 4C) within the five corresponding management areas to have an average tree size of "very large" (i.e., ≥16" dbh). The Forest is above the large tree objective for Management Areas 4.1, 5.1 and 5.6 and below the objective for Management Areas 5.4 and 5.43. Structural Stage 4 with a tree size of "very large" continued to decline in MA 5.4 to 8.7% (below objective). MA 5.43 is small and a large portion of the management area burned in the 1980s. Because of this, the trees have not matured on much of the management area. Management Area 5.43 represents 0.8 percent of the Forest. Subsequently, a large tree deficiency in this management area has a minor effect Forest-wide. See Monitoring Item 9 for more detailed information on vegetative diversity by structural stages.

The Forest is conserving habitat for the northern flying squirrel in regards to spruce habitat, but progress towards increasing the acres of structural stage 5 and the very large tree component in Management Areas 5.4 and 5.43 is still needed to enhance habitat.

Monitoring Item 19d, Emphasis Species, Ungulates

Species of Local Concern

Mammals, Ungulates (Rocky Mountain Bighorn Sheep, Mountain Goat)

The monitoring indicator for bighorn sheep and mountain goat are population estimates provided by the South Dakota Department of Game, Fish and Parks. Both species are classified as big game animals and are hunted through a limited permit system. The 2009 estimates were not available at the time of this report.

The bighorn sheep is native to the Black Hills, but the original subspecies (Audubon's race) is no longer present here. The animals inhabiting the Forest today descended from introductions of the Rocky Mountain race (Higgins et al. 2000). The estimate in 2000 was 175-200 animals (Smith 2001). The bighorn sheep population estimate for the Black Hills proper has increased from 2004-2006 (Huxoll 2005, 2006, 2007) and has remained stable through 2009 at 350 (Huxoll 2008, 2009, 2010). The Forest is conserving habitat for the bighorn sheep consistent with Objective 221 based on the trend in bighorn sheep numbers.

Black Hills Bighorn Sheep Population Estimates, 2000-2009						
2000	2004	2005	2006	2007	2008	2009
175-200	270	300	350	350	350	350

Mountain goats are not native to the Black Hills, but were introduced in 1924 (Higgins et al. 2000). Population estimates for this species have declined over the past few years as summarized in the table below. Hunter harvest is closely regulated for this species, so this is not likely the cause of the decline. Classic mountain goat habitat includes rocky subalpine and alpine zones above treeline, which does not exist in the Black Hills. Here, the species is associated primarily with rocky areas in the Harney Peak area. Optimal habitat may be limited for this species in the Black Hills.

Black Hills Mountain Goat Population Estimates, 2000-2009						
2000	2004	2005	2006	2007	2008	2009
140-180	125	90	70	60	80	80

Source: Huxoll 2005, 2006, 2007, 2008, 2009, 2010

The cause of the mountain goat population decline is unknown. Possible causes include high predator (mountain lion) numbers, genetics (all descendants from a small number of goats in 1924), and/or loss of habitat. The Forest will continue to coordinate with the South Dakota Department of Game, Fish and Parks to determine if more specific habitat management actions are needed to conserve/enhance habitat for this species.

Monitoring Item 19e, Emphasis Species, Birds

Species of Local Concern

Birds (American Dipper, Black-and-White Warbler, Broad-winged Hawk, Cooper's Hawk, Northern Saw-whet Owl, Pygmy Nuthatch, Sharp-shinned Hawk)

All of these bird species are considered uncommon or rare in the Black Hills (Tallman et al. 2002), and typically require specialized survey methods to effectively monitor. The Forest tracks all of these species except the American dipper through incidental observations collected through the MBBH program (see table at the end of this discussion). Monitoring Item 21 (Emphasis Species – MIS, Non-game Birds section) provides more detailed information on the MBBH program.

American Dipper

Although the dipper is uncommon, it is easier to monitor than the other SOLC birds because it has a limited distribution and is fairly conspicuous in its stream habitat. Its breeding distribution in the Black Hills (and all of South Dakota) is limited primarily to Spearfish and Whitewood Creeks. No breeding population exists in the Bearlodge Mountains. The South Dakota Department of Game, Fish and Parks monitors dippers on Spearfish and Whitewood creeks. Data on nesting attempts and nest success is shown in the following table. The number of successful nests declined along Spearfish Creek and remained stable along Whitewood Creek in 2009.

American Dipper Nest Monitoring Results, 2003-2009							
Stream	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Spearfish Creek							
Nesting Attempts	26	39	42	36	44	32	-
Successful nests	n/a	15	24	21	26	22	18
Nesting Success	n/a	39%	57%	58%	59%	69%	-
Whitewood Creek							
Nesting Attempts	8	13	7	3	6	4	-
Successful nests	n/a	9	5	1	2	2	2
Nesting Success	n/a	69%	71%	33%	33%	50%	-
Source: Lovett 2006, 2007, 2008 and SDGFP online:							

American Dipper Nest Monitoring Results, 2003-2009							
Stream	2003	2004	2005	2006	2007	2008	2009
http://www.sdgfp.info/Wildlife/Diversity/dipper/index.htm							

Black-and-White Warbler

This warbler is found mostly at lower elevations in the Black Hills in bur oak woodlands and associated edges. Because these woodlands occur in canyon bottoms at low elevations, much of this species habitat may be on private land (Hutton et al. 2007). Two observations in ponderosa pine habitat occurred in 2009. The vegetative composition of the habitats preferred by this species has not been analyzed, but it is suspected that bur oak, green ash, aspen, and other hardwoods are important, as is a dense understory of shrubs such as ninebark, chokecherry, hawthorn, and currants.

Progress is being made to achieve the desired condition for bur oak (Objective 201). Subsequently, habitat is being conserved for this species. For more information, see Monitoring Item #8.

Broad-winged Hawk

This hawk occurs primarily in the northern Black Hills and Bearlodge Mountains although it has been observed Forest-wide. Two were detected during MBBH in 2009. The highest number of detections occurred in 2004 in aspen habitat, though this species has been detected in most of the other habitats except shrubland and grassland. Monitoring Item 9 discusses the Forest's progress towards the structural stage objectives for Management Areas 4.1, 5.1, 5.4, 5.43 and 5.6. Additional time and effort is needed to achieve the structural stage percentages.

Coopers Hawk

The Cooper's Hawk appears to be distributed through most of the Black Hills and Bearlodge Mountains, though it is fairly uncommon. The MBBH program has recorded the species in all of the major habitat types, with no obvious affinity for any one. White et al. (2010) did not observe any individuals during the 2009 field season. Monitoring Item 9 discusses the Forest's progress towards the structural stage objectives for Management Areas 4.1, 5.1, 5.4, 5.43 and 5.6. Additional time and effort is needed to achieve the structural stage percentages.

Northern Saw-whet Owl

There are few documented observations of the saw-whet owl on the Forest, mainly because of the bird's nocturnal habits. No observations were recorded by White et al. (2010) during the 2009 field season. Drilling (2010) found that saw-whet owls are the most common and widespread owl in the Black Hills. Drilling (2010) detected them at 15% of all survey points and 93% of all routes, and at all elevations and in all months. Monitoring Item 9 discusses the Forest's progress towards the structural stage objectives for Management Areas 4.1, 5.1, 5.4, 5.43 and 5.6. Additional time and effort is needed to achieve the structural stage percentages.

Pygmy Nuthatch

The pygmy nuthatch is a rare but regular and widespread resident in the Black Hills. Three were observed in 2009. Monitoring Item 9 discusses the Forest's progress towards the structural stage objectives for Management Areas 4.1, 5.1, 5.4, 5.43 and 5.6. Additional time and effort is needed to achieve the structural stage percentages.

Sharp-shinned Hawk

The sharp-shinned hawk occurs throughout the Black Hills, but is perhaps the rarest of the three accipiters. Four sharp-shinned hawks were observed in 2009 (White et al. 2010). Monitoring Item 9 discusses the Forest's progress towards the structural stage objectives for Management Areas 4.1, 5.1, 5.4, 5.43 and 5.6. Additional time and effort is needed to achieve the structural stage percentages.

Species of Local Concern Bird Incidental Observations, 2001-2007									
Species	2001	2002	2003	2004	2005	2006	2007	2008	2009
Black-and-white Warbler	5	7	2	3	6	7	0	1	2
Broad-winged Hawk	3	6	0	24	19	3	2	5	2
Cooper's Hawk	10	4	3	9	9	2	3	5	0
Northern Saw-whet Owl	1	0	0	1	0	0	0	0	0
Pygmy Nuthatch	3	2	0	1	4	3	6	0	3
Sharp-shinned hawk	2	4	3	6	3	0	1	1	4
Source: MBBH data (Panjabe 2001, 2003, 2004, 2005, Hutton et al. 2007, Giroir et al. 2007, White and Giroir 2008, White et al. 2010)									

The MBBH program provides a means to loosely track the above species. More intensive and focused efforts involving call-response surveys to monitor raptors or night-time surveys to monitor the northern saw-whet owl would be needed to effectively monitor these species.

Monitoring Item 20k, Emphasis Species, Threatened and Endangered Species

Objective 220: Conserve or enhance habitat for federally listed threatened, endangered and proposed species.

Currently there are no federally threatened, endangered or proposed species or designated critical habitat on the Forest.

Monitoring Item 21a-i, Emphasis Species, Management Indicator Species

Objective 238: The following are objectives for management indicator species (MIS). MIS will be monitored using trends in habitat; however, when available, population trends may be used as a

strong indicator of management response. Monitoring will be conducted at a Forest scale and not at the project level. Population monitoring will be discretionary as provided by 36 CFR §219.14f.

a. Maintain or enhance habitat for ruffed grouse, beaver, song sparrow, grasshopper sparrow, white-tailed deer and brown creeper; as outlined in specific direction pertaining to aspen, other hardwoods, riparian areas, grasslands, spruce and ponderosa pine (e.g., Objectives 201, 205, 211, 239-LVD, 5.1-204).

b. Maintain habitat opportunities for black-backed woodpeckers across the Forest, as outlined in specific direction pertaining to conifer habitat, snags and recently burned habitat (e.g., Objectives 211, 11-03, 5.1-204, Standard 2301).

c. Maintain habitat for golden-crowned kinglets, as outlined in specific direction pertaining to spruce habitat (e.g., Objective 239-LVD).

d. Maintain or enhance habitat quality and connectivity for mountain suckers, as outlined in specific direction pertaining to aquatic resources (e.g., Objectives 103, 104, 215, Standards 1201, 1203, 1205, Guideline 1115).

Nine species are designated as MIS on the Forest. They are: beaver, white-tailed deer, black-backed woodpecker, brown creeper, golden-crowned kinglet, grasshopper sparrow, ruffed grouse, song sparrow, and mountain sucker. Species-specific monitoring data follow below.

Monitoring Item 21a, Emphasis Species, Beaver
Management Indicator Species
Mammals, Beaver

Monitoring

Beaver were not monitored in 2009. For the latest beaver monitoring data see the 2008 Monitoring and Evaluation Report.

Monitoring Item 21b, Emphasis Species, White-tailed Deer
Management Indicator Species
Mammals, White-tailed Deer

White-tailed deer were selected as an MIS to evaluate forest conditions, including understory shrubs, needed to support this species. Forest Plan Objective 217 supports habitat management for 60,000 white-tailed and mule deer combined in South Dakota. This figure matches the South Dakota Department of Game, Fish and Park's population objective for the Black Hills (USDA Forest Service 1996b, p. 349). South Dakota has released the 2009 population estimates (Huxell 2010). The most current data for Wyoming is 2008 (Sandrini 2009). The South Dakota Black Hills white-tailed deer population peaked in 2006 and has declined since then. The white-tailed deer

population in the Wyoming Black Hills Herd Unit #706 is above the Wyoming objective of 40,000 animals (Sandrini 2009). This Unit includes lands outside the boundary of the Black Hills National Forest.

Estimated Deer Population in South Dakota and Wyoming Black Hills, 2000-2009										
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
SD White-tails	29,000	30,000	35,000	40,000	46,000	50,000	54,000	50,000	45,000	43,000
WY White-tails	n/a	n/a	39,274	45,437	42,997	42,018	42,196	44,125	43,044	--

Habitat trends

Monitoring Item #6 is not reported this year. According to Monitoring Item #8, Aspen and bur oak have increased slightly in 2009 and have been stable over the past five years. Likewise, grasslands and meadows increased slightly in 2009 and over the past 5 years. Ponderosa Pine structural stages 3A and 4A continue to increase. These cover types provide forage for deer.

Structural stage 3C declined in 2009 and over the past five years. Structural stage 4C continued to increase in 2009 as it has over the past 5 years. These structural stages provide visual cover for deer. Overall, cover structural stages appear stable. For more information on structural stage trends, see monitoring item #9.

Evaluation

The Forest-wide habitat trend is stable or increasing. Open habitat that provides forage is increasing and screening cover is stable. The Forest is meeting Objective 217 and Objective 238a based on white-tailed deer habitat and population trends.

Monitoring Item 21c-h, Emphasis Species, Non-game Birds

Management Indicator Species

Birds, Non-Game Birds

In 2001 the Forest began funding the Rocky Mountain Bird Observatory (RMBO) to monitor long-term trends of bird populations through point-count transect surveys. The monitoring program is titled Monitoring Birds of the Black Hills (MBBH). Results are reported to the Forest annually (Panjabi 2001, 2003, 2004, and 2005; Beason et al. 2006; Hutton et al. 2007; Giroir et al. 2007, White and Giroir 2008, White et al. 2009). Ten habitats throughout the Forest are being monitored: white spruce, northern hills ponderosa pine, southern hills ponderosa pine, late-successional ponderosa pine, aspen, pine-juniper shrubland, mixed-grass prairie, montane riparian, foothill riparian, and burn area (mainly the Jasper fire of 2000). Not all habitats are monitored in all years, and adjustments in habitat classifications and transect locations have been and may continue to be necessary as we refine the monitoring program. The monitoring is designed to provide rigorous population trend data on most regularly occurring diurnal (day active) breeding species in the Black

Hills using a statistically sound sampling design. The species sampled include all of the non-game MIS birds (i.e., black-backed woodpecker, brown creeper, golden-crowned kinglet, grasshopper sparrow, and song sparrow).

In 2009, RMBO sampled five habitats: burned area, late-successional pine, ponderosa pine north, ponderosa pine south, and white spruce. For the first time, in 2009 RMBO also surveyed 57 transects using a spatially-balanced design. The new transects were part of a larger program encompassing all of the Badlands and Prairies Bird Conservation Region (BCR 17). Additional results are found in White et al. (2010). This was the ninth year of a long-term monitoring effort; continued monitoring is needed to detect long-term trends. The Forest is obtaining valuable data on species densities and habitat associations crucial to long-term trend detection and evaluation of management effects.

The MBBH program is the source of data for all of the non-game bird MIS accounts provided below, unless otherwise indicated.

Monitoring Item 21c, Emphasis Species, Black-backed Woodpecker
Management Indicator Species
Birds, Non-Game Birds, Black-backed Woodpecker

Monitoring

Relative Densities in Preferred Habitats: In the Black Hills, black-backed woodpeckers are highly associated with ponderosa pine forests that: 1) are recently burned (i.e., within 5 years), or 2) have high bark beetle populations. Another important habitat for this woodpecker is healthy ponderosa pine forests that have dense mature or late successional structure (i.e., structural stages 4C and 5). This third habitat type is especially important when neither recently burned areas or high beetle populations are available.

Burned habitat was sampled in 2009. Burned habitats were monitored in 2007 and from 2001 through 2005. Burned area transects are located almost exclusively within the Jasper Burn. This burn is now 10 years old, and exceeds the age preferred by black-backed woodpeckers. Also, because the Jasper Burn is limited to the southwestern Black Hills, transects are not well-distributed across the Forest. Black-backed woodpecker relative densities (birds/km^2) in burned area habitat reached a high in 2002 and declined thereafter until 2009 when it reached the highest density (White et al. 2010). The jump in relative density in 2009 could be from the abundance insect activity occurring across the Forest.

Relative Density (birds/km^2) of Black-backed Woodpeckers in burned area habitat on the Black Hills NF, 2001-2009

Habitat	2001	2002	2003	2004	2005	2006	2007	2008	2009
Burned Area	.06	6.2	4.7	4.4	2.5	-	2.3	-	6.8

Source: White et al. 2010

The MBBH program does not specifically monitor areas with high mountain beetle populations, so no density estimates are available from this methodology. However, Rumble (2002) measured black-backed woodpecker densities in the heavily infested Beaver Park area of the Black Hills. He found approximately 9 birds per km^2 in the areas with the highest beetle activity.

Structural stages 4C and 5 are both included in MBBH's late successional habitat. Although this is different than how the Forest defines late succession, it matches the third habitat definition given above for black-backed woodpeckers. Late succession habitat in the MBBH was sampled in 2009, but observations were insufficient for density estimate calculations. Late succession by the MBBH definition was monitored in 2001, 2002, 2004 and 2007. Of the years monitored, black-backed woodpecker observations were sufficient for density estimate calculations only in 2002 (Panjabi 2003). In that year, 1.3 birds per km^2 were estimated to occur in MBBH's late successional habitat.

Acres of Preferred Habitat – Burned Areas: According to Monitoring Item 12, a total of 7,672 acres of burned forest habitat was created and largely retained over the last five years. The acres of recently burned habitat are declining as fires move beyond five years since burn date. All but 30 acres (99.6%) have been retained as burned habitat to achieve Objective 11-03.

Acres of Preferred Habitat – Bark Beetle Infestations: As mentioned in Monitoring Item 23, the mountain pine beetle continues to be an issue across many areas on the forest, particularly the central Hills and in Black Elk Wilderness. The overall condition on the Forest is still for a high beetle infestation. This translates into short-term favorable habitat conditions for the black-backed woodpecker.

Acres of Preferred Habitat – Dense Mature and Late Successional Stands: Forest Plan Objectives 4.1-203, 5.1-204, 5.4-206, 5.43-204, and 5.6-204 guide the Forest to provide 5% of the pine in structural stage 4C and 5% of the pine in structural stage 5 in these management areas, partly to ensure habitat for species like the woodpecker. Monitoring Item 9 displays structural stage data. All of the above management areas are meeting the desired percentage for structural stage 4C, but none of them are meeting the desired percentage of structural stage 5.

The table below shows the acres of ponderosa pine structural stages 4C and 5 Forest-wide. Structural stage 4C declined in 2009 as some areas were thinned to reduce insect risk. Structural stage 5 increased in 2009, likely due to improved inventory. Structural Stages 4C and 5 combined declined in 2009.

Acres of Ponderosa Pine Structural Stages 4C and 5 Forest-wide, 1997-2009						
Structural Stage	1997	2005	2006	2007	2008	2009
4C	114,798	135,694	134,533	142,339	149,151	147,475
5	22,409	2,677	3,445	4,494	4,579	5,422
TOTAL 4C & 5	**137,207**	**138,371**	**137,978**	**146,833**	**153,730**	**152,897**

Evaluation

The black-backed woodpecker is distributed in low densities throughout most of the Black Hills. Where numerous wildfires and insect outbreaks have recently occurred, the species has been observed much more frequently and in higher densities.

The Forest-wide relative density for this species is probably higher than “normal” given the current habitat conditions. Black-backed woodpecker populations are ‘eruptive” as reflected in their densities in burned habitat. This pattern of rapid colonization and subsequent decline is consistent with findings of other studies (Anderson 2003). This species’ Forest-wide population trend is likely to decline in the future as vegetation management efforts to reduce the fire-hazard and insect-risk continue.

Overall, habitat for this species is being provided consistent with Objective 238b, Objective 221 and Objective 11.03 (see Monitoring Item #12). The “aging” of large burned areas, such as the Jasper Fire, into habitat less suitable for black-backed woodpeckers is likely being offset by the increasing acreage of insect-infested timber stands and the stable acreage of large diameter, older pine trees. Though additional time is needed to grow more of structural stage 5.

Monitoring Item 21d, Emphasis Species, Brown Creeper
Management Indicator Species
Birds, Non-Game Birds, Brown Creeper

Monitoring

Relative Densities in Preferred Habitats: In the Black Hills, brown creepers are highly associated with late successional pine forests (structural stages 4C and 5) and spruce forests (Panjabi 2005). These habitats were monitored in 2009. See the table below for annual density estimates for spruce, late successional pine, and pine north habitat types since 2001. Relative Densities continued to decline in pine north habitat, rebounded slightly in white spruce habitat and rebounded considerably in pine south and late successional habitat.

Relative Density (birds/km^2) of Brown Creepers one the Black Hills NF by habitat, 2001-2009

Habitat	2001	2002	2003	2004	2005	2006	2007	2008	2009
White Spruce	7.8	11.8	12.2	-	8.5	-	2.1	-	3.9
Late Successional Pine	11.1	11.8	-	14.1	-	-	3.7	-	9.2
Pine North	3.4	6.1	7.3	-	7.3	-	2.4	-	1.2
Pine South	3.2	4.3	6.0	-	2.5	-	1.3	-	4.0

Source: White et al. 2010

Acres of Preferred Habitats: The table below summarizes habitat data from monitoring items 8 and 9 that represent preferred habitat for this species. Spruce habitat has been stable and above the objective over the past 5 years. Ponderosa pine structural stages 4C and 5 declined in 2009 after four years of increasing trend.

Acres of Preferred Brown Creeper Habitat, 1997-2009

	1997	2005	2006	2007	2008	2009
White Spruce	21,737	25,462	26,483	26,110	25,724	25,749
Structural Stages 4C & 5	137, 207	134,129	137,978	146,833	153,730	152,897
TOTAL	**158,944**	**159,591**	**164,461**	**172,943**	**179,454**	**178,645**

Large trees with a closed canopy are also an important habitat component for brown creepers. The table below shows the amount of structural stage 4C Forest-wide with a tree size of very large. The acreage in 2009 was the highest since 2005. For more information on stands with very large trees, see Monitoring Item 10.

Forest-wide Acres of Structural Stage 4C with a Tree Size of Very Large, 2005-2009.				
2005	**2006**	**2007**	**2008**	**2009**
7,800	10,631	8,051	10,917	11,570

Over all, preferred habitat has been stable or slightly increasing on the Forest over the past 5 years.

Evaluation

The MBBH data suggests the brown creeper is well distributed throughout the Black Hills. Overall, the species occurs in fairly low densities across the Forest, but it is most abundant in late successional pine forests and white spruce habitats. In 2009, for the first time the relative density in pine south was higher than white spruce.

Blakesly et al. (2008) projected it will take 25 years to detect a 3% annual decline for this species in pine-north, late successional and white spruce habitats and 30 years in pine-south habitat. In the short-term, relative densities declined for this species in 2007 compared to previous years, but rebounded in 2009 in most habitats sampled (White et al. 2010).

The Forest-wide habitat is stable. Although preferred habitat defined by structural stages 4C and 5 decreased slightly, the acres of structural stage 4C with very large trees (>16" dbh) has increased. Monitoring Item 9 discusses the Forest's progress towards the structural stage objectives for Management Areas 4.1, 5.1, 5.4, 5.43 and 5.6. It appears that Objective 238a is being met. Continued effort and additional time is needed to increase the acres of structural stage 5.

Monitoring Item 21e, Emphasis Species, Golden-crowned Kinglet

Emphasis Species, Management Indicator Species
Birds, Non-Game Birds, Golden-crowned Kinglet

Monitoring

Relative Densities in Preferred Habitats: In the Black Hills, the golden-crowned kinglet is highly associated with white spruce. This is the basis for its MIS status. Spruce habitat was sampled in 2009. The table below shows kinglet relative densities since 2001 (White et al. 2010). Kinglet densities (birds/km^2) were highest in 2005 (white spruce) and showed the lowest densities in 2007. Relative densities rebounded considerably in 2009 in both late successional and white spruce habitats.

Relative Density (bird/km2) of Golden Crown Kinglets on the Black Hills National Forest by Habitat , 2001-2009									
Habitat	2001	2002	2003	2004	2005	2006	2007	2008	2009
White Spruce	25.4	22.9	58.1	-	63.6	-	4.8	-	23.0
Late Successional Pine	0.6	3.5	-	19.5	-	-	3.7	-	15.6

Source: White et al. 2010

Acres of Preferred Habitat: The acres of white spruce habitat are displayed in Monitoring Item 8. Habitat for the golden-crowned kinglet has increased over the long-term and is exceeding the Forest-wide target of 20,000 acres (Objective 239).

Evaluation

The MBBH data suggests the golden-crowned kinglet is distributed primarily in the northern half of the Black Hills, although it is also found in more localized areas of the southern Hills and Bearlodge Mountains as well. Blakesley et al. (2008) projected it will take 20 years to detect a 3% annual decline for this species in white spruce habitat. The Forest is meeting Objective 238a based on the acres of preferred habitat. In the short-term, the relative density has rebounded considerably since the low in 2007. Spruce habitat continues to increase and exceed Objective 239.

Monitoring Item 21f, Emphasis Species, Grasshopper Sparrow
Emphasis Species, Management Indicator Species
Birds, Non-Game Birds, Grasshopper Sparrow

Monitoring

In the Black Hills, the grasshopper sparrow is highly associated with mixed-grass prairie. This is the basis for its MIS status. Mixed-grass prairie was not monitored in 2009 in the MBBH program. For the latest evaluation of grasshopper sparrows, see the 2008 Monitoring and Evaluation Report.

Monitoring Item 21g, Emphasis Species, Song Sparrow
Emphasis Species, Management Indicator Species
Birds, Non-Game Birds, Song Sparrow

Monitoring

In the Black Hills, the song sparrow is strongly associated with riparian habitats. This is the basis for its MIS status. Neither the foothills nor montane riparian habitats were monitored in 2009 as part of the MBBH program. For the latest evaluation of song sparrows, see the 2008 Monitoring and Evaluation Report.

Monitoring Item 21h, Emphasis Species, Ruffed Grouse
Emphasis Species, Management Indicator Species
Birds, Game Birds, Ruffed Grouse

Monitoring

The ruffed grouse is a year-round resident in the Black Hills. It occurs widely but in low abundance (Panjabi 2003). The species may require a variety of aspen structural stages to thrive, including late successional aspen for drumming logs and most other stages for buds and catkins (SAIC 2005). The strong association between ruffed grouse and aspen is the basis for the bird's MIS status.

The South Dakota Department of Game, Fish and Parks collected ruffed grouse data along transects in 2003 (Wrede 2004). These transects crossed a variety of habitat types in the northern and central Black Hills, and are presented in the adjacent table.

Ruffed Grouse	Estimated Density in 2003 (birds/lineal mile)
All Routes Combined	0.16
Routes - Grouse Detected	0.28

The Forest worked with the South Dakota Department of Game, Fish and Parks and the Rocky Mountain Research Station to develop a new monitoring protocol for ruffed grouse (Hansen et al. detecting ruffed grouse on the BHNF is largely influenced by date and wind speed. Preliminary 2008). Drumming count data was collected in April - May 2007 and 2008. The probability of occupancy estimates are shown below. These estimates form a baseline for future monitoring comparison.

Ruffed Grouse habitat Occupancy estimates, 2008-2009		
	2008	2009
Ocupancy rate	.106	.111

Ruffed grouse are also detected through the MBBH program. However, because the peak period for detecting grouse occurs before the MBBH sampling season, it is a less accurate method for estimating densities. Therefore, no MBBH data are presented for ruffed grouse.

Trend in Preferred Habitat: According to Monitoring Item 8, stands dominated by aspen currently occupy approximately 45,805 acres on the Forest. There was a slight increase (694 acres) in aspen acres in 2009, and about a one percent increase compared to 1997. Aspen stands have been replaced by pine and spruce in many areas of the Forest, and may have declined since pre-settlement times (USDA Forest Service 2005b p. 111-28).

Evaluation

The long-term habitat trend for ruffed grouse is one of decline given the reduction of aspen acreage compared to historic condition. It is likely that there has been an associated population decline in ruffed grouse. There has been a slight increase in aspen acres over the past five years. The Forest continues to meet Objective 238a by maintaining aspen habitat. Additional time and effort will be needed to increase aspen acreage. Implementation of a ruffed grouse monitoring protocol should allow for the detection of long-term population trend.

Monitoring Item 21i, Emphasis Species, Mountain Sucker

Emphasis Species – Management Indicator Species

Fish – Mountain Sucker

Objective 238d: Maintain or enhance habitat quality and connectivity for mountain suckers, as outlined in specific direction pertaining to aquatic resources (e.g. Objectives 103, 104, 215, Standards 1201, 1203, 1205, Guideline 1115).

Monitoring

A Forestwide MIS monitoring protocol was completed in 2008 (Dauwalter et al. 2008) to monitor the distribution and abundance of mountain suckers. The protocol identified twenty-six sites for mountain sucker abundance monitoring. A total of nineteen sites identified for abundance monitoring were sampled from 2008 thru 2009. The Wyoming Game and Fish Department (WGFD) conducted fish surveys on Beaver Creek (upstream and downstream of Cook Lake). The South Dakota Department of Game, Fish and Parks (SDGFP) surveyed streams on the southern half of the Forest in 2009. The northern half of the Forest was surveyed in 2008. Boxelder, Middle Boxelder and South Boxelder creeks were not surveyed due to high flows in 2008. Annie Creek, tributary to Spearfish Creek, was sampled using a non-standardized survey in both 2008 and 2009.

The protocol identified thirty 8th-level Hydrologic Unit Code watersheds (HUC8s) to monitor the distribution of mountains suckers. Thirteen of these HUC8s were sampled in 2007-09 by the SDGFP or WGFD.

The SDGFP is funding a graduate research project at South Dakota State University (SDSU) to (1) document the current distribution of mountain sucker in South Dakota for comparison with historic records, (2) evaluate factors influencing their distribution, and (3) assess their thermal criteria. Mountain sucker population and habitat surveys began in 2009 and are ongoing.

Evaluation

Insufficient time and survey effort has occurred to evaluate the mountain sucker population trend per the 2008 MIS protocol. Of the nineteen abundance sites sampled in 2008-2009, mountain suckers were captured at six sites (Annie Creek, Battle Creek, Beaver Creek (Bearlodge Mountains upstream of Cook Lake), Castle Creek, Elk Creek and Swede Gulch). Mountain suckers were collected in presence/absence surveys in Annie Creek in 2008, but not in 2009. The table below shows mountain sucker numbers at MIS abundance monitoring sites (in **bold**) as well as sites not on National Forest System lands. Survey sites are 100 meters in length.

STREAM	SITE DESCRIPTION	LOCATION	# fish in site	# fish / mile
Annie Creek	**ANN02; Tributary to Spearfish Creek**	**T4N, R2E, S4**	**n/a**	**n/a**
Battle Creek	**BAT09; Below Harney**	**T2S, RR6E, S11**	**2**	**n/a**
Beaver Creek	**BVR01; Above Cook Lake**	**T53N, R63W, S22**	**26**	**467**
Beaver Creek	Below Cook Lake	T54N, R63W, S26	1	17
Castle Creek	**CAS06 (2009 Site #181); below Castle Peak Campground**	**T1N, R3E, S2**	**1**	**16**
Crow Creek	CRW05; Below McNenny Fish Hatchery	T7N, R1E, S16	1	16
Elk Creek	**ELK04; Andy Larson Ranch (1985 Site 8)**	**T4N, R4E, S27**	**40**	**644**
Swede Gulch	**SWD01; below Slaughterhouse Gulch confluence**	**T3N, R3E, S32**	**1**	**16**
Whitewood Creek	WWC01; Rodeo Grounds (above bridge)	T5N, R3E, S23	7	113
Whitewood Creek	WWC27; upstream of Crook City	T6N, R4E, S33	308	4,956
Whitewood Creek	WWC05; Immediately upstream of I-90	T6N, R4E, S22	114	1,834

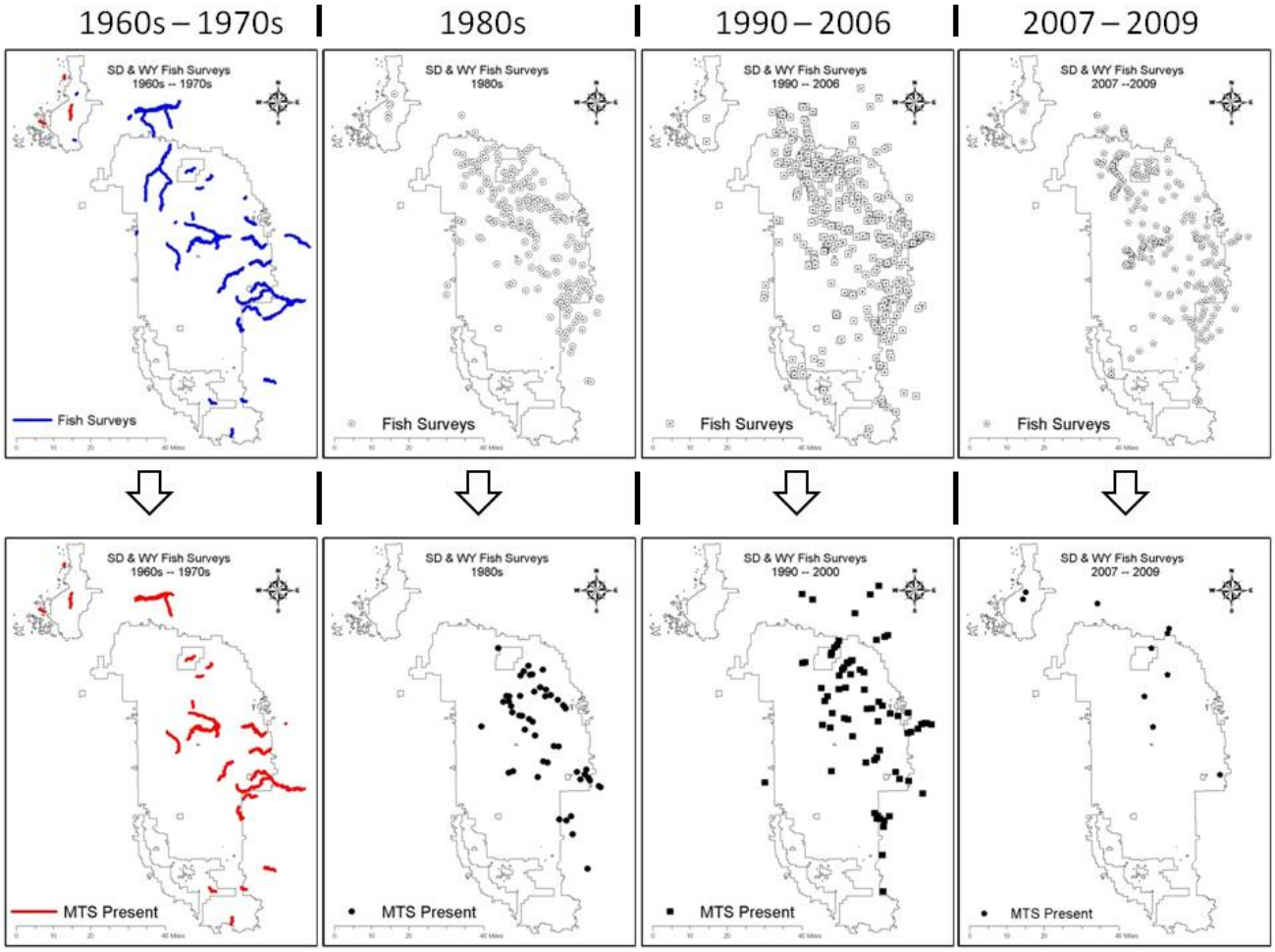
The mountain sucker was detected in three of the thirteen watersheds sampled to date for distribution monitoring. Watersheds (HUC8s) identified for distribution monitoring were randomly selected through a scientific process. Some of these watersheds have marginal habitat and limited recreational fishing potential. As a result, many of these watersheds have not been surveyed as part of past or ongoing SDGFP or WGFD fish monitoring.

Additional survey effort is needed to complete the initial abundance and distribution monitoring identified in the 2008 MIS Protocol. Portions of Bear Butte Creek, Castle and Annie creeks and additional stream reaches of interest (notably in the Upper Rapid Creek and Boxelder Creek watersheds) will be sampled by SDSU in 2010 (Shultz 2010 pers.comm.).

Basic life history information for the mountain sucker is lacking specific to the Black Hills. Additional research regarding reproduction (spawning season, habitat preference), interactions with non-native fish species (competition, predation) and dispersal (upstream/downstream migration patterns, swimming/jumping ability) is needed.

The Final Environmental Impact Statement (USDA Forest Service 2005b) for the Forest Plan Phase II Amendment identified a decline in the Forest-wide population trend for mountain sucker when comparing past to present occurrence on National Forest System lands. This decline continues based upon the best available information. SDGFP and WGFD survey efforts have repeatedly sampled suitable mountain sucker habitat over the past fifty years. The figure below shows a

decrease in mountain sucker distribution in the Black Hills. Many survey sites are off-Forest or on private inholdings which may not be indicative of site-specific Forest Service management activities, but are relevant to the mountain sucker's status in the Black Hills.



The long-term trend in aquatic habitat is influenced by a variety of natural and anthropogenic factors. Increased rainfall and higher flows greatly improved stream conditions in 2008 and 2009 compared to the previous 7-8 years of drought. Stream connectivity remains fragmented due to instream structures, such as dams and road culverts. These structures impede mountain sucker passage and likely prevent this species from reoccupying upstream habitat once favorable flows have returned. The completion of riparian/stream enhancement projects along with the implementation of Forest Plan standards and guidelines, Regional watershed conservation practices and best management practices contribute to maintaining or enhancing aquatic and riparian habitat and stream connectivity for the mountain sucker consistent with Objective 238d. These habitat conservation projects and resource protection measures alone may be insufficient to increase the numbers and distribution of mountain sucker without some future transplanting efforts done in coordination with SDGFP.

Monitoring Item 22, Invasive Species, Noxious Weeds & Aquatic Nuisance Species

Objective 230: Eradicate or limit spread (acres) of new introductions of non-native pests (insects, diseases, plants) to minimize ecosystem disruption.

Objective 231: *Prevent new infestations and manage to reduce established noxious-weed infestations. Treat at least 8,000 acres per year during the next ten years to limit noxious-weed infestations.

At the time of the Forest Plan Phase II Amendment, these Objectives related to noxious weed prevention and treatment. Forest Plan Objective 230 deals with all non-native pests. This discussion has been broadened to include Aquatic Nuisance Species (ANS) as well as noxious weeds. The Phase II Amendment to the 1997 Land and Resource Management Plan includes several standards and guidelines in the 4300 category which relates to weed prevention and treatment. In particular Guideline 4303 from the Phase II amendment sets the new priority for management of invasive species.

Noxious Weeds Species

Control noxious-weeds using the following priority order:

1. R2 sensitive and species of local concern occurrences of snails and plants.
2. Research Natural Areas.
3. Botanical Areas.
4. New invaders.
5. New areas of infestation.
6. Spreading or expanding infestations.
7. Existing infestations.

The “Invasive Species Action Plan” which is a three year action plan showing needs in the Invasive Species Program is available at:
http://fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5177432.pdf

Treatments 2002-2009; Objective 231 discusses treatment of at least 8000 acres, as you can see we have been above the level since 2003 and plan to continue to increase the program as funding is available.

Year of Treatment	Acres Treated	Year of Treatment	Acres Treated
2002	**7,515**	**2006**	**15,685**
2003	**14,700**	**2007**	**11,649**
2004	**15,744**	**2008**	**11,523**
2005	**13.882**	**2009**	**10,206**

Infestation acreage is difficult to measure, and our inventory methods and tracking continue to improve. The Weed Environmental Assessment signed in January 2003 has an estimate of approximately 82,000 acres. Our current estimate is closer to 180,000 acres. A portion of the increase in our acreage estimates is due to the spread of weeds, but much of this increase is because of improved inventory methods. Historical data is being compiled into the Terra database, and the estimated acreage of infestation by species will continue to be updated. This information should reflect better inventory and additional infestations because of better tracking. Some of the new infestations are a result of large fires over the past several years.

New and additional Invasive Weeds have been found on or near the National Forest

The Northern Hills Ranger District has found Meadow Knapweed (Tyrol) (*Centaurea pratensis)* and Giant Knotweed (*Fallopia sachalinensis*) on and near the Forest. The Hell Canyon RD found Whitetop (*Cardaria darba)* near the Forest along Highway 16 (Custer County has around 400 Acres within the county). The Mystic Ranger District has been finding new infestations of Yellow toadflax (*Linaria vulgaris*) likely due to good growing conditions with the increased moisture. Spotted knapweed (*Centaurea maculosa auct*) and Leafy spurge (*Euphorbia esula*) has also increased in areas not found in the past five years. Mystic and Hell Canyon are finding Oxeye daisy (*Leucanthemum vulgare*) in a few places in the recreational sites and along roads. Many of the new sites were treated in FY 09. New sites are being aggressively treated when found and are being checked. We are seeing an increase in outbreaks of other species also, again likely do to good growing conditions.

Biological Controls

Biological control measures were established as early as 1985. The weather affected the outcome of the insect populations. The drought caused a significant decline of both the Leafy spurge (*Euphorbia pseudovirgata*) and Canada thistle (*Cirsium arvense*) biological control insects. With the moisture in the past three years, reintroduction of the insects has showed promise again. The gall fly (*Urophora cardui*) has increased in all areas of the Mystic District. With insects released in FY 08, the damaged was noted in all release sites. In FY 09, 38 sites of Canada thistle insects (*Hadroplontus litura*) 107 sites with Leafy spurge insects (*Aphthona* mix and *Oberea erythrocephala*) were established. With the establishment of these sites on forest and private lands, the purchase of insects for the control of noxious weeds may be less needed.

- Pennington County has been contracted to maintain and monitor established biological control sites throughout the Mystic Ranger District. Each year, a report is sent to us with logged site information and GPS corrected files. These established sites will be visited throughout the year and checked for quantity and plant damage.

Education

- At the districts orientations each year, weed identification training is offered. This provides new employees and other district personnel with information on the problems with invasive weeds and who to notify when weeds are found on the district. This also makes the personnel aware of how vehicles, shoes, ATV's, and even snowmobiles can transfer weeds from one area to another.
- Weed crews gives spot briefings to the general public as complaints are received. Public contacts are briefed on the chemical use and biological controls as needed. General

identification training was also given to the public and weed identification books are given out with each contact. 56 contacts were made in FY 09.

- In the spring of each year, Mike Stenson, of the South Dakota Department of Agriculture give spray personnel an overview on identification of noxious weeds that exist in South Dakota and the surrounding states. Bill Walker of Crop Production Services explains how our spray units work and shows weed personnel why calibration is extremely important.
- The Mystic District has educational material and display boards in the foyer on noxious weeds. Noxious weed identification and biological control booklets are also available at most District and the Supervisor's front offices.
- The Mystic Distinct has put on programs about invasive plants through the Dakota Digital Network (DDN). This program reaches schools throughout the state of South Dakota and other neighboring states.
- Hell Canyon gave a talk for Earth Day Children's Noxious Weed Program in Custer.

We are currently working with theSouth Dakota Invasive Species Management Association to coordination and further intagrated weed management. See the web page at; http://www.sisma-sd.org/

Aquatic Nuisance Species (ANS)

A variety of activities occurred in 2009 specific to ANS. The first ANS Action Plan for the Black Hills National Forest was signed on June 30, 2009. This 3-year action plan provides general guidance on ANS management and is available online at (see Appendix B page 11): http://fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5177432.pdf

Biologists on the Northern Hills and Mystic districts sampled amphibians for the chytrid fungus (*Batrachochytrium dendrobatidis*) in support of a University of South Dakota research project. All samples tested negative. *Batrachochytrium dendrobatidis* (hereafter Bd) – was first described in 1999 as a new species infecting amphibians and causing the often fatal disease, chytridiomycosis. Since that discovery, Bd has been identified in association with amphibian population declines on every amphibian-inhabited continent.

The U.S. Bureau of Reclamation in combination with the South Dakota Department of Game, Fish and Parks sampled for zebra and quagga mussels at Black Hills reservoirs, including Angostura, Belle Fourche (Orman), Deerfield and Pactola reservoirs. All samples tested negative. Sheridan Reservoir is a Forest Service impoundment and was not sampled.

Research continues on the effects of *Didymosphenia geminata* (didymo). This diatom (single-celled algae) was first reported in Rapid Creek below Pactola Dam in 2002. Nuisance blooms of didymo have been associated with reduced aquatic and aesthetic conditions. The appearance of didymo coincided with drought-related low stream flows and a crash in the trophy brown trout fishery in Rapid Creek. The South Dakota State University with support from the South Dakota Department of Game, Fish and Parks is comparing brown trout diets from didymo impacts and non-impacted streams. The South Dakota School of Mines and Technology is studying how nutrient availability and stream flow rate at different sites contribute to the growth of *D. geminata.* The density of didymo was reduced in 2009 due to increased rainfall and higher flows released from Pactola Dam.

Monitoring Item 23a, Insects and Diseases, Population, Sub-Item: Mountain Pine Beetles and Ips

Evaluations of mountain pine beetle were conducted for the Nautilus and Pactola areas and parts of the Norbeck area, particularly around Mt. Rushmore in the Black Hills. These evaluations consisted of a multi stage sampling based on aerial surveys and ground surveys to estimate mountain pine beetle infestations and how they are changing. Based on the ground surveys, beetle-caused mortality is increasing in these areas. The Nautilus and Pactola areas are relatively newer infestations and are expanding exponentially. In both areas, there are significantly more green infested trees than trees that were killed last year, indicating that beetle mortality is increasing. Much of the areas in and around these infestations are susceptible to continued expansion of beetle mortality. The Black Elk Wilderness, which is part of the Norbeck area, is still a growing beetle epidemic. Large diameter trees are abundant in this area and are getting killed at a rapid pace, also, stands of small diameter material (3-4 inch doghair stands) and more open grown trees which are typically not targeted by the beetle are also being killed. There have even been instances of spruce trees being attacked by mountain pine beetle as they ran out of their host trees. At the present time, there is still a large and active mountain pine beetle epidemic in the central part of the Hills. There are also rapidly expanding epidemics starting in the northern Black Hills south of Custer Peak in the Experimental Forest, around the west side of Pactola Reservoir, particularly the Canyon City area and over towards O'Neill Pass.

Studies looking at alternative control measures, such as preventative sprays for high value trees, have been ongoing for mountain pine beetle. For preventative sprays, two chemicals proved to be effective, depending on dose, at protecting trees from attack for one season. These insecticides are effective for treating individual, high value trees but are not practical for widespread use. With the ongoing beetle outbreak, there has been a renewed interest in the potential of anti-aggregation pheromones (Verbenone) for protecting high value trees and stands from beetle attack. Verbenone has been used in Custer State Park for protection of their limber pine stand and has so far proven to be effective at keeping most of those trees alive in the middle of an ongoing outbreak. Verbenone is still very questionable as being effective for protecting ponderosa pine, as has been reported before.

The level of tree mortality caused by *Ips* beetles continues to decline, and is now at endemic levels across most of the Black Hills. *Ips* are highly sensitive to drought conditions, especially spring moisture, and for the last 2-3 years we have been at normal to above normal spring moisture, which has reduced the number of new areas with infestation. Also, as areas of recent fire or storm damage have gone down, so has the *Ips* population. There is some activity still in urban interface areas, however, this also appears to be declining. There is increased *Ips* activity in piles left from logging operations and small handpiles created during fuels work, however, we have not seen these populations spill out and infest surrounding forest, instead, remaining in the piles.

Evaluation

The mountain pine beetle is at epidemic levels across many areas on the forest, particularly the central Hills. At this time, this is still an issue as far as number of trees killed and acres affected. Both tree mortality and acres affected will continue to increase over the next year. Effective and

economical pheromone or chemical treatments for widespread use on the Forest to reduce or eliminate pests have not been found. Some existing chemical methods that protect individual high-value trees are available for use. Silvicultural treatment of stands to reduce density is the only long term solution to reducing the overall impact of mountain pine beetle. Targeted sanitation efforts to remove currently infested trees can also be effective in small areas over a short time prior to larger forest management activities starting.

Health of Aspen in the Black Hills

There has been increased concern over the past few years about decline of aspen stands in the Rocky Mountain Region. In 2009 a study was begun to look at the health of aspen stands on the Black Hills. 60 stands were measured for overstory tree mortality, overstory crown health, regeneration within the stands and any insect, disease or other damages occuring.

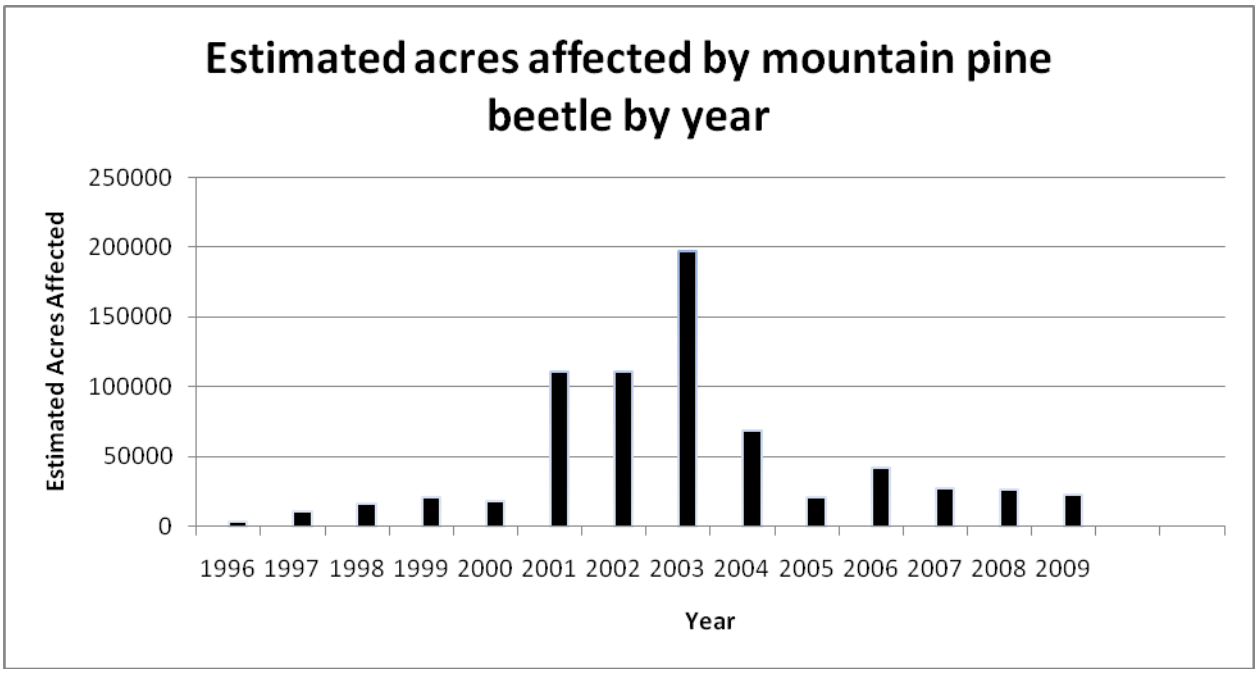
Overall, the aspen stands on the Hills are in generally good shape. The average crown health across the forest was high, mortality of overstory trees was averaging about 3% per year (very similar to background) and by and large regeneration was relativley good in the stands. Based on the stands we sampled, the average age across the forest is around 60 years, so the stands are becoming mature and may begin to show decline in future years. The most common damage agents found on overstory trees were cankers, while browsing was the most common damage agent on regeneration.

Monitoring Item 23a, Insects and Diseases, Sub-Item: Tree Mortality

Figure 1. Estimated number of acres affected by mountain pine beetle from 1996 to 2009, based on aerial surveys over the entire Black Hills of South Dakota and Wyoming[1].

[1] Due to the nature of aerial surveys, this data will only provide rough estimates of location, intensity and the resulting trend information for any given agent. The data presented should only be used as an indicator of insect and disease activity, and should be validated on the ground for actual location and casual agent. Many of the most destructive diseases are not represented in this data because these agents are not detectable from aerial surveys.

The insect and disease data is available digitally from the USDA Forest Service, Region Two Forest Health Management group. The cooperators reserve the right to correct, update, modify or replace GIS products. Using this data for purposes other than those for which it was intended may yield inaccurate or misleading results.



The above graph shows the estimated number of acres affected based on aerial surveys for the past 14 years for all ownerships. There has been approximately 356,000 acres affected by beetles on NFS lands in the last 14 years. The 2009 beetle flight affected approximately 20,000 acres on NFS lands. There is an appearance that mortality has declined in recent years, however, that may be due to a number of factors, including removal of large numbers of green infested trees prior to beetle flight and differences in timing and mapping techniques employed by different mappers. The overall trend on the forest is certainly still for an increasing beetle situation in parts of the forest and an overall above average amount of acres infested by beetles.

Evaluation

The mountain pine beetle epidemic we have been experiencing the past few years continues to move around and grow bigger in a number of areas. It may be down in some areas, but it has increased in just as many or more areas. There were noted increases in the Northern Hills in the O'Neill Pass, around the Experimental Forest, in and around Pactola reservoir and in the Black Elk Wilderness. Other places such as the central Hills around Deerfield and Bear Mountain continue to suffer from high levels of beetle activity and tree mortality. It is likely that we are only about mid-point in the cycle of this current outbreak, and so higher levels of beetle mortality are likely to continue into the coming few years.

Monitoring Item 23a, Insect and Diseases, Sub-Item: Hazard

The R2 FSVEG database was used to rate the overall hazard of the forest. These ratings are based on structural stages and how susceptible they are to beetle attack. In this system all ponderosa pine stands are rated. Stands that are structural stage 1 and 2 and 3A are considered low susceptibility. Stands that are stage 3B and 4A are rated as medium susceptibility. Stands in stages 3C, 4B and 4C are rated as high. Based on that data, 17% were rated as low hazard, 36% were rated as moderate hazard and 47% were rated as high hazard to mountain pine beetle. These numbers are very similar to what was reported last year.

The reductions in high and moderate categories should start to occur as more acres are treated and entered into the database along with areas that have suffered high mortality being accounted for.

One note on stand hazard is that it is based solely on stand conditions, with no inference of beetle pressure or activity in the area. During times when there are epidemic beetle populations in any number of areas throughout the Black Hills, almost any stand over 60 basal area can be susceptible to beetle mortlaity. To get a true risk factor, the stand conditions (as noted in hazard ratings above) and the beetle conditions both need to be considered. Based on this, the current situation is one of elevated risk over the coming year that beetle infestations will continue to be present and expand into almost any of the pine that is near infestations.

Monitoring Item 24, Insect and Diseases, Exotics

Monitoring

Detection surveys for the gypsy moth were continued at recreation and administrative sites on the Forest in 2009. No moths were caught in recreation sites on the National Forest, however, we continue to catch moths in other nearby recreation areas. Since these are mostly single moth catches, it is assumed that these are transient and there is no local population established at this time.

Another exotic insect that is gaining more attention regionally is the emerald ash borer. This insect has caused widespread destruction of ash stands in Michigan. It is not known to occur in the Black Hills, and there is little host for the insect on the forest (native ash), however, one of the main ways the insect is spread is through firewood that is infected and brought into new areas. With the amount of recreationists visiting the Black Hills every year, there certainly could be avenue for this insect to affect nearby native ash stands and community forests.

Monitoring Item 25, Fire Hazard (WUI & Interior)

Objective 10-01: Manage for 50 to 75 percent moderate-to-low fire hazard in the wildland-urban

interface and reduce the fire hazard within proximity of structures to current NFPA standards except within specific management areas. Manage the remainder of the Forest for 50 percent moderate-to-low fire hazard except for specific management areas.

Fire Hazard Rating Acres

YEAR	LOW	MODERATE	% LOW+MOD	HIGH/ VERY HIGH	% HIGH/ VERY HIGH	TOTAL
BASELINE 1995	23,669	509,578	43%	696,524	57%	1,229,771
2006	108,365	421,218	43%	712,459	57%	1,242,042
2007	108,345	398,984	41%	734,783	59%	1,242,112
2008	104,874	437,737	43%	706,457	57%	1,249,068
2009	96,533	434,435	43%	712,288	57%	1,249,256

Note: All cover types, structural stages and management areas. Difference in total acres may be due to land acquisitions, trades, and data refinement.

Evaluation

Fire hazard has remained largely unchanged since 1995. Fuel treatments reduce fire hazard, but over time, increasing tree density moves areas previously rated as low to moderate up to high and very high ratings (roughly a 2% increase in areas rated as high/very high from the baseline of 1995). Analysis of fire hazard will continue. A Forest-Wide WUI map was recently completed. In FY10, the fire hazard data should be separated by WUI/NON-WUI per Forest Plan objectives using new map.

Monitoring Item 26, Fuel Treatment

Monitoring

In FY09 the Forest Service tracked fuel treatments in 2 broad categories: 1) “core” treatments that are funded by appropriated fuels reduction (WFHF) funds, and 2) “integrated” treatments that reduce fire hazard but are accomplished coincidental to other projects using other funding sources. The total is termed “unified” fuel treatment as a sum of all the treatments that reduce fire hazard.

Mechanical treatments are defined as a broad spectrum of treatment methods including, thinning, hand piling, machine piling, mastication, lop and scatter, and chipping. Prescribed fire treatments are defined as broadcast burning, machine pile burning, hand pile burning, jackpot burning, etc.

Core Fuel Treatment:
The Forest accomplished fuel-treatment-related activities funded by appropriated WFHF funds on a total of 13,724 acres of the National Forest in FY2009 (Not including monitoring or weed spraying). Included in this work were activities as listed below:

CATEGORY	MECHANICAL (acres)	PRESCRIBED FIRE (acres)	TOTAL (acres)
WUI	4451	5654	10,105 (74%)
NON-WUI	723	2896	3,619 (26%)
GRAND TOTAL	5174	8550	13,724 (100%)

(Source: Database of Record, FACTS, 07/13/2010).

Integrated Fuel Treatment:
Fire hazard was reduced via integrated fuel reduction on 38,768 acres done through tree thinning, timber harvest, forest health, and wildlife and range management projects

Total (unified) Fuel Treatment:
13,724 (core) + 38,768 (integrated) = 52,510 Acres (Unified)

Evaluation

Aggressive fuel treatments to thin trees, convert some pine types to hardwood, and treat ground fuels must continue to keep ahead of continuously increasing fire hazard as the seedlings establish and forested areas grow and become more dense. Treatments must include a combination of mechanical treatments to remove heavy forest fuels and thin trees followed by prescribed fire to remove smaller fuels and encourage fire resistance in trees. A secondary benefit is anticipated to include improved forage and vegetative diversity.

Monitoring Item 27a, Fire, Prevention

Status of fire management agreements with partner agencies: All cooperator agreements and annual operating plans were reviewed and signed as required in 2009.

Involvement in interagency fire training exercises: The Forest continues to play a lead role in interagency fire training by providing qualified instructors, financial support, and course coordination for fire training offered in the Black Hills and surrounding areas in 2009.

Involvement in South Dakota Interagency Fire Council (SDIFC) meetings and other interagency activities: The Forest is a member of the SDIFC and an ad hoc member of the Black Hills Fire Advisory Board (BHFAB). Both of these organizations provide interagency coordination of prevention, pre-suppression, and suppression activities in the Black Hills and surrounding areas. The Forest has representation at all meetings and participates in and provides representation to various committees and task groups of these two active organizations.

Evaluation

The Forest has extensively cooperated with private, state, and other federal agencies to develop joint fuel management and protection strategies for intermixed landownership in partnership with private, state, and other federal agencies and was actively involved in development of Community Wildfire Protection Plans during 2009.

Monitoring Item 27b, Fire, Suppression

Monitoring

All wildfires on the Black Hills National Forest in 2009 were suppressed through appropriate suppression responses in accordance with management area emphasis, existing values, and fuel hazards within the incident area. Total acres burned were 8,083 acres less than the 33 year average of 8,275 acres burned per year.

Confined: **All** Contained: **All** Controlled: **All**

Following is a summary of the number of fires and total burned acreage on National Forest System lands in 2009.

CAUSE	NUMBER OF FIRES	ACRES BURNED
Lightning	37	34
Human	12	11
TOTAL	49	45

The 2009 acres burned and number of starts was well below 33 year average of 135 statistical fires per year and 8,275 acres burned per year as listed in Page III-343 of the Phase II FEIS. Approximately 97% of these acres were forested. Approximately 75% of all statistical fires occurring in 2009 where lightning caused with the remaining 25% being human caused.

Evaluation

There were no structure burned and there were no injuries to firefighters or the public. The number of starts and corresponding low number of acres burned were near recorded, all time historic lows. This was the direct result of a wet five month period that began in early May and lasted through September. Significant improvement in drought conditions that were prevelent since 2000 were experienced in 2008 and 2009 and significant improvement in both live and dead fuel moistures occurred over the course of the summer.

Literature Cited

Anderson, T. 2003. Conservation assessment for the woodpeckers in the Black Hills National Forest, South Dakota and Wyoming. U.S. Forest Service, Rocky Mountain Region, Black Hills National Forest. Custer, South Dakota. 176 pp.

Beason, J., K. Hutton, A. Panjabi, R. Sparks, and D. Hanni. 2006. Monitoring the birds of the Black Hills: 2005 field season report. Tech. Rep. M-MBBH05-01. Rocky Mountain Bird Observatory, Brighton, CO. 113pp.

Blakesley, J. A., G. Giroir, and C. White 2008. Population densities and trend detection of avian species on the Black Hills National Forest. Tech. Rep. M-MBBH07-02. Rocky Mountain Bird Observatory, Brighton, CO, 45 pp.

Dauwalter, D.C., F.J. Rahel, S.R. Hirtzel, K.G. Gerow and G.D. Hayward. 2008. Mountain sucker MIS monitoring protocol. Black Hills National Forest, USDA Forest Service Region 2. Available online: http://fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5112526.pdf

Drilling, N. E. 2010. 2009 Black Hills Owl Surveys. Tech. Rep. M-SDBBA2-03. Rocky Mountain Bird Observatory, Brighton, CO, 13 pp.

Frest, T. and E. Johannes. 2002. Land snail survey of the Black Hills National Forest, South Dakota and Wyoming summary report, 1991-2001. Final Report submitted to Black Hills National Forest. 127pp + appendices.

Giroir, G., White, C. Sparks, R. 2007. Monitoring the Birds of the Black Hills: 2007 field season report. Tech. Rep. M-MBBH07-01. Rocky Mountain Bird Observatory, Brighton, CO. 81 pp. Available online: http://fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5114242.pdf

Hansen, Chris, J. Millspaugh, and M.A. Rumble. 2008. Factors affecting the probability of detecting ruffed grouse in the Black Hills National Forest. Progress Report 1. January 24, 2008. *FS Agreement Number: 05-JV-11221609-239.*

Higgins, K.F., E.D. Stukel, J.M. Goulet, and D.C. Backlund. 2000. Wild mammals of South Dakota. South Dakota Department of Game, Fish and Parks, Pierre. 278pp.

Hoxie, Jim and Carson Engelskirger. 2009. 2009 Field Audit Report – Implementation Monitoring and Evaluation of South Dakota Forestry Best Management Practices.

Hutton, K.; J. Beason, G. Girior, A. Panjabi, R. Sparks, and D. Hanni. 2007. Monitoring the birds of the Black Hills: 2006 field season report. Tech. Rep. M-MBBH06-01. Rocky Mountain Bird Observatory, Brighton, CO. 71 pp. Available online: http://fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5114241.pdf

Huxoll, C. 2005. Big game harvest projections, 2004 annual report. South Dakota Game Report No. 2005-03. South Dakota Dept. Game, Fish and Parks, Pierre. Available online: http://www.sdgfp.info/Wildlife/hunting/Harvest/Projections.htm

Huxoll, C. 2006. Big game harvest projections, 2005 annual report. South Dakota Game Report No. 2006-04. South Dakota Dept. Game, Fish and Parks, Pierre. Available online: http://www.sdgfp.info/Wildlife/hunting/Harvest/Projections.htm

Huxoll, C. 2007. Big game harvest projections, 2006 annual report. South Dakota Game Report No. 2007-04. South Dakota Dept. Game, Fish and Parks, Pierre. Available online: http://www.sdgfp.info/Wildlife/hunting/Harvest/Projections.htm

Huxoll, C. 2008. Big game harvest projections, 2007 annual report. South Dakota Game Report No. 2008-02. South Dakota Dept. Game, Fish and Parks, Pierre. Available online: http://www.sdgfp.info/Wildlife/hunting/Harvest/Projections.htm

Huxoll, C. 2009. Big game harvest projections, 2008 annual report. South Dakota Game Report No. 2009-03. South Dakota Dept. Game, Fish and Parks, Pierre. Available online: http://www.sdgfp.info/Wildlife/hunting/Harvest/Projections.htm

Huxoll, C. 2010. Big game harvest projections, 2009 annual report. South Dakota Game Report No. 2010-01. South Dakota Dept. Game, Fish and Parks, Pierre. Available online: http://www.sdgfp.info/Wildlife/hunting/Harvest/Projections.htm

Isaak, D.J., W.A. Hubert and C.R. Berry, Jr. 2003. Conservation Assessment for Lake Chub, Mountain Sucker, and Finescale Dace in the Black Hills National Forest, South Dakota and Wyoming.

Knowles, C. J., and P. R. Knowles. 2008. Nesting ecology of the northern goshawk in the Black Hills of South Dakota report for the 2008 nesting season. Prepared for the South Dakota Dept. of Game, Fish and Parks. Pierre, SD. 66pp.

Knowles, C. J., and P. R. Knowles. 2009. Nesting ecology of the northern goshawk in the Black Hills of South Dakota report for the 2009 nesting season. Prepared for the South Dakota Dept. of Game, Fish and Parks. Pierre, SD. 41pp.

Lorenzen, P. 2010. E-mail dated 04/15/2010 from Paul Lorenzen, South Dakota Department of the Environment and Natural Resources to Steve Hirtzel, Fisheries Biologist, Black Hills National Forest regarding non-attainment of coldwater permanent fish use at Deerfield Reservoir due to temperature.

Lovett, K. 2006. American dipper (*Cinclus mexicanus*) 2006 nest monitoring Whitewood Creek and Spearfish Creek watershed. South Dakota Department of Game, Fish and Parks.

Lovett, K. 2007. American Dipper (*Ciinclus mexicanus*) 2007 Nest Monitoring, White Creek and Spearfish Creek Watershed in the Black Hills of South Dakota. A report to the Department of Game, Fish and Parks, Pierre, South Dakota.

Lovett, K. 2008. American dipper (*Cinclus mexicanus*) 2008 nest monitoring Spearfish Creek watershed and Whitewood Creek in the Black Hills of South Dakota. A report to the Department of Game, Fish and Parks, Pierre, South Dakota.

McQueen, Cyrus B. and Richard E. Andrus. 2007. *Sphagnaceae*. In: Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. 15+ vols. New York and Oxford. Vol. 27, pp. 45-101.

Moan, C. 2009. E-mail dated 08/21/2009 from Chris Moan, Wyoming Game and Fish Department to Steve Hirtzel, Fisheries Biologist, Black Hills National Forest regarding 2009 fish surveys.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of Life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Online [www.natureserve.org/explorer] Accessed February 8, 2010.

National Weather Service. 2010. Drought Conditions for Western South Dakota and Northeastern Wyoming. Online. Accessed August 9, 2010. www.crh.noaa.gov/unr/?n=drought_information

Panjabi, A. 2001. Monitoring birds of the Black Hills: Year 1. Final Report. Rocky Mountain Bird Observatory. Fort Collins, Colorado.

Panjabi, A. 2003. Monitoring birds of the Black Hills: Year 2. Final Report. Rocky Mountain Bird Observatory. Brighton, Colorado.

Panjabi, A. 2004. Monitoring birds of the Black Hills: Year 3. Annual Report. Rocky Mountain Bird Observatory. Brighton, Colorado.

Panjabi, A. 2005. Monitoring birds of the Black Hills: Year 4. Annual Report. Rocky Mountain Bird Observatory. Brighton, Colorado.

Parrish J.B., D.J. Herman, D.J. Reyher, and Black Hills National Forest. 1996. A century of change in Black Hills forest and riparian ecosystems. U.S. Forest Service Agricultural Experiment Station, U.S. Department of Agriculture, South Dakota State University. 20pp.

Rumble, M.A. 2002. Evaluation of mountain pine beetle epidemics as habitat for cavity nesting birds. Preliminary finding for ISA 203-02-020. Report to the Black Hills National Forest from the Rocky Mountain Research Station, Rapid City, SD. 16pp.

SAIC. 2005. Selection of management indicator species on the Black Hills National Forest Phase II Plan Amendment. Science Publication International Corporation.

Salafsky, S.R., R.T. Reynolds, and B.R. Noon. 2005. Patterns of temporal variation in goshawk reproduction and prey resources. J. Raptor Res. 39:237-246.

Sandrini, Joe. 2009. 2008 Job Completion Report. White-tailed Deer. Black Hills Unit. Wyoming Game and Fish Department.

Schultz, L. 2010. E-mail dated 02/01/2010 re: 2009 Mountain Sucker Annual Summary.

SD DENR (South Dakota Department of Environment and Natural Resources). 2008. 2008 South Dakota Integrated Report for Surface Water Quality Assessment. Available at: http://www.state.sd.us/denr/Documents/08IRFinal.pdf

SD DENR (South Dakota Department of Environment and Natural Resources). 2010. The 2010 South Dakota Integrated Report for Surface Water Quality Assessment. Available at: http://denr.sd.gov/documents/10irfinal.pdf

SDGFP (South Dakota Department of Game Fish and Parks). 2001. Statewide fisheries surveys, 2000. Survey of public waters. Part 1; Lakes – Region 1. Annual Report No. 02-11.

SDGFP (South Dakota Department of Game Fish and Parks). 2006. Statewide fisheries surveys, 2005. Survey of public waters. Part 1; Lakes – Region 1. Annual Report No. 06-10.

Smith, A. 2001. Big game harvest projections, 2000 annual report. South Dakota game report. no. 2001-01. South Dakota Dept. Game, Fish and Parks, Pierre.

Tallman, D.A., D.L. Swanson, and J.S. Palmer. 2002. Birds of South Dakota. Midstates/Quality Quick Print. Aberdeen, South Dakota. 441pp.

USDA Forest Service. 1992. Forest Service Handbook. Denver, CO. FSH 2509.18 – Soil Management Handbook.

USDA Forest Service. 1996a. Rangeland Analysis and Management Training Guide – Rocky Mountain Region. Denver, Colorado. August 1996.

USDA Forest Service. 1996b. Revised Land and Resource Management Plan Final Environmental Impact Statement. Black Hills National Forest. Custer, South Dakota.

USDA Forest Service. 2001. Forest Service Handbook Denver, CO. FSH 2509.25 – Watershed Conservation Practices Handbook.

USDA Forest Service. 2005b. Black Hills National Forest Phase II Amendment Final Environmental Impact Statement. Black Hills National Forest, Custer, South Dakota.

USDA Forest Service. 2006a. Black Hills Land and Resource Management Plan as amended, March 2006. Black Hills National Forest, Custer, South Dakota.

USDA Forest Service 2006b. Black Hills National Forest FY 2005 Monitoring and Evaluation Report. USDA Forest Service, Black Hills National Forest. Custer, South Dakota. September 2006. Available on-line at: http://go.usa.gov/cNq

USDA Forest Service. 2007a. Black Hills National Forest FY 2006 Monitoring and Evaluation Report. US Department of Agriculture-Forest Service, Black Hills National Forest. Custer, South Dakota. May2007. Available on-line at: http://go.usa.gov/cNq

USDA Forest Service. 2007b. Forest Service Manual 2600 – Wildlife, fish, and sensitive plant habitat management, Chapter 2670 – Threatened, endangered and sensitive plants and animals, Region 2 supplement no. 2600-2007-1. Denver, CO. Effective June 8, 2007.

USDA Forest Service 2008. Black Hills National Forest FY 2007 Monitoring and Evaluation Report. US Department of Agriculture-Forest Service, Black Hills National Forest. Custer, South Dakota. December 2008. Available on-line at: http://go.usa.gov/cNq

USDA Forest Service. 2008b. Unpublished BMP review information provided by the Bearlodge District, Black Hills National Forest. 2008.

USDA Forest Service. 2009a. Forest Service Manual 2600 – Wildlife, fish, and sensitive plant habitat management, Chapter 2670 – Threatened, endangered and sensitive plants and animals, Region 2 supplement no. 2600-2009-1. Denver, CO. Effective June 24, 2009.

USDA Forest Service 2009b. Unpublished Watershed Conservation Practices and Timber Sale/Road Projects Correspondence Letter. July 1, 2009.

USDA Forest Service 2009c. Black Hills National Forest FY 2008 Monitoring and Evaluation Report. USDA Forest Service, Black Hills National Forest. Custer, South Dakota. September 2009. Available on-line at: http://go.usa.gov/cNq

USDA Forest Service. 2009d. 2009 Englewood Springs Botanical Area Thistle Test Plot and Weed Pulling Report. O:\nfs\BlackHills\Program\2600Botany\SO\2660PlantsAdmin\2660_01Reports\ForestPlan_PlantMonitoring\additional_monitoringdata\ 2009_englewood_thistle_test_plot_and weed_pulling.doc

USDA Forest Service. 2010a. Black Hills National Forest Plant Database. Black Hills National Forest, Custer, South Dakota.

USDA Forest Service. 2010b. Black Hills National Forest Fen Inventory. Housed at the Mystic Ranger District. Rapid City, South Dakota.

USDA Forest Service. 2010c. Unpublished. Watershed Conservation Practices review information provided by the Mystic Ranger District, Black Hills National Forest. Prepared by S. Thomas. 2010.

USDA Forest Service. 2010d. Unpublished. Watershed Conservation Practices review information provided by the Hell Canyon Ranger District, Black Hills National Forest. Prepared by S. Thomas. 2010.

Woodbridge, B. and C.D. Hargis. 2005. Northern goshawk inventory and monitoring technical guide. USDA Forest Service, Washington, D.C. 62pp.

Wrede, J. 2004. E-mail message from John Wrede, South Dakota Dept. Game, Fish and Parks, to K. Burns, Black Hills National Forest, dated July 6, 2004. Subject: Ruffed Grouse.

White, C. and G. Giroir. 2008. Monitoring the Birds of the Black Hills, 2008 Field Season Report. Tech. Rep. M-MBBH-USFS08, SDDFG08. Rocky Mountain Bird Observatory, Brighton, CO. 57 pp.

White, C.M., J. A. Blakesley, D. C. Pavlacky, and D. J. Hanni. 2010. *Monitoring the Birds of Black Hills National Forest: 2009 Field Season Report.* Tech. Rep. SC-RMRUSFS09-01. Rocky Mountain Bird Observatory, Brighton, CO, 54 pp.

Wyoming State Forestry Division. 2007. Wyoming Forestry Best Management Practices. Forest Stewardship Guidelines for Water Quality 2007 Field Audit Report (Accessed at: http://slf-web.state.wy.us/forestry/adobe/2007BMPaudit.pdf)