sage grouse

Nancy Hilding

Sage Grouse
#2

1. Appeal to NNF on ROD Fall River West GA
2. Madsen/Deisch report 2013
3. Biological Assessment & Evaluation - Fall River West GA
4. Hodorff Report 2005
5. map of historic leks from SDGFP - Travis Runia 2014

Nancy Hilding
Prairie Hills Audubon
P.O. Box 788
Black Hawk, SD 57719
605-787-6779

BEFORE THE REGIONAL FORESTER, USDA FOREST SERVICE REGION II FROM DECISIONS OF THE FALL RIVER AND OGLALA RANGER DISTRICTS, NEBRASKA NATIONAL FORESTS AND GRASSLANDS

Dec 30th, 2013

APPELLANTS:

Nancy Hilding, 6300 West Elm, Black Hawk, SD 57718, 605-787-6779
Nancy Hilding, President, Prairie Hills Audubon Society, P.O. Box 788, Black Hawk, SD 57718
Duane Short, Wild Species Program Director, Biodiversity Conservation Alliance, P.O. Box 1512 Laramie, Wyoming 82073
Jonathan B. Ratner, Western Watersheds Project, P.O. Box 1160, Pinedale, WY, 82941

v.

Responsible Officials:
Mike McNeill, District Ranger, Fall River Ranger District, 1801 Hwy 18 Truck Bypass, Hot Springs, SD 57747
Carla Loop, Acting District Ranger, Pine Ridge Ranger District, Nebraska National Forest

Appeal Reviewing Officer:

USDA Forest Service Region 2,
Appeal Review Officer,
740 Simms Street,
Golden, CO 80401
(Fax) 303-275-5134.
appeals-rocky-mountain-regional-office@fs.fed.us

Appeal of the Record of Decision for Fall River West Geographic Areas, the Record of Decision for Oglala Geographic Areas and the Final Environmental Impact Statement for Allotment Management Planning on the Fall River West and Oglala Geographic Areas, USDA Forest Service, Nebraska National Forests and Grasslands, Fall River County, SD.

Notice of Appeal,
Statement of Reasons and
Request for Relief

I. NOTICE OF APPEAL

In Sept 25th, 2013, Fall River District Ranger Mike McNeill and Carla Loop, Acting District Ranger Pine Ridge Ranger District both signed a Record of Decision (ROD) each, approving implementation of Alternative 3 of the Final Environmental Impact Statement for Allotment Management Planning on the Fall River West and Oglala Geographic Areas (FEIS), which authorizes continuation of livestock grazing on the allotments in the project area, using adaptive management strategies.

Fall River's Record of Decision (FR ROD) covers the livestock grazing allotments on the Fall River West GA portion of the project area. There are 117,548 acres and forty-one allotments in the Fall River West GA. The ROD will not change management on seven allotments, and it does not change the current authorized AUMs or grazing seasons for thirty-two allotments. On nine allotments, the stocking rate (AUMs) will be reduced. The decision also assigns eight small federal parcels (Cottonwood Miscellaneous and Indian Miscellaneous) to existing allotments.

Oglala's Record of Decision (ROD) will change the grazing season for pastures in eighteen allotments. For pastures in fourteen allotments, management will not change under the decision.

Pursuant to 36 CFR 215 and 5 USC 555(b), NOTICE IS HEREBY GIVEN Nancy Hilding, Prairie Hills Audubon Society (PHAS), & Western Watersheds Project (WWP) and Biodiversity Conservation Alliance (BCA) hereby appeal to the Region 2, Appeal Review Officer of the United States Forest Service for relief from District Ranger McNeil's & Acting District Ranger Carla Loop's decisions to authorize Alternative 3 of the Final Environmental Impact Statement for Allotment Management Planning on the Fall River West and Oglala Geographic Areas.

Appellants Hilding, PHAS, BCA & WWP have been participating in commenting on public lands management for years. PHAS members use the Buffalo Gap District lands for recreation. Appellants bring this Appeal on its own behalf of PHAS, BCA, WWP and Hilding (as an individual). Appellant's interests are within the zone of interests protected by the statutes at issue in this Appeal and would be redress able in the federal courts.

II STATEMENT OF REASONS

A. BAD TITLE TO FALL RIVER (FR) ROD

The Title of the Fall River (FR) Record of Decision (ROD) is in error, as it places Fall River County in Nebraska. This error occurs on the cover page and on page 1 of the ROD. Thus the Nebraska National Forest's Fall River ROD applies to a non-existent county in Nebraska, not to a real and true County in SD (Fall River County is in SD). ROD is in error as it improperly sites the location of land the Decision applies to. This is a violation of NEPA and CEQ rules, as it provides incorrect and confusing information to the public.

B. WRONG APPEAL REVIEWING/DECIDING OFFICER - VIOLATION OF 36 CFR 215

The Appeal Regulation at 36 CFR 215.2 provides definitions of Appeal Deciding Officer and Responsible Official. In the definition of Appeal Deciding Officer, it says he/she is the Forest Service line officer that is one organizational level above the Responsible Official or various others with the delegation of authority relevant to the provisions of this part. At 36 CFR 215.8 Appeal Deciding Officer, the Forest Service Appeal regulations shows that the Appeal Deciding

Officer for a District Ranger is the Forest Supervisor.

The Two Record of Decisions were signed by District Rangers who are the responsible officials, as per definition of responsible official. Their immediate supervisor is the Forest Supervisor. This appeal should be reviewed by Jane Darnell, Nebraska National Forest (NNF) Supervisor, and should not be reviewed by the Region 2 headquarters. However we must send it to the Regional Office as directed.

C. FALL RIVER (FR) ROD AND FEIS FAILURES FOR SAGE GROUSE - MANAGEMENT INDICATOR SPECIES (MIS)

Violates the NFMA and the FS Planning regulations and Forest Plan

FR ROD at page 2 says:

> "At the geographic area scale, there is little difference between existing and desired conditions on the Fall River West GA, particularly for vegetation structure and seral stage. However in individual allotments, resources in some areas are not meeting or moving toward desired conditions or management efficiency could be improved. " *(Emphasis added)*

This is a bizarre statement, as in 2006 a MIS (greater sage grouse) was extirpated from the Fall River West GA. We don't think that extirpation of MIS a desired condition on the Fall River District, the NNF or the USDA Forest Service generally. We believe the District is violating the directions of the Forest Plan for sage-grouse conservation. The Forest Plan directed the District to increase sage grouse populations, not extirpate them.

Direction for the Fall River West Geographic Area Buffalo Gap National Grassland - Fall River Ranger District is provided on page 2-22 of the Nebraska National Forest Land and Resource Management Plan. It says for:

> " 1. Management Indicator Species:
> Sage Grouse
> ☐ Provide habitat conditions that, in combination with sagebrush habitat on adjoining lands, helps support stable to increasing sage grouse populations (long-term trends) in the western part of this geographic area. Objective
> ☐ Establish and maintain quality nesting and brooding habitat for sage grouse (Appendix H) and associated wildlife across most of the sagebrush habitat in this geographic area within 10 to 15 years. Objective " *(emphasis added)*

On page 3-23 of FEIS it says:

> "Sage-grouse lek monitoring: Since 1991, sage-grouse numbers in the Fall River West GA have varied from a high of 17 birds observed to a low of zero. There have been no sage grouse observed in the GA since 2006." *(Emphasis added)*

FEIS at 3-22 it also says:

> "There have been two comprehensive studies of sagebrush habit on the project area: in 1992 and in 2003-2004. Both studies were conducted in the northwest section of the GA

in the area the LRMP designated as MA 3.64 Special Plant and Wildlife Habitat: Sage-grouse. A comparison of the variables measured (sagebrush height, canopy coverage of grasses and forbs, percent of the area in the different canopy coverage classes) indicates the sagebrush community in MA 3.64 did not change significantly in eleven years. For a complete discussion of the studies, please see the Biological Assessment and Evaluation on file in the project record." *(Emphasis added)*

On page 3-10 of FEIS it says:

> A significant sagebrush community lies north of the Black Hills Army Ordnance Depot and is designated as a 3.64 management area for greater sage grouse. A 2004 study determined that seven pastures contained adequate sagebrush for greater sage-grouse nesting and winter habitat. Currently, no areas are being managed for sagebrush expansion. *(Emphasis added)*

FEIS at 3-22 says:

> "Because the greater sage-grouse is considered a sagebrush obligate species, the lack of sagebrush is the limiting factor for sage-grouse in the project area." *(Emphasis added)*

At page 3-23 of the FEIS

> Total canopy cover of shrubs in MA 3.64 is 6% and that occurs on less than 10% of the area. This is less than Connelly's optimum values for breeding, brood-rearing, and winter habitat show in the table below.
>
> "Table 3-7. Canopy cover requirements and areal extent for three sage-grouse habitats types.

Habitat type	Amount of Canopy Coverage	Over What Percent of the Total Area
Breeding	15% to 25%	80%
Brood rearing	10% to 25%	40%
Winter	10% to 30%	80%

Source: Connelly et al. 2000

> Based on data collected in 2003 and 2004, the MA 3.64 portions of the Fall River West GA that emphasize sage-grouse do not have enough sagebrush to provide canopy cover for breeding, brood-rearing, and winter habitat. The sagebrush in these areas has sufficient canopy coverage, but there isn't enough sagebrush overall. "*(Emphasis added)*

The FEIS then provides a chart that shows a high count of sage-grouse of 17 in 1991-1992 and the last lone bird seen in 2006. The grouse is an MIS, and had extremely small numbers of individuals. We believe those small numbers, should have lead Forest Service staff to question it's viability in 1991 or prior to 2001 during Plan Revision. How did the Forest Service respond to its monitoring showing small numbers and insufficient habitat, with action to protect the grouse? If the past protective actions taken, are discussed within the FEIS we have not yet found such discussion. If in 2003 and 2004 the FS concluded it did not have enough sagebrush, did it start a plan to plant new sagebrush? This is not disclosed, but we don't believe it happened as FEIS indicates that the sagebrush habitat has been static and amounts did not change.

Page 3-14 of FEIS says:

> "Areas managed for sage-grouse would have high structure. If successful, the future option of sagebrush seeding or planting would increase sagebrush habitat in seven allotments. Areas managed for swift fox would have a mosaic of structure, and areas managed for prairie dogs would have low structure."
>
> "**Cumulative effects**: Sagebrush spraying, travel management and the Cain Creek land exchange are the activities listed in table 3-1 with the potential for effects on rangeland vegetation. Across the GA, the effects of reducing sagebrush via spraying and the positive benefits to sagebrush from grazing would result in a neutral effect – loss of sagebrush in some areas and increased sagebrush density in others. " *(Emphasis added)*

This appears to be a strange quote, that indicates the Forest Service may exercise an option to plant sagebrush, while at the same time still permitting herbicide treatments designed to kill sagebrush and also that FS believes that grazing benefits sagebrush plants, while concluding elsewhere grazing may harm sage grouse populations.

The FEIS admits to past chemical treatment (sagebrush spraying) to eradicate sagebrush (see FEIS at page 3-4). The FR ROD indicates only 7 allotments now currently have sagebrush habitat. How many allotments once had sagebrush habitat, before the FS allowed poisoning of the sagebrush and reduced sagebrush habitat circa 1960s? FS admits on page 3-22 of FEIS to not having saved the historical records:

> "There is no documentation of the time and extent of the treatment in the Forest Service files so this activity cannot be quantified. It is believed that the spraying occurred in the 1960s when this was a common activity across the sagebrush country."

It admits that it does not know the extent of area that could currently support sage grouse: "Monitoring needed to determine existence of potential habitat" is provided as an answer to how the Project area meets Forest Plan direction for its MIS of sage grouse (Appendix A page12-13).

On page 3-11 of FEIS it says:

> "The sagebrush community north of the Black Hills Army Ordnance Depot is designated as MA 3.64 for greater sage-grouse. The desired conditions for this area are as follows:
> ♦ ... provide quality nesting cover in all sagebrush stands within at least 3.0 miles of active display grounds (consistent with GA vegetation objectives) where sagebrush is irregularly distributed around the display ground. A minimum distance can be reduced to 2.0 miles where sagebrush is uniformly distributed around display grounds.
> ♦ Maintain or enhance wet and sub-irrigated meadows, seeps, riparian habitats, and other wetland areas that occur in or adjacent to sage-grouse habitat as quality sage-grouse foraging areas during the spring, summer, and fall.
> ♦ Maintain or increase the size of big sagebrush patches in sage-grouse habitat.
> ♦ Maintain small openings within big sagebrush stands at a maximum ratio of 1 acre of

opening to 3 acres of shrub.
♦ Manage for high vegetation structure in areas where it would enhance sage-grouse nesting habitat.

"This direction applies to the following eleven pastures:

♦ Beebe-Markey allotment: Winter pasture
♦ Cottonwood Group allotment: West and Childers pastures
♦ Ellison Dam allotment: Soper and Fossil Point pastures
♦ Porter allotment: West Dry Creek and Sheaman pasture
♦ Tubbs allotment: East Dry Creek, School, and Fritz pastures"

Thus while the FEIS admits that current amount of sagebrush habitat is insufficient to support viable populations, it allows or permits a future scenario of just maintaining (i.e. not increasing) such habitat as an option. The Forest Service can chose not to recover habitat and species and be in compliance with this Project's ROD.

On page age 16 of FR ROD under Monitoring these are two sections that may apply to sage grouse:

"Monitoring Item	**Frequency**	**Method**	**Objectives "**
" Sage grouse leks and nesting	Every 1 - 3 years	Lek surveys Droop height	Ensure rangeland health and grouse habitat are meeting or moving toward desired conditions. "
"Rangeland vegetation	Approximately every 5 years on representative sites in the GA	NRCS range analysis Similarity index	Determine if rangeland vegetation is meeting, moving toward, or not meeting or moving toward desired conditions

Approxima years on re range sites

Sage Grouse monitoring is also discussed in similar language in FEIS at page 2-29

On page 3-24 the FEIS admits that removing livestock would help sage-grouse and cover (which may contradict quote on Page 3-14 where livestock grazing is said to help sagebrush), but that inadequate habitat is the real problem. For Alternative 1 – No Action: No livestock grazing it says:

> "Removal of livestock from the area would increase cover of the herbaceous understory which should be beneficial to nesting sage-grouse. Also, removal of livestock would enable the land managers to remove fences and any infrastructure used to maintain livestock. This would eliminate the hazards to sage-grouse cause by these structures (drowning in stock tanks, colliding with fences, etc.). Finally, removal of livestock would eliminate the need for people to visit the area to check livestock which would eliminate any direct or indirect effects caused by this activity.

> Even though a reduction in grazing could have positive effects on nesting cover for sagegrouse, it is doubtful a sustained sage-grouse population could live in the area without a dramatic increase in sagebrush and sagebrush cover. Sagebrush cover generally increases as utilization of the herbaceous understory increases (Crawford et al. 2004); however, sagebrush spread is a slow process, so it is doubtful any change would be detectable over the life of this project. " *(Emphasis added)*

FEIS at page 3-25

> The cause of sage-grouse demise in the area is unknown. Given that sage-grouse were in the areas grazed by livestock for many years, it is doubtful livestock grazing is the sole cause of the current problem (although it may be a contributor).
>
> As mentioned previously, the lack of sagebrush canopy cover is a limiting factor for sagegrouse in this area. *(Emphasis added)*

On Page 18 of the FR ROD it says the below quote about Sage Grouse MIS for which Appellants have special concern:

> "**Management indicator species**: My decision to select alternative 3 may improve habitat for the greater sage-grouse and black-tailed prairie dogs which are management indicator species on the Fall River West GA. In seven allotments/pastures containing sage-grouse habitat, permitted AUMs will be reduced or stocking rates will be reduced through a rotation grazing system. These actions are designed to increase vegetation structure for sage-grouse. In addition, my decision to implement alternative 3 includes a future adaptive option of sagebrush seeding or planting in allotments with sagebrush habitat. This would benefit both greater sage-grouse and Brewer's sparrow, a region 2 sensitive species." *(Emphasis added)*

On page 4, the FR ROD allows that " Seed or plant sagebrush for restoration purposes" is a potential adaptive management actions available for all allotments in the Fall River West GA.

Changes Between Draft and Final on page 3-1 of FEIS. lists changes for " Rangeland vegetation, rare plants, wildlife (sage-grouse and Brewer's sparrow), cultural resources, water quality, and recreation sections" as

> "Added effects analysis of potential sagebrush seeding or planting under alternative 3. This adaptive option could affect seven allotments in the Fall River West GA."
(Emphasis added)

The FEIS at Table 2 5. Fall River West GA proposed actions, lists the following change:

> "Added sagebrush planting to the proposed action as a future adaptive management option in the following allotments/pastures: Beebe-Markey (North), Benton (West Dry Creek), Cottonwood Group (Childers), Ellison Dam (North, Soper, South), Fossil Point, Porter (Sheaman), Tubbs (School).'

The Forest Service fails to discuss or establish what a viable population of greater sage grouse is, what other sage grouse populations this area could have connectivity with and whether recovery of sagebrush habitat in the 7 pastures alone, would provide sufficient sagebrush and sage grouse

recovery to support viable population of sage grouse.

FEIS fails to identify which pastures were poisoned historically to remove previously existing sagebrush habitat. Attempts at restoration might need to include immediate planting with sagebrush plants or seeds in pastures that were once poisoned to create better connectivity to Wyoming sage grouse populations. This may require a Forest Plan Amendment.

Stocking rates may need to be reduced to facilitate restoration of lost sage habitat. Fences may need to be removed and/or tagged, stock tanks may need to be made safe so as prevent drowning & disturbance of grouse areas may need to limited, when the grouse return. Riparian areas need protection from adverse grazing impacts. We are not aware of any proposed activity to limit fences or place tags on fences. A full slate of protective actions need to listed and held in reserve, as FS should plan for restoration of habitat and return of birds, as soon as possible. These above fixes are needed as part of relief requested.

The Forest Service in this document must identify all areas on the two Geographic Areas that have the conditions that could support sagebrush habitat. It must study how sagebrush habitat in the eastern fringe of the sage grouse's range, may differ from sagebrush habitat in the more central areas studied by Connelly. Does Connelly's chart on page 3-23 of the FEIS, apply to western SD or to other areas west of SD that are more centrally located in sage grouse range?

FS alleges more sagebrush habitat is needed in the District and violates the NFMA and the FS Planning regulations by failing to require immediate and constant action to recover sagebrush habitat for a MIS species that is extirpated. The FS violates National Environmental Policy Act (NEPA) and the Council on Environmental Quality (CEQ) regulations by insufficient disclosure of affected environment, mitigations and impacts.

FR ROD & FEIS provide inadequate response to sage grouse. Actions to reduce AUMs or stocking rates will happen but plans to seed or plant sagebrush are merely an "adaptive option" rather than an immediately required response in face of an extirpated MIS -- the greater sage grouse. The FEIS tells us repeatedly that not enough sagebrush is the basic problem, so why isn't addressing it mandatory? FS needs to estimate how many sage grouse it needs for a viable population and many acres of sagebrush habitat at what canopy cover, are needed to support a viable population. It needs to decide if the MA 3.64 special area for greater sage-grouse is of sufficient size and close enough to existing Wyoming sage-grouse populations to support necessary restoration work. Will reintroduction of birds be necessary? It needs to look at connectivity with the nearest sage grouse populations to the west in Wyoming and who owns the land that supports the nearby Wyoming sage grouse.

It needs to calculate livestock grazing levels that can be associated with such planting. It needs to discuss irrigation of seedlings & where budget for sagebrush/sage grouse restoration will come from. If the MA 3.64 is of inadequate size to support recovery, than additional areas need to be included, which may require Forest Plan Amendment.

Changed circumstances (extirpation of MIS) warrant revisiting of Forest Plan Direction for sage-grouse. The Forest Plan has a guideline that may need to be changed via this NEPA Document:

> "Pastures will be managed for sage grouse/big sagebrush only if they contain 5% or more canopy cover of big sagebrush. "

If you plan to recover areas with planting of sagebrush, you may need more flexibility in areas to

be planted and managed for sage grouse/sagebrush.

Various standards that are protective of sage grouse are contingent on active areas currently inhabited by sage grouse. These standards & guidelines were obviously inadequate protection to maintain sage grouse, as despite those protections it disappeared! Some of them are totally not applicable now that it is gone (some standards and guidelines no longer apply once grouse gone). The extirpation is a changed circumstance that drives a need for Forest Plan Amendment, which should be incorporated in this FEIS.

Failure to comply with Forest Planning Regulations and the NFMA.

A Notice of Intent (NOI) for this project was first published February 22, 2008 (73 No. 36 FR 9760-9762). A second notice was published 6 months later. The Forest Plan, which governs it, was revised under the 1982 Forest Planning regulations. The Management Indicator Species (MIS) concept is derived from the 1982 planning regulations.

We are not sure which Forest Planning regulations apply, given that scoping on the project started before the new 2012 Planning rules were adopted and the Forest Plan was written under the 1982 regulations. We have heard that the Forest Service plans to use the 1982 regulations as it currently proceeds with Forest Plan amendments for sage grouse across the sage grouse range.

However the new planning rule says

> § 219.17 Effective dates and transition.
> (c) Plans developed, amended, or revised under a prior planning regulation. This part supersedes any prior planning regulation. No obligations remain from any prior planning regulation, except those that are specifically included in a unit's existing plan. Existing plans will remain in effect until revised. This part does not compel a change to any existing plan, except as required in § 219.12(c)(1). None of the requirements of this part apply to projects or activities on units with plans developed or revised under a prior planning rule until the plan is revised under this part, except that projects or activities on such units must comply with the consistency requirement of § 219.15 with respect to any amendments that are developed and approved pursuant to this part. *(Emphasis added)*

Given that the core issue in this Appeal is how you are treating an MIS and the MIS status for the sage grouse still exists in the NNF Land and Resource Management Plan, we argue you must still comply with the 1982 Rule direction with respect to MIS.

NFMA requires the Secretary of Agriculture to promulgate forest planning regulations that "specif[y] guidelines for land management plans . . . [to] provide for diversity of plant and animal communities based on the suitability and capability of the specific land area." 16 U.S.C. § 1604(g)(3)(B) (2010). To meet this statutory requirement, the 1982 planning regulations directed USFS to manage habitat "to maintain viable populations of existing native and desired nonnative vertebrate species in the planning area." 36 C.F.R. § 219.19 (1999). The provision goes on to define a "viable population . . . as one which has the estimated numbers and distribution of reproductive individuals to insure its continued existence is well distributed in the planning area." Id. To accomplish this, USFS must provide habitat "to support, at least, a minimum number of reproductive individuals and that habitat must be well distributed so that those individuals can interact with others in the planning area." Id. Furthermore, § 219.19(a)(1) requires USFS to identify and select as management indicator species (MIS) "certain vertebrate and/or invertebrate species present in the area" in order to monitor the "effects of management

activities."

Following such selection based on appropriate criteria, USFS must monitor population trends of MIS and determine relationships to habitat changes. 36 C.F.R. § 219.19(a)(6). Also, "[p]lanning alternatives shall be stated and evaluated in terms of both amount and quality of habitat and of animal population trends of [MIS]." 36 C.F.R. § 219.19(a)(2) (emphasis added). The 1982 planning regulations have never been overturned by a federal court, a notable indication they legally satisfy Congress' intent in enacting NFMA.

Instead, the 1982 provisions of the planning regulations requires that "[p]opulation trends of the management indicator species . . . be monitored and relationships to habitat changes determined" in order to satisfy NFMA. 36 C.F.R. § 219.19(a)(6) (1999). USFS must conduct "inventories" that "include quantitative data making possible the evaluation of diversity in terms of its prior and present conditions." Id. § 219.26. USFS "must evaluate planning alternatives for projects that affect the selected management indicator species 'in terms of both amount and quality of habitat and of animal population trends of the management indicator species.'" Forest Guardians v. U.S. Forest Serv., Civ. No. 00-714 JP/KPM-ACE (D. N.M. 2001) (quoting 36 C.F.R. § 219.19(a)(2) (1999). This stems from the prescription that forest plans must contain "[m]onitoring and evaluation requirements that will provide a basis for periodic determination and evaluation of the effects of management practices." 36 C.F.R. § 219.11(d) (1999).

We thus argue failure to comply adequately with the 1982 provisions for Management Indicator Species and thus to comply with the 1982 Planning Regulations and the National Forest Management Act and the Land and Resource Management Plan that implement the above.

While we don't think the 2012 Rules apply in this case, if the Forest Service thinks they do, we argue that this FEIS and the RODs fail to comply with 36 C.F.R § 219.9 Diversity of plant and animal communities and 36 C.F.R § 219.8 Sustainability, as it fails to provide adequately for recovery of the sage grouse, an MIS and a candidate species for the USFWS.

If the Transition rule is ever held to once again apply to Forest Service projects, we argue, this Project is not consistent with best available science.

We cite all the above, given the tendency of Planning rules to be overturned by the Courts.

FAILURE TO ADHERE TO BEST SCIENCE & VIOLATION OF NEPA/CEQ REGULATIONS:

The following Council on Environmental Quality Regulations (and NEPA) are violated by the inadequate review:

> 1500.1 Purpose
> "(b) NEPA procedures must insure that environmental information is available to the public officials and citizens before decisions are made and before actions are taken. The information must be of high quality. Accurate scientific analysis, expert agency comments, and public scrutiny are essential to implementing NEPA. Most important, NEPA documents must concentrate on the issues that are truly significant to the action in question, rather than amassing needless detail."(40 CFR Ch. V1500.1 (b))

It fails to take a "hard look" at the environmental consequences of its actions. It fails to obtain the information necessary to assess impacts to the human environment (see 40 CFR 1500.1 (b), 1502.1, 1502.15, 1502.22) It fails to respond to public comments and concerns (40 CFR 1503.4 (a)). It fails to adequately analyze and disclose direct, indirect, and cumulative impacts with scientific and professional integrity (40 CRF 1502.16, 1502.24).

We believe efforts by the BLM and the Thunderbasin National Grassland with respect to planning for the greater sage grouse and amendment or revision of their Resource Management Plans and Land and Resource Management Plans in Wyoming, may be connected action to this AMP, as these Federal Lands may hold greater sage grouse populations who could be managed to benefit the recovery in Fall River and visa versa. The FEIS should fully explore the relationship if it's sage grouse to those on federal lands in Wyoming, disclose such relation to the public and conclude if this project and federal planning in Wyoming are connected actions. ((40 CRF 1508.25)

Contradictory Statements

FEIS on page 3-22 says

> "Table 3-6. Federally listed species for Dawes and Sioux Counties, Nebraska and for Fall River County, South Dakota.
>
> | Common Name | Status | Occurs in Project Area | Habitat in Project Area |
> |---|---|---|---|
> | Greater sage-grouse* | Candidate | Yes, Fall River West GA | Yes" |

On page 3-23 of FEIS it says:

> "Sage-grouse lek monitoring: Since 1991, sage-grouse numbers in the Fall River West GA have varied from a high of 17 birds observed to a low of zero. There have been no sage grouse observed in the GA since 2006." *(Emphasis added)*

These statements are mutually exclusive, one say grouse occurs and the other says none observed for about 8 years. There is also Table 3-7, on FEIS page 3-23 that shows no sage grouse seen since 2005.

As pointed out above, the FEIS & FR ROD conclude that actions won't result in loss of viability for sage-grouse in the planning area, ironically when the species is extirpated & viability is already lost. This is simply illogical reasoning & not best or adequate science of professional quality. Such lack also violates NEPA/CEQ regulations.

FEIS can't agree on what the 2004 study says or there are two 2004 studies that contradict each other.

On page 3-10 of FEIS it says:

> A significant sagebrush community lies north of the Black Hills Army Ordnance Depot and is designated as a 3.64 management area for greater sage-grouse. A 2004 study determined that seven pastures contained **adequate** sagebrush for greater sage-grouse nesting and winter habitat. Currently, no areas are being managed for sagebrush

expansion. *(Emphasis added)*

At page 3-23 of the FEIS

> Total canopy cover of shrubs in MA 3.64 is 6% and that occurs on less than 10% of the area. This is less than Connelly's optimum values for breeding, brood-rearing, and winter habitat show in the table below. ...
>
> Based on data collected in 2003 and 2004, the MA 3.64 portions of the Fall River West GA that emphasize sage-grouse **do not have enough** sagebrush to provide canopy cover for breeding, brood-rearing, and winter habitat. The sagebrush in these areas has sufficient canopy coverage, but there isn't enough sagebrush overall." *(Emphasis added)*

These contradictory statements are not quality science.

EFFECTS FROM GRAZING ON GROUSE NOT DISCLOSED WELL ENOUGH - NEPA VIOLATIONS

FEIS at page 3-24 says

> "Grazing and its effects on the density and canopy of sagebrush is controversial, and there is little direct experimental evidence linking grazing practices to sage-grouse population levels (Connelly et al. 2004). However, grass height and cover affect sage-grouse nest site selection and success. Thus, indirect evidence suggests that if grazing (by livestock or wild herbivores) significantly reduces the herbaceous understory in breeding habitat, there may be negative impacts on sage-grouse populations (Connelly et al. 2000). Improper grazing can also facilitate invasions by exotic plants species (Connelly et al.] 2004). "*(Emphasis added)*

FEIS at page 3-14 says:

> "Across the GA, the effects of reducing sagebrush via spraying and the positive benefits to sagebrush from grazing would result in a neutral effect – loss of sagebrush in some areas and increased sagebrush density in other" "*(Emphasis added)*

The EA seems to ignore the existence of extensive literature on adverse grazing impacts to sage grouse. NNF doesn't get a "pass" on grazing effects, just because they got a head start by contributing to the grouse's local extinction.

Grazing is the most widespread use of sagebrush steppe and almost all sagebrush habitat is managed for grazing (Connelly et al. 2004; Knick et al. 2003; Knick et al. 2011). Livestock grazing disturbs the soil, removes native vegetation, and spreads invasive species in sagebrush steppe (Knick et al. 2005). Cattle or sheep grazing in sage-grouse nesting and brood-rearing habitat can negatively affect habitat quality; nutrition for gravid hens; clutch size; nesting success; and/or chick survival (Connelly and Braun 1997; Beck and Mitchell 2000; Barnett and Crawford 1994; Coggins 1998; Aldridge and Brigham 2003). Livestock may directly compete with sage-grouse for grasses, forbs and shrub species; trample vegetation and sage-grouse nests; disturb individual birds and cause nest abandonment (Vallentine 1990; Pederson et al. 2003; Call

and Maser 1985; Holloran and Anderson 2003; Coates 2007). The potential conflict between livestock grazing and sage-grouse intensifies near riparian and mesic habitats due to the importance of these areas to sage-grouse, particularly during brood-rearing and in summer. Heavy cattle grazing near springs, seeps, and riparian areas can remove grasses used for cover by grouse (Klebenow 1982). Connelly et al. (2007), citing Coggins (1998) and Beck and Mitchell (2000), stated that "[t]he large number of documented negative impacts of livestock grazing in sagebrush shrub steppe appears to neutralize or outweigh any positive effects." Manier et al. (2013) describe multiple effects of grazing on sagebrush steppe and ranked grazing the third most important threat to sage-grouse in Management Zone II.

The FEIS & FR ROD should adopt a more conservative approach to grazing in sagebrush steppe to maintain and restore native vegetation and reduce impacts on sage-grouse. Management objectives should be based on, in priority order, potential natural community within the applicable Ecological Site Description, Connelly et al. (2000: 977, Table 3), or other objectives that have been demonstrated to be associated with increasing sage-grouse populations. Utilization levels should not exceed 25 percent annually to support habitat restoration (Holecheck et al. 2010; BLM & USFS 1994).

Habitat objectives should be included in grazing management plans in sage-grouse habitat and should include the following three conservation measures: (1) grazing should maintain ≥ 18 cm grass height in sage-grouse nesting and brooding-rearing habitat (Connelly et al. 2000; Braun et al. 2005); (2) livestock grazing should be restricted where cheatgrass (*Bromus tectorum*) occurs in sagebrush steppe to avoid contributing further to its incursion on the landscape (Reisner et al. 2013); and (3) grazing permit retirement should be prioritized in sage-grouse habitat to lessen impacts on the species (see SGNTT 2011: 17).

FOREST SERVICE NEEDS TO STUDY LOCAL RESEARCH AS WELL AS CONNELLY

Reliance on Connelly ignores research on sage grouse on the eastern fringes of its range. We will attach PhD Theses of Kaczor and Herman-Brunson.

Kaczor (2008) reported an average percent sagebrush cover of 10.2% for occupied nest sites in South Dakota, versus 6.2% for random locations. Also average sagebrush height was 27.9 cm at nest sites, undoubtedly less than Connelly et al guidelines. Kaczor (2008: 24):

> "Connelly et al. (2000) recommended 15-25% sagebrush canopy coverage for nesting sage-grouse. Meta-analysis (Hagen et al. 2007) confirmed mean sagebrush canopy coverage at sage-grouse nest sites was 21.51%. In South Dakota, sage-grouse selected the best of what was available, but that was less than the optimum. In contrast to sagebrush, grass structure in South Dakota exceeds both management recommendations (Connelly et al. 2000) and range-wide averages (Hagen et al. 2007). Western South Dakota forms a transition zone between the northern wheatgrass-needlegrass prairie that dominates most of the Dakotas and the big sagebrush plains of Wyoming (Johnson and Larson 1999). Thus, while South Dakota may have sub-optimal sagebrush cover for sage-grouse, the grass structure may be compensating the sagebrush component."

Kaczor (2008: 25-26):

> Grazing by domestic sheep (*Ovis aries*) has effectively controlled sagebrush (Baker et al. 1976) which could reduce sagebrush cover further in South Dakota.

> Range management practices that could increase sagebrush and grass cover and height might include: rest-rotation grazing, where the rested pasture in not grazed until early July to allow for undisturbed nesting, or reduced grazing intensities and/or season of use to reduce impact on sagebrush and grass growth (Adams et al. 2004). Land managers should attempt to leave or maintain maximum grass heights ! 26 cm, the inflection point for 50% nest success. In addition, annual grazing utilization should not exceed 35% in order to improve rangeland conditions, particularly sagebrush cover (Holechek et al. 1999). Construction of new fences should be avoided as fences provide predator corridors, raptor perches, and pose a risk for collisions (Braun 1998). We agree with Braun (2006) and Woodward (2006) that larger pastures with fewer fences are better. Wyoming big sagebrush typically recovers from a fire in 50-120 years (Baker 2006), and because the restricted distribution and limited cover of sagebrush in South Dakota, we recommend no use of prescribed fire in areas with sagebrush.

Herman-Brunson reported 10% average sagebrush cover at nest sites in North Dakota, which was nonetheless higher than the 7% cover at random sites. Useful quotes from Herman-Brunson (2007: 26):

> "Increasing total vegetative cover by 10%, increased the probability of the site to be a nest by a multiplicative factor of 0.60 Å} 0.52 (CI 95%), and increasing sagebrush density by 50 shrubs/hectare, increased the probability of the site to be a nest by a multiplicative factor of 4.3 Å} 0.85 (CI 95%) (Table 9)."

Herman-Brunson (2007:31):

> "Sagebrush density at nest-sites in my study was about 1/2 that reported in Nevada (Klebenow 1969) and 1/3 that reported for Montana (Wallestand and Pyrah 1974), while in south-central Idaho sagebrush density (Connelly 1991) was only slightly greater than in my study."

Herman-Brunson (2007: 32):

> Across their range, female sage-grouse usually select sagebrush patches for nests with shrub canopy cover of 15-25%, and avoid sparse or excessively dense patches (Connelly et al. 2000). However, in southwestern North Dakota, hens may have to select different nest-site characteristics to maintain adequate cover because of restricted patches of remaining sagebrush habitats, all of which are similar in habitat quality.

We believe this inadequate review of relevant science is a failure to comply with NEPA,

VIOLATIONS OF ESA AND USFWS REGULATIONS

We doubt that a determination that there would be "no effect" would pass muster with the USFWS, particularly given the history of chemical treatment, and without any obligatory effort to restore the vegetative component that has been degraded due to past acts.

On Page 18 of FR ROD, in "**Table 5. Determination of effects of the decision for endangered, threatened, proposed and candidate species and Region 2 sensitive species**" it lists the below

conclusions for a species that was extirpated in 2006 and for which the FEIS says there is not enough habitat:

"Species		Determination
Greater sage-grouse (candidate species)	Population trend Viability	Neutral effect May adversely impact individuals but is not likely to result in a loss of viability in the planning area nor cause a trend toward federal listing or a loss of species viability range wide

T&E wildlife species determinations for Sage grouse are also discussed in similar language in the FEIS at page 2-29.

The species was extirpated from the NNF in 2006 and the loss of species is believed to be dependent on insufficient habitat, which was inadequate but stable for the past 11 years. How can you conclude that your plans, (which don't include mandatory replanting of suitable habitat sage) --

> "May adversely impact individuals <u>but is not likely to result in a loss of viability in the planning area</u> nor cause a trend toward federal listing or a loss of species viability range wide". *(Emphasis added)* (On Page 18 of FR ROD)

D. FALL RIVER (FR) & OGLALA (O.) ROD AND FEIS FAILURES FOR BLACK-TAILED PRAIRIE DOG - MIS

<u>Violates the NFMA and the FS Planning regulations and Forest Plan</u>
<u>Inadequate response to failure to provide minimum prairie dog acres in GAs.</u>

FEIS at 3-27 says:

> "The 2008 prairie dog management decision calls for a minimum of 1,000 acres and a maximum of 3,600 acres of active prairie dog colonies on the Fall River West GA. In 2012, there were 947 active acres. Under the 2008 decision, the Oglala GA is to be managed for a minimum of 1,000 acres and a maximum of 2,800 acres of active prairie dog colonies. In 2012, one of the largest colonies on the Oglala GA had a mass die-off likely due to an outbreak of plague. This is the first suspected outbreak of plague on the GA and its long-term effect on prairie dog populations in unclear. Presently, the Oglala GA has approximately 745 active acres of prairie dog colonies."

FEIS at 3-31 says:

> Alternative 3 includes livestock grazing management aimed at expanding prairie dog colony acres in the Fall River West GA.

For the Fall River West GA, the boundary management zone is 1/2 mile from private land; the minimum number of active acres of prairie dogs to be maintained on the landscape is 1,000 acres and the maximum is 3,600 acres. For the Oglala GA, the boundary management zone is 1/2 mile from private land; the minimum number of active acres of prairie dogs to be maintained on the landscape is 1,000 acres and the maximum is 2,800 acres.

FEIS at 3-44 says:

> "Overstocking in some pastures, combined with the presence of prairie dog colonies, has the potential to contribute sediment and add to the impairment of the Beaver Creek to Cascade Creek portion of the Cheyenne River drainage."

Is this myth masquerading as science? We are not aware of scientific proof that prairie dog colonies contribute significantly to bad water quality. Prairie dog colonies are generally in flat areas, without much run off. We request relief of a literature citation to back up allegation and thus proof that this assumption is based in science. However, the NNF LMPR has an exception for run off from prairie dog colonies:

> "Manage land treatments to maintain enough organic ground cover in each land unit to prevent harmful increased runoff (exceptions shall occur in special habitat situations (e.g. prairie dog habitat). **Standard**"

On Page 18 of FR ROD, in "**Table 5. Determination of effects of the decision for endangered, threatened, proposed and candidate species and Region 2 sensitive species**"

"Black-tailed prairie dog, burrowing owl	Population trend* Viability	Neutral effect No impact"

"* The population trend determination is only for the black-tailed"

The Oglala (O.) ROD has similar language at page 17 of O. ROD for Black-tailed prairie dog.

Sensitive species determinations for Black-tailed prairie dog and Burrowing owl is also discussed with similar language in the FEIS at page 2-29

On Page 18 of the FR ROD it says the below quote about Black-tailed Prairie Dog MIS for which Appellants have special concern:

> "My decision uses livestock grazing as a tool to achieve objectives for prairie dog acres. In five pastures, stocking rates will be increased through the rotation grazing system. These actions are designed to reduce vegetation structure and help expand existing prairie

dog colony boundaries. This may move us closer to the desired minimum prairie dog acreage of 1,000 on the GA. As of 2009, the Fall River West GA had 796 acres of prairie dog colonies. "

The NNF LRMP has a guideline

"41. To optimize habitat for burrowing owls, manage for active prairie dog colonies that are larger than 80 acres. **Guideline**"

The FEIS should disclose how this guideline is complied with.

The NNF LRMP provides the following standard:

d. Before rodenticide use can occur, the minimum range of prairie dog acres for the GA must be achieved. Non lethal methods can be used at any time (see Forest Plan Amendment 3, Supplement 1 – Implementation Plan). **Standard**

As neither Geographic area has achieved minimum required acres of prairie dogs, poisoning must be suspended. Failure to require tat as needed is a violation of the Forest Plan, Planning Regulations and NFMA.

One of the causes cited is devastation to prairie dog acres by plague. Plague had not yet arrived on the NNF when the last Forest Plan Amendment to address black-tailed prairie dogs was created. This is a changed circumstance and the LRMP has insufficient direction to address the issue. A Forest Plan Amendment is needed.

However if such does not occur, the FEIS and ROD must provide for dusting of prairie dog colonies for fleas and for funding such expense from the 1/2 percent of grazing fees to be returned to the land as improvements to the land.

The FEIS and ROD should also review and provide for cessation of prairie dog shooting in GAs that don't meet the minimum prairie dog acreage.

III. RELIEF REQUESTED

WRONG COUNTY/STATE RELATIONSHIP

Remand the FR ROD. Reissue it with Fall River County declared as in SD not Nebraska

WRONG REVIEWING/DECIDING OFFICERS OF APPEAL

Remand the Fall River & Oglala RODs. Reissue Notice of Appeal Opportunity with the correct reviewing/deciding Officers listed.

INADEQUATE PLANS FOR SAGE GROUSE RESTORATION

Remand the Fall River ROD to improve sage grouse habitat restoration and population recovery plans. In the above text we ask for much relief on this issue, however to review such issues:

Define an objective of the number of sage grouse needed to establish a viable population, which may be 500-5,000 sage grouse. Discuss whether goals will be met on NNF lands alone or in connectivity with other habitat on other lands and/or other states, and who owns such lands.

Develop clear plans with goals and timelines for restoration and replanting of sagebrush habitat. Attempts at restoration should include immediate planting with sagebrush plants or seeds in a sufficient area and use of irrigation should be considered and used if needed. If needed all areas that could support sagebrush should be included in restoration-- this may need to include NNF pastures that were once poisoned/treated, not just ones that currently have sage plants and require expansion of area dedicated to sage grouse support. FS should learn how to identify traits of landscape that identify suitable areas for restoration. Irrigation will likely be needed, thus adequate water sources are part of planning. Finances should be discussed, including the option to use the half percent of grazing fees spent on local improvements.

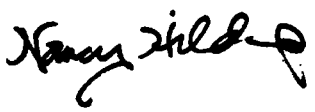
List as an adaptive management option/goal -- reducing or tagging fencing (to prevent grouse/fence collisions) to benefit sage grouse, making stock tanks safe from drowning risk, and reduction of disturbance. You should have specific plan to reduce cattle grazing more -- specific goals for forb & grass utilization rates and/or residual cover -- this should be part of the plan to facilitate restoration of lost sage grouse habitat. Riparian areas need protection from grazing.

Please amend Forest Plan to provide new standards and guidelines that address changed circumstances of extirpated MIS - some of the protective standards don't apply if sage grouse not on the land. Greater flexibility may be needed in your standards and guidelines to facilitate recovery efforts. Please review greater sage grouse planning occurring on federal lands in Wyoming as a connected action.

INADEQUATE PLANS FOR MEETING BLACK-TAILED PRAIRIE DOG MINIMUMS IN GA

Remand the FR And O. ROD to more aggressively address failure to achieve required minimum prairie dog acres. The Districts should eliminate shooting of prairie dogs as sport & poisoning, until prairie dog numbers reach minimum acres. The District should trap and relocate prairie dogs to acres that currently don't have them. Identify plague areas and dust using half percent of grazing fees spent on local improvements. The NNF should revise or amend its LRMP to address the occurrence of plague.

Sincerely,



Nancy Hilding
President
Prairie Hills Audubon Society
P.O Box 788
Black Hawk, SD 577i8
nhilshat@rapidnet.com
605-787-6779

Duane Short

Duane Short
Wild Species Program Director
Biodiversity Conservation Alliance
P.O. Box 1512
Laramie, Wyoming 82073
Phone 307-742-7978
Fax 307-742-7989
duane@voiceforthewild.org
http://www.voiceforthewild.org

Jonathan B. Ratner
Western Watersheds Project
P.O. Box 1160
Pinedale, WY 82941
(877) 746-3628

And on behalf of

Nancy Hilding
6300 West Elm Street
Black Hawk, SD 57718
(605) 787-6779
nhilshat@rapidnet.com

References

Aldridge, C. L. and R. M. Brigham. 2003. Distribution, status and abundance of Greater Sagegrouse, Centrocercus urophasianus, in Canada. Canadian Field-Natur. 117: 25-34.

Barnett, J. F. and J. A. Crawford. 1994. Pre-laying nutrition of sage-grouse hens in Oregon. J. Range Manage. 47: 114-118.

Beck, J. L. and D. L. Mitchell. 2000. Influences of livestock grazing on sage grouse habitat. Wildl. Soc. Bull. 28(4): 993-1002.

(BLM & USFS) Bureau of Land Management, U.S. Forest Service. 1994. Rangeland Reform '94 Draft Environmental Impact Statement. U.S. Department of Interior, Bureau of Land Management; U.S. Department of Agriculture, Forest Service. Washington, DC.

Braun, C. E., J. W. Connelly, M. A. Schroeder. 2005. Seasonal habitat requirements for sage-grouse: spring, summer, fall and winter. Pages 38-42 in N. L. Shaw, M. Pellant, S. B. Monsen (compilers).

Sage-grouse Habitat Restoration Symposium Proceedings; June 4-7, 2001; Boise, ID. RMRS-P-38. U.S. Forest Service, Rocky Mountain Research Station. Fort Collins, CO.

Call, M. W. and C. Maser. 1985. Wildlife habitats in managed rangelands – the Great Basin of southeastern Oregon: sage grouse. Gen. Tech. Rep. PNW-187. U.S. Forest Service, Pacific Northwest Forest and Range Exp. Stn. Portland, OR.

Coates, P. S. 2007. Greater Sage-grouse (Centrocercus urophasianus) nest predation and incubation behavior. Ph.D. Diss. Idaho State Univ. Pocatello, ID.

Coggins, K. A. 1998. Relationship between habitat changes and productivity of sage grouse at Hart Mountain National Antelope Refuge, Oregon. M.S. thesis. Oregon State University. Corvallis, OR.

Connelly, J. W. and C. E. Braun. 1997. Long-term changes in sage-grouse Centrocercus urophasianus populations in western North America. Wildl. Biol. 3: 229-234.

Connelly, J. W., C. E. Braun, M. A. Schroeder, C. A. Hagen. 2007. Setting the record straight: a response to "Sage-Grouse at the Crossroads." Rangelands 29(6): 35-39.

Connelly, J. W., M. A. Schroeder, A. R. Sands, C. E. Braun. 2000. Guidelines to manage sage-grouse populations and their habitats. Wildl. Soc'y Bull. 28(4): 967-985.

Connelly, J. W., S. T. Knick, M. A. Schroeder, S. J. Stiver. 2004. Conservation assessment of Greater Sage-grouse and sagebrush habitats. Western Association of Fish and Wildlife Agencies. Cheyenne, WY. (July 22, 2004).

Copeland, H. E., A. Pocewicz, D. E. Naugle, T. Griffiths, D. Keinath, J. Evans, J. Platt. 2013. Measuring the effectiveness of conservation: a novel framework to quantify the benefits of sagegrouse conservation policy and easements in Wyoming. PLoS ONE 8(6): e67261. doi:10.1371/journal.pone.0067261. Available at www.plosone.org/article/fetchObject.action?uri=info%3Adoi%2F10.1371%2Fjournal.pone.0067261&representation=PDF.

Doherty, K. E. 2008. Sage-grouse and energy development: integrating science with conservation planning to reduce impacts. Ph.D. dissertation. University of Montana. Missoula, MT.

Doherty, K. E., D. E. Naugle, B. L. Walker. 2010. Greater Sage-grouse nesting habitat: the importance of managing at multiple scales. J. Wildl. Manage. 74(7): 1544-1553.

Doherty K.E., J.D. Tack, J.S. Evans, and D.E. Naugle. 2010. Breeding densities of greater sage-grouse: A tool for range-wide conservation planning. Prepared for the Bureau of Land Management, BLM Completion Report: Interagency Agreement # L10PG00911

Herman-Brunson, K. H. 2007. Nesting and brood-rearing habitat selection of greater sage-grouse and associated survival of hens and broods at the edge of their historic distribution. Thesis, South Dakota State University, Brookings, USA.

Hegener, J. 2013. Letter from Jeff Hegener, Director, Montana Fish, Wildlife and Parks, to Brian Hockett, Project Manager, Bureau of Land Management (June 20, 2013). Hockett – Ref:DO256-13, 3pp.

Holechek, J. L., R. D. Pieper, C. H. Herbel. 2010. RANGE MANAGEMENT: PRINCIPLES AND PRACTICES. 6th ed. Prentice-Hall. Upper Saddle River, NJ.

Holloran, M. J. 2005. Greater sage-grouse (Centrocercus urophaisianus) population response to natural gas field development in western Wyoming. PhD Diss., Univ. of Wyoming. Laramie, WY.

Holloran, M. J. and S. H. Anderson. 2005. Spatial distribution of Greater Sage-grouse nests in relatively contiguous sagebrush habitats. Condor 107(4): 742-752.

Kaczor, N. W. 2008, Nesting and brood-rearing success and resource selection of greater sage-grouse in Northwestern South Dakota. Thesis, South Dakota State University, Brookings, USA

Kirol, C. P. 2012. Quantifying habitat importance for greater sage-grouse (Centrocercus urophasianus) population persistence in an energy development landscape. M.S. thesis. Univ. of wyoming. Laramie, WY.

Klebenow, D. A. 1982. Livestock grazing interactions with sage grouse. Proc. Wildlife-Livestock Relations Symp. 10: 113-123.

Knick, S. T., A. L. Holmes, R. F. Miller. 2005. The role of fire in structuring sagebrush habitats and bird communities. Pages 63-75 in V. A. Saab and H. D. W. Powell (eds.). FIRE AND AVIAN ECOLOGY IN NORTH AMERICA. Studies in Avian Biology, no. 30. Cooper Ornithological Society. Boise, ID.

Knick, S. T., D. S. Dobkin, J. T. Rotenberry, M. A. Schroeder, W. M. Vander Haegen, C. van Riper. 2003. Teetering on the edge or too late? Conservation and research issues for avifauna of sagebrush habitats. Condor 105(4): 611-634.

Knick, S. T., S. E. Hanser, R. F. Miller, D. A. Pyke, M. J. Wisdom, S. P. Finn, E. T. Rinkes, C. J. Henny. 2011. Ecological influence and pathways of land use in sagebrush. Pages 203-251 in S. T.

Knick and J. W. Connelly (eds). GREATER SAGE-GROUSE: ECOLOGY AND CONSERVATION OF A LANDSCAPE SPECIES AND ITS HABITATS. Studies in Avian Biol. Series, vol. 38. Cooper Ornithological Society. Univ. Calif. Press. Berkeley, CA.

Knick, S. T., S. E. Hanser, K. L. Preston. 2013. Modeling ecological minimum requirements for

distribution of greater sage-grouse leks: implications for population connectivity across their western range, U.S.A. Ecology and Evolution, available at http://onlinelibrary.wiley.com/doi/10.1002/ece3.557/pdf.

Manier, D. J., D. J. A. Wood, Z. H. Bowen, R. M. Donovan, M. J. Holloran, L. M. Juliusson, K. S. Mayne, S. J. Oyler-McCance, F. R. Quamen, D. J. Saher, A. J. Titolo. 2013. Summary of science, activities, programs, and policies that influence the rangewide conservation of greater sage-grouse (Centrocercus urophasianus). U.S. Geological Survey, Open-File Report 2013–1098; available at http://pubs.usgs.gov/of/2013/1098/.

Moynahan, B. J. 2004. Landscape-scale factors affecting population dynamics of Greater Sagegrouse (Centrocercus urophasianus) in northcentral Montana, 2001-2004. PhD Diss. Univ. of Montana. Missoula, MT.

Pederson, E. K., J. W. Connelly, J. R. Hendrickson, W. E. Grant. 2003. Effect of sheep grazing and fire on sage grouse populations in southeastern Idaho. Ecol. Model. 165(1): 23-47.

Reisner, M. D., J. B. Grace, D. A. Pyke, P. S. Doescher. 2013. Conditions favouring Bromus tectorum dominance of endangered sagebrush steppe ecosystems. J. Applied Ecol., available at http://onlinelibrary.wiley.com/doi/10.1111/1365-2664.12097/pdf.

(SGNTT) Sage-grouse National Technical Team. 2011. A Report on National Greater Sage-grouse Conservation Measures. Available at www.blm.gov/pgdata/etc/medialib/blm/wo/Information_Resources_Management/policy/im_fs/2012.Par.52415.File.dat/IM%202012-044%20Att%201.pdf.

Taylor, R. L., D. E. Naugle, L. S. Mills. 2012. Viability analysis for conservation of sage-grouse populations: Buffalo Field Office, Wyoming. BLM Contract 09-3225-0012; Number G09AC00013.
Final Report. Prepared for Bureauf of Land Management, Buffalo Field Office. Buffalo, WY.

Vallentine, J. F. 1990. GRAZING MANAGEMENT. Academic Press. San Diego, CA.

Past and Current Vegetation Conditions of Core Sagebrush Habitat and Leks of the Greater Sage-Grouse (*Centrocercus urophasianus*) at the eastern most extent of its range in Western South Dakota (Butte, Harding and Fall River Counties, SD)

Grant Agreement #T-51-R-1
Amendment #0

Submitted by

Daryl E. Mergen and Carin J. Corley,
Mergen Ecological Delineations, Inc.,
Colorado Springs, CO

And

Shelly Deisch,
SD Dept. of Game, Fish and Parks,
Rapid City, SD

July 16, 2013

TABLE OF CONTENTS

Past and Recent Vegetation Conditions of Sagebrush Habitat and Habitat of the Greater Sage-Grouse (*Centrocercus urophasianus*) in Western South Dakota

by

Daryl E. Mergen, Carin J. Corley, and Shelly Deisch

With a Special Acknowledgement to Art Carter, Chuck Berdan and Bob Hodorff, all former wildlife biologists with the SD Dept. of Game, Fish and Parks, Bureau of Land Management and USFS Buffalo Gap National Grasslands, respectively.

Introduction

This report is a compilation and summary of vegetation data collected in sagebrush steppe habitat in western South Dakota (SD) since 1992. Wildlife biologists began to collect data on greater sage-grouse (*Centrocercus urophasianus*) numbers in 1970 and collected habitat information beginning in 1992. Data collected in 2012 in Harding, Butte, and Fall River Counties in SD are the most recent. Data contained in this report can be considered baseline data and potentially the initial phase of a long-term monitoring program of sagebrush steppe habitat in western SD. Vegetation data in this report will be summarized and displayed at various spatial scales, the smallest is the individual site level, and then county, and finally data compiled and summarized for western SD.

Vegetation characteristics thought to be important for greater sage-grouse are summarized and displayed in tables and graphs by year for comparison purposes. These comparisons are done to demonstrate that vegetation trends can be viewed at various spatial scales with the same data. Most site level comparisons will be displayed in tables in Appendix at the end of the report. Data summaries available from other studies in the same areas were included (Smith 2003, Lewis 2004, Herman-Brunson 2007, Kaczor 2008, Swanson 2009, Herman-Brunson et al. 2009 and Kaczor et al. 2011).

The project area includes greater sage-grouse habitat. Greater sage-grouse is a bird that currently inhabits the western portion of SD (Harding, Butte, and Fall River Counties, Figure 1) and is a sagebrush obligate. South Dakota's sagebrush habitat represents the eastern most current and historical range of greater sage-grouse. Because SD's habitat is on the fringe and somewhat fragmented from larger contiguous sagebrush habitats in Wyoming, Montana and North Dakota, it may be one of the first areas to show declines in healthy sagebrush and sage-grouse abundance and distribution.

Sagebrush steppe habitat is also desirable habitat for the short-horned lizard (*Phrynosoa hemandesi*), sage thrasher (*Oreoscoptes montanus*), sagebrush vole (*Lemmiscus curtatus*), and pronghorn (*Antilocapra americana*) and many other species not yet identified as at risk. The goal for sage-grouse management by the South Dakota Game, Fish and Parks (SDGFP) is to monitor and maintain a sage-grouse population and habitats consistent with the ecological, social, and aesthetics values of SD citizens while addressing the concerns and issues of both residents and visitors of SD (SDGFP 2008). Sagebrush habitat in western SD is currently managed by SDGFP, Bureau of Land Management (BLM), the United States Forest Service,

Buffalo Gap National Grasslands (BGNG), SD School and Public Lands, private landowners, and possibly others. Sage-grouse populations are counted jointly among SDGFP, BLM and BGNG by conducting spring bird counts on known leks.

Objectives

Project objectives were to:

1. Summarize available sagebrush steppe vegetation data that has been collected in western SD` from 1992 to 2012.
2. Develop a baseline data set to document past and current vegetation condition and trend of sagebrush steppe habitat, particularly vegetation characteristics that may be important for sage-grouse, and
3. Examine and compile information about sagebrush habitat restoration methods.

Unpublished vegetation data collected in 1992 and 1993 near and at known sage-grouse leks in Harding and Butte Counties are compared to data collected at the same lek locations in 2012 using the same data collections methods. The 1992-93 data is referred to as "Carter data" in reference to Art Carter, a retired SDGFP Wildlife Biologist who, together with Chuck Berdan, BLM, and Bob Hodorff, BGNG, initiated vegetation data collection in 1992. The Carter data was collected in areas determined at the time to be some of the best sage-grouse habitat. Data collected by other studies between 1992 and 2012 are included as tabular summaries or figures within Harding, Butte, and Fall River Counties, but are often at different locations (some random, others where sage-grouse were found). We have compiled this data including GPS coordinate information which will give researchers a spatial component of this long-term data set.

A similar summary of data collected in sagebrush steppe habitat throughout the Buffalo Gap National Grasslands (BGNG) in Fall River County is also included. This data has been collected in three time periods (1992, 2003, and 2012). Carter data collected in 1992 was from a smaller portion of the sagebrush steppe habitat located in the northwest portion of BGNG. It is summarized and presented as part of the long-term County summaries. Data collected in 2003 (SDGFP and BGNG) and 2012 were collected from the same locations in Fall River County.

The various forms of data from all sources were not collected using the same methodologies. One recommendation resulting from this project is the need to standardize vegetation data collection methods for all three Counties. Having comparable data will make future studies, data collection, and potential vegetation monitoring more uniform and give it more power for determining vegetation trend. It is best for vegetation and sage-grouse monitoring projects to have specific objectives and goals determined before monitoring details are finalized and results from this project may aid towards strategic planning efforts.

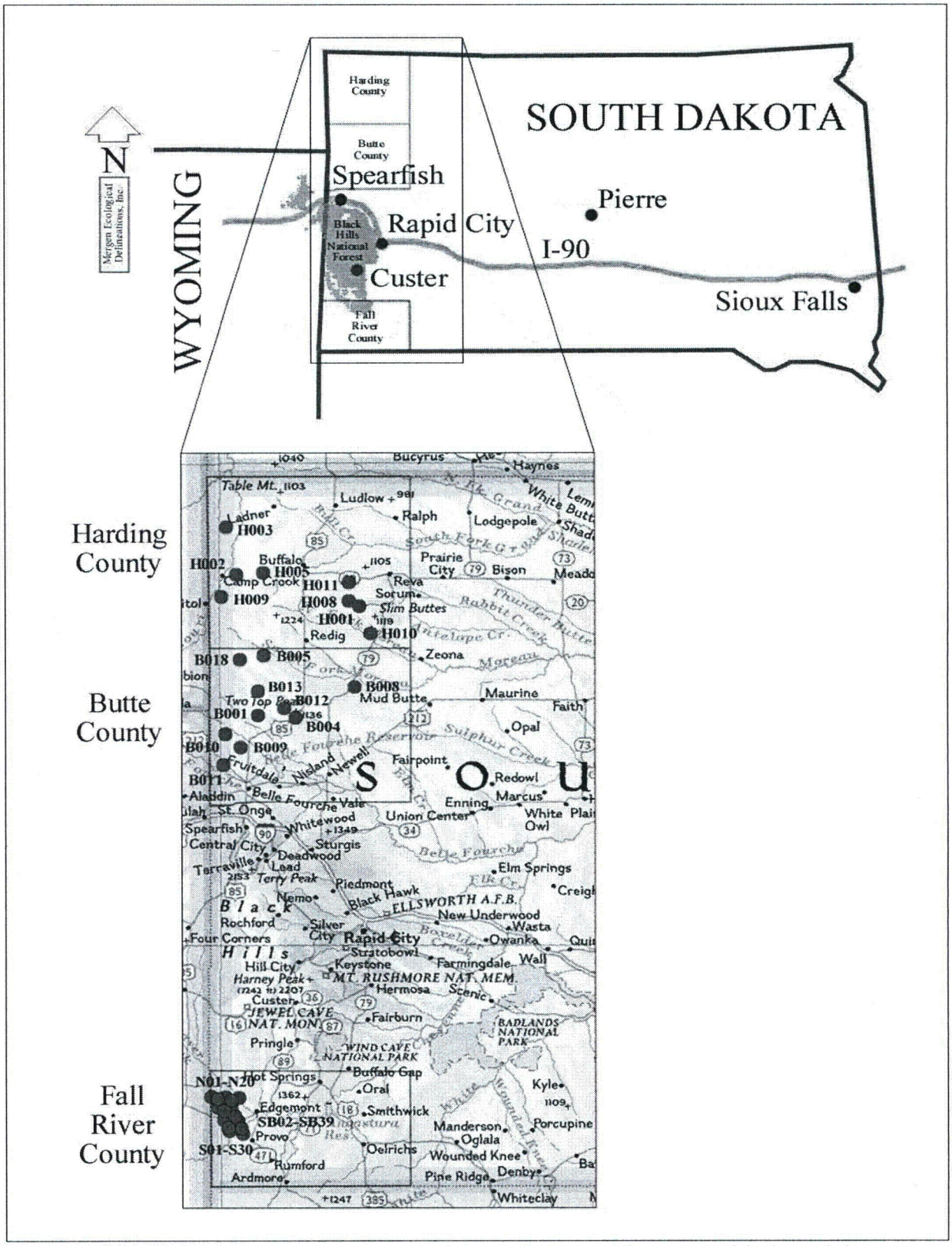


Figure 1. Vicinity map of the western part of South Dakota. The areas with the red dots represent locations within the sagebrush-steppe ecotype where data were collected within western South Dakota (Harding, Butte, and Fall River Counties).

Methods

Method instructions were not included with the Carter data but former biologists that worked on the original project were consulted. The Carter data was collected in 1992 and 1993. Some data for a particular lek location were collected in both years. In a summary of the Carter data, data collected from these two years were combined to simplify comparisons. The 1992-93 data can be thought of as baseline data for sagebrush habitat 20 years ago.

The Carter sites in Butte and Harding Counties were lek locations identified using Natural Resources Conservation Service (NRCS) soil survey maps. In 2012, Global Position Coordinates (GPS) of the Carter locations were generated, downloaded to a handheld GPS unit and used to re-locate the original Carter sites in Harding and Butte Counties. In the process of re-sampling the Carter sites in 2012, it was discovered that several of the sites were marked with a green t-post and wooden survey stakes that marked transect locations of the original Carter data. The sites marked with permanent markers were sites that Art Carter and Chuck Berdan determined to be some of the best habitat for sage-grouse in northwestern SD. Using the original maps to generate GPS coordinates in both Harding and Butte Counties generally worked well enough to get one within sight of previously placed t-posts and wooden stakes enough times that one may be assured the 2012 locations highly correspond to the original Carter locations. If not exactly placed, the 2012 sites were very near the original sites where data was collected in 1992-93. A few 2012 sites were moved or not sampled because of access issues across private lands. The Carter data was collected at additional locations radiating out from the center of the study sites, however the distance or directions were unknown and sample sizes varied in 1992-93. The 2012 data was only collected from the center of the study sites.

In Fall River County, an original GPS file with coordinates labeled as UTM NAD83 (Universal Transverse Mercator coordinate system, North American Datum 83) was downloaded to handheld GPS units. These points were located in the field and in most cases the GPS coordinate corresponded to the previous study with 20-year old green t-posts and wooden stakes. Previously placed t-post and wooden stakes were found on approximately 65% of the 72 sites. In some instances, the specified location lacked a t-post or wooden stake and a new location (GPS coordinates) was recorded and data was collected. New locations were selected within sagebrush steppe habitat and transect locations were selected to remain within an area of similar sagebrush density. Newly placed transects were orientated along a similar contour to reduce site variability.

Methods used in both areas (Carter data and 2003 Fall River data) included collecting canopy cover and frequency by species using the Daubenmire (1959) method along two parallel, 30 m long transects. Transects are 20 m apart and canopy cover by species, total cover, litter, bare ground, and rock were estimated at 1 m intervals along each transect. Therefore, canopy cover and frequency data were collected within thirty $0.1m^2$ plots along each of two transects for 60 total estimates per site. Another method was to measure herbaceous plant height. The tallest forb and tallest graminoid was collected within each of the thirty $0.1m^2$ plots along each transect for an average tallest forb and tallest graminoid height.

In Harding and Butte Counties, Robel pole (Visual Observation Readings or VOR) data was collected that included both a high and a low reading. This was collected along a 200 m transect

at 10 m intervals. Four readings per station were collected and data were averaged. The high estimate gave a reading of the greatest height of vegetation observed on the Robel pole. The low measurement recorded the lowest ½ inch band width visible. VOR data was not collected in Fall River County. VOR data collected in 1992-93 was always recorded as an even number band and the band width could not be determined. For lack of knowing the band width, the 1992-93 data was assumed to be ½ inch bands because a 1-inch band would have made the residual vegetation height illogical. The 1992-93 VOR data should not be considered as baseline information until knowledge of which incremental reading can be resolved. Therefore, as of this report, no direct comparison of 1992-93 VOR has been included.

Shrub heights and shrub densities were also collected by species within a belt transect 10 m wide by 30 m long in 2012 in Harding and Butte Counties. Shrub heights were measured to the nearest 5 cm within the belt. Shrub height and shrub density data was collected in 1992-93 in Harding and Butte Counties, but various areas of the belt transect was used, often based on shrub densities encountered at a site. Plot shape also varied. The 1992-93 belt transects were various sized sample areas, but were generally set at 450 m^2 (15 m x 30 m) or less when noted on the data sheets. The 1992-93 data were converted to a 450 m^2 area (15 m x 30 m) if actual area surveyed was not recorded; an appropriate conversion factor was used for plot sizes less than 450 m^2. For comparison with 2012 data, all 1992-93 shrub data was converted to shrub numbers per category based on an area of 300 m^2 and plotted for Harding and Butte Counties. Shrub densities were converted to shrubs per m^2 for comparisons.

Since the 2012 data could be the initial phases of long-term monitoring, data summaries and comparisons are made at the individual site level, county level, and summary comparison for all 3 counties representing western SD. The data could also be summarized and compared based on individual ranch plans (Harding and Butte County data) or by specific allotment and pastures (Fall River County data). Land and wildlife managers knowledgeable of these specific counties, sagebrush, and sage-grouse or other species may have better ideas as to how data could be summarized for their specific purposes and objectives. This project and report offer the 3 agencies (SDGFP, BLM and BGNG) time to discuss the data, relate it to agency planning efforts, and decide how best to analyze the data. Other summaries could easily be accomplished with the current data stored as an Excel file.

The 1992-93 data included many unknown plant species. Some species were identified by 4-12 letter codes, which do not match any plants known or suspected to occur in western South Dakota. Therefore, we retained or assigned all plant species or plant species codes with a number. Some of the unknown plants may be represented by several unknown codes because they were collected by different persons over different years. Throughout all the tables we included the scientific name of each plant species only. In Appendix E is the species list for all three counties combined. This species list can be easily referenced for the PLANTS (http://plants.usda.gov/java/) database code, scientific name, common name, and codes used in the past. Tables listed in Appendix Tables generally contain the most common or most frequent plant species and often do not list every species (including unknowns) within the list. All species are included on the digital files of data for each county.

Details of all sample methodologies are described in the Methods section in Appendix E. Data compiled from other studies list reference citations. Refer to each citation for specific methodologies.

Canopy cover data was summarized as percent canopy cover by life forms, bare ground, litter, dung, rock, and individual plant species. Percent frequency of life form, bare ground, litter, dung, rock, and individual plant species was also included in tables to show if a plant was rarely observed or frequently occurred at each site. An Index also calculated is a product of percent canopy cover and percent frequency. An Index is just another method that can give temporal data more stability between years when data comparisons are made. Cover of some perennial species can change between years base on preceding precipitation and grazing intensity, however the frequency of occurrence may remain similar. All data comparisons of between and among years were made graphically, by percentage changes, calculated differences, or using simple linear regression (trend lines) for graphic displays only. Statistical test procedures were not included at this time. Data will be further analyzed and published at a later date.

Project Purpose and Needs

Carter data represents some of the best leks and sage-grouse habitat known in 1992. The areas studied may be of greatest biological importance and should be considered for conservation of some of the most productive locations that meet life history requirements of sage-grouse in western SD.

The purpose of this project was to organize and compile available data. The provided data baseline can be used to initiate a discussion among agencies to look at the feasibility and implementation of a long-term sage-grouse and sagebrush habitat monitoring. Comparisons between years were to demonstrate changes in vegetation such as canopy cover, frequency, density, heights, or other vegetation characteristic. Comparisons were generally variables that have been identified as important for sage-grouse (Connelly 2000) or variables that demonstrate potential ecological consequences.

The needs are to assure management of greater sage-grouse and other sagebrush steppe species are considered in management decisions and provide managers the best available data and information to maintain and/or restore areas within this unique ecological community.

This study and future publications will provide land managers with quantitative vegetation data concerning sagebrush habitat of some of the most important sage grouse breeding areas and best habitat identified in SD and provide a detailed vegetation description of the past and recent sagebrush habitat within the eastern most distribution of greater sage-grouse. Managers will have quantitative spatial data at a landscape scale to map and analyze risk and propose the necessary conservation, management plans, and restoration measures to maintain good management practices and to prevent further habitat degradation, loss, or fragmentation.

Results and Discussions

Data collected were summarized into tables and are arranged in Appendix A-C by county. Currently, all data is designated for internal use only until inter-agency coordination can be completed and final publication of data. For purposes of sensitivity of data and lek locations, all

raw data for Appendices A-D and G are retained for internal use only. The plant species list with codes, life forms, common plant names, and scientific names and all methodologies used to collect the vegetation data in this study are in Appendix E. Precipitation data is in Appendix F.

Vegetation characteristics of total vegetation cover, graminoid cover, forbs, shrubs, litter cover, bare soil, big sagebrush (*Artemisia tridentata*) cover, also shrub, graminoid, and forb heights, and VOR were compared. Shrub density was also included. Most dominant plant species were included in tabular comparisons among sites. Because GPS coordinates were taken for each individual site, the dataset can be easily incorporated into ArcView for both spatial and temporal display based on future project objectives.

Individual site comparisons

Data for each site located within each of the three counties were summarized by year and are displayed in Appendix A, B, C for Harding, Butte, and Fall River Counties respectively (data for internal use only). Six sites are directly compared in Harding County, 7 sites in Butte County, and 72 in Fall River County. Some of the observed differences among individual sites are discussed for Harding County and Butte County only.

Harding County (Individual leks 1, 2, 3, 5, 9, and 10)

Details can be viewed in tables for the 6 direct individual lek comparisons for Harding County in Appendix A (data for internal use only). Comparing a site over time can give very specific species trend data for each site. Although these locations are identified as leks, they represent sage-grouse and sagebrush habitat and may be the center of a lek, adjacent to a lek, or be some unknown distance from a lek.

Lek 1

Total graminoid cover decreased 13% from 1992-93 to 2012. Blue grama (*Bouteloua gracilis*), western wheatgrass (*Pascopyrum smithii*), and all bluegrass species combined (*Poa* spp.) decreased 41%, 6%, and 4% respectively. Buffalograss (*Bouteloua dactyloides*) and combined Japanese brome (*Bromus arvensis*, also known as field brome) and downy brome (*Bromus tectorum*, also known as cheatgrass) increased 15% and 2% respectively. Total shrubs increased 2% which was an increase of big sagebrush.

Lek 2

Total grass cover decreased 46% and total forb cover decreased 33% from 1992-93 to 2012. Blue grama, western wheatgrass, all Carex species, and all bluegrasses combined decreased 6%, 12%, 4% and 2% respectively. Total shrub cover remained similar, but big sagebrush increased about 6% over this period. Fringed sagewort (*Artemisia frigida*) decreased about 6% also over this period. The amount of litter decreased about 50% and bare soil increased 29% on lek 2.

Lek 3

Total grass cover increased 60% and total forb cover increased 8% from 1992-93 to 2012. Blue grama, buffalograss and green needlegrass (*Nassella viridula*) all increased 4% while western wheatgrass increased 11%. Total shrub cover was similar, but big sagebrush decreased about 1% over this period. Fringed sagewort increased about 2% over this period. The amount of litter increased about 76% and bare soil decreased 78% on lek 3 over this time period.

Lek 5

Total grass cover increased 48% and total forb cover decreased 17% from 1992-93 to 2012. Blue grama increased 27% while western wheatgrass remained near equal. All the Carex species combined increased about 8%. Total shrubs and big sagebrush decreased 17% over this period. Litter cover decreased about 22% and bare soil decreased by 32% on lek 3 over this time period. Most forbs decreased on this lek over time.

Lek 9

Total grass cover decreased 21% and total forb remained the same while total shrub cover increased 9% (8% increase in big sagebrush) from 1992-93 to 2012. Blue grama increased 39% and western wheatgrass decreased 22% on this lek over time.

Lek 10

Total grass and total forb cover decreased 13% and 22% from years 1992-93 to 2012 while total shrub decreased about 6%. Blue grama increased 9% and western wheatgrass and all bluegrasses decreased 8% on this lek. Most graminoids and forbs decreased with the exception of cheatgrass (*Bromus tectorum*) and field brome (*Bromus arvensis*) which increased about 0.5%. All the Carex species combined decreased about 2%. Total shrubs decreased 6% over this period including about a 1% decrease of big sagebrush and loss of silver sagebrush (*Artemisia cana*) and broom snakeweed (*Gutierrezia sarothrae*).

These observed changes at the site level were among some of the most dominant plant species recorded. Canopy cover was only discussed, but frequencies were also observed. These differences noted are for single site comparisons only. A single site (2 transects of canopy cover data) compared to a single site about 20 years later show some mixed results in that some sites had increased amount of canopy cover while other showed decreased results.

Harding County Combined Lek Results

Details can be viewed between averages from all transect data collected in 1992-93 from 7 sites and the 7 collected in 2012 on the Harding County leks in Appendix A (data for internal use only). Comparing at the county level can give trend data for lek conditions over time. It may be possible to extrapolate the data for the general sagebrush habitat condition and trend within Harding County. Comparisons between life forms, litter, bare ground and plant species with values greater than 1% were reviewed to determine if changes were observed between the 1992-93 Carter data compared to data collected in 2012.

Total vegetation cover increased approximately 6%, graminoid cover remained equal, but there were declines of 10% and 12% for total forb and total shrub cover respectively. The frequency that shrubs were recorded over the 20-year period was about 29% less in 2012 compared to 1992-93. Canopy cover of lichen species combined decreased about 4% while frequency of lichen increased slightly (5%). Big sagebrush cover declined 6-7% and frequency of big sagebrush declined 10%. Broom snakeweed, although less than 1% in canopy cover, doubled in both cover and frequency over the same time period.

Graminoid cover remained about 57-58% over the 20-year period. However, there was a major shift in species composition over this same time period. Blue grama and buffalograss increased

3-4% in cover and 10-15% in frequency while four other major forage grasses declined. Canopy cover of needle and thread grass (*Hesperostipa comata*) and green needlegrass decreased about 2-4% and frequency of occurrence of needle and thread grass decreased by 9% while it increased by 7% for green needlegrass. Prairie Junegrass (*Koeleria macrantha*) declined by about half for both cover and frequency while western wheatgrass declined over 7%. Frequency of occurrence of western wheatgrass increased about 7% from 1992-93 to 2012.

Fringed sagewort remained the same and pricklypear (*Opuntia* spp.) declined about half, although it represented less than 2% cover. Scurfpeas species (*Psoralidium* spp.) combined declined about 5% and frequency declined about 25% overall. Most other forbs recorded in 1992-93 showed decline in cover when compared to 2012 data. Forb cover represented by many species with low cover (<1%) and frequency amounts.

Figure 2 illustrates two methods this data can be used for long-term monitoring. The top two graphs show averages by sample periods for total vegetation cover, total graminoid cover, total forb cover, and total shrub cover. Along with values recorded in 1992-93 and 2012 are long-term means. Long-term means were calculated as an average of all sample periods, in this case there were only 2 sample periods. The long-term mean, also called the running average, gives a true long-term average in Harding County for each specific variable. It is only calculated for 4 variables in Figure 2, but can be calculated for each variable. Data averages collected in 1992-93 and 2012 can be compared with each other and with the long-term mean.

Total vegetation cover illustrates an increase, total graminoid cover little or no change, and total forb cover a decrease over the two sample periods. Total shrub cover shows a greater decrease compared to the previous 3 variables. Also included are values for big sagebrush and broom snakeweed. Big sagebrush was similar to the long-term mean value of total shrubs in 1992-93, but has since declined in canopy cover over the near 20-year period. Broom snakeweed shows very little change over time and represents very little canopy (less than 0.5%) cover either year.

The bottom two graphs show average values recorded in Harding County of the major forage grasses recorded and primary weedy grasses. Blue grama and buffalograss both show increases over time in canopy cover while needle and thread, prairie Junegrass, green needlegrass, and western wheatgrass all show decreases in canopy cover. During this same period there has been an increase in canopy cover of cheatgrass while field brome and a combined category of these two brome species used in 1992-93 show declines. Graphically, the brome species shows canopy cover values less than 1%; however, it can also be viewed as an increase in these species, particularly cheatgrass at 5 times greater.

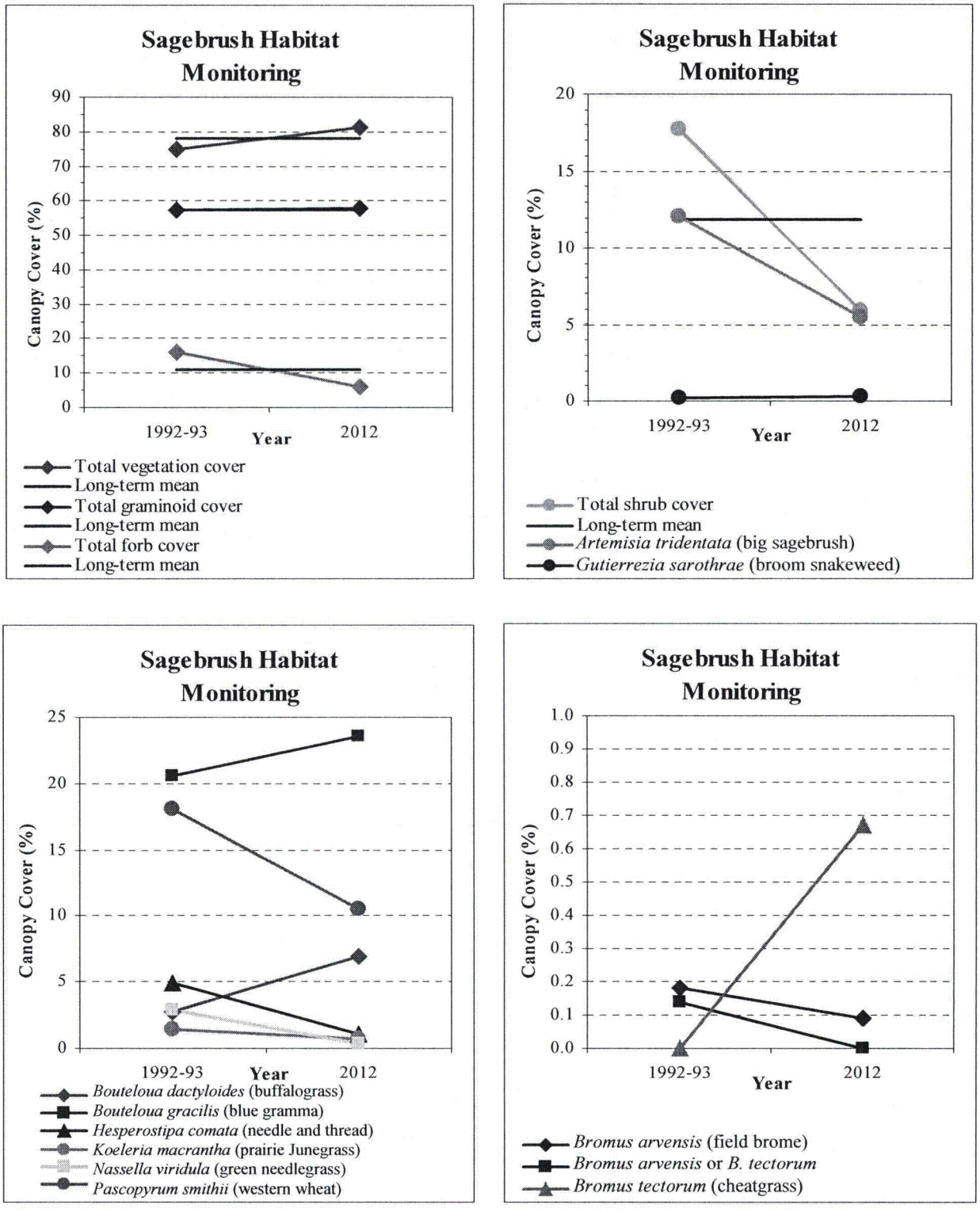


Figure 2. Canopy cover of most common plant species, life forms, and total cover among two time periods (1992-93 and 2012) in Harding County. Top two graphs show the long-term means plotted on the graph as horizontal black lines. Long-term means were calculated as an average of values for the two sample periods.

Sagebrush heights and densities were measured in a belt transect (plot) and counted based on shrub height categories. Plot sizes used in 1992-93 were variable, but based on 15 m x 30 m plot size (450 m^2). Plot shape sometimes varied also. All 2012 data were collected in 10 m x 30 m plots (300 m^2). All 1992-93 data were converted to 300 m^2 areas and plotted with 2012 data for comparisons (Figure 3).

The numbers of shrubs observed in the 1992-93 data are greater compared to 2012 shrub data (Figure 3). The general shape of the two monitoring years' mean lines in Figure 3 represent sagebrush height demographics in Harding County appear similar. This indicates that numbers of plants representing certain heights have declined in most categories over the last 20 years. Shorter plants show the greatest declines in number. This large decrease in small shrubs (5-15 cm tall) could be an indication that recruitment of new shrubs is lacking. There appears to be a decrease in the tallest shrubs based on graph as well, but this could be from fewer samples (smaller sample area) collected at each lek in 2012 compared to 1992-93. The results of fewer shrubs observed in 2012 may be why the canopy cover, frequency of shrubs, and shrub densities have decreased over the 20-year period.

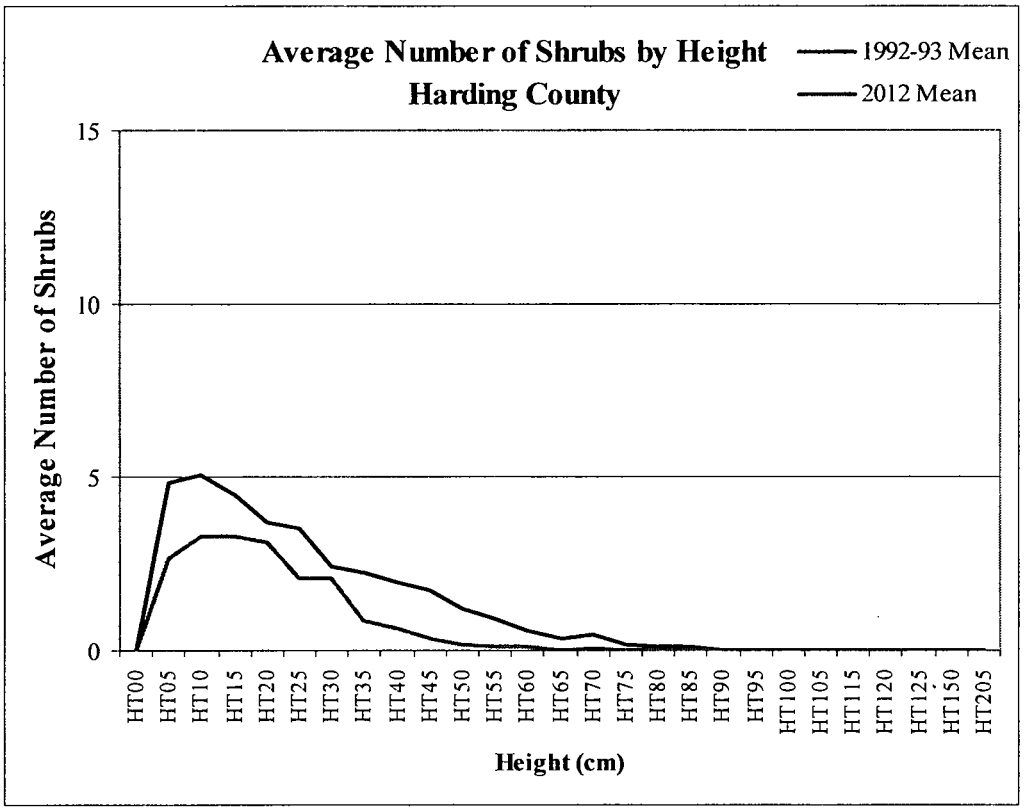


Figure 3. Average number of shrubs by shrub height classes in Harding County showing a decline in the number of shrubs from 1992-93 to 2012. This decrease in shrub numbers has impacted all height categories of shrubs.

Harding County Summary

Although total cover and total graminoids remained about the same over the 20-year period there were declines in total shrubs. Total forbs and graminoid composition appears to have changed or is changing to more dominant C4 (warm season) species while C3 (cool season) species decline. Big sagebrush canopy cover declined 12% and frequency of occurrence was recorded 29% less. The forb decline could be expected in 2012 since precipitation was below average. However, there was an increase in warm season grasses that are more tolerant to drought and grazing (blue grama and buffalograss) while the major cool season grasses like needle and thread, green needlegrass, prairie Junegrass, and western wheatgrass all decreased in amount of canopy and often in frequency.

Butte County (Individual leks 1, 4, 5, 8, 11, 12, and 13)

Details can be viewed in tables for the 7 direct individual lek comparisons for Butte County in Appendix B (data for internal use only). Comparing a site over time can give very specific species trend data for each site.

Lek 1

Total graminoid cover increased about 3%, but total forb and total shrub cover decreased 7% and 12% respectively from 1992-93 to 2012. Big sagebrush decreased 9% and broom snakeweed and greasewood (*Sarcobatus vermiculatus*) decreased 3% or less. Blue grama decreased 5%, Carex species combined increased about 2%, green needlegrass, and all bluegrasses decreased 6% and 11% respectively. Western wheatgrass, prairie Junegrass, sand dropseed (*Sporobolus cryptandrus*), and needle and thread all increased 2% or less. Buffalograss increased 19% over the same time. Differences in forb species were generally less than 1% with the exception of a decrease of about 2% for *Trifolium* species. Litter increased about 9% and bare ground decreased about 13%.

Lek 4

Total graminoid cover decreased 33% and total shrub cover decreased 7%, but total forb cover increased 9% from 1992-93 to 2012. Big sagebrush decreased 6% and fourwing saltbush (*Atriplex canescens*) increased about 1%. Silver sagebrush was not recorded in 2012. Bentgrass (*Agrostis* spp.) and fescue (*Festuca* spp.) species both decreased 3-4% and western wheatgrass decreased by 6%. Crested wheatgrass (*Agropyron cristatum*) increased by 2% and all bluegrasses combined increased only 1%. Differences in forb species were generally less than 1%. Litter was about the same and bare ground increased about 12%.

Lek 5

Total graminoid cover increased 5%, but total forb and total shrub cover decreased 9% and 10% respectively from 1992-93 to 2012. Big sagebrush decreased 10%. Broom snakeweed and fourwing saltbush increased slightly (0.1-0.3%). Western wheatgrass increased 3% while other graminoids were very uncommon. Differences in forb species were generally less than 1% with the exception of a near 8% decrease for textile onion (*Allium textile*). Litter increased about 11% and bare ground decreased about 20%.

Lek 8

Total graminoid, forb, and shrub cover decreased 19%, 5%, and 10% respectively from 1992-93

to 2012. Big sagebrush decreased 10% and was the only shrub recorded either time. Blue grama indicated a 5% increase, however *Bouteloua* species showed an approximately 50% decline. Buffalograss showed a 14% increase. These differences could be indicative of species misidentification in 1992-93 and the combining of blue grama and buffalograss into a *Bouteloua* species category because the difficulty in identifying these two short grasses. Western wheatgrass decreased 7% and bluegrass declined about 3%. Litter increased about 22% and bare ground decreased about 3%.

Lek 11

This lek had few species recorded in either sample period. Total graminoid cover increased 25% and total forb increased 6%, but total shrub cover decreased 46% between 1992-93 and 2012. Big sagebrush indicated a 46% decrease. Carex species combined and western wheatgrass increased by 13% and 5% respectively in canopy cover. Differences in forb species were generally less than 1% with the exception of a 6% increased cover of common yarrow (*Achillea millefolium*). Litter decreased 2% and bare ground decreased about 12%.

Lek 12

Total graminoid cover increased 18% and shrub cover decreased 28% while total forb cover remained about the same from 1992-93 to 2012. Big sagebrush decreased 27%. Results of this lek showed a category of *Agropyron* species (wheatgrasses combined) recorded in 2012 was 23% and very little western wheatgrass was recorded (0.1%) in 2012. Data collected in 1992-93 resulted in 23% western wheatgrass and no *Agropyron* species. The condition of wheatgrasses (drought, grazing, or both) could not be easily differentiated in the field in 2012 at this site so a genera group was created to include all species thought to be wheatgrasses. Therefore, results of wheatgrasses indicated no change occurred. Buffalograss increased about 16% between dates. Differences in forb species were generally less than 1%. Litter increased over 81% and bare ground decreased 50%.

Lek 13

This lek had many species recorded in both sample periods. Total graminoid and shrub cover both decreased 3%. Total forb cover increased 1% and the 3% shrub decline was from big sagebrush. Western wheatgrass decreased by 4% and bluegrasses decreased 0.5%. Two unidentified grasses recorded in 1992-93 either disappeared or were identified in 2012, this accounted for 4% change. Green needlegrass accounted for 10% canopy cover in 2012 while a *Stipa* group in 1992-93 had about 1% of this grass recorded. Differences in forb species were generally less than 1%. Litter cover increased 17% and bare ground decreased about 35%.

The observed changes at the site level were among some of the most dominant plant species recorded. Canopy cover was only discussed, but observations among frequencies were also observed. The differences noted are for single site comparisons only. A single site (2 transects of canopy cover data) compared to a single site about 20 years later show some mixed results in that some sites had increased amount of canopy cover while other showed decreased results.

Butte County Combined Lek Results

Details can be viewed between averages from transect data collected in 1992-93 from 11 leks and 7 collected in 2012 in the Butte County (Appendix B (data for internal use only)).

Comparing at the county level can give trend data for leks over time. It may be possible to extrapolate the data to show general sagebrush habitat condition and trend in Butte County.

Comparisons between life forms, litter, bare ground and plant species with values greater than 1% were reviewed to determine changes observed between the 1992-93 Carter data compared to data collected in 2012. Total vegetation cover increased approximately 7%, graminoid cover remained equal, but there were declines of 6% and 14% for total forb and total shrub cover respectively. The average frequency that shrubs were recorded over the 20-year period was about 29% less in 2012. Canopy cover of lichen species combined was nearly equal while frequency increased 24%. Big sagebrush declined 12-13% and frequency of big sagebrush declined 27%, while all other shrubs species (although less than 1% canopy cover) declined except for fourwing saltbush which was similar.

Graminoid cover remained 32% over the 20-year period. However, there was a shift in species composition over the same time period. Blue grama cover remained the same over the 20 years but frequency of occurrence increased over 13%. Buffalograss increased 6% in canopy cover and 25% in frequency. Needle and thread grass, green needlegrass, and a *Stipa* species group (assumed to represent needle and thread and green needlegrass combined show slight increases (less than 1%). Prairie Junegrass also decreased less than 1% and western wheatgrass decreased 5% from 1992-93 to 2012 but frequency remained about equal. All bluegrass species combined resulted in a 3-4% decline in these grasses over the 20-year time.

Fringed sagewort remained about the same, pricklypear declined about 1% in cover and about half in frequency, although it represented less than 2% cover total. Common yarrow increased very little. There was a decline of over 2% in cover and 23% in frequency of American vetch (*Vicia americana*). Most other forbs recorded in 1992-93 showed decline in cover when compared to 2012 data.

Figure 4 illustrates two methods this data can be used for long-term monitoring. The top two graphs show averages by sample periods for total vegetation cover, total graminoid cover, total forb cover, and total shrub cover. Along with values recorded in 1992-93 and 2012 are long-term means. Long-term means were calculated as an average of all sample periods, in this case there were only 2 sample periods. The long-term mean also called the running average gives a true long-term average in Butte County for each specific variable. Long-term means were only calculated for 4 variables in Figure 4, but can be calculated for each variable. Data averages collected in 1992-93 and 2012 can be compared with each other and with the long-term mean.

Total vegetation cover illustrates an increase, total graminoid cover little or no change, and total forb cover a decrease over the two sample periods (Figure 4). Total shrub cover shows a greater decrease compared to the previous 3 variables. Also included are two sample values for big sagebrush. Big sagebrush shows similar declines as total shrubs and about 7-8% less canopy cover compared to the long-term mean of total shrubs over the near 20-year period.

The bottom two graphs show average values recorded in Butte County of the major forage grasses recorded and primary weedy grasses (Figure 4). Buffalograss shows an increase over time in canopy cover while prairie Junegrass, western wheatgrass, and all bluegrasses combined

all show decreases in canopy cover. The needle grasses remained near equal over the 20 years in canopy cover. During this same period there has been little change or a slight decrease in canopy cover of cheatgrass. Field brome shows a slight increase over time while the combined category of these two brome species used in 1992-93 show declines. Graphically, the brome species shows canopy cover values less than 1%.

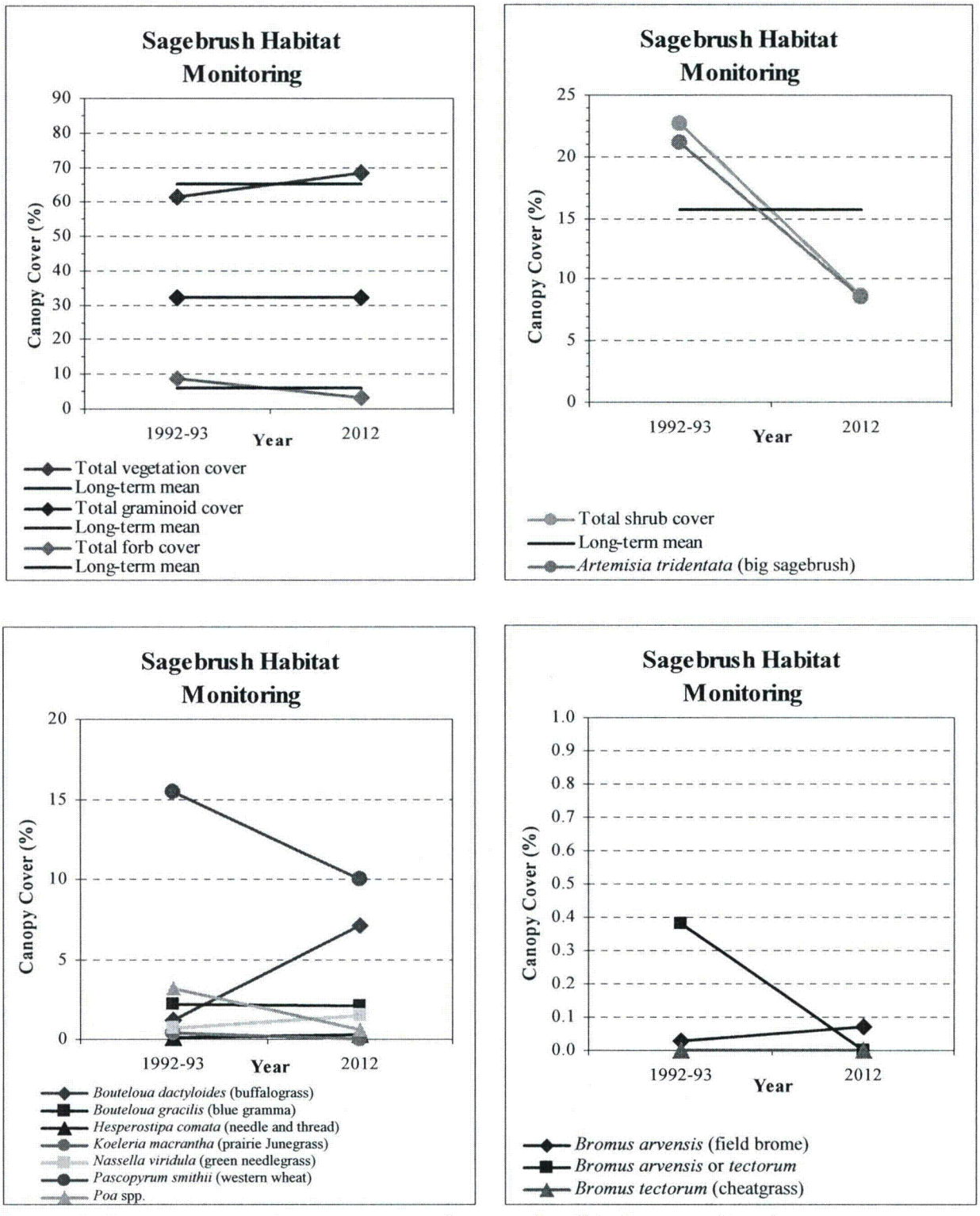


Figure 4. Canopy cover of most common plant species, life forms, and total cover among two time periods (1992-93 and 2012) in Butte County. Top two graphs show the long-term means plotted on the graph as horizontal black lines. Long-term means were calculated as an average of values for the two sample periods.

Sagebrush heights and densities were measured in a belt transect (plot) and counted based on shrub height categories. Plot sizes used in 1992-93 were variable, but based on 15 m x 30 m plot size (450 m^2). Plot shape sometimes varied also. All 2012 data were collected in 10 m x 30 m plots (300 m^2). All 1992-93 data were converted to 300 m^2 areas and plotted with 2012 data for comparisons (Figure 5).

The numbers of shrubs observed in the 1992-93 data are greater compared to 2012 shrub data (Figure 5). The general shape of the two monitoring years' mean lines in Figure 5 represent sagebrush height demographics in Butte County appear similar. This indicates that numbers of plants representing certain heights have declined in every category over the last 20 years. Shorter plants show the greatest declines in number. This large decrease in small shrubs (less than 20 cm tall) could be an indication that recruitment of new shrubs is lacking or reduced. There appears to be a decrease in the tallest plants based on graph as well, but this could be from fewer samples (smaller sample area) collected at each lek in 2012 compared to 1992-93. The results of fewer shrub observed in 2012 may be why the canopy cover and frequency of shrubs have decreased over the 20-year period.

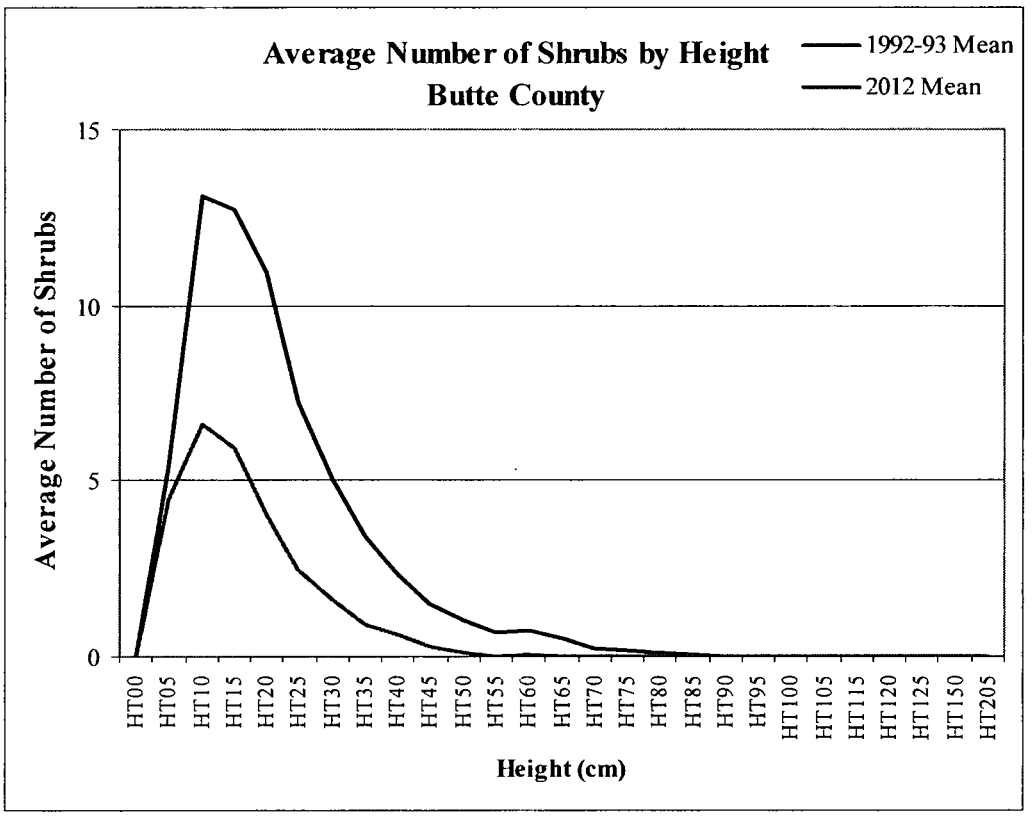


Figure 5. Average number of shrubs by shrub height classes in Butte County showing a decline in the number of shrubs from 1992-93 to 2012. This decrease in shrub numbers has impacted all height categories of shrubs.

Butte County Summary

Although total cover and total graminoids remained about the same (32%) over the 20-year period there were declines in total shrubs (14%) and total forbs (6%). Graminoid composition appears to have changed or is currently changing to more dominant C4 (warm season) species while C3 (cool season) species decline or remain similar. Big sagebrush canopy cover declined 13% and frequency of occurrence was recorded 27% less. The forb decline could be expected in 2012 since precipitation was below average. However, there was an increase in warm season grasses that were more tolerant to drought and grazing (buffalograss and blue grama) while the major cool season grasses like needle and thread and green needlegrass changed little. Prairie Junegrass almost disappeared from the sample and western wheatgrass decreased over 5%. All bluegrass species combined decreased about 3% over the 20 years.

Fall River County (Individual leks not included)

Tables for the 44 sites collected in 1992, 72 sites collected in 2003, and 69 sites collected in 2012 provide vegetation data summaries and comparisons for Fall River County and can be viewed in Appendix C (data for internal use only). Three sites were burned in a wildfire in 2012 and had no live vegetation present and data were not collected. Comparing a single site can give very specific species trend data for each site and identify plant species change. Butte and Harding County vegetation data was collected at or near leks determined to be some of the best lek habitat in the early 1990's. Fall River County collection sites were not established based on past, current, best leks, or best sagebrush habitat. Sites are distributed throughout sagebrush habitat on BGNG but do include known lek sites in Fall River. There were a greater number of sites established within this area of Fall River County. Data viewed at the County level can give good estimates of vegetation trend over time. Data in Fall River County represents a smaller area sampled (compared to Harding and Butte Counties) and it was sampled at a greater density.

Discussion of individual site comparison for each of the 72 sites in Fall River County will be omitted here due to the large number of sites for possible comparisons. The data collected from all 72 sites in 2003 and 2012 can be viewed and compared individually in Appendix C (data for internal use only). All 1992 data at the county level was compared to the 72 sites collected in both 2003 and 2012.

The three sites (sites SB13, SB14, and SB15) located at the most northwestern part of the 2003 and 2012 project area were burned during a wildfire in 2012 and sampling took place shortly after the fire. These 3 sites represent about 4% of the dataset. Data collected in 2003 resulted in total cover being 74-81% on these three sites. Total graminoids were recorded as 34-53% cover and forb cover was less than 4%. Canopy cover of sagebrush on these three sites averaged between 13-21%. Data was not collected from the three sites in 2012 because of the severity of the burn resulting in a lack of vegetation. All live vegetation cover burned and no vegetation had re-grown by the time of the 2012 sample. All sagebrush on these sites had been completely burned and sagebrush plants were assumed to be dead. The loss of sagebrush at the 3 sites was included as missing data. If samples had been collected and zero data were included (instead of missing data) the percentage of sagebrush at the county level would have been less than reported for 2012 data.

Each site in the Fall River data can be easily assigned to an individual BGNG allotment and to an

individual pasture based on Forest Service management. Summarizing data by each allotment and pasture could be another method of monitoring with the dataset. This could be the best method if there were ever a change in management at a pasture or allotment level. All sites sampled appeared to have been grazed by cattle, domestic sheep, and wildlife. Changes in AUM (animal unit months) at a pasture level could probably be detected over time in amount of species cover, frequency recorded or both.

Fall River County Sites Results

Tables for the Fall River County comparisons can be viewed in Appendix C (data for internal use only). Details can be viewed between averages from the 69 Fall River County sites collected in 2012 and all transect data collected in 1992 and 2003. Comparing at the county level can give trend data for lek conditions over time and it may be possible to extrapolate for the general sagebrush habitat condition and trend.

Fall River has three years of data collected over a twenty year time period (1992, 2003 and 2012) which can be used as a summary of sagebrush habitat, particularly on BGNG. However, data collected in 1992 represents a smaller geographical area compared to data collected in 2003 and 2012 so differences observed between 1992 and later years must be treated with knowledge of potential greater spatial variation associated with this county summary. Data for most common species and life forms have been used in a graphical representation (Figure 6) over three sample periods; a long-term mean (also referred to as a running mean) has been calculated from all three years of data. Over time the long-term mean represents the best possible estimate for vegetation cover that is site specific and each sample can be easily viewed as exceeding or being below the long-term mean in addition to comparisons with previous annual samples.

Canopy cover of plant species were compared for species with canopy cover values greater than 1%. Total cover was shown to increase about 10% when 1992 and 2003 data were compared and decreased less than 2% between 2003 and 2012 (tables in Appendix C (data for internal use only) and Figure 6). Total graminoid cover fluctuated slightly between 43-47% over the 20 years. Total forb cover showed about a 3% decrease from 1992 to 2003 and a 1% increase from 2003 to 2012 based on the Fall River county data combined. Total litter showed an increase in 2003 followed by a decrease in 2012, whereas bare ground showed a steady decline over the 20-year period.

Big sagebrush, one of the most dominant plant species within the study area, was examined based on canopy cover and frequency of occurrence. Comparing canopy cover over time shows there was a 7% decline, followed by a slight (0.7%) increase between 2003 and 2012. Percent frequency of big sagebrush was compared over time and its trend showed a 13% decline between 1992 and 2003 followed by another 3% decline from 2003 to 2012. Although canopy cover of big sagebrush has changed little since 2003, its frequency of occurrence decreased. Sagebrush would have been less if zero data would have been collected and summarized from the 3 burned sites.

Individual grasses compared include blue grama, buffalograss, needle and thread, and western wheatgrass. There was little difference in either blue grama or buffalograss between 2003 and 2012, but greater increases since 1992. Needle and thread grass more than doubled between

2003 and 2012. Western wheatgrass showed over a 13% decline from 1992 to 2003 followed by a 4-5% increase from 2003-2012 (Figure 6). Another grass, not included in the figure, was crested wheatgrass; it has shown a 2-3% increase in 2012 compared to either previous sample. This could be an indication crested wheatgrass has either been planted since 2003, conditions in 2012 were excellent, or it made an increase from previous natural seedings from plants recorded in 1992 and 2003.

Figure 6 illustrates two methods this data can be used for long-term monitoring. The top two graphs show averages by sample periods for total vegetation cover, total graminoid cover, total forb cover, total litter, total bare soil, and total shrub cover. Along with values recorded in 1992, 2003, and 2012 are long-term means. Long-term means were calculated as an average of all three sample periods. The long-term mean gives a true long-term average in Fall River County for each specific variable. It is only calculated for 6 variables in Figure 6, but can be calculated for any variable. Data averages collected in 1992, 2003, and 2012 can be compared with each other and to the long-term mean.

Total vegetation cover, total graminoid, and total forb cover show little change over the past 20 years and slight fluctuations among the three sample years. Long-term means are similar to values recorded. Total litter cover shows an increase in 2003 followed by a decrease in 2012. This larger fluctuation in canopy cover of litter is partially explained by available monthly precipitation and cumulative precipitation. Precipitation in 2003 was above average most months except May and July while in 2012 monthly totals were below or near average each month. Cumulative precipitation in 2003 was above average all months and below average in 2012 (Appendix F). Bare soil shows little change over the past 20 years and three sample dates. Total shrub cover shows a great decrease from 1992 to 2003 followed by a slight increase with 2012 data.

Blue grama and buffalograss (bottom graphs of Figure 6) show an increase since 1992 while western wheatgrass has declined with a slight increase in 2012. Needle and thread has remained relatively the same since 1992. Field brome and cheatgrass show great increases in 2003 followed by decreases in 2012, which again could be fluctuation in available precipitation levels. Precipitation amounts in 1992 were more similar to 2012, being average or below average most months, with greater precipitation in 2003. The weedy grasses are present throughout the grasslands and depending upon precipitation amounts and timing will determine the number of plants that germinate, survive and be recorded as canopy cover.

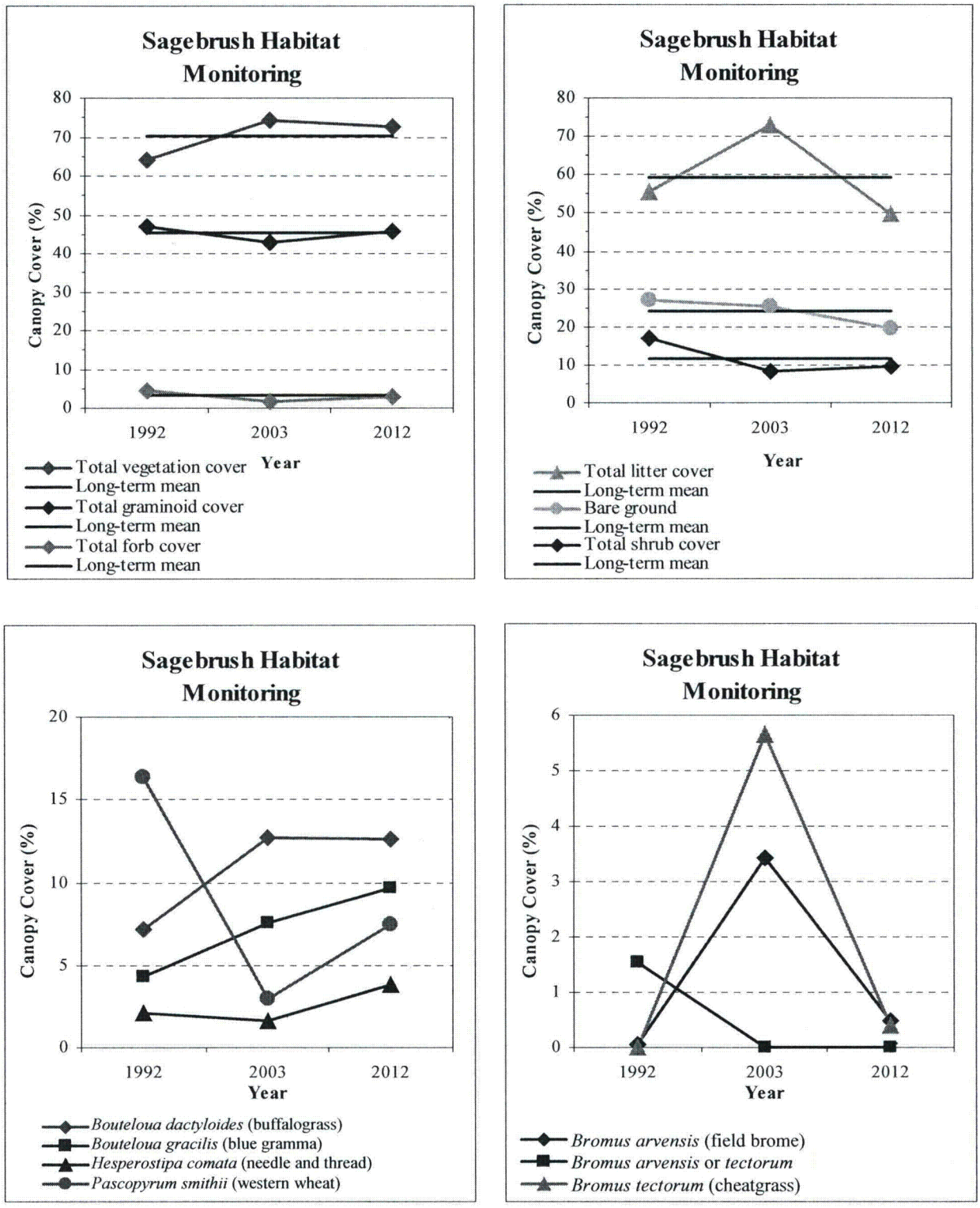


Figure 6. Canopy cover of most common plant species, life forms, total cover, bare ground, and litter among three years (1992, 2003 and 2012) in Fall River County. Top two graphs show the long-term means plotted on the graph as horizontal black lines. Long-term means are calculated as an average of values for all three sample periods.

Fall River County Summary

From the initial comparisons of the most dominant grasses, big sagebrush, total cover, total forb, litter and bare ground there is little change in percent cover among the three sample periods. This lack of change can be interpreted in different ways. The vegetation community sampled in Fall River County has changed little (measured as percent change in canopy cover) the past 20 years. Little change may mean the sagebrush-grass plant community is at a relatively stable state, management practices have changed little over the past 20 years and the differences observed may represent sample variability of some type or influences in precipitation amounts over time and coinciding with sample dates.

Changes in canopy cover of blue grama and buffalograss continue to increase or remain near equal over the three sample periods while needle and thread has declined overall since 1992 and western wheatgrass decreased from 1992 to 2003 and increased little since 2003. Both these C3 plants represent less canopy cover compared to the C4 blue grama and buffalograss.

Sagebrush data compiled for western South Dakota 1992-2012

Habitats that sage-grouse select change based on the specific life history stage in western South Dakota (Connelly 2000, Crawford et al. 2004). All stages are important understanding components of population dynamics in sage-grouse numbers observed over the past 40 years. Shrub heights, canopy, and density may be the most important characteristics of the vegetation required for sage-grouse. Results of this project indicate canopy cover, frequency, shrub height, and shrub density has been decreasing in the three counties in western SD over the past 20 years. Components of critical habitat include tall grasses (>18 cm) and an adequate canopy cover of tall grasses (Crawford et al. 2004). Results of this study suggest tall grasses (C3 grasses) are being replaced with short stature grasses (C4 grasses). Forb cover is important because of its forage value and invertebrate habitat (invertebrates provide critical protein in grouse diets). Overall cover and forb cover appears to be decreasing in western SD. Riparian plant species are also determined to be important for certain life stages of sage-grouse and these, while not specifically measured in this study, should be monitored to determine if this ecological zone follows similar declines as observed in upland habitat.

Data compiled for sagebrush steppe habitat in western SD include the following data:

1. 1992-93 in Harding, Butte and Fall River Counties by Carter, Berdan and Hodorff (SDGFP, BLM, BGNG unpublished data)
2. 2012 in Harding, Butte and Fall River Counties by this project Mergen, Corely and Deisch (SDGFP unpublished data)
3. 2003 in Fall River County by Deisch and Hodorff (SDGFP and BGNG unpublished data)

This unpublished data was compiled into a single data set that included published data values from the following;

1. Smith 2003
2. Lewis 2004
3. Herman-Brunson 2007, Herman-Brundon et al. 2009
4. Kaczor 2008, Kaczor et al. 2011
5. Swanson 2009

The published values reported in thesis, dissertations, and published articles contain mean values for some vegetation characteristics that have been determined to be important for sage-grouse (Connelly et al. 2000). In addition, some of the published values were for specific portions of sage-grouse life stages: nests, brood, and winter habitats, also random. Some published data was designed to collect information on bird species richness and use, and not designed specifically for sage-grouse knowledge, but was collected in sagebrush habitat in western SD. All these data sources were sorted by date and means were plotted with a trend line (Excel 2003).

Canopy cover percent

Long-term trends based on available data for this project include a downward trend for total vegetation cover, total graminoid cover, total forb cover, total shrub cover, big sagebrush cover, litter cover, and bare ground. The results for western SD were similar to results reported at the county level and include additional sources with data sampled between 1992 and 2012 (Smith 2003, Lewis 2004, Herman-Brunson 2007, Kaczor 2008, Swanson 2009, Herman-Brunson et al. 2009 and Kaczor et al. 2011). The canopy cover variables values and bare ground values were expected to fluctuate over time since they were collected during years with different amounts and timing of rainfall and possibly different amounts and timing of livestock and wildlife grazing.

The trend lines are somewhat similar to data observed at the county levels, except total vegetation cover and total graminoid cover were similar between the twenty year span of 1992-93 Carter data and 2012 data. Graminoid information at the county levels identified changes in grass species composition over time. Data collected for the project influences trend lines since it is at the end of Figures 7-18, but overall trends show downward trends of all canopy cover variables displayed.

Total vegetation canopy cover over western SD shows a decreasing trend even though 2012 data is greater than most values reported for total vegetation cover (Figure 7). Total vegetation canopy cover collected at random sites is generally less when compared to sites sampled that were selected by sage-grouse.

Total graminoid cover in western SD also has a declining trend line (Figure 8). Most data show greater graminoid cover at sites selected by sage-grouse with the exception of winter sites (Swanson 2009). Figure 9 shows a decreasing forb canopy cover over time, based on data and associated trend line. Forb cover has been less than 10% in most data collections. Less forb data was reported compared to total vegetation and total graminoids.

Total shrub cover (Figure 10) and big sagebrush cover (Figure 11) both show a decreasing amount of shrub and big sagebrush canopy cover throughout western SD over the past 20 years. More big sagebrush data was reported, and in the 2012 sample, indicate the majority of shrub cover is composed of big sagebrush. Randomly selected sites in studies between 1992 and 2012 had less sagebrush cover reported than sample sites that were selected based on known sage-grouse use.

Sagebrush is one of the most important variables sampled, as it has been determined to be important to sage-grouse during most life stages. All information supports a decline in sagebrush over the past two decades.

Both total litter cover and bare ground recorded (Figures 12 and 13, respectively) show declines in both values for western SD. Litter cover (Figure 12) is quite variable and may be influenced by precipitation received the year prior to sampling or the year of sampling. Bare ground also shows a slight decline, which could be seen as a positive impact. Less bare soil is generally associated with less sediment yield. However, this slight decrease in bare soil could be an indication the amount of bare soil observed is declining because the amount of sagebrush is declining. There is often greater bare soil recorded under sagebrush compared to areas without sagebrush.

Plant heights and shrub density

Long-term declines in trend were observed with shrub heights, and VOR over 20 years. Increases in shrub density and forbs heights were observed with trend lines of all compiled data. Graminoids height showed only a slight increase

Shrub height showed a decrease over time as expected when canopy cover of shrubs, particularly big sagebrush was decreasing over time. Figures 3 and 5 clearly indicate a decrease in shrub numbers by every height category measured. On a per meter basis, shrub density has also shown a decline of about 50% in both Harding and Butte Counties between 1992-93 and 2012. Figure 14 also shows data selected randomly generally was shorter than data selected by sage-grouse. The exception was random sagebrush data collected by Swanson (2009) was taller than sagebrush selected for winter use.

Shrub density, greatly influenced by Swanson's (2009) winter use and random data, indicated an increase over time (Figure 15). However, all other data shows shrub densities to be less than 1 shrub per m^2. There were declines in shrub heights, big sagebrush, and total shrubs.

Grass and forb heights are greatly influenced by precipitation received before the sample date and the grazing intensity before data were collected. Grass height recorded in many studies is quite variable and has been determined to be important for sage-grouse habitat (Figure 16). Forb height on the other hand was only recorded or reported in 2012 (Figure 17). Both of these variables are recommended to be collected before nesting of sage-grouse, but all data collected for forb height was collected after sage-grouse nesting. Much of the 2012 data were collected in July through September.

Visual obstruction readings (VOR) were collected in many studies (Figure 18). The VOR readings may be a better method than simply collecting the height of the tallest grass or forb along transects or within a 0.1 m^2 plot. The VOR method of collecting data includes not only height of vegetation, but also density. The method needs to be standardized among studies so VOR is collected using the same methodology. A result of plotting all VOR data indicates a decrease in VOR over time (Figure 18).

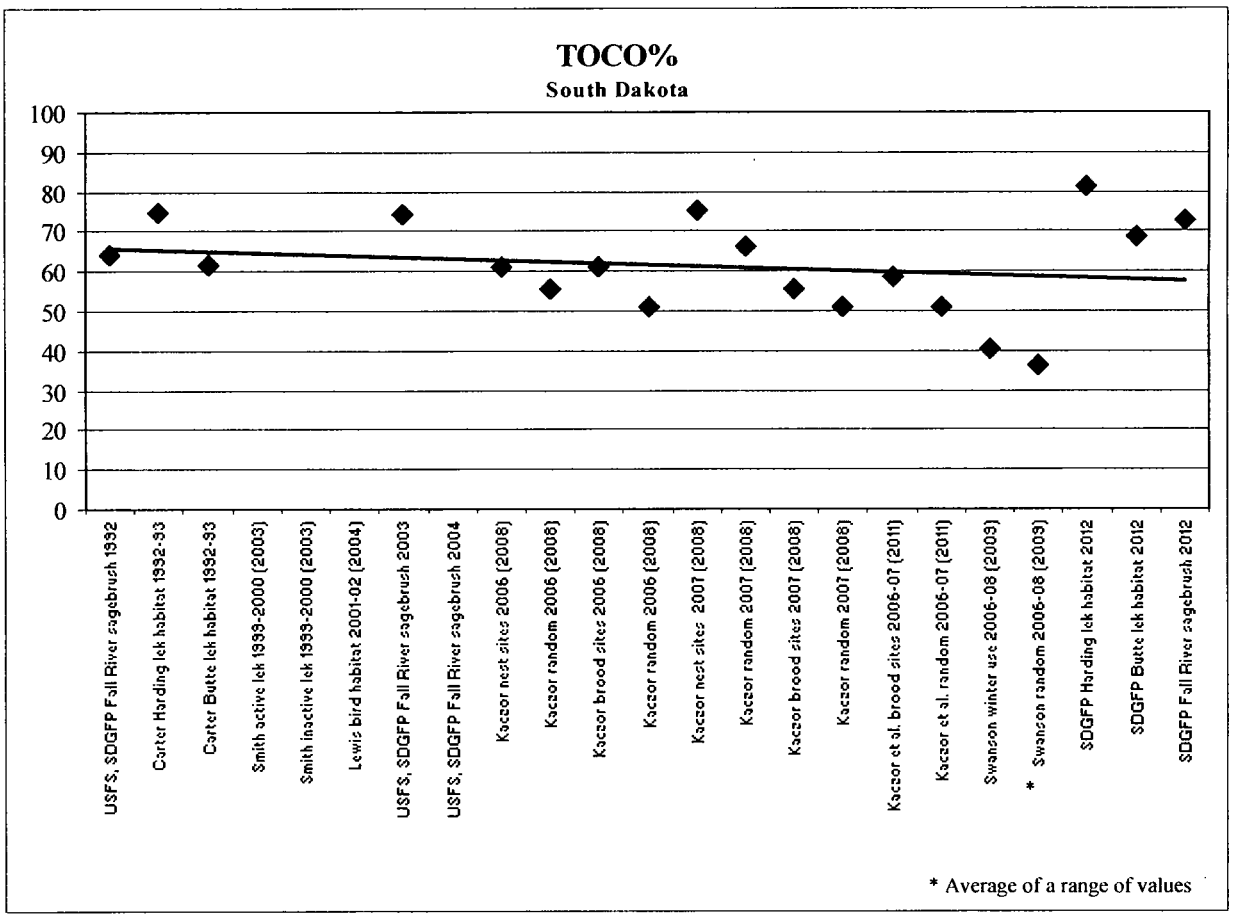


Figure 7. Mean values for total vegetation cover (TOCO%) recorded in sagebrush habitat in western South Dakota from this project and others (Smith 2003, Lewis 2004, Herman-Brunson 2007, Kaczor 2008, Swanson 2009, Herman-Brunson et al. 2009 and Kaczor et al. 2011) and plotted with 1992-93 Carter data to 2012 data collected in Harding, Butte, and Fall River Counties.

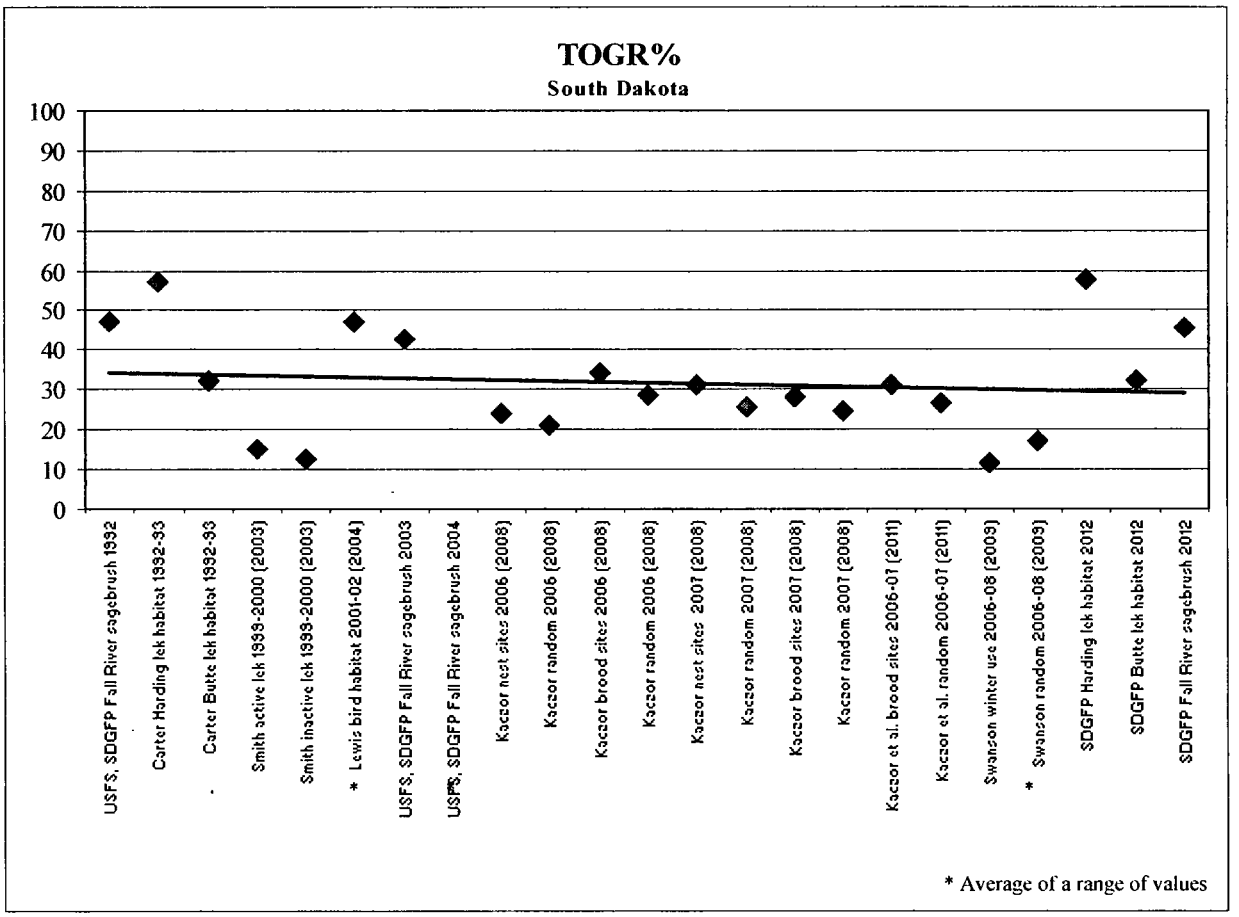


Figure 8. Mean values for total graminoid cover (TOGR%) recorded in sagebrush habitat in western South Dakota from this project and others (Smith 2003, Lewis 2004, Herman-Brunson 2007, Kaczor 2008, Swanson 2009, Herman-Brunson et al. 2009 and Kaczor et al. 2011) and plotted with 1992-93 Carter data to 2012 data collected in Harding, Butte, and Fall River Counties.

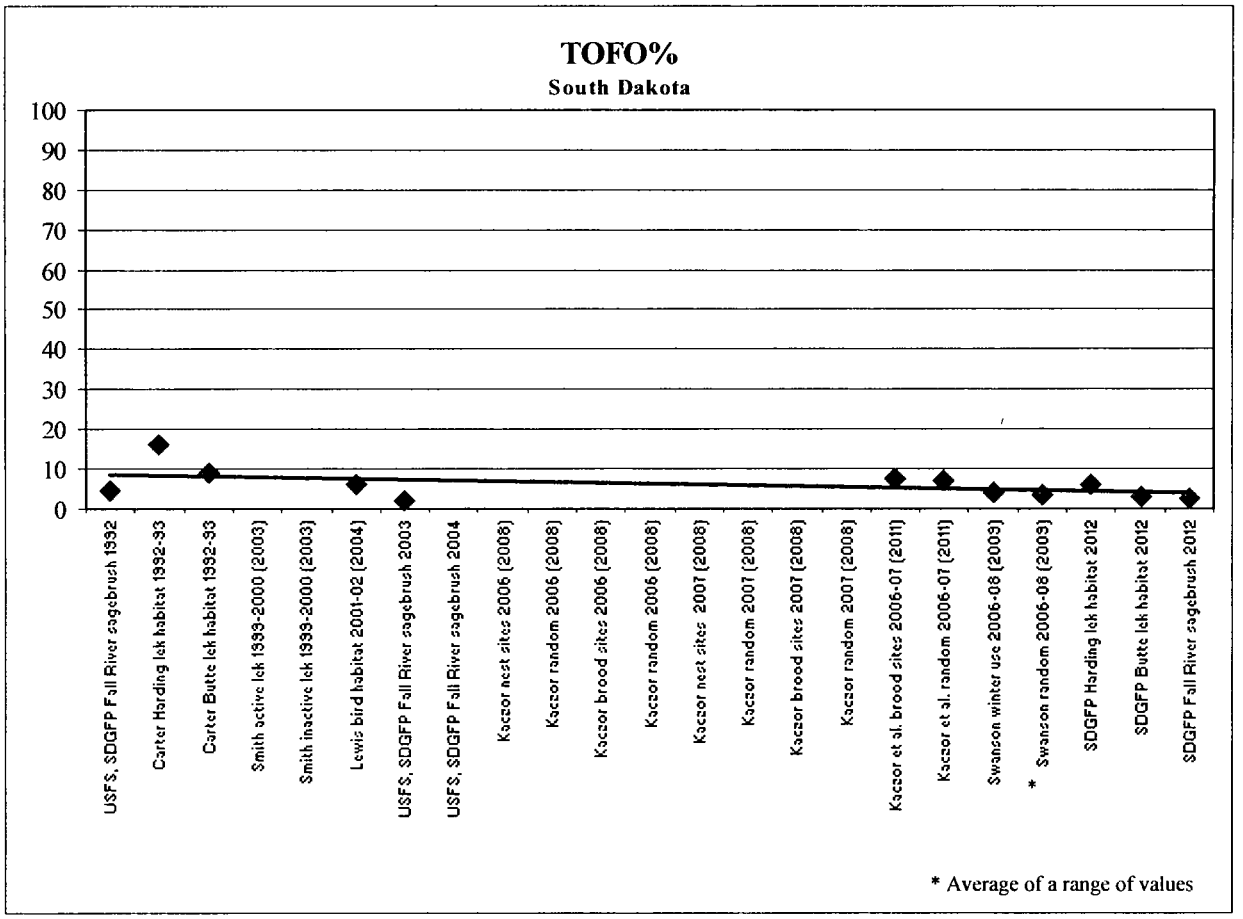


Figure 9. Mean values for total forb cover (TOFO%) recorded in sagebrush habitat in western South Dakota from this project and others (Smith 2003, Lewis 2004, Herman-Brunson 2007, Kaczor 2008, Swanson 2009, Herman-Brunson et al. 2009 and Kaczor et al. 2011) and plotted with 1992-93 Carter data to 2012 data collected in Harding, Butte, and Fall River Counties.

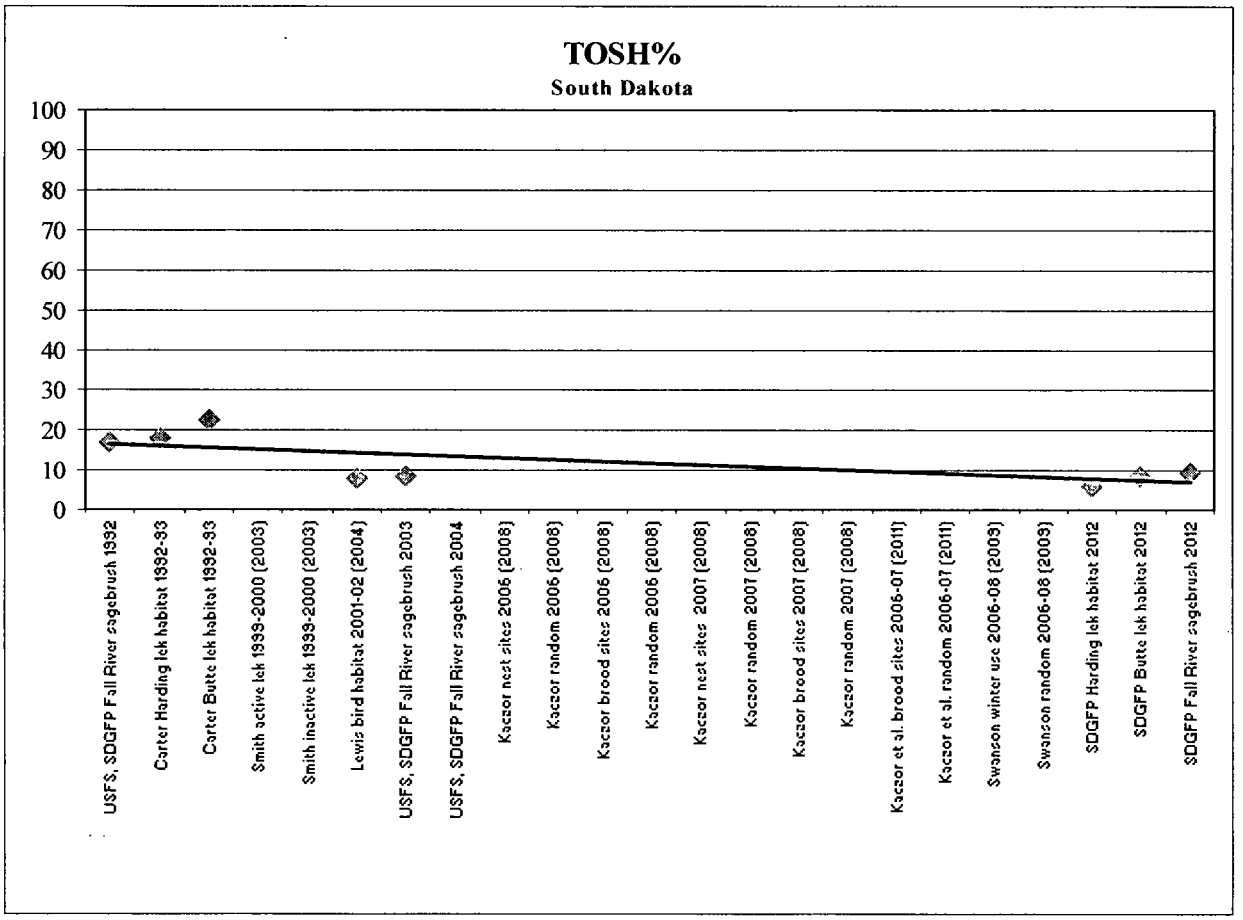


Figure 10. Mean values for total shrub cover (TOSH%) recorded in sagebrush habitat in western South Dakota from this project and others (Smith 2003, Lewis 2004, Herman-Brunson 2007, Kaczor 2008, Swanson 2009, Herman-Brunson et al. 2009 and Kaczor et al. 2011) and plotted with 1992-93 Carter data to 2012 data collected in Harding, Butte, and Fall River Counties.

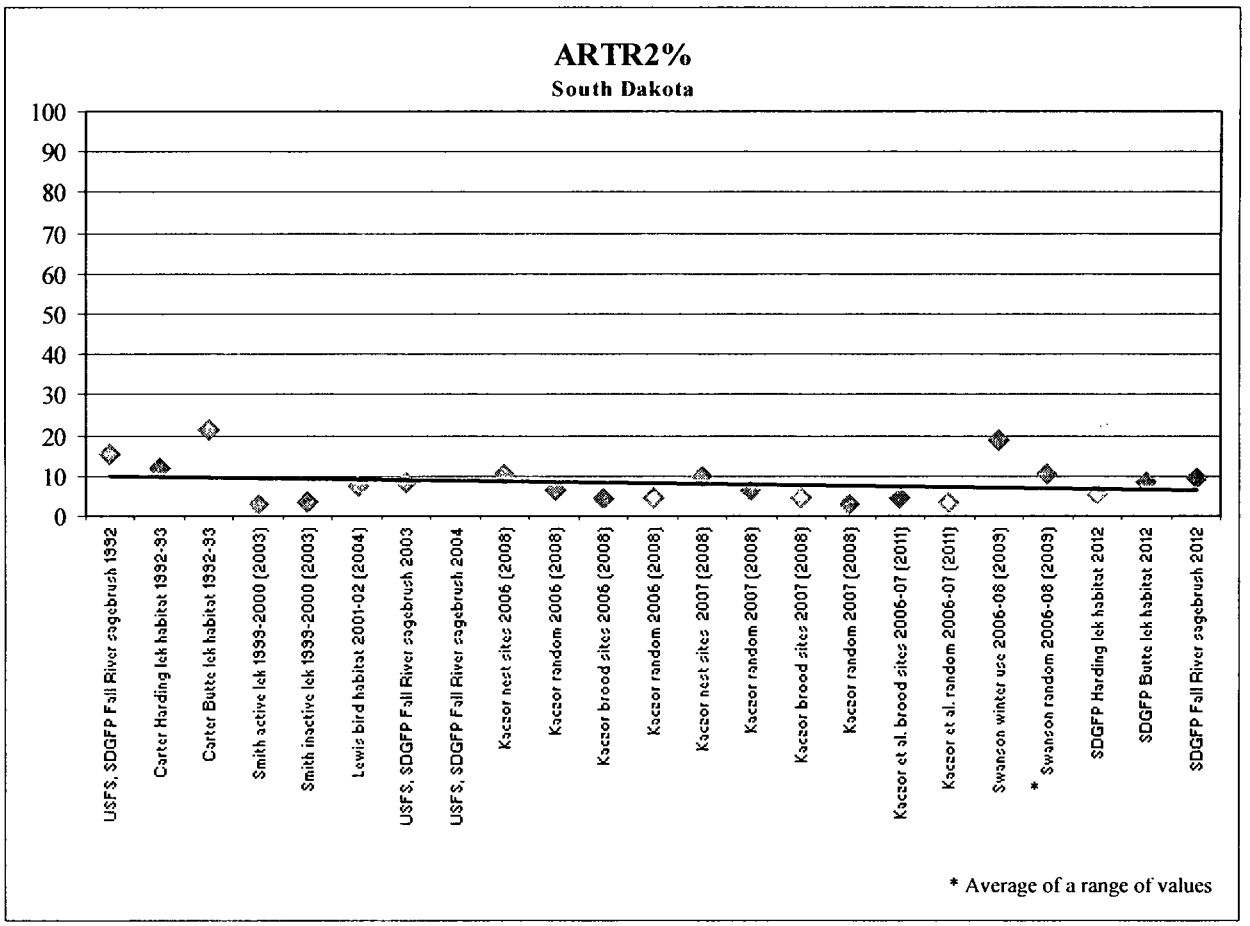


Figure 11. Mean values for big sagebrush cover (ARTR2%) recorded in sagebrush habitat in western South Dakota from this project and others (Smith 2003, Lewis 2004, Herman-Brunson 2007, Kaczor 2008, Swanson 2009, Herman-Brunson et al. 2009 and Kaczor et al. 2011) and plotted with 1992-93 Carter data to 2012 data collected in Harding, Butte, and Fall River Counties.

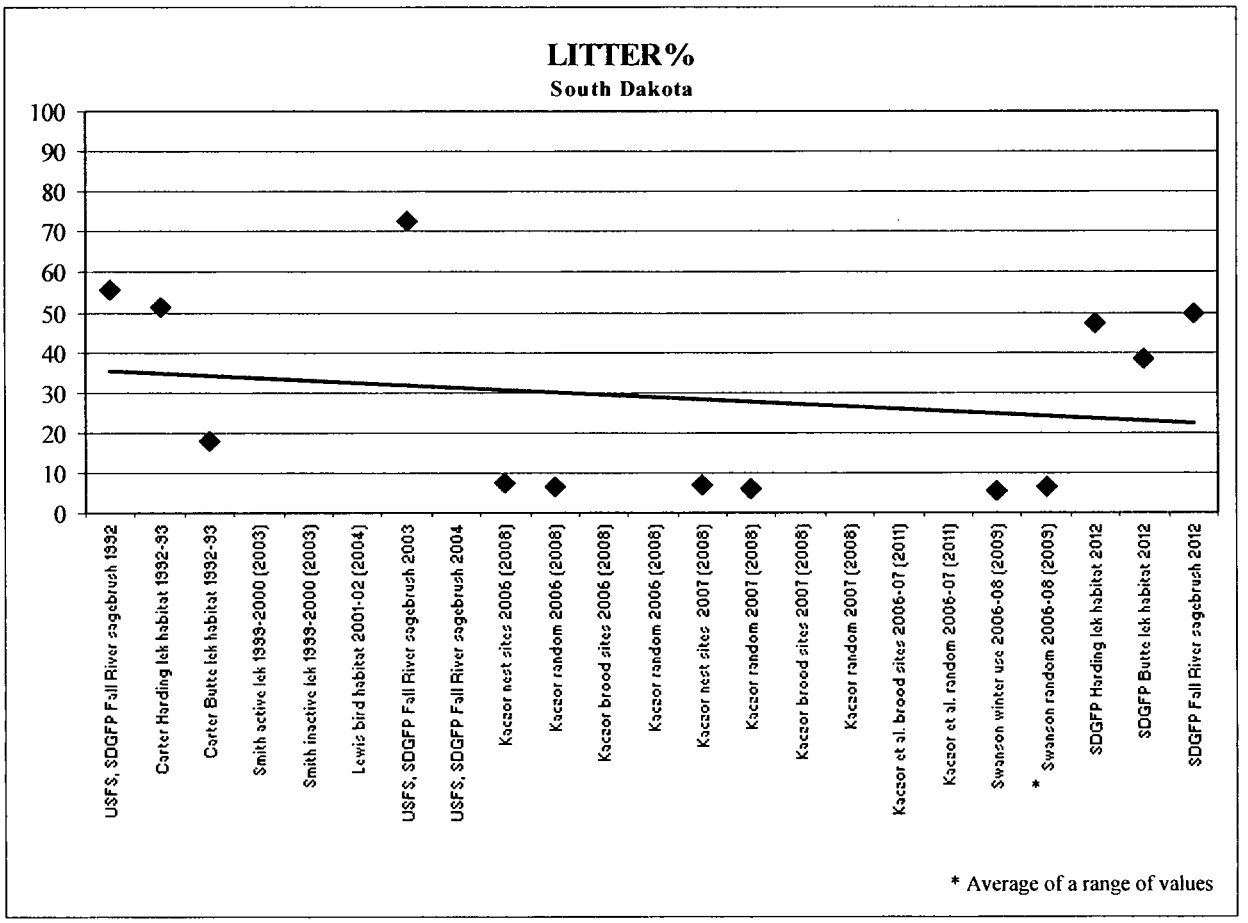


Figure 12. Mean values for total litter cover (LITTER%) recorded in sagebrush habitat in western South Dakota from this project and others (Smith 2003, Lewis 2004, Herman-Brunson 2007, Kaczor 2008, Swanson 2009, Herman-Brunson et al. 2009 and Kaczor et al. 2011) and plotted with 1992-93 Carter data to 2012 data collected in Harding, Butte, and Fall River Counties.

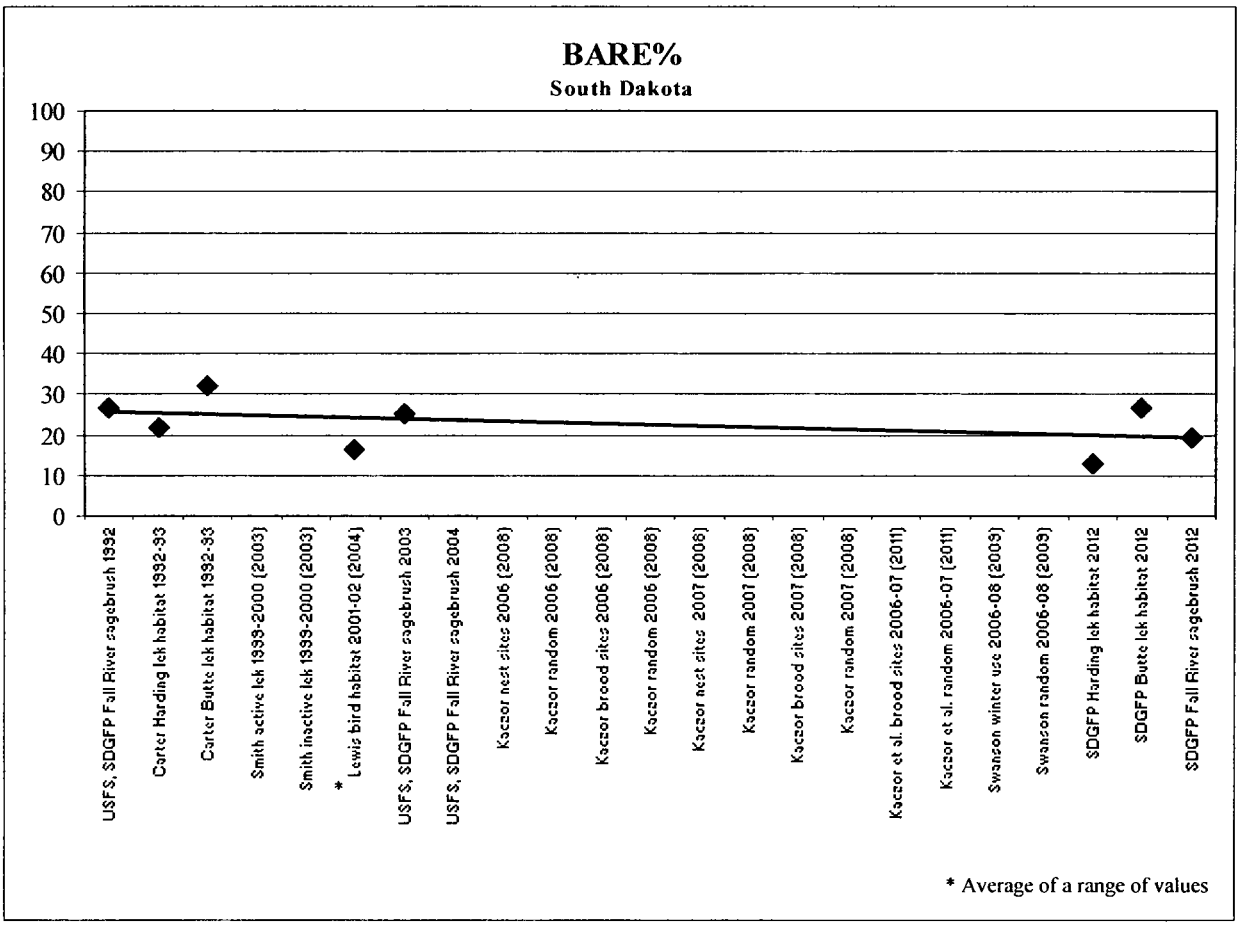


Figure 13. Mean values for bare ground (BARE%) recorded in sagebrush habitat in western South Dakota from this project and others (Smith 2003, Lewis 2004, Herman-Brunson 2007, Kaczor 2008, Swanson 2009, Herman-Brunson et al. 2009 and Kaczor et al. 2011) and plotted with 1992-93 Carter data to 2012 data collected in Harding, Butte, and Fall River Counties.

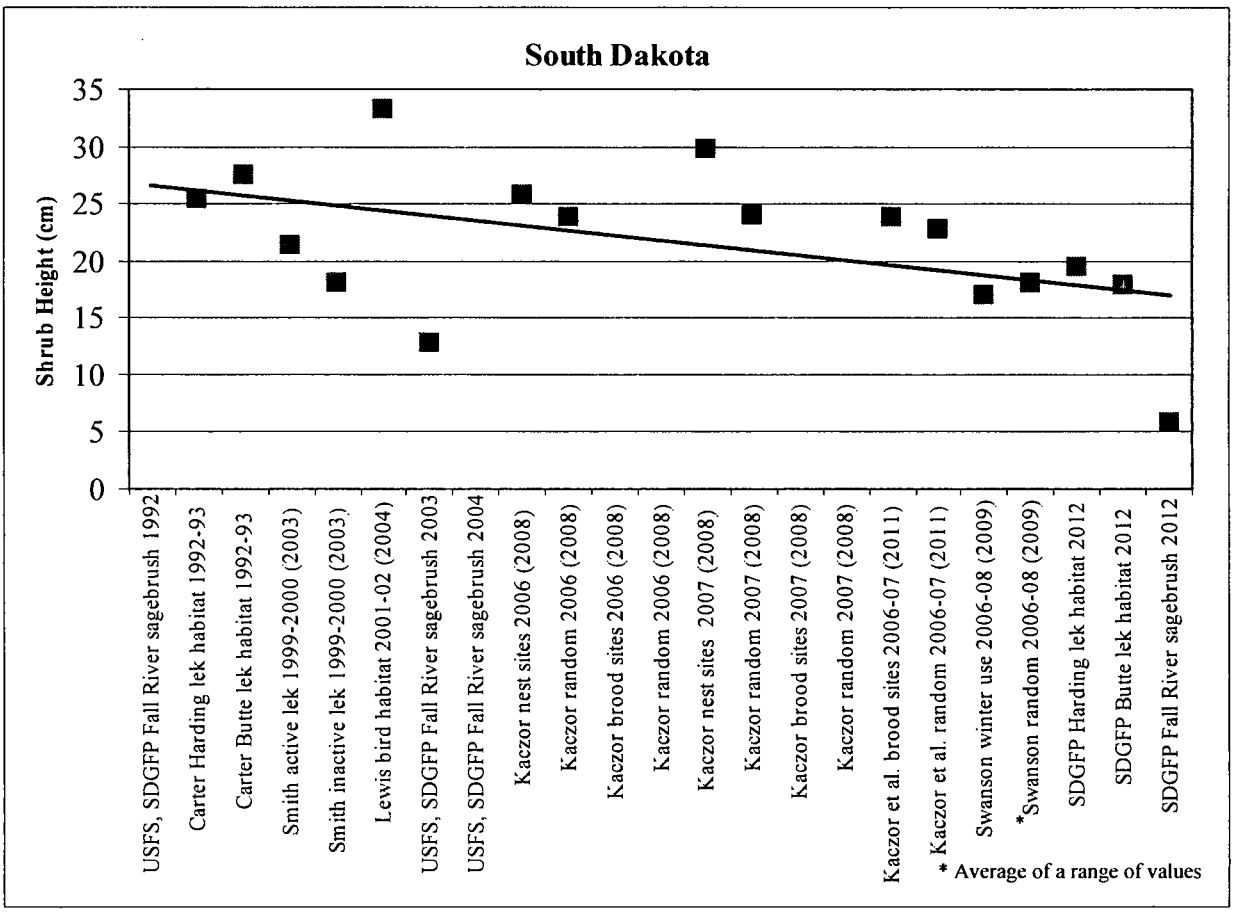


Figure 14. Mean values for shrub heights recorded in sagebrush habitat in western South Dakota from this project and others (Smith 2003, Lewis 2004, Herman-Brunson 2007, Kaczor 2008, Swanson 2009, Herman-Brunson et al. 2009 and Kaczor et al. 2011) and plotted with 1992-93 Carter data to 2012 data collected in Harding, Butte, and Fall River Counties.

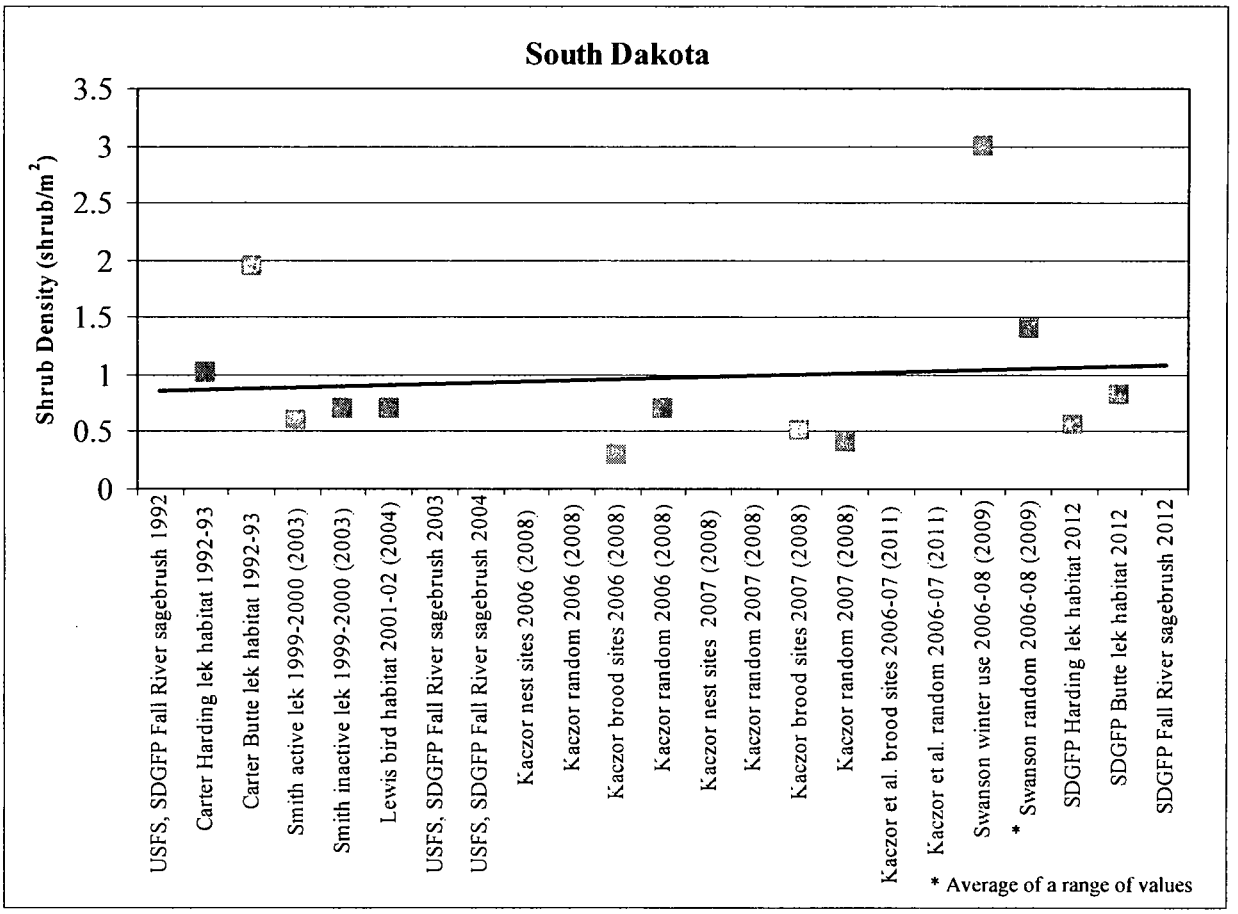


Figure 15. Mean values for shrub densities per square meter recorded in sagebrush habitat in western South Dakota from this project and others (Smith 2003, Lewis 2004, Herman-Brunson 2007, Kaczor 2008, Swanson 2009, Herman-Brunson et al. 2009 and Kaczor et al. 2011) and plotted with 1992-93 Carter data to 2012 data collected in Harding, Butte, and Fall River Counties.

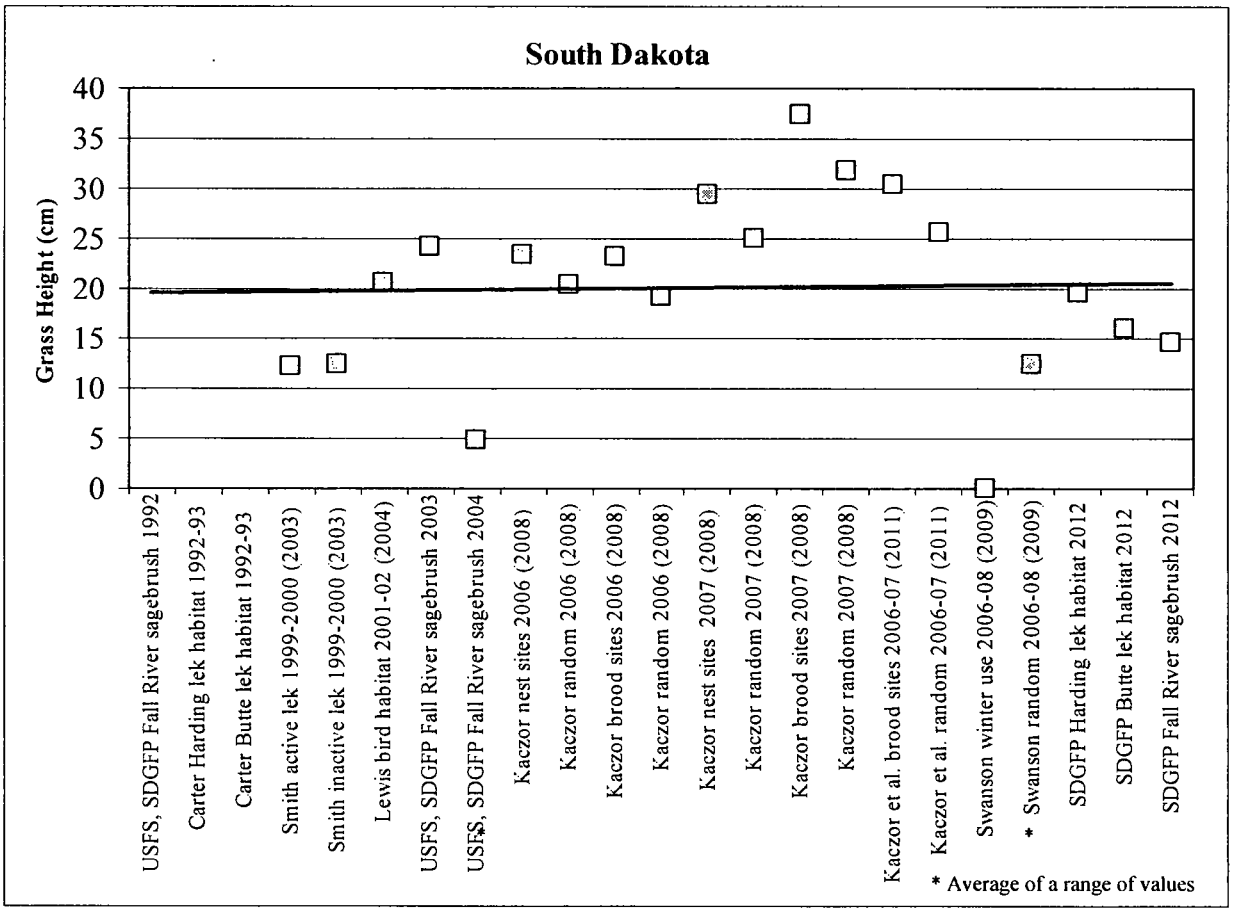


Figure 16. Mean values for total graminoid height (cm) recorded in sagebrush habitat in western South Dakota from this project and others (Smith 2003, Lewis 2004, Herman-Brunson 2007, Kaczor 2008, Swanson 2009, Herman-Brunson et al. 2009 and Kaczor et al. 2011) and plotted with 1992-93 Carter data to 2012 data collected in Harding, Butte, and Fall River Counties.

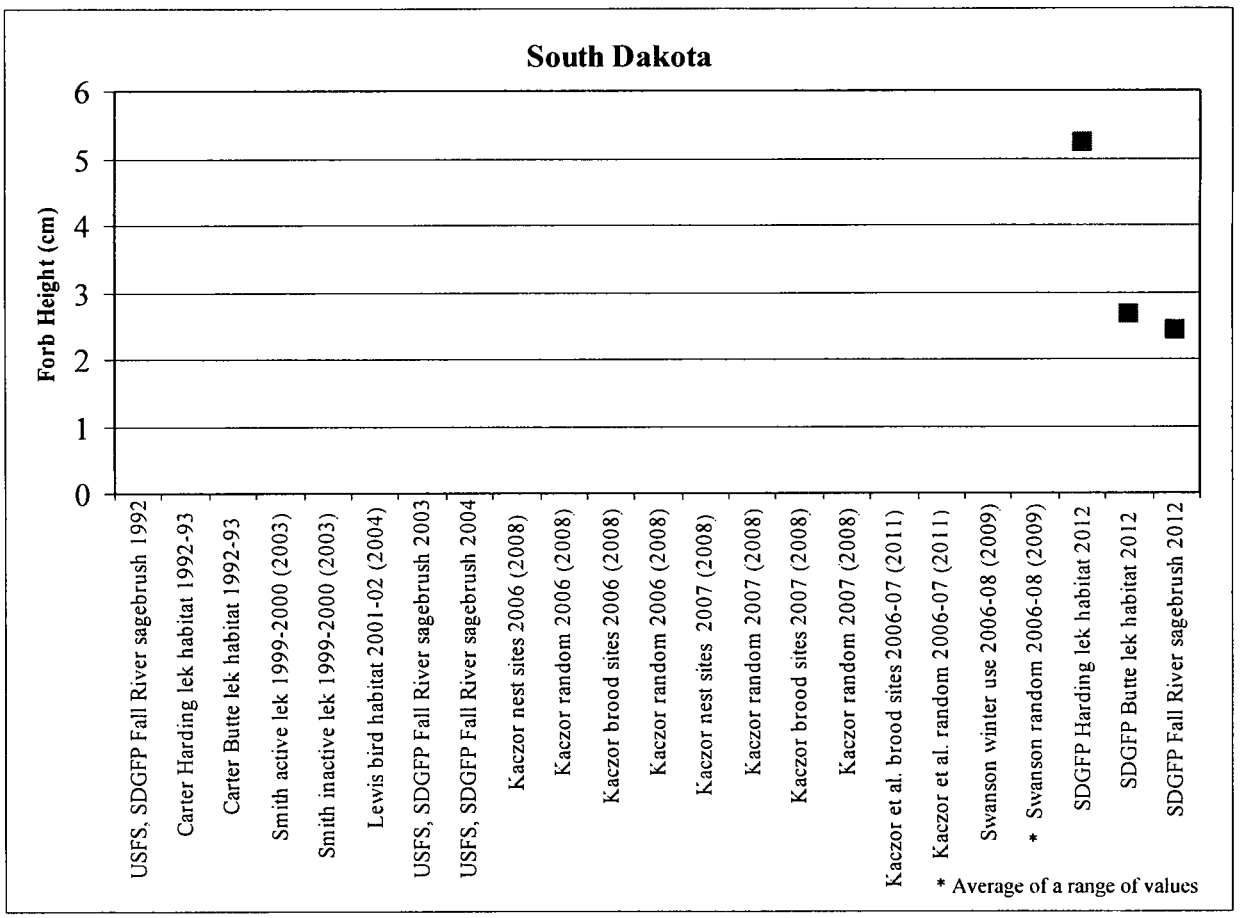


Figure 17. Mean values for total forb height (cm) recorded in sagebrush habitat in western South Dakota from this project and others (Smith 2003, Lewis 2004, Herman-Brunson 2007, Kaczor 2008, Swanson 2009, Herman-Brunson et al. 2009 and Kaczor et al. 2011) and plotted with 1992-93 Carter data to 2012 data collected in Harding, Butte, and Fall River Counties.

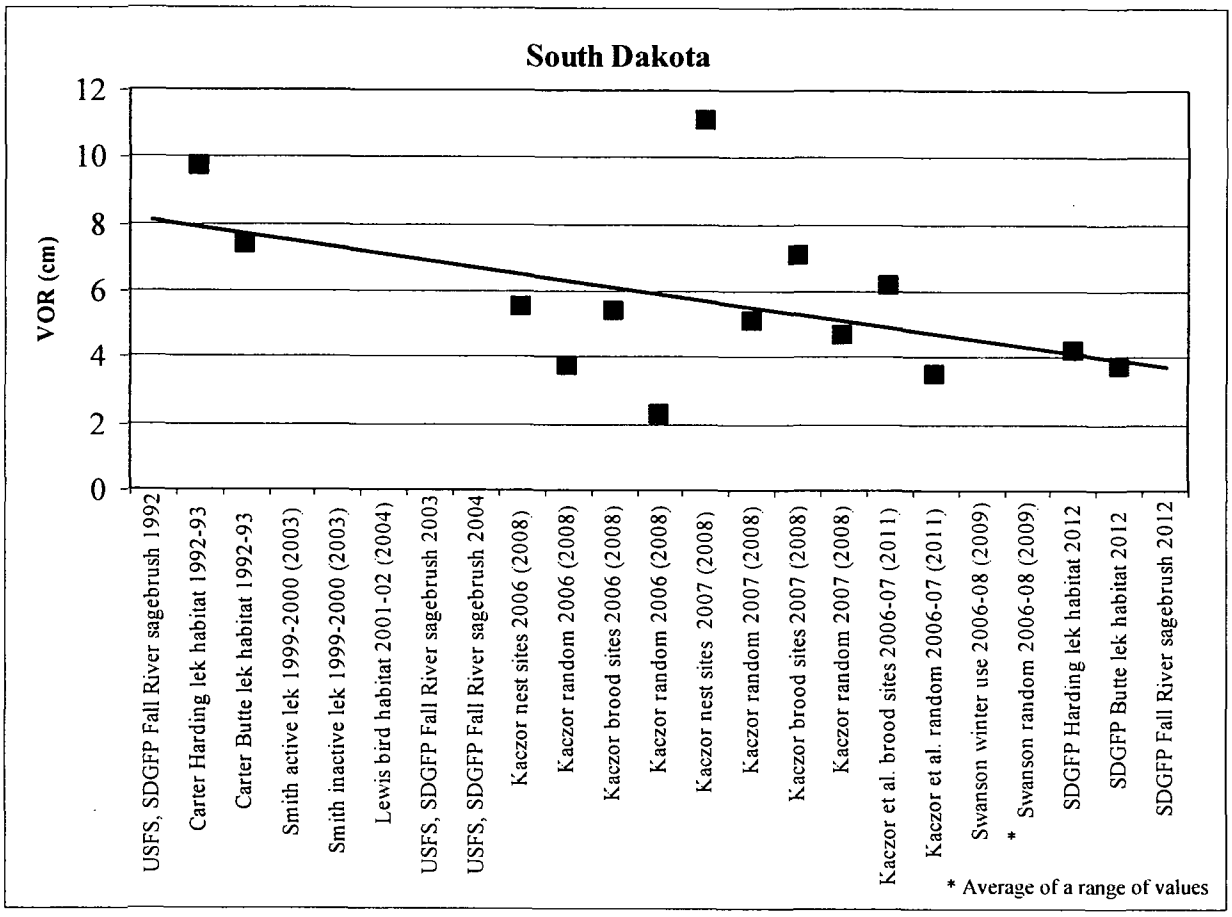


Figure 18. Mean values for visual obstruction readings (cm) recorded in sagebrush habitat in western South Dakota from this project and others (Smith 2003, Lewis 2004, Herman-Brunson 2007, Kaczor 2008, Swanson 2009, Herman-Brunson et al. 2009 and Kaczor et al. 2011) and plotted with 1992-93 Carter data to 2012 data collected in Harding, Butte, and Fall River Counties.

Sage-grouse data compiled for western South Dakota 1970-2012

Data of sage-grouse counts were summarized by lek but after discussions with SDGFP staff, it was determined that only the priority leks should be considered. Appropriate lek data will be considered in upcoming analysis.

Sagebrush restoration methods

Restoration activities can be implemented as active or passive methods. Active methods would be to restore or reclaim disturbed sagebrush habitat with plantings, seedings, weed treatment, soil amendments, or soil preparation following any disturbance, but commonly used following large fires or human induced disturbances like road and pad creation during oil and gas exploration or installation of pipelines. Passive restoration is a simple and less costly method and is done by management actions. Reducing or limiting livestock grazing or basing livestock use on prior precipitation amounts and available forage or herbage (instead of historic use) would be the easiest method to attempt to restore sagebrush habitats to 1992-93 levels.

Results of comparisons of 1992-93 data and 2012 data at the individual site, County level, and for western South Dakota indicate declines in many vegetation characteristics determined to be important to sage-grouse ecology. Restoration activities could be initiated in an attempt to restore vegetation conditions to those observed in 1992-93 or some other determined values. However, clear defined objectives and goals, including timelines should be determined before any restoration activities begin. Vegetation monitoring (based on stated objectives), including times of re-sampling areas, should be established before spending efforts and monies on restoration activities.

For example, a specific objective could be to decrease C4 graminoids to 1992-93 levels measured as canopy cover (+/- 5%), increase big sagebrush canopy by 10% and increase the number of forb species at sage-grouse lek habitat and surrounding area in Harding County similar to the values observed in 1992-93 within 5 years. This clear objective with very specific vegetation characteristics slated for change, including specific goals and a timeline for specific change. A specific vegetation monitoring plan could be established to measure desired changes. The current land management practices, particularly livestock grazing and energy developments must be closely reviewed before any active restoration activities are started Changing current land management practices permanently on public lands has potential to create desired restoration goals (1992-93 vegetation levels) without use of plantings or seedings or other labor intense restoration methods. It is unknown how climate change plays a factor in the changing vegetation composition and structure. However, making no changes in land uses regardless of climate change, most likely will result in declining trends in vegetation characteristics. Compounding factors of climate and vegetation changes and land use patterns may have impacts on all sage obligate species. West Nile may also play a factor with sage-grouse.

Large scale fires, increases in energy development, or other man-made or environmental events not yet considered could quickly make restoration of sagebrush habitat a priority. Therefore, common methods of restoration were briefly reviewed for this report. Restoration plans could be based on providing the greatest benefits for sage-grouse and sagebrush habitat. Data collected in 1992-93 could be used as the reference or baseline data to set agency management directives.

Models based on vegetation, topography, and sage-grouse avoidance to oil and gas development can be used to identify the best remaining winter habitats, and potentially other critical habitats in an area to mitigate oil and gas development (Doherty et al. 2008). Sedgwick (2004) provides a literature review for sage-grouse habitat restoration. In Shaw et al. (2005) papers are provided from a restoration proceedings symposium on sage-grouse habitat restoration.

Plantings and seedings

Much information in the literature exists for site specific results of various active restoration methods like plantings and seedings. Plantings and seedings would be required for degradation of habitats from fires, roads and development associated with oil, gas development or powerline or pipeline installations, severe long-term drought, exotic weed invasion, or other impacts failed to be considered or combinations of these

Prior to planting or seeding big sagebrush as restoration methods, site specifics such as soils, potential and capabilities of plant communities should be considered. Plant species diversity,

production, sagebrush varieties, and potential for sage-grouse habitat should all be considered for a specific site when planning restoration (Goodrich 2005). Since some sites have potential to be more productive because of better soils these areas may be the first to be avoided but as a last resort for restoration, they may have the best potential for restoration efforts. However, critical habitat and spatial location should also be considered during planning.

Strategies used to enhance structure and species diversity in crested wheatgrass stands can be employed to enhance sage-grouse habitat (Pellant and Lysne 2005). This strategy is to reduce crested wheatgrass with treatments that include herbicide, burning, mechanical treatment, or livestock grazing, or drought and then seed or plant seedlings to increase desired structure and diversity.

Seeding of silver sagebrush worked best in northern mixed prairies when seeds were broadcast in existing stands of perennial grasses and done in the fall after temperatures reached freezing or in the spring shortly after snowmelt. Disturbing the seedbed increased the density of seedlings, but it was not necessary and would be based on situation, particularly if disturbance was associated with erosion or weed risk (Romo and Grilz 2002).

Seeding big sagebrush at shallow depths using rollers that have ridges and valleys to ensure seeds are in contact with soil (Lysne 2005) increase germination and survival. Increasing soil surface roughness is more conducive to slowing or retaining runoff (allowing greater time for infiltration) in small topographic depressions that result in with greater soil moisture, thus increasing likelihood of greater seed germination, survival and establishment.

Transplanting bare root containerized big sagebrush may be preferred in sagebrush stands determined to be critical habitats (Lysne 2005). Critical habitat could be winter, brood, nest, or migratory corridors and would provide greatest benefit to sagebrush restoration and sage-grouse habitat. Plantings may perform better compared to seedings because of the variability of precipitation received in western South Dakota.

Current land management practices such as livestock grazing must be considered if any restoration is planned. It is recommended that seedings of native plants including big sagebrush should be allowed to become establish (a minimum of 3-5 years) before livestock grazing is allowed (Lambert 2005).

Treatments of sagebrush habitat

Hess and Beck (2012) found burning or mechanical treatment (mowing) of sagebrush reduced big sagebrush canopy and height below minimum levels for adequate sage-grouse habitat. Grass canopy increased with burning but not height. They concluded that treatment of big sagebrush should not be done since it took 19 years for burned sites to meet sage-grouse minimums of cover and height and 9 years for mowed sites to recover. They recommended no treatments to maintain sagebrush and improve livestock grazing to increase grass height and cover.

Most burning, mechanical treatment, and mowing that reduced sagebrush canopy and height decreased sage-grouse habitat minimums below those recommended by Connelly et al. (2000) and had mixed results with herbaceous vegetation height, cover, and production. Therefore, any

planned treatment to sagebrush habitat should be avoided since benefits generally fail to be greater than detriments to habitat.

Livestock grazing

Livestock grazing currently can be considered a continuous treatment to sagebrush and sage-grouse habitat in western SD. When previous precipitation, herbaceous height and density, and forage or herbage are not considered and accounted for each year concurrent with livestock grazing, it is likely that periods of average and especially below average precipitation can negatively impact sagebrush and sage-grouse habitats.

Changes in grazing can include early season light to moderate grazing to promote forb abundance and availability in upland and riparian habitat while greater utilization decreases herbaceous cover and may promote invasion of undesirable plants like weeds or low-stature grasses. Changes in vegetation composition since 1992-93 indicate forb abundance and availability has decreased as have the amount of tall cool season grasses.

Summary of restoration

Treatments to sagebrush should be avoided or reduced because negative impacts to habitat are greater or are not returned to minimum conditions suitable for sage-grouse for up to 20 years. Plantings and seedings are a proven method to enhance sagebrush and sage-grouse habitat. Details of any restoration activity should be planned for site specific areas based on desired goals, site community potential, and location of critical habitat. A specific vegetation monitoring plan should be included with all restoration, including re-sample times, and specific goals to be achieved based on a referenced vegetation community. The reference vegetation community can be based on results of 1992-93 data summaries which represent a baseline vegetation of sage-grouse habitat that was selected because it represented the best remaining sage-grouse habitat in Harding, Butte and Fall River Counties at that time.

Conclusions

The preliminary results of this project certainly indicate a more thorough and robust analysis of the data is needed. The preliminary findings also suggest that we need to determine if there is a correlation of changes with vegetation to changes in land uses, such as livestock grazing, energy developments, fire, herbicide applications, etc., and ultimately determine if there is a correlation to sage-grouse abundance, distribution or population dynamics. Something is causing changes in vegetation, which will result in impacts to all sage obligates and historical uses of public lands. SDGFP, BLM, BGGN need time to further analyze data and incorporate agency management strategies before making any hard conclusions at this time.

Data at the individual site level can be important especially if single plant species are determined important to sage-grouse or other species and can clearly demonstrate year to year variability of vegetation characteristics collected. Differences observed based a single plant species can be greatly influenced by error in transect relocation and orientation of transects to be sampled. Relocating transects and transect orientation introduce variation into results of vegetation cover estimates. It is better to collect a large number of transects at each sample time within a monitoring site compared than to an attempt to collect data from a few transects that are permanently located (Bonham and Reich 2009). Land managers can determine which levels of

comparisons are to be made based on their specific objectives.

Including long-term means over time as presented in Figures 2, 4 and 6 can better demonstrate long-term averages and can provide more reliability to site averages over time. Data can be compared with reference to the long-term mean as well as all previous samples. In addition, fluctuations can be closely tied to precipitation over the long term and may explain much of the variation observed.

Similar trend data has been presented for vegetation characteristics identified within the core regions of sage-grouse habitat as important to sage-grouse life histories (Connelly et al. 2000). Most of the vegetation characteristics identified as important to sage-grouse survival also indicate decline. In addition, changes were detected in the major grasses that species compositional changes over 20 years may be occurring. Taller bunchgrass species (dominant C3 grasses) are being replaced with shorter stature C4 sod grasses which may be less beneficial to sage-grouse. Sagebrush is declining in height, canopy cover, frequency, and VOR. Forb height appears to be increasing while forb cover is declining, especially at the county level of comparison. It would be interesting to conduct an invertebrate abundance and diversity study to see how changes in plant species and structure may affect invertebrates, a critical protein source for sage-grouse.

This project has established a defensible source of data and information compiled over 20 years that can be used as a foundation to maintain or modify land management practices that enhance sagebrush steppe habitat in western SD. This baseline data can be used to compare monitoring results of these activities at set time intervals to determine if goals are being met. Results provide an array of vegetation data that can be used for long-term monitoring of all sagebrush steppe habitats in western SD.

Recommendations

Vegetation data should be collected on a much shorter time frame than 20 years (Elzinga 1998). Specific objectives, including time frames and set goals should be determined so an actual vegetation monitoring program can be developed and achieved. All future studies initiated within sagebrush steppe habitat and funded by land and resource management agencies in western SD should encourage all participants to collect basic vegetation data using the same methods used in this study so future comparisons of data can be reliable. Because this report offers preliminary findings, no statistical analysis has been conducted and this report should not be cited as final, definitive conclusions. The authors and agencies reserve the right to further analysis, presentations and/or publications of our data.

Acknowledgments

We greatly appreciate Art Carter and Chuck Berdan with the foresight and knowledge twenty years ago to initiate vegetation data collection in Butte and Harding Counties. Bob Hodorff is also recognized for his efforts to collect wildlife habitat data over time in Fall River County. Thank you to SDGFP employees and graduate students that have spent many summer days tracking and studying sage-grouse or other sage steppe species in western SD. Thanks are also extended to all former technicians that helped collect data compiled in this report and to all persons that provided comments and suggestions in reviews of this report. We look forward to further analysis of the data.

Literature cited

Barnett, J.K. and J.A. Crawford. 1994. Pre-laying nutrition of sage grouse hens in Oregon. J.Range Manage. 47:114-118.

Bonham, C.D. 2013. Measurements for Terrestrial Vegetation. 2nd Edition. John Wiley & Sons, Ltd. 246 p.

Bonham, C.D. and R.M. Reich. 2009. Influences of transect relocation errors on line-point estimates of plant cover. Plant. Ecol. (204) 173-178.

Carter, A. et al. 1992. Unpublished data collected to represent best sage-grouse habitat and lek sites in western South Dakota in 1992.

Connelly, J.W., M.A. Schroeder, A.R. Sands, and C.E. Braun. 2000. Guidelines to manage sage grouse populations and their habitats. Wildl. Soc. Bul. 28(4):967-985.

Elzinga, C.L., D.W. Salzer, and J.W. Willoughby. 1998. Measuring and monitoring plant populations. BLM Tech. Ref. 1730-1. US Dept. of Interior. Denver, CO.

Flake, L.D., J.W. Connelly, T.R. Kirschenmann, and A.J. Lindbloom. 2010. Grouse of Plains and Mountains – The South Dakota Story. South Dakota Department of Game, Fish, and Parks, Pierre.

Goodrich, S. 2005. Classification and capabilities of woody sagebrush communities of western North America with emphasis on sage-grouse habitat. *In*: Shaw, N.L., M. Pellant, S.B. Monsen, comps. 2005. Sage-grouse habitat restoration symposium proceedings, 2001 June 4-7, Boise, ID. Proc. RMRS-P-38. Fort Collins, CO: USDA, Forest Service, RMRS. 130 p.

Hodorff, R. 2005. Habitat assessment and conservation strategy for sage grouse and other selected species on Buffalo Gap National Grasslands. Unpublished Final Report Sept. 20, 2005. Nebraska National Forest, Fall River Ranger District.

Herman-Brunson, K.M. 2007. Nesting and Brood-Rearing Habitat Selection of Greater Sage-Grouse and Associated Survival of Hens and Brooks at the Edge of Their Historic Distribution. MS Thesis, SDSU, Brookings. 115 pp.

Kaczor, N.W. 2008. Nesting and brood-rearing success and Resource Selection of Greater Sage-Grouse in Northwestern South Dakota. MS Thesis, SDSU, Brookings. 99 pp.

Kaczor, N.W., K.C. Jensen, R.W. Klaver, M.A. Rumble, K.M. Herman-Brunson, and C.C. Swanson. 2011. Nesting success and resource selection of Greater Sage-Grouse. Pp. 107-118 *in* B.K. Sandercock, K. Martin, and G. Segelbacher (editors). Ecology, conservation, and management of grouse. Studies in Avian Biology (no. 39) University of California Press, Berkeley, CA

Lambert, S.M. 2005. Seeding considerations in restoring big sagebrush habitat. *In*: Shaw, N.L., M. Pellant, S.B. Monsen, comps. 2005. Sage-grouse habitat restoration symposium proceedings, 2001 June 4-7, Boise, ID. Proc. RMRS-P-38. Fort Collins, CO: USDA, Forest Service, RMRS. 130 p.

Lysne, C.R. 2005. Restoring Wyoming big sagebrush. *In*: Shaw, N.L., M. Pellant, S.B. Monsen, comps. 2005. Sage-grouse habitat restoration symposium proceedings, 2001 June 4-7, Boise, ID. Proc. RMRS-P-38. Fort Collins, CO: USDA, Forest Service, RMRS. 130 p.

Lewis, A. 2004. Sagebrush steppe habitats and their associated bird species in South Dakota, North Dakota and Wyoming: Life on the Edge of the Sagebrush Ecosystem. PhD Dissertation, SDSU, Brookings. 138 pp.

McClanahan, R.C. 1940. Original and present breeding ranges of certain game birds in the United States. US Department of the Interior Bureau of Biological Survey Wildlife Leaflet BS-158.

Oregon Fish and Wildlife. 2011. Greater sage-grouse conservation assessment and strategy for Oregon: A plan to maintain and enhance populations and habitat Draft March 1, 2011. pp. 220. Accessed April 14 at:
http://www.dfw.state.or.us/wildlife/sagegrouse/docs/20110301_GRSG_March_final_red.pdf

Pellant, M. and C.R. Lysne. 2005. Strategies to enhance plant structure and diversity in crested wheatgrass seedings. *In*: Shaw, N.L., M. Pellant, S.B. Monsen, comps. 2005. Sage-grouse habitat restoration symposium proceedings, 2001 June 4-7, Boise, ID. Proc. RMRS-P-38. Fort Collins, CO: USDA, Forest Service, RMRS. 130 p.

Romo, J.T. and R.W. Grilz. 2002. Establishment of silver sagebrush in the northern mixed prairie. J. Range Manage. 55:217-221.

Schroeder, M.A., J.R. Young, and C.E. Braun. 1999. Sage grouse (*Centrocercus urophasianus*). Pages 1-28 *in* A. Poole and F. Gill, Editors. The birds of North America, No. 425. The Birds of North America, Inc., Philadelphia PA, USA.

Sedgwick, J.A. 2004. Habitat restoration for Gunnison and Greater Sage-grouse, A literature review. Prepared for US Dept. of Interior, BLM Gunnison Field Office. 65 p. accessed online at: http://archive.org/details/habitatrestorati00sedg. May 23, 2013.

Smith, J. T. 2003. Greater sage grouse on the edge of their range: leks and surrounding landscapes in the Dakotas. MS Thesis South Dakota State University. pp 213.

SDGFP. 2006. South Dakota Comprehensive Wildlife Conservation Plan. SDGFP, Pierre. Wildlife Division Report 2006-08. 261 pp.
(http://gfp.sd.gov/wildlife/management/plans/wildlife-action-plan.aspx)

SDGFP. 2008. Greater Sage-Grouse Management Plan. SDGFP, Pierre. Wildlife Division Report 2008-2017. 22 pp. (http://gfp.sd.gov/wildlife/docs/sage-grouse-management-plan.pdf).

Swanson, C.C. 2009. Ecology of Greater Sage-Grouse in the Dakotas. PhD Dissertation, SDSU, Brookings. 184 pp.

Uresk, D.W. and T.A. Benzon. 2007. Monitoring with a Modified Robel Pole on Meadows in the Central Black Hills, South Dakota. Western North American Naturalist 67(1):46-50.

USDA, Forest Service. Nebraska National Forest. 2001. Land and Resource Management Plan 2001 Revision. Rocky Mountain Region (Region 2). (http://www.fs.usda.gov/wps/portal/fsinternet/!ut/p/c4/04_SB8K8xLLM9MSSzPy8xBz9CP0os3gjAwhwtDDw9_AI8zPyhQoY6BdkOyoCAGixyPg!/?ss=110207&navtype=BROWSEBYSUBJECT&cid=FSM9_028050&navid=130000000000000&position=Feature*&ttype=detail&pname=Nebraska National Forests and Grasslands- Land & Resources Management)

USDI, Bureau of Land Management. 1985. Resource Management Plan. South Dakota Resource Area, Miles City District. (http://www.blm.gov/mt/st/en/prog/planning/south_dakota.html)

APPENDIX A
Harding County

Data for Internal Use Only

APPENDIX B
Butte County

Data for Internal Use Only

APPENDIX C
Fall River County

Data for Internal Use Only

APPENDIX D
Western South Dakota tables and figures

Data for Internal Use Only

APPENDIX E
Species list and methods

Plant Species List

CODE	LF*	Common name or other Life Forms	Scientific name or other Life Forms	Comments	Alternative code used
TOCO	A1	Total vegetation cover	Total vegetation cover		
TOGR	A2	Total graminoid cover	Total graminoid cover		
TOFO	A3	Total forb cover	Total forb cover		
TOSH	A4	Total shrub cover	Total shrub cover		
LITT	A5	Total litter cover	Total litter cover		
BARE	A6	Bare ground	Bare ground		
ROCK	A7	Total rock cover	Total rock cover		
LICH	L	Total lichen cover	Total lichen cover		
SELAG	E	Total *Selaginella* cover	Total *Selaginella* cover		
FUNGI	M	Total fungi cover	Total fungi cover		
DUNG	D	Ground covered with dung	Ground covered with dung		
		SHRUBS			
ARCA13	S	Silver sagebrush	*Artemisia cana*		ARTCAN, ARCA
ARFI2	S	Sand sagebrush	*Artemisia filifolia*		
ARTEM	S	Sagebrush	*Artemisia* spp.		
ARTR2	S	Big sagebrush	*Artemisia tridentata*		ARTTRI
ATCA2	S	Fourwing saltbush	*Atriplex canescens*		
ATRIP	S	Saltbush	*Atriplex* spp.		
ERNA10	S	Rubber rabbitbrush	*Ericameria nauseosa*		ERINAU, CHNA
GUSA2	S	Broom snakeweed	*Gutierrezia sarothrae*		GUTSAR, GUSA
KRLA2	S	Winterfat	*Krashkinninikovia lanata*		KRALAN, EULA, CELA
RHTR	S	Skunkbush sumac	*Rhus trilobata*		RHUARO
ROAR3	S	Prairie rose	*Rosa arkansana*		ROSARK
ROSA5	S	Rose	*Rosa* spp.		
ROWO	S	Wood's rose	*Rosa woodsii*		
SAVE4	S	Greasewood	*Sarcobatus vermiculatus*		SAVE
SYOC	S	Western snowberry	*Symphoricapos occidentalis*		
		GRAMINOIDS			
ACHY	G	Indian ricegrass	*Achnatherum hymenoides*		ACHHYM
AGCR	G	Crested wheatgrass	*Agropyron cristatum*		ACGCRI

CODE	LF*	Common name or other Life Forms	Scientific name or other Life Forms	Comments	Alternative code used
AGFR	G	Siberian wheatgrass	*Agropyron fragile*		
AGROP2	G	Wheatgrass	*Agropyron* spp.		AGSP
AGROS2	G	Bentgrass	*Agrostis* spp.		
AGST2	G	Creeping bentgrass	*Agrostis stolonifera*		AGST
ARPU9	G	Red threeawn	*Aristida purpurpea*	All *Aristida* labeled as this	ARIPUR, ARLO
BOCU	G	Sideoats grama	*Bouteloua curtipendula*		BOUCUR
BODA2	G	Buffalograss	*Bouteloua dactyloides*	*Buchloe dactyloides*	BUCDAC, BUDA
BOGR2	G	Blue grama	*Bouteloua gracilis*		BOUGRA
BOHI	G	Hairy grama	*Bouteloua hirsuta*		
BOUTE	G	Grama grass	*Bouteloua* spp.		
BROMU			*Bromus* (*arvensis* or *tectorum*)		BROM
BRAR5	G	Field brome (Japanese brome)	*Bromus arvensis*	*Bromus japonicus* (Japanese brome)	BROJAP, BRJA
BRIN2	G	Smooth brome	*Bromus inermis*		
BRTE	G	Downy brome (cheatgrass)	*Bromus tectorum*		BROTEC
CALO	G	Prairie sandreed	*Calamovilfa longifolia*		CALLON
CADU6	G	Needleleaf sedge	*Carex duriuscula*		CARDUR, CAEL
CAFI	G	Threadleaf sedge	*Carex filifolia*		CARFIL
CAIN9	G	Sun sedge	*Carex inops*		CARINO
CAINH2	G	Sun sedge	*Carex inops* ssp. *heliophila*		
CAREX	G	Carex species	*Carex* spp.		
DAGL	G	Orchardgrass	*Dactylis glomerata*		
DISP	G	Inland saltgrass	*Distichlis spicata*		DISSPI
ELEL5	G	Squirreltail	*Elymus elymoides*		ELYELY, SIHY
ELELE	G	Squirreltail	*Elymus elymoides* ssp. *elymoides*		SIHY
ELLA3	G	Thickspike wheatgrass	*Elymus lanceolatus*		
ELTRT	G	Slender wheatgrass	*Elymus trachycaulus*		AGCA
ERSP	G	Purple lovegrass	*Eragrostis spectabilis*		
FESTU	G	Fescue	*Festuca* spp.		
HECO26	G	Needle and thread	*Hesperostipa comata*		STICOM, STCO
STIPA	G	Needle and thread	*Hesperostipa* or *Nassella*		STSP, STIPA
HOJU	G	Foxtail barley	*Hordeum jubatum*		HORJUB
HOPU	G	Little barley	*Hordeum pusillum*		HORPUS
KOMA	G	Prairie Junegrass	*Koeleria macrantha*		KOEMAC, KOCR

CODE	LF*	Common name or other Life Forms	Scientific name or other Life Forms	Comments	Alternative code used
MUAS	G	Scratchgrass	*Muhlenbergia asperifolia*		SPAS, SPAS3
NAVI4	G	Green needlegrass	*Nassella viridula*		NASVIR
PAVI2	G	Switchgrass	*Panicum virgatum*		PAVI
PASM	G	Western wheatgrass	*Pascopyrum smithii*		PASSMI, AGSM
POCO	G	Canada bluegrass	*Poa compressa*		
POGL	G	Glaucous bluegrass	*Poa glaucous*		
POPR	G	Kentucky bluegrass	*Poa pratensis*		POAPRA
POSE	G	Sandberg's bluegrass	*Poa secunda*		POASEC
POSP	G	Bluegrass	*Poa* spp.		POA, POSA, UNPOA
PSSP6	G	Bluebunch wheatgrass	*Pseudoroegneria spicata*		PSUSPI
SCPA	G	Tumblegrass	*Schedonnardus paniculatus*		SCHPAN
SCSC	G	Little bluestem	*Schizachyrium scoparium*		SCHSCO
SPPE	G	Prairie cordgrass	*Spartina pectinata*		
SPAI	G	Alkali sacaton	*Sporobolus airoides*		SPOAIR
SPCR	G	Sand dropseed	*Sporobolus cryptandrus*		SPOCRY
THIN6	G	Intermediate wheatgrass	*Thinopyrum intermedium*		AGIN
VUOC	G	Sixweeks fescue	*Vulpia octoflora*		VULOCT, VUOC
		FORBS			
ACMI2	F	Common yarrow	*Achillea millefolium*		
AGGL	F	False dandelion	*Agoseris glauca*		AGOGLA
ALLIU	F	Onion	*Allium* spp.		
ALTE	F	Textile onion	*Allium textile*		
ALDE	F	Dwarf alyssum	*Alyssum desertorum*		ALYDES
AMARA	F	Pigweed	*Amaranthus* spp.		AMAR
AMPS	F	Cuman ragweed	*Ambrosia psilostachya*		
AMBRO	F	Ragweed	*Ambrosia* spp.		
ANOC2	F	Western rock jasmine	*Androsace occidentalis*		
ANSE4	F	Rock jasmine	*Androsace septentrionalis*		ANDSEP
ANNE	F	Field pussytoes	*Antennaria neglecta*		
ANPA4	F	Small-leaf pussytoes	*Antennaria parvifolia*		ANTPAR
ANRO2	F	Rosy pussytoes	*Antennaria rosea*		
ANTEN	F	Pussytoes	*Antennaria* spp.		

CODE	LF*	Common name or other Life Forms	Scientific name or other Life Forms	Comments	Alternative code used
ARHOC	F	Collins rockcress	*Arabis holboellii* var. *collinsii*		ARHOC
ARFR4	F	Fringed sagewort	*Artemisia frigida*		ARTFRI, ARFR
ARLU	F	White sage	*Artemisia ludoviciana*		ARTLUD
ASSP	F	Showy milkweed	*Asclepias speciosa*		
ASTER	F	Aster	*Aster* or other genera		
DAISY	F	Unidentified aster species	*Aster* or other genera		
ASDR3	F	Drummond's milkvetch	*Astragalus drummondii*		ASTDRU
ASMI10	F	Missouri milkvetch	*Astragalus missouriensis*		ASTMIS
ASRA2	F	Creamy poison vetch	*Astragalus racemosus*		ASTRAC
ASSP6	F	Tufted milkvetch	*Astragalus spatulatus*		ASTSPA
ASTRA	F	Vetch	*Astragalus* spp.		
BASC5	F	Burning bush	*Bassia scoparia*		KOSC
BRASS2	F	Unidentified mustard species	*Brassicaceae* spp.		MUSTARD
BREUC	F	False boneset	*Brickellia eupatorioides* var. *coymbulosa*		
CAMI2	F	Littlepod false flax	*Camelina microcarpa*		
CASE5	F	Downy paintbrush	*Castilleja sessiliflora*		CASSES
CEAR4	F	Field chickweed	*Cerastium arvense*		
CHSE4	F	Matted sandmat	*Chamaesyce serpens*		
CHAL7	F	Lambsquarters	*Chenopodium album*		CHAL
CHDE	F	Aridland goosefoot	*Chenopodium desiccatum*		
CIAR4	F	Canada thistle	*Cirsium arvense*		
CIRSI	F	Thistle species	*Cirsium* spp.		
CIUN	F	Wavyleaf thistle	*Cirsium undulatum*		CIRUND
COLI2	F	Tiny trumpet	*Collomia linearis*		
COUM	F	Bastard toadflax	*Comandra umbellata*		COUMP
COUMP	F	Pale bastard toadflax	*Comandra umbellata* ssp. *pallida*		
COCA5	F	Horseweed	*Conyza canadensis*		CONCAN
CORYP	F	Beehive cactus	*Coryphantha* spp.		
DAPU5	F	Purple prairie clover	*Dalea purpurea*		DALPUR
DAUCU	F	Wild carrot	*Daucus* spp.		
DESO2	F	Flixweed tansymustard	*Descuriania sophia*		DESSOP
DRRE2	F	Carolina draba	*Draba reptans*		
DYPA	F	Fetid marigold	*Dyssodia papposa*		

CODE	LF*	Common name or other Life Forms	Scientific name or other Life Forms	Comments	Alternative code used
ERPU2	F	Shaggy fleabane	*Erigeron pumilus*		ERIPUM
ERIGE2	F	Fleabane	*Erigeron* spp.		
ERPA9	F	Littleleaf eriogonum	*Eriogonum pauciflorum*		ERIPAU
ERPAP6	F	Fewflowered eriogonum	*Eriogonum pauciflorum* var. *pauciflorum*		
ERIOG	F	Buckwheat	*Eriogonum* spp.		
ERAS2	F	Western wallflower	*Erysimum asperum*		ERIASP, ERAS
ESCOB	F	Foxtail cactus	*Escobaria* (syn. *Coryphantha)* spp.		
ESMI3	F	Missouri pincushion	*Escobaria missouriensis*		CORMIS, COMI
GACO5	F	Scarlet gaura	*Gaura coccinea*		GAUCOC, GACO
GEUM	F	Avens	*Geum* spp.		
GNPA	F	Western marsh cudweed	*Gnaphalium palustre*		GNAPAL
GRSQ	F	Curlycup gumweed	*Grindelia squarrosa*		GRISQU
HAFL2	F	Manyflower stickseed	*Hackelia floribunda*		HACFLO
HALOG	F	Saltlover	*Halogeton* spp.		
HAPLO11	F	Haplopappus	*Haplopappus* spp.		
HEDR	F	Drummond's false pennyroyal	*Hedeoma drummondii*		
HEHI	F	False pennyroyal	*Hedeoma hispida*		HEDHIS
HEAN3	F	Annual sunflower	*Helianthus annuus*		HEAN
HEPE	F	Prairie sunflower	*Helianthus petiolaris*		
HEVI4	F	Hairy goldaster	*Heterotheca villosa*		HETVIL
HYFI	F	Fineleaf hymenopappus	*Hymenopappus filifolius*		HYMFIL
TEACA2	F	Stemless hymenoxys	*Hymenoxys acaulis*		HYMACA
LABI	F	Tall blue lettuce	*Lactuca biennis*		LASP
LACTU	F	Lettuce	*Lactuca* spp.		
LAPO2	F	Manystem pea	*Lathyrus polymorphus*		
LEDE	F	Common pepperweed	*Lepidium densiflorum*		
LEAL	F	Alpine bladderpod	*Lesquerella alpina*		
LELU	F	Foothill bladderpod	*Lesquerella ludoviciana*		LESLUD
LESQU	F	Bladderpod	*Lesquerella* spp.		
LIPU	F	Dotted gayfeather	*Liatris punctata*		LIAPUN
LIRI	F	Stiffstem flax	*Linum rigidum*		LINRIG
LINUM	F	Flax	*Linum* spp.		
LIIN2	F	Narrowleaf stoneseed	*Lithospermum incisum*		

CODE	LF*	Common name or other Life Forms	Scientific name or other Life Forms	Comments	Alternative code used
LOFO	F	Desert biscuitroot	*Lomatium foeniculaceum*		LOMFOE
LUPIN	F	Lupine	*Lupinus* spp.		
LYJU	F	Rush skeletal plant	*Lygodesmia juncea*		LYGJUN
MACA2	F	Hoary tansyaster	*Machaeranthera canescens*		MACSPI
MAGR2	F	Rayless tansyaster	*Machaeranthera grindelioides*		
MAPI	F	Lacy tansyaster	*Machaeranthera pinnatifida*		MACPIN
MAPIP4	F	Lacy tansyaster	*Machaeranthera pinnatifida* ssp. *pinnatifida*		
MEDIC	F	Alfalfa	*Medicago* spp.		
MEOF	F	Yellow sweetclover	*Melilotus officinalis*		MELOFF
MELIL	F	Sweetclover	*Melilotus* spp.		
MERTE	F	Bluebells	*Mertensia* spp.		
MIAL5	F	Winged four o'clock	*Mirabilis alipes*	unknown in area - wrong code?	MIRLIN
MIHI	F	Hairy four o'clock	*Mirabilis hirsuta*		
MILI3	F	Narrowleaf four o'clock	*Mirabilis linearis*		
MUDI	F	Leafy wildparsley	*Musineon divaricatum*		MUSDIV
MUSIN	F	Wildparsley	*Musineon* spp.		
OECA10	F	Tufted evening primrose	*Oenothera caespitosa*		
OENOT	F	Evening primrose	*Oenothera* spp.		
OPFR	F	Fragile pricklypear	*Opuntia fragilis*		OPUFRA
OPPO	F	Plains pricklypear	*Opuntia polyacantha*		OPUPOL
OPSP	F	Pricklypear	*Opuntia* spp.		
ORLU2	F	Yellow owl's-clover	*Orthocarpus luteus*		ORLU4
OXLA3	F	Purple locoweed	*Oxytropis lambertii*		
OXSE	F	White locoweed	*Oxytropis sericea*		
OXYTR	F	Locoweed	*Oxytropis* spp.		
PEAR6	F	Silverleaf scurfpea	*Pediomelum argophylla*		PEDARG, PSAR
PECU3	F	Tall breadroot scurfpea	*Pediomelum cuspidata*		PEDCUS
PEES	F	Large Indian breadroot	*Pediomelum esculentum*		
PENST	F	Penstemon	*Penstemon* spp.		PEN (Sp)
PHHO	F	Hood's phlox	*Phlox hoodii*		PHLHOO
PHLO	F	Longleaf phlox	*Phlox longifolia*		
PHLOX	F	Phlox	*Phlox* spp.		
PLPA2	F	Indianwheat	*Plantago patagonica*		PLAPAT, PLSP

CODE	LF*	Common name or other Life Forms	Scientific name or other Life Forms	Comments	Alternative code used
POAL4	F	White milkwort	*Polygala alba*		
POLYG4	F	Knotweed	*Polygonum* spp.		KNOT
POTEN	F	Cinquefoil	*Potentilla* spp.		
PSLA3	F	Lemon scurfpea	*Psoralidium lanceolatum*		
PSORA2	F	Scurfpea	*Psoralidium* spp.		PSORALEA
PSTE5	F	Slimflower scurfpea	*Psoralidium tenuiflora*		PEDTEN
RACO3	F	Upright paririe coneflower	*Ratibida columnifera*		
RATIB	F	Prairie coneflower	*Ratibida* spp.		
RUDBE	F	Coneflower	*Rudbeckia* spp.		
SIAL2	F	Tall tumblemustard	*Sisymbrium altissimum*		SIAL
SORO	F	Buffalobur nightshade	*Solanum rostratum*		
SOLAN	F	Nightshade	*Solanum* spp.		
SOMI2	F	Missouri goldenrod	*Solidago missouriensis*		SOLMIS
SOLID	F	Goldenrod	*Solidago* spp.		
SOSP	F	Goldenrod	*Solidago* spp.		SOSP
SPCO	F	Scarlet globemallow	*Sphaeralcea coccinea*		SPHCOC
SYER	F	Heath aster	*Symphiotrichum ericoides*		SYMERI
SYLA3	F	Smooth blue aster	*Symphyotrichum laeve*		
TAOF	F	Dandelion	*Taraxacum officinalis*		TAROFF
TEAC	F	Stemless four-nerve daisy	*Tetraneuris acaulis*		
THRH	F	Prairie goldenpea	*Thermopsis rhombifolia*		THERHO
THAR5	F	Field pennycress	*Thlaspi arvense*		THAR
TRBR	F	Longbract spiderwort	*Tradescantia bracteata*		
TRDU	F	Salsify	*Tragopogon dubius*		TRADUB
TRIFO	F	Clover	*Trifolium* spp.		
UNKF63	F	Unknown plant/code	UDEW, UGRX, UNFORBG, UNKPLANT combined		
MANYAST	F	Unknown aster	Unidentified *Aster*		MANYASTER
MONYAST	F	Unknown aster	Unidentified *Aster*		
GOLDAST	F	Aster species	Unidentified *Aster*		GOLDASTER
UNASTER1	F	Unknown aster	Unidentified *Aster*		
BORAGE	F	Boraginaceae	Unidentified Boraginaceae		
CACTUS	F	Cactus species	Unidentified Cactus		
CLOVER	F	Clover species	Unidentified clover		

CODE	LF*	Common name or other Life Forms	Scientific name or other Life Forms	Comments	Alternative code used
MINT	F	Unidentified mint	Unidentified mint		
VIAM	F	American vetch	*Vicia americana*		VICAME
VINU2	F	Nuttall's violet	*Viola nuttallii*		
VIOLA	F	Violet	*Viola* spp.		
XYGL	F	Smooth woodyaster	*Xylorhiza glabriuscula*		XYLGLA
ZIDE	F	Showy deathcamas	*Zigadenus elegans*		ZIGDEN?, ZIEL?
ZIVE	F	Meadow death camas	*Zigadenus venenosus*		
		Unidentified shrubs			
UNKS01	S	Unidentified shrub species	Unidentified shrub		
UNKS1	S	Unidentified shrub species	Unidentified shrub		
UNKS1	S	Unidentified shrub species	Unidentified shrub		UNKS1
UNKS2	S	Unidentified shrub species	Unidentified shrub		
UNSHRUB1	S	Unidentified shrub species	Unidentified shrub		
UNSHRUB2	S	Unidentified shrub species	Unidentified shrub		
		Unidentified graminoids			
GRASSA	G	Unidentified graminoid species	Unidentified grass		
GRASSC	G	Unidentified graminoid species	Unidentified grass		
GRX	G	Unidentified graminoid species	Unidentified grass		
UNGRAS1	G	Unidentified graminoid species	Unidentified grass		
UNGRAS2	G	Unidentified graminoid species	Unidentified grass		
UNGRAS3	G	Unidentified graminoid species	Unidentified grass		
UNGRAS4	G	Unidentified graminoid species	Unidentified grass		
UNKG01	G	Unidentified graminoid species	Unidentified grass		
UNKG02	G	Unidentified graminoid species	Unidentified grass		
UNKG03	G	Unidentified graminoid species	Unidentified grass		
UNKG04	G	Unidentified graminoid species	Unidentified grass		
UNKG05	G	Unidentified graminoid species	Unidentified grass		
UNKG06	G	Unidentified graminoid species	Unidentified grass		
UNKG07	G	Unidentified graminoid species	Unidentified grass		
UNKG08	G	Unidentified graminoid species	Unidentified grass		
UNKG09	G	Unidentified graminoid species	Unidentified grass		

CODE	LF*	Common name or other Life Forms	Scientific name or other Life Forms	Comments	Alternative code used
UNKG10	G	Unidentified graminoid species	Unidentified grass		
UNKG11	G	Unidentified graminoid species	Unidentified grass		
UNKG12	G	Unidentified graminoid species	Unidentified grass		
		Unidentified forbs			
ASBI	F	Unidentified forb species	Unidentified forb		
ASCR	F	Unidentified forb species	Unidentified forb		
ASMT	F	Unidentified forb species	Unidentified forb		
ASRA	F	Unidentified forb species	Unidentified forb		
ATNU	F	Unidentified forb species	Unidentified forb		
CEAL	F	Unidentified forb species	Unidentified forb		
COCO	F	Unidentified forb species	Unidentified forb		
COCR	F	Unidentified forb species	Unidentified forb		
COOR	F	Unidentified forb species	Unidentified forb		
CRESS	F	Unidentified forb species	Unidentified forb		
DEW	F	Unidentified forb species	Unidentified forb		
ERCAC	F	Unidentified forb species	Unidentified forb		
FORBD	F	Unidentified forb species	Unidentified forb		
FORBE	F	Unidentified forb species	Unidentified forb		
FORBF	F	Unidentified forb species	Unidentified forb		
HASP	F	Unidentified forb species	Unidentified forb		
HYRI	F	Unidentified forb species	Unidentified forb		
LEDU	F	Unidentified forb species	Unidentified forb		
LYDU	F	Unidentified forb species	Unidentified forb		
ORLU4	F	Unidentified forb species	Unidentified forb		
POPA	F	Unidentified forb species	Unidentified forb		
ROGEED	F	Unidentified forb species	Unidentified forb		
ROSET	F	Unidentified forb species	Unidentified forb		
SIDEWALK	F	Unidentified forb species	Unidentified forb		
SIH4	F	Unidentified forb species	Unidentified forb		
UNFORB1	F	Unidentified forb species	Unidentified forb		
UNFORB10	F	Unidentified forb species	Unidentified forb		
UNFORB11	F	Unidentified forb species	Unidentified forb		

CODE	LF*	Common name or other Life Forms	Scientific name or other Life Forms	Comments	Alternative code used
UNFORB12	F	Unidentified forb species	Unidentified forb		
UNFORB13	F	Unidentified forb species	Unidentified forb		
UNFORB14	F	Unidentified forb species	Unidentified forb		
UNFORB15	F	Unidentified forb species	Unidentified forb		
UNFORB16	F	Unidentified forb species	Unidentified forb		
UNFORB17	F	Unidentified forb species	Unidentified forb		
UNFORB18	F	Unidentified forb species	Unidentified forb		
UNFORB2	F	Unidentified forb species	Unidentified forb		
UNFORB3	F	Unidentified forb species	Unidentified forb		
UNFORB4	F	Unidentified forb species	Unidentified forb		
UNFORB5	F	Unidentified forb species	Unidentified forb		
UNFORB6	F	Unidentified forb species	Unidentified forb		
UNFORB7	F	Unidentified forb species	Unidentified forb		
UNFORB8	F	Unidentified forb species	Unidentified forb		
UNFORB9	F	Unidentified forb species	Unidentified forb		
UNK	F	Unidentified forb species	Unidentified forb		
UNK1	F	Unidentified forb species	Unidentified forb		
UNK2	F	Unidentified forb species	Unidentified forb		
UNK3	F	Unidentified forb species	Unidentified forb		
UNKF	F	Unidentified forb species	Unidentified forb		
UNKF	F	Unidentified forb species	Unidentified forb		UNKF
UNKF01	F	Unidentified forb species	Unidentified forb		
UNKF01	F	Unidentified forb species	Unidentified forb		UNKF01
UNKF02	F	Unidentified forb species	Unidentified forb		
UNKF02	F	Unidentified forb species	Unidentified forb		UNKF02
UNKF03	F	Unidentified forb species	Unidentified forb		
UNKF03	F	Unidentified forb species	Unidentified forb		UNKF03
UNKF04	F	Unidentified forb species	Unidentified forb		
UNKF04	F	Unidentified forb species	Unidentified forb		UNKF04
UNKF05	F	Unidentified forb species	Unidentified forb		
UNKF05	F	Unidentified forb species	Unidentified forb		UNKF05
UNKF06	F	Unidentified forb species	Unidentified forb		
UNKF06	F	Unidentified forb species	Unidentified forb		UNKF06

CODE	LF*	Common name or other Life Forms	Scientific name or other Life Forms	Comments	Alternative code used
UNKF07	F	Unidentified forb species	Unidentified forb		
UNKF07	F	Unidentified forb species	Unidentified forb		UNKF07
UNKF08	F	Unidentified forb species	Unidentified forb		
UNKF08	F	Unidentified forb species	Unidentified forb		UNKF08
UNKF09	F	Unidentified forb species	Unidentified forb		
UNKF09	F	Unidentified forb species	Unidentified forb		UNKF09
UNKF1	F	Unidentified forb species	Unidentified forb		
UNKF10	F	Unidentified forb species	Unidentified forb		
UNKF10	F	Unidentified forb species	Unidentified forb		UNKF10
UNKF11	F	Unidentified forb species	Unidentified forb		
UNKF11	F	Unidentified forb species	Unidentified forb		UNKF11
UNKF12	F	Unidentified forb species	Unidentified forb		
UNKF12	F	Unidentified forb species	Unidentified forb		UNKF12
UNKF13	F	Unidentified forb species	Unidentified forb		
UNKF14	F	Unidentified forb species	Unidentified forb		
UNKF15	F	Unidentified forb species	Unidentified forb		
UNKF16	F	Unidentified forb species	Unidentified forb		
UNKF17	F	Unidentified forb species	Unidentified forb		
UNKF18	F	Unidentified forb species	Unidentified forb		
UNKF19	F	Unidentified forb species	Unidentified forb		
UNKF2	F	Unidentified forb species	Unidentified forb		
UNKF20	F	Unidentified forb species	Unidentified forb		
UNKF21	F	Unidentified forb species	Unidentified forb		
UNKF22	F	Unidentified forb species	Unidentified forb		
UNKF22	F	Unidentified forb species	Unidentified forb		
UNKF23	F	Unidentified forb species	Unidentified forb		
UNKF24	F	Unidentified forb species	Unidentified forb		
UNKF25	F	Unidentified forb species	Unidentified forb		
UNKF26	F	Unidentified forb species	Unidentified forb		
UNKF27	F	Unidentified forb species	Unidentified forb		
UNKF28	F	Unidentified forb species	Unidentified forb		
UNKF29	F	Unidentified forb species	Unidentified forb		
UNKF3	F	Unidentified forb species	Unidentified forb		

CODE	LF*	Common name or other Life Forms	Scientific name or other Life Forms	Comments	Alternative code used
UNKF30	F	Unidentified forb species	Unidentified forb		
UNKF31	F	Unidentified forb species	Unidentified forb		
UNKF32	F	Unidentified forb species	Unidentified forb		
UNKF33	F	Unidentified forb species	Unidentified forb		
UNKF34	F	Unidentified forb species	Unidentified forb		
UNKF35	F	Unidentified forb species	Unidentified forb		
UNKF36	F	Unidentified forb species	Unidentified forb		
UNKF37	F	Unidentified forb species	Unidentified forb		
UNKF38	F	Unidentified forb species	Unidentified forb		
UNKF39	F	Unidentified forb species	Unidentified forb		
UNKF40	F	Unidentified forb species	Unidentified forb		
UNKF41	F	Unidentified forb species	Unidentified forb		
UNKF42	F	Unidentified forb species	Unidentified forb		
UNKF43	F	Unidentified forb species	Unidentified forb		
UNKF44	F	Unidentified forb species	Unidentified forb		
UNKF45	F	Unidentified forb species	Unidentified forb		
UNKF46	F	Unidentified forb species	Unidentified forb		
UNKF47	F	Unidentified forb species	Unidentified forb		
UNKF48	F	Unidentified forb species	Unidentified forb		
UNKF49	F	Unidentified forb species	Unidentified forb		
UNKF50	F	Unidentified forb species	Unidentified forb		
UNKF51	F	Unidentified forb species	Unidentified forb		
UNKF52	F	Unidentified forb species	Unidentified forb		
UNKF53	F	Unidentified forb species	Unidentified forb		
UNKF54	F	Unidentified forb species	Unidentified forb		
UNKF55	F	Unidentified forb species	Unidentified forb		
UNKF56	F	Unidentified forb species	Unidentified forb		
UNKF57	F	Unidentified forb species	Unidentified forb		
UNKF58	F	Unidentified forb species	Unidentified forb		
UNKF59	F	Unidentified forb species	Unidentified forb		
UNKF60	F	Unidentified forb species	Unidentified forb		
UNKF61	F	Unidentified forb species	Unidentified forb		
UNKF62	F	Unidentified forb species	Unidentified forb		

CODE	LF*	Common name or other Life Forms	Scientific name or other Life Forms	Comments	Alternative code used
UNKFDBL	F	Unidentified forb species	Unidentified forb		
UNONDE	F	Unidentified forb species	Unidentified forb		
UNTRMA	F	Unidentified forb species	Unidentified forb		
UNTROU	F	Unidentified forb species	Unidentified forb		
UNVERE	F	Unidentified forb species	Unidentified forb		
		Unidentified plant species or code			
ANSC	U	Unidentified plant species or code	Unidentified plant		
ANSP	U	Unidentified plant species or code	Unidentified plant		UANSP
ANSP	U	Unidentified plant species or code	Unidentified plant		UANSP
APPO	U	Unidentified plant species or code	Unidentified plant		
ASER	U	Unidentified plant species or code	Unidentified plant		
BOGA	U	Unidentified plant species or code	Unidentified plant		
BRSA	U	Unidentified plant species or code	Unidentified plant		
BRSA	U	Unidentified plant species or code	Unidentified plant		UBRSA
BRSP	U	Unidentified plant species or code	Unidentified plant		
BRSP	U	Unidentified plant species or code	Unidentified plant		UBRSP
BRTR	U	Unidentified plant species or code	Unidentified plant		
CAMUS	U	Unidentified plant species or code	Unidentified plant		
CHSP	U	Unidentified plant species or code	Unidentified plant		UCHSP
CHSP	U	Unidentified plant species or code	Unidentified plant		UCHSP
COVI	U	Unidentified plant species or code	Unidentified plant		UCOVI
COVI	U	Unidentified plant species or code	Unidentified plant		UCOVI
ELEA	U	Unidentified plant species or code	Unidentified plant		UELEA
ELEA	U	Unidentified plant species or code	Unidentified plant		UELEA
ERSP	U	Unidentified plant species or code	Unidentified plant		UERSP
ERSP	U	Unidentified plant species or code	Unidentified plant		UERSP
FLEA	U	Unidentified plant species or code	Unidentified plant		UFLEA
FLEA	U	Unidentified plant species or code	Unidentified plant		UFLEA
HEHN	U	Unidentified plant species or code	Unidentified plant		UHEHN
HEHN	U	Unidentified plant species or code	Unidentified plant		UHEHN
HESP	U	Unidentified plant species or code	Unidentified plant		
HYPA	U	Unidentified plant species or code	Unidentified plant		UHYPA

CODE	LF*	Common name or other Life Forms	Scientific name or other Life Forms	Comments	Alternative code used
HYPA	U	Unidentified plant species or code	Unidentified plant		UHYPA
LISP	U	Unidentified plant species or code	Unidentified plant		ULISP
LISP	U	Unidentified plant species or code	Unidentified plant		ULISP
PLANT	U	Unidentified plant species or code	Unidentified plant		
PSSP	U	Unidentified plant species or code	Unidentified plant		UPSSP
PSSP	U	Unidentified plant species or code	Unidentified plant		UPSSP
SAKI	U	Unidentified plant species or code	Unidentified plant		
UNK	U	Unidentified plant species or code	Unidentified plant		UNK
UNK1	U	Unidentified plant species or code	Unidentified plant		UNK1
UNK2	U	Unidentified plant species or code	Unidentified plant		UNK2
UNK92	u	Unidentified plant species or code	Unidentified plant		UNK
UNK92	U	Unidentified plant species or code	Unidentified plant		UNK92
UNPOAR	U	Unidentified plant species or code	Unidentified plant		
UNSHPA	U	Unidentified plant species or code	Unidentified plant		
USAKI	U	Unidentified plant species or code	Unidentified plant		UUSAKI
		Other codes included			
TOHE	Z3	Total herbaceous cover	Total herbaceous plant cover		TOHE
TOSH DA	Z4	Total Shrub DA	Total shrubs other than canopy cover		TOSH DA
TOSH LI	Z5	Big sagebrush	*Artemisia tridentata* by Line Intercept method		TOSH LI
TOSH LI	Z6	Total Shrub LI	Total shrubs by Line Intercept method		TOSH LI

*LF stands for life form

Methods used to collect 1992-93 and 2012 data

Site selection

Sites in Harding and Butte Counties were originally selected because they represented the best sage-grouse habitat in these counties at the time (1992). Since then data from other studies have been selected based on sage-grouse or lek locations, or random sites near grouse locations or leks. Most data is sampled within sagebrush habitat that represents sage-grouse habitat. Most recent site selection has Global Position Coordinates (GPS) of these locations. Some of the original locations established in 1992 and 1993 had a t-post to represent the plot center at the edge and 4 wooden stakes to establish the two parallel 30 m long transects. Figure 1 shows a general layout of data collected at each site. A site represents a single location where all vegetation data were collected. Future samples should include GPS coordinates with all data collected at each site.

In Fall River County sites included GPS coordinates labeled as UTM NAD83 (Universal Transverse Mercator coordinate system, North American Datum 83). Data in 1992 lacked any map or location information other than a small scale map with site locations. The Fall River data does include known sage-grouse leks within the project areas, but it was not specifically designed to collect data on the best sagebrush or sage-grouse habitat.

Plot layout

Located at each site the following plot layout can be seen in Figure 1 below.

Canopy cover and frequency of plant species

Methods used in both areas (Carter data and Fall River data) include collecting canopy cover and frequency by species using the Daubenmire (1959) method along two parallel, 30 m long transects. Transects are set 20 m apart and canopy cover by species, total cover, litter, bare ground, and rock were estimated at 1 m intervals along each transect. Therefore, canopy cover and frequency data were collected within thirty $0.1m^2$ plots along each of two transects for 60 total estimates per site.

Plant heights

To measure herbaceous plant height we used a meter stick and recorded the tallest forb and tallest graminoid present within each of the thirty $0.1m^2$ plots along each transect. All these data were averaged for provide an average height measure for the tallest forb and graminoid at each site. This data was recorded on the canopy cover data sheet and collected before estimating canopy cover.

Visual Obstruction Readings VOR

In Harding and Butte County Robel VOR data was collected since it was collected in 1992-93. A modified Robel pole was used to collected VOR data that included both a high and a low reading. Data in 2012 use a modified Robel pole with ½ inch bands. This was collected along a 200 m transect at 10 m intervals. Four readings per station were collected and data were averaged (80 readings per transect). The high estimate gave a reading of the greatest height of vegetation observed on the Robel pole. The low measurement recorded the lowest ½ inch band width visible. Data collected in 1992-93 using the Robel pole was always recorded as an even

number and the band width could not be determined. We treated the 1992-93 data as ½ inch band, but the 1992-93 Carter VOR data should not be considered as baseline information and knowledge of this problem.

Shrub heights and shrub densities

Shrub heights and shrub densities were also collected by species within a belt transect 10 m wide by 30 m long in 2012 in Harding and Butte Counties. Shrub heights were measured to the nearest 5 cm with a meter stick within this belt. Shrub numbers per height category based on 5 cm height differences were counted within the 300 m^2 belt transect (also referred to as a plot). We summarized the shrub counts to calculate a shrub density with this data. We divided this total number of shrubs counted within a 300 m^2 plot by 300 to produce a shrub density per meter square. We also plotted the shrub counts by each height category to give a condition of shrub demographics in Harding and Butte Counties.

Data collected in 1992-93 in Harding and Butte Counties generally used a belt transect 450 m^2 area (15 m x 30 m). The plots used were various sized and shaped sample areas, but were generally set at 450 m^2 (15 m x 30 m) or less and noted on the data sheets.

Line intercept

Line intercept of shrubs were collected along a 50 m transect located between the two 30 m long parallel transects used to collect canopy cover. Plant height was also collected along this transect to measure the tallest graminoid and tallest forb. The length of the shrub that intersected the 50 m transect was used to give another estimate of cover of shrubs (Bonham 2013).

Summary of Methods

Specifics of each method, biases associated with each method, alternative methods, can be found in Bonham (2013) or other sources. We are recommending following the specific plot layout (Figure 1) in the future because it is an efficient method and can be easily modified to collect more or fewer vegetation variables. We are not recommending collecting all the variables collected in 2012, some duplication was done, but we were including past methods for the 2012 sample.

Specifics for future vegetation data collection to be used for monitoring purposes will need to be determined based on specific objectives determined by resource and land managers. Line intercept method and canopy cover by Daubenmire (1959) method both give canopy cover estimates of all shrubs by species, both methods may not be required. The modified Robel pole method (Uresk and Benzon 2007) with ½ inch bands may be better method than measuring the tallest plant along transects because it gives an average plant height along with density of vegetation included in the measurement. In addition, this data can be easily modeled to relate herbage (lbs $acre^{-1}$ or kg ha^{-1}) based on band width.

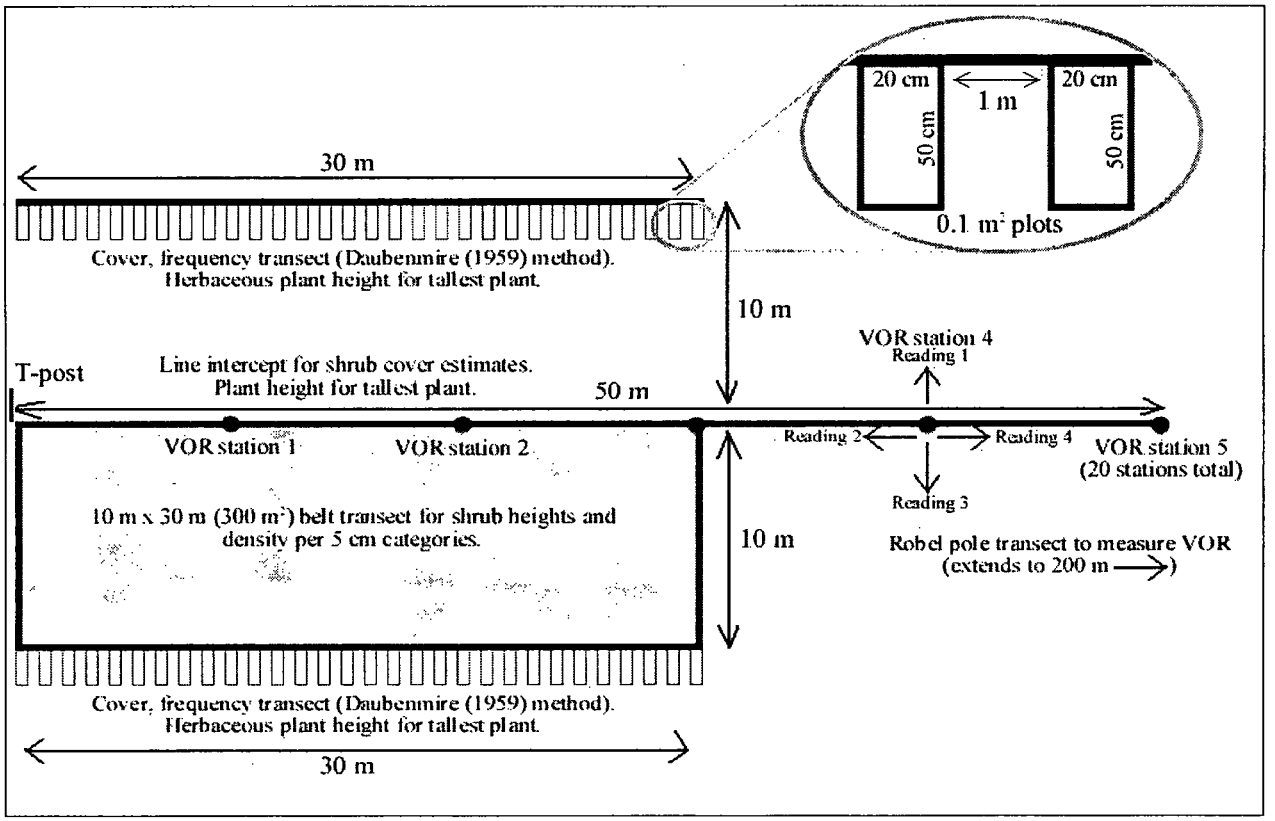


Figure 1. Methods layout.

Database File

Codes used for identification of life forms in data base files.

TOCO = A1; represents total plant canopy cover
TOGR = A2; represents total grass canopy cover
TOFO = A3; represents total forb canopy cover
TOSH = A4; represents total shrub canopy cover
LITT = A5; represents total litter cover on soil surface
BARE = A6; represents total bare ground
ROCK = A7; represents total rock cover
DUNG = D; represents total fecal material encountered on soil surface
FUNGI = M; represents total fungi canopy cover
LICH = L; represents total lichen canopy cover
SELAG = E; represents total Selaginella canopy cover

APPENDIX F
Precipitation

Precipitation

Harding County, South Dakota

The combined long-term monthly precipitation totals are from January 1893 to March 2013; the long-term average was calculated from all available data from Antelope Range Station SD (3/1/1951 to 1/31/2008), Camp Crook SD (1/1/1893 to 3/31/2013), Ellingson 1 NW SD (6/1/1909 to 8/31/1963), Harding 3 SE SD (12/2/1951 to 3/31/2013), Ludlow SD (3/11/1924 to 3/31/2013), Ralph 3 NW SD (6/1/1941 to 7/31/2003), Redig 9 NE SD (10/13/1914 to 12/31/2011), and Knobs MT (9/5/1951 to 3/31/2013) listed on the High Plains Regional Climate Center website (http://www.hprcc.unl.edu/data/historical/ -- specifically monthly precipitation totals at http://www.hprcc.unl.edu/cgi-bin/cli_perl_lib/cliMAIN.pl?sd0223, sd1294, sd2614, sd3560, sd5048, sd6907, sd7062, and mt4715). Precipitation data was compiled for 1991, 1992, 1993, 2011, and 2012 from Antelope Range Station, Camp Crook, Harding 3 SE, Ludlow, Ralph 3 NW, Redig 9 NE, South Dakota and Knobs, Montana. The combined long-term average is compared graphically with the average 1991, 1992, 1993, 2011, and 2012 monthly precipitation amounts below.

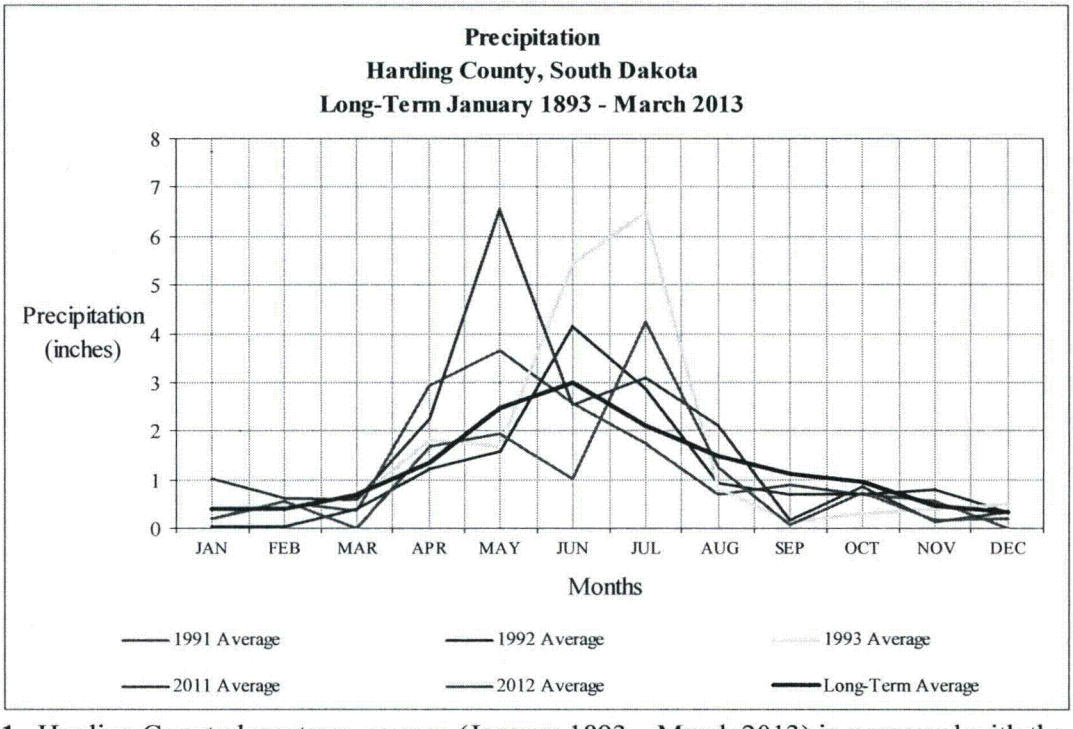


Figure 1. Harding County long-term average (January 1893 – March 2013) is compared with the average precipitation data for 1991, 1992, 1993, 2011, and 2012.

Table 1. Harding County long-term average (January 1893 – March 2013) is compared with the average precipitation data for 1991, 1992, 1993, 2011, and 2012.

	JAN	FEB	MAR	ARP	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Harding County, SD Long-Term Average	0.39	0.38	0.69	1.36	2.47	3.00	2.12	1.47	1.12	0.95	0.45	0.32
1991 Average	0.21	0.54	0.36	2.93	3.67	2.58	1.74	0.68	0.89	0.71	0.55	0.00
1992 Average	0.03	0.02	0.39	1.21	1.57	4.16	2.88	0.91	0.70	0.68	0.79	0.32
1993 Average	0.41	0.51	0.59	1.80	1.68	5.43	6.49	0.83	0.13	0.31	0.41	0.50
2011 Average	1.03	0.62	0.60	2.25	6.54	2.53	3.08	2.09	0.17	0.84	0.15	0.35
2012 Average	0.21	0.55	0.00	1.67	1.95	1.04	4.24	1.26	0.07	0.72	0.17	0.20

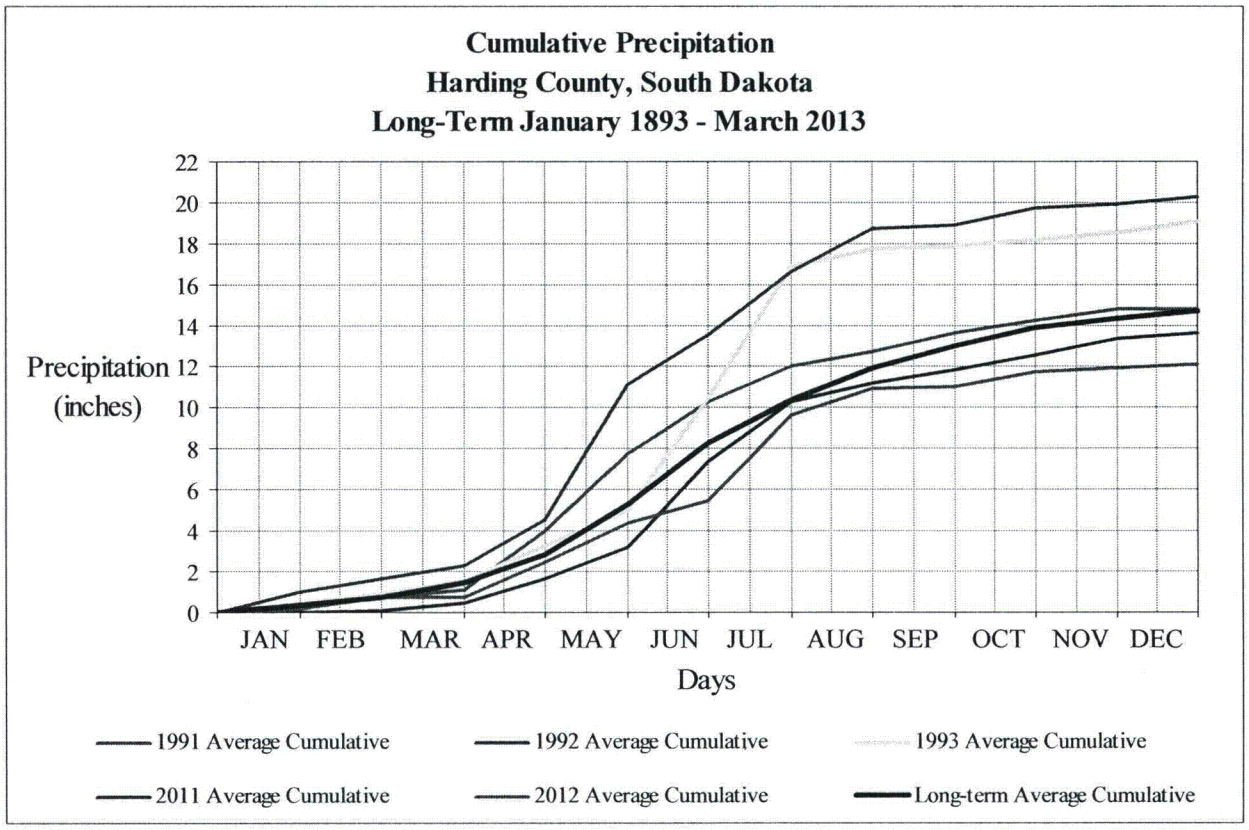


Figure 2. Harding County long-term average cumulative precipitation (January 1893 – March 2013) is compared with the average cumulative precipitation data for 1991, 1992, 1993, 2011, and 2012.

The long-term monthly precipitation data recorded at eight weather stations throughout Harding County are compared with average monthly precipitation data for 1991, 1992, 1993, 2011, and 2012 recorded at Antelope Range Station, Camp Crook, Harding 3 SE, Ludlow, Ralph 3 NW, Redig 9 NE, South Dakota and Knobs, Montana. Figure 2 shows 2012 monthly average cumulative precipitation in Harding County was below the long-term average cumulative precipitation for the entire year (12 months). Cumulative precipitation from January through June 2012 was 2.9 inches less compared to the long-term average (8.3). By the end of September 2012 cumulative precipitation was 2.0 inches less compared to the long-term average. By the end of December 2012 cumulative precipitation was 2.6 inches below the long-term average. Less than average precipitation and the lack of adequate residual measured in 2012 may have greater negative impacts in 2013 compared to 2012. Monthly precipitation within Harding County could be characterized as below average for 2012.

Butte County, South Dakota

The combined long-term monthly precipitation totals are from January 1893 to March 2013; the long-term average was calculated from all available data from Belle Fourche 20 NNE SD (6/1/1962 to 5/31/1970), Belle Fourche 22 NNW SD (5/1/1980 to 2/28/2013), Belle Fourche 29 NNW SD (7/1/1951 to 9/30/1979), Belle Fourche SD (6/1/1908 to 3/31/2013), Newell SD (9/1/1920 to 3/31/2013), Orman SD (5/1/1906 to 6/30/1974), Sulphur 2 W SD (8/1/1949 to 9/30/1957), Vale SD (2/15/1908 to 7/31/1978), and Zeona 10 SSW SD (8/1/1949 to 6/30/2002) listed on the High Plains Regional Climate Center website (http://www.hprcc.unl.edu/data/historical/ -- specifically monthly precipitation totals at http://www.hprcc.unl.edu/cgi-bin/cli_perl_lib/cliMAIN.pl?sd1560, sd0565, sd0567, sd0559, sd6054, sd6357, sd8107, sd8552 and sd9537). Precipitation data was compiled for 1991, 1992, 1993, 2011, and 2012 from Belle Fourche 22 NNW, Belle Fourche, Newell, and Zeona 10 SSW, South Dakota. The combined long-term average is compared graphically with the average 1991, 1992, 1993, 2011, and 2012 monthly precipitation amounts below.

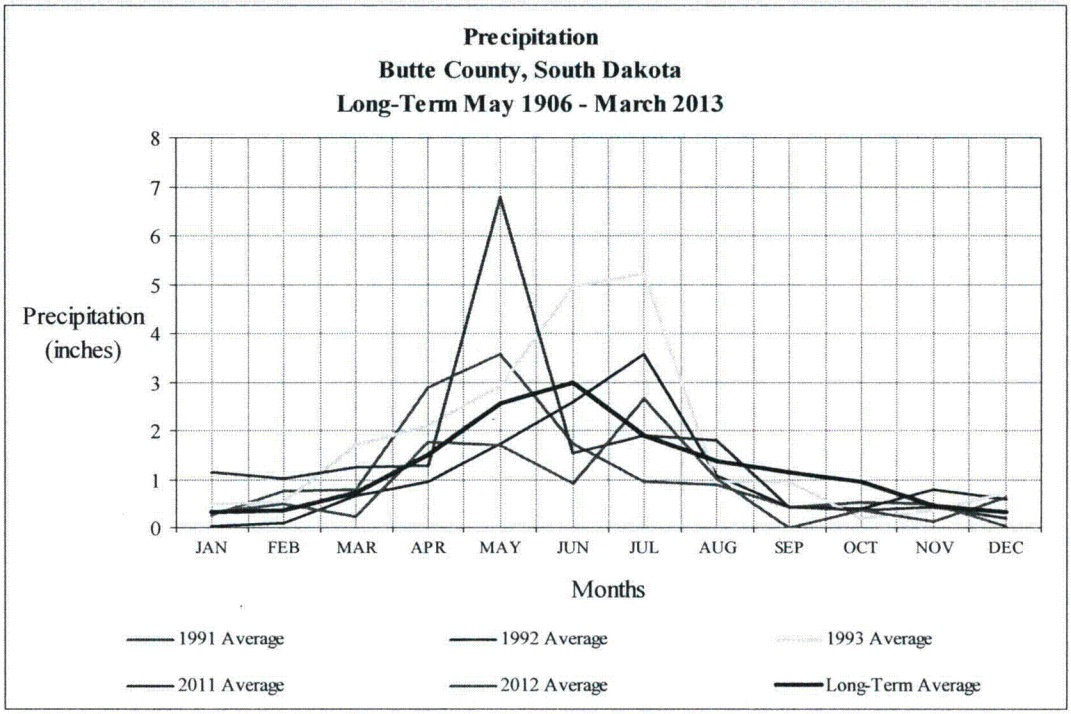


Figure 3. Butte County long-term average (May 1906 – March 2013) is compared with the average precipitation data for 1991, 1992, 1993, 2011, and 2012.

Table 2. Butte County long-term average (May 1906 – March 2013) is compared with the average precipitation data for 1991, 1992, 1993, 2011, and 2012.

	JAN	FEB	MAR	ARP	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Butte County, SD Long-Term Average	0.31	0.38	0.71	1.50	2.57	2.99	1.89	1.38	1.15	0.94	0.47	0.34
1991 Average	0.25	0.76	0.80	2.89	3.58	1.74	0.95	0.90	0.44	0.53	0.50	0.02
1992 Average	0.04	0.10	0.64	0.96	1.75	2.60	3.59	1.09	0.41	0.40	0.78	0.59
1993 Average	0.50	0.53	1.69	2.11	2.92	4.97	5.22	0.94	0.94	0.18	0.37	0.74
2011 Average	1.16	1.03	1.26	1.27	6.79	1.55	1.91	1.82	0.41	0.35	0.42	0.21
2012 Average	0.34	0.48	0.22	1.77	1.71	0.92	2.65	1.01	0.00	0.36	0.13	0.63

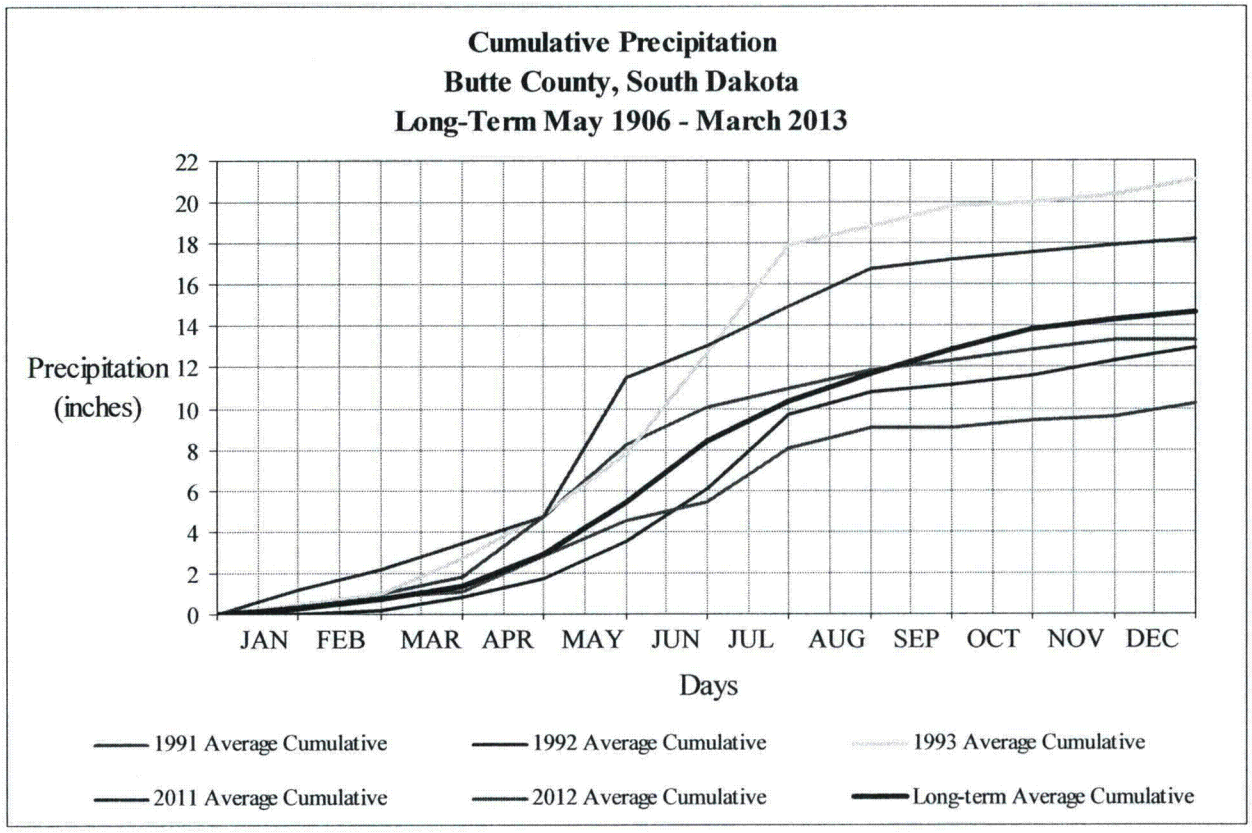


Figure 4. Butte County long-term average cumulative precipitation (May 1906 – March 2013) is compared with the average cumulative precipitation data for 1991, 1992, 1993, 2011, and 2012.

The long-term monthly precipitation data recorded at nine weather stations throughout Butte County are compared with average monthly precipitation data for 1991, 1992, 1993, 2011, and 2012 recorded at Belle Fourche 22 NNW, Belle Fourche, Newell, and Zeona 10 SSW, South Dakota. Monthly precipitation for 2012 were near equal or slightly greater than the long-term average values for January, February, and March. Figure 4 shows 2012 monthly average cumulative precipitation in Butte County was below the long-term average cumulative precipitation from April to December (9 months). Cumulative precipitation from January through June 2012 was 3.0 inches less compared to the long-term average (8.5). By the end of September 2012 cumulative precipitation was 3.8 inches less compared to the long-term average. By the end of December 2012 cumulative precipitation was 4.4 inches below the long-term average. Less than average precipitation and the lack of adequate residual measured in 2012 may have greater negative impacts in 2013 compared to 2012. Monthly precipitation within Butte County could be characterized as below average for 2012.

Fall River County, South Dakota

The combined long-term monthly precipitation totals are from January 1893 to March 2013; the long-term average was calculated from all available data from Angostura Dam SD (10/1/1947 to 5/12/1971), Ardmore 4 NNE SD (11/1/1908 to 3/31/2013), Dewey SD (11/1/1948 to 9/30/1957), Edgemont 10 N SD (11/1/1948 to 9/27/1957), Edgemont 23 NNW SD (10/1/1989 to 1/31/2013), Edgemont SD (8/1/1948 to 3/31/2013), Hot Springs 7 W SD (11/1/1948 to 6/30/1958), Hot Springs 9 SW SD (11/1/1948 to 9/29/1957), Hot Springs SD (2/1/1894 to 3/31/2013), Oelrichs 8 W SD (11/1/1948 to 6/30/1958), Oelrichs SD (1/1/1893 to 3/31/2013), Oral SD (5/1/1971 to 3/31/2013), Provo SD (11/1/1948 to 6/30/1958), Rumford SD (11/1/1948 to 6/30/1958), and Smithwick 6 SW SD (11/1/1948 to 8/31/1957) listed on the High Plains Regional Climate Center website (http://www.hprcc.unl.edu/data/historical/ -- specifically monthly precipitation totals at http://www.hprcc.unl.edu/cgi-bin/cli_perl_lib/cliMAIN.pl?sd0217, sd0236, sd2312, sd2559, sd2565, sd2557, sd4009, sd4010, sd4007, sd6214, sd6212, sd6304, sd6812, sd7367, and sd7797). Precipitation data was compiled for 1991, 1992, 2002, 2003, 2004, 2011, and 2012 from Ardmore 4 NNE, Edgemont 23 NNW, Edgemont, Hot Springs, Oelrichs, and Oral, South Dakota. The combined long-term average is compared graphically with the average 1991, 1992, 2002, 2003, 2004, 2011, and 2012 monthly precipitation amounts below.

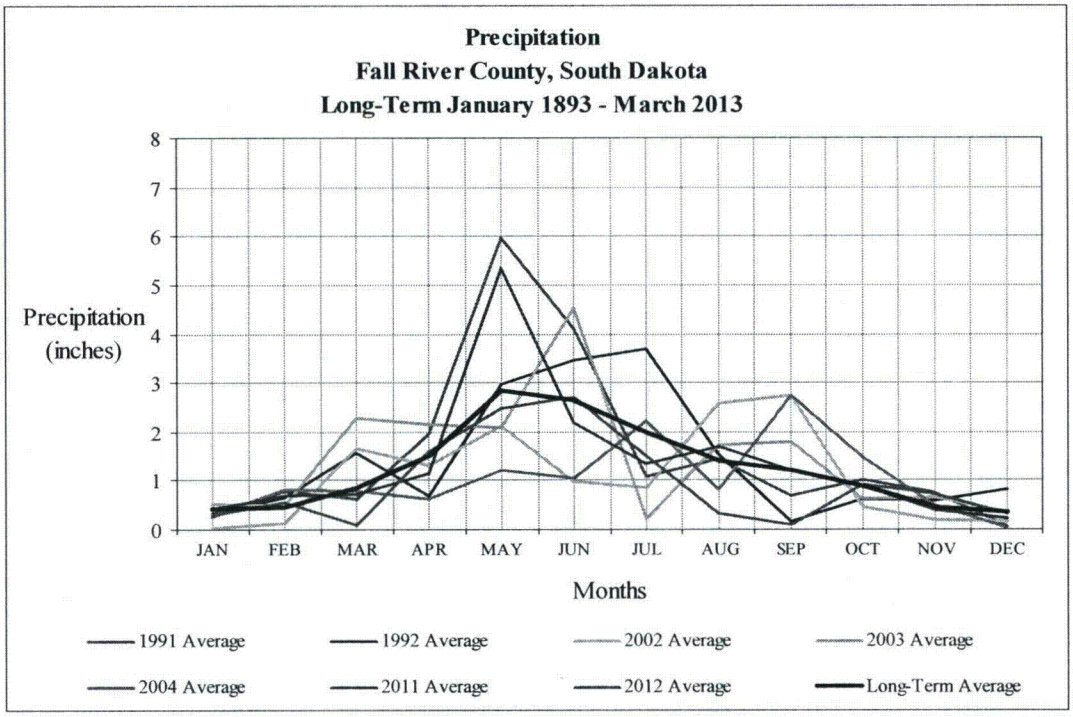


Figure 5. Fall River County long-term average (January 1893 – March 2013) is compared with the average precipitation data for 1991, 1992, 2002, 2003, 2004, 2011, and 2012.

Table 3. Fall River County long-term average (January 1893 – March 2013) is compared with the average precipitation data for 1991, 1992, 2002, 2003, 2004, 2011, and 2012.

	JAN	FEB	MAR	ARP	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Fall River County, SD Long-Term Average	0.42	0.46	0.85	1.50	2.84	2.63	1.98	1.40	1.22	0.89	0.46	0.36
1991 Average	0.26	0.78	0.61	1.95	5.98	4.13	1.08	1.45	0.69	1.02	0.75	0.07
1992 Average	0.34	0.67	1.57	0.70	2.99	3.45	3.70	1.54	0.17	0.62	0.59	0.81
2002 Average	0.05	0.14	1.66	1.32	2.14	0.99	0.84	2.59	2.74	0.45	0.19	0.16

	JAN	FEB	MAR	ARP	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2003 Average	0.51	0.48	2.27	2.16	2.08	4.53	0.24	1.73	1.80	0.61	0.65	0.35
2004 Average	0.29	0.83	0.80	0.62	1.20	1.05	2.23	0.83	2.74	1.49	0.51	0.03
2011 Average	0.42	0.70	0.73	1.14	5.35	2.19	1.34	1.70	1.21	0.87	0.40	0.23
2012 Average	0.29	0.54	0.11	1.59	2.48	2.71	1.52	0.33	0.09	0.93	0.73	0.32

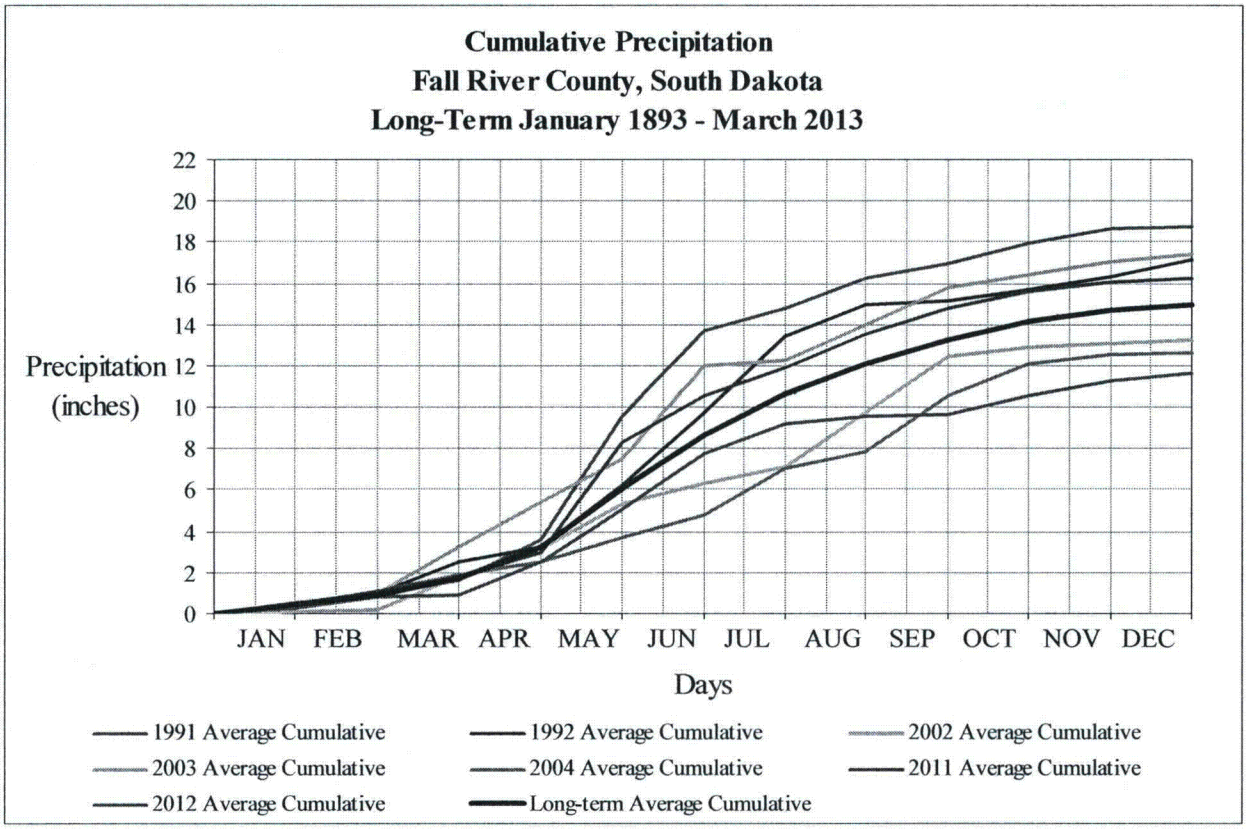


Figure 6. Fall River County long-term average cumulative precipitation (January 1893 – March 2013) is compared with the average cumulative precipitation data for 1991, 1992, 2002, 2003, 2004, 2011, and 2012.

The long-term monthly precipitation data recorded at fifteen weather stations throughout Fall River County are compared with average monthly precipitation data for 1991, 1992, 2002, 2003, 2004, 2011, and 2012 recorded at Ardmore 4 NNE, Edgemont 23 NNW, Edgemont, Hot Springs, Oelrichs, and Oral, South Dakota. Figure 6 shows 2012 monthly average cumulative precipitation in Fall River County was below the long-term average cumulative precipitation for the entire year (12 months). Cumulative precipitation from January through June 2012 was 1.0 inches less compared to the long-term average (8.7). By the end of September 2012 cumulative precipitation was 3.7 inches less compared to the long-term average. By the end of December 2012 cumulative precipitation was 3.4 inches below the long-term average. Less than average precipitation and the lack of adequate residual measured in 2012 may have greater negative impacts in 2013 compared to 2012. Monthly precipitation within Fall River County could be characterized as below average for 2012.

APPENDIX G
GPS, maps and sage-grouse numbers

Data for Internal Use Only

APPENDIX H
Lewis 2004

APPENDIX H Table 1. Locations of study sites are listed below with their UTM coordinates. The Datum was WGS84 and the Zone was 13 unless otherwise specified. (Lewis 2004)

Site Code	State	County	Easting	Northing
FR1Control	SD	Fall River	641309	4796079
FR101	SD	Fall River	631302	4800136
FR103	SD	Fall River	639628	4796043
FR104	SD	Fall River	640916	4797365
FR105	SD	Fall River	631986	4795637
FR106	SD	Fall River	583536	4794872
FR107	SD	Fall River	594067	4795052
FR108	SD	Fall River	594690	4793585
FR109	SD	Fall River	593370	4792093
FR110	SD	Fall River	592082	4791282
FR111A	SD	Fall River	588789	4789619
FR111B	SD	Fall River	588789	4789619
FR112	SD	Fall River	584878	4790405
FR113	SD	Fall River	583393	4790067
FR114	SD	Fall River	583287	4787415
FR115	SD	Fall River	578656	4786899
FR116	SD	Fall River	579085	4786960
FR117	SD	Fall River	588795	4763733
FR121	SD	Fall River	595108	4791775
FR125	SD	Fall River	581409	4796209
FR126	SD	Fall River	581515	4796901
FR127	SD	Fall River	581931	4796872
FR128	SD	Fall River	582756	4797008
FR129	SD	Fall River	582653	4798166
FR2Control	SD	Fall River	642373	4784000
FR201	SD	Fall River	631310	4800105
FR203	SD	Fall River	644035	4804341
FR204	SD	Fall River	637466	4795813
FR204Control	SD	Fall River	641313	4796104
FR205	SD	Fall River	633341	4796734
FR205Control	SD	Fall River	640689	4797695
FR206	SD	Fall River	587222	4793023
FR207	SD	Fall River	593686	4794231
FR208	SD	Fall River	594690	4793585
FR209	SD	Fall River	593370	4792093
FR210	SD	Fall River	592082	4791255
FR211A	SD	Fall River	588820	4789668
FR211B	SD	Fall River	588789	4789619
FR212	SD	Fall River	585319	4789933
FR213	SD	Fall River	583315	4789969
FR213Control	SD	Fall River	583246	4790360
FR214	SD	Fall River	583353	4787467
FR215	SD	Fall River	579845	4786535
FR216	SD	Fall River	579206	4786928
FR221	SD	Fall River	595108	4791775

Site Code	State	County	Easting	Northing
FR222	SD	Fall River	593563	4791718
FR225	SD	Fall River	581842	4796146
FR226	SD	Fall River	581786	4796596
FR227	SD	Fall River	581931	4796507
FR227Control	SD	Fall River	583115	4787172
FR228	SD	Fall River	582706	4797072
FR229	SD	Fall River	582653	4798166
FR231	SD	Fall River	591219	4805112
FR233Control	SD	Fall River	580105	4786577
H101	SD	Harding	613505	5020952
H102	SD	Harding	614022	5031781
H103	SD	Harding	613509	5034002
H104	SD	Harding	629294	5045862
H105	SD	Harding	637202	5044518
H106	SD	Harding	649156	5038704
H107	SD	Harding	644410	5029586
H108	SD	Harding	644231	5021802
H109	SD	Harding	644345	5019182
H110	SD	Harding	634826	5014735
H110A	SD	Harding	639319	5014795
H110B	SD	Harding	636385	5014339
H110C	SD	Harding	631851	5013896
H111	SD	Harding	616780	5013930
H112	SD	Harding	622773	5030399
H113	SD	Harding	633281	5030649
H115	SD	Harding	631517	5039326
H116	SD	Harding	617493	5060109
H119	SD	Harding	580109	5074474
H120	SD	Harding	579410	5065160
H121	SD	Harding	579842	5055121
H123	SD	Harding	580022	5020515
H124	SD	Harding	577809	5026532
H124A	SD	Harding	576724	5030010
H126	SD	Harding	577097	5034147
H127	SD	Harding	578553	5038053
H129	SD	Harding	580084	5040596
H129Control	SD	Harding	580734	5042244
H130	SD	Harding	583108	5044512
H131	SD	Harding	588709	5046552
H133	SD	Harding	591018	5036219
H134	SD	Harding	609005	5017624
H135	SD	Harding	611584	5017927
H135Control	SD	Harding	610473	5017514
H138	SD	Harding	611600	5058117
H139	SD	Harding	610372	5062910
H140A	SD	Harding	609064	5063955
H140B	SD	Harding	608164	5069677

Site Code	State	County	Easting	Northing
H140C	SD	Harding	607266	5073589
H142	SD	Harding	601657	5080379
H143	SD	Harding	602634	5085838
H144	SD	Harding	609675	5083749
H145	SD	Harding	614530	5084944
H146	SD	Harding	595109	5065076
H148	SD	Harding	607695	5049995
H201	SD	Harding	613505	5020952
H206	SD	Harding	648742	5038652
H207	SD	Harding	644410	5029586
H208	SD	Harding	644171	5021257
H209	SD	Harding	644345	5019182
H210	SD	Harding	634826	5014735
H210A	SD	Harding	639133	5015154
H210B	SD	Harding	636519	5014269
H210C	SD	Harding	631851	5013896
H211	SD	Harding	616738	5013714
H212	SD	Harding	622879	5030482
H215	SD	Harding	631492	5039360
H216	SD	Harding	617716	5061335
H217	SD	Harding	581449	5078110
H218	SD	Harding	577933	5070359
H219	SD	Harding	580109	5074474
H220	SD	Harding	579410	5065160
H221	SD	Harding	579904	5055079
H223	SD	Harding	591032	5036248
H224	SD	Harding	576725	5027862
H224A	SD	Harding	576724	5030010
H226	SD	Harding	577050	5034233
H227	SD	Harding	578553	5038053
H229	SD	Harding	580137	5040451
H230	SD	Harding	584160	5044838
H231	SD	Harding	588716	5046464
H233	SD	Harding	579972	5020949
H234	SD	Harding	611601	5017923
H235	SD	Harding	611584	5017927
H238	SD	Harding	611573	5057875
H239	SD	Harding	610372	5062910
H240	SD	Harding	608191	5072142
H243	SD	Harding	602325	5085374
H244	SD	Harding	609709	5083841
H245	SD	Harding	614567	5085148
H246	SD	Harding	595135	5064169
H248	SD	Harding	607695	5049995
H249	SD	Harding	606752	5066281
H250	SD	Harding	602843	5065494
H1Control	SD	Harding	614790	5084888

Site Code	State	County	Easting	Northing
H2Control	SD	Harding	582675	5069592
H3Control	SD	Harding	611237	5017413
H4Control	SD	Harding	590869	5041214
H5Control	SD	Harding	580098	5039107
U101	SD	Butte	582977	4955129
U101B	SD	Butte	583921	4954727
U102	SD	Butte	590879	4960861
U103	SD	Butte	590578	4961801
U104	SD	Butte	593054	4967656
U105Control	SD	Butte	596874	4981716
U105A	SD	Butte	596596	4979474
U105B	SD	Butte	596972	4977291
U106Control	SD	Butte	596734	4990910
U106A	SD	Butte	596470	4988170
U106B	SD	Butte	596492	4986685
U107	SD	Butte	609763	5005782
U108A	SD	Butte	602835	4973304
U108B	SD	Butte	602359	4973083
U109	SD	Butte	609178	4977301
U111	SD	Butte	614354	4993239
U112	SD	Butte	613934	4999703
U114	SD	Butte	605103	4954935
U115	SD	Butte	600449	4958945
U116	SD	Butte	590700	4972959
U117	SD	Butte	590677	4974362
U118	SD	Butte	590475	4976999
U119	SD	Butte	585643	5000608
U119Control	SD	Butte	586106	4996131
U120	SD	Butte	581505	4976041
U121	SD	Butte	588485	4971792
U122	SD	Butte	587705	4972412
U123	SD	Butte	599504	4956194
U124	SD	Butte	606780	4969900
U201	SD	Butte	583816	4954366
U202	SD	Butte	590879	4960861
U203	SD	Butte	590472	4962231
U204	SD	Butte	592124	4968674
U205A	SD	Butte	596596	4979474
U205B	SD	Butte	596657	4977065
U205Control	SD	Butte	596874	4981716
U206A	SD	Butte	596470	4988170
U206B	SD	Butte	596370	4994139
U206Control	SD	Butte	596734	4990910
U207	SD	Butte	604989	5003207
U208A	SD	Butte	602333	4973429
U208B	SD	Butte	606876	4975615
U209	SD	Butte	610119	4978273

Site Code	State	County	Easting	Northing
U211	SD	Butte	613849	4993443
U212	SD	Butte	613763	5006188
U214	SD	Butte	605103	4954935
U215	SD	Butte	603082	4960378
U216	SD	Butte	590502	4972194
U217	SD	Butte	590574	4976168
U218	SD	Butte	589547	4977907
U219	SD	Butte	586149	4994841
U219Control	SD	Butte	586106	4996131
U220	SD	Butte	582334	4974922
U221	SD	Butte	588787	4971749
U222	SD	Butte	587914	4973071
U223	SD	Butte	602660	4951588
U224	SD	Butte	606780	4969900
GV102	ND	Golden Valley	579966	5159625
GV202	ND	Golden Valley	579966	5159625
S103	ND	Slope	582337	5131936
S104	ND	Slope	581850	5133674
S105	ND	Slope	581640	5134387
S106	ND	Slope	581290	5135319
S106Control	ND	Slope	581312	5135100
S107	ND	Slope	581537	5136580
S108	ND	Slope	580399	5139445
S109A	ND	Slope	577417	5141062
S109B	ND	Slope	576729	5141521
S109C	ND	Slope	576635	5141856
S110	ND	Slope	576505	5143314
S111	ND	Slope	576833	5144460
S112	ND	Slope	576628	5144663
S113	ND	Slope	577169	5146633
S114A	ND	Slope	576612	5147319
S114B	ND	Slope	576558	5147102
S115	ND	Slope	576354	5149241
S116	ND	Slope	576383	5149985
S116Control	ND	Slope	575867	5150200
S117	ND	Slope	594286	5132466
S118	ND	Slope	592042	5132525
S119	ND	Slope	587353	5129098
S120	ND	Slope	586353	5129108
S120Control	ND	Slope	585166	5128268
S122	ND	Slope	593221	5156579
S203	ND	Slope	582930	5132355
S204	ND	Slope	581498	5134393
S206Control	ND	Slope	581222	5133849
S207	ND	Slope	580797	5137785
S208	ND	Slope	580664	5139641
S209A	ND	Slope	516317	5141853

Site Code	State	County	Easting	Northing
S209B	ND	Slope	576907	5141419
S209C	ND	Slope	575961	5142897
S210	ND	Slope	576505	5143314
S211	ND	Slope	577223	5143683
S212	ND	Slope	576628	5144663
S213	ND	Slope	576383	5145114
S214A	ND	Slope	576982	5145656
S214B	ND	Slope	577217	5146609
S215	ND	Slope	576354	5149241
S216	ND	Slope	575754	5150678
S216Control	ND	Slope	576147	5152403
S217	ND	Slope	594286	5132466
S218	ND	Slope	589472	5132398
S219	ND	Slope	586844	5128690
S220	ND	Slope	585719	5128245
S220Control	ND	Slope	585189	5728389
S222	ND	Slope	592940	5156643
O101	ND	Bowman	603535	5101612
O102	ND	Bowman	601780	5098159
O103	ND	Bowman	594951	5097678
O104	ND	Bowman	591718	5096629
O105	ND	Bowman	590730	5093237
O106	ND	Bowman	585946	5096133
O108	ND	Bowman	587281	5106544
O109	ND	Bowman	588004	5106616
O110	ND	Bowman	589241	5105308
O111	ND	Bowman	589962	5107201
O113	ND	Bowman	597218	5111029
O114	ND	Bowman	580966	5124542
O115	ND	Bowman	581064	5120937
O116A	ND	Bowman	580252	5103407
O116B	ND	Bowman	580430	5104617
O117	ND	Bowman	579945	5099073
O118	ND	Bowman	581280	5095951
O120	ND	Bowman	603027	5091863
O121	ND	Bowman	601501	5095152
O122	ND	Bowman	599401	5091291
O124	ND	Bowman	601932	5103159
O125	ND	Bowman	598599	5103544
O127	ND	Bowman	595436	5105126
O201	ND	Bowman	603535	5101612
O202	ND	Bowman	601653	5098132
O203	ND	Bowman	594853	5097562
O204	ND	Bowman	591521	5096359
O205	ND	Bowman	590730	5093237
O206	ND	Bowman	585815	5095972
O209	ND	Bowman	588004	5106616

Site Code	State	County	Easting	Northing
O210	ND	Bowman	589247	5105144
O211	ND	Bowman	590196	5107399
O213	ND	Bowman	595617	5104491
O214	ND	Bowman	580686	5125036
O215	ND	Bowman	580200	5120368
O216A	ND	Bowman	580252	5103407
O216B	ND	Bowman	580448	5103165
O217	ND	Bowman	579945	5099073
O218	ND	Bowman	580279	5095488
O219	ND	Bowman	583835	5093851
O220	ND	Bowman	602456	5091795
O221	ND	Bowman	600704	5094801
O222	ND	Bowman	598176	5090973
O224	ND	Bowman	598691	5101369
O227	ND	Bowman	595443	5104690
W201	WY	Natrona	349163	4712512
W202	WY	Natrona	349446	4707930
W203	WY	Fremont	12T 733496	4763389
W204	WY	Natrona	343056	4723402
W205	WY	Natrona	351593	4724543
W206	WY	Natrona	358705	4728685
W207	WY	Natrona	366786	4734830
W208	WY	Natrona	364206	4742537
W209	WY	Natrona	356591	4745332
W210	WY	Natrona	369082	4765044
W211	WY	Natrona	371280	4776515
W212	WY	Natrona	370085	4781441
W213	WY	Natrona	370024	4786563
W214	WY	Natrona	364293	4797061
W215	WY	Natrona	361944	4800278
W216	WY	Natrona	357839	4802391
W217	WY	Fremont	283208	4744768
W218	WY	Fremont	279551	4749353
W219	WY	Fremont	272011	4753180
W220	WY	Fremont	270283	4753889
W221	WY	Fremont	258159	4761923
W222	WY	Fremont	12T 742684	4761945
W223	WY	Fremont	12T 738915	4762318
W224	WY	Natrona	355058	4726706
W225	WY	Natrona	371258	4769407
W214Control	WY	Natrona	363183	4798819
W218Control	WY	Fremont	276880	4750738

APPENDIX I
Herman-Brunson 2007

APPENDIX I Table 6. Combined average distributions of vegetation characteristics for nest-sites and random sites of sage-grouse in southwestern North Dakota using MRPP, 2005-2006. (Herman-Brunson 2007)

Variable	Nest 0 (n=34)	Random 0 (n=50)	p-value
Total cover (%)	70	54	<0.001
Total grass (%)	27	19	0.0111
Total forb (%)	15	11	<0.001
Total sagebrush (%)	10	7	0.003
Bare ground (%)	21	33	0.0058
Litter (%)	13	8	<0.001
Sagebrush density/hectare	2,576.1	1,399.4	<0.001
Nest-VOR	9.3	7	0.0019

APPENDIX I Table 7. Average vegetation characteristics of nest-site and random sites between years for sage-grouse in southwestern North Dakota using MRPP, during 2005-2006. (Herman-Brunson 2007)

Variable	Nest 2005 (n=17)	Nest 2006 (n=17)	p-value	Random 2005 (n=17)	Random 2006 (n=33)	p-value
Total Forb (%)	23	8	<0.001*	16	8	<0.001*
Total Sage (%)	11	8	0.0242*	9	6	0.0238*
Bare ground (%)	27	16	0.0269*			
Grass hgt. in shrub (cm)	35.1	29.9	0.0185*	41.5	32.2	0.0041*
Avg. width of shrubs (cm)	41.5	53	0.0061*	48.5	31.8	<0.001*
Nest-VOR (in)	9.7	8.9	0.6525	23.6	6.7	<0.001*
VOR 1m	4.1	3.7	0.7094	9.9	2.4	<0.001*
VOR 2m	3.4	2.5	0.3131	7.8	2.2	<0.001*
VOR 3m	2.6	2.4	0.2705	6.6	2.1	<0.001*
VOR 4m	2.2	2.6	0.6016	7.1	2.1	<0.001*
VOR 5m	2.3	2.1	0.9263	7.3	2.2	<0.001*
VOR 10m	2.2	2.2	0.8988	8.4	1.8	<0.001*
VOR 20m	1.6	2.2	0.1289	6.8	1.4	<0.001*
VOR 30m	2.2	2.2	0.7868	7.3	1.5	<0.001*
VOR 40m	2.1	2.2	0.6366	6.6	1.5	<0.001*
VOR 50m				5	1.1	<0.001*

Asterisks (*) indicates significant difference between nests of 2005 and 2006, and significant differences between random sites compared between 2005 and 2006.

APPENDIX I Table 15. Average vegetation characteristic of sage-grouse brood and random sites used in the best model to explain brood sites in southwestern North Dakota, USA, 2005-2006. (Herman-Brunson 2007)

	Broods 2005	Randoms 2005	Broods 2006	Randoms 2006
Variable	0	0	0	0
Forb cover (%)	16	13	6	4
Grass cover (%)	29	23	34	19
Sagebrush cover (%)	5	5	5	3
Bare ground cover (%)	25	35	11	29
Sagebrush height (cm)	38	38	30	29
Sagebrush width (cm)	53	55	50	47

APPENDIX I Table 11. Combined average distributions of vegetation characteristics for brood sites and random sites of sage-grouse in southwestern North Dakota using MRPP, 2005-2006. (Herman-Brunson 2007)

Variable	Brood (n=130)	Random (n=107)	p-value
Vegetative cover (%)	74	55	<0.001*
Grass cover (%)	32	21	<0.001*
Forb cover (%)	11	9	<0.001*
Sagebrush cover (%)	5	4	0.041*
Bare ground cover (%)	17	32	<0.001*
Site-VOR (in)	3	2	0.107*
Sagebrush density/hectare	2,300	1,546	<0.001*
Sage (%)	5	3	<0.001*
Vegetation height/site (in)	12	14	0.065*
Grass height beneath the sagebrush (cm)	41	42	0.431
Sagebrush height (cm)	33	33	0.646
Sagebrush width (cm)	48	48	0.298

Asterisks (*) indicates significance. (Definition of each variable in Herman-Brunson 2007 Appendix E).

APPENDIX I Table 12. Combined average distributions of habitat characteristics for brood sites compared between years and random sites compared between years of sage-grouse in southwestern North Dakota using MRPP, 2005-2006. (Herman-Brunson 2007)

Variable	Brood 2005 (n=55)	Brood 2006 (n=75)	p-value	Random 2005 (n=47)	Random 2006 (n=60)	p-value
Vegetative cover (%)	67	79	<0.001*	57	54	0.429
Forb cover (%)	16	6	<0.001*	13	6	<0.001*
Grass cover (%)	29	33	0.145	23	19	0.249
Sagebrush cover (%)	5	5	0.334	5	3	0.016*
Bare ground cover (%)	25	10	<0.001*	34	29	0.113
Site-VOR (cm)	6	1	<0.001*	3	1	<0.001*
Sagebrush density/hectare	1,619	2,991	0.001*	1,011	1,966	<0.103*
Sagebrush (%)	5	5	0.4075	4	3	0.22
Grass hgt beneath the sagebrush (cm)	48	36	<0.001*	49	37	<0.001*
Sagebrush hgt (cm)	38	30	<0.001*	38	29	<0.001*
Sagebrush width (cm)	51	45	0.011*	53	44	<0.002*

Asterisks (*) indicates significance. (Definition of each variable in Herman-Brunson 2007 Appendix E).

APPENDIX I Table 13. Logistic regression models predicting greater sage-grouse brood sites (n = 130) versus random sites (n = 107) using vegetal data collected in North Dakota, USA, 2005-2006. Loglikelihood *(-2 ln [L])*, number of parameters including year indicator variable plus 2 *(intercept + SE) (K)*, Akaike's Information Criterion adjusted for small sample size *(AICc)*, difference in AICc *()AICc),* Akaike weights *(wi)*. Models with)AICc < 2 are highlighted as the best model. (Herman-Brunson 2007)

Model	Loglikelihood	K	AICc	)AICc	Wi
Togr(+)+Tofo(+)+Tosh(+)+Bare(-)Shrubhgt(-)+Shrubw(-)	-135.97149	9	258.9682	0	0.89
Toco(+)+cover(+)+Shrubhgt(-)+Shrubw(-)	-123.91192	7	263.215	4.247	0.106
Toco(+)	-123.78395	8	271.0118	12.044	0.002
Tofo(+)+Togr(+)+Tosh(+)+Bare(-)+Cover(+)	-140.64085	8	271.943	12.975	0.001
Tofo(+)+Togr(+)+Tosh(+)	-145.71992	6	288.5111	29.543	<0.001
Tofo(+)+Togr(+)+Tosh(+)+Bare(-)	-137.64685	7	288.5452	29.577	<0.001
Toco(+)+Cover(+)+Shrubden(+)	-136.44906	6	289.1771	30.209	<0.001
Tofo(+)+Togr(+)+Cover(+)+Shrubden(+)	-137.97987	7	296.9288	37.961	<0.001
Tofo(+)+Togr(+)+Cover(+)	-146.78395	6	304.6572	45.689	<0.001
Tofo(+)+Togr(+)+Tosh(+)+Bare(-)+Height(-)+Shrubw(-)	-134.03130	9	314.2952	55.327	<0.001

a I [Herman-Brunson] included the following vegetation variables in my models: total vegetative cover (TOCO), percent forb cover (TOFO), percent grass cover (TOGR), percent sagebrush cover (TOSH), sagebrush height (SHRUB HGT), sagebrush width (SHRUB W), site-VOR (COVER), percent bareground cover (BARE), sagebrush density/hectare (SHRUB DEN), and grass height around the Robel pole (HEIGHT).

b To facilitate interpretation, I [Herman-Brunson] excluded year indicator variable from model column.

APPENDIX J
Kaczor 2008

APPENDIX J Table 1. Mean vegetation characteristics of nest sites and random sites between years for greater sage-grouse used in logistic regression models in northwestern South Dakota, USA, using MRPP (Mielke and Berry 2001), 2006-2007. (Kaczor 2008)

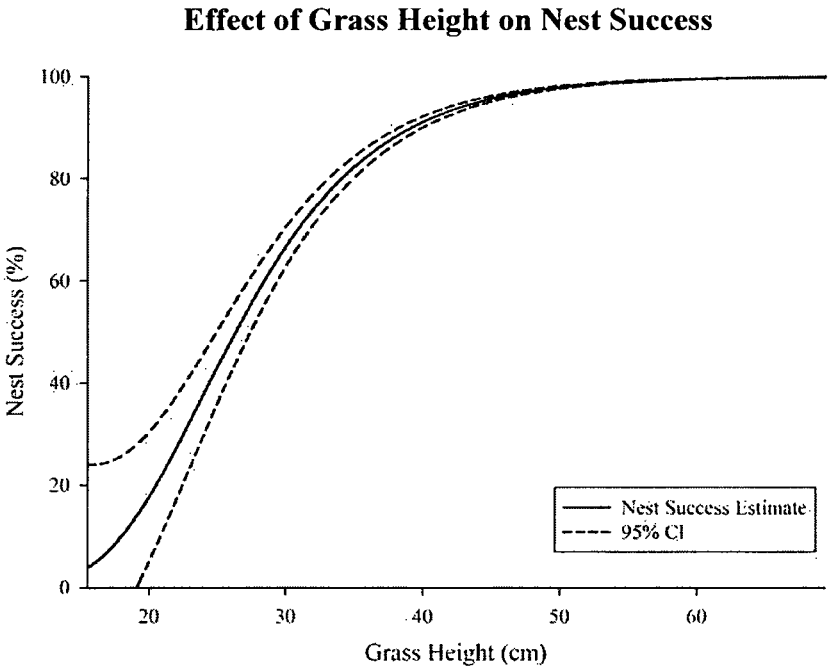
	Nest			Random			Both Years		
	2006	2007		2006	2007		Nest	Random	
Variable	(n=34)	(n=39)	P-value	(n=35)	(n=39)	P-value	(n=73)	(n=74)	P-value
Total Cover (%)	61.1	75.1	<0.01	55.8	66.1	<0.01	68.6	61.2	<0.01
Litter Cover (%)	7.6	7.1	0.79	6.5	6.1	0.88	7.4	6.3	0.04
Grass Cover (%)	24.2	31.4	0.01	21.1	25.8	0.21	28.1	23.6	0.01
Max Grass Hgt. (cm)	23.4	29.5	<0.01	20.4	25.0	<0.01	26.7	22.8	<0.01
Max Grass Hgt. 0-5 (cm)	25.7	30.9	0.02	20.3	24.3	0.01	28.5	22.4	<0.01
Visual Obstruction (cm)	5.5	11.1	<0.01	3.7	5.1	0.14	8.5	4.4	<0.01
Visual Obstruction 0m (cm)	20.8	29.4	<0.01	10.5	8.9	0.13	25.4	9.6	<0.01
Visual Obstruction 1m (cm)	7.3	13.7	<0.01	3.7	4.1	0.05	10.7	3.9	<0.01
Sagebrush Cover (%)	10.3	10.1	0.75	6.3	6.3	0.98	10.2	6.2	<0.01
Sagebrush Hgt. (cm)	25.8	29.7	0.04	23.8	24.0	0.97	27.9	23.9	<0.01

APPENDIX J Table 2. Observed mean values for habitat variables between greater sage-grouse successful and failed nests used in nest success models in northwestern South Dakota, USA, using MRPP (Mielke and Berry 2001) 2006-2007. (Kaczor 2008)

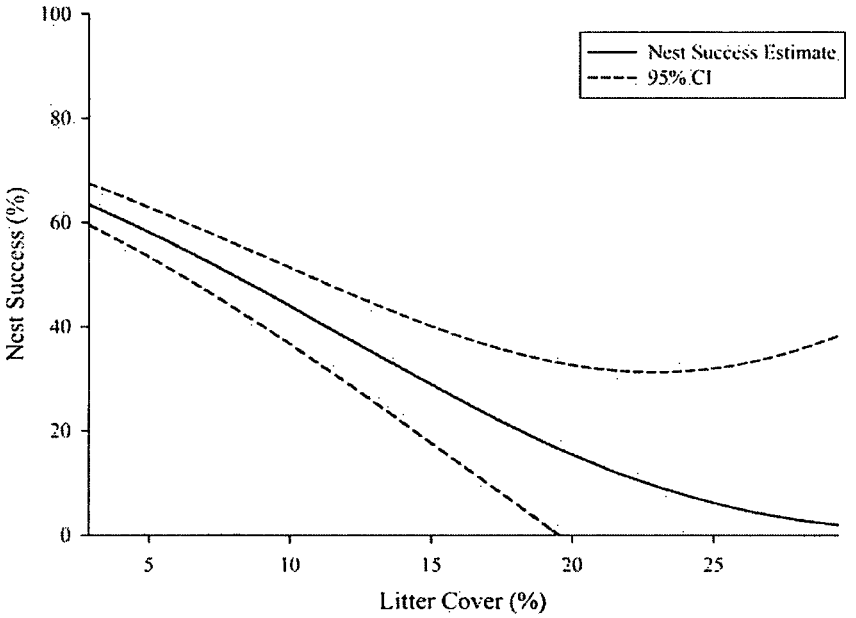
	Successful (n=33)		Failed (n=40)		
Variable	**Mean**	**SE**	**Mean**	**SE**	**P-value**
Max Grass Hgt. (cm)	30.64	1.6	23.4	1.0	<0.01
Litter Cover (%)	6.4	0.5	8.1	0.8	0.07
Forb Cover 0m (%)	5.3	0.8	3.9	0.6	0.09
Visual Obstruction (cm)	10.2	1.1	7.2	0.8	0.02

APPENDIX J Table 8. Observed mean values for habitat variables between greater sage-grouse brood-rearing and random sites, and between years used in logistic regression in northwestern South Dakota, USA, using MRPP (Mielke and Berry 2001) 2006-2007. (Kaczor 2008)

	Brood			Random			Both Years		
	2006	2007		2006	2007		Brood	Random	
Variable	(n=59)	(n=60)	P-value	(n=56)	(n=60)	P-value	(n=119)	(n=116)	P-value
Sagebrush Density (plants/m^2)	0.3	0.5	<0.01	0.7	0.4	<0.01	0.4	0.5	0.08
Sagebrush Cover (%)	4.6	4.7	0.94	4.5	2.8	0.03	4.6	3.6	0.04
Visual Obstruction (cm)	5.4	7.1	0.12	2.3	4.7	<0.01	6.2	3.5	<0.01
Grass Height (cm)	23.3	37.5	<0.01	19.2	31.9	<0.01	30.5	25.7	<0.01
Total Cover (%)	61.3	55.6	<0.01	51.0	51.0	1.00	58.4	51.0	<0.01
Grass Cover (%)	34.4	28.3	<0.01	28.6	24.8	0.26	31.3	26.6	<0.01
Japanese Brome Cover (%)	10.4	9.9	0.66	4.9	11.4	<0.01	10.1	8.3	0.04
Bluegrass Cover (%)	5.9	2.3	<0.01	3.8	2.2	<0.01	4.0	3.0	0.08



APPENDIX J Figure 5. Effect of grass height on greater sage-grouse nest success in northwestern South Dakota, USA, 2006-2007. Nest success estimate derived from back-transformed beta estimates included in top model. Confidence intervals estimated from the delta method (Seber 1982). (Kaczor 2008)



APPENDIX J Figure 7. Effect of litter canopy coverage on greater sage-grouse nest success in northwestern South Dakota, USA, 2006-2007. Nest success estimate derived from backtransformed beta estimates included in top model. Confidence intervals estimated from the delta method (Seber 1982). (Kaczor 2008)

APPENDIX J Appendix 3. Demographic information for all greater sage-grouse captured in northwestern South Dakota, USA, 2006-2007. (Kaczor 2008)

Band #	Capture Date	X[a]	Y[a]	Nearest Lek	Sex[b]	Age[c]	Weight (g)	Radio Freq.
1001	28-Mar-06	583058	4972413	Crago	F	A	1654	150.064
1002	31-Mar-06	583874	4972344	Crago	F	A	1552	150.073
1003	1-Apr-06	605131	4983015	Two Top	F	A	1618	150.083
1004	1-Apr-06	604838	4982844	Two Top	F	Y	1612	150.094
1005	1-Apr-06	604840	4983075	Two Top	F	A	1602	150.103
1006	1-Apr-06	605197	4983537	Two Top	F	A	1732	150.114
1007	1-Apr-06	605399	4982814	Two Top	F	A	1648	151.074
1008	3-Apr-06	594044	4989246	Widdoss	F	A	1586	150.133
1009	3-Apr-06	595437	4988647	Widdoss	F	Y	1734	150.145
1010	3-Apr-06	595437	4988647	Widdoss	F	Y	1464	150.155
1011	3-Apr-06	595437	4988647	Widdoss	F	Y	1482	151.085
1012	3-Apr-06	595594	4988735	Widdoss	F	A	1594	150.173
1013	3-Apr-06	595758	4988629	Widdoss	F	Y	1482	150.183
1014	3-Apr-06	595619	4988954	Widdoss	F	Y	1520	150.193
1015	4-Apr-06	623696	4994653	McFarland	F	A	1758	150.204
1016	4-Apr-06	623922	4994453	McFarland	F	Y	1556	150.214
1017	5-Apr-06	583265	4972042	Crago	F	A	1650	150.353
1018	5-Apr-06	581965	4969635	Rumph	F	Y	1520	150.363
1019	7-Apr-06	606987	5006247	County Line	F	Y	1610	150.373
1020	7-Apr-06	606596	5006738	County Line	F	A	1704	150.383
1021	7-Apr-06	606596	5006738	County Line	F	A	1626	151.014
1022	7-Apr-06	606490	5006922	County Line	F	A	1610	151.022
1023	7-Apr-06	606616	5007299	County Line	F	A	1806	151.033
1024	7-Apr-06	606053	5006751	County Line	F	A	1590	150.503
1025	7-Apr-06	605932	5006832	County Line	F	A	1642	150.703
1026	7-Apr-06	605849	5006714	County Line	F	A	1634	150.714
1027	8-Apr-06	623462	4994283	McFarland	F	A	1756	150.732
1028	8-Apr-06	623243	4995268	McFarland	F	A	1738	150.973
1029	8-Apr-06	623243	4995268	McFarland	F	Y	1470	150.764
1030	8-Apr-06	623494	4994808	McFarland	F	A	1606	150.772
1031	9-Apr-06	583034	4972327	Crago	F	Y	1472	150.785
1032	9-Apr-06	581219	4969831	Rumph	F	Y	1628	150.804
1033	9-Apr-06	581315	4969863	Rumph	F	Y	1613	150.812
1034	9-Apr-06	581512	4969966	Rumph	F	A	1636	151.333
1035	9-Apr-06	581403	4970033	Rumph	F	A	1782	151.343
1036	9-Apr-06	583487	4972092	Crago	F	Y	1544	151.353
1037	9-Apr-06	594466	4990149	Widdoss	F	A	1690	151.362
1038	10-Apr-06	605130	4983164	Two Top	F	Y	1658	151.375
1039	10-Apr-06	604967	4983102	Two Top	F	Y	1594	151.382
1040	10-Apr-06	604946	4983024	Two Top	F	Y	1480	151.393
1041	17-Jul-06	626931	4986394	Quad 7	unk	C	558	150.024
1042	17-Jul-06	626931	4986394	Quad 7	unk	C	422	151.553
1043	17-Jul-06	626931	4986394	Quad 7	unk	C	468	151.533
1044	17-Jul-06	617726	4993470	McFarland	unk	C	466	150.993
1045	17-Jul-06	617726	4993470	McFarland	unk	C	664	151.442
1046	17-Jul-06	617726	4993470	McFarland	unk	C	476	151.422
1047	18-Jul-06	602067	4986019	Widdoss	unk	C	490	150.573
1048	18-Jul-06	600432	4986227	Widdoss	unk	C	576	150.654

Band #	Capture Date	X[a]	Y[a]	Nearest Lek	Sex[b]	Age[c]	Weight (g)	Radio Freq.
1049	18-Jul-06	600432	4986227	Widdoss	unk	C	698	151.503
1050	18-Jul-06	600512	4987086	Widdoss	unk	C	338	151.151
1051	18-Jul-06	600512	4987086	Widdoss	unk	C	432	151.524
1052	18-Jul-06	600512	4987086	Widdoss	unk	C	600	151.245
1053	18-Jul-06	600512	4987086	Widdoss	unk	C	466	151.524
1054	18-Jul-06	596981	4987357	Widdoss	unk	C	646	151.562
1055	18-Jul-06	596981	4987357	Widdoss	unk	C	838	151.483
1056	17-Jul-06	617726	4993470	McFarland	F	A	1362	151.413
1057	18-Jul-06	596981	4987357	Widdoss	unk	C	812	151.543
1058	18-Jul-06	596981	4987357	Widdoss	unk	C	816	151.094
1059	18-Jul-06	596981	4987357	Widdoss	unk	C	644	151.533
1060	19-Jul-06	606966	4983857	Two Top	unk	C	642	151.713
1061	19-Jul-06	606966	4983857	Two Top	unk	C	628	151.453
1062	20-Jul-06	600796	4987123	Widdoss	unk	C	552	151.733
1063	31-Jul-06	599438	4991214	Widdoss	unk	C	430	150.284
1064	31-Jul-06	599438	4991214	Widdoss	unk	C	396	150.303
1065	2-Aug-06	606586	5004830	County Line	unk	C	566	151.043
1066	10-Aug-06	600069	5012561	Split Lek	unk	C	602	150.443
1067	10-Aug-06	600069	5012561	Split Lek	unk	C	494	150.524
1069	19-Jul-07	600206	4986435	Two Top	M	C	612	151.942
1070	19-Jul-07	600206	4986435	Two Top	unk	C	486	151.803
1071	19-Jul-07	600206	4986435	Two Top	unk	C	552	151.755
1072	19-Jul-07	600206	4986435	Two Top	unk	C	656	151.763
1073	19-Jul-07	600206	4986435	Two Top	unk	C	510	151.783
1074	19-Jul-07	600206	4986435	Two Top	M	C	552	151.934
1077	19-Jul-06	569728	4980943	State Line	unk	C	630	150.402
1078	19-Jul-06	569728	4980943	State Line	unk	C	500	150.127
1079	19-Jul-06	569728	4980943	State Line	unk	C	662	150.022
1080	31-Jul-06	570999	4978754	State Line	unk	C	420	150.163
1081	31-Jul-06	570999	4978754	State Line	unk	C	460	150.742
1082	20-Jul-06	600777	4987058	Widdoss	unk	C	632	N/A
1083	20-Jul-06	600777	4987058	Widdoss	unk	C	520	N/A
1084	20-Jul-06	600777	4987058	Widdoss	unk	C	584	N/A
1085	20-Jul-06	600234	4986337	Widdoss	unk	C	568	N/A
1086	20-Jul-06	600234	4986337	Widdoss	unk	C	626	N/A
1087	20-Jul-06	600234	4986337	Widdoss	unk	C	642	N/A
1088	20-Jul-06	600234	4986337	Widdoss	unk	C	640	N/A
1090	22-Aug-06	603221	4985402	Widdoss	unk	C	N/A	N/A
1092	22-Aug-06	603221	4985402	Widdoss	unk	C	N/A	N/A
1093	22-Aug-06	603221	4985402	Widdoss	unk	C	N/A	N/A
1094	22-Aug-06	603221	4985402	Widdoss	F	Y	N/A	N/A
1095	22-Aug-06	603221	4985402	Widdoss	F	C	N/A	151.123
1096	22-Aug-06	603221	4985402	Widdoss	unk	C	N/A	N/A
1097	20-Mar-07	624299	4994777	McFarland	F	Y	1566	150.984
1098	21-Mar-07	585688	4972089	Crago	F	Y	1474	150.954
1099	20-Mar-07	628371	4995961	Quad 7	F	A	N/A	N/A
1100	21-Mar-07	624274	4994608	McFarland	F	A	N/A	N/A
1101	22-Mar-07	603438	5007080	County Line	F	Y	1492	151.002
1102	22-Mar-07	585462	4970879	Crago	F	A	N/A	N/A
1103	26-Mar-07	594427	4989883	Widdoss	F	Y	1396	151.053

Band #	Capture Date	X[a]	Y[a]	Nearest Lek	Sex[b]	Age[c]	Weight (g)	Radio Freq.
1104	26-Mar-07	594408	4989863	Widdoss	F	A	1684	151.064
1105	1-Apr-07	unk	unk	unk	F	unk	unk	N/A
1106	1-Apr-07	unk	unk	unk	F	unk	unk	N/A
1107	1-Apr-07	unk	unk	unk	F	unk	unk	N/A
1108	1-Apr-07	unk	unk	unk	F	unk	unk	N/A
1109	23-Mar-07	605528	4982812	Two Top	F	A	N/A	N/A
1110	26-Mar-07	594255	5990427	Widdoss	F	Y	1498	151.103
1111	26-Mar-07	593709	4990683	Widdoss	F	A	1634	151.115
1112	26-Mar-07	593709	4990683	Widdoss	F	Y	1552	151.133
1119	19-Jul-07	603730	4988165	Two Top	unk	C	560	151.133
1120	19-Jul-07	603730	4988165	Two Top	unk	C	380	150.624
1121	19-Jul-07	603730	4988165	Two Top	unk	C	422	150.064
1122	19-Jul-07	606678	4984369	Two Top	unk	C	798	150.643
1123	19-Jul-07	606678	4984369	Two Top	unk	C	774	150.673
1124	19-Jul-07	606678	4984369	Two Top	unk	C	772	150.683
1125	19-Jul-07	606678	4984369	Two Top	unk	C	812	151.824
1126	23-Jul-07	580091	4970734	South Owl	unk	C	590	150.722
1127	23-Jul-07	589059	4991119	Widdoss	unk	C	532	150.793
1128	23-Jul-07	589059	4991119	Widdoss	unk	C	506	150.824
1129	23-Jul-07	589059	4991119	Widdoss	unk	C	682	150.833
1130	23-Jul-07	589059	4991119	Widdoss	unk	C	562	150.764
1131	24-Jul-07	606022	5009500	County Line	unk	C	602	150.373
1132	24-Jul-07	592056	4990220	Widdoss	unk	C	914	151.895
1133	24-Jul-07	600496	4985607	Two Top	unk	C	874	150.873
1134	2-Aug-07	608346	5002699	County Line	unk	C	966	150.883
1135	2-Aug-07	606150	5009419	County Line	unk	C	554	150.914
1136	7-Aug-07	594637	4987901	Widdoss	unk	C	566	150.923
1151	24-Oct-07	605829	5006655	County Line	M	C	2252	151.583
1152	24-Oct-07	595309	4988513	Widdoss	F	A	1500	151.393
1153	24-Oct-07	595420	4988559	Widdoss	F	A	1544	150.094
1154	24-Oct-07	605921	5006498	County Line	F	A	1496	151.363
1155	24-Oct-07	605844	5006720	County Line	F	A	1476	150.973
1501	31-Mar-06	583997	4972302	Crago	M	A	3040	151.036
1502	4-Apr-06	623572	4994708	McFarland	M	A	2920	151.194
1503	10-Apr-06	604849	4982804	Two Top	M	A	3320	151.574
1504	10-Apr-06	604701	4983175	Two Top	M	A	3216	151.585
1505	10-Apr-06	604879	4982796	Two Top	M	A	3304	151.594
1506	4-May-06	606663	5006951	County Line	M	A	3058	151.604
1507	4-May-06	606476	5006526	County Line	M	A	3048	151.614
1508	4-May-06	606663	5006951	McFarland	M	A	3022	151.962
1509	4-May-06	624042	4994699	McFarland	M	A	3094	151.973
1510	4-May-06	606508	5007060	County Line	M	A	2962	151.645
1511	5-May-06	583496	4972516	Crago	M	A	3040	151.655
1512	5-May-06	583783	4972382	Crago	M	A	3254	151.664
1513	5-May-06	581257	4969846	Rumph	M	A	2954	151.675
1514	5-May-06	594613	4989913	Widdoss	M	A	3078	151.983
1515	5-May-06	594548	4989957	Widdoss	M	A	3206	151.994
1516	5-May-06	594573	4989618	Widdoss	M	A	3044	151.036
1517	5-May-06	594437	4989670	Widdoss	M	A	3066	N/A
1518	5-May-06	594393	4989788	Widdoss	M	A	3010	N/A

Band #	Capture Date	X[a]	Y[a]	Nearest Lek	Sex[b]	Age[c]	Weight (g)	Radio Freq.
1519	5-May-06	594605	4989797	Widdoss	M	A	3030	N/A
1520	20-Mar-07	624060	4994448	McFarland	M	A	3344	151.982
1522	26-Mar-07	594402	4989990	Widdoss	M	A	3140	151.803
1523	26-Mar-07	593674	4989252	Widdoss	M	Y	2378	151.813
1524	26-Mar-07	594499	4989909	Widdoss	M	A	3124	151.824
1525	26-Mar-07	594409	4989727	Widdoss	M	A	3206	151.834
1526	8-May-07	606576	5006401	County Line	M	A	2932	151.843
1527	8-May-07	606581	5006401	County Line	M	Y	2302	151.854
1528	8-May-07	606648	5006757	County Line	M	A	2762	151.883
1529	8-May-07	606649	5006756	County Line	M	Y	2174	151.903
1530	10-Apr-07	583326	4972901	Crago	M	A	3234	151.914
1531	10-Apr-07	583278	4972599	Crago	M	Y	2752	151.923
1532	10-Apr-07	583280	4972594	Crago	M	Y	2550	151.934
1533	6-Apr-07	623766	4994869	McFarland	M	A	3138	151.942
1534	6-Apr-07	623813	4994912	McFarland	M	A	3046	151.956
1535	10-Apr-07	583324	4972905	Crago	M	A	2958	151.895
1536	8-May-07	632577	5029924	Squaw Creek	M	A	3230	N/A
1537	8-May-07	632419	5029864	Squaw Creek	M	A	2804	N/A
1538	8-May-07	632427	5029824	Squaw Creek	M	A	3146	N/A
1539	8-May-07	632308	5029856	Squaw Creek	M	A	3051	N/A
1540	8-May-07	632283	5029860	Squaw Creek	M	A	3190	N/A
1541	8-May-07	632251	5029908	Squaw Creek	M	A	2962	N/A
1542	8-May-07	632296	5029969	Squaw Creek	M	A	2500	N/A
1543	8-May-07	632281	5029958	Squaw Creek	M	A	2900	N/A
1544	8-May-07	632356	5029936	Squaw Creek	M	A	3190	N/A
1545	8-May-07	632099	5029946	Squaw Creek	M	A	2806	N/A
1546	8-May-07	594446	4989880	Widdoss	M	Y	2316	151.175
1547	9-May-07	605043	4982559	Two Top	M	A	2926	151.824
1548	9-May-07	583447	4972548	Crago	M	A	2828	151.895
1549	9-May-07	583149	4972598	Crago	M	Y	2310	151.914
1550	9-May-07	583115	4972531	Crago	M	A	3134	151.923
1601	16-May-06	586803	5042787	Valley Creek	M	Y	2352	N/A
1604	16-May-06	586476	5042810	Valley Creek	M	A	2874	N/A
1606	16-May-06	586717	5042928	Valley Creek	M	Y	2414	N/A
1607	16-May-06	586319	5042651	Valley Creek	M	A	2868	N/A
1608	16-May-06	586522	5042693	Valley Creek	M	A	3170	N/A
1609	16-May-06	586685	5042726	Valley Creek	M	A	3002	N/A
1610	16-May-06	586528	5042756	Valley Creek	M	A	2922	N/A
1611	16-May-06	586794	5042842	Valley Creek	M	Y	2298	N/A
1612	16-May-06	586799	5042754	Valley Creek	M	A	2864	N/A
1613	16-May-06	586671	5042868	Valley Creek	M	A	2918	N/A
1614	16-May-06	586660	5042780	Valley Creek	M	A	2738	N/A
1615	16-May-06	586597	5042715	Valley Creek	M	A	2852	N/A
1616	16-May-06	586509	5042708	Valley Creek	M	A	2990	N/A
1617	16-May-06	586433	5042659	Valley Creek	M	A	2920	N/A
1618	16-May-06	586317	5042837	Valley Creek	M	A	3034	N/A
1619	16-May-06	586459	5042861	Valley Creek	M	A	2896	N/A

[a] UTM coordinates in NAD27, zone 13.

[b] Sex classification are: F-female, M-male, and unk-unknown.

[c] Age classification are: A-adult, Y-yearling, and C-hatch year chick.

APPENDIX K
Smith 2003

APPENDIX K Appendix H. Selected microhabitat survey information form lek sites and sample sites within 1.5 km buffer of North Dakota, South Dakota, and Montana greater sage grouse leks, 2001 and 2002. (Smith 2003)

Year	State	County	Lek	Site	Easting	Northing	Cover % ARTR2	Cover % ARCA13	Cover % Forb	Cover % Grass	Cover % Bare	Cover % Litter
2001	SD	Butte	3B	LEK	599523	4986753	10	0	0.98	31.4	70.45	11.15
2001	SD	Butte	3B	1	599023	4987753	0	0	2.5	74	6.5	33
2001	SD	Butte	3B	2	600023	4987753	2	0	15.45	40.15	28.3	41.28
2001	SD	Butte	3B	3	598523	4987253	0	0	4.05	73.65	2.23	31.15
2001	SD	Butte	3B	4	599523	4987253	10	0	1.3	36.08	58.43	13.28
2001	SD	Butte	3B	5	600523	4987253	1	0	16.03	38.13	23.43	53.5
2001	SD	Butte	3B	6	599023	4986753	8	0	0.8	39.03	58.48	9.18
2001	SD	Butte	3B	7	600023	4986753	10	0	1.08	22.65	73.63	7.88
2001	SD	Butte	3B	8	598523	4986253	0	0	4.38	52.43	30.19	27.7
2001	SD	Butte	3B	9	599523	4986253	0	0	3.65	62.2	10.18	46.98
2001	SD	Butte	3B	10	600523	4986253	2	0	1.4	32.45	31.85	40.9
2001	SD	Butte	3B	11	599023	4985753	5	0	4.3	49.95	43.43	21.15
2001	SD	Butte	3B	12	600023	4985753	7	0	2.33	30.43	63.35	9.98
2001	SD	Butte	4B	LEK	612622	4977981	0	0	1.6	57.8	42.83	9.33
2001	SD	Butte	4B	1	612122	4978981	0	0	1.23	65.13	24.5	23.7
2001	SD	Butte	4B	2	613122	4978981	0	0	4.43	21.95	75.03	5.13
2001	SD	Butte	4B	3	611622	4978481	0	0	4.95	60.88	21.13	36
2001	SD	Butte	4B	4	612622	4978481	0	0	0.95	58.05	37.5	12.08
2001	SD	Butte	4B	5	613622	4978481	0	0	12.23	38.28	41.73	24.35
2001	SD	Butte	4B	6	612122	4977981	0	0	3.08	45.03	49.5	15.48
2001	SD	Butte	4B	7	613122	4977981	0	0	2.5	41.83	45.4	19.83
2001	SD	Butte	4B	8	611622	4977481	3	0	8.78	47.55	34.23	24.75
2001	SD	Butte	4B	9	612622	4977481	5	0	10.08	46.53	35.28	22.38
2001	SD	Butte	4B	10	613622	4977481	0	0	12.63	33.4	39.98	36.15
2001	SD	Butte	4B	11	612122	4976981	4	0	5.5	33.83	58.3	14.05
2001	SD	Butte	4B	12	613122	4976981	6	0	5.85	34.55	46.4	24.05
2001	SD	Butte	5B	LEK	606336	5006861	2	0	17.3	51.95	34.98	12.5
2001	SD	Butte	5B	1	605836	5007861	2	0	8.5	53.8	23.25	21.08
2001	SD	Butte	5B	2	606836	5007861	1	0	3.83	56.5	9.15	41.23
2001	SD	Butte	5B	3	605336	5007361	7	0	13.2	33.03	45.58	14.25
2001	SD	Butte	5B	4	606336	5007361	6	0	0.9	25.98	45.4	29.9
2001	SD	Butte	5B	5	607336	5007361	2	0	5.58	54.2	12.98	50
2001	SD	Butte	5B	6	605836	5006861	9	0	0.5	26.2	67.9	8.68
2001	SD	Butte	5B	7	606836	5006861	16	0	0.95	6.73	67.4	17.78
2001	SD	Butte	5B	8	605336	5006361	3	0	8.68	45.63	22.9	28.93
2001	SD	Butte	5B	9	606336	5006361	6	0	3.45	20.85	73.1	8.05
2001	SD	Butte	5B	10	607336	5006361	4	0	5.65	24.05	47.75	27.63
2001	SD	Butte	5B	11	605836	5005861	6	0	3.08	17.38	61.48	20.35

Year	State	County	Lek	Site	Easting	Northing	Cover % ARTR2	Cover % ARCA13	Cover % Forb	Cover % Grass	Cover % Bare	Cover % Litter
2001	SD	Butte	5B	12	606836	5005861	3	0	2.4	66.75	16.43	23.1
2001	SD	Butte	6B	LEK	587317	4996578	4	0	1.68	42.9	51.63	17.43
2001	SD	Butte	6B	1	586817	4997578	0	0	6.7	46.88	23.3	34
2001	SD	Butte	6B	2	587817	4997578	0	0	6.48	78.48	7.1	20.35
2001	SD	Butte	6B	3	586317	4997078	0	0	9.9	82.8	7.98	44.4
2001	SD	Butte	6B	4	587317	4997078	0	0	4.38	53	29.75	27.43
2001	SD	Butte	6B	5	588317	4997078	2	0	6.58	51.75	15.9	45.18
2001	SD	Butte	6B	6	586817	4996578	3	0	5.88	49.7	34.4	31.8
2001	SD	Butte	6B	7	587817	4996578	0	0	7.63	43.65	37.63	30.38
2001	SD	Butte	6B	8	586317	4996078	1	0	0.6	45	39.78	26.35
2001	SD	Butte	6B	9	587317	4996078	3	0	2	51.5	33.98	19.73
2001	SD	Butte	6B	10	588317	4996078	5	0	6.15	36.75	54.68	21.13
2001	SD	Butte	6B	11	586817	4995578	3	0	2.53	39.4	53.03	20.28
2001	SD	Butte	6B	12	587817	4995578	2	0	5.3	32.23	53.63	25.53
2001	SD	Butte	9B	LEK	587883	4963874	5	0	14.53	79.38	3.9	20.95
2001	SD	Butte	9B	1	587383	4964874	.	.	.	.	.	.
2001	SD	Butte	9B	2	588383	4964874	8	0	6.98	73.2	11.13	27.75
2001	SD	Butte	9B	3	586883	4964374	0	0	3.7	84.35	0.93	22.75
2001	SD	Butte	9B	4	587883	4964374	12	0	1.63	25.05	67.88	14.35
2001	SD	Butte	9B	5	588883	4964374	8	0	4.5	49.95	27.75	30.65
2001	SD	Butte	9B	6	587383	4963874	0	0	4.7	88.55	3.48	19.75
2001	SD	Butte	9B	7	588383	4963874	6	0	13.1	68.98	17.43	15.23
2001	SD	Butte	9B	8	586883	4963374	6	0	0.85	52.15	45.88	13.98
2001	SD	Butte	9B	9	587883	4963374	2	0	11.1	85.63	4.33	12.35
2001	SD	Butte	9B	10	588883	4963374	12	0	5.58	47.08	38.6	25.35
2001	SD	Butte	9B	11	587383	4932874	5	0	9.75	63.7	20.93	20.3
2001	SD	Butte	9B	12	588383	4932874	2	0	3.95	85.65	7.08	14.9
2001	SD	Butte	10B	LEK	580779	4969908	0	0	10.2	32.15	42.1	24
2001	SD	Butte	10B	1	580279	4970908	1	0	9.28	41.43	32.78	32.5
2001	SD	Butte	10B	2	581279	4970908	5	6	7.5	80.85	0.65	57.25
2001	SD	Butte	10B	3	579779	4970408	1	0	2.35	36.65	57.28	15.6
2001	SD	Butte	10B	4	580779	4970408	11	0	24.15	57.43	0.15	48.38
2001	SD	Butte	10B	5	581779	4970408	1	0	5.13	79.28	0.15	25.83
2001	SD	Butte	10B	6	580279	4969908	6	0	8.43	61	12.83	31.25
2001	SD	Butte	10B	7	581279	4969908	4	0	10.3	56.18	12.18	37.43
2001	SD	Butte	10B	8	579779	4969408	1	0	10.68	28.83	49.75	27.05
2001	SD	Butte	10B	9	580779	4969408	8	0	6.1	64.83	13.8	33.63
2001	SD	Butte	10B	10	581779	4969408	7	0	12.08	67.88	4.3	40.75
2001	SD	Butte	10B	11	580279	4968908	0	0	0.98	20.83	75.75	6.1
2001	SD	Butte	10B	12	581279	4968908	1	0	8.15	24.08	53.3	25.93

Year	State	County	Lek	Site	Easting	Northing	Cover % ARTR2	Cover % ARCA13	Cover % Forb	Cover % Grass	Cover % Bare	Cover % Litter
2001	SD	Butte	11B	LEK	580877	4956628	1	0	0.35	30.85	57.18	12.13
2001	SD	Butte	11B	1	580377	4957628	4	0	6.03	29.95	57.03	7.7
2001	SD	Butte	11B	2	581377	4957628	3	0	6.53	35	40	20.78
2001	SD	Butte	11B	3	579877	4957128	0	0	37.68	3.38	45.2	14
2001	SD	Butte	11B	4	580877	4957128	4	0	7.43	33.25	46.33	13.25
2001	SD	Butte	11B	5	581877	4957128	.	.	.	.	.	.
2001	SD	Butte	11B	6	580377	4956628	1	0	2.98	35.4	44.8	24
2001	SD	Butte	11B	7	581377	4956628	4	0	3.43	23.55	61.55	11.85
2001	SD	Butte	11B	8	579877	4956128	0	0	10.88	27.33	43.38	21.65
2001	SD	Butte	11B	9	580877	4956128	1	1	2.4	42.48	42.15	11.38
2001	SD	Butte	11B	10	581877	4956128	4	0	2.25	21.05	60.73	16.13
2001	SD	Butte	11B	11	580377	4955628	4	0	10.18	39.18	24.48	26.83
2001	SD	Butte	11B	12	581377	4955628	3	0	2.33	31.73	42.35	23.93
2001	SD	Butte	12B	LEK	605185	4982068	0	0	10.73	59.18	8.7	36.03
2001	SD	Butte	12B	1	604685	4983068	6	0	16.25	45.03	34.3	22.8
2001	SD	Butte	12B	2	605685	4983068	4	0	5.18	66.7	4.45	35.8
2001	SD	Butte	12B	3	604185	4982569	4	0	13.35	50.25	23.48	29.88
2001	SD	Butte	12B	4	605185	4982569	8	0	7.58	28.75	65.5	5.13
2001	SD	Butte	12B	5	606185	4982569	0	0	8.4	77.33	1	22.43
2001	SD	Butte	12B	6	604685	4982068	3	0	11.08	53.18	20.05	35.3
2001	SD	Butte	12B	7	605685	4982068	4	0	5.5	70.18	7.45	28.35
2001	SD	Butte	12B	8	604185	4981568	1	0	9.42	42.5	13.29	52.76
2001	SD	Butte	12B	9	605185	4981568	4	0	16.35	55.63	10.75	41.13
2001	SD	Butte	12B	10	606185	4981568	5	0	9.08	43.83	18.53	42.13
2001	SD	Butte	12B	11	604685	4981068	4	0	7.98	56.25	29.93	21.5
2001	SD	Butte	12B	12	605685	4981068	0	0	8.8	39.53	41.65	24.83
2001	SD	Butte	13B	LEK	594639	4989792	7	0	3.65	18.93	71.6	10.73
2001	SD	Butte	13B	1	594139	4990792	5	0	5.25	37.88	48.3	22.3
2001	SD	Butte	13B	2	595139	4990792	0	0	6.8	45.25	37.58	31.43
2001	SD	Butte	13B	3	593639	4990292	6	0	6.5	25.25	65.03	15.55
2001	SD	Butte	13B	4	494639	4990292	6	0	5.53	27.78	61.9	14.68
2001	SD	Butte	13B	5	595639	4990292	1	0	4.73	35.5	55.95	13.5
2001	SD	Butte	13B	6	594139	4989792	3	0	9.1	35.5	37	24
2001	SD	Butte	13B	7	595139	4989792	8	0	3.5	45.45	41.4	22.88
2001	SD	Butte	13B	8	593639	4989292	12	0	5.93	39.4	38.93	34
2001	SD	Butte	13B	9	594639	4989292	2	0	14.68	51.53	14.78	45.5
2001	SD	Butte	13B	10	595639	4989292	7	0	7.05	35.38	59.5	20.48
2001	SD	Butte	13B	11	595139	4988792	0	0	15.63	36.4	11.88	58.33
2001	SD	Butte	13B	12	595139	4988792	7	0	2.83	27.18	73.95	10.8
2001	SD	Butte	14B	LEK	591209	4982129	0	0	4.4	36.58	37.75	30.25

Year	State	County	Lek	Site	Easting	Northing	Cover % ARTR2	Cover % ARCA13	Cover % Forb	Cover % Grass	Cover % Bare	Cover % Litter
2001	SD	Butte	14B	1	590809	4983129	0	0	12.98	52	19.8	23.13
2001	SD	Butte	14B	2	591809	4983129	0	0	6.85	59.83	20.9	17.88
2001	SD	Butte	14B	3	590309	4982629	0	0	7.8	93.05	0.2	7.2
2001	SD	Butte	14B	4	591309	4982629	0	0	4.15	55.53	19.25	34.73
2001	SD	Butte	14B	5	592309	4982629	0	0	15.3	49.1	21.78	28.1
2001	SD	Butte	14B	6	590809	4982129	0	0	10.55	65	9.2	26.5
2001	SD	Butte	14B	7	591809	4982129	0	0	14.23	66.25	3.95	34.13
2001	SD	Butte	14B	8	590309	4981629	0	0	9.1	65	21.48	33.38
2001	SD	Butte	14B	9	591309	4981629	0	0	21	58.3	25.45	19.53
2001	SD	Butte	14B	10	592309	4981629	0	0	14.45	62.75	38.95	14.93
2001	SD	Butte	14B	11	590809	4981129	0	0	5.88	83.63	1.03	43.5
2001	SD	Butte	14B	12	591809	4981129	0	0	24.85	66.38	15.4	20.5
2001	SD	Butte	15B	LEK	583325	4972585	0	0	5.18	25.18	64.28	13.55
2001	SD	Butte	15B	1	582825	4973585	0	0	5.86	5.07	84.29	9.21
2001	SD	Butte	15B	2	583825	4973585	0	0	9.68	15.9	71.4	8.33
2001	SD	Butte	15B	3	582325	4973085	3	2	7.95	61.3	17.18	34.38
2001	SD	Butte	15B	4	583325	4973085	3	0	6.13	40.78	35.6	27.5
2001	SD	Butte	15B	5	584325	4973085	1	0	2.1	37.78	52	18.2
2001	SD	Butte	15B	6	582825	4972585	5	0	12.3	41.55	27.13	35.63
2001	SD	Butte	15B	7	583825	4972585	1	0	3.63	53.6	23.7	29
2001	SD	Butte	15B	8	582325	4972085	3	0	6.95	51.38	15.05	36.38
2001	SD	Butte	15B	9	583325	4972085	1	0	12.8	56.83	12.78	29
2001	SD	Butte	15B	10	584325	4972085	4	0	6	30.85	40.08	23.8
2001	SD	Butte	15B	11	582825	4971585	6	0	10.7	53.6	24.38	29.05
2001	SD	Butte	15B	12	583825	4971585	0	0	7.43	59.05	13.25	34.38
2001	SD	Fall River	1FR	LEK	581629	4796587	2	0	12.38	37.7	34.7	15.25
2001	SD	Fall River	1FR	1	581129	4797587	0	0	2.88	90.75	0	11.5
2001	SD	Fall River	1FR	2	582129	4797587	1	0	8.05	49.18	9.25	34.58
2001	SD	Fall River	1FR	3	580629	4791087	0	0	4.48	37.88	41.35	16.88
2001	SD	Fall River	1FR	4	581629	4791087	0	0	6.8	25	56.5	12
2001	SD	Fall River	1FR	5	582629	4791087	0	0	3.68	45.43	8.48	43.5
2001	SD	Fall River	1FR	6	581129	4796587	0	0	2.8	41.88	38.05	17.53
2001	SD	Fall River	1FR	7	582129	4796587	1	0	6.23	21.8	59.55	13.05
2001	SD	Fall River	1FR	8	580629	4796087	0	0	3.48	62.1	17.45	17.08
2001	SD	Fall River	1FR	9	581629	4796087	2	0	5.45	45.83	17.3	38.95
2001	SD	Fall River	1FR	10	582629	4796087	7	0	6.68	42	35.48	27.33
2001	SD	Fall River	1FR	11	581129	4795587	0	0	4.13	59.75	19.5	16.5
2001	SD	Fall River	1FR	12	582129	4795587	0	0	0.65	68.8	22.55	18.13
2001	SD	Harding	1H	LEK	637154	5029503	2	0	9.3	42.78	5.78	54.18
2001	SD	Harding	1H	1	636654	5030503	.	.	.	.	.	.

Year	State	County	Lek	Site	Easting	Northing	Cover % ARTR2	Cover % ARCA13	Cover % Forb	Cover % Grass	Cover % Bare	Cover % Litter
2001	SD	Harding	1H	2	637654	5030503	0	2	16.18	62.58	2.6	30.53
2001	SD	Harding	1H	3	636154	5030003	12	0	11.55	48.35	13.3	38.5
2001	SD	Harding	1H	4	637154	5030003	0	3	21.8	54.15	4.2	46.75
2001	SD	Harding	1H	5	638154	5030003	14	0	5.7	55.85	10.45	44.55
2001	SD	Harding	1H	6	636654	5029503	5	0	14.75	35.83	12.13	50.65
2001	SD	Harding	1H	7	637654	5029503	1	2	13.35	51.55	5.5	45.93
2001	SD	Harding	1H	8	636154	5029003	3	6	10.9	45.33	2.1	63.33
2001	SD	Harding	1H	9	637154	5029003	0	2	9.08	48.33	7.6	44.75
2001	SD	Harding	1H	10	638154	5029003	1	3	14.58	58.75	2.25	36
2001	SD	Harding	1H	11	636654	5028503	3	3	12.03	38.03	14.68	47.14
2001	SD	Harding	1H	12	637654	5028503	4	1	11.18	41	30.53	32.53
2001	SD	Harding	2H	LEK	584376	5044130	7	0	2.05	25.75	23.73	57.43
2001	SD	Harding	2H	1	583876	5045130	0	0	7.45	24.68	16.95	62.03
2001	SD	Harding	2H	2	584876	5045130	0	0	12.83	67.95	1.43	32.55
2001	SD	Harding	2H	3	583376	5044630	2	0	4.3	25.78	7.53	72.28
2001	SD	Harding	2H	4	584376	5044630	4	0	2.03	44.95	6.15	59.6
2001	SD	Harding	2H	5	585376	5044630	0	0	3.53	75.78	2.55	25.13
2001	SD	Harding	2H	6	583876	5044130	6	0	3.2	48.68	3.43	59
2001	SD	Harding	2H	7	584876	5044130	2	0	3.5	72.8	4.28	27.3
2001	SD	Harding	2H	8	583376	5943630	7	0	0.28	14.5	21.13	73.08
2001	SD	Harding	2H	9	584376	5043630	11	0	2.1	40.63	24.33	41.28
2001	SD	Harding	2H	10	585376	5043630	2	0	9.68	65.65	4.65	31.13
2001	SD	Harding	2H	11	583876	5043130	0	0	8.42	56.55	8.12	40.64
2001	SD	Harding	2H	12	584876	5043130	9	0	1.25	29.2	22.9	53.95
2001	SD	Harding	3H	LEK	580533	5065647	1	0	6.58	44.28	5.98	57
2001	SD	Harding	3H	1	580033	5066647	0	0	9.93	77.63	5.05	22.63
2001	SD	Harding	3H	2	581033	5066647	0	0	12.2	70.5	3.78	33.13
2001	SD	Harding	3H	3	579533	5066147	0	0	8.78	52.45	1	54.08
2001	SD	Harding	3H	4	580533	5066147	1	0	6.1	51	6.38	50.38
2001	SD	Harding	3H	5	581533	5066147	2	0	2.65	39.25	11.68	62.08
2001	SD	Harding	3H	6	580033	5065647	0	0	13.05	46.7	2.3	51.93
2001	SD	Harding	3H	7	581033	5065647	3	0	3.8	30.05	23.23	60.98
2001	SD	Harding	3H	8	579533	5065147	6	0	8.95	48.75	8.58	44.75
2001	SD	Harding	3H	9	580533	5065147	0	0	21.08	48.95	6.05	40.85
2001	SD	Harding	3H	10	581533	5065147	1	0	5.53	59.33	5.2	49.75
2001	SD	Harding	3H	11	580033	5064647	1	1	7.75	66.38	2.55	45.55
2001	SD	Harding	3H	12	581033	5064647	3	0	12.58	43.1	10.65	47.18
2001	SD	Harding	4H	LEK	591718	5067383	0	1	10.45	45.7	6.8	53.5
2001	SD	Harding	4H	1	591218	5068383	3	0	4.8	38.3	24.98	45.68
2001	SD	Harding	4H	2	592218	5068383	3	1	13.97	34.83	7.03	66.33

Year	State	County	Lek	Site	Easting	Northing	Cover % ARTR2	Cover % ARCA13	Cover % Forb	Cover % Grass	Cover % Bare	Cover % Litter
2001	SD	Harding	4H	3	590718	5067883	.	.	.	.	.	.
2001	SD	Harding	4H	4	591718	5067883	0	1	10.15	40.95	3.43	63.13
2001	SD	Harding	4H	5	592718	5067883	8	0	5.13	55.55	15.3	37.1
2001	SD	Harding	4H	6	591218	5067383	0	1	6.3	55.18	14.05	38.8
2001	SD	Harding	4H	7	592218	5067383	0	0	11.38	40.15	4.5	61.23
2001	SD	Harding	4H	8	509718	5066883	0	0	7.13	55.98	7.25	47.23
2001	SD	Harding	4H	9	591718	5066883	0	0	4.08	52.33	23.68	29.58
2001	SD	Harding	4H	10	592718	5066883	.	.	.	.	.	.
2001	SD	Harding	4H	11	591218	5066383	10	0	4.8	71.15	0.93	37.8
2001	SD	Harding	4H	12	592218	5066383	4	0	10.53	50.03	9.23	49.33
2001	SD	Harding	7H	LEK	599665	5061000	6	0	6.23	40.38	12.9	56.38
2001	SD	Harding	7H	1	599165	5062000	3	1	12.23	46.28	1.78	57.5
2001	SD	Harding	7H	2	600165	5062000	1	0	15.58	46.73	1.43	54.38
2001	SD	Harding	7H	3	598665	5061500	0	0	8.43	62.75	1	42
2001	SD	Harding	7H	4	599665	5061500	9	0	8	30.23	22.5	56.4
2001	SD	Harding	7H	5	600665	5061500	2	0	7.58	36.45	0.6	72.73
2001	SD	Harding	7H	6	599165	5061000	0	0	5.58	46.05	10.35	57
2001	SD	Harding	7H	7	600165	5061000	3	0	12.73	38.6	11.83	54.7
2001	SD	Harding	7H	8	598665	5060500	1	0	2.17	46.96	41.08	15
2001	SD	Harding	7H	9	599665	5060500	0	0	24.75	64.5	4.25	20.78
2001	SD	Harding	7H	10	600665	5060500	9	0	5.18	60.55	2.2	46.33
2001	SD	Harding	7H	11	599165	5060000	1	0	19.98	57.33	2	36.7
2001	SD	Harding	7H	12	600165	5060000	4	0	7.33	44.55	10.3	52.13
2001	SD	Harding	8H	LEK	632285	5032649	6	1	11.75	57.38	11.33	31.5
2001	SD	Harding	8H	1	631785	5033649	0	1	10.93	56.03	2.4	41.63
2001	SD	Harding	8H	2	632785	5033649	0	0	10.23	69.33	2.55	28.63
2001	SD	Harding	8H	3	631285	5033149	0	1	6.98	64.13	0.65	40
2001	SD	Harding	8H	4	632285	5033149	0	1	4.18	68.33	5.48	29.2
2001	SD	Harding	8H	5	633285	5033149	0	2	8.03	41.28	7.28	55
2001	SD	Harding	8H	6	631785	5032649	5	1	9.9	47.18	3.3	54.63
2001	SD	Harding	8H	7	632785	5032649	1	4	9.45	58.45	11.7	32
2001	SD	Harding	8H	8	631285	5032149	5	0	4.83	49.98	18.6	35.4
2001	SD	Harding	8H	9	632285	5032149	8	0	10.98	59.2	11.25	29.2
2001	SD	Harding	8H	10	633285	5032149	0	1	18.25	60.43	0.48	47.25
2001	SD	Harding	8H	11	631785	5031649	3	0	4	51.3	14.78	36.75
2001	SD	Harding	8H	12	632785	5031649	3	1	15.5	45.93	7.13	44.95
2001	SD	Harding	9H	LEK	578999	5033369	0	0	3.03	41.5	2.28	64.5
2001	SD	Harding	9H	1	578499	5034369	3	4	14.93	37.1	15.55	47.25
2001	SD	Harding	9H	2	579499	5034369	2	0	5.28	48.13	1.5	56.8
2001	SD	Harding	9H	3	577999	5033869	0	0	1.85	58.15	2.2	47.88

Year	State	County	Lek	Site	Easting	Northing	Cover % ARTR2	Cover % ARCA13	Cover % Forb	Cover % Grass	Cover % Bare	Cover % Litter
2001	SD	Harding	9H	4	578999	5033869	13	0	6.28	37.3	0.45	70.68
2001	SD	Harding	9H	5	578499	5033869	5	0	6.55	44.3	23.28	35.75
2001	SD	Harding	9H	6	578499	5033369	8	0	2.68	45.7	3.28	58.55
2001	SD	Harding	9H	7	579499	5033369	0	0	4.58	44.55	2.13	58.88
2001	SD	Harding	9H	8	577999	5032869	0	0	7.95	54.2	9.13	36.38
2001	SD	Harding	9H	9	578999	5032869	5	0	5.65	44.33	4.75	54.85
2001	SD	Harding	9H	10	579999	5032869	0	0	2.03	54.69	13.6	34.57
2001	SD	Harding	9H	11	578499	5032369	0	0	1.75	48.08	2.65	56.68
2001	SD	Harding	9H	12	579499	5032369	9	0	4.4	41.63	13.6	46.18
2001	SD	Harding	10H	LEK	641740	5016832	4	0	4.18	38.33	9.3	57.13
2001	SD	Harding	10H	1	641240	5017832	1	1	8	63.33	22.63	8.33
2001	SD	Harding	10H	2	642240	5017832	0	0	2.98	57.5	3.48	44.5
2001	SD	Harding	10H	3	640740	5017332	0	2	8.78	41.95	4.4	56.15
2001	SD	Harding	10H	4	641740	5017332	4	0	4.08	18.53	53.58	29.35
2001	SD	Harding	10H	5	642740	5017332	0	1	10.85	50.95	1.53	50.13
2001	SD	Harding	10H	6	641240	5016832	2	0	4.23	40.93	12	55.5
2001	SD	Harding	10H	7	642240	5016832	2	0	3.28	35.5	8.8	61.28
2001	SD	Harding	10H	8	640740	5016332	0	0	2.93	52.25	5.5	54.63
2001	SD	Harding	10H	9	641740	5016332	0	2	11.98	74.6	1.3	19.38
2001	SD	Harding	10H	10	642740	5016332	0	0	9.23	72.31	3.91	26.29
2001	SD	Harding	10H	11	641240	5015832	.	.	.	.	.	.
2001	SD	Harding	10H	12	642240	5015832	1	0	6.13	59.98	5.75	36.2
2002	SD	Harding	5H	1	596256	5045727	11	0	7.15	60.95	15.5	21.98
2002	SD	Harding	5H	2	597256	5045727	0	0	3.98	74.63	13.73	14.63
2002	SD	Harding	5H	3	595756	5045227	5	3	7.5	77.28	9.58	12.58
2002	SD	Harding	5H	4	596756	5045227	17	0	4.25	41.93	51.13	6.95
2002	SD	Harding	5H	5	597756	5045227	0	0	5.08	79.18	11.73	10.7
2002	SD	Harding	5H	6	596256	5044727	0	0	17	63.93	14.8	7.43
2002	SD	Harding	5H	7	597256	5044727	0	0	6.38	87.18	2.58	11.1
2002	SD	Harding	5H	8	595756	5044227	5	0	3.15	65.83	19.85	14.45
2002	SD	Harding	5H	9	596756	5044227	0	0	4.33	80.9	11.38	8.4
2002	SD	Harding	5H	10	597756	5044227	0	0	6.6	66.65	24.78	12.1
2002	SD	Harding	5H	11	596256	5043727	0	1	2.48	71.58	19.5	13.48
2002	SD	Harding	5H	12	597256	5043727	0	0	2.26	96.41	0.71	4.62
2002	SD	Harding	6H	1	600785	5058816	2	0	7.08	88.53	5.73	3.8
2002	SD	Harding	6H	2	601785	5058816	1	2	3.28	75.25	7.05	18.55
2002	SD	Harding	6H	3	600285	5058316	1	1	11.35	85.6	0.9	14
2002	SD	Harding	6H	4	601285	5058316	10	1	8.03	84.63	3.58	9.2
2002	SD	Harding	6H	5	602285	5058315	1	4	6	75.9	0.63	22.78
2002	SD	Harding	6H	6	600785	5057816	2	1	10.55	72.58	12.3	12.3

Year	State	County	Lek	Site	Easting	Northing	Cover % ARTR2	Cover % ARCA13	Cover % Forb	Cover % Grass	Cover % Bare	Cover % Litter
2002	SD	Harding	6H	7	601785	5057816	11	1	9.3	59.88	15.4	22.4
2002	SD	Harding	6H	8	600285	5057316	8	2	7.68	82.98	10.55	4.18
2002	SD	Harding	6H	9	601285	5057316	17	0	7.43	67.15	21.25	8.33
2002	SD	Harding	6H	10	602285	5057316	6	3	13.45	69	12.33	16.25
2002	SD	Harding	6H	11	600785	5056816	5	0	3.83	93.48	0.38	6.6
2002	SD	Harding	6H	12	601785	5056816	11	1	18.75	65.33	4.6	27.23

"." missing data.

Year	State	County	Lek	Site	Easting	Northing	Density ARTR2	Density ARCA13	Visual obs % 0.10m	Visual obs % 0.25m	Visual obs % 0.50m	Ht. (cm) ARTR2	Ht. (cm) ARCA13	Ht. (cm) Grass
2001	SD	Butte	3B	LEK	599523	4986753	2.6	0	90	10	0	16.63	0	10.58
2001	SD	Butte	3B	1	599023	4987753	0.02	0	80	0	0	22	0	15.13
2001	SD	Butte	3B	2	600023	4987753	0.57	0	75	0	0	18.93	0	12.28
2001	SD	Butte	3B	3	598523	4987253	0	0	100	0	0	20	0	15.88
2001	SD	Butte	3B	4	599523	4987253	2.54	0	95	10	0	17.88	0	11.6
2001	SD	Butte	3B	5	600523	4987253	0.32	0	90	0	0	19.46	0	10.78
2001	SD	Butte	3B	6	599023	4986753	1.66	0	75	0	0	17.95	0	10.95
2001	SD	Butte	3B	7	600023	4986753	2.75	0	90	0	0	13.5	0	8.05
2001	SD	Butte	3B	8	598523	4986253	0.41	0	90	0	0	10.67	0	10.08
2001	SD	Butte	3B	9	599523	4986253	0.14	0	20	0	0	22	0	8.73
2001	SD	Butte	3B	10	600523	4986253	1.13	0	80	0	0	10.09	0	9.5
2001	SD	Butte	3B	11	599023	4985753	1.48	0	100	0	0	12.38	0	10.53
2001	SD	Butte	3B	12	600023	4985753	2.18	0	50	0	0	12	0	7.48
2001	SD	Butte	4B	LEK	612622	4977981	0	0	85	0	0	0	0	10.75
2001	SD	Butte	4B	1	612122	4978981	0	0	90	0	0	0	0	14.48
2001	SD	Butte	4B	2	613122	4978981	0	0	10	0	0	0	0	7.98
2001	SD	Butte	4B	3	611622	4978481	0	0	100	0	0	0	0	14.9
2001	SD	Butte	4B	4	612622	4978481	0	0	100	0	0	0	0	13.5
2001	SD	Butte	4B	5	613622	4978481	0	0	100	0	0	0	0	13.18
2001	SD	Butte	4B	6	612122	4977981	0	0	60	0	0	0	0	10.08
2001	SD	Butte	4B	7	613122	4977981	0	0	0	0	0	0	0	5.45
2001	SD	Butte	4B	8	611622	4977481	1.19	0	45	0	0	16.54	0	11.2
2001	SD	Butte	4B	9	612622	4977481	1.65	0	90	0	0	17.15	0	12.33
2001	SD	Butte	4B	10	613622	4977481	0.4	0	85	5	0	19.35	0	10.25
2001	SD	Butte	4B	11	612122	4976981	1.93	0	70	0	0	14.08	0	10.15
2001	SD	Butte	4B	12	613122	4976981	2.19	0	80	0	0	14.72	0	11.03
2001	SD	Butte	5B	LEK	606336	5006861	0.4	0	100	0	0	20.3	0	12.63
2001	SD	Butte	5B	1	605836	5007861	0.56	0	70	0	0	17.83	0	12.55
2001	SD	Butte	5B	2	606836	5007861	0.29	0	65	0	0	19.68	0	11.95
2001	SD	Butte	5B	3	605336	5007361	0.95	0	65	15	0	26	0	11.53
2001	SD	Butte	5B	4	606336	5007361	1.47	0	100	0	0	15.67	0	10.35
2001	SD	Butte	5B	5	607336	5007361	0.6	0	65	10	0	22.17	0	13.65
2001	SD	Butte	5B	6	605836	5006861	2.45	0	100	0	0	15.08	0	6.98
2001	SD	Butte	5B	7	606836	5006861	3.38	0	80	0	0	11.93	0	4.83
2001	SD	Butte	5B	8	605336	5006361	0.89	0	50	10	0	27.33	0	11.3
2001	SD	Butte	5B	9	606336	5006361	2.39	0	40	0	0	12.23	0	7.3
2001	SD	Butte	5B	10	607336	5006361	1.24	0	30	0	0	15.23	0	10
2001	SD	Butte	5B	11	605836	5005861	2	0	55	0	0	12.45	0	7.18
2001	SD	Butte	5B	12	606836	5005861	0.67	0	25	0	0	16.64	0	8.93

Year	State	County	Lek	Site	Easting	Northing	Density ARTR2	Density ARCA13	Visual obs % 0.10m	Visual obs % 0.25m	Visual obs % 0.50m	Ht. (cm) ARTR2	Ht. (cm) ARCA13	Ht. (cm) Grass
2001	SD	Butte	6B	LEK	587317	4996578	1.28	0	65	5	0	15.26	0	9.85
2001	SD	Butte	6B	1	586817	4997578	0	0	90	0	0	0	0	14.35
2001	SD	Butte	6B	2	587817	4997578	0.01	0	100	0	0	27	0	15.8
2001	SD	Butte	6B	3	586317	4997078	0.01	0	100	0	0	29	0	13.55
2001	SD	Butte	6B	4	587317	4997078	0.02	0	95	0	0	24	0	11.8
2001	SD	Butte	6B	5	588317	4997078	0.51	0	55	0	0	20.14	0	10.3
2001	SD	Butte	6B	6	586817	4996578	1.14	0	65	5	0	20.93	0	12.08
2001	SD	Butte	6B	7	587817	4996578	0.05	0	30	0	0	14.83	0	10.55
2001	SD	Butte	6B	8	586317	4996078	0.5	0	10	0	0	15.8	0	7.53
2001	SD	Butte	6B	9	587317	4996078	1.4	0	75	0	0	12.55	0	7.08
2001	SD	Butte	6B	10	588317	4996078	2.25	0	90	0	0	18.38	0	10.58
2001	SD	Butte	6B	11	586817	4995578	1.19	0	15	0	0	13.71	0	8.68
2001	SD	Butte	6B	12	587817	4995578	1.08	0	60	0	0	12.93	0	9.6
2001	SD	Butte	9B	LEK	587883	4963874	1.2	0	90	5	0	21.59	0	11.5
2001	SD	Butte	9B	1	587383	4964874	.	.	.	.	.	.	.	.
2001	SD	Butte	9B	2	588383	4964874	1.72	0	95	25	5	33.08	0	16.7
2001	SD	Butte	9B	3	586883	4964374	0.09	0	100	15	0	20	0	11.9
2001	SD	Butte	9B	4	587883	4964374	3.31	0	100	20	0	18.73	0	7.88
2001	SD	Butte	9B	5	588883	4964374	1.6	0	70	15	0	22.6	0	12.98
2001	SD	Butte	9B	6	587383	4963874	0.04	0	40	0	0	16	0	11.35
2001	SD	Butte	9B	7	588383	4963874	1.29	0	60	5	0	21.71	0	13.05
2001	SD	Butte	9B	8	586883	4963374	1.17	0	90	15	0	27.11	0	14.9
2001	SD	Butte	9B	9	587883	4963374	0.44	0	95	5	0	26.41	0	11.48
2001	SD	Butte	9B	10	588883	4963374	2.39	0	80	30	0	22.63	0	10.95
2001	SD	Butte	9B	11	587383	4932874	1.62	0	100	40	5	29.68	0	12.25
2001	SD	Butte	9B	12	588383	4932874	0.24	0	100	25	0	22.22	0	14.88
2001	SD	Butte	10B	LEK	580779	4969908	0	0	30	0	0	17	0	9.1
2001	SD	Butte	10B	1	580279	4970908	0.21	0	80	0	0	19.32	0	11.4
2001	SD	Butte	10B	2	581279	4970908	0.19	1.47	100	60	5	37.42	49.21	20.68
2001	SD	Butte	10B	3	579779	4970408	0.86	0	80	25	0	25	0	14.7
2001	SD	Butte	10B	4	580779	4970408	0.76	0	100	55	5	50.15	0	16.88
2001	SD	Butte	10B	5	581779	4970408	0.04	0	100	0	0	36.17	0	14.33
2001	SD	Butte	10B	6	580279	4969908	0.73	0	100	25	0	30.03	0	15.33
2001	SD	Butte	10B	7	581279	4969908	0.72	0	35	5	0	24.21	0	12.33
2001	SD	Butte	10B	8	579779	4969408	0.3	0	90	0	0	12.56	0	10.95
2001	SD	Butte	10B	9	580779	4969408	1.03	0	90	40	5	30.7	0	15.23
2001	SD	Butte	10B	10	581779	4969408	0.64	0	100	40	0	33.08	0	14.15
2001	SD	Butte	10B	11	580279	4968908	0.04	0	55	15	5	14.75	0	6.05
2001	SD	Butte	10B	12	581279	4968908	0.42	0	5	0	0	14.96	0	5.95
2001	SD	Butte	11B	LEK	580877	4956628	0.28	0.01	35	2.5	0	14.47	8	12.53

Year	State	County	Lek	Site	Easting	Northing	Density ARTR2	Density ARCA13	Visual obs % 0.10m	Visual obs % 0.25m	Visual obs % 0.50m	Ht. (cm) ARTR2	Ht. (cm) ARCA13	Ht. (cm) Grass
2001	SD	Butte	11B	1	580377	4957628	1.54	0	97.5	5	0	19.69	0	16.18
2001	SD	Butte	11B	2	581377	4957628	1.08	0	92.5	2.5	0	17.77	0	12.25
2001	SD	Butte	11B	3	579877	4957128	0.04	0	0	0	0	13	0	1.6
2001	SD	Butte	11B	4	580877	4957128	1.12	0	90	15	0	30.63	0	10.7
2001	SD	Butte	11B	5	581877	4957128	.	.	.	.	.	.	.	.
2001	SD	Butte	11B	6	580377	4956628	0.19	0.28	47.5	5	0	21.38	8	12.38
2001	SD	Butte	11B	7	581377	4956628	1.08	0	60	22.5	0	24.84	0	11.78
2001	SD	Butte	11B	8	579877	4956128	0.03	0	47.5	2.5	0	14	0	6.88
2001	SD	Butte	11B	9	580877	4956128	0.07	0.41	97.5	32.5	0	16	5.29	17.78
2001	SD	Butte	11B	10	581877	4956128	1.32	0	100	30	0	27.85	0	13.13
2001	SD	Butte	11B	11	580377	4955628	0.69	0	75	15	0	22.23	0	10.85
2001	SD	Butte	11B	12	581377	4955628	1.12	0	100	15	0	20.42	0	13.78
2001	SD	Butte	12B	LEK	605185	4982068	0.03	0	100	0	0	26.33	0	13.15
2001	SD	Butte	12B	1	604685	4983068	2.05	0	95	0	0	16.56	0	10.98
2001	SD	Butte	12B	2	605685	4983068	0.69	0	95	0	0	22.78	0	13.85
2001	SD	Butte	12B	3	604185	4982569	1.3	0	100	30	0	19.45	0	13.53
2001	SD	Butte	12B	4	605185	4982569	2.12	0	85	0	0	15.28	0	10.13
2001	SD	Butte	12B	5	606185	4982569	0.08	0	100	5	0	27.36	0	13.15
2001	SD	Butte	12B	6	604685	4982068	1.08	0	100	0	0	18.82	0	12.75
2001	SD	Butte	12B	7	605685	4982068	0.76	0	95	5	0	25.03	0	13.53
2001	SD	Butte	12B	8	604185	4981568	0.23	0	60	0	0	13.56	0	10.32
2001	SD	Butte	12B	9	605185	4981568	0.79	0	100	10	0	21.19	0	14.3
2001	SD	Butte	12B	10	606185	4981568	0.93	0	100	15	0	18.26	0	12.45
2001	SD	Butte	12B	11	604685	4981068	1.4	0	80	0	0	14.29	0	12.95
2001	SD	Butte	12B	12	605685	4981068	0.05	0	85	0	0	17.43	0	10.23
2001	SD	Butte	13B	LEK	594639	4989792	3.28	0	50	0	0	13.23	0	8.75
2001	SD	Butte	13B	1	594139	4990792	1.28	0	100	5	0	20.65	0	12.25
2001	SD	Butte	13B	2	595139	4990792	0.04	0	100	0	0	18.78	0	12.03
2001	SD	Butte	13B	3	593639	4990292	2.55	0	95	0	0	13.88	0	11.8
2001	SD	Butte	13B	4	494639	4990292	2.27	0	45	0	0	14.5	0	8.85
2001	SD	Butte	13B	5	595639	4990292	0.29	0	30	0	0	19.06	0	11.18
2001	SD	Butte	13B	6	594139	4989792	0.62	0	100	0	0	18.5	0	11.2
2001	SD	Butte	13B	7	595139	4989792	2.43	0	100	25	0	16.25	0	14.65
2001	SD	Butte	13B	8	593639	4989292	3.09	0	100	15	0	17.13	0	12.93
2001	SD	Butte	13B	9	594639	4989292	0.47	0	100	5	0	21.48	0	16
2001	SD	Butte	13B	10	595639	4989292	2.66	0	90	0	0	14.43	0	10.13
2001	SD	Butte	13B	11	595139	4988792	0.06	0	30	0	0	16.75	0	9.68
2001	SD	Butte	13B	12	595139	4988792	2.66	0	20	0	0	13.38	0	8.7
2001	SD	Butte	14B	LEK	591209	4982129	0	0	95	0	0	0	0	11.73
2001	SD	Butte	14B	1	590809	4983129	0	0	100	0	0	0	0	13.1

Year	State	County	Lek	Site	Easting	Northing	Density ARTR2	Density ARCA13	Visual obs % 0.10m	Visual obs % 0.25m	Visual obs % 0.50m	Ht. (cm) ARTR2	Ht. (cm) ARCA13	Ht. (cm) Grass
2001	SD	Butte	14B	2	591809	4983129	0	0	95	0	0	0	0	12.63
2001	SD	Butte	14B	3	590309	4982629	0	0	95	0	0	0	0	15.28
2001	SD	Butte	14B	4	591309	4982629	0	0	70	0	0	0	0	11.6
2001	SD	Butte	14B	5	592309	4982629	0	0	100	0	0	0	0	11.38
2001	SD	Butte	14B	6	590809	4982129	0	0	100	0	0	0	0	11.9
2001	SD	Butte	14B	7	591809	4982129	0	0	100	0	0	0	0	12
2001	SD	Butte	14B	8	590309	4981629	0	0	100	0	0	0	0	13.2
2001	SD	Butte	14B	9	591309	4981629	0	0	95	0	0	0	0	14.1
2001	SD	Butte	14B	10	592309	4981629	0	0	100	0	0	0	0	12.88
2001	SD	Butte	14B	11	590809	4981129	0	0	100	0	0	0	0	16.35
2001	SD	Butte	14B	12	591809	4981129	0.24	0	100	0	0	19.17	0	11.35
2001	SD	Butte	15B	LEK	583325	4972585	0.31	0	55	0	0	4.48	0	7.4
2001	SD	Butte	15B	1	582825	4973585	0.07	0	0	0	0	18	0	4
2001	SD	Butte	15B	2	583825	4973585	0	0	10	0	0	14	0	5.03
2001	SD	Butte	15B	3	582325	4973085	4.84	0.01	50	20	5	34.38	30.95	14.65
2001	SD	Butte	15B	4	583325	4973085	1	0	35	5	0	15.9	18	6.48
2001	SD	Butte	15B	5	584325	4973085	0.16	0	20	0	0	20.06	0	9.2
2001	SD	Butte	15B	6	582825	4972585	0.77	0	75	10	0	25.74	0	9.43
2001	SD	Butte	15B	7	583825	4972585	0.3	0	70	0	0	22.04	0	11.23
2001	SD	Butte	15B	8	582325	4972085	0.42	0	85	30	0	24.68	0	10.15
2001	SD	Butte	15B	9	583325	4972085	0.21	0	95	10	0	25.72	0	12.63
2001	SD	Butte	15B	10	584325	4972085	0.85	0	85	20	0	18.32	0	9.78
2001	SD	Butte	15B	11	582825	4971585	0.98	0	85	35	0	28.55	0	13.55
2001	SD	Butte	15B	12	583825	4971585	0.09	0	95	0	0	17.69	0	14.33
2001	SD	Fall River	1FR	LEK	581629	4796587	0.27	0.26	100	27.5	0	30.93	6.85	11.43
2001	SD	Fall River	1FR	1	581129	4797587	0	0	97.5	0	0	0	0	11.05
2001	SD	Fall River	1FR	2	582129	4797587	0.03	0	97.5	0	0	42.75	0	8.68
2001	SD	Fall River	1FR	3	580629	4791087	0.05	0	87.5	0	0	18.56	0	6.68
2001	SD	Fall River	1FR	4	581629	4791087	0.02	0.15	2.5	0	0	24.33	6.33	8.35
2001	SD	Fall River	1FR	5	582629	4791087	0	0	0	0	0	23	0	3.3
2001	SD	Fall River	1FR	6	581129	4796587	0.09	0.04	30	0	0	25.29	6.4	9.4
2001	SD	Fall River	1FR	7	582129	4796587	0.23	0.6	40	0	0	31.46	5.31	7.8
2001	SD	Fall River	1FR	8	580629	4796087	0.07	0	100	0	0	18	0	12.6
2001	SD	Fall River	1FR	9	581629	4796087	0.17	0	45	4.5	0	34.86	0	7.48
2001	SD	Fall River	1FR	10	582629	4796087	0.68	0	100	50	15	41.81	0	10.83
2001	SD	Fall River	1FR	11	581129	4795587	0.09	0	100	0	0	23.5	0	7.65
2001	SD	Fall River	1FR	12	582129	4795587	0	0	100	0	0	0	0	11.58
2001	SD	Harding	1H	LEK	637154	5029503	0.39	0.16	60	0	0	22.27	17.8	10.35
2001	SD	Harding	1H	1	636654	5030503	.		.	.	.	.	.	.
2001	SD	Harding	1H	2	637654	5030503	0	0.46	95	15	5	0	37.33	19.08

Year	State	County	Lek	Site	Easting	Northing	Density ARTR2	Density ARCA13	Visual obs % 0.10m	Visual obs % 0.25m	Visual obs % 0.50m	Ht. (cm) ARTR2	Ht. (cm) ARCA13	Ht. (cm) Grass
2001	SD	Harding	1H	3	636154	5030003	1.22	0.13	80	65	10	33.28	37.53	15.43
2001	SD	Harding	1H	4	637154	5030003	0.03	0.94	100	35	0	27.33	23.85	14.13
2001	SD	Harding	1H	5	638154	5030003	1.12	0.11	100	25	0	35.87	27.5	20.98
2001	SD	Harding	1H	6	636654	5029503	0.85	0.02	55	5	0	20.57	33	10.8
2001	SD	Harding	1H	7	637654	5029503	0.15	0.52	100	30	5	32.57	32.13	17.85
2001	SD	Harding	1H	8	636154	5029003	0.17	0.62	95	25	0	28.79	39.09	15.48
2001	SD	Harding	1H	9	637154	5029003	0.02	0.63	55	25	0	30	30.93	13.8
2001	SD	Harding	1H	10	638154	5029003	0.01	0.69	100	25	0	32.5	39.03	22.03
2001	SD	Harding	1H	11	636654	5028503	0.51	0.29	90	30	0	27.45	28.57	15.86
2001	SD	Harding	1H	12	637654	5028503	0.82	0.2	75	0	0	21.64	29.13	12.35
2001	SD	Harding	2H	LEK	584376	5044130	1.81	0	75	5	0	19.65	0	12.18
2001	SD	Harding	2H	1	583876	5045130	0.15	0	20	0	0	28.67	0	7.5
2001	SD	Harding	2H	2	584876	5045130	0.01	0	90	0	0	18	0	19.38
2001	SD	Harding	2H	3	583376	5044630	0.42	0	70	20	0	27.42	0	10.2
2001	SD	Harding	2H	4	584376	5044630	0.7	0	75	25	0	24.4	0	15.13
2001	SD	Harding	2H	5	585376	5044630	0	0	100	0	0	0	0	17.3
2001	SD	Harding	2H	6	583876	5044130	0.68	0	95	35	0	31.53	0	15.78
2001	SD	Harding	2H	7	584876	5044130	0.38	0	95	15	0	34.19	0	17.25
2001	SD	Harding	2H	8	583376	5943630	1.64	0	55	5	0	14.25	0	9.63
2001	SD	Harding	2H	9	584376	5043630	1.02	0	80	35	0	30.9	0	13.73
2001	SD	Harding	2H	10	585376	5043630	0.22	0	100	15	0	28.88	0	18.43
2001	SD	Harding	2H	11	583876	5043130	0.07	0	50	0	0	29	0	11.36
2001	SD	Harding	2H	12	584876	5043130	1.28	0	95	15	0	24.13	0	12.15
2001	SD	Harding	3H	LEK	580533	5065647	0.09	0	100	0	0	23.79	0	13.28
2001	SD	Harding	3H	1	580033	5066647	0	0	100	0	0	0	0	14.38
2001	SD	Harding	3H	2	581033	5066647	0	0	100	0	0	0	0	14.28
2001	SD	Harding	3H	3	579533	5066147	0.04	0	85	0	0	24.4	0	12.18
2001	SD	Harding	3H	4	580533	5066147	0.29	0	80	0	0	19.1	0	13.18
2001	SD	Harding	3H	5	581533	5066147	0.34	0	55	5	0	19.58	0	11.85
2001	SD	Harding	3H	6	580033	5065647	0.05	0	75	0	0	30.67	0	12.93
2001	SD	Harding	3H	7	581033	5065647	0.66	0	55	15	0	18.66	0	9.05
2001	SD	Harding	3H	8	579533	5065147	0.63	0.01	85	15	0	31.29	0	13.63
2001	SD	Harding	3H	9	580533	5065147	0	0	100	0	0	0	0	12.8
2001	SD	Harding	3H	10	581533	5065147	0.15	0	90	10	5	28.61	0	13.93
2001	SD	Harding	3H	11	580033	5064647	0.19	0.1	100	20	5	28.2	40.08	15.43
2001	SD	Harding	3H	12	581033	5064647	0.39	0	75	0	0	22.33	0	12.23
2001	SD	Harding	4H	LEK	591718	5067383	0.02	0.18	50	0	0	17.4	25.5	11.98
2001	SD	Harding	4H	1	591218	5068383	0.68	0.03	50	0	0	16.91	32.63	11.95
2001	SD	Harding	4H	2	592218	5068383	0.62	0.18	70	5	0	23.62	26.27	9.81
2001	SD	Harding	4H	3	590718	5067883	.		.	.	.	.	.	.

Year	State	County	Lek	Site	Easting	Northing	Density ARTR2	Density ARCA13	Visual obs % 0.10m	Visual obs % 0.25m	Visual obs % 0.50m	Ht. (cm) ARTR2	Ht. (cm) ARCA13	Ht. (cm) Grass
2001	SD	Harding	4H	4	591718	5067883	0.08	0.33	75	0	0	18	29.61	12.45
2001	SD	Harding	4H	5	592718	5067883	0.91	0.06	85	20	0	31.06	32.6	17.03
2001	SD	Harding	4H	6	591218	5067383	0.15	0.25	40	0	0	26.63	31.57	11.85
2001	SD	Harding	4H	7	592218	5067383	0.06	0.02	50	0	0	24	17.5	9.88
2001	SD	Harding	4H	8	509718	5066883	0.01	0.05	100	0	0	0	21	14.48
2001	SD	Harding	4H	9	591718	5066883	0.03	0	80	0	0	18.27	0	12.2
2001	SD	Harding	4H	10	592718	5066883	.		.	.	.	.	.	.
2001	SD	Harding	4H	11	591218	5066383	0.57	0.03	100	30	5	40.51	40	19.4
2001	SD	Harding	4H	12	592218	5066383	0.65	0.04	90	10	0	25.29	42.33	11.8
2001	SD	Harding	7H	LEK	599665	5061000	0.87	0	90	20	0	24.21	0	13.9
2001	SD	Harding	7H	1	599165	5062000	0.27	0.24	70	10	0	31.18	27.63	13.98
2001	SD	Harding	7H	2	600165	5062000	0.05	0.02	50	5	0	28	27	12.13
2001	SD	Harding	7H	3	598665	5061500	0.01	0.05	100	0	0	0	23	19.83
2001	SD	Harding	7H	4	599665	5061500	1.03	0.01	100	10	0	27.61	0	13.23
2001	SD	Harding	7H	5	600665	5061500	0.31	0.07	60	5	0	22.61	28.5	12.3
2001	SD	Harding	7H	6	599165	5061000	0	0	85	0	0	27	21	11.43
2001	SD	Harding	7H	7	600165	5061000	0.55	0.03	100	0	0	24.22	14	11.5
2001	SD	Harding	7H	8	598665	5060500	0.01	0	30	0	0	34.67	0	9.63
2001	SD	Harding	7H	9	599665	5060500	0.01	0	60	0	0	0	0	11.78
2001	SD	Harding	7H	10	600665	5060500	0.38	0	55	30	0	38.8	53.5	15.13
2001	SD	Harding	7H	11	599165	5060000	0.13	0	90	0	0	26.67	0	13.5
2001	SD	Harding	7H	12	600165	5060000	0.4	0	65	5	0	24.5	0	13.7
2001	SD	Harding	8H	LEK	632285	5032649	0.85	0.12	85	10	0	28.66	33.85	18.03
2001	SD	Harding	8H	1	631785	5033649	0	0.48	100	5	0	28	25.53	17.6
2001	SD	Harding	8H	2	632785	5033649	0	0.21	100	15	0	0	29.33	14.85
2001	SD	Harding	8H	3	631285	5033149	0.01	0.32	100	60	10	0	40.41	18.03
2001	SD	Harding	8H	4	632285	5033149	0	0.19	100	0	0	0	25.07	15.08
2001	SD	Harding	8H	5	633285	5033149	0.01	0.48	55	25	0	0	27.22	12.65
2001	SD	Harding	8H	6	631785	5032649	0.34	0.2	60	5	0	28.33	29	16.38
2001	SD	Harding	8H	7	632785	5032649	0.24	0.52	90	0	0	25.33	29.32	15.83
2001	SD	Harding	8H	8	631285	5032149	0.71	0.12	85	15	0	22.19	28.91	13.15
2001	SD	Harding	8H	9	632285	5032149	0.84	0.01	90	20	0	28.26	32	14.58
2001	SD	Harding	8H	10	633285	5032149	0.12	0.47	100	10	0	29.2	31.47	17.15
2001	SD	Harding	8H	11	631785	5031649	0.77	0.02	85	10	0	29.04	28.86	13.78
2001	SD	Harding	8H	12	632785	5031649	0.46	0.16	85	15	0	24.8	33.36	14.03
2001	SD	Harding	9H	LEK	578999	5033369	0.01	0	40	0	0	19.33	44	12.4
2001	SD	Harding	9H	1	578499	5034369	0.16	0.48	70	5	0	27.33	36.14	13.25
2001	SD	Harding	9H	2	579499	5034369	0.12	0	75	5	0	24.13	29	14.33
2001	SD	Harding	9H	3	577999	5033869	0.02	0.01	100	0	0	17.67	19	13.95
2001	SD	Harding	9H	4	578999	5033869	0.9	0.11	70	30	0	36.31	42	16.3

Year	State	County	Lek	Site	Easting	Northing	Density ARTR2	Density ARCA13	Visual obs % 0.10m	Visual obs % 0.25m	Visual obs % 0.50m	Ht. (cm) ARTR2	Ht. (cm) ARCA13	Ht. (cm) Grass
2001	SD	Harding	9H	5	578499	5033869	0.76	0.01	100	20	0	22.77	0	14.05
2001	SD	Harding	9H	6	578499	5033369	0.48	0.01	65	25	0	33.87	73	15.25
2001	SD	Harding	9H	7	579499	5033369	0	0	0	0	0	22	0	10.7
2001	SD	Harding	9H	8	577999	5032869	0	0	80	5	0	0	0	13.55
2001	SD	Harding	9H	9	578999	5032869	0.65	0.03	80	15	0	21.82	29	14.1
2001	SD	Harding	9H	10	579999	5032869	0	0	80	0	0	30	0	14.14
2001	SD	Harding	9H	11	578499	5032369	0	0	40	0	0	0	0	11.43
2001	SD	Harding	9H	12	579499	5032369	1	0	40	15	0	24.5	0	8.35
2001	SD	Harding	10H	LEK	641740	5016832	0.52	0.06	70	25	0	25.84	25	11
2001	SD	Harding	10H	1	641240	5017832	0.39	0.28	65	0	0	16.25	22.17	12.33
2001	SD	Harding	10H	2	642240	5017832	0.02	0	100	0	0	20	70	13.88
2001	SD	Harding	10H	3	640740	5017332	0	0.47	100	0	0	42	27.33	15
2001	SD	Harding	10H	4	641740	5017332	1.24	0.01	100	0	0	14.79	30	6.15
2001	SD	Harding	10H	5	642740	5017332	0.08	0.33	100	0	0	15.93	41.11	16.48
2001	SD	Harding	10H	6	641240	5016832	0.48	0.12	70	0	0	17.56	29.3	13.38
2001	SD	Harding	10H	7	642240	5016832	0.47	0.07	100	0	0	21.65	18	13
2001	SD	Harding	10H	8	640740	5016332	0	0.07	100	0	0	0	44.36	15.5
2001	SD	Harding	10H	9	641740	5016332	0.01	0.54	100	10	0	28.5	30.43	15.13
2001	SD	Harding	10H	10	642740	5016332	0.02	0	100	0	0	36	0	14.89
2001	SD	Harding	10H	11	641240	5015832	.		.	.	.	.	.	.
2001	SD	Harding	10H	12	642240	5015832	0.13	0.04	70	0	0	24.29	24.4	12.03
2002	SD	Harding	5H	1	596256	5045727	1.53	0	100	10	0	30.97	0	18.75
2002	SD	Harding	5H	2	597256	5045727	0	0	0	0	0	0	0	9.45
2002	SD	Harding	5H	3	595756	5045227	0.36	0.23	45	15	0	37.85	50.44	12.75
2002	SD	Harding	5H	4	596756	5045227	1.52	0	90	0	0	22.46	0	11.8
2002	SD	Harding	5H	5	597756	5045227	0	0	100	20	0	0	0	18.3
2002	SD	Harding	5H	6	596256	5044727	0.03	0	35	0	0	34.67	0	12.5
2002	SD	Harding	5H	7	597256	5044727	0.07	0	90	10	0	30.41	0	18.53
2002	SD	Harding	5H	8	595756	5044227	0.34	0.03	55	0	0	41.58	25.5	13.88
2002	SD	Harding	5H	9	596756	5044227	0.01	0	80	5	0	26.33	0	14.33
2002	SD	Harding	5H	10	597756	5044227	0.07	0	75	0	0	26.75	0	13.48
2002	SD	Harding	5H	11	596256	5043727	0.05	0.11	15	5	0	37.57	41	9.5
2002	SD	Harding	5H	12	597256	5043727	0	0	100	55	0	0	60	26.15
2002	SD	Harding	6H	1	600785	5058816	0.52	0.01	70	0	0	20.26	10	14.1
2002	SD	Harding	6H	2	601785	5058816	0.22	0.34	90	20	5	34.57	35.85	14.75
2002	SD	Harding	6H	3	600285	5058316	0.08	0.12	95	15	0	25.5	44.2	19.73
2002	SD	Harding	6H	4	601285	5058316	0.78	0.06	100	65	30	42.62	43	15.83
2002	SD	Harding	6H	5	602285	5058315	0.06	0.2	75	10	0	44.75	43.6	15.23
2002	SD	Harding	6H	6	600785	5057816	0.21	0.19	50	15	0	37.35	32.13	13.48
2002	SD	Harding	6H	7	601785	5057816	1.29	0.12	75	49	0	33.45	51.75	15.13

Year	State	County	Lek	Site	Easting	Northing	Density ARTR2	Density ARCA13	Visual obs % 0.10m	Visual obs % 0.25m	Visual obs % 0.50m	Ht. (cm) ARTR2	Ht. (cm) ARCA13	Ht. (cm) Grass
2002	SD	Harding	6H	8	600285	5057316	1.07	0.08	90	15	0	28.7	52.43	17.88
2002	SD	Harding	6H	9	601285	5057316	2.27	0.1	70	30	0	28.21	40	12.28
2002	SD	Harding	6H	10	602285	5057316	0.8	0.25	60	10	0	28.88	52.09	15.63
2002	SD	Harding	6H	11	600785	5056816	0.31	0	85	30	0	32.9	0	20.8
2002	SD	Harding	6H	12	601785	5056816	0.47	0.07	80	20	5	42.8	34	14.1

"." missing data.

BIOLOGICAL ASSESSMENT AND EVALUATION

for the

RANGE ALLOTMENT MANAGEMENT PLAN IN THE FALL RIVER WEST AND OGLALA GEOGRAPHIC AREAS

Administered by Nebraska National Forest

Rocky Mountain Region

U.S.D.A. Forest Service

Prepared by:

Bob Hodorff, wildlife biologist

Bob Hodorff	November 19, 2012 *Date*

Updated and submitted by Phil Dobesh, wildlife biologist

Phil Dobesh	September 25, 2013 *Date*

hi Jo Was color original only a few color pages are included but copied as B & W mostly

Table of Contents

Regulatory Framework

Section 7 of the ESA requires federal agencies to use their authorities to carry out programs to conserve endangered and threatened species, and to insure that actions authorized, funded, or carried out by them are not likely to jeopardize the continued existence of listed or proposed species, or result in the destruction or adverse modification of their designated critical habitats. A biological assessment (BA) must be prepared for federal actions that are "major construction activities" (defined under the National Environmental Policy Act (NEPA) as a project significantly affecting the quality of the human environment) to evaluate the potential effects of the proposal on listed or proposed species. The contents of the BA are at the discretion of the federal agency, and will depend on the nature of the federal action (50 CFR 402.12(f)).

The Forest Service has established direction in Forest Service Manual 2670 to guide habitat management for Threatened, Endangered, Proposed, and Sensitive species (TEPS). Preparation of a biological evaluation (BE) as part of the NEPA process ensures that TEPS species receive full consideration in the decision-making process.

A biological assessment and evaluation reviews and provides documentation of findings, of all Forest Service planned, funded, executed, or permitted programs and activities for possible effects on federally listed endangered, threatened, proposed, or Regional Forester Sensitive species (FSM 2672.4).

Species addressed in this assessment and evaluation includes federally listed species, geographic area management indicator species, and Regional Forester sensitive species. The objectives of this report are:

- To ensure that Forest Service actions do not contribute to loss of viability of any native or desired non-native plant or animal, or contribute to a trend towards Federal listing of any species (FSM 2672.41).
- To comply with the requirements of the Endangered Species Act - that actions of Federal agencies not jeopardize or adversely modify critical habitat of federally listed species (FSM 2672.41).
- To provide a process and standard by which to ensure that threatened endangered, proposed, and sensitive species receive full consideration in the decision-making process (FSM 2672.41).
- To "estimate the effects of each alternative on fish and wildlife populations" (Management Indicator Species)(36 CFR part 219).

Methodology for Analysis

Best available information on threatened, endangered, candidate, and sensitive species addressed in this analysis was obtained from many sources. Included were peer-viewed papers from scientific journals, field guides to wildlife species, popular magazine articles, and publications by resource agencies and conservation organizations. The files at the Fall River and Pine Ridge Ranger District were searched for records of surveys and sightings made of these species of animals and plants. The species were discussed with Forest Service district resource personnel with field experience, and Commission and U.S. Fish and Wildlife Service biologists.

Desired Condition

The Land and Resource Management Plan (LRMP), 2001 Revision, Nebraska National Forest and Associated Units, lists the desired conditions for Fall River West Geographic Area (WGA) and Oglala

Geographic Area (OGA) (USDA Forest Service 2001). Some desired conditions from the plan that are pertinent to habitat management concerning TES species viability are:

Upland Grasslands: These upland areas will be managed perpetuate diverse and healthy mixed grass and forb communities, representing both cool and warm season species such as western wheatgrass, green needlegrass, buffalograss, blue grama, big and little bluestem, threadleaf sedge and forbs. Upland grassland habitat will be managed to provide sufficient residual cover for those wildlife species requiring higher grassland structure levels. Objectives for the desired percentages of the WGA & OGA in each seral stage and structural category are listed in the 2001 LRMP are presented in Tables 1&2.

Table 1. Desired Plant Species Composition across the WGA & OGA

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

Table 2. Desired Vegetation Structural Objectives for the WGA & OGA

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

Appendix I of the LRMP describes the suggested stocking rates that are expected to help provide the desired mosaic of seral stages and vegetative structure on rangelands.

The stocking rate for light grazing intensity is 30 to 40% lighter than the suggested stocking rates used by the Natural Resources Conservation Service (NRCS) (USDA Natural Resource Conservation Service 2011a) in the local area. Stocking rates at this level are expected to provide quality habitat for animal species that benefit from diverse and high vegetation structure on rangelands and reduces habitat suitability for wildlife species requiring low structure grasslands.

The stocking rate for moderate grazing intensity is at the suggested NRCS stocking rate for the local area. This stocking rate is expected to result in the majority of the area to produce moderate structure and intermediate seral stages.

The stocking rates for heavy grazing intensity are 10 to 20% more than the NRCS suggested stocking rate for the local area. This grazing intensity encourages early successional stages and low plant structure. This grazing intensity typically provides no quality habitat for the plant and animal species requiring diverse and high structure rangeland vegetation, but provides quality habitat for those species that use low structure (average visual obstruction readings or stubble heights < 2 inches) grasslands. Included within the low structure grassland are prairie dog colonies. Amendment 3 of the LRMP sets the range of fully active prairie dog colonies for the WGA as 1,000 to 3,600 acres and for the ONG 1,000 to 2,800 acres. This covers approximately 1-3% of the geographic areas and is below the desired objectives for the areas.

Woody draw/riparian: These draws will be managed to perpetuate multiple layers and age classes of vegetation including herbaceous plants, shrubs, and trees.

Wetland/aquatic habitat: These areas will be managed to maintain soil moisture to perpetuate riparian plant communities with strong root masses, emphasize healthy submergent and emergent vegetative cover along streams and shorelines while reducing sediment levels to maintain high quality aquatic habitat. Plant species include sedges, rushes, and willows.

Prairie Dog Colonies: These areas will be managed to maintain and enhance low structure grassland habitat on 10 to 30 percent of this geographic area to facilitate black-tailed prairie dog expansion.

Sagebrush: Associated with sage grouse will be managed to provide an abundance of residual herbaceous cover for nesting.

Greasewood: Greasewood: No specific mention is made of the desired condition of the greasewood habitat in the LRMP, but it can be assumed that this habitat will be managed to maintain a healthy greasewood community.

Existing Condition

The WGA encompasses about 119,749 acres of National Forest System lands on the southwestern portion of the Fall River Ranger District. The OGA encompasses about 94,174 acres of National Forest System lands in northwestern Nebraska.

The dominant vegetation for the WGA includes western wheatgrass in the uplands, with scattered cottonwood and chokecherry communities. Ponderosa pine can be found along the escarpment of Fiddle Creek. A significant sagebrush community lies north of the Black Hills Army Ordnance Depot. The 45,760 acre sage brush area is identified in the LRMP as Management Area 3.64 Special Plant and Wildlife Habitat: Sage Grouse. Habitat evaluation report of the sage area is on file (Hodorff 2005). Throughout this document this area will be referred as the sage grouse area. Scattered greasewood communities can be found along creek bottoms throughout the geographic area.

The upland grassland is the primary vegetation/habitat type of the OGA. Mid grasses dominate the native vegetation, but include short grasses and a variety of forbs. Badlands provide a unique habitat for some plants and animals that are suited to open, barren soils. Although the woody draw/riparian woodland habitat comprise a small portion of the geographic area, this habitat type is critical for many wildlife species. Principle woody species include cottonwood, green ash, boxelder, silver buffaloberry, snowberry, willow and wildrose. The Roundtop area of the Oglala Geographic Area consists of a ponderosa pine/grassland mix typical of the Pine Ridge Geographic area. Wetland/aquatic habitat is unusual in this geographic area and much of it is located near constructed water impoundments that provide waterfowl habitat and support warm-water fisheries. The sagebrush habitat type is very limited and found along several of the major floodplain areas scattered across this geographic area.

Upland Grasslands: The key habitat component in the upland grassland community is vegetative structure. Vegetative structure is defined in the LRMP as "the vertical characteristics of vegetation". Different wildlife species respond to vegetative structure in different ways. Some species like the bobolink can be found exclusively in tall dense grass, while the McCown's longspur is a short grass species. Other species may use a wide array of vegetative structure classifications for different activities. For example sharp-tailed grouse will select short sparse vegetation for display grounds and tall dense vegetation for nesting and brood rearing. Figure 1 illustrates how some species of birds respond to different grassland vegetative structure. Vegetative structure parameters for the WGA & OGA were set in the LRMP and are listed above. Vegetative structure is measured using a Robel pole as described in Rangeland Analysis and Management Training Guide (USDA 1996) or in the WGA as droop height (Connelly et. al. 2000) (Robel pole is ineffective in sagebrush areas).

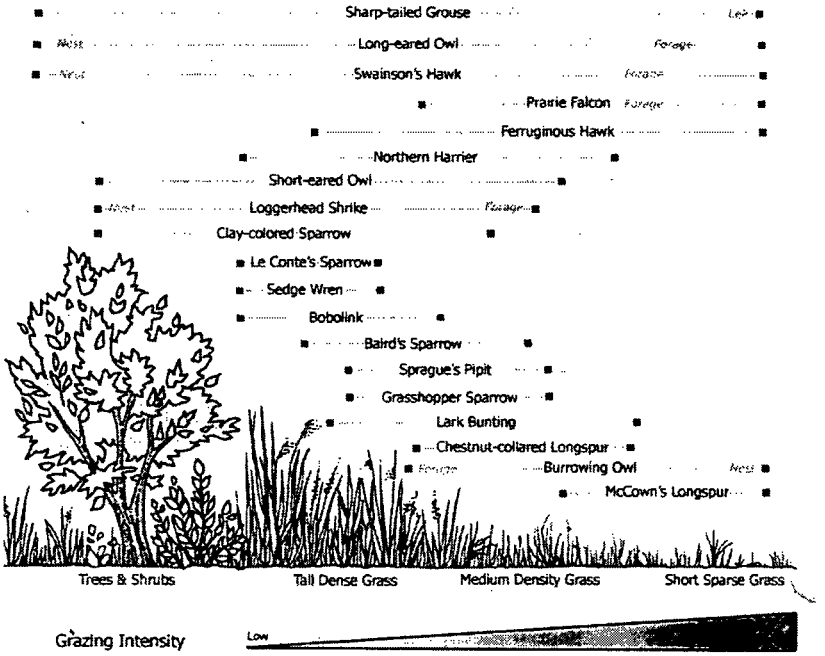


Figure 1. Avian selection of vegetation grassland structure.

A Desired Condition of the LRMP is that upland grassland habitat will be managed to provide sufficient residual cover for those wildlife species requiring higher grassland structure levels. The LRMP objectives for desired structure levels for the WGA and OGA take into account the needs for several wildlife species including but not limited to the sharp-tailed grouse (management indicator species (MIS) on the OGA) and greater sage grouse (MIS on the WGA). Both species are upland game and are considered MIS for different Geographic Areas on the Nebraska National Forests & Grasslands (NNF&G). Appendix I of the LRMP provides guidance on how structure can be maintained using livestock, and an LRMP standard is to modify livestock grazing practices as needed to reduce adverse impacts of drought on food and cover for prairie grouse and other wildlife.

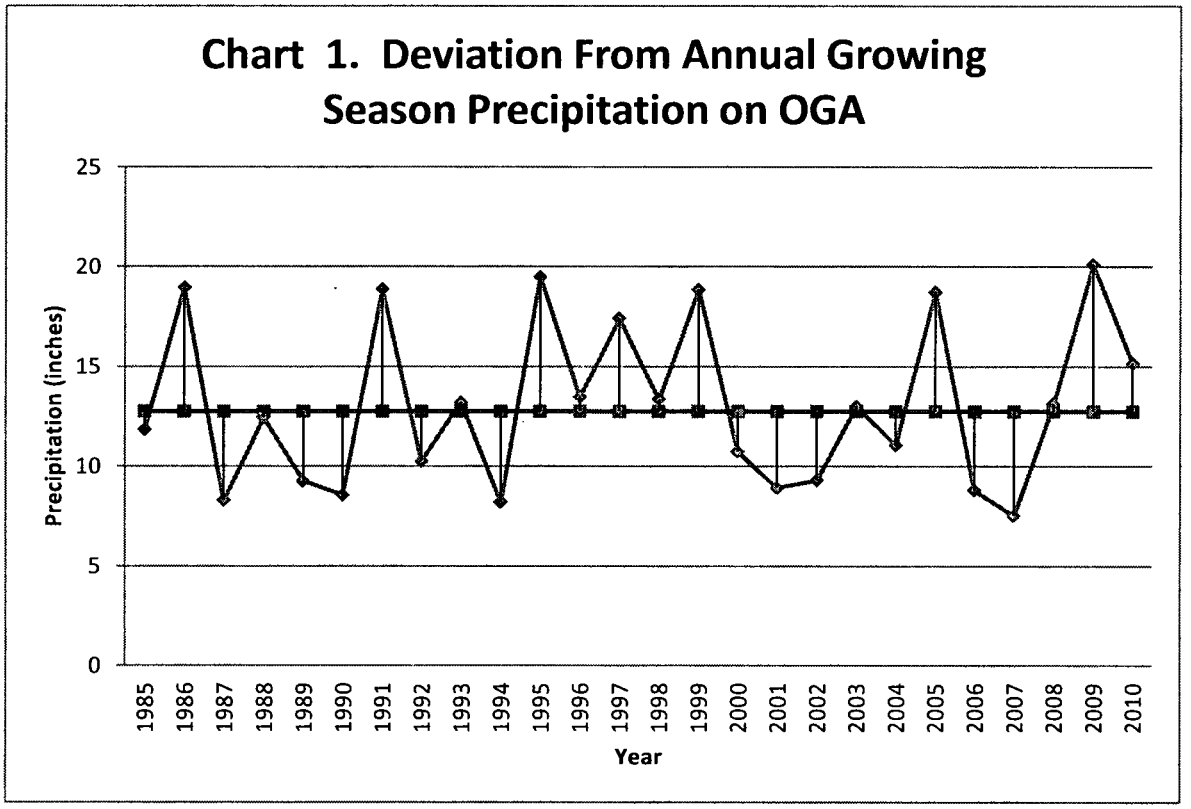
Robel transects were established to monitor residual cover in the OGA. Thirty-two (2004) to thirty-three (2005 and 2006) transects were selected at random and data was collected in 2004 – 2006. A summary of this data is presented in Table 3. An extended drought was occurring during the times this data was collected. Precipitation data collected from the NOAA Harrison (COOP) Station indicates that the first below average year for growing season precipitation occurred in 2000 and returned to average or above growing season precipitation in 2008 (Chart 1). During that drought period, average or above growing season precipitation was only seen in 2003 and 2005 (Chart 1 and Table 3). Because of the drought conditions it would be expected that vegetative production will be low and this is reflected in the numbers especially in 2004 and 2005 when the majority of the OGA had low structure. In 2006 the numbers approached LRMP objectives but were still low in the moderate category and high in the low category while meeting desired conditions in the high category.

Sharp-tailed grouse select short sparse vegetation for display grounds and tall dense vegetation for nesting and brood rearing. Under the current stocking rates we were not currently meeting the desired condition for vegetative structure as of 2006, but the data shows that the vegetation structure appeared to be trending toward the desired condition (Table 3). Since 2008 the NOAA Harrison (COOP) weather station has shown growing season precipitation data to be at or above the average annual growing season precipitation (Chart 1). If the spring vegetation structure composition trend is continuing to hold true, we might expect that the OGA is meeting or near meeting the desired vegetation structure composition under

the current stocking rates. It would be recommended that the Pine Ridge Ranger District resume its Robel transect monitoring in the OGA over the next several years in order to determine the current status of the vegetation structure in the Geographic Area.

Table 3. Vegetation Structure for the OGA 2004-2006

Precip Data (inches)		Spring Structure Composition			
Year	Growing Season (April-Sept)	Year	% High (3+)	% Moderate (2-2.9)	% Low (<2)
2003	12.99	2004	10	6	84
2004	11.06	2005	0	25	75
2005	18.75	2006	16	37	47
Average Growing Season Precipitation	12.72"	Desired	10-30%	50-70%	10-30%



Robel pole transects have not been completed on the WGA. The presence of sagebrush makes the data difficult to interpret. Two methods are being used to evaluate range structure in the area, droop height of herbaceous vegetation and stocking rates.

Appendix I of the LRMP describes the suggested stocking rates that are expected to help provide the desired mosaic of seral stages and vegetative structure on rangelands. A description of stocking rates and the expected results is summarized in the desired condition section of this document (page 3). Table 4

illustrates the current structure conditions for the WGA assuming stocking rate of less than 70% of NRCS suggested stocking will produce high structure, stocking rates of greater than 110 % of NRCS suggested stocking will produce low structure with everything else resulting in moderate structure. It would be recommended that the Fall River Ranger District implement vegetative structure monitoring on the WGA over the next several years in order to determine if the stocking rates in Appendix I. achieve the desired structure components.

Table 4. Expected Existing WGA Structure Based on LRMP Appendix I

	High Structure	Moderate Structure	Low Structure
Current status	12%	62%	26%

Within the sagebrush community Connelly et. al. (2000) suggestion the best way to assess herbaceous structure was to measure the droop height of herbaceous plants. Droop height (Connelly et. al. 2000) of herbaceous vegetation was measured in the summers of 2003 & 2004 on 67 sites within the WGA. The average droop height measured in 2003 was 32.9 and in 2004 it was 10.2. This information is presented below in the sagebrush section (page 8) in a more thorough fashion.

Woody draw/riparian: Woody draw/riparian woodland habitat comprise a small portion of the two geographic areas, but this habitat type is critical for many wildlife species. The woody draw/riparian woodlands provide the highest diversity of both plant and animal life in the geographic area. On the OGA the principle woody species include cottonwood, green ash, boxelder, silver buffaloberry, snowberry, willow and wildrose. The Roundtop area of the OGA consists of a ponderosa pine/grassland mix typical of the Pine Ridge Geographic Area. The woodlands that occur on the WGA are mostly cottonwood and chokecherry communities, and a few ponderosa pines can be found along the escarpment of Fiddle Creek.

Those pastures with woody draw/riparian areas within the WGA are listed in Table 5.

Table 5. Those pastures with woody draw/riparian areas within the WGA and OGA.

Allotment / Pasture	Habitat Type	Current Management
Beebe-Markey / North	Cottonwood	Winter Grazing
Cottonwood Group / Northwest	Cottonwood	No Grazing
Ellison Dam / North	Cottonwood	No Grazing
Fuch / Fuch	Cottonwood	Winter Grazing
Porter / Moss Agate	Cottonwood	Winter Grazing
Simons / North	Shale / Chokecherry[1]	None
Honadel / Starner	Shale / Chokecherry[1]	None
Trotter-Coal Crk / Burning Ground	Shale / Chokecherry[1]	Exclosure
Phister/ Perimeter	Shale / Chokecherry[1]	Early Spring
Miller 514 / Winter	Cottonwood	Winter Grazing
Miller 387 / Duck Creek	Cottonwood	Winter Grazing

Allotment / Pasture	Habitat Type	Current Management
Miller 387 / Hat Creek	Cottonwood	Winter Grazing
Miller 387 / Hay Creek	Cottonwood	Winter Grazing
Indian Misc / Skinny	Cottonwood	No Grazing
Cow Camp / Cow Creek	Cottonwood	Deferred Rotation / Avoiding growing season
Cow Camp / 299	Cottonwood	No Grazing
Brush Creek / Brush Creek	Cottonwood	No Grazing
Antelope Creek /12A	Cottonwood	Deferred Rotation, Grazed Spring or Fall
Antelope Creek / 12	Cottonwood	Deferred Rotation, Grazed Spring or Fall
Badlands / 33B	Cottonwood / Willow	5-Pasture Deferred Rotation
Badlands / 37	Cottonwood	5-Pasture Deferred Rotation
Burlington / 23N Riparian	Cottonwood	Spring Grazing
Hat Creek / 17N	Cottonwood	Winter Grazing
Hat Creek / 17E	Cottonwood	Winter Grazing
Hat Creek / 17W	Cottonwood	Winter Grazing
Horn / 40S	Cottonwood / Willow	Spring Grazing
Indian-Brush / 1N	Cottonwood / Willow	Spring Grazing
Long Branch / 21B	Cottonwood	Spring Grazing
Long Branch / 21E	Cottonwood	Fall Grazing
Prairie Dog / 45	Cottonwood	Swing Pasture
Sand Creek / 38E & E Riparian	Cottonwood / Willow	Deferred Rotation, Grazed Spring or Fall
Sugarloaf / 31N	Cottonwood	Spring Grazing
Waldon Hills / 27S Ungrazed exclosure	Cottonwood	No Grazing
Warbonnet / 14 exclosure	Cottonwood / Willow	No Grazing
Warbonnet / 15	Cottonwood	2-Pasture Rotation
Whitehead / 19A	Cottonwood	2-Pasture Alternating Rotation

Allotment / Pasture	Habitat Type	Current Management
Whitehead / 19	Cottonwood	2-Pasture Alternating Rotation

[1] Chokecherry patches are located in Grummit Shallow Clay range site - livestock have little effect on these areas.

Wetland/aquatic habitat: The wetland/aquatic habitats of the WGA and OGA occur in the drainage bottom or are located in constructed water impoundments. On the WGA, drainages generally flow north into the Cheyenne River. Primary tributaries flowing into the Cheyenne River in this geographic area include, from north to south: Moss Agate Creek, Dry Creek, Fiddle Creek, Cottonwood Creek, Coal Creek, Alkali Creek, Indian Creek and Hat Creek. The primary creeks and drainages on the OGA include Sand Creek, Longbranch Creek, Whitehead Creek, Hat Creek, Antelope Creek, Indian Creek and Brush Creek. The majority of water impoundments were constructed to water livestock, but they do provide habitat for many aquatic species including waterfowl and some support a warm-water fishery. These stockdams vary in size from a fraction of an acre to 20 acres.

All drainages directly affected by grazing allotments within the WGA portion of the project area are ephemeral with some drainages approaching intermittent during years of high precipitation. These drainages carry snowmelt and overland flow resulting from cloud bursts normally occurring during the summer months.

There is a controversial flowing well that feeds into Coal Creek, which is tributary to Cottonwood Creek above the Miller 514 Winter Pasture within the WGA. Water from this well maintains flow in Cottonwood Creek for most of the year and is the reason fish inhabit this stream. There have been proposals to cap this well and use the water in a pipeline system, which would change alter greatly stream habitat in Cottonwood Creek.

There are some live stream courses within the OGA. They are portions of: Antelope Creek, Long Branch Creek, Whitehead Creek, Sand Creek, Indian Creek, Hat Creek, and Jim Creek. None of the project area directly affects the Cheyenne River, Angostura Reservoir, or the White River. Wetland/aquatic habitat is unusual in this geographic area and much of it is located near constructed water impoundments that provide waterfowl habitat and support warm-water fisheries.

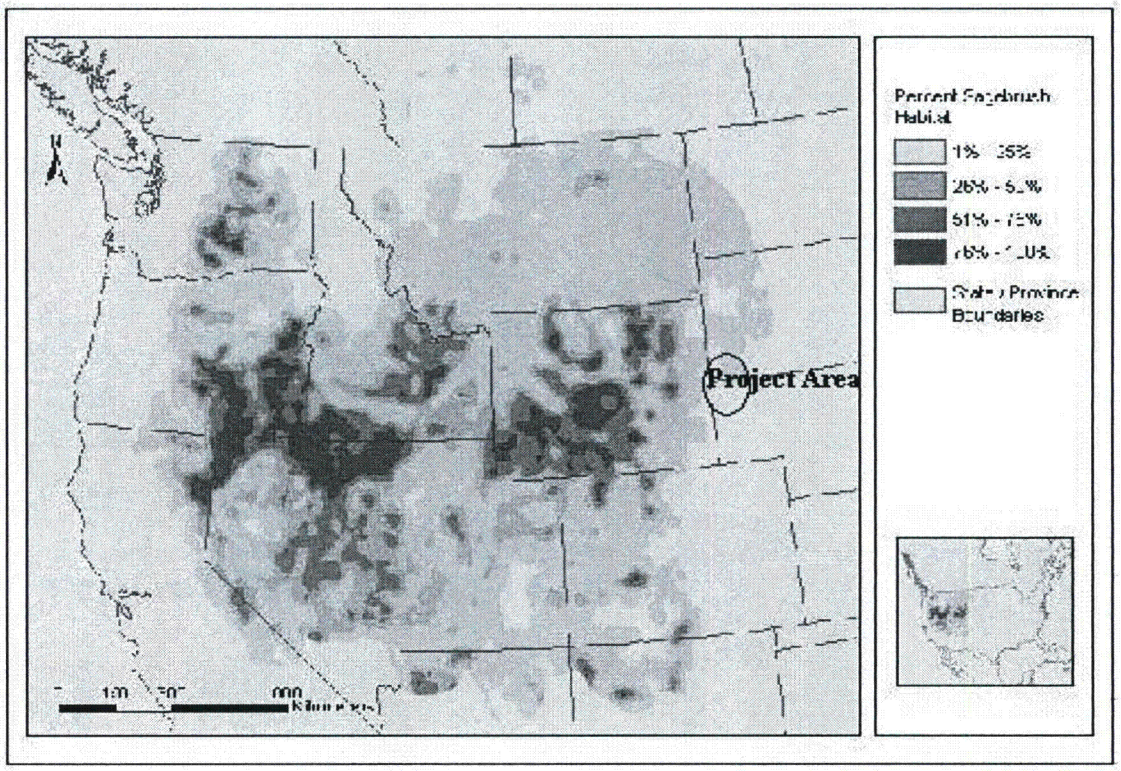
Prairie Dog Colonies: Two decisions have been completed concerning prairie dog management on the Nebraska Nations Forest. These decisions present the overall objectives for prairie dog management on the two geographic areas.

1. USDA Forest Service 2005 - Black-Tailed Prairie Dog Conservation and Management on the Nebraska National Forest and Associated Units (Forest Plan Amendment 2) (Boundary Management) (USDA Forest Service 2001). This decision established a boundary management zone of ½ mile from private land and authorized lethal control within the ½ mile buffer for both the OGA & WGA.
2. USDA Forest Service 2008 - Black-Tailed Prairie Dog Management on the Nebraska National Forest and Associated Units (Forest Plan Amendment 3) (Interior Management) (USDA Forest Service 2001). For both the WGA & OGA the minimum number of active acres of prairie dogs to be maintained on the landscape is 1,000 acres. The maximum number of active prairie dog colony acres to be maintained on the OGA is 2,800 acres and on the WGA it's 3,600 acres.

In 2009 there were 2,048 acres (1,417 acres Interior Management Zone) of active prairie dog colonies on the OGA and 796 acres on the WGA.

Sagebrush: The sagebrush (*Artemisia* spp.) biome has changed since settlement by Europeans. The current distribution, composition and dynamics, and disturbance regimes of sagebrush ecosystems have been altered by interactions among disturbance, land use, and invasion of exotic plants (Connelly et. al. 2004). The project area is located adjacent to the eastern sagebrush steppe region (the *Bouteloua* region) and is on the transition zone between this sagebrush community to the west and the mixed grass prairie to the east (Map 1). This fact plays an instrumental role in how the plant communities in the project area responded to disturbances and treatments that have been applied in the past and can be applied in the future.

Map 1. Distribution of Sagebrush across the western United States (Connelly et. al. 2004).

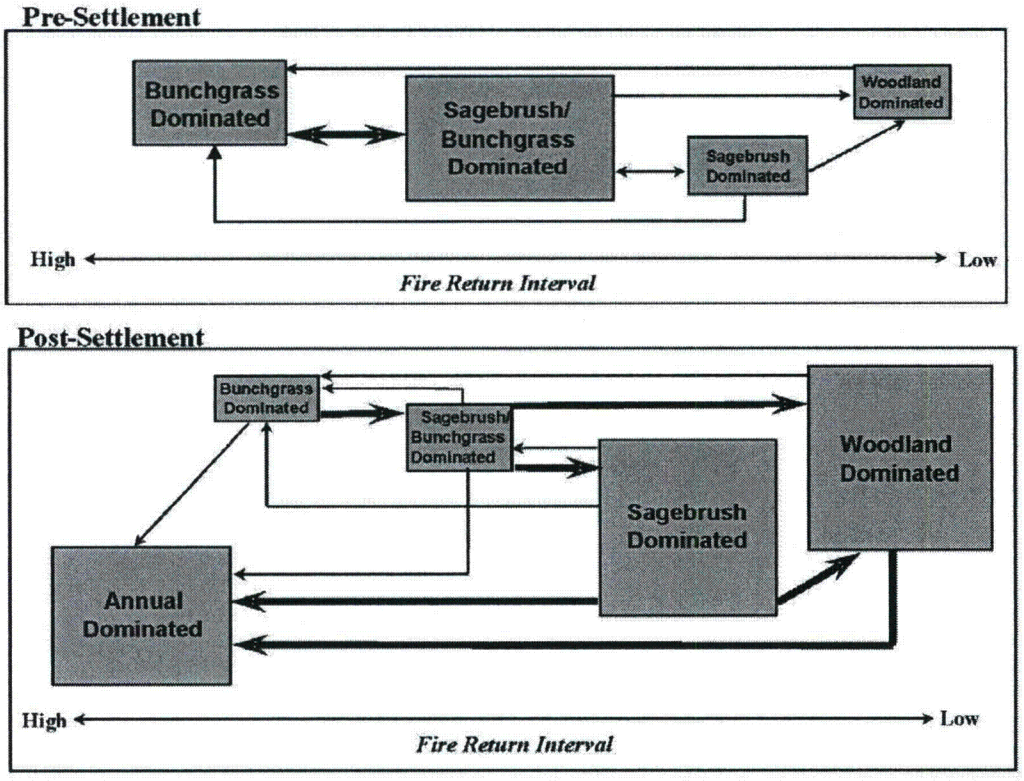


The pattern and influence of livestock grazing in sagebrush habitats is different from the system in which the plants evolved over the past 10-12,000 years before present (BP). Much of the western sagebrush biome (the *Agropyron* region) has had a long period in which large hoofed grazers were rare. Large herbivores became extinct at end of Pleistocene (10,000 – 12,000 years BP) and the American bison (*Bison bison*) largely withdrew its distribution, but small numbers still ranged in some parts of the Great Basin region and western Montana and were relatively common in eastern Idaho prior to European settlement. In the eastern sagebrush steppe region (the *Bouteloua* region) (the project area is located within this region), grazing by bison was locally intense but highly variable in space and time (Connelly et. al. 2004).

The traditional state and transition model for sagebrush steppe habitat is presented in Table 6 (Connelly et. al. 2004). This model best illustrates the intertwined relationship between many of the factors effecting the sagebrush community pre and post settlement. Fire return interval is the variable that

appears to drive the system. In the pre-settlement time the sagebrush bunch grass community was dominant and as the fire interval increased the community changed to a more bunch grass dominated community and as it decreases the shift was toward sagebrush dominated community. In the project area the shift to a woodland dominated community does not occur, so this will not be discussed. Post settlement many disturbance factors were added to the system including, but not limited to, grazing by domestic livestock and the spread introduced annual grasses. In this system introduced annual grasses have facilitated the spread of fire through the sagebrush community. As fire intervals increase more sagebrush is burned and the community moves toward an annual dominated community. As the fire interval decreases in the post-settlement system the community shifts to sagebrush dominated community. It is believed that domestic livestock eat the native herbaceous plants that exist beneath the sagebrush which in turns allows the sagebrush to expand and leads to a denser canopy of sagebrush. This has led to treatments to increase forage and reduce sagebrush and other plant species unpalatable to livestock.

Table 6. Pre- and post-settlement dynamics in the sagebrush biome. Box and arrow size is an estimate of the relative proportion of the shift from one steady state (community) to another (Connelly et. al. 2004)

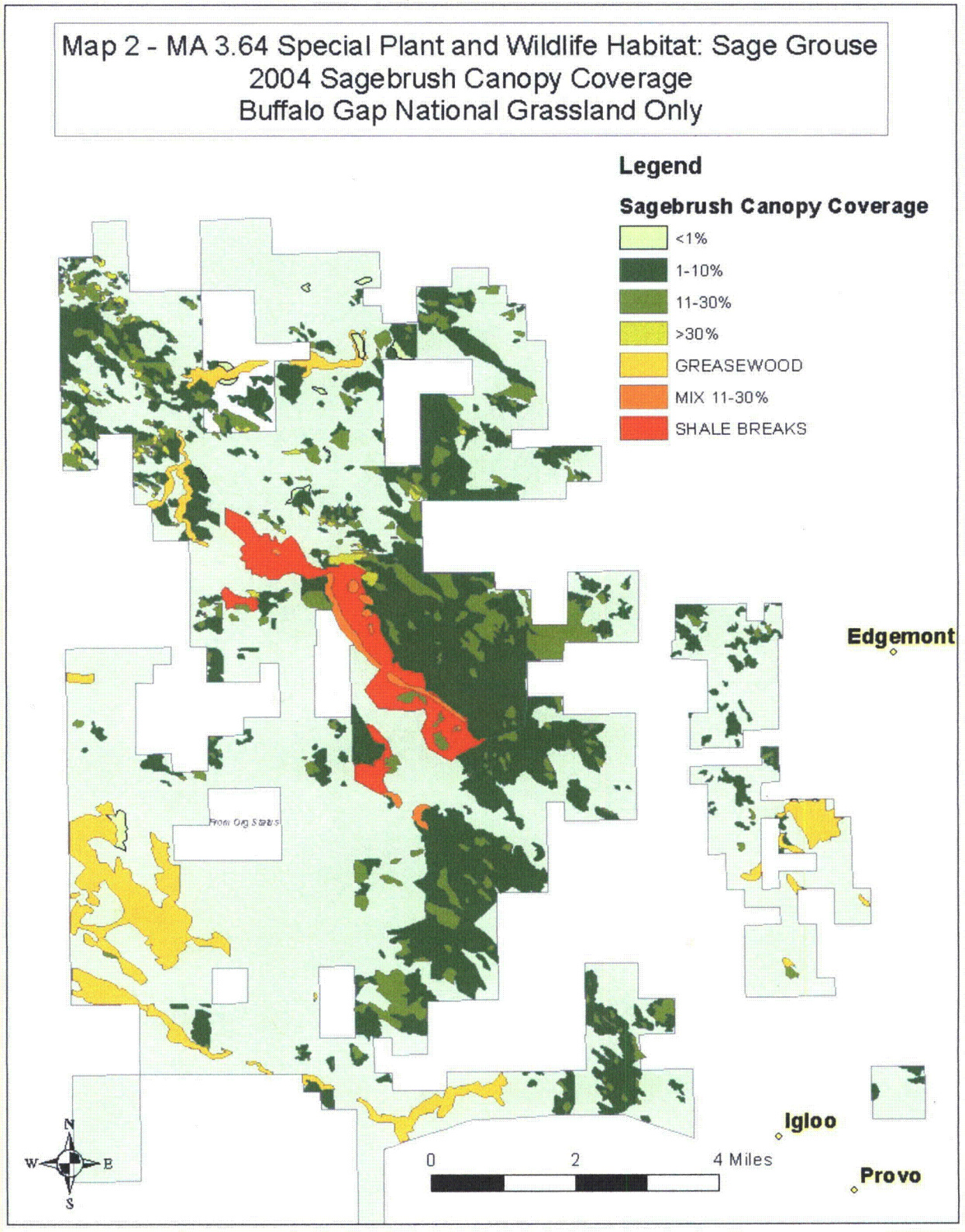


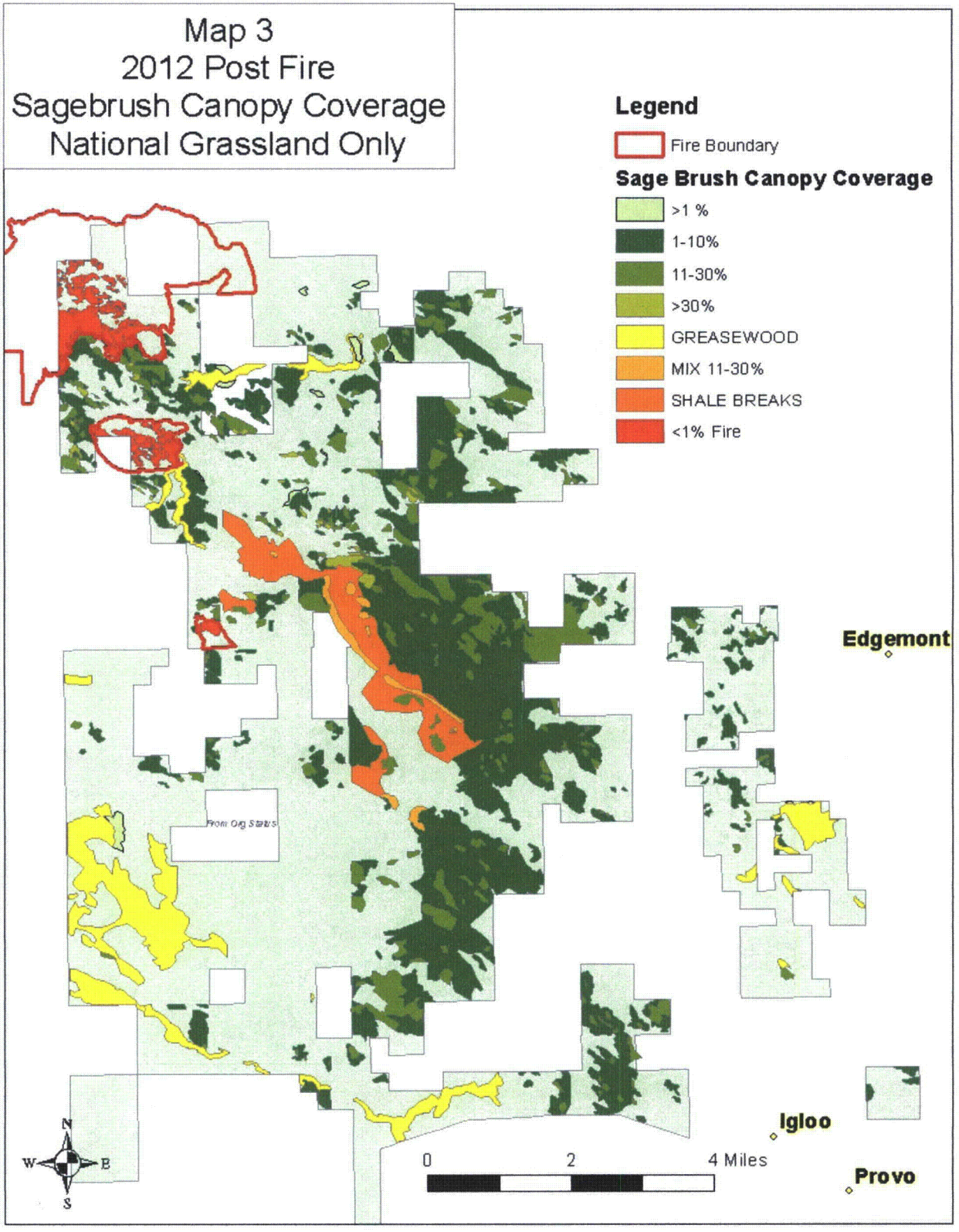
It is unclear how this state and transition model works in the transition zone between the sagebrush community and the mid grass prairie. Which is where the project area is located. It is obvious on the landscape where either wild fire or herbicide treatments have occurred Photo 1. Although we do not know exact dates of the disturbances we do know that it was at least 40 years since the sagebrush was removed and little or no sagebrush regeneration has occurred. It is obvious that natural restoration of sagebrush in this area is long process. It is entirely possible that the natural process in the transition zone is the plant community will permanently shift to a mixed grass prairie when sagebrush is removed.

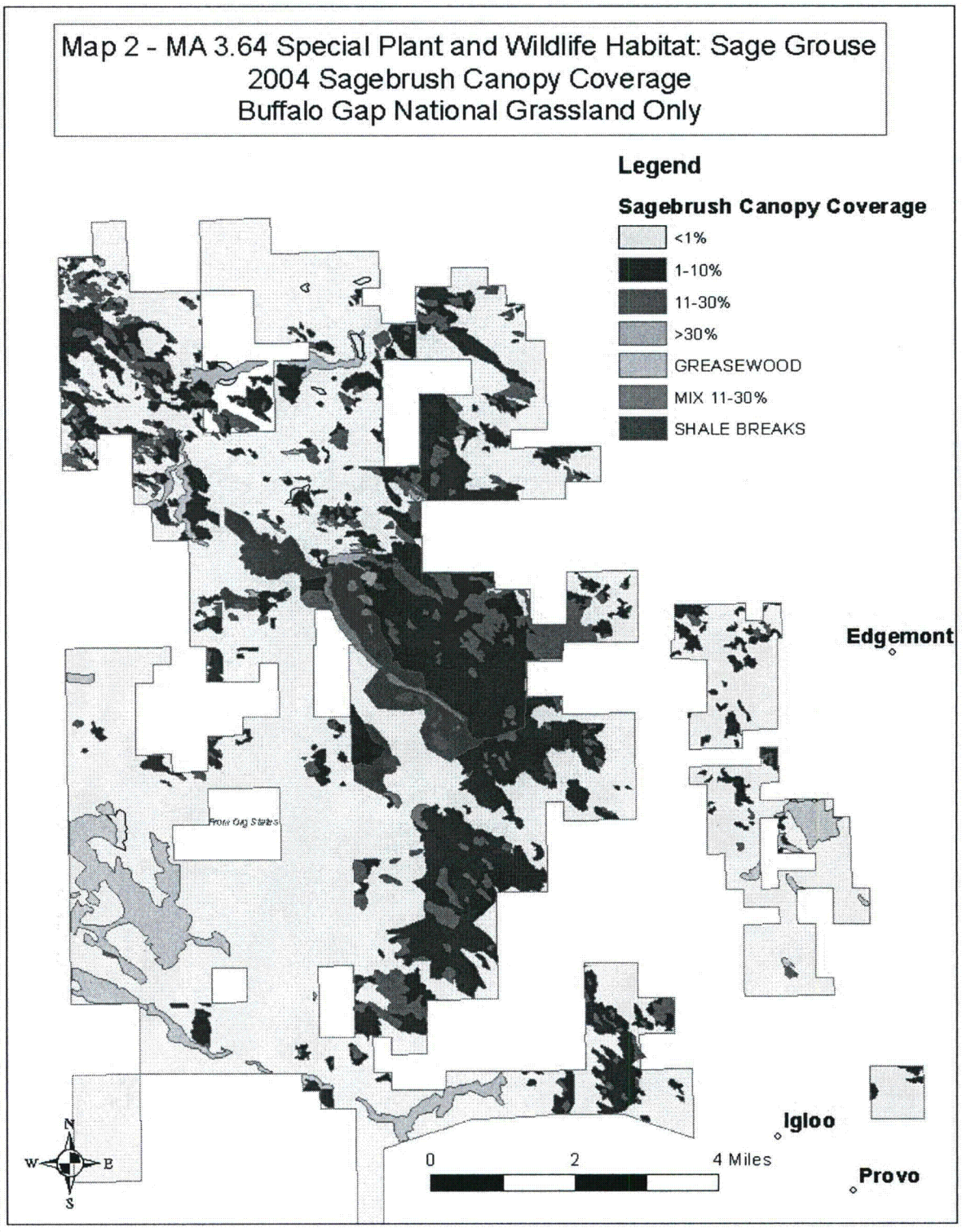
Photo 1. Photo of where either fire or herbicide treatment has eliminated the sagebrush in the WGA.

Sagebrush exists on the landscape of the WGA in scattered patches. Some of this pattern can be attributed to the fact that the area is located on this transition zone and the sage naturally thins before the landscape changes to prairie. Also, sagebrush tends to be killed by fire and fires have moved through the area on a regular basis. Another reason for the patchy distribution is the sagebrush in the area was treated with herbicide in the past. There is no documentation of the time and extent of the treatment in the Forest Service files so this activity cannot be quantified. It is believed that the spraying occurred in the 1960's when this was a common activity across the sagebrush country.

Two comprehensive studies were conducted to assess the sagebrush habitat on the project area. Both studies were conducted in the northwest section of the WGA. This is the area that was identified in the 2001 revision of the LRMP as MA 3.64 Special Plant and Wildlife Habitat: Sage Grouse. This area will be referred to throughout this document as the Sage Grouse Area (Map 2.)


Map 2 - MA 3.64 Special Plant and Wildlife Habitat: Sage Grouse
2004 Sagebrush Canopy Coverage
Buffalo Gap National Grassland Only
Legend
Sagebrush Canopy Coverage
<1%
1-10%
11-30%
>30%
GREASEWOOD
MIX 11-30%
SHALE BREAKS
Edgemont
Igloo
Provo
From Org Stats
N
W
E
S
0
2
4 Miles


Map 3
2012 Post Fire
Sagebrush Canopy Coverage
National Grassland Only
Legend
Fire Boundary
Sage Brush Canopy Coverage
>1 %
1-10%
11-30%
>30%
GREASEWOOD
MIX 11-30%
SHALE BREAKS
<1% Fire
Edgemont
Igloo
Provo
N
W
E
S
0
2
4 Miles


Map 2 - MA 3.64 Special Plant and Wildlife Habitat: Sage Grouse
2004 Sagebrush Canopy Coverage
Buffalo Gap National Grassland Only
Legend
Sagebrush Canopy Coverage
<1%
1-10%
11-30%
>30%
GREASEWOOD
MIX 11-30%
SHALE BREAKS
Edgemont
Igloo
Provo
N
W
E
S
0
2
4 Miles

The first study was conducted in 1992. In 1992 the MIS for the sagebrush habitat was the pronghorn and the objective of the 1992 study was to evaluate the area using a Habitat Suitability Index for pronghorn. The sage grouse was selected in the 2001 revision of the LRMP as the management indicator species (MIS) for the sagebrush habitat in the West Geographic Area.

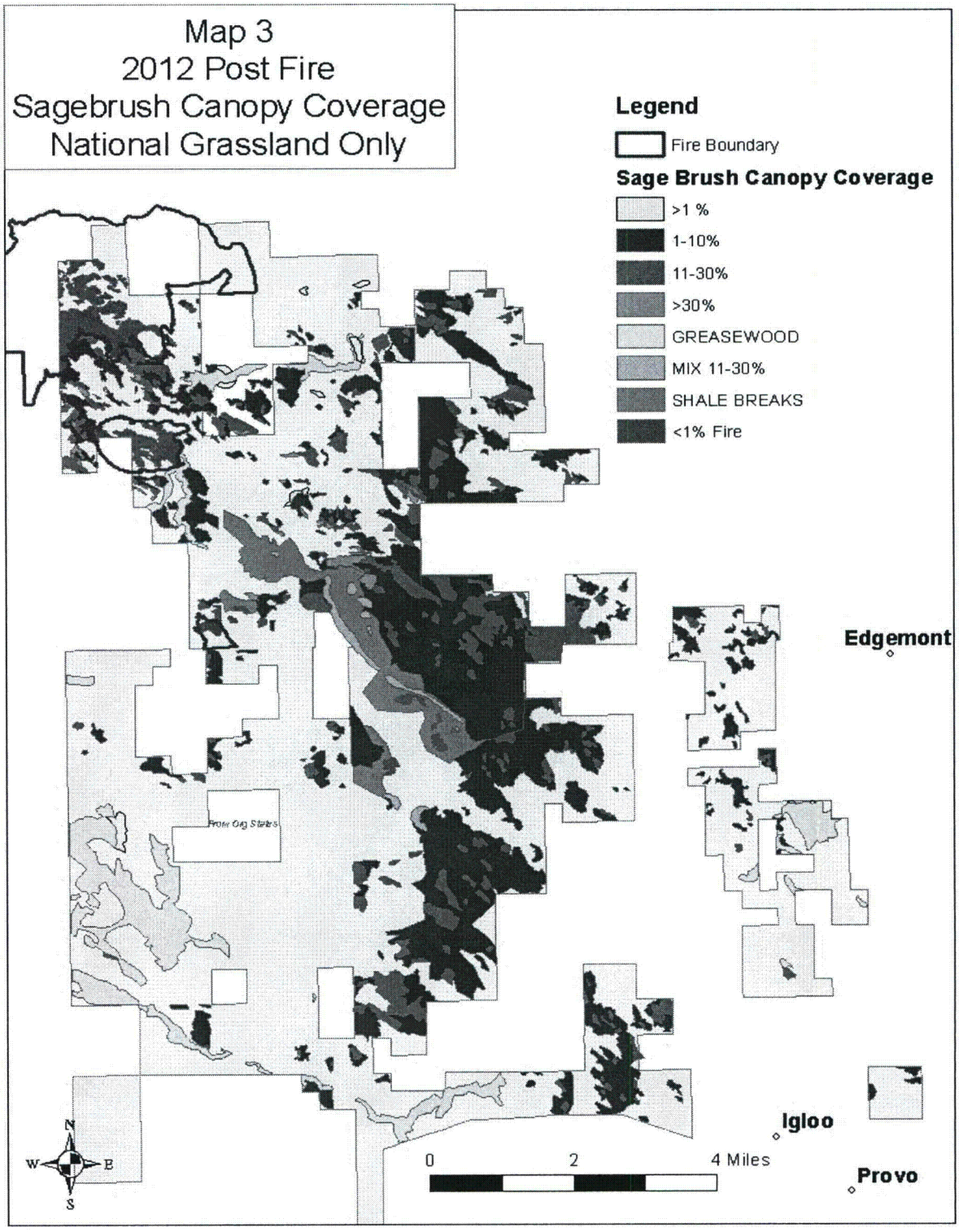
Based on Connelly et. al. (2000) the habitat variables that are important to assess in sage grouse habitat are: canopy coverage of sagebrush, height of the sagebrush, canopy coverage of grasses, canopy coverage of forbs, and height of grass-forbs during the nesting period. With the exception of the height of grass-forbs the same variables were collected in the 1992 study.

In the 2003-4 study aerial photos were used to map the density of sagebrush in the area. This map was then ground truthed. Map 2 displays the location of the sagebrush and the density of sage brush within the sage grouse area (Hodorff 2005). Table 7 presents a breakdown of the canopy coverage of the different sagebrush classes by acres and percent of the total area.

Since 2004 three large fires have burned substantial acres within the sage grouse area. Map 3 shows the location of the fires. Any sagebrush located within the boundaries of these fires was destroyed, which moved it to the <1% category. Table 7 also shows the number of acres that burned and recalculates the percentages of the area in each sagebrush canopy coverage category after the fires.

Table 7. Summary of big sagebrush canopy coverage in the sagebrush management area pre and post fires

Sagebrush Canopy Coverage Classification	2004		2012 Post Wildfires		
	Acres	% of the area	Acres burned	Acres post Fire	% of the area Post Burn
<1 %	30,929	64.5	1337	31,676	66.0
1-10%	9,979	20.8	470	9,509	19.8
11-30%	2,764	5.8	214	2,550	5.3
>30%	223	0.5	63	160	0.3
Shale Breaks 11-30%	222	0.5	0	222	0.5
Shale Breaks 1-10%	1,365	2.8	0	1,365	2.8
Silver sagebrush	141	0.3	0	141	0.3
Sand sagebrush	14	0	0	14	0.0
Greasewood	2,335	4.9	0	2,335	4.9
Grand Total	47,971	100	2084	47,972	100


Map 3
2012 Post Fire
Sagebrush Canopy Coverage
National Grassland Only
Legend
Fire Boundary
Sage Brush Canopy Coverage
>1 %
1-10%
11-30%
>30%
GREASEWOOD
MIX 11-30%
SHALE BREAKS
<1% Fire
Edgemont
Igloo
Provo
0
2
4 Miles
N
W
E
S

Comparison of 1992 and 2004 study

Figures 2-5 are taken directly from the report prepared by FS personnel (Hodorff 2005).

The height of the sagebrush was greater in all categories in 2003 compared to 1992 (Figure 2). The canopy coverage of grasses (Figure 3) and forbs (Figure 4) were slightly higher in 1991 compared to 2003. The percent of the area in the different canopy coverage classifications are similar (Figure 5). Although no statistics have been completed on any of these variables, it is very doubtful that there are any significant differences between the two different studies. It appears the sagebrush community within the SGA has not change significantly in 11 years.

Figure 2.

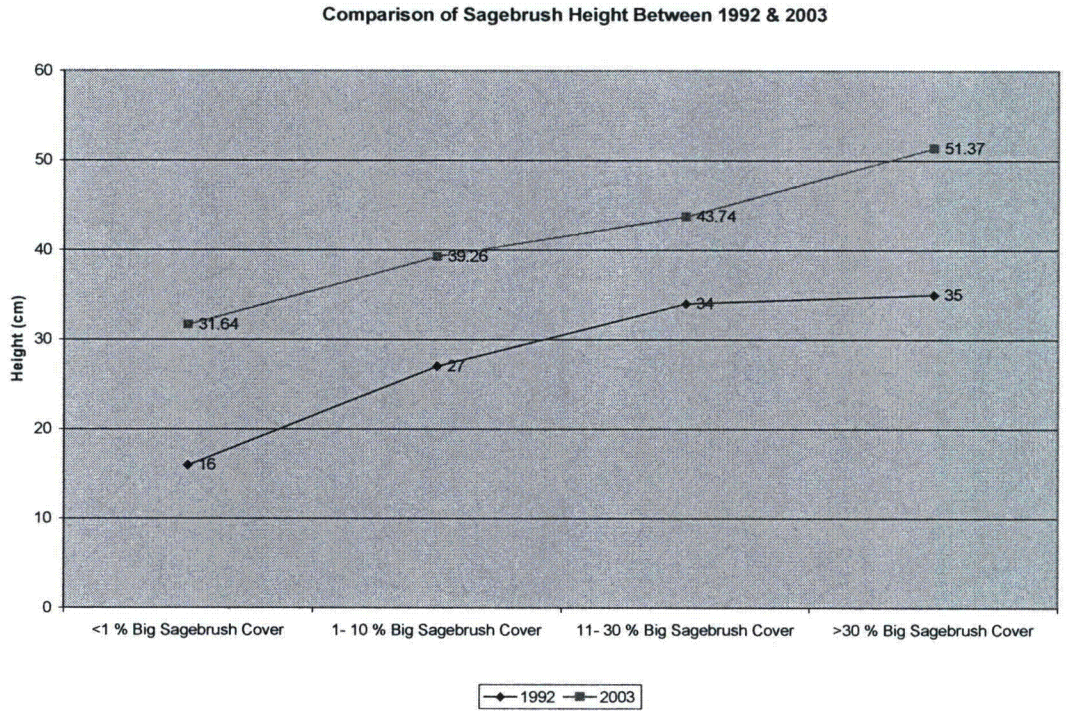


Figure 3.

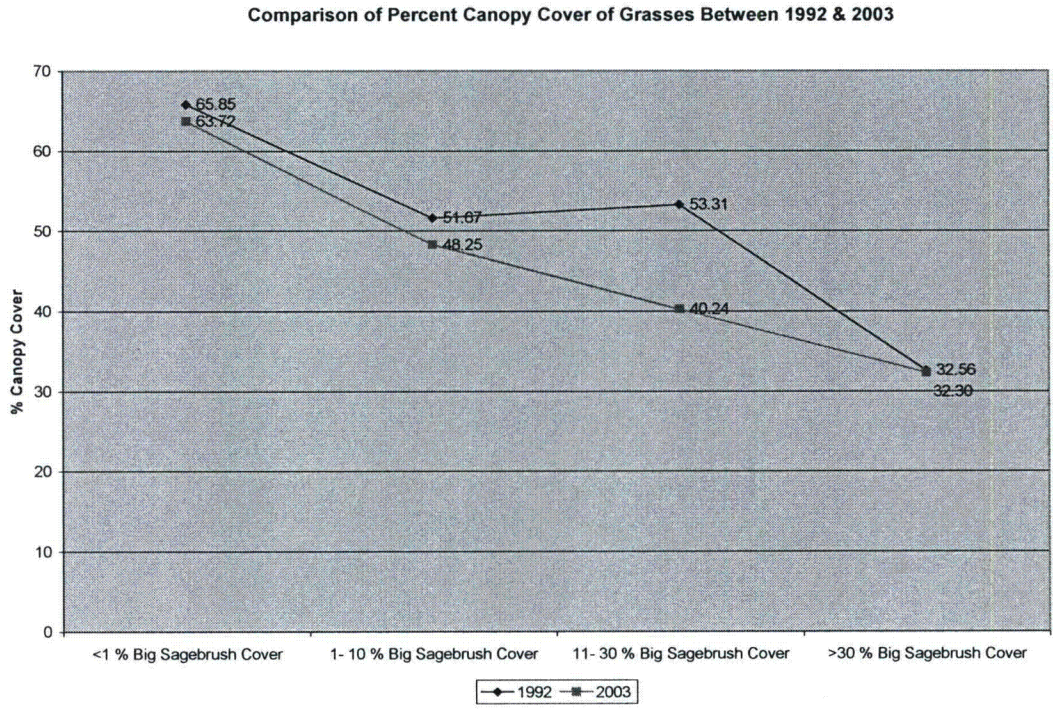


Figure 4.

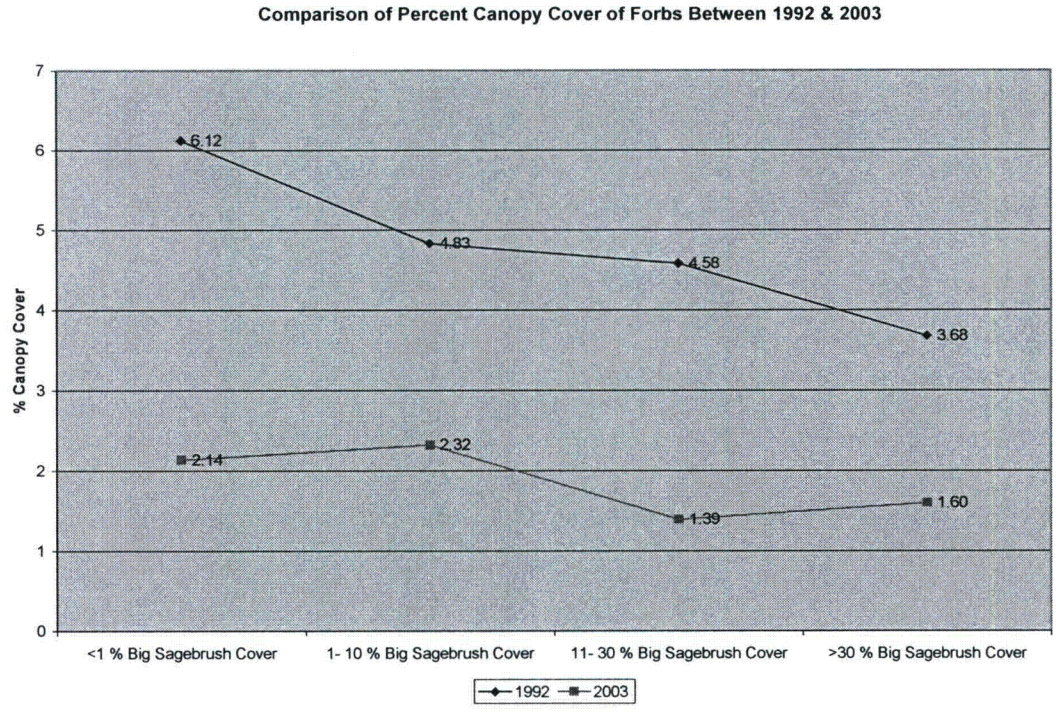
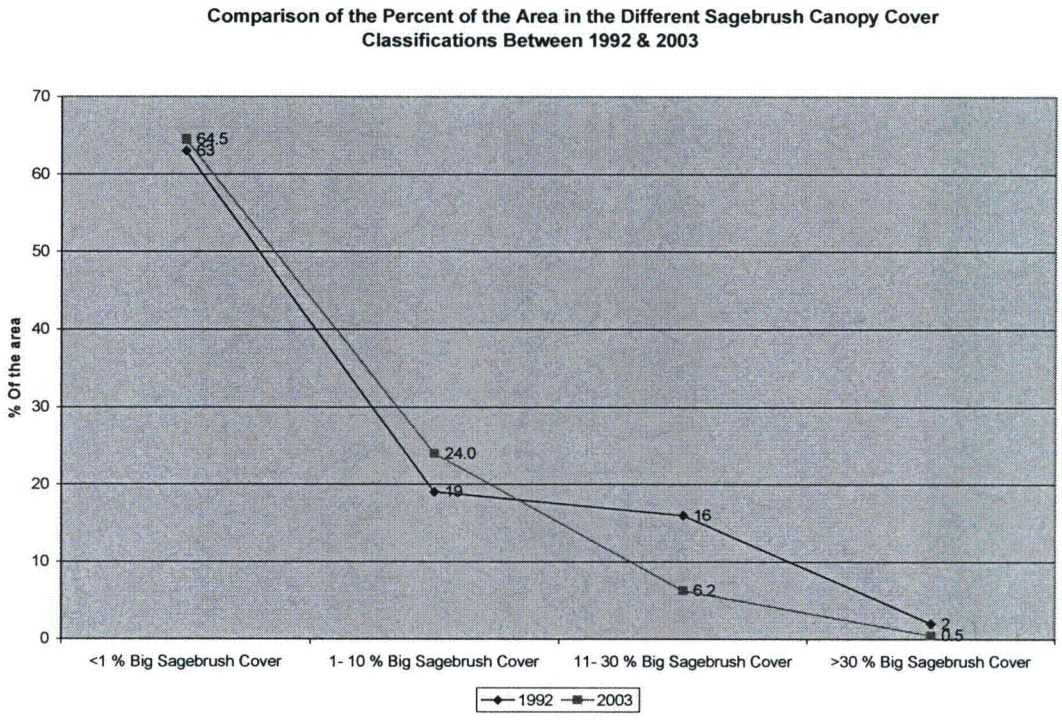


Figure 5.



Annual habitat requirements for sage grouse are partitioned into 3 categories: breeding habitat, brood rearing habitat, and winter habitat. The information presented in Table 8 summarizes the data collected in 2004 and presents the optimum habitat characteristics for productive sagebrush habitat for the different sage grouse habitat categories (Connelly et. al. 2000).

The variables that fall below Connell's recommended optimum values were the percent of the area with 10% or greater canopy coverage of sagebrush, the total canopy coverage of forbs, and the droop height of herbaceous vegetation in 2004 (Table 8).

Connelly et. al. (2000) stated that optimum values for sage grouse breeding habitat is 80 % of the total area should support canopy coverage of sagebrush between 15 & 25 per cent. For brood rearing habitat 40 % of the total area should support canopy coverage of sagebrush between 10 & 25 per cent. In optimum winter sage grouse habitat 80 % of the total area should support canopy coverage of sagebrush between 10 & 30 percent. Only 7% of the total area of the sage grouse area was classified to have canopy coverage of sagebrush that is 10% or greater and the fires that occurred since the study was completed reduced the total canopy coverage of shrubs to 6%.

Connelly et. al. (2000) suggests that optimum sage grouse breeding habitat contain a total herbaceous cover that is greater than 25% in a mixture of grasses and forbs with the grass coverage being greater than 15 % and the forb coverage being greater than 10 %. The entire sage grouse management area exceeds the minimum herbaceous cover requirements with the exception of the shale areas. Measurements taken during the sagebrush study indicate that the canopy coverage of forbs within the sage grouse area fall below the optimum minimum. The highest canopy coverage of forbs occurred on the shale area and was 3.27%. All the rest of the forb canopy coverage measurements averaged below 2.3 % (Table 8).

The optimum height of the herbaceous cover in breeding habitat is droop height that is greater than 18 cm (Connelly et. al. 2000). The droop heights obtained in 2003 averaged 32.9 which is considerably higher than the minimum value of for productive sagebrush habitat (Connolly et. al. 2000) (Table 8). The droop heights of herbaceous vegetation in the areas that have sufficient sagebrush cover to be classified as productive sage grouse habitat (11-30% and >30% sagebrush canopy cover) are nearly twice as high (34.4 & 38.8 cm respectively) as the optimum value (18 cm). Considering that precipitation measured in Edgemont in 2003 was 1.38 inches below average, it would follow that plant production in 2003 was below average. It can be surmised that in years when the precipitation is slightly below, at or above average the 18 cm value for droop height will be exceeded which should lead to adequate cover for nesting and brood rearing.

The cover values obtained in 2004 are lower than the minimum value 18 cm needed for productive sagebrush habitat (Table 8). In 2004, the Edgemont rain gauge recorded 11.68 inches of precipitation, which is 4.39 inches below average. These are drought conditions. It is doubtful that plants would grow to 18 cm in height with or without livestock grazing in these conditions.

On the OGA, the sagebrush habitat type is very limited and only found along several of the major floodplain areas scattered across the geographic area.

Table 8. Summary of the actual measurements obtained for the different habitat variable compare to the optimum values.

		Sagebrush		Grass-forb		Grass-forb	Grass	Forb	
	# of plots	Height (cm)	Canopy(%)	Droop Height (cm)		Canopy (%)	Canopy (%)	Canopy (%)	% of the area
				2003	2004				
<1 % Big Sagebrush Cover	9	31.6	0.7	27.5	7.2	65.5	63.7	2.1	64.5
1- 10 % Big Sagebrush Cover	23	39.3	5.6	31.0	12.4	50.4	48.2	2.3	20.8
11- 30 % Big Sagebrush Cover	28	43.7	18.3	34.4	10.7	41.7	40.2	1.4	5.8
>30 % Big Sagebrush Cover	7	51.4	32.7	38.8	10.6	33.7	32.3	1.6	0.5
Shale 1- 10 % Shrub Cover	2	29.1	4.1			10.6	9.5	3.3	2.8
Shale 11-30 % Shrub Cover	3	40.9	12.7			9.7	9.2	0.8	0.5
Optimum									
Breeding		40-80	15-25	>18	>18	≥25	≥15	≥10	>80
Brood-rearing		40-80	10-25	Variable	Variable	>15	N/A	N/A	>40
Winter		25-35	10-30	N/A	N/A	N/A	N/A	N/A	>80

Greasewood Scattered black greasewood (*Sarcobatus vermiculatus*) communities can be found along creek bottoms throughout the WGA. Black greasewood is present on the OGA, but usually consists of scattered individuals that tend to be located in lowland flats. Black greasewood is an important winter browse plant for domestic sheep, cattle, and big game animals. It also receives light to moderate use by domestic sheep, cattle, mule deer, and pronghorn during spring and summer months (Anderson 2004). Black greasewood plants contain sodium and potassium oxalates and are toxic to livestock. Browsing black greasewood can be fatal if even low to moderate quantities are consumed without large quantities of other forage in the diet. Black greasewood is poisonous year round, but plants can be consumed safely in light to very moderate amounts in the spring while the leaves are growing, as long as there is a substantial amount of other preferable forage available. No specific data has been collected in the greasewood communities.

Alternatives

Alternative 1 – No Action/No livestock grazing

Under this alternative, domestic livestock grazing would be discontinued on all 76 allotments in the Oglala (35 Allotments) and Fall River West (41 Allotments) GAs. As provided in FSH 2209.13 Section 16.6, all term grazing permits and grazing agreements would be terminated two grazing seasons after the record of decision is signed (36CFR222.4(a)(1)), and no livestock grazing would be authorized after that date. Private lands included in these allotments could continue to be grazed at the landowner's discretion; however, the landowner would be required to keep the livestock off the national forest/grasslands.

All existing rangeland structural improvements would remain in place but would not be maintained. Periodic inspection of improvements would be done to determine whether removal or maintenance is needed. Removal would be authorized by a separate administrative decision.

Noxious weed control would continue under the 1993 Management of Undesirable Plant Species Decision Notice.

Alternative 2 – No Change/Current Livestock Grazing Management

Under this alternative, permitted livestock grazing would continue on all allotments as is currently prescribed in existing allotment management plans. No adaptive management practices would be used.

All existing rangeland structural improvements would remain in place and would be maintained. Structural improvements approved in the existing allotment management plans would continue to be built.

Noxious weed control would continue under the 1993 Management of Undesirable Plant Species Decision Notice.

Detailed information about allotment conditions can be found in the project record and may be viewed at the Nebraska National Forest Supervisor's Office in Chadron, NE.

Specific information that is pertinent to the individual habitats located within the WGA & OGA:

Upland Grasslands: Currently there are 30,560 AUM's permitted on the WGA. Specific descriptions of the current grazing management systems are summarized in the Range specialist report.

Woody draw/riparian: Pastures with woody draw/riparian habitat and subject to special woody draw management are summarized in the existing condition section of this report (Page 6).

Wetland/aquatic habitat: On the WGA the portion of Cottonwood Creek located on the Miller 514 Allotment - Winter Pasture is the only stream that currently has enough water to maintain a fish population. It is currently being managed as a woody draw/riparian habitat and grazed with moderate stocking rates winter grazed.

1. Stockdams on the WGA that have special management in place:
    a. Crow Dam - Exclosure - Grazed as needed
    b. Simons Dam - Exclosure - Grazed as needed
    c. Rogers Dam - Exclosure - Grazed as needed
    d. Ellison dam Exclosure - Grazed as needed

Prairie Dog Colonies: Prairie dogs managements is outlined in Amendments 2 & 3 of the LRMP

Sagebrush: No specific management in place – There are currently 6,134 AUM's permitted for grazing within the 3.64 Special Plant and Animal Habitat: Sage grouse area.

Greasewood: No specific management in place.

Alternative 3 – Proposed Action/Livestock Grazing with Adaptive Management

Under the proposed action, the Pine Ridge and Fall River Ranger Districts would implement best management grazing practices and activities associated with adaptive management and monitoring strategies to work to resolve disparities between current conditions and site-specific desired conditions for the Oglala and Fall River West GAs described in the 2001 Forest Plan.

In adaptive management, decisions are made as part of an ongoing process. Adaptive management involves planning, implementing, monitoring, evaluating, and incorporating new knowledge into management approaches based on scientific findings and the needs of society. Results are used to modify future management methods.

Under the proposed action, selected practices would be implemented on a site-specific basis where monitoring indicates a need for a management changes. Monitoring would be used to evaluate whether management practices are accomplishing the site-specific objectives set forth in the FEIS. When monitoring indicates specific management practices are not accomplishing adequate movement toward meeting the desired conditions, changes will be made.

All existing rangeland structural improvements would remain in place and would be maintained.

Additional range improvements are as listed in Table 9.

Table 9. Alternative 3 Proposed Range Structure Improvements

	New Fences (Miles)	Fence Removed (Miles)	Fence Reconstruction (Miles)	New Creek Crossing (Miles)	New Pipeline (Miles)	New Water Tanks	Water Tank Removal	New Dams / Dugouts	Repair Dams / Dugouts	Repair Cistern	Relocate Cattle-guard
WGA	9.02	2.21	7.6	0	56.72	63	0	4	5	5	1
OGA	16.22	1.93	0.34	0.05	2.9	8	2	2	12	1	0
Total	25.24	4.14	7.94	0.05	59.62	71	2	6	17	6	1

Noxious weed control would continue under the 1993 Management of Undesirable Plant Species Decision Notice.

The adaptive management strategies listed in the Environmental Impact Statement (EIS) can be implemented singly or in combination to best meet or move toward the desired conditions. For those

pastures presently not meeting the desired ecological conditions, where a reduced stocking rate is required, the NRCS stocking rate guideline was used. The midpoint between suggested stocking rates at low seral and low intermediate seral stages was used.

Specific initial changes to individual habitats located within the WGA & OGA

Upland Grasslands:

Reduction of 1,068 AUM's permitted compared to Alternative 2.

Specific Management to comply with LRMP Direction

Trotter/Coal Creek Allotment: One pasture per year will be stocked below 70 % of capacity to promote high structure.

Antelope Allotment: One of the 5 pastures of the allotment will be stocked below 70 % of capacity to promote high structure.

Cow Camp Allotment: One pasture per year will be stocked below 70 % of capacity to promote high structure.

East Association: One pasture per year will be stocked below 70 % of capacity to promote high structure.

Fossil Point will be stocked below 70 % of capacity to promote high structure.

Furrow Allotment: One pasture per year will be stocked below 70 % of capacity to promote high structure.

Henry Allotment: Hay Creek and Northeast pastures will be stocked above 100% of capacity to promote low cover and more specifically swift fox habitat.

Miller 387 Allotment: North pasture will be stocked above 100% of capacity to promote low cover and more specifically swift fox habitat.

Moody Allotment: North pasture will be stocked above 100% of capacity to promote low cover and more specifically swift fox habitat.

Mule Creek Allotment: North pasture will be stocked above 100% of capacity to promote low cover and more specifically swift fox habitat.

Table 10 displays the predicted structure conditions in the adaptive management alternative for the WGA assuming stocking rate of less than 70% of NRCS suggested stocking will produce high structure, stocking rates of greater than 110 % of NRCS suggested stocking will produce low structure with everything else resulting in moderate structure.

Table 10. Predicted WGA Vegetation Structure in Alternative 3 Based on LRMP Appendix I

	High Structure	Moderate Structure	Low Structure
Predicted status	23%	61%	16%

Woody draw/riparian:

Continue all of the woody draw/riparian management in Alternative 2

Specific Management to comply with LRMP Direction

In riparian pastures 12A and 15 graze in early spring or late fall to improve the current habitat trends of these riparian areas.

In the Brush Creek Exclosure, graze once every 5 years under a short duration high intensity treatment not to exceed 50 AUMs in the spring or fall if monitoring indicates that some disturbance would be beneficial.

In Pasture 1N graze May 10 to May 23, but graze in the fall some years for no more than 14 days between September 1 and October 31 with 304 AUMs (85% of capacity).

Wetland/aquatic habitat:

Continue all of Wetland/aquatic habitat management in Alternative 2 Specific Management to comply with LRMP Direction

Repair exclosure on the tail end of Fiddle Creek Dam

Prairie Dog Colonies: Same As alternative 2

Antelope Allotment: 4- Section and East pastures will be stocked above 100% of capacity to promote low cover and more specifically prairie dog expansion.

Cottonwood Group Allotment: West Pasture will be stocked above 100% of capacity to promote low cover and more specifically prairie dog expansion.

Sagebrush: MA 3.64 Special Plant and Wildlife habitat: Sage Grouse: Reduction of 562 AUM's

Greasewood: Same As Alternative 2

Environmental Consequences

General Effects

Direct effects

Direct effects are caused by the action and occur at the same time and place (50 CFR 1508.8). Direct mortality could occur by livestock stepping on an individual animal such as a nesting bird. Also, direct mortality could be caused by collisions with vehicles driven by livestock permittees or by people intentionally killing animals for one reason or another while checking their livestock. Direct mortality could be caused by structures that are in place to tend livestock such as fences, windmills and stock tanks. Examples of such mortality are birds hitting fences or animals drowning in stock tanks. The construction of range improvements can also directly affect some species of wildlife. Animals can be killed in the construction process itself by the machinery being used. If a particular project requires extensive digging, like pipeline construction, animals in dens can be vulnerable. Also, people involved in the construction process can kill animals intentionally or accidently.

Indirect effects

Indirect effects are caused by the action and are later in time or farther removed in distance, but still reasonably foreseeable (50 CFR 1508.8).

The removal of vegetation by grazing livestock could affect the composition and structure of vegetation which in turn could affect the habitat of wildlife species. The effects of livestock grazing will vary depending on the frequency, intensity (number of animals), duration, & timing of grazing. In general, heavily stocked pastures grazed for long periods of time would result in early seral stage and low vegetation structure. Conversely, light grazing for short periods of time would result in high seral and high vegetation structure. The later that livestock are turned into a pasture results in elevated plant vigor and production and the likelihood of later seral condition and higher vegetative structure.

Grazing management in turn would affect the habitat of wildlife species. Early seral stage and low structured grassland habitat will attract species like the chestnut-collard longspur or long-billed curlew, while the late seral, high structured grasslands will attract species like the sharp-tailed grouse or short-eared owl.

Grazing and its effects on the density and canopy of sagebrush are controversial, and there is little direct experimental evidence linking grazing practices to sage grouse population levels. Opinions and supporting evidence on the effects of livestock grazing are separated across a chasm from a viewpoint of completely compensatory or beneficial influence on sagebrush habitats on one side to a total destructive force that should be removed immediately on the other (Connelly et. al. 2004).

Within the SGA two issues are thought to be important. Herbaceous vegetation, height and cover, affect sage grouse nest site selection and success. Grazing by livestock or wild herbivores that significantly reduce the herbaceous understory in breeding habitat may have negative impacts on sage grouse populations (Connelly et. al. 2000). Sagebrush cover generally increases as utilization of the herbaceous understory increases (Crawford et. al. 2004). Grazing by livestock can stimulate the canopy coverage and expansion of sagebrush.

Livestock grazing impacts sagebrush habitats in several interrelated ways. Its greatest impact is soil disturbance that promotes the germination of annual plant seeds and, thus, promotes the invasion of exotic annual plants into otherwise undisturbed areas. Where grazing removes the herbaceous understory altogether, sagebrush is allowed to spread and create dense sagebrush stands with a sparse understory of annuals and unpalatable perennials. While it is not clear that this situation would be detrimental to sage-dependent species, it ultimately discourages livestock use. Throughout the century, this has led to the destruction of sagebrush habitats as range managers used fire, herbicides, chaining, and other methods to remove dense sagebrush stands and re-establish grass forage, often reseeding with introduced grass species (Holmes and Johnson 2005).

Livestock affect deciduous woodlands by eating shrubs and trees, trampling and doing other physical damage. Prolonged use could compact the soil and affect species composition. Summer grazing, at almost any stocking rate, would concentrate livestock in woodlands because of the lush vegetation and shade. Livestock tend to congregate in these areas eating and/or trampling young trees and shrubs and damaging old trees by rubbing on them.

Greasewood habitats are not greatly affected by livestock grazing. They are toxic to livestock and the greatest threat to this habitat is herbicide application and mechanical treatment to eliminate greasewood from the landscape. Proper grazing management of understory vegetation is critical to maintaining healthy greasewood sites (USDA Natural Resource Conservation Service 2011b).

Another indirect effect of livestock grazing is physical disturbance to the soil and plants caused by hooves stepping on individual plants and breaking up the soil. The effect of "hoof action" will vary depending on frequency, intensity (number of animals), & timing of grazing. Trampling could hasten the return of plant material (dead or alive) to the soil. Hooves could break up soil and stimulate new plant growth. As the length of time that livestock are in an area increases, movement patterns begin to develop which could result in soil compaction, and trail formation.

Other indirect effects could be caused by the physical presence of livestock. Some species may avoid an area because livestock are present. Also, the people and structures that come with livestock grazing could also affect how and if different species of wildlife use the habitats on the project area.

Fences, salt and mineral stations, stock tanks, and other developments associated with livestock could have an effect on the vegetation of the WGA & OGA and the wildlife species that inhabit the area. Fences can be obstacles to different wildlife species. Big game animals like deer and antelope movement could be effected if fences are not constructed to allow for passage (see Appendix B LRMP). Birds could be killed or injured if they collide with a fence in flight. Sage grouse are especially susceptible (USDA

Natural Resource Conservation Service 2010). Fence posts can be used for perches by predatory birds which could be beneficial or detrimental depending on if you are the predator or the prey. Stock tanks could be a problem if an animal goes for water and gets trapped in the tank and drowns. Adequate escape ramps are required in the LRMP (see Chapter 1- Standards and Guidelines - Section F - # 3 LRMP). A stock tank or stockdam providing water to an area could change the dynamics of an area by attracting species that would not normally be there without a direct water source. Any watering source for livestock will be visited by livestock frequently. This will result in the area immediately adjacent to it to be low seral and low structure grassland.

Fences and the corresponding size of the pasture that they create and the number and placement of water sources, would have an effect on livestock distribution, which in turn would affect the grassland structure in an individual pasture. Stocking rate (number of animals on a pasture and for how long (AUM's)) is the principal variable in determining livestock distribution across a pasture. The more AUM's allowed on a pasture the greater chance there is for each plant to be grazed which would result in a lower more homogenous grassland structure. It is also true, that if stocking rate is constant, and more water sources are provided, livestock would be evenly distributed across the landscape resulting in a more homogeneous grassland structure. Also, smaller pastures would result in even livestock distribution and homogenous vegetative structure. The opposite is also true, lightly stocked large pastures with a small number of water sources would result in uneven livestock distribution, resulting in heterogeneous vegetative structure across the landscape.

The construction of range improvements can have an effect on animals in the immediate area of the construction. Animals like the ferruginous hawk that are intolerant of human beings may leave an area during the construction process. The soil disturbance that occurs during the construction process will reduce the amount of habitat that is available to the wildlife species that use the affected habitat. There are both short term and long term effects of this process. In the short term any surface disturbance will change the plant community and result in a reduction of habitat for animals that used the particular site before the construction occurred. In the long term the construction area can be reclaimed either naturally or mechanically and result in there being no effect. It should be noted that most range improvement construction disturbs very little ground and when compared to the surrounding area would be considered insignificant.

Cumulative effects

Cumulative effects are defined as the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of agency (Federal or non-Federal) or person that undertakes such actions. Cumulative impacts could result from individually minor but collectively significant actions taking place over a period of time (50 CFR 1508.7).

Mid-American ecosystems supporting mixed-grass prairie have been heavily impacted by civilization. Wildlife species dependent on this vegetation, especially birds, have experienced declining populations (North American Bird Conservation Initiative 2009). Many prairie ecosystems have been lost to the plowing of sod for crop production. Some federal programs pay landowners to retain grassland, and other programs pay to replace prairie where it has been lost. The Conservation Reserve Program is an example, however, re-authorization of such programs is not guaranteed, and some grassland may disappear when funding for these programs is cut. Private land management varies from operator to operator, resulting in various vegetation conditions of high to low vegetation structures.

Other agricultural activities that can affect wildlife include the application of pesticides and herbicides. These activities may reduce the effectiveness of wildlife habitats, or kill species directly or indirectly. Pesticide and herbicide application on the Nebraska National Forests and Grasslands is minimal. Applications are concentrated to isolated invasive plant and animal pests (i.e. noxious weeds, prairie dogs).

As prairie settlements increase in population and housing developments spread on the countryside, wildlife habitat is lost. Obviously, the construction of buildings and highways displace wildlife. Free-ranging pets harm wildlife, as does the increase in vehicle traffic.

The Plains are one of the windiest sections of the country, and this natural force is being harnessed to produce useable energy. Large concentrations of wind turbines have been implicated in harming some species of wildlife (i.e. bats and birds). Habitat on the western Plains has also been affected by oil and gas development, especially for coal bed methane. Both drilling activities and associated infrastructure developments (i.e. roads) may damage wildlife habitat.

Increased recreation could harm some wildlife species. This is especially true of recreation involving the creation of new roads or the use of off-highway vehicles. The Nebraska National Forests and Grasslands are in the process of implementing a decision which designates where and what kind of travel will be allowed on the Nebraska National Forests and Grasslands.

Short-term drought could have a devastating effect on some species of wildlife. Over longer periods, climate change has the potential to harm numerous species over a much wider area, changing both the floral and faunal compositions of an ecosystem and ultimately completely changing the ecosystem function.

Comparison of the Alternatives

Effects caused by the physical presence of livestock.

Direct effects: In Alternative 1, no livestock grazing would occur on WGA & OGA it follows that all direct effects would also be eliminated. All range structures such as stock tanks and fences could be removed and there would be no need for people to manage livestock so all indirect effects would also be eliminated.

In Alternatives 2 and 3, the existing range structures would remain in place so the direct & indirect effects caused by them will be the same. In Alternative 3 there are plans for the construction of additional tanks, fences, stockdams and pipelines. Considering there will be additional range structures on the land and that there will be some negative effects occurring during the construction process, it follows that there will be more negative effects as a result of range structures in Alternative 3 when compared to Alternative 2 (Table 11).

There are 1,068 less AUM's authorized in Alternative 3 than Alternative 2. It follows that there would be less chance for livestock to encounter any of the wildlife species using the area which results less chance for direct mortality to occur if Alternative 3 were implemented compared to Alternative 2. The amount of disturbance caused by the physical presence of livestock could also be slightly more in Alternatives 2 compared to Alternative 3 (Table 11).

Effects caused by livestock on the major wildlife habitats on WGA & OGA.

Upland Grassland: The grassland community in the project area consists of differing levels of vegetative structure (high, moderate and low) and species composition (seral stages). If Alternative 1were selected, high grass and forb structure would prevail. Grassland species composition would increase to late seral stage. More residual ground cover would be present in early spring compared to the other alternatives. With time, however, both the structure and the seral stage would decline somewhat, as productivity declines due to lack of nutrient and mineral cycling and through shading by grass litter. However, the grass structure would still be higher than under the other alternatives, especially during low-precipitation periods.

Alternative 2 is the current condition and Alternative 3 is the adaptive alternative. In Alternative 3 there is a reduction of 1,068 AUM's allowed on the two geographic areas. Also, in Alternative 3 in the WGA there are planned rotations that will result in 4 additional pastures being lightly grazed. The reduction in

grazing, coupled with the intense management, should result in approximately 23 % of the WGA to have high structure in a given year which meets the objectives for high structure for the WGA in the LRMP. This will favor any species that prefer high cover when compared to Alternative 2. The converse also being true, there will be slightly less habitat for species that prefer low structured habitat under Alternative 3 compared to Alternative 2 (Table 11).

Woody draw / Riparian: The no grazing alternative would theoretically favor the establishment and maintenance of woody vegetation and result in this alternative having the least negative impact on wildlife that uses this habitat of the three alternatives. The decreased grazing and implementing grazing strategies to promote woody vegetation proposed in Alternative 3 should result in a plant community with more woody plants and a higher and denser grass and forb component than Alternative 2 (Table 11).

Wetland/Aquatic: The no grazing alternative would eliminate the affects of livestock on any of the wetland / aquatic habitats and result in this alternative having the least negative impact on wildlife of the three alternatives. If Alternative 2 would be selected the riparian habitats would continue to trend in their current path based on how these habitats are currently being managed. In Alternative 3 at least one riparian area will be fenced off in order to create an additional riparian pasture. Alternative 3 also reduces the amount of time cattle spend on some riparian pastures and changes the grazing season to either early spring or late fall in order to improve the current trends of these riparian areas. Considering the size of the project area and scope of the proposed actions, the difference in impacts to wildlife between Alternatives 2 and 3 is insignificant, but Alternative 2 would probably have a larger negative impact to wildlife than Alternative 3 (Table 11).

Sagebrush: If the no grazing alternative (Alternative 1) were selected, high grass and forb structure will exist within the sagebrush community. The reduction of AUM's proposed in Alternative 3 compared to Alternative 2 would result in higher vegetation in Alternative 3 but Alternative 1 would still provide the greatest amount of herbaceous cover (Table 11).

Sagebrush cover generally increases as utilization of the herbaceous understory increases. It would follow that if Alternative 1 (no graze) were selected the canopy of sagebrush could theoretically be reduced. Using this logic it would follow that the canopy coverage of sagebrush could become less if Alternative 3 were selected because of the reduction in grazing called for in this alternative. The alternative causing the least impact on the canopy coverage of sagebrush is Alternative 2 (Table 11).

Prairie Dog Colonies: Decisions on the number of acres and general locations of prairie dog colonies for the OGA & WGA were made previously and this decision does not alter the other decisions. In general the negative impacts caused by any of the alternatives to prairie dog colonies are relatively insignificant.

If the no grazing alternative (Alternative 1) would be implemented, the vegetation structure would increase off colony (and possibly on the colony) which would reduce the rate of prairie dog colony spread, but would also produce more forage for the prairie dogs living in the colony compared to Alternatives 2 & 3. The rate of colony spread may be higher in Alternative 2 compared to Alternative 3 due to reduced AUM's, but the AUM reduction is relatively minor and because of other proposed ground disturbing activities tied to Alternative 3 in the vicinity of prairie dog colonies, we would expect that the rate of colony spread may be higher in Alternative 3 than in Alternative 2. In addition some of the proposed fences and grazing regimes in Alternative 3 may also help to increase the rate of spread for some prairie dog colonies (Table 11).

Alternative 1 could increase the amount of visual barriers in and around the colony which would also increase the probability of dogs and other wildlife on the colony of being predated compared to Alternatives 2 & 3 where the cows would help to reduce the visual barrier. Visual barriers may be slightly lower in Alternative 2 than in Alternative 3 due to the reduced AUM's in Alternative 3 (Table 11).

Alternative 1 could also decrease the amount of low structure habitat available for short grass prairie species in the project area depending on annual precipitation and the rate at prairie dogs can clip

encroaching vegetation compared to Alternatives 2 & 3 which both have the ability to increase the amount of low structure depending on annual weather and grazing patterns (Table 11).

Greasewood: Greasewood habitats are not greatly affected by moderate livestock grazing. It is doubtful that any of the alternatives would cause a detectable change in the greasewood community (Table 11).

Table 11. Relative negative impacts of each alternative on the different wildlife habitats and species.

Effects caused by Livestock Presence	Variable used to determine impact	Relative negative impact by alternative		
		High negative Impact ⟵		Low negative Impact
Direct Mortality Indirect Disturbance[1]	AUM/Acre	Alt. 2	Alt. 3	Alt. 1
Range Structures	AUM/Acre	Alt. 3	Alt. 2	Alt. 1
Effects on Key Wildlife Habitats				
Upland Grassland High Structure[2]	AUM/Acre	Alt. 2	Alt. 3	Alt. 1
Upland Grassland Low Structure[3]	AUM/Acre	Alt. 1	Alt. 3	Alt. 2
Woody draw / Riparian[4]	AUM/Acre	Alt. 2	Alt. 3	Alt. 1
Wetland/Aquatic[5]	AUM/Acre	Alt. 2	Alt. 3	Alt. 1
Sagebrush Canopy Coverage of Sagebrush[6]	AUM/Acre	Alt. 1	Alt. 3	Alt. 2
Sagebrush Herbaceous understory[7]	AUM/Acre	Alt. 2	Alt. 3	Alt. 1
Prairie Dog Colonies[8]	AUM/Acre	Alt. 1	Alt. 2	Alt. 3
Greasewood[9]	AUM/Acre	No Impact	No Impact	No Impact

[1] Includes indirect human disturbance and problems caused by range structures
[2] Grasshopper Sparrow, Short-eared Owl, Northern Harrier, Regal Fritillary Butterfly, Ottoe Skipper
[3] Black-tailed Prairie dog, Swift fox, Burrowing Owl, Ferruginous Hawk, McKown's Longspur, Chestnut-collard Longspur, Long-billed Curlew
[4] Hoary Bat, Loggerhead Shrike
[5] Northern Leopard Frog, Plains Leopard Frog, Plains Minnow, Sturgeon Chub, Flathead Chub
[6] Greater sage grouse, Brewer's sparrow
[7] Greater sage grouse
[8] Black-tailed Prairie dog, Burrowing Owl
[9] Loggerhead Shrike

Biological Assessment and Evaluation Process

Two lists of animal and plant species were developed: species that are currently protected under the ESA (Table 15) and species that have been identified as sensitive on Forest Service lands in Region 2 (Table 18).

Information on species at risk and their habitats was obtained from a large volume of published and unpublished references such as assessments by the Forest Service Species Conservation Project. Other scientific papers that were not quoted in the above assessments, information from the files from the Fall River and Pine Ridge District Offices, unpublished reports on local wildlife and plant surveys, and information from conversations with local resource personnel provided additional information. The Biological Assessment and Evaluation effects analyses conducted in the Northern Great Plains Final Environmental Impact Statement, including viability analysis for these species, are incorporated by reference to this project analysis.

Biological Determinations

This BA and BE process culminates with a determination of the likely effects of each alternative to each species. The types of determinations that can be made for those species protected under ESA are determined by the U.S. Fish and Wildlife Service (1998) (Table 12). No ESA critical habitat has been proposed or designated on the OGA & WGA. Determinations that can be made for Forest Service Sensitive Species are shown in Table 13. Determinations that can be made for Forest Service Management Indicator Species are shown in Table 14.

Table 12. Terminology for biological determinations for species that are federally listed and species that are proposed for federal listing.

Terms for Threatened and Endangered Species:	
Determination	**Abbreviation**
• No effect	NE
• May affect, not likely to adversely affect	MA-NLAA
• May affect, likely to adversely affect	MA-LAA
Terms for Species Proposed for Federal Listing:	
Determination	**Abbreviation**
• Not likely to jeopardize continued existence	NLJ
• Likely to jeopardize continued existence	LJ

Table 13. Terminology for Biological Determinations for Forest Service Sensitive Species and federally listed candidate species.

Terms for Forest Service Sensitive Species:	
Determination	**Abbreviation**
• No impact	NI
• Beneficial impact	BI
• May adversely impact individuals but not likely to result in a loss of viability on the planning area, nor cause a trend to federal listing or a loss of species viability range wide	MAII

• Likely to result in a loss of viability on the planning area, in a trend to federal listing, or in a loss of species viability range-wide	LRLV

Table 14. Terminology for Biological Determinations for Forest Service Management Indicator Species

Terms for Forest Service Management Indicator Species:	
Determination	**Abbreviation**
• Positive Effect on population trend	POS
• Neutral Effect on population trend	NEU
• Negative Effect on population trend	NE

Threatened, Endangered, and Proposed Species Considered in the Analysis

Consultation History

The Fish and Wildlife Service web site was referenced on June 23, 2011 and a list of threatened, endangered and proposed species was obtained for Dawes and Sioux Counties, Nebraska & Fall River county in South Dakota (Table 15)(USFWS 2010 & 2011).

Table 15. Federally Listed Species for Dawes and Sioux Counties, Nebraska[1] and for Fall River County, South Dakota[2].

Common Name *Species Status*	**Counties Listed**	**Species Known to Occur in the Project Area**	**Species Habitat Identified in Project Area**
Mammals			
Black-footed Ferret ***ESA: Endangered***	Dawes and Sioux	No	Yes
Gray Wolf ***ESA: Threatened***	Dawes and Sioux	No	Yes
Birds			
Whooping Crane ***ESA: Endangered***	Dawes and Sioux	No	No
Sprague's Pipit ***ESA: Candidate***	Fall River	No	No
Greater Sage Grouse ***ESA: Candidate***	Fall River	Yes	Yes

NNF&G WGA: MIS[3]			
Plants			
Ute Ladies'-tresses ***ESA: Threatened***	Sioux	No	No

[1] http://www.fws.gov/mountain%2Dprairie/endspp/CountyLists/Nebraska.pdf

[2] http://www.fws.gov/southdakotafieldoffice/endangered_species_newVersionP2.htm

[3] MIS = Management Indicator Species

Species Eliminated from Further Analysis

To reduce the number of analyses, any species that met one or more of the following evaluation criteria (screens) was eliminated from further consideration:

Screen 1 – (Importance of Area). Presence of the species and suitable habitat is doubtful and has not been documented.

Screen 2 – (Lack of Threats). The species or potential habitat for the species may occur, but it's highly unlikely that land uses and allocations authorized by the Forest Service would affect the species and/or its habitat either on NFS lands or downstream.

The species listed below have been eliminated from further analysis for the reasons stated, and the species determinations apply to all alternatives.

Screen 1 – (Importance of the Area)

Presence of the species and suitable habitat is doubtful and has not been documented.

Whooping Crane *Grus americana*

Habitat: On the Plains, the migrating whooping cranes use shallow water, including stock dams, as overnight roost sites (Ashton and Dowd 1991). Most wetlands used for roosting during migration were less than about 10 acres in size and within approximately 0.5 miles of suitable feeding sites, croplands or wetlands (Lewis 1995). The birds are omnivorous and feed on plants and animals, including grain (Ashton and Dowd 1991).

Determination & Rationale: Whooping cranes are extremely rare migrants through the OGA and WGA, and the species presence only occurs during migration. Although this species is not expected to occur in the project area, flying into a fence during fog or low light could be a remote possibility although highly unlikely. The potential management changes set forth in this plan would be inconsequential to migrating whooping cranes. The determination is "no effect" for this species.

Sprague's Pipit *Anthus spragueii*

Habitat: Sprague's Pipits are grassland specialists endemic to the mixed-grass prairie in the northern Great Plains of North America. Sprague's Pipits are short to medium distance migrants, moving from breeding grounds in the northern prairies of southern Canada and northern United States to the wintering

grounds in southern United States and northern México. Sprague's Pipits migrate through the Great Plains states of the United States and would only be found on the project area during the migration (Jones 2010).

Determination & Rationale: There are no records of Sprague's pipits on the OGA or WGA. They are considered a rare migrant in the project area (Tallman et. al. 2002). The determination is "no impact" for this species.

Ute Ladies'-tresses Orchid *Spiranthes diluvialis*

Habitat: Prefers moist meadows associated with perennial stream terraces, floodplains, and oxbows at elevations between 4300-6850 feet (1310-2090 meters) (Fertig et. al. 2005). In Nebraska it is associated with the headwaters of the Niobrara River.

Determination & Rational: There is no suitable habitat for Ute ladies'-tresses orchid in the project area. The determination is "no effect" for this species.

Screen 2 – (Lack of Threats)

The species or potential habitat for the species may occur, but it's highly unlikely that land uses and allocations authorized by the Forest Service would affect the species and/or its habitat either on NFS lands or downstream.

Black-footed Ferret *Mustela nigripes*

Habitat: The black-footed ferret is a rare mustelid that solely occupies prairie dog colonies in open areas of grasslands. Ferrets utilize prairie dog burrows to raise their young and prey almost exclusively on prairie dogs.

Determination & Rationale: The black-footed ferret has the narrowest range of ecological tolerance of any North American predatory mammal (Jones et al. 1983). They live and feed in prairie dog colonies. No known ferrets inhabit WGA or OGA.

The Nebraska National Forest made two decisions on black-tailed prairie dogs one in 2005 which dealt with boundary management and another in 2008 which dealt with interior management. These decisions guide the management of prairie dogs and resulting black-footed ferret management and are not altered by this plan. The determination is "no effect" for this species.

Gray Wolf *Canis lupus*

Habitat: "Wolves are habitat generalists and have the potential to occupy areas with an adequate abundance of hoofed prey (Fuller 1995). Given sufficient prey, the chance of an area being occupied and the number of wolves that could be supported is related to the proximity of source populations and the extent of human-caused mortality (Fuller 1995)" (MIDNR 2008).

Determination & Rational: Although suitable habitat is present in the project area, currently no wolves are known to reside on the OGA or WGA, nor is there a source population nearby. The determination is "no effect" for this species.

Analysis of Effects for T & E Species

Greater Sage Grouse *Centrocercus urophasianus*

Distribution and Status: Currently, greater sage grouse occur in somewhat disjunct ranges within suitable sagebrush habitats in central Washington through southern Idaho, much of Montana, extreme southeastern Alberta and southwestern Saskatchewan, south to the southwestern corner of North Dakota,

northwestern and southwestern South Dakota, most of Wyoming, western Colorado, and portions of Utah, and west to Nevada, extreme eastern California, and southeastern Oregon (Rowland 2004).

The sage grouse is relatively common in the core of its range, but range has contracted significantly (now extirpated in five states and one province). Populations have declined 45 to 80 per cent since the 1950s and by an average of 33 per cent across ten states (essentially rangewide) since 1985. The birds are threatened by loss, fragmentation and degradation of sagebrush habitat (NatureServe 2012). In South Dakota, they are listed as a locally uncommon permanent resident of the far west on the sagebrush prairies (Tallman et al. 2002). The only occurrence on the NNF is in the Fall River West Geographic Area (FRWGA).

Habitat: Sagebrush shrubland is the habitat of the sage grouse. Sagebrush is the primary food of sage grouse during the summer and is almost the exclusive diet during winter. Almost all sage grouse activity occurs in sagebrush or in meadows or openings adjacent to sagebrush.

Sage grouse are unique in that they lack a muscular gizzard like other gallinaceous birds and cannot grind and digest seeds (Wallestad 1975), so they feed exclusively on soft material, mostly sagebrush during the winter and a combined diet of sagebrush and various forbs during the spring and summer. Juveniles initially consume a diet of forbs and invertebrates.

Based on Connelly et al. (2000) the habitat variables that are important to assess in sage grouse habitat are: canopy coverage of sagebrush, height of the sagebrush, canopy coverage of grasses, canopy coverage of forbs, and height of grass-forbs during the nesting period. Annual habitat requirements for sage grouse are partitioned into 3 categories: breeding habitat, brood rearing habitat, and winter habitat.

Conservation Status
ESA –Candidate
Global-G3
Nebraska-S1
South Dakota-S2
Forest Service , Region 2- Sensitive

Status definitions can be viewed at http://www.natureserve.org/explorer/ranking.htm

Existing Condition: prior to 1991, there was one known sage grouse lek in the SGA it was named 48GL002. It was visited periodically by various people, but to our knowledge no formal surveys were conducted. Table 16 is a summary of the data that was located about this lek.

Table 16. Previously Reported Observations of Sage Grouse Leks in SGA.

Date	No. of Males	Observer
4/25/1980	8	Richard C. Rosche
4/14/1984	8	Richard A. Peterson
4/15/1985	4	Richard A. Peterson
5/3/1986	6	Richard A. Peterson
4/11/1987	3	Richard A. Peterson

In 1991 & 1992, a cooperative sagebrush study between the South Dakota Game Fish and Parks and the Forest Service was completed and the area was searched methodically looking for additional leks. Starting in 1993 and continuing until 1998, the established lek sites located in the 1991 & 1992 surveys were visited at least once a year. While driving between lek sites, all grouse (sage or sharp-tailed) encountered were recorded, but no attempt was made to do a systematic search of the area. In 1999 a thorough search of the SGA was once again conducted. From 2000-2002 the leks that were found in the 1999 surveys were visited at least once a year. Complete surveys of the area were conducted in the spring of 2003 through 2011.

During the 1991-92, surveys, there were no birds found at or near lek site 48GL002. However, 17 sage grouse were observed at a lek site approximately ¾ of a mile to the north (49GL004). One other sage grouse was seen displaying in 1991 (48GL001).

Sage grouse numbers at lek 49GL004 reached a high of 17 in 1991 and varied between 14 and 2 until 2003 at which time no birds were observed. In 2003, a total of four sage grouse hens were observed in the study area (not at lek) and one sage grouse dropping (not fresh) was found on sage grouse lek 49GL004 on April 9. No males were seen. In 2004, no sage grouse were observed anywhere in the study area during the courtship and nesting seasons. In 2005, one male was seen displaying (48GL005). On April 5, 2006, 5 males and 3 females were observed at 48GL006. The birds were actively displaying. There were no birds observed during a subsequent visit to the area on May 3, 2006. These were the last sage grouse observed on the Sage Grouse Area to the present. Summary of the sage grouse lek surveys is presented in Table 17.

It is impossible to determine the cause of the disappearance of sage grouse from the area. It could be management of the area or a natural occurrence. A Range Allotment Management Plan was written in May of 1991. Within this plan, there was a slight reduction in overall Animal Unit Months authorized for grazing (Approximately 650 AUM's or 4%). There were some season of use changes, turn out date changes, and livestock rotation changes. All of the changes were made with the objective of improving the overall health of the range and to bringing the area into compliance with the LRMP written in 1984. Also, livestock numbers were reduced in 2003 to 2009 in response to the drought conditions that existed during this period.

Comprehensive sage brush vegetation studies were completed in 1992 and 2004 (Hodorff 2005) (See page 14-16 of this document). Comparing vegetation data collected during the two years, the changes were slight, with the only difference that could have an impact on sage grouse population being the reduction in forbs. Considering that in both years the canopy coverage of forbs is below the optimum value, it is doubtful that canopy coverage of forbs is a major factor in the disappearance of sage grouse.

One coinciding event that occurred in western South Dakota with the disappearance of sage grouse was an outbreak of the West Nile Virus, which has been known to affect sage grouse.

Table 17. Summary of observations of sage grouse leks in the SGA.

	YEAR										
Lek ID Number	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	
48GL001		1									
48GL002	0	0							0	0	
48GL005											
48GL006											
49GL001*	0	0									
49GL002*	0	0									
49GL004	17	8	4	5	6	10	10	11	14	11	
Total # of Leks	1	2	1	1	1	1	1	1	1	1	
Total # of Birds	17	9	4	5	6	10	10	11	14	11	
Lek ID Number	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
48GL001						0	0	0	0	0	0
48GL002	0	0	0	0	0	0	0	0	0	0	0
48GL005					1	0	0	0	0	0	0
48GL006						8	0	0	0	0	0
49GL001*			0	0		0	0	0	0	0	0
49GL002*			0	0		0	0	0	0	0	0
49GL004	4	4	0	0	0	0	0	0	0	0	0
Total # of Leks	1	1	0	0	1	1	0	0	0	0	0
Total # of Birds	4	4	0	0	1	8	0	0	0	0	0

* These locations were given to the District by the local Game Warden as possible display grounds. There is no records of birds being counted at any of these sights.

Vegetative studies were completed in the MA 3.64 Special Plant and Wildlife Habitat: Sage Grouse area in 1992 and 2003-4. For a description of the existing vegetation on the sagebrush see that section of this report.

The variables that fall below Connelly's recommended optimum values were the percent of the area with 10% or greater canopy coverage of sagebrush, the total canopy coverage of forbs, and the droop height of herbaceous vegetation in 2004.

Connelly et. al. (2000) recommended that there be a minimum of 10 % canopy coverage of forbs in an area for optimum sage grouse habitat. The Sage Grouse Area ranged between .8 and 3.3 % canopy coverage in 2003-4 depending on the density of sage. This is below the 10% minimum.

The optimum height of the herbaceous cover in breeding habitat is droop height that is greater than 18 cm (Connelly et. al. 2000). The droop heights obtained in 2003 averaged 32.9 which are considerably higher than the minimum value of for productive sagebrush habitat (Connolly et. al. 2000). The droop heights of herbaceous vegetation in the areas that have sufficient sagebrush cover to be classified as productive sage grouse habitat (11-30% and >30% sagebrush canopy cover) are nearly twice as high (34.4 & 38.8 cm respectively) as the optimum value (18 cm). Considering that precipitation measured in Edgemont in

2003 was 1.38 inches below average, it would follow that plant production in 2003 was below average. It can be surmised that in years when the precipitation is slightly below, at or above average the 18 cm value for droop height will be exceeded which should lead to adequate cover for nesting and brood rearing. The cover values obtained in 2004 are lower than the minimum value 18 cm needed for productive sagebrush habitat. In 2004, the Edgemont rain gauge recorded 11.68 inches of precipitation, which is 4.39 inches below average. These are drought conditions. It is doubtful that plants would grow to 18 cm in height with or without livestock grazing in these conditions.

Connelly et. al. (2000) stated that optimum values for sage grouse breeding habitat is 80% of the total area should support canopy coverage of sagebrush between 15 & 25 per cent. For brood rearing habitat 40% of the total area should support canopy coverage of sagebrush between 10 & 25 percent. In optimum winter sage grouse habitat 80 % of the total area should support canopy coverage of sagebrush between 10 & 30 percent. Only 7% of the total area of the sage grouse area was classified to have canopy coverage of sagebrush that is 10% or greater and the fires that occurred since the study was completed reduced the total canopy coverage of shrubs to 6%.

Bearing in mind that sage grouse are considered a sagebrush obligate, and depend on sagebrush for food and cover for most of the year, it follows that the lack of sagebrush is the limiting factor for sage grouse in the area. The lack of forbs and the height of herbaceous cover in extreme drought conditions are problematic, but they are far outweighed by the lack sagebrush canopy coverage. It follows that any management directions that are aimed at increasing the habitat capacity for sage grouse should be steered at increasing the number of sagebrush plants and sagebrush canopy coverage.

Direct, Indirect, and Cumulative Effects: Livestock grazing could harm individual sage grouse. Nests or young birds could be stepped on by livestock. Human activities in support of livestock grazing could have similar effect. Vehicle tires could crush nests and young birds that cannot fly. Also, there is possibility of individual sage grouse being affected by infrastructure that is in place to manage livestock (colliding with fences drowning in stack tanks etc).

Grazing by livestock has occurred over virtually the entire range of sage grouse and its influence on sage grouse habitat (sagebrush) is perhaps the most pervasive of any land management practice (Rowland 2004). Before European man arrived on the continent, in northern, eastern, and more mesic regions of the sagebrush biome grazing by buffalo was the primary agent disturbance. This makes this area more compatible with livestock grazing than other areas in the sagebrush biome. However, introduction of domestic livestock by European man did increase, at the least, the frequency of grazing.

Grazing and its effects on the density and canopy of sagebrush is controversial, and there is little direct experimental evidence linking grazing practices to sage grouse population levels (Connelly et. al. 2004). Research suggests that moderate livestock grazing or less in mid to late summer, fall, or winter is generally compatible with the maintenance of perennial grasses and forbs in sagebrush habitat. Herbaceous species in sagebrush plant communities are predominantly cool-season (C-3) plants that are vulnerable to defoliation during late spring and early summer. Heavy grazing (approximately 60% or greater utilization by weight) during this time has predictable results: 1) the vigor, yield, and cover of late-seral grasses and forbs decrease; 2) early-seral species (including annual grasses) may increase; 3) sagebrush density and canopy cover may increase; and 4) transition of sagebrush uplands to higher ecological status is inhibited (Crawford et. al. 2004).

Determination of Effect and Rationale for the Greater Sage Grouse

It is problematic that sage grouse no longer exist in the project area and to make viability determinations seem unreasonable. The choices in this document are to move sage grouse into the category "species eliminated from further analysis" using Screen 1 (Importance of Area - Presence of the species and suitable habitat is doubtful and has not been documented) as the justification for doing so or to proceed with the analysis making the determinations on the potential habitat in the area. Because sage grouse

have been known to exist in the study area in the recent past and we believe potential habitat exists we have proceeded with the analysis.

Alternative 1: No action (No Grazing)

The biological determination for the Greater Sage Grouse viability is "*no impact*". The biological determination for the Greater Sage Grouse population trend is a "*neutral effect*".

Rationale: Removal of livestock from the area will result in an increase cover of the herbaceous understory which in turn should be beneficial to nesting sage grouse. Also, removal of livestock would enable the land mangers to remove fences and any infrastructure used to maintain livestock. This would eliminate the hazards to sage grouse caused by these structures (drowning in stocktanks, colliding with fences, etc.). Finally, the removal of livestock would eliminate the need for people to visit the area to check livestock which would eliminate any direct or indirect effects caused by this activity.

The limiting factor for sage grouse in the area appears to be the amount of sagebrush that covers the landscape. Connelly et. al. (2000) stated that optimum values for sage grouse breeding habitat is 80% of the total area should support canopy coverage of sagebrush between 15 & 25 percent. For brood rearing habitat 40% of the total area should support canopy coverage of sagebrush between 10 & 25 percent. In optimum winter sage grouse habitat 80% of the total area should support canopy coverage of sagebrush between 10 & 30 percent. Only 7% of the total area in the sage grouse area was classified to have canopy coverage of sagebrush that is 10% or greater and the fires that have occurred since the study was completed have reduced the total canopy coverage of shrubs to 6%.

Sage brush cover generally increases as utilization of the herbaceous understory increases (Crawford et. al. 2004). In the project area, it is uncertain what effect the removal of livestock will have on the canopy coverage or the spread of sagebrush in the area. Because this is a slow process, whatever happens is unlikely to be detected over the life of this plan. Even though a reduction in grazing could have positive effects for nesting sage grouse it is doubtful that a sustained population could live in the area without a dramatic increase in sagebrush and sage brush cover.

It is true that sage grouse have lived in the area in the past, but there are no records of large populations inhabiting the area that can be found. It is doubtful that an area that is on the fringe of the sage grouse range, in marginal habitat, will have much effect on the overall population or status sage grouse.

Alternative 2: Current Management

The biological determination for the Greater Sage Grouse viability is *may adversely impact individuals but not likely to result in a loss of viability on the planning area, nor cause a trend to federal listing or a loss of species viability range wide*. The biological determination for Greater Sage Grouse population trend is "*neutral effect*".

Rationale: With continuation of the present management, all of the direct and indirect effects of livestock grazing will be applicable. Although there are no known sage grouse currently inhabiting the area, there is always a possibility of grouse moving onto the area from the sagebrush habitat that exists west of the Sage Grouse Area. For any birds that may exist in the area, there will always be the possibility of sage grouse hitting fences, nests stepped on, nesting cover being affected, etc. thus the may impact individual determination.

It is unknown what caused the demise of sage grouse in the area at the present time. Considering that livestock grazing is not a new thing and sage grouse occupied the area with livestock for many years, it is doubtful that livestock grazing is the sole cause of the current problem (although it may be a contributor). There is some evidence that livestock grazing in an area may be beneficial to the expansion of sage brush. This is a very slow process as indicated by the absence of change in sage canopy coverage between 1992 and 2003.

It is true that sage grouse have lived in the area in the past, but there are no records of large populations inhabiting the area that can be found. It is doubtful that an area that is on the fringe of the sage grouse range, in marginal habitat, will have much effect on the overall population or status sage grouse.

Alternative 3: Proposed Action (Adaptive Management)

The biological determination for the Greater Sage Grouse viability is *may adversely impact individuals but not likely to result in a loss of viability on the planning area, nor cause a trend to federal listing or a loss of species viability range wide.* The biological determination for Greater Sage Grouse population trend is "*neutral effect*".

Rationale: This alternative allows livestock grazing of the area, so it follows that all of the direct and indirect effects of livestock grazing will be applicable. Although there are no known sage grouse currently inhabiting the area, there is always a possibility of grouse moving onto the area from the sagebrush habitat that exists west of the Sage Grouse Area. For any birds that may exist in the area, there will always be the possibility if sage grouse hitting fences, nests stepped on, nesting cover being affected, etc. thus the may impact individual determination.

It is unknown what caused the demise of sage grouse in the area at the present time. Considering that livestock grazing is not a new thing and sage grouse where in the area with the livestock for many years it is doubtful that livestock grazing is the sole cause of the current problem (although it may be a contributor). There is some evidence that livestock grazing in an area may be beneficial to the expansion of sage brush. This is a very slow process as indicated by the absence of change in sage canopy coverage between 1992 and 2003.

This alternative reduces grazing in the Sage Grouse Area by 562 AUM's. All of the reductions were put in place to bring the stocking rates into to a maximum of 100% of NRCS recommended capacities. Also, some management changes that will be implemented include rotations that will insure more pastures will be stocked less than 70% of recommended capacity to facilitate cover an increase of residual nesting and brood rearing cover that will almost certainly have a positive impact on nesting sage grouse if they return to the area. These changes will bring the area into compliance with the structure requirements within the 2001 revision of the LRMP.

The limiting factor for sage grouse in the area appears to be the amount of sagebrush that covers the landscape. Connelly et. al. (2000) stated that optimum values for sage grouse breeding habitat is 80% of the total area should support canopy coverage of sagebrush between 15 & 25 per cent. For brood rearing habitat 40% of the total area should support canopy coverage of sagebrush between 10 & 25 percent. In optimum winter sage grouse habitat 80 % of the total area should support canopy coverage of sagebrush between 10 & 30 percent. Only 7% of the total area in the sage grouse area was classified to have canopy coverage of sagebrush that is 10% or greater and the fires that have occurred since the study was completed have reduced the total canopy coverage of shrubs to 6%.

Alternative 3 is the adaptive management alternative. Within adaptive management strategies (Table 2-3 FRONG EIS) there exists different management applications that can be applied to specifically address the sagebrush density/canopy coverage problem. These include planting of sagebrush either from seed or seedlings, manipulation of livestock numbers and grazing patterns, fencing etc. Through application of treatments and monitoring this Alternative gives the best chance for the reestablishment of sagebrush.

It is true that sage grouse have lived in the area in the past, but there are no records of large populations inhabiting the area that can be found. It is doubtful that an area that is on the fringe of the sage grouse range, in marginal habitat, will have much effect on the overall population or status sage grouse.

Forest Service Sensitive and Other Species Considered in the Analysis

Table 18. Sensitive Species and Other Species of Concern in the WGA & OGA Areas.

Common Name	Species Known to Occur in the Project Area	Species Habitat Identified in Project Area	Preferred Habitat
Mammals			
Black-tailed Prairie Dog	Yes	Yes	Upland Grasslands Low Structure
Townsend's Big-eared Bat	No	Yes	Forest/Riparian
Hoary Bat	Yes	Yes	Woody Draw/Riparian
Fringed Myotis	No	Yes	Forest/Riparian
Rocky Mountain Bighorn Sheep	Yes	Yes	Steep Open Terrain
Swift Fox	Yes	Yes	Upland Grasslands Low Structure
Birds			
Northern Goshawk	No	No	Mature Conifer Forest/ Forest Edge
Grasshopper Sparrow	Yes	Yes	Upland Grasslands High Structure
Short-eared Owl	Yes	Yes	Upland Grasslands High Structure
Burrowing Owl	Yes	Yes	Upland Grasslands Low Structure
American Bittern	No	Yes	Large Wetlands/Aquatic Habitat
Ferruginous Hawk	Yes	Yes	Upland Grasslands Low Structure
McCown's Longspur	Yes	Yes	Upland Grasslands Low Structure
Chestnut-collared Longspur	Yes	Yes	Upland Grasslands Low Structure
Mountain Plover	No	Yes	Upland Grasslands Low Structure

Common Name	Species Known to Occur in the Project Area	Species Habitat Identified in Project Area	Preferred Habitat
Black Tern	Yes	Yes	Marsh/Wetland Habitats
Northern Harrier	Yes	Yes	Upland Grasslands High Structure
Yellow-billed Cuckoo	No	Yes	Woody Draw/Riparian
Trumpeter Swan	No	No	Freshwater Marshes, Lakes and Ponds/Wetland Habitat
American Peregrine Falcon	No	No	Tall Cliffs Usually Near Water
Bald Eagle	Yes	Yes	Mature Trees Usually Near Water
Loggerhead Shrike	Yes	Yes	Woody Draw/Riparian Greasewood
Lewis's Woodpecker	Yes	No	Open Forests and Woodlands
Long-billed Curlew	Yes	Yes	Upland Grasslands Low Structure
Brewer's Sparrow	Yes	Yes	Sagebrush
Plains sharp-tailed grouse (MIS for the Oglala GA)	Yes	Yes	Open, relatively treeless habitats with a mix of grasses, forbs, and many species of shrubs.
Amphibians			
Northern Leopard Frog	Yes	Yes	Wetland/Aquatic Habitat
Plains Leopard Frog	Possible Hybrid	Yes	Wetland/Aquatic Habitat
Fishes			
Plains Minnow	Yes	Yes	Turbid to Clear Riparian/Aquatic Habitat
Sturgeon Chub	No	No	Turbid Riparian/

Common Name	Species Known to Occur in the Project Area	Species Habitat Identified in Project Area	Preferred Habitat
			Aquatic Habitat
Flathead Chub	Yes	Yes	Turbid Riparian/ Aquatic Habitat
Insects			
Regal Fritillary	No	Yes	Upland Grasslands High Structure
Ottoe Skipper	No	Yes	Upland Grasslands High Structure
Plants			
Visher's Buckwheat	No	Yes	Badlands
Barr's Milkvetch	No	Yes	Badlands

[1] http://fsweb.r2.fs.fed.us/rr/R2_TES_Site_2007/sensitive.html#list Matrix of TES species by unit (USDA Forest Service 2012)

Species Eliminated From Further Analysis

To reduce the number of analyses, any species listed in that met one or more of the following evaluation criteria (screens) was eliminated from further consideration:

Screen 1 – (Importance of Area). Presence of the species and suitable habitat is doubtful and has not been documented.

Screen 2 – (Lack of Threats). The species or potential habitat for the species may occur, but it's highly unlikely that land uses and allocations authorized by the Forest Service would affect the species and/or its habitat either on NFS lands or downstream.

The species listed below have been eliminated from further analysis for the reasons stated, and it has been determined that the actions proposed would have "no impact" upon them.

Screen 1 – (Importance of Area)

Presence of the species and suitable habitat is doubtful and has not been documented.

Northern Goshawk *Accipiter gentiles*

Habitat: They are found in and at the edges of mixed or coniferous forests, hunting medium-sized birds in ambush attacks through dense cover (Sibley 2000).

Determination & Rationale: Occurrence of this species on or near the planning unit is highly incidental, unpredictable and limited to migrants passing through the area. There have not been any documented sightings of goshawks in the project area. The woody draw/riparian woodland habitats and ponderosa pine areas on the OGA & WGA could provide marginal habitat at best for these birds. The determination is "no impact" for this species.

American Peregrine Falcon *Falco peregrinus*

Habitat: In North America they breed in open landscapes with cliffs (or skyscrapers) for nest sites. They can be found up to about 12,000 feet, as well as along rivers and coastlines or in cities, where the local Rock Pigeon populations offer a reliable food supply. In migration and winter you can find Peregrine Falcons in nearly any open habitat, but with a greater likelihood along barrier islands, mudflats, coastlines, lake edges, and mountain chains.

Determination & Rationale: Occurrence of this species on or near the planning unit is highly incidental, unpredictable and limited to migrants passing through the area. These falcons are listed as uncommon spring and rare fall migrants in South Dakota (Tallman et. al. 2002). They might use a wide variety of prairie and shoreline habitats when they pass through the area. Suitable nesting habitat is nonexistent. The determination is "no impact" for this species.

Trumpeter Swan *Cygnus buccinator*

Habitat: At the local scale, trumpeter swans are restricted to shallow, freshwater marshes, ponds, lakes, and occasionally slow-moving rivers. Suitable wetlands can vary substantially in their physical (i.e., size, topography, elevation, hydrology) and biological (i.e., macrophyte and invertebrate communities, surrounding vegetation) characteristics, but several basic features are required: approximately 100m of unimpeded water for taking off for flight, accessible forage, shallow, non-fluctuating levels of unpolluted water, structural materials to build a nest platform, such as an island, a muskrat lodge, or emergent vegetation and low human disturbance (Slater 2006).

Determination & Rationale: There are no records of on the OGA & WGA. These birds are incidentally seen in the area. The stockdams on the OGA & WGA would not be considered trumpeter swan habitat (Slater 2006) because they do not meet all of the criteria listed above. The determination is "no impact" for this species.

Sturgeon Chub *Macrhybopsis gelida*

Habitat: Primarily inhabit large, turbid rivers and prefer the main channel near sand or gravel bars. Rarely found in backwater areas or small tributaries (Rahel and Thel 2004b).

Determination & Rationale: There are not any large rivers in the project area. Various surveys have been conducted in the project area and the sturgeon chub was not found. The determination is "no impact" for this species.

Screen 2 – (Lack of Threats):

The species or potential habitat for the species may occur, but it's highly unlikely that land uses and allocations authorized by the Forest Service would affect the species and/or its habitat either on NFS lands or downstream.

Townsend's Big-eared Bat *Corynorhinus townsendii*

Habitat: This bat is dependent year–round upon underground roosting sites (caves or mines) (Tigner and Dowd Stukel 2003). They feed on insects and there is no information to suggest that livestock grazing affects the number of insects.

Determination & Rationale: Bat surveys were conducted in the WGA in the summer of 2007 and Townsend's big-eared bats were not found. Based on survey information utilized by Gruver and Keinath (2006) the Townsend's big-eared bat has only been identified in Sheridan County in Nebraska and is not known to inhabit the Oglala Geographic Area (OGA) at this time. Occurrence of this species in the project area would be highly incidental and unpredictable. The determination is "no impact" for this species.

Fringed Myotis *Myotis thysanodes*

Habitat: Typically, these bats roost in caves, natural rock crevices and abandoned buildings. Males, when netted, were frequently found to have dirt or clay like substances within their fur and crevices of their wing membranes suggesting day roosting in soft soil crevices (Tigner and Dowd Stukel 2003). Fringed myotis are nocturnal.

Determination & Rationale: Bat surveys were conducted in the WGA in the summer of 2007 and fringed myotis were not found. Based on survey information utilized by Keinath (2004) the fringed myotis has not been identified on the Oglala Geographic Area (OGA) at this time. The determination is "no impact" for this species.

Rocky Mountain Bighorn Sheep *Ovis canadensis*

Habitat: Rocky Mountain bighorn sheep inhabit alpine meadows, foothills, cliffs, and rock outcrops (Orabona et. al. 2009, Clark and Stromberg 1987). Merwin (2000) noted that bighorn sheep often selected areas with good visibility (i.e., <40 percent canopy closure) within suitable distance of water and escape terrain. Bighorn's like open areas so they can see possible predators. The availability of escape terrain is critical, especially during the lambing period (Higgens et. al. 2000). Escape terrain generally consists of steep, rugged topography that allows bighorn's freedom of movement but difficult for predators. Steep, rugged Badland formations as well as rocky, open cliffs are examples of escape terrain.

Determination & Rationale: Within the last few years some bighorn sheep have shown a preference to lambing in a few areas of the Oglala National Grassland, these include areas around Eagle's Eye Rock (also referred to as the buttes behind L. Douthit's) and Round Top (Tucker and Wollesen 2009 and Wollesen 2008 & 2009). Although these locations are in the project area, occurrence of this species would be highly incidental and unpredictable. Most bighorn sheep activity occurs further south of these areas on the Soldier Creek Area, Fort Robinson State Park and surrounding private lands. The only new range structure proposed in areas where bighorn sheep may be present is a windmill and water tank which would actually be beneficial to the species. There are no proposals to allow domestic sheep grazing on federal lands through this process which would be the largest threat to the species due to the potential transmission of disease. There are no resident bighorn sheep on the WGA. We do not expect any impact on the species due to the implementation of this project. The determination is "no impact" for this species.

American Bittern *Botaurus lentiginosus*

Habitat: American bitterns use tall, dense, shallow- or deep-water emergent vegetation in wetlands; native vegetation in wet meadows; and moderately tall, dense, native or tame vegetation in uplands adjacent to wetlands. American bitterns prefer relatively large (≥ 8 acres) wetlands, ranging in size from 8 to 550 acres (Dechant et al. 2003a) (Wiggins 2006).

Determination & Rationale: There are few wetlands of appropriate size for the American bittern in the project area. The American bittern is listed on the Pine Ridge Ranger District bird list (1993) for the OGA, although it has never been identified on the Oglala National Grassland Breeding Bird Survey (1999-Present) (USGS 2012), and it has not been seen on the OGA for many years. No bitterns have been seen in the WGA. The determination is "no impact" for this species.

Mountain Plover *Charadrius montanas*

Habitat: Mainly found in native shortgrass prairie. Where taller vegetation exists, they are generally restricted to areas with prairie dogs or heavy grazing (Dinsmore 2003).

Determination & Rationale: The South Dakota Ornithologist Union (Tallman et. al. 2002) list the status of the mountain plover in South Dakota as accidental. There are no recent records of mountain plover on either the OGA or WGA. The determination is "no impact" for this species.

Black Tern *Chlidonias niger*

Habitat: Optimum black tern habitat is described as the hemi-marsh stage (50:50 open water to emergent vegetation). Black tern use of wetland habitat was related positively to wetland area and negatively to isolation of wetland habitat. Black terns were found absent from wetlands less than 12 acres in size (Naugle 2004).

Determination & Rationale: Black terns may be limited by wetland size as they were absent from Iowa marshes < 5 ha (12.3 acres) and were most common in wetlands > 20 ha (49.4 acres) (Naugle 2004).

There are few wetlands of this size in the area but the isolation of these dams reduces their suitability as black tern habitat. The only wetland on federal land that black terns have been seen at is the Grabb dam in which black terns were observed during the BBS in 1994. This appeared to be an incidental sighting. This dam has been visited during the BBS survey every year since 1991. They have been seen on 4 different occasions at a large dam on private property that is within the project area. The black tern is listed on the Pine Ridge Ranger District bird list (1993) for the OGA, although it has never been identified on the Oglala National Grassland Breeding Bird Survey (1999-Present) (USGS 2012), and it has not been seen on the OGA for many years. No alternative in this document will negatively affect the incidental use of stockdams in the area by black terns. The determination is "no impact" for this species.

Yellow-Billed Cuckoo *Coccyzus Americanus*

Habitat: Yellow-billed cuckoos prefer to nest in open woodlands with an understory of dense vegetation, especially near water. On the Great Plains, the favored nesting habitats are well-wooded river valleys and associated deciduous forests. Cuckoo foraging habitat is similar to that used for nesting (Wiggins 2005b).

Determination & Rationale: The South Dakota Ornithologist Union (Tallman et. al. 2002) list the status of the yellow-billed cuckoo in South Dakota as an uncommon migrant and summer resident southeastern portions of the state, and rare to uncommon elsewhere. There are no recent records of yellow-billed cuckoo on either the OGA or WGA. It is doubtful that habitat for this species exists in the project area. The determination is "no impact" for this species.

Bald Eagle *Haliaeetus leucocephalus*

Habitat: Breeds in forested areas near large bodies of water and winters in coastal areas, along large rivers, and large unfrozen lakes.(Sibley 2000).

Determination & Rationale: Occurrence of this species on the planning unit is highly incidental and unpredictable. They occur as migrants passing through the area and uncommon winter residents. They are known to winter along the Cheyenne River. The bald eagle is mostly found near water, primarily on river systems, large lakes, reservoirs and coastal areas. Neither the OGA nor WGA contain this type of habitat. There have been incidental sightings of bald eagles in the fall and winter, but no nests have been located in the WGA or OGA. The determination is "no impact" for this species.

Lewis's Woodpecker *Melanerpes lewis*

Habitat: Primary habitat is the open forests of western North America. Optimal breeding habitat should include 30 percent tree canopy cover, with >50 percent shrub canopy cover, and optimal winter habitat should include 100 percent canopy cover of hard mast producing shrubs and trees, residual corn within 800 meters (m) of the nearest mast storage site, and at least one snag >30.5 centimeter (cm) diameter at breast height (dbh) per 0.4 hectares (Abele et. al. 2004).

Determination & Rationale: One Lewis's woodpecker was seen on the WGA Cottonwood BBS route in 2011. This was most likely an incidental sighting of a bird moving through the area. There is no suitable habitat for Lewis's woodpecker in the project area. The determination is "no impact" for this species.

Barr's Milkvetch *Astragalus barrii*

Habitat: Occurs in dry badlands areas, rocky prairie breaks, slopes, knolls, and ridges (areas with low vegetation cover). It typically grows in soils composed of sandstone, limestone, shale, and silts (Ladyman 2006a).

Determination & Rationale: In 2009 surveys were conducted to determine if Barr's milkvetch was present on the OGA, but the species was not detected (Kostel 2009). Although badlands habitat is available, it was suspected that the soil chemistry in the exposed soil layers was not suitable for the propagation of Barr's milkvetch. There are no known populations of Barr's milkvetch on either the WGA or OGA. The determination is "no impact" for this species.

Dakota Wild Buckwheat *Eriogonum visheri*

Habitat: Found in deep, white clays at the base of badlands buttes and slopes (Kostel et. al. 2006).

Determination & Rationale: There are no known populations of Dakota wild buckwheat on either the WGA or the OGA. Further the project area does not appear to be with the current species range (Ladyman 2006b). The determination is "no impact" for this species.

Analysis of Effects for Sensitive Species

Black-Tailed Prairie Dog *Cynomys ludovicianus*

Distribution and Status: Throughout the Great Plains, the range of the prairie dog extends from southern Canada to northern Mexico (Higgins et al. 2000). The U.S. Fish and Wildlife Service (2004) reported that state agencies currently estimate that prairie dog occupied habitat is approximately 1,842,000 acres. In Canada and Mexico, an additional 51,589 acres of prairie dog habitat exist as reported by the U.S. Fish and Wildlife Service in a news release dated August 12, 2004.

The U.S. Fish and Wildlife Service (2000) determined that listing of the black-tailed prairie dog was warranted but precluded by other higher priority listing actions. Later, the U.S. Fish and Wildlife Service (2004) concluded that the black-tailed prairie dog does not warrant listing.

Habitat: This species occurs mostly on shortgrass and mixed grass prairie. Suitability of habitats for this species is enhanced by low vegetative cover and increased visibility to detect predators and enhance social behaviors. Because of this, these animals prefer areas with disturbed soils and/or grasslands grazed by cattle or bison. They typically colonize grasslands of a wide variety of soil types that are flat to gently rolling. They avoid wetlands and areas with high water tables.

Conservation Status
ESA –None
Global-G4
Nebraska-S3S4
South Dakota-S4

Forest Service , Region 2- Sensitive

Status definitions can be viewed at http://www.natureserve.org/explorer/ranking.htm

Existing Conditions: Two decisions have been completed concerning prairie dog management on the Nebraska Nations Forest:

1. USDA Forest Service 2005 - Black-Tailed Prairie Dog Conservation and Management on the Nebraska National Forest and Associated Units (Forest Plan Amendment 2) (Boundary Management) (USDA Forest Service. 2001).
2. USDA Forest Service 2008 - Black-Tailed Prairie Dog Management on the Nebraska National Forest and Associated Units (Forest Plan Amendment 3) (Interior Management) (USDA Forest Service. 2001).

These decisions are the basis for all prairie dog management in the WGA and OGA.

Control: Prairie dog control has been an ongoing process in the WGA for a number of years. In the recent past prairie dogs in the WGA were controlled in 1989 (1 colony - 50 acres), 1991 (12 colonies - 158 acres), 1994 (9 colonies – 123 acres) and in 1997 (11 colonies – 111 acres). In 1999, all prairie dog control worked ceased because of the petition for listing in 1998. In the fall of 2004, prairie dog control resumed. There were 11 colonies and 769 acres controlled in 2004, 6 colonies and 784 acres controlled in 2005, 9 colonies and 376 acres controlled in 2006, 3 colonies and 245 acres controlled in 2007, 9 colonies and 178 acres controlled in 2008, 7 colonies and 136 acres controlled in 2009 and 8 colonies and 166 acres in 2012. Control was carried out on prairie dog colonies that were located within ½ mile of private land.

Prairie dog control on the OGA has also been fairly extensive with records showing that treatment has occurred since at least 1978. In the recent past prairie dog control has occurred on the OGA in 1989 (3 pastures(2 colonies) – 316 acres), 1990 (9 pastures(8 colonies) – 857 acres), 1991 (3 pastures(3 colonies) – 292 acres), 1992 (4 pastures(3 colonies) – 336 acres), 1997 (6 pastures(6 colonies) – 354 acres), and 1998 (5 pastures(5 colonies) – 295 acres). During the moratorium and the development of the 2005 Black-tailed Prairie dog decision, all prairie dog control work ceased. In the fall of 2005, prairie dog control resumed. In 2005, 965 acres were treated in 8 colonies across 11 pastures, 2006, 962 acres were treated in 13 colonies across 15 pastures, 2007, 1006 acres were treated in 11 colonies across 13 pastures, 2008, 250 acres were treated in 5 colonies across 4 pastures, 2009, 470 acres were treated in13 colonies across 11 pastures, and in 2010, 242 acres were treated in 9 colonies across 11 pastures. All control efforts since 2005 have been under the 2005 decision. At this time the 2008 decision has not been implemented on the OGA.

Plague: A probable plague outbreak was discovered in the WGA in the summer of 2006 when the colonies were visited to complete the scheduled inventory. These colonies were not visited in the summer of 2005 (only colonies that were controlled were inventoried). The outbreak occurred sometime in the summer of 2005 or spring of 2006. Plague caused die-offs in 11 colonies and affected 455 acres of prairie dogs.

On the OGA plague is suspected to have caused the die-off of a 700 acre colony that was located in pastures 18 and 8A. This die-off occurred sometime between the fall of 2011 and spring of 2012. This colony was last confirmed to be active in September of 2011 by a USFS employee who was conducting validation monitoring for prairie dog encroachment complaints. By the spring of 2012 rumors where coming in from prairie dog shooters that the town was inactive, and the PRRD wildlife biologist confirmed the inactivity in early August of 2012. During the 2012 OGA prairie dog inventory, approximately 5.5 active acres of prairie dog colony were found in the old colony. This is the only

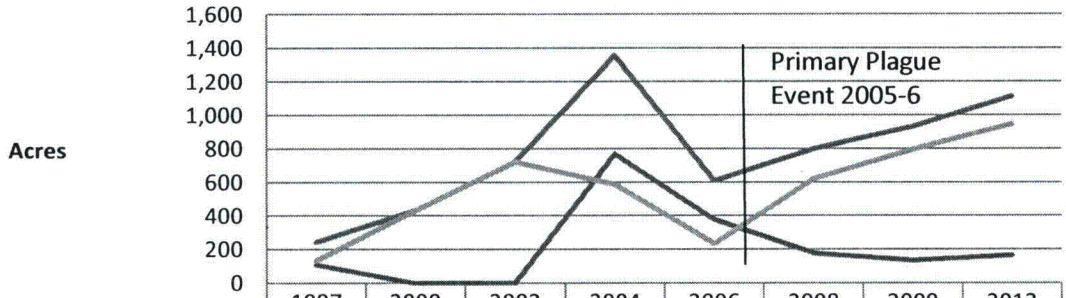
colony on the OGA that is suspected to have been impacted by plague to date, and it is unclear what type of effect plague may have on the prairie dog colonies of the OGA.

Summary: The year 1997 is used as a starting point for the analysis of prairie dog colonies in the WGA because it was the last year any control work was completed in the WGA before the prairie dog was petitioned for listing and the Forest Service decided to stop all prairie dog control. Complete inventories were carried out in 1997, 2000, 2002, 2004, 2006, 2008, 2009 and 2012. A summary of the results of the inventories is presented in Chart 2.

Complete inventories of the OGA were carried out in 1996, 1999, 2000, 2001, 2002, 2004, 2006, 2007, 2009, and 2012. A summary of the results of the inventories is presented in Chart 3.

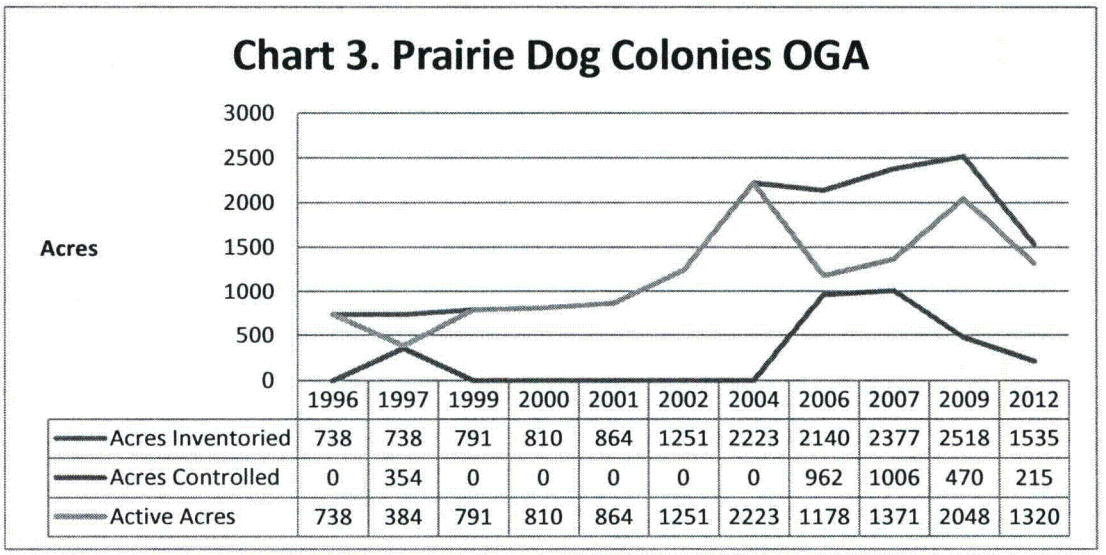
There were 44 prairie dog colonies that were active at one time or another in the WGA between 1997 and 2009. Of these, 14 have not been controlled or subjected to a plague outbreak (active), 11 have been exposed to plague only, 6 were located in an area where they were controlled and also exposed to plague. The last 13 are believed to only have been controlled. Colonies thought to be effected by plague are all located north of Highway 18. There is no sign of plague south of the highway to date. There has been no sign of additional plague since 2005.

Chart 2. Prairie Dog Colonies WGA



	1997	2000	2002	2004	2006	2008	2009	2012
Acres Inventoried	244	433	722	1,357	611	799	932	1113
Acres Controlled	111	0	0	769	376	178	136	166
Active Acres	133	433	722	588	234	621	796	947

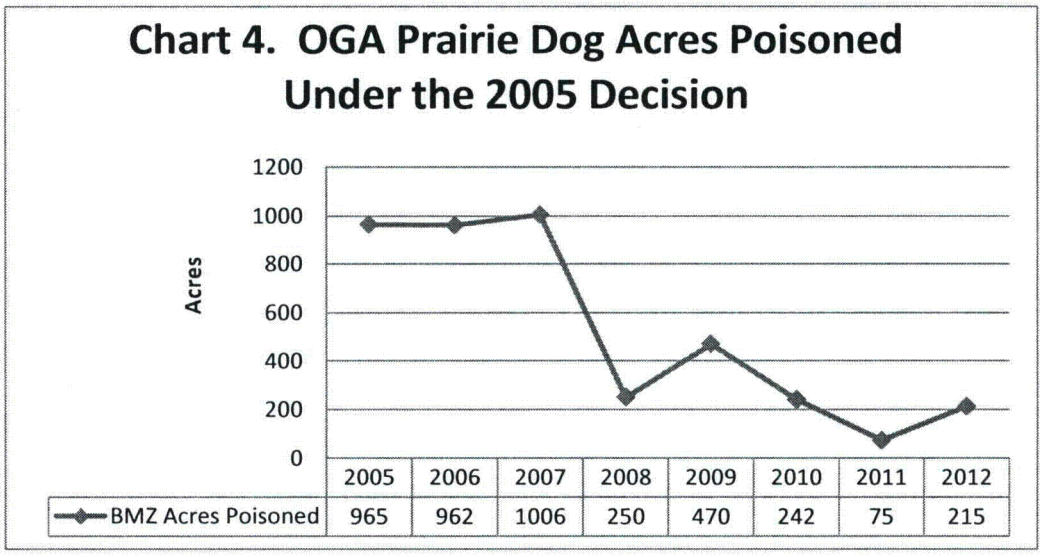
In 1997, 244 acres of prairie dogs were located during the inventory. All of the colonies were controlled in the fall of 1997 except CW27 which left 133 acres of active prairie dog colonies in the WGA. There were 1,357 acres of active prairie dogs found within the WGA before control efforts began in 2004 (Chart 2). These acres were reduced to 588 acres after control was applied in the fall and winter of 2004. A post 2004 low occurred in 2006 (234 acres of active prairie dog colonies) after two years of control and plague moving through many of the colonies in the WGA. As the colonies not affected by plague and not controlled continued to grow and the colonies subjected to a plague outbreak recovered, the total acreage of active prairie dog colonies in the WGA increased to 796 in 2009 and 947 in 2012.



Forest Plan Compliance:

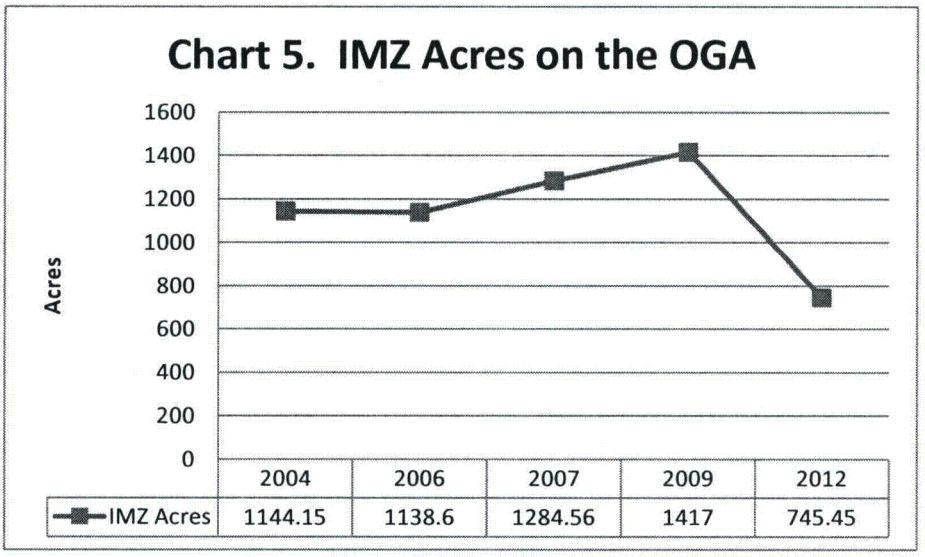
Amendment 2:

Lethal control: All of the control completed after 2004 was completed in the BMZ for both the WGA and the OGA. Summary of control for the WGA is presented in Chart 2 in the control section above and for the OGA in Chart 4 below.



Non-lethal control: There have been no fences built in the WGA or the ONG to date. All of the non-lethal control has been done through manipulation of grazing schedules. Livestock was kept off pastures in the early spring after control was applied to allow for vegetative recovery.

Amendment 3: The WGA will be managed for a minimum of 1,000 acres and a maximum of 3,600 acres of active prairie dog colonies. There were 1,357 active acres in 2004. These colonies were located in both the IMZ and BMZ and 769 acres were controlled leaving 588 acres. A low occurred in 2006 (234 acres of active prairie dog colonies) after two years of control and plague moving through many of the colonies in the WGA. There were 947 active acres in the IMZ in 2012, which is 43 acres short of the minimum of 1,000 acres called for in Amendment 3.



The OGA will be managed for a minimum of 1,000 acres and a maximum of 2,800 acres of active prairie dog colonies. Since at least 2004 the OGA has been within the desired range of IMZ prairie dog colony acres that was established with the 2008 decision (Forest Plan Amendment 3) until 2012 (Charts 4 & 5). In 2012 one of the largest colonies on the OGA had a mass die-off likely due to an outbreak of plague. This is the first suspected outbreak of plague on the OGA and it is unclear how plague will affect the prairie dog populations on the OGA at this time. The OGA has approximately 745 active acres (Chart 5) of prairie dog colony on the IMZ which is 255 acres short of the minimum of 1,000 acres called for in Amendment 3.

Direct, Indirect, and Cumulative Effects: Livestock grazing could harm individual prairie dogs directly by stepping on them or stepping on a burrow and causing it to collapse on a prairie dog, but this would be rare and highly unlikely. Indirectly the poisoning and or killing of prairie dogs to reduce the competition for forage between livestock and prairie dogs have had huge implications in the past and will continue to in the future. This species occurs mostly on shortgrass and mixed grass prairie, and habitat suitability for this species is enhanced by low vegetative cover and increased visibility to detect predators and enhance social behaviors. Because of this, these animals prefer areas with disturbed soils and/or grasslands grazed by cattle or bison. In general it is believed that grazing improves conditions for prairie dog expansion. The livestock make it easier for the prairie dogs to maintain low vegetative cover by grazing in the colony and the opposite is also true. An in-depth analysis of the effects of prairie dogs is presented in the EIS's for the two prairie dog management decisions (USDA Forest Service 2005) (USDA Forest Service 2008).

Determination of Effect and Rationale for the Black-tailed Prairie Dog

Alternative 1: No Action (No Grazing)

The biological determination for the black-tailed prairie dog viability is *no impact.* The biological determination for black-tailed prairie dog population trend is "*neutral effect*".

Rationale: Management decisions for boundary management and interior management have been made. Within these decisions it was decided where and when control will take place and the number of acres of prairie dogs that will be maintained in each geographic area (USDA Forest Service 2001). This decision will not alter the previous decisions. In general no grazing may make it more difficult for land managers

to maintain prairie dogs in the WGA of OGA, but it will not alter the decisions that have already been made.

For the WGA the boundary management zone is ½ mile from private land and the minimum number of active acres of prairie dogs to be maintained on the landscape is 1,000 acres and the maximum is 3,600 acres. For the OGA the boundary management zone is ½ mile from private land and the minimum number of active acres of prairie dogs to be maintained on the landscape is 1,000 acres and the maximum is 2,800 acres.

Alternative 2: Current Management

The biological determination for the black-tailed prairie dog viability is *no impact.* The biological determination for black-tailed prairie dog population trend is "*neutral effect*".

Rationale: Management decisions for boundary management and interior management have been made. Within these decisions it was decided where and when control will take place and the number of acres of prairie dogs that will be maintained in each geographic area (USDA Forest Service 2001). This decision will not alter the previous decisions.

For the WGA the boundary management zone is ½ mile from private land and the minimum number of active acres of prairie dogs to be maintained on the landscape is 1,000 acres and the maximum is 3,600 acres. For the OGA the boundary management zone is ½ mile from private land and the minimum number of active acres of prairie dogs to be maintained on the landscape is 1,000 acres and the maximum is 2,800 acres.

Alternative 3: Proposed Action (Adaptive Management)

The biological determination for the black-tailed prairie dog viability is *no impact.* The biological determination for black-tailed prairie dog population trend is "*neutral effect*".

Rationale: Management decisions for boundary management and interior management have been made. Within these decisions it was decided where and when control will take place and the number of acres of prairie dogs that will be maintained in each geographic area (USDA Forest Service 2001). There are instances within this decision that stocking rates of livestock are increased to facilitate the expansion of prairie dogs, but this decision will not alter the previous decisions.

For the WGA the boundary management zone is ½ mile from private land and the minimum number of active acres of prairie dogs to be maintained on the landscape is 1,000 acres and the maximum is 3,600 acres. For the OGA the boundary management zone is ½ mile from private land and the minimum number of active acres of prairie dogs to be maintained on the landscape is 1,000 acres and the maximum is 2,800 acres.

Hoary Bat *Lasiurus cinereus*

Distribution and Status: Hoary bats are currently distributed from Northern Canada, throughout the 48 contiguous United States and Hawaii, south into portions of Central and South America (NatureServe 2012). Hoary bats are the most wide spread of all the North American bats although they are never found in high densities (South Dakota Bat Working Group 2004). The species is found throughout Nebraska and South Dakota, including the Pine Ridge of Nebraska and the Black Hills of South Dakota (Czaplewski et. al. 1979, South Dakota Bat Working Group 2004), and is consider to be common in both states (NatureServe 2012).

Habitat: Hoary bats are migratory in Nebraska and South Dakota. In Nebraska, they arrive as early as May and leave as late as October (Freeman et. al. 1997). In the Black Hills of South Dakota, hoary bats are captured between early June and late August (South Dakota Bat Working Group 2004). Being solitary animals, hoary bats tend to roost singly or in family groups consisting of mother and offspring

(Freeman et. al. 1997). The species is generally found near water, and tends to roost in trees on the edge of deciduously forested areas with "adequate foliage cover above and minimal foliage cover below", although they have also been found in coniferous trees with adequate foliage (South Dakota Bat Working Group 2004). Roost sites are generally found in edge trees with heights of 3 to 5 m (South Dakota Bat Working Group 2004). Hoary bats tend to forage over water or at tree top levels above the canopy. Their diet consists mainly of moths, but is also supplemented with beetles and mosquitoes (South Dakota Bat Working Group 2004). Mating usually occurs in late summer or early fall with fertilization occurring the following spring. Hoary bats bear offspring (usually twins) once annually before mid-June. The young are able to migrate south with the adults in the fall (Freeman et. al. 1997 and South Dakota Bat Working Group 2004). Females are frequently susceptible to windstorms, especially while carrying offspring. Hoary bats may also be susceptible to the loss of selected tree roosts (South Dakota Bat Working Group 2004).

Conservation Status
ESA –PS
Global-G5
Nebraska-S5
South Dakota-S5
Forest Service , Region 2- Sensitive

Status definitions can be viewed at http://www.natureserve.org/explorer/ranking.htm

Existing Conditions: Bat surveys were conducted on the WGA in 2007 (Tigner 2007). Mist nets and echolocation equipment where set up on 8 different sites within the WGA. No hoary bats were captured. Hoary bats were detected using the echolocation equipment on 6 of the sites which indicate that hoary bats are fairly common on the WGA. The status of this species on the ONG is currently unknown, but the species is likely to be present. During surveys in July and early August 2012, a few hoary bats were captured in mist nets over water near the Soldier Creek Area of the Pine Ridge Ranger District.

Direct, Indirect and Cumulative Effects: Appropriate roosts, available surface water, and food are essential components of suitable bat habitat. Hoary bats may be susceptible to the loss of selected tree roost. Protecting deciduous and coniferous tree roosts is important to this species. Hoary bats are dependent on live trees at least 3 m tall with adequate foliage cover for roost sites. Typically, hoary bats select trees on the edges of forest areas (South Dakota Bat Working Group 2004). Cattle grazing can affect woodlands in the project area which in turn can affect the area for habitation by hoary bats.

Bats can be attracted to an area by increases surface area of water and will drink from stock tanks. New water tanks could actually favor expansion of hoary bat habitat if the other two components are close (Chung-MacCoubrey 1996).

There are an insufficient number of studies to provide a comprehensive overview of the effects of grazing and fire suppression on arthropod community composition, structure, and distribution (Chung-MacCoubrey 1996) which would indirectly affect the availability of food for Hoary bats and potentially their diet in a given area.

Determination of Effect and Rationale for Hoary Bat

Alternative 1: No Action (No Grazing)

The determination for hoary bat under this alternative is *no impact.*

Rationale: No livestock grazing would reduce the impacts to trees hoary bats could roost in, but may affect the number of water sources available for the species in the project area.

Alternative 2: Current Management

The determination for hoary bats under this alternative is *may adversely impact individuals, but is not likely to result in a loss of viability in planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rationale: A few bats may be killed directly by livestock management activities. Livestock may browse and trample trees and shrubs that hoary bats rely on for roosting.

Alternative 3: Proposed Action (Adaptive Management)

The determination for hoary bats under this alternative is *may adversely impact individuals, but is not likely to result in a loss of viability in planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rationale: A few bats may be killed directly by livestock management activities. Livestock may browse and trample trees and shrubs that hoary bats rely on for roosting. There would be less grazing in this alternative compared to Alternative 2. This alternative would encourage growth of woody plants and result in better habitat for the hoary bats at least when compared to Alternative 2.

Swift Fox *Vulpes velox*

Distribution and Status: Swift fox are currently distributed from south-central Canada (reintroduced population) south through portions of Montana, Wyoming, South Dakota, Colorado, Nebraska, Kansas, Oklahoma, Texas, and New Mexico. The present South Dakota distribution, which is reduced from historical times, is concentrated primarily in southwestern counties (Higgins et. al. 2000).

Habitat: This species inhabits open prairies, plains and shrubby desert areas. It is found in areas with gently rolling hills or undulating topography. Swift fox prefer short to midgrass prairies and loamy soils and utilize dens year around (Harrison and Whitaker-Hoagland 2003). Soil type might be a better predictor of swift fox habitat suitability than vegetation type (Harrison and Whitaker-Hoagland 2003). Swift fox select loamy soils over clayey soils for den sites. This species is an opportunistic feeder on small mammals, birds, insects, berries, vegetation and carrion (Ashton and Dowd 1991). Predation by coyotes appears to be the most common mortality factor for swift fox (Allardyce & Sovada 2003) (Stephens & Anderson 2005). The key factor in swift fox management is to provide suitable habitat where the swift fox can obtain prey while avoiding predation.

Conservation Status
ESA –None
Global-G3
Nebraska-S2
South Dakota-S1
Forest Service , Region 2- Sensitive

Status definitions can be viewed at http://www.natureserve.org/explorer/ranking.htm

Existing Conditions: Incidental sightings of swift were reported throughout the area over the years. Formal surveys were conducted in the late 1980's south of the army depot. No swift fox were found at that time. After finding a dead swift fox in the area it was decided to do formal surveys in the area again. The surveys were conducted as a part of a graduate research projected conducted through South Dakota State University. As a part of the project swift fox were live trapped in an area south of the Army Depot and a summary of the results is presented in Table 19.

Table 19. WGA Swift Fox Project Results

2010	18 captures	14 Individual Foxes
2009	30 captures	16 Individual Foxes
2008	16 captures	15 Individual Foxes

Swift fox data for the OGA is very limited. A few incidental sightings and road killed swift fox have been reported, but no active dens are known on the OGA although they probably exist. In 2009 Chadron State College did some track plot surveys on the OGA and had a few positive identifications and 1scat sample.

Direct, Indirect, and Cumulative Effects: Livestock grazing could harm individual swift fox directly by stepping on them or stepping on a den and causing it to collapse on a fox but this would be rare. Human activities in support of livestock grazing could have similar effect. Vehicle tires could crush young fox or it is possible that a fox could be killed by someone who sees them as a threat to their livestock. Foxes may also leave areas that are constantly disturbed by humans checking livestock. There is also the possibility of individual fox being affected by infrastructure that is in place to manage livestock (colliding with fences drowning in stack tanks etc).

Indirectly swift fox habitat can be affected by livestock grazing. Swift fox prefer short to midgrass prairies. Swift foxes used locations with greater visibility to avoid coyote predation. Russell (2006) found that swift fox avoid vegetation over 30 cm in height. Livestock grazing, especially in high precipitation years, is important to keep the vegetation at a level that will insure survival of swift fox.

Determination of Effect and Rationale for the Swift Fox

Alternative 1: No Action (No Grazing)

The biological determination for the swift fox is *may adversely impact individuals, but not likely to result in a loss of viability in planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rationale: Swift fox are compatible with livestock grazing and in some areas may need livestock to reduce the vegetation height to enable them to survive in the area. In the study area, in times of high precipitation, the vegetation will grow over 30 cm which may cause swift fox to avoid the area. Elimination of livestock grazing could cause swift fox to leave the area in high production years but drought conditions will lower production and they can return. That is why a "may impact" determination is rendered rather than a "likely to result in a loss of viability" determination. Certainly a case could be made for either determination.

Alternative 2: Current Management

The biological determination for the swift fox with this alternative is *may adversely impact individuals, but not likely to result in a loss of viability in planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rationale: Livestock grazing could result in direct mortality to an individual swift fox but that would be a rare isolated incident. Swift fox are compatible with livestock grazing and in some areas may need livestock to reduce the vegetation height to enable them to survive in the area. In the study area, in times of high precipitation, the vegetation will grow over 30 cm which may cause swift fox to avoid the area. Livestock grazing may actually be necessary for survival of swift fox in the area over time.

Alternative 3: Proposed Action (Adaptive Management)

The biological determination for the swift fox with this alternative is *may adversely impact individuals, but not likely to result in a loss of viability in planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rationale: Livestock grazing could result in direct mortality to an individual swift fox, but that would be a rare isolated incident. Swift fox are compatible with livestock grazing and in some areas may need livestock to reduce the vegetation height to enable them to survive in the area. In the study area, in times of high precipitation, the vegetation will grow over 30 cm which may cause swift fox to avoid the area. Livestock grazing may actually be necessary for survival of swift fox in the area over time. Compared to Alternative 2 this alternative will have less grazing and more intensive management which could result in habitat conditions less favorable to swift fox. It is doubtful the changes will be enough to effect swift fox populations.

Grasshopper Sparrow *Ammodramus savannarum*

Distribution and Status: The grasshopper sparrow has a widespread distribution throughout most of the Americas, but it often breeds locally and is considered rare to uncommon in much of its range (Vickery 1996) (Dechant 2003e).

The grasshopper sparrow is considered globally "secure" by the Natural Heritage Program because of its wide distribution across North America. However, according to the Breeding Bird Survey, grasshopper sparrow populations have declined by over 60 percent during the past 25 years. The U.S. Fish and Wildlife Service list the grasshopper sparrow as a species of special concern. Within the states of Forest Service Region 2, which represent the core of this species breeding range, grasshopper sparrow populations have also exhibited long-term declines. Declines in Colorado and South Dakota have outpaced national trends.

These small ground-dwellers sing in a hissing, insect-like buzz (Sibley 2000). Hawks are infrequent predators, and loggerhead shrikes commonly impale adult and immature grasshopper sparrows (Vickery 1996). Low-level parasitization of grasshopper sparrow nests by brown-headed cowbirds also occurs (Slater 2004).

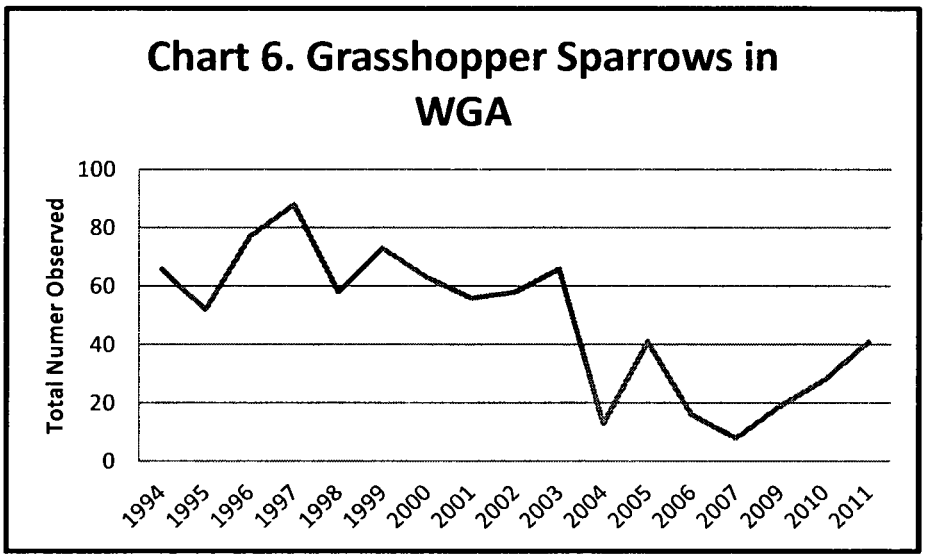
Habitat: During the nesting season, these sparrows generally occupy intermediate height grassland habitat and prefer drier, sparser sites in tall grass prairies and thicker, brushier sites in short-grass prairies (Vickery 1996). The sparrow prefers moderately open grasslands and prairies with patchy bare ground, avoiding extensive shrub cover (Vickery 1996). They have been known to inhabit bunchgrasses over sod-forming grasses, although research on Fort Pierre National Grassland did not confirm this (Fritchner 1998). On Fort Pierre National Grassland, positive correlations of grasshopper sparrows with mean vegetation height, litter depth, and visual obstruction indicated western wheatgrass (*Agropyron smithii*) and green needlegrass (*Stipa viridula*) habitats supported the highest densities of grasshopper sparrows (Fritchner 1998), and there was a negative correlation with bare ground and short buffalograss (*Buchloe dactyloides*). These birds are more likely to occupy large tracts of habitat than small fragments (Slater 2004). They nest near the ground in a domed structure in over-hanging grasses with a side entrance (Vickery 1996). The birds forage on open ground in summer to satisfy a diet that consists of about 60 percent invertebrates—preferably grasshoppers—and 40 percent seeds (Vickery 1996).

Conservation Status
ESA –None
Global-G5
Nebraska-S4
South Dakota-S4B
Forest Service , Region 2- Sensitive

Status definitions can be viewed at http://www.natureserve.org/explorer/ranking.htm

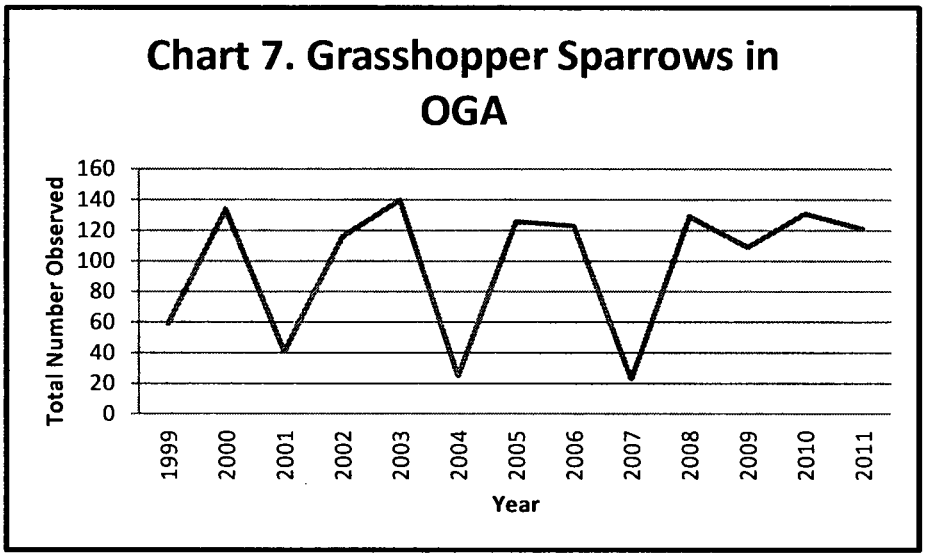
Existing Conditions: Grasshopper sparrows are common in both geographic areas. They were detected regularly while conducting all of the Breeding Bird Survey (BBS) routes in the project area.

On the WGA, during the 1990's when the precipitation was high, the numbers of grasshopper sparrows detected was also high. During the drought years in the early 2000's, numbers of grasshopper sparrows fell off. As precipitation increase in 2009 – 2011, there has been a corresponding increase in the numbers of grasshopper sparrows detected during the BBS (Chart 6). It is assumed that the amount of precipitation directly affects the height and density of vegetation.



On the OGA this pattern does not appear to hold true. The number of grasshopper sparrows detected annually on the Oglala breeding bird survey route appears to be fairly consistent except for when the numbers detected dip, which has occurred inconsistently every couple of years since the route was established (Chart 7)(USGS 2012). Although this BBS route was established in 1999 right before the drought began on the OGA, one of the lowest grasshopper sparrow counts came from the1999 survey which had been preceded by four years of average or higher growing season precipitation (Chart 1. (Page 6) & Chart 7). Since the OGA has come out of the drought in the spring of 2009, we have not seen significant increases in the number of grasshopper sparrows detected on the Oglala BBS route (Chart 7).

Structure is addressed in the LRMP and if the objective of 10-30% of the area is maintained in high cover this should meet the needs of grasshopper sparrows.



Direct, Indirect, and Cumulative Effects: Livestock grazing could harm individual grasshopper sparrows directly. Nests or young birds could be stepped on. The same could be true of human activities accomplished to support livestock grazing. Vehicle tires could crush nests and young birds that cannot fly. Affected individual sparrows, however, would be a small percent of the total population, and this would not be a factor in population viability under grazing at anticipated intensities.

The height and density of ground cover defines the structure of the vegetation. As described above, these birds prefer habitats with intermediate grass height and density. The birds also like bare ground to forage on (Slater 2004). Indirectly, grazing is important in determining the quality of grasshopper sparrow habitat because they prefer intermediate grass structure and some open under story.

Cumulatively, the loss of native prairies and grasslands for agriculture and urban development (Slater 2004) has been a pervasive impact on habitat. Intensive and extensive grazing has had negative impacts on this species, too (Vickery 1996). Hayfields can serve as habitat, but conversion of these to crop fields has had extensive impacts (Slater 2004). Government initiatives, such as the conservation reserve program, can provide habitat for grasshopper sparrows, but the loss of these efforts due to funding cuts could have a negative effect on the species.

Determination of Effect and Rationale for the Grasshopper Sparrow

Alternative 1: No Action (No Grazing)

The biological determination for the grasshopper sparrow is *beneficial impact.*

Rationale: Removal of livestock from the area will result in an increase height and density of the herbaceous understory which in turn should be beneficial grasshopper sparrows. Also, removal of livestock would enable the land managers to remove fences and any infrastructure used to maintain livestock. This would eliminate the hazards to grasshopper sparrow's cause by these structures (drowning in stocktanks, colliding with fences, etc.). Finally, the removal of livestock would eliminate the need for people to visit the area to check livestock which would eliminate any direct or indirect effects caused by this activity.

Alternative 2: Current Management

The biological determination for the grasshopper sparrow with this alternative is *may adversely impact individuals, but not likely to result in a loss of viability in planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rationale: With continuation of the present management all of the direct and indirect effects of livestock grazing will be applicable. There will be the possibility of grasshopper sparrows being killed, nests stepped on, nesting cover being affected, etc. thus the may impact individual determination.

Grasshopper sparrows inhabit the area and their numbers have fluctuated over the years (Chart 6 & 7). There is no reason to believe that this trend would not continue, so it follows that the current management will not lead to a loss of viability.

Alternative 3: Proposed Action (Adaptive Management)

The biological determination for the grasshopper sparrow with this alternative is *may adversely impact individuals, but not likely to result in a loss of viability in planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rationale: With continuation of grazing in alternative 3, all of the direct and indirect effects of livestock grazing will be applicable. There will be the possibility of grasshopper sparrows being killed, nests stepped on, nesting cover being affected, etc. thus the may impact individual determination.

Grasshopper sparrows inhabit the area and their numbers have fluctuated over the years (Chart 6 & 7). In this alternative there is a reduction of grazing in some areas and some more intensive grazing management in others which will likely lead to higher plant structure and density compared to alternative 2.

Short-eared Owl *Asio flammeus*

Distribution and Status: In North America, short-eared owls breed from Alaska and continental Canada, including the southern Baffin Islands, south to central California, and east through Kansas, eastern Oklahoma, eastern Ohio, Pennsylvania, Maryland, and Prince Edward Island (Dechant et. al. 2003d). This medium-sized owl of open country is an uncommon migrant and irruptive summer resident in western South Dakota (Tallman et. al. 2002). Partners in Flight list it as a species of continental concern in the prairie biome (Rich et. al. 2004).

Habitat: The short-eared owl lives in over mid to tall grasses and marshes. Small rodents, especially voles *(Microtis sp.),* compose a preponderance of its diet, and there have been strong shifts between years in the density and location of breeding owls, depending on fluctuating food resources (Wiggins 2004). The abundance of prairie voles in central South Dakota was positively correlated with vegetation variables that measured the height and density of the vegetation and litter, although vole abundance seemed to be correlated with litter rather than the seral stage of prairie vegetation (Fritcher 1998). Short-eared owls build their nests on the ground in open country (Clark 1975), and nests found in the Dakotas have been in cover about 12 to 24 inches high and were well concealed from the sides (Duebbert and Lokemoen 1977). Clutch size is highly variable both within and between localities (Wiggins 2004), but it is known that clutch size is higher in years of food abundance (Clark 1975, Holt and Leasure 1993). The current and historical threats to viable short-eared owl populations in Region 2 can be ranked as follows: 1. Loss of native grassland and wetland habitats. 2. Degradation of existing grasslands due to overgrazing by livestock. 3. Degradation of grassland habitat due to fragmentation. (Wiggins 2004).

Conservation Status
ESA –None
Global-G5

Nebraska-S1
South Dakota-S3B S3N
Forest Service , Region 2- Sensitive

Status definitions can be viewed at http://www.natureserve.org/explorer/ranking.htm

Existing Conditions: Fifteen (8 Cottonwood and 7 Indian) short-eared owls have been seen in the WGA while completing BBS routes. On the OGA, eight short-eared owls have been identified on the Oglala BBS route since it was established in 1999. This is too few numbers to determine any trends accept that they are not abundant in the area. They prefer high cover. Structure is addressed in the LRMP and if the objective of 10-30% of the area is maintained in high cover this should meet the needs of short-eared owls.

Direct, Indirect, and Cumulative Effects: The movements of livestock about WGA and OGA and the actions associated with livestock grazing could harm individual short-eared owls directly. This would be especially true for young birds in nests that could be stepped on. The same could be true of human activities to support livestock grazing. Vehicle tires could crush nests and young birds that cannot fly. Affected individual owls, however, would be a small percent of the total population, so this would not be a factor in population viability under grazing prescribed by the alternatives.

The height and density of ground cover defines the structure of the vegetation, and this is important habitat quality for short-eared owls. These birds nest on prairies of moderate to high structure, and they feed on voles that inhabit such habitat. Grazing that is too intense for annual growing conditions could result in low structure grasslands that are not suitable for short-eared owl nesting or as habitat for the rodents that they feed on.

Cumulatively, the loss of native prairies and grasslands for agriculture and urban development has been a pervasive impact on habitat. Prairie is plowed and marshes are drained for places to grow row crops. Grazing has had negative impacts on this species when it removes nesting and foraging cover. Government initiatives, such as the conservation reserve program, can provide habitat for short-eared owls, but the loss of these efforts due to funding cuts has a negative effect on the species.

Determination of Effect and Rationale for the Short-Eared Owl

Alternative 1: No Action (No Grazing)

The biological determination for the short-eared owl with this alternative is *beneficial impact.*

Rationale: With no grazing, there would be no livestock or ranch vehicles to occasionally destroy nests and young owls. In years of above average precipitation, high structure ground vegetation would be prevalent. Even under moderate drought, however, cover of intermediate height could provide nest protection. Ground litter levels could build up, and this could provide habitat for voles and other rodents that short-eared owls prey on.

Alternative 2: Current Management

The biological determination for the short-eared owl with this alternative is *may adversely impact individuals, but not likely to result in a loss of viability in planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rationale: A few nests could be destroyed and young owls killed by livestock or by activities associated with managing them. During years of above average precipitation, vegetative structure could be generally favorable for this species on the more productive soils. This could be especially true in pastures with

uneven livestock distribution in places where only light grazing had occurred. In dry years, vegetative production may not be sufficient to produce quality habitat for short-eared owls with or without grazing.

Alternative 3: Proposed Action (Adaptive Management)

The biological determination for the short-eared owl with this alternative is *may adversely impact individuals, but not likely to result in a loss of viability in planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rationale: A few nests could be destroyed or young owls killed by grazing livestock or by activities associated with managing them. During years of above average precipitation, a relatively high percent of the area could have cover suitable for nesting by this species and as habitat for voles and other rodents. This alternative will reduce the amount of grazing and contains more intense grazing management, which will produce slightly higher vegetative production and residual cover compared to Alternative 2.

Burrowing Owl *Athene cunicularia*

Distribution and Status: The burrowing owl has a wide distribution in Canada, Mexico, and the western U.S. In the Great Plains, the species is found on all national grasslands and forests, although extirpated from the Sheyenne National Grassland in eastern North Dakota.

The historical range of the western burrowing owl once included the southern interior of British Columbia, east into Manitoba, south including Minnesota, Iowa and south-central Texas, but it is now extirpated from these areas. The historical range in Mexico is not known, though museum specimens in Mexico suggest that burrowing owls were once found in 28 of 32 states.

Most jurisdictions in Canada and the U.S. have shown overall declines in populations since the 1980s. No historical numbers of burrowing owls exist prior to the decline detected in the mid 1980s. The historical breeding distribution of burrowing owl was likely more extensive in the late 1800s when North America was covered by over 100 million acres of prairie dog colony habitat. This specific type of breeding habitat has been reduced to only 1.9 million acres, which is a substantial loss of breeding habitat (McDonald et. al. 2004).

Habitat: Burrowing owl habitat typically consists of open, dry, treeless areas on plains, prairies, and deserts. These areas are also occupied by burrowing mammals and other animals that provide nest burrows. The prairie dog is a keystone species in the Great Plains and its burrows were undoubtedly the principal breeding habitat of the burrowing owl. Indeed, the burrowing owl is often viewed as one of the unique species of a prairie dog colony. Although burrowing owls are capable of using badger and coyote burrows, and still use the burrows of Richardson's ground squirrel (*Spermophilus richardsonii*) in the far northern Great Plains, in grasslands without prairie dogs burrowing owls occur at very low densities(McDonald et. al. 2004).

Conservation Status
ESA –None
Global-G4
Nebraska-S5
South Dakota-S3S4B
Forest Service , Region 2- Sensitive

Status definitions can be viewed at http://www.natureserve.org/explorer/ranking.htm

Existing Conditions: Burrowing owl habitat on the WGA & OGA is in essence black-tailed parried dog colonies. They are common in the prairie dog colonies of the WGA & OGA. See the prairie dog discussion for a discussion of this habitat.

Direct, Indirect, and Cumulative Effects: Livestock grazing could harm individual burrowing owls directly by stepping on them or stepping on a burrow and causing it to collapse on a burrowing owl, but this would be rare and highly unlikely. Indirectly the poisoning and or killing of prairie dogs to reduce the competition for forage between livestock and prairie dog has huge implications on burrowing owls. As dogs are poisoned their burrows are left abandon, and over time the burrows slowly cave in which reduces the amount habitat available for burrowing owls. Prairie dogs occur mostly on shortgrass and mixed grass prairie, and habitat suitability for prairie dogs is enhanced by low vegetative cover and increased visibility to detect predators and enhance social behaviors. In general it is believed that grazing improves conditions for prairie dog expansion which in turn creates more habitat for burrowing owls. An in-depth analysis of the effects of prairie dogs and their management on burrowing owls is presented in the EISs for the two prairie dog management decisions (USDA Forest Service 2005) (USDA Forest Service 2008).

Determination of Effect and Rationale for the Burrowing Owl

Alternative 1: No Action (No Grazing)

The biological determination for the burrowing owl is *no impact.*

Rationale: Prairie dog management is in turn burrowing owl management. Management decisions for boundary management and interior management of prairie dogs have been made. Within these decisions it was decided where and when control will take place and the number of acres of prairie dogs that will be maintained in each geographic area (USDA Forest Service 2001). This decision will not alter the previous decisions. In general no grazing may make it more difficult for land mangers to maintain prairie dogs in the WGA of OGA, but it will not alter the decisions that have already been made.

For the WGA the boundary management zone is ½ mile from private land and the minimum number of active acres of prairie dogs to be maintained on the landscape is 1,000 acres and the maximum is 3,600 acres. For the OGA the boundary management zone is ½ mile from private land and the minimum number of active acres of prairie dogs to be maintained on the landscape is 1,000 acres and the maximum is 2,800 acres.

Alternative 2: Current Management

The biological determination for the burrowing owl is *no impact.*

Rationale: Prairie dog management is in turn burrowing owl management. Management decisions for boundary management and interior management have been made. Within these decisions it was decided where and when control will take place and the number of acres of prairie dogs that will be maintained in each geographic area (USDA Forest Service 2001). This decision will not alter the previous decisions.

For the WGA the boundary management zone is ½ mile from private land and the minimum number of active acres of prairie dogs to be maintained on the landscape is 1,000 acres and the maximum is 3,600 acres. For the OGA the boundary management zone is ½ mile from private land and the minimum number of active acres of prairie dogs to be maintained on the landscape is 1,000 acres and the maximum is 2,800 acres.

Alternative 3: Proposed Action (Adaptive Management)

The biological determination for the burrowing owl is *no impact.*

Rationale: Prairie dog management is in turn burrowing owl management. Management decisions for boundary management and interior management have been made. Within these decisions it was decided where and when control will take place and the number of acres of prairie dogs that will be maintained in each geographic area (USDA Forest Service 2001). This decision will not alter the previous decisions.

For the WGA the boundary management zone is ½ mile from private land and the minimum number of active acres of prairie dogs to be maintained on the landscape is 1,000 acres and the maximum is 3,600 acres. For the OGA the boundary management zone is ½ mile from private land and the minimum number of active acres of prairie dogs to be maintained on the landscape is 1,000 acres and the maximum is 2,800 acres.

Ferruginous Hawk *Buteo regalis*

Distribution and Status: The ferruginous hawk is an open-country raptor that inhabits grasslands, shrub steppes, and deserts in the central and western part of North American (Bechard and Schmutz 1995). These hawks listed as uncommon migrant and summer resident of western South Dakota (Tallman et. al. 2002). Cultivation of the prairie, grazing, poisoning small mammals, along with mining and fire in nesting habitats, are factors that have caused ferruginous hawk declines (Olendorff 1993). Cultivation is the most serious.

Habitat: Ferruginous hawks are well adapted to semiarid grasslands of the Great Plains and are specialized for hunting grassland rodents and lagomorphs (Johnsgard 1990). Their primary prey are rabbits (*Lepus* spp.), ground squirrels (*Spermophilus* spp.), and prairie dogs (*Cynomys* spp.) (Bechard and Schmutz 1995). After killing, prey is eviscerated routinely, which may retard degradation of the carcass (Schmutz and Hungle 1989). These hawks construct their nests of sagebrush stems, sticks, twigs, or ground debris (Bechard and Schmutz 1995). They place their nests in trees and shrubs (49 percent), on cliffs (21 percent), on utility structures (12 percent), or on ground outcrops (10 percent) (Olendorff 1993).

Conservation Status
ESA –None
Global-G4
Nebraska-S1
South Dakota-S4B
Forest Service , Region 2- Sensitive

Status definitions can be viewed at http://www.natureserve.org/explorer/ranking.htm

Existing Conditions: There have been 22 different ferruginous nest sites identified in the WGA over the years. None were active in the spring of 2011. There have been 17 ferruginous hawks seen while completing the 2 BBS route that are located within the WGA. There have been ferruginous hawk nest sites on the OGA historically, but at this time there are no known active nest sites on the OGA. Since the Oglala BBS route was established in 1999, only 2 ferruginous hawk sightings have been noted at stops during the survey. One was identified in 2000 and the other was sighted in 2007. In 2011 one was also seen between stops during the Oglala BBS. There is no good population trend data for the project area.

It is unclear why nesting has stopped in the area. Most of the trees are still available for nesting. Grazing by domestic livestock has not been drastically changed. It appears that human disturbance seems to be the most important factor. It is doubtful that there is an increase in human activity as a result of livestock grazing from times when there were more ferruginous hawks to the present. The only prey species that is

tracked in the WGA or OGA is prairie dogs and the acres of active prairie dogs have actually increased in the recent past (see prairie dog section of this report).

Direct, Indirect, and Cumulative Effects: Ferruginous hawks are sensitive to disturbance by humans which causes the day to day activities of maintaining livestock to be a factor. Most individuals are extremely sensitive during the early phases of nesting, and somewhat less so as the young near fledging. Individuals often became accustomed to routine disturbance especially if humans are not visibly associated with it. Brief disturbances that do not keep incubating females from eggs for a long duration are less detrimental as the female is more likely to return to incubation. However, more frequent disturbance or longer duration disturbances are likely to have substantial impacts, including nest desertion. Human activity near nests may also impact nestlings by causing them to fledge prematurely (Collins and Reynolds 2005).

Livestock grazing can affect ferruginous hawks in three ways: (1) changes in nest site availability, (2) effects on prey abundance, and (3) effects on prey vulnerability (Collins and Reynolds 2005). Overgrazing can pose a serious indirect threat to ferruginous hawk populations through its effects on ferruginous hawk prey populations. However, there can be potential short-term benefits of overgrazing to ferruginous hawks. In the short-term, overgrazing may increase certain prey densities as well as their vulnerability to ferruginous hawks, thereby providing short-term benefits to individual ferruginous hawks and populations. In general, long-term overstocking of rangelands is detrimental to ferruginous hawk prey populations, and, thus, to ferruginous hawks. Seemingly, there is a conflict for managers charged with providing optimal habitat for ferruginous hawk populations. However, management for overgrazing in order to provide short-term benefits to ferruginous hawk populations is illogical in light of the possible catastrophic long-term effects on ecosystems. Grazing practices pose the least threat to ferruginous hawks when the vegetative structure in grazed areas is adequate to support high numbers of prey species, but not so dense as to significantly decrease prey vulnerability (Collins and Reynolds 2005).

The impact of current livestock grazing regimes on ferruginous hawk populations and individuals may also directly and negatively affect nesting substrates, such as traditional nest trees. Indeed, livestock often congregate under the limited trees that are typical of ferruginous hawk breeding habitat within WGA & OGA, trampling the trees' root systems, eating seedlings needed for replacement of senescent trees, and girdling nest trees by using them as scratching posts. These activities can pose a serious threat to ferruginous hawk productivity by eliminating suitable nest trees, or by direct disturbance to breeding ferruginous hawk pairs (Collins and Reynolds 2005).

Determination of Effect and Rationale for the Ferruginous Hawk

Alternative 1: No action (No Grazing)

The biological determination for the ferruginous hawk with this alternative is *may adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rational: Exceptionally high, dense vegetation, which could develop in places under this alternative, might affect some prey animals adversely thus the "may effect" determination. The elimination of livestock and more importantly the elimination of the human activity that surrounds livestock grazing will have beneficial effects to nesting ferruginous hawks.

Alternative 2: Current Management

The biological determination for the ferruginous hawk with this alternative is *may adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rational: Livestock grazing and livestock management might have an adverse effect on an individual hawk because ferruginous hawks are very sensitive to human activity associated with livestock grazing, especially during the nesting period.

Livestock grazing can affect ferruginous hawks in three ways: (1) changes in nest site availability, (2) effects on prey abundance, and (3) effects on prey vulnerability (Collins and Reynolds 2005). Although there were problems in the current management they were not severe enough to be the reason for the current down turn in ferruginous hawk nesting in the area. There is sound woody draw management in place and there are no incidences of severe overgrazing.

Alternative 3: Proposed Action (Adaptive Management)

The biological determination for the ferruginous hawk with this alternative is *may adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rational: Livestock grazing and livestock management might have an adverse effect on an individual hawk because ferruginous hawks are very sensitive to human activity associated with livestock grazing, especially during the nesting period.

Livestock grazing can affect ferruginous hawks in three ways: (1) changes in nest site availability, (2) effects on prey abundance, and (3) effects on prey vulnerability (Collins and Reynolds 2005). With the adaptive management alternative there is some reduction in numbers and more intensive management. The objective of all of the changes is to bring the area into compliance with 2001 LRMP direction.

McCown's Longspur *Calcarius mccownii*

Distribution and Status: McCown's longspurs breed from southern Alberta and southern Saskatchewan, south through Montana, eastern and central Wyoming, and north central Colorado, and east to western Nebraska, north central South Dakota and southwestern North Dakota (Dechant et. al. 2003c). In South Dakota they are listed as a casual migrant and accidental visitor in the far west (Tallman et. al. 2002). In Region 2 of the Forest Service, they commonly breed only on the Pawnee National Grassland in Colorado and the Thunder Basin National Grassland in Wyoming (Sedgwick 2004b).

Most populations appear to be stable or increasing, but due to a historical long-term decline in abundance on both their breeding and wintering grounds, this species is ranked by various state, federal, and private conservation organizations as a grassland "species of concern", "high priority", "imperiled", with "pressing needs", "state imperiled", or a species of "conservation concern" (Sedgwick 2004b). In South Dakota, they're listed as a rare migrant through the western tier of counties (Tallman et. al. 2002). In Nebraska, breeding has been documented in southern Sioux County (Johnsgard 1979).

Habitat: McCown's longspurs use grasslands with little litter and low vegetation cover, such as that provided by shortgrass or heavily grazed mixed-grass prairie (Dechant et. al. 2003c). They breed in shortgrass prairie; especially where vegetation coverage is sparse due to low soil moisture or heavy grazing, or where it is interspersed with shrubs or taller grasses. Blue grama (*Bouteloua gracilis*) and buffalograss (*Buchloe dactyloides*) are dominant plants in nesting areas (Sedgwick 2004b).

There has been no research on whether or not McCown's longspurs specifically prefer the habitat created by prairie dogs (Sedgwick 2004b). Certainly, areas used by prairie dogs would create habitat characteristics that would be favorable to the McCown's longspur within the project area.

Conservation Status
ESA –None

Global-G4
Nebraska-S3
South Dakota-SUB
Forest Service , Region 2- Sensitive

Status definitions can be viewed at http://www.natureserve.org/explorer/ranking.htm

Existing Conditions: The Buffalo Gap National Grassland is outside of the current distribution of the McCown's longspur (Dechant et. al. 2003c). Suitable habitat for the McCown's longspurs within the project area is the long-term low structure grasslands. All grassland areas on Oglala National Grassland are potential McCown's longspur habitat, depending on management. Prairie dog colonies may be the best long-term habitat within the area.

The most recent sighting of McCown's longspur on the OGA occurred in pasture 7 on June 14, 2011 (while scouting occurred for the 2011 Oglala BBS). Two individuals were seen, one male and one female. At this time no McCown's longspurs have been identified at a stop during the Oglala BBS (USGS 2012). The Oglala National Grassland is very close to both breeding and wintering population of McCown's longspurs (Dechant et. al. 2003c) (Sedgwick 2004b).

Direct, Indirect, and Cumulative Effects: The movements of livestock about the WGA and OGA and the actions associated with livestock grazing could harm individual McCown's longspur directly. This would be especially true for young birds in nests that could be stepped on. The same could be true of human activities to support livestock grazing. Vehicle tires could crush nests and young birds that cannot fly. Affected individual longspurs, however, would be a small percent of the total population, so this would not be a factor in population viability under grazing prescribed by the alternatives.

McCown's longspurs are not, with certain exceptions, negatively impacted by grazing. They breed in short grass, especially where vegetation coverage is sparse due to grazing or low soil moisture. In fact, they often prefer to breed in heavily grazed areas and may respond positively to livestock grazing. Higher densities of this species were found on heavily grazed pastures than on less intensely grazed ones, and summer-grazed areas were preferred over winter-grazed areas (Sedgwick 2004b).

McCown's longspur is not dependent on prairie dog colonies for its existence, but prairie dogs would create habitat characteristics that would be favorable to the McCown's longspur within the WGA & OGA.

Determination of Effect and Rationale for the McCown's Longspur

Alternative 1: No Action (No Grazing)

The biological determination for the McCown's longspur is *likely to result in a loss of viability on the planning area, in a trend to federal listing, or in a loss of species viability range-wide.*

Rationale: McCown's longspur breed in short grass, especially where vegetation coverage is sparse due to grazing or low soil moisture. In fact, they often prefer to breed in heavily grazed areas and may respond positively to livestock grazing. Elimination of grazing will reduce the available habitat in the project area.

Alternative 2: Current Management

The biological determination for the McCown's longspur with this alternative is *may adversely impact individuals, but not likely to result in a loss of viability in planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rationale: With continuation of the present management all of the direct and indirect effects of livestock grazing will be applicable. There will be the possibility of McCown's longspurs being killed, nests stepped on, etc. thus the may impact individual determination.

Currently the only know occurrences of McCown's longspur in the project area are on the OGA and it is difficult to assess if management practices are the cause of this or if suitable habitat is a limiting factor at the present time (the OGA & WGA are on the edges of their range). The possibility of McCown's longspurs moving into unoccupied portions of the project area containing suitable short grass habitat does exist.

Alternative 3: Proposed Action (Adaptive Management)

The biological determination for the McCown's longspur with this alternative is *may adversely impact individuals, but not likely to result in a loss of viability in planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rationale: With continuation of the present management all of the direct and indirect effects of livestock grazing will be applicable. There will be the possibility of McCown's longspurs being killed, nests stepped on, etc. thus the may impact individual determination.

Currently the only know occurrences of McCown's longspur in the project area are on the OGA and it is difficult to assess if management practices are the cause of this or if suitable habitat is a limiting factor at the present time (the OGA & WGA are on the edges of their range). The possibility of McCown's longspurs moving into unoccupied portions of the project area containing suitable short grass habitat does exist.

.

Chestnut-collared Longspur *Calcarius ornatus*

Distribution and Status: Chestnut-collared longspurs are small, stocky birds that live on the ground (Sibley 2000). A rufous patch lies on the nape of their neck. The birds breed from southern Alberta to southern Manitoba, south to west central Colorado, and east through North Dakota and South Dakota to western Minnesota (Dechant et. al. 2003b). They winter from northern Arizona, central & northern New Mexico, eastern Colorado, and central Kansas south into Mexico (DeGraff et. al. 1991).

The chestnut-collared longspur is listed as "secure" both globally and nationally. There is some indication of reduction of historic breeding and winter ranges and long-term population declines. The chestnut-collared longspur is listed a common migrant and summer resident western South Dakota (Tallman et. al. 2002). Elimination of prairie habitat by cultivation and conversion to urban development is listed as the primary threat. Long-term population declines are likely to continue as native rangeland is converted to cropland (NatureServe 2012).

Habitat: Chestnut-collared longspurs use level to rolling mixed grass and short grass uplands, and, in drier habitats, moist lowlands. They prefer open prairie and avoid excessively shrubby areas. Grasslands with dense litter accumulations are avoided (Dechant et. al. 2003b).

They prefer native pastures with fairly short vegetation and sparse litter accumulation. In dry, sparse short grass prairie, light to moderate grazing is more appropriate, and heavy grazing or overgrazing may be detrimental to chestnut-collared longspurs (Dechant et. al. 2003b).

Conservation Status
ESA –None
Global-G5
Nebraska-S3
South Dakota-S4B
Forest Service , Region 2- Sensitive

Status definitions can be viewed at http://www.natureserve.org/explorer/ranking.htm

Existing Conditions: Chestnut-collared longspurs were regularly observed on the two BBS routes in the WGA until 2006 when they were no longer seen. This also corresponds to a change in the observer. Observer error is very possible. At this point there is a marked increase in the number of lark buntings in the error which could also be observer error. A possibility is that chestnut-collared longspurs were counted as lark bunting. There is also a possibility that as lark bunting increased they moved the long spurs out of the area. Because of the discrepancy a trend cannot be determined for this species.

Chestnut-collared longspurs are infrequently counted during the Oglala BBS on the OGA (USGS 2012). The same observer has run this route since it was established in 1999 and to date only 4 chestnut-collared longspurs have been identified during the BBS (Two were identified in 2002, one in 2005, and one in 2008). Although not many have been identified during the BBS chestnut-collared longspurs do inhabit the OGA. In 2011 the Oglala BBS route observer identified 4 chestnut collared longspurs in pasture 7 on the OGA while scouting for the 2011 BBS. The longspurs have consistently been seen in this area over the years but the Oglala BBS route does not run through pasture 7 which could explain why more birds have not been seen during the BBS. Much like the WGA, we cannot identify a population viability trend for the chestnut-collared longspur on the OGA due to the limited amount of information available for this species in the geographic area.

Direct, Indirect, and Cumulative Effects: The movements of livestock about WGA and OGA and the actions associated with livestock grazing could harm individual chestnut-collared longspurs directly. This would be especially true for young birds in nests that could be stepped on. The same could be true of human activities to support livestock grazing. Vehicle tires could crush nests and young birds that cannot fly. Affected individual longspurs, however, would be a small percent of the total population, so this would not be a factor in population viability under grazing prescribed by the alternatives.

Grazing management is the primary land management tool available to resource managers. While heavy grazing can be detrimental on arid grasslands, in the more mesic northern parts of its range the chestnut-collared longspur may require moderate to heavy grazing to maintain habitat condition (Sedgwick 2004a).

Overgrazing in drier, shortgrass habitats is a threat to chestnut-collared longspurs. In shortgrass prairies, especially in areas of low precipitation, no grazing, or only light to moderate grazing is tolerated by chestnut-collared longspurs. Areas where vegetation is already sparse and short from overgrazing are not favored longspur habitats and should be protected to improve their condition (Sedgwick 2004a).

Grazing in more mesic, mixed-grass habitats may benefit chestnut-collared longspurs. Mixed-grass areas or areas where the grass is too tall or thick can be made suitable for breeding chestnut-collared longspurs by implementing moderate grazing. In even moister, more thickly vegetated mixed-grass habitat, chestnut-collared longspurs actually avoid tall, dense vegetation, and prefer sparser upland grasslands with more bare ground. In these situations, undergrazing is a threat (Sedgwick 2004a).

Determination of Effect and Rationale for the Chestnut-Collared Longspur

Alternative 1: No Action (No Grazing)

The biological determination for the chestnut-collard longspur with this alternative is *may adversely impact individuals, but not likely to result in a loss of viability in planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rationale: Without grazing, vegetation structure on the unit would be much higher and denser than these birds prefer. Eventually, the range could stagnate. Grass structure could decrease, but it could still be higher than the birds prefer. Litter levels could be high.

Alternative 2: Current Management

The biological determination for the chestnut-collard longspur with this alternative is *may adversely impact individuals, but not likely to result in a loss of viability in planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rationale: A few nests could be destroyed or young birds killed by grazing livestock or by activities associated with managing them. Grazing management is the primary land management tool available to resource managers. While heavy grazing can be detrimental on arid grasslands, in the more mesic northern parts of its range the chestnut-collared longspur may require moderate to heavy grazing to maintain habitat condition. The levels of grazing in the current management have not eliminated this bird.

Alternative 3: Proposed Action (Adaptive Management)

The biological determination for the chestnut-collard longspur with this alternative is *may adversely impact individuals, but not likely to result in a loss of viability in planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rationale: A few nests could be destroyed or young birds killed by grazing livestock or by activities associated with managing them. Grazing management is the primary land management tool available to resource managers. While heavy grazing can be detrimental on arid grasslands, in the more mesic northern parts of its range the chestnut-collared longspur may require moderate to heavy grazing to maintain habitat condition.

With the adaptive management alternative there is some reduction in livestock numbers and more intensive grazing management. The objective of all of the changes are to bring the area into compliance with 2001 LRMP direction which should produce adequate habitat for this bird.

Northern Harrier *Circus cyaneus*

Distribution and Status: Northern harriers are slender hawks with an owl-like facial disc (Sibley 2000). These raptors nest in the northern United States and Canada, and winter in the eastern and southern U.S., in the western coastal mountains, south through Mexico and Central America (MacWhirter and Bildstein 1996). They are year-round residents of the Central Plains (MacWhirter and Bildstein 1996). The U.S. Fish and Wildlife Service list the northern harrier as a bird of conservation concern in the region that includes Nebraska (Slater and Rock 2005). In South Dakota they are listed as a summer resident most common in the west (Tallman et. al. 2002).

Habitat: This slim hawk hunts by coursing low over open habitats, such as fields and marshes, catching its prey with a sudden pounce (Sibley 2000, Macwhirter and Bildstein 1996). In summer, its foods are small- and medium-sized mammals, primarily rodents, birds (chiefly passerines and small water birds), reptiles, and frogs (MacWhirter and Bildstein 1996). In the north during winter, they consume Microtis voles almost exclusively (MacWhirter and Bildstein 1996). Although harriers can nest in suitable marsh vegetation, they apparently preferred upland sites in North Dakota (Dubbert and Lokemoen 1977). But

during the South Dakota Breeding Bird Atlas surveys, 60 percent of harrier nests were in marshes (Peterson 1995). In seeded fields in north central South Dakota and central North Dakota, harriers preferred tall, dense cover as upland nesting sites (Dubbert and Lokemoen 1977). They placed 52 percent of nests in cover more than about 24" tall. Forty-one percent of nests were in cover from about 12 in. to 24 in. tall. The nests were well concealed from the sides but open above. Undisturbed grasslands, especially with western snowberry (*Symphoricarpos occidentalis*) shrubs, were the locations for over half of 129 nests (Kantrud and Higgins 1992).

Conservation Status
ESA –None
Global-G5
Nebraska-S4
South Dakota-S5B
Forest Service , Region 2- Sensitive

Status definitions can be viewed at http://www.natureserve.org/explorer/ranking.htm

Existing Conditions: Fifty-two (31 Cottonwood Route and 21 Indian Route) northern harriers have been seen in the WGA while completing BBS routes. They prefer high cover. The highest numbers occurred in 2000 & 2001which was 8. This corresponded with a few years of above average precipitation. There were no harriers observed in 2005 & 2006 (which was at the end of a drought period). Ten northern harriers have been identified on the OGA during the Oglala BBS (USGS 2012). Half of the birds (5 northern harriers) identified were seen in 1999 when the OGA was coming out of several years of average or higher growing season precipitation. The rest of the birds were seen in 2000, 2001, 2005, 2006, and 2010 (One harrier each year). The drought on the OGA ran from about 2000 to 2008. Although it is not reflected in the Oglala BBS, northern harriers and frequently sighted on the OGA, and during the 2011 Oglala BBS one harrier was seen between stops. Structure is addressed in the LRMP and if the objective of 10-30% of the area is maintained in high cover this should meet the needs of northern harriers.

Direct, Indirect, and Cumulative Effects: There is an unlikely chance that northern harrier eggs or very young birds in the nest could be trampled by livestock or run over by vehicles used to manage livestock grazing. The intensity of impacts associated with livestock grazing determines the structure of vegetation, whether it is low, moderate or high. Moderate and high structure grassland, with plenty of litter, provides good habitat for voles (*Microtis sp.*) that are important prey for this raptor. Such habitat also provides cover to protect nesting harriers.

Cumulatively, the loss of native prairies and grasslands to agriculture and urban development has been a common impact on habitat. Prairie is plowed and marshes are drained for places to grow row crops. Government initiatives, such as the Conservation Reserve Program, can provide habitat for harriers, but the loss of these efforts due to funding cuts could negatively affect the species.

Determination of Effect and Rationale for Northern Harrier

Alternative 1: No Action (No Grazing)

The biological determination for the northern harrier with this alternative is *beneficial impact.*

Rationale: There would be no activity associated with grazing to directly hurt these hawks. A lot of grass litter could build up in places which would provide good habitat for harrier nesting and brood rearing. The increased litter could also create good habitat for voles *(Microtis sp.)*, potentially increasing

their populations. These small rodents are a favorite prey of northern harriers, and if their populations increased, there would be a larger prey base available for the harriers, which may all trigger a northern harrier population increase.

Alternative 2: Current Management

The biological determination for the northern harrier with this alternative is *may adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rationale: A few nests could be destroyed and young harriers killed by livestock or by activities associated with managing them. During years of above average precipitation, vegetative structure could be generally favorable for this species on the more productive soils. This could be especially true in pastures with uneven livestock distribution in places where only light grazing had occurred. In dry years, vegetative production may not be sufficient to produce quality habitat for northern harriers with or without grazing.

Alternative 3: Proposed Action (Adaptive Management)

The biological determination for the northern harrier with this alternative is *may adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rationale: A few nests could be destroyed or young harriers killed by grazing livestock or by activities associated with managing them. During years of above average precipitation, a relatively high percent of the area could have cover suitable for nesting by this species and provide quality habitat for voles and other rodents. This alternative will reduce the amount of grazing and contains more intense grazing management, which will produce slightly higher vegetative production and residual cover compared to Alternative 2.

Loggerhead Shrike *Lanius ludovicianus*

Distribution and Status: Smaller than a robin, these birds are predatory songbirds with strong, hooked bills that they use to kill and dismember prey (Sibley 2000). They impale prey on sharp objects in conspicuous places or wedge prey in narrow V-shaped forks (Wiggins 2005a). The southern United States and most of Mexico is year-long habitat for this species and some shrikes breed in the Midwest up into the Canadian Prairie Provinces, while others nest in eastern Oregon and Washington, the mid-South, and a relatively small area in southern Ontario. Texas near the RioGrande, Mexico inland from the Gulf Coast, and the southern Pacific coast are wintering areas (Wiggins 2005a). In several western and Midwestern U.S. states, it is given priority status in Partners in Flight plans and is given a vulnerable rank by the Nature Conservancy (Wiggins 2005a). In Nebraska, there are breeding records for loggerhead shrikes from throughout the state, but winter records exist only from the southeast (Wiggins 2005a). In South Dakota the South Dakota Ornithologist's Union (Tallman et. al. 2002) lists the loggerhead shrike as an uncommon migrant and summer resident, less numerous east and casual in the higher Black Hills.

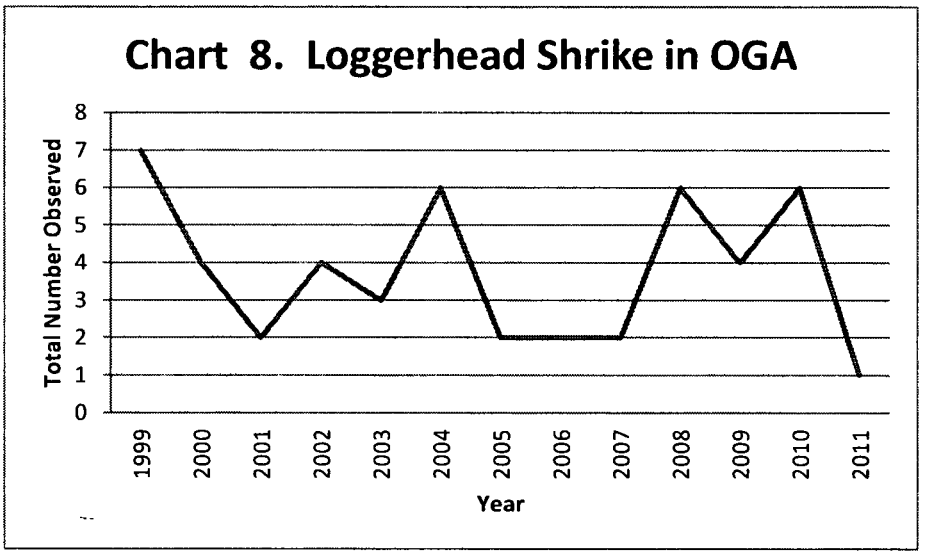
Habitat: In the breeding range, loggerhead shrike habitat is open country with short vegetation: pastures with fence rows, old orchards, mowed roadsides, cemeteries, golf courses, agricultural fields, riparian areas, and open woodlands (Wiggins 2005a). Nests are typically placed in trees or thick shrubs within pastures and grasslands (Wiggins 2005a). Nesting birds nested in such habitats on the Comanche National Grassland in southeastern Colorado, but appeared to avoid areas not protected from livestock (Wiggins 2005a). Scant evidence suggests that in short grass prairie, shrikes prefer ungrazed or lightly grazed grasslands, whereas in tall grass areas, they prefer moderate to heavily grazed sites (Wiggins 2005a). An essential component of shrike foraging habitat appears to be exposed perches within open habitat (Wiggins 2005a). This species of shrike feeds on arthropods, amphibians, small to medium-sized

reptiles, small mammals and birds (Wiggins 2005a). The bird also feeds on road kills and carrion (Anderson 1976).

Conservation Status
ESA –None
Global-G4
Nebraska-S5
South Dakota-S3S4B
Forest Service , Region 2- Sensitive

Status definitions can be viewed at http://www.natureserve.org/explorer/ranking.htm

Existing conditions: Thirty-one (13 Cottonwood Route and 18 Indian Route) loggerhead shrikes have been seen in the WGA while completing BBS routes. Forty-nine loggerhead shrikes have been identified during the Oglala BBS since 1999 (Chart 8) (USGS 2012). In 2011 only one shrike was seen at a stop, but 2 others were seen between stops on the Oglala BBS route. They are fairly common in the greasewood habitat. There is no clear population viability trend data for this species in the project area.



Direct, Indirect, and Cumulative Effects: Shrikes might be killed directly by activities related to managing livestock, such as driving trucks. They may also drown in stock tanks. Considering potential indirect effects, grazing management that left grass cover at the extreme ends of the vegetative structure spectrum—very short or very tall—might produce habitat in which foraging by shrikes would be more difficult. Livestock browsing and trampling might destroy the trees and shrubs that these birds use for nesting, and on which they perch while hunting. Shrikes also impale their prey on thorns and the sharp stubs of broken branches. Cumulatively, activities that destroy the prairie or even alter pastureland could be detrimental to this bird. This would include clearing shrub land and plowing prairies and pastures supporting shrubs to plant row crops. Construction activities and fragmentation of the prairie for such projects such as highway construction could also hurt populations of this bird.

Determination of Effect and Rationale for Loggerhead Shrike

Alternative 1: No Action (No Grazing)

The determination for loggerhead shrikes under this alternative is *may adversely impact individuals, but is not likely to result in a loss of viability in planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rationale: No livestock grazing would reduce the impacts to trees and shrubs that shrikes nest in and hunt from. However, tall, dense grass could cover the area which could make hunting more difficult for species. Shrikes prefer vegetation cover of moderate height, and this type of vegetation structure might reduce the percent of the area that is suitable for them.

Alternative 2: Current Management

The determination for loggerhead shrikes under this alternative is *may adversely impact individuals, but is not likely to result in a loss of viability in planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rationale: A few birds may be killed directly by livestock management activities. Livestock may browse and trample trees and shrubs that loggerhead shrikes rely on for nesting or hunting perches. For the most part, however, grazing is compatible with survival of this species, and, in fact, the birds prefer grass cover of moderate structure height.

Alternative 3: Proposed Action (Adaptive Management)

The determination for loggerhead shrikes under this alternative is *may adversely impact individuals, but is not likely to result in a loss of viability in planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rationale: Livestock grazing and browsing may harm individual birds, their nests or habitats. There would be less grazing in this alternative compared to Alternative 2. This alternative would encourage growth of woody plants and result in better habitat for the loggerhead shrike at least when compared to Alternative 2. For the most part, however, actions proposed in this alternative are compatible with survival of this species, and, in fact, will provide adequate structure for the species.

Long-billed Curlew *Numenius americanus*

Basic Description, Distribution and Status: These large, buff-colored sandpipers have a long down-curved bill (Sibley 2000). Long-billed curlews breed from interior British Columbia and southern Alberta through southern Manitoba, south to northeastern New Mexico, central Nevada, and northern Utah, and east to southwestern North Dakota and central South Dakota and Nebraska (Sedgwick 2006).

They are globally secure, but there are indications of long-term population declines (Sedgwick 2006).

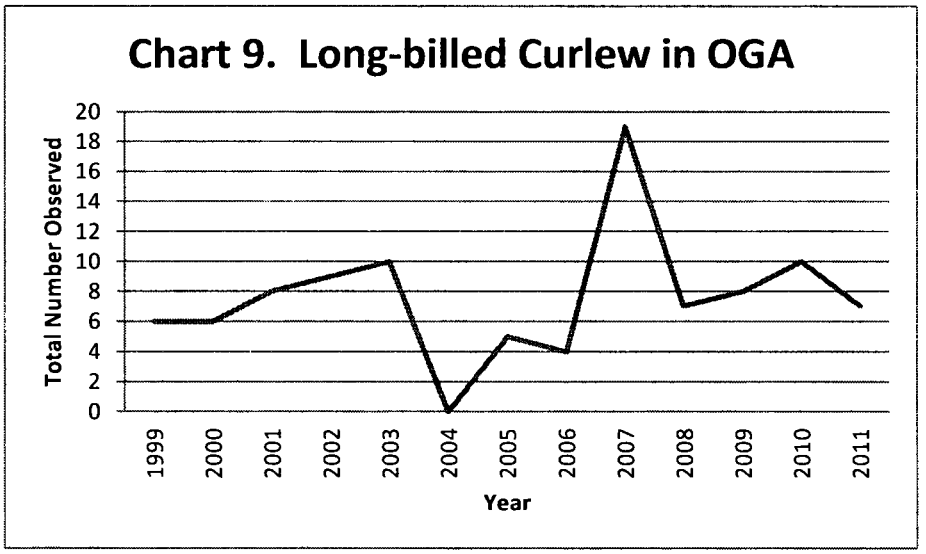
Habitat: Long-billed curlews are native prairie specialists, nesting primarily in short grass or mixed-grass prairies with flat to rolling topography. They prefer short vegetation, generally less than 30 cm tall (often less than 10 cm), and generally avoid trees, high-density shrubs, and tall, dense grass. Open, sparse grassland may facilitate sighting predators and foraging with their long bills. Vegetation at ground nest sites is "patchier" than curlew habitat in general. The birds choose relatively dry, exposed sites for nests reasonably close to water (Sedgwick 2006).

Long-billed curlews are entirely carnivorous, their diet consisting primarily of terrestrial insects, crustaceans, benthic invertebrates, and some vertebrates. They use their long, curved bill to forage by probing for earthworms or burrow-dwelling organisms (Sedgwick 2006).

Conservation Status
ESA –None
Global-G5
Nebraska-S5
South Dakota-S3B
Forest Service , Region 2- Sensitive

Status definitions can be viewed at http://www.natureserve.org/explorer/ranking.htm

Existing Conditions: The long-billed curlew is a summer resident of the OGA & WGA, inhabiting short, mid, and tall grasses; wet meadows; shorelines; and prairie dog colonies (Peterson 1993). Eighty (30 Cottonwood and 50 Indian) long-billed curlews have been seen in the WGA while completing BBS routes. No clear population viability trend was detected over the years. There were spikes in 1997 & 2006 when 10 & 11 were seen respectively. None were observed in 1999. Ninety-nine long-billed curlews have been identified during the Oglala BBS since 1999 (Chart 9) on the OGA (USGS 2012). In 2007 during the peak of the drought on the OGA, 19 curlews were identified during the Oglala BBS, and in 2004 no curlews were identified during the BBS. No clear population viability trend was detected over the years.



Direct, Indirect, and Cumulative Effects: Directly, some activities related to managing livestock might harm curlews from time to time. For example, a curlew could die in a collision with a vehicle during livestock management activities. Since these birds nest on the ground, livestock could trample nests or nestlings. Indirectly, very intensive grazing would not leave enough grass cover to shield nests or young birds. No grazing or very light grazing would leave high/dense grass cover, obstructing the vision of curlews and hiding predators, making the birds more susceptible to predation. Cumulatively, destruction or fragmentation of the prairie by plowing or development would be detrimental to these birds.

Determination of Effect and Rationale for the Long-billed Curlew

Alternative 1: No Action (No Grazing)

The determination for long-billed curlews under this alternative is *likely to result in a loss of viability in planning area, in a trend to federal listing, or in a loss of species viability range wide.*

Rationale: These birds need some relatively short vegetation within their summer home ranges, places where they forage for their popular food items yet still be able to spot predators from a distance. Good habitat management for curlews should involve some grazing, prescribed fire and mowing.

Alternative 2: Current Management

The determination for long-billed curlews under this alternative is *may adversely impact individuals, but is not likely to result in a loss of viability in planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rationale: Certain livestock management activities, such as driving vehicles to care for stock or maintain improvements, might pose a hazard to these birds, and could cause isolated mortality. In general the long-billed curlew prefers areas with short vegetation. Alternative 2 allows the most grazing which would result in the most habitat for the long-billed curlew.

Alternative 3: Proposed Action (Adaptive Management)

The determination for long-billed curlews under this alternative is *may adversely impact individuals, but is not likely to result in a loss of viability in planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rationale: Certain livestock management activities, such as driving vehicles to care for stock or maintain improvements, might pose a hazard to these birds, and could cause isolated mortality. In general the long-billed curlew prefers areas with short vegetation. Due to the slightly lower stocking rate in Alternative 3 compared to Alternative 2, it would be expected that the habitat resulting from the management actions in Alternative 3 would be less desirable for the curlew than Alternative 2.

Brewer's Sparrow *Spizella breweri*

Distribution and Status: Brewer's sparrows breed from southern British Columbia east to southeastern Alberta and southwestern Saskatchewan, south through the Columbia River Basin east of the Cascade crest, and throughout the Great Basin east of the Sierra Nevada crest as far south as southern California, southern Nevada, and northern Arizona. The species regularly breeds east to northwestern New Mexico, eastern Colorado, northwestern Nebraska, western South Dakota, and southwestern North Dakota, with sporadic breeding in western Nebraska, extreme southwestern Kansas, western Oklahoma, and northern Texas (Walker 2004). In South Dakota they are listed as an uncommon summer resident in the extreme southeast and northwest (Tallman et. al. 2002, Holmes and Johnson 2005). In Nebraska they have been documented in Sioux county (Holmes and Johnson 2005).

Habitat: Brewer's sparrows are closely associated with shrub lands dominated by big sagebrush (*Artemisia tridentata*). For that reason, they generally are considered a "sagebrush-obligate" or "shrub land-obligate" species (Walker 2004). Suitable habitat includes sagebrush-dominated shrub lands with >10 percent average shrub cover and an average shrub height of 0.5 - 1.5 m (Walker 2004). In general, Brewer's sparrow abundance decreases as average shrub cover decreases below 10-13 percent, and Brewer's sparrows disappear entirely when average shrub cover decreases below 3-8 percent (Walker 2004). Brewer's sparrow abundance may decrease if shrub cover exceeds 50 percent (Walker 2004).

Landscape level attributes that are positively associated with Brewer's sparrow density include high shrub cover, large patch size, little fragmentation, low disturbance, and habitat heterogeneity. Brewer's sparrows were more likely to occur in sites with high shrub cover and large patch size and were associated with Wyoming big sagebrush (*Artemisia tridentata wyomingensis*) communities. The minimum patch size and the degree of patch isolation required for breeding have not been determined, but

isolated stands of sagebrush smaller than 2 ha are not likely to be nesting habitat (Holmes and Johnson 2005).

In spring and summer Brewer's sparrows consume many insects (e.g., alfalfa weevils, aphids, beet leafhoppers, caterpillars, beetles) and in the fall and winter they feed on seeds (NatureServe 2012).

Conservation Status
ESA –None
Global-G5
Nebraska-S3
South Dakota-S2B
Forest Service , Region 2- Sensitive

Status definitions can be viewed at http://www.natureserve.org/explorer/ranking.htm

Existing Conditions: Eighty-three (82 Cottonwood and 1 Indian) Brewer's sparrows have been seen in the WGA while completing BBS routes. No clear population viability trend was detected over the years. The Brewer's sparrow has never been detected during the Oglala BBS (USGS 2012) and the current population status is unknown for the OGA.

See Existing Condition section on Page 10 of this document for a description of the current sagebrush habitat. Brewer's sparrows were more likely to occur in sites with high shrub cover and large patch size and were associated with Wyoming big sagebrush (*Artemisia tridentata wyomingensis*) communities. It follows that amount of sagebrush appears to be a limiting factor for Brewer's sparrow.

Direct, Indirect, and Cumulative Effects: The movements of livestock about WGA and OGA and the actions associated with livestock grazing could harm individual Brewer's sparrows directly. This would be especially true for young birds in nests that could be stepped on. The same could be true of human activities to support livestock grazing. Vehicle tires could crush nests and young birds that cannot fly. Affected individual sparrows, however, would be a small percent of the total population, so this would not be a factor in population viability under grazing prescribed by the alternatives.

Grazing by livestock has occurred over virtually the entire range of sagebrush habitat and its influence on sagebrush habitat is perhaps the most pervasive of any land management practice (Rowland 2004). Before European man arrived on the continent, in northern, eastern, and more mesic regions of the sagebrush biome grazing by buffalo was the primary agent of disturbance. This makes this area more compatible with livestock grazing than other areas in the sagebrush biome. However, introduction of domestic livestock by European man did increase, at the least, the frequency of grazing.

Sage brush cover generally increases as utilization of the herbaceous understory increases. Cattle, sheep and horses eat grass dominated diets in all seasons of the year. Livestock consume little or no sagebrush unless the snow is deep (Crawford et. al. 2004).

Livestock grazing impacts sagebrush habitats in several interrelated ways. Its greatest impact is soil disturbance that promotes the germination of annual plant seeds and, thus, promotes the invasion of exotic annual plants into otherwise undisturbed areas. Where grazing removes the herbaceous understory altogether, it allows sagebrush to spread and create dense sagebrush stands with a sparse understory of annuals and unpalatable perennials. While it is not clear that this situation would be detrimental to sage-dependent species, it ultimately discourages livestock use. Throughout the century, this has led to destruction of sagebrush habitats as range managers have used fire, herbicides, chaining, and other

methods to remove dense sagebrush stands and re-establish grass forage, often reseeding with introduced grass species (Holmes and Johnson 2005).

Determination of Effect and Rationale for the Brewer's sparrow

Alternative 1: No action (No Grazing)

The biological determination for the Brewer's sparrow is *may adversely impact individuals, but not likely to result in a loss of viability in planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rationale: With no grazing, there would be no livestock or ranch vehicles to occasionally destroy nests and young sparrows. Also, removal of livestock would enable the land mangers to remove fences and any infrastructure used to maintain livestock. This would eliminate the hazards to Brewer's sparrows cause by these structures (drowning in stocktanks etc.).

Sage brush cover generally increases as utilization of the herbaceous understory increases (Crawford et. al. 2004). Because the cover of sagebrush is a limiting factor for Brewer's sparrows in the area, elimination of grazing in the least may inhibit the spread of sagebrush and could actually facilitate some die off of sagebrush considering that we are on the western edge of the sagebrush habitat type.

Alternative 2: Current Management

The biological determination for the Brewer's sparrow is *may adversely impact individuals but not likely to result in a loss of viability on the planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rationale: With continuation of the present management all of the direct and indirect effects of livestock grazing will be applicable. There will be the possibility of Brewer's sparrows hitting fences, nests stepped on, nesting cover being affected, etc. thus the may impact individual determination.

Before European man arrived on the continent, in northern, eastern, and more mesic regions of the sagebrush biome grazing by buffalo was the primary agent of disturbance. This makes this area more compatible with livestock grazing than other areas in the sagebrush biome. Sage brush cover generally increases as utilization of the herbaceous understory increases (Crawford et. al. 2004). Some level of grazing may be beneficial to Brewer's sparrows because it may promote the expansion of sagebrush.

Alternative 3: Proposed Action (Adaptive Management)

The biological determination for the Brewer's sparrow is *may adversely impact individuals but not likely to result in a loss of viability on the planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rationale: With continuation of the present management all of the direct and indirect effects of livestock grazing will be applicable. There will be the possibility of Brewer's sparrows hitting fences, nests stepped on, nesting cover being affected, etc. thus the may impact individual determination.

Before European man arrived on the continent, in northern, eastern, and more mesic regions of the sagebrush biome grazing by buffalo was the primary agent of disturbance. This makes this area more compatible with livestock grazing than other areas in the sagebrush biome. Sage brush cover generally increases as utilization of the herbaceous understory increases (Crawford et. al. 2004). Some level of grazing may be beneficial to Brewer's sparrows because it may promote the expansion of sagebrush.

It is unclear how the reduced stocking rates and improved management strategies associated with this alternative will affect the spread of sagebrush. It will likely be minimal so there will be little difference between Alternatives 2 & 3 for the Brewer's sparrow.

Sharp-tailed Grouse *Tympanuchus phasianellus*

Distribution and Status: "Historically, sharp-tailed grouse ranged from Alaska south through western Canada, east to the Hudson Bay and west to northeastern California and Nevada. Sharp-tails originally occupied 21 states and 8 Canadian provinces and territories. Populations probably reached their peak during the settlement era of the early 1900s and have declined since then. They have been extirpated from Kansas, Illinois, California, Oklahoma, Iowa, Nevada, New Mexico, and Oregon. Most southern populations now occupy smaller portions of their historic range, and many populations may still be declining due to habitat loss and degradation. On the other hand, far northern populations seem to be secure because they inhabit remote, relatively inaccessible areas. Of the seven known subspecies of sharp-tailed grouse, one is extinct. The other six subspecies are currently found throughout much of central and western North America" (Marks 2007).

Habitat: " Sharp-tailed grouse use a variety of open, relatively treeless habitats including shrub steppe, meadow steppe, mountain shrub, brushy grassland, and riparian/deciduous habitats. They often use transitional areas between habitat types, especially when the area contains a mixture of vegetative species and structure. Good sharp-tail habitat contains a mix of grasses, forbs, and many species of shrubs. Sharp-tails primarily choose habitat based on openness of landscape, height and density of vegetation, and type of vegetation. Preferred vegetation types vary greatly by geographic region. Sharp-tails' prefer flat to gentle topography over steep slopes" (Marks 2007).

Conservation Status
ESA –None
Global-G5
Nebraska-S4
NNFG, Oglala GA- MIS

Status definitions can be viewed at http://www.natureserve.org/explorer/ranking.htm

Existing Conditions: The Sharp-tailed grouse is a Management Indicator Species (MIS) for the Oglala Geographic Area (OGA). LRMP **Objectives** for this species in the OGA include:

- Over the life of the plan provide diverse and quality grassland habitat across the geographic area at levels that, in combination with habitat on adjoining lands, helps support stable to increasing populations of sharp-tailed grouse and other wildlife with similar habitat needs.
- Establish and maintain quality nesting and brooding habitat for sharp-tailed grouse (See LRMP appendix H) and associated wildlife by meeting vegetation objectives for high structure within 10 years.
- Establish and maintain quality foraging habitat for sharp-tailed grouse and associated wildlife species by enhancing and /or maintaining a diversity of forb species in grassland communities and regeneration of shrub patches and the shrub component of wooded draws and riparian habitats.

Forest plan **guidance** is to have 10-30% of the OGA in high vegetation structure in order to provide adequate nesting cover in areas that can support such vegetation especially in the proximity of known sharp-tailed grouse display grounds and important foraging and cover areas (i.e. shrub habitats, private croplands).

Based on monitoring data (OGA Visual Obstruction Readings (VORs)) the OGA does not meet Forest plan guidance for vegetation structure during times of drought, but possibly could during years when the

GA receives average and higher amounts of precipitation during the growing season. Additional monitoring would be required to determine if this is true. Shortly after the drought began in the early 2000's the total number of sharp-tailed grouse leks and the total birds counted across all of the leks sharply declined after peaking in 2000 (see charts below). After the drought has ended around 2008, we've seen a slow but steady increase on the total number of grouse counted on leks in the spring since 2008 (see charts below). The annual growing season precipitation has also been at or above the average annual growing season precipitation since 2008 (Chart 1) Over the past 15 years the abundance of sharp-tailed grouse counted on the leks in the spring appears to be more closely correlated to precipitation than habitat management through the use of grazing. Based on lek count information under the existing management it appears that the sharp-tailed grouse population trend on the OGA is neutral to slightly positive. The trend line includes data going back to 1993 when 0 grouse where counted on leks on the OGA (Chart 11).

Direct, Indirect, and Cumulative Effects: Other activities occurring or that have occurred on or near the Oglala Geographic Area include the Sand Creek land exchange, Travel Management implementation, Prairie Dog Control, Mountain Pine Beetle treatments, wild fires, fossil theft, and regulated hunting. Cumulatively the effects of all the identified actions in combination with any of the alternatives would be rather insignificant to the population trend of sharp-tailed grouse across its current geographic range based on the scope and duration of the identified activities. Of the identified actions, regulated hunting would have the greatest impact on the population trend of the species, but it is currently not considered a threat to the survival of the species and the sharp-tailed grouse hunting season in Nebraska has recently been expanded. Of the proposed alternatives the no grazing alternative (Alternative 1) would be most beneficial to sharp-tailed grouse, but none of the alternatives are expected to negatively affect the population trend of the species across the OGA.

Chart 10. Total number of sharp-tailed grouse leks on the Oglala GA.

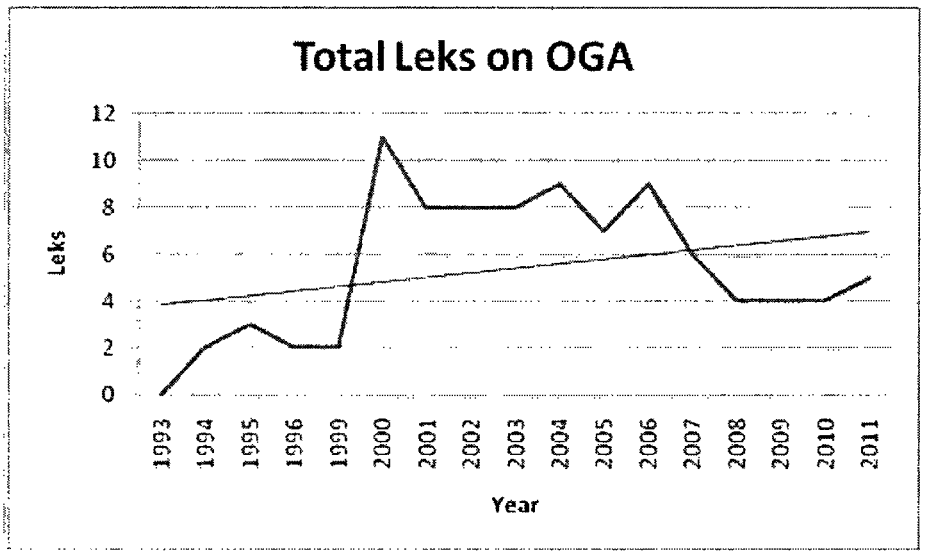
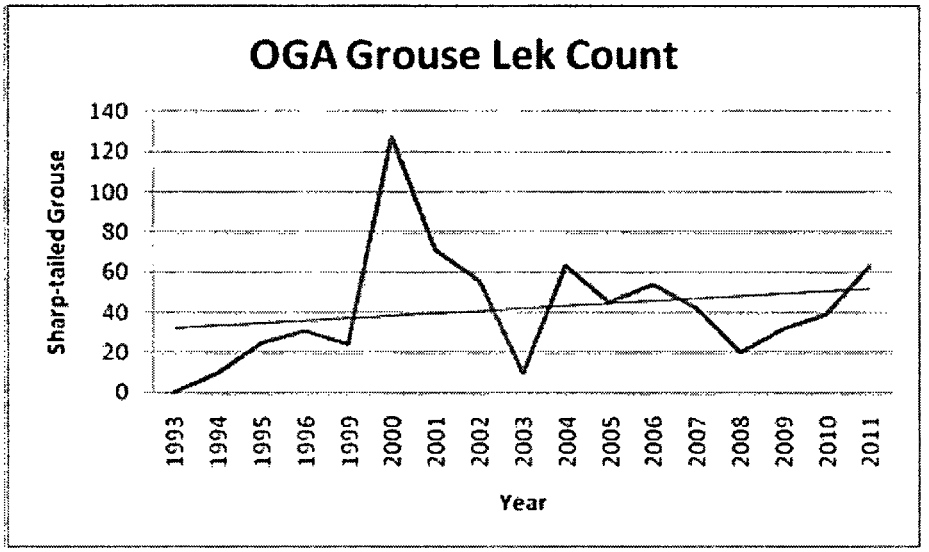


Chart 11. Number of grouse counted on the leks on the Oglala GA.



Determination of Effect and Rationale for the sharp-tailed Grouse

Alternative 1: No Action (No Grazing)

The biological determination for the sharp-tailed grouse in this alternative is *a **positive effect** on the population trend of the species in the Oglala Geographic Area.*

Rationale: Removal of livestock from the area will result in an increase height and density of the herbaceous understory which in turn should be beneficial sharp-tailed grouse. Also, removal of livestock would enable the land managers to remove fences and any infrastructure used to maintain livestock. This would eliminate the hazards to sharp-tailed grouse caused by these structures (drowning in stocktanks, colliding with fences, etc.). Finally, the removal of livestock would eliminate the need for people to visit the area to check livestock which would eliminate any direct or indirect effects caused by this activity.

Although the removal of cattle is expected to be largely beneficial to sharp-tailed grouse, annual weather patterns will play a major role in the population trend of the species on the OGA. Under a prolonged drought or through climate change it is still possible for a negative population trend to occur.

Alternative 2: Current Management

The biological determination for the sharp-tailed grouse in this alternative is *a **neutral effect** on the population trend of the species in the Oglala Geographic Area.*

Rationale: With continuation of the present management all of the direct and indirect effects of livestock grazing will be applicable. Although there is the possibility of sharp-tailed grouse being killed, nests stepped on, and nesting cover being affected which may adversely impact individual grouse; long term population trends on the OGA do not appear to be negatively impacted by these activities which appear to be less significant than the annual weather patterns.

Sharp-tailed grouse inhabit the area and their numbers have fluctuated over the years, but there is no reason to believe that the population trend of sharped-tailed grouse the OGA would be affected either positively or negatively by the current grazing practices unless there was a prolonged drought or change in climate, thus the neutral impact determination.

Alternative 3: Proposed Action (Adaptive Management)

The biological determination for the sharp-tailed grouse in this alternative is *a **neutral effect** on the population trend of the species in the Oglala Geographic Area.*

Rationale: With the continuation of grazing in alternative 3, all of the direct and indirect effects of livestock grazing will be applicable. Although there is the possibility of sharp-tailed grouse being killed, nests stepped on, and nesting cover being affected which may adversely impact individual grouse; long term population trends on the OGA do not appear to be negatively impacted by these activities which appear to be less significant than the annual weather patterns.

Sharp-tailed grouse inhabit the area and their numbers have fluctuated over the years, and given the limited differences between the current grazing practices and the proposed adaptive management alternative there is no reason to believe that the population trend of sharped-tailed grouse the OGA would be affected either positively or negatively by the proposed adaptive management grazing alternative unless there was a prolonged drought or change in climate, thus the neutral impact determination.

Northern Leopard Frog *Rana pipens*

Plains Leopard Frog *Rana blairi*

Distribution and Status: The northern leopard frog is a ranid frog of moderate size (5.1 to 9.0 cm snout-vent length), with brown or green background color, and two or three irregular rows of dark spots on the dorsum (Smith and Keinath 2007). It is also characterized by conspicuous dorsolateral ridges bordering the spots at the edge of the dorsum (Smith and Keinath 2007). Dorsolateral ridges on northern leopard frogs are commonly not broken or indented towards the center of the body; dorsolateral folds usually fall straight down the back of the frog till the fold stops near the hind legs.

The plains leopard frog is a ranid frog of moderate size (5.1 to 9.0 cm long), with brown or green background color, and two or three irregular rows of dark spots on the dorsum (Smith and Keniath 2005). The species is difficult to distinguish from the northern leopard frog (*Rana pipiens*), but it can be distinguished by the presence of a light spot in the middle of the tympanum, a distinct light line along the upper jaw, and "dorsolateral ridges [that are] interrupted just anterior to the groin and inset medially" (Smith and Keniath 2005).

Northern leopard frogs range from the northern part of the Canadian Prairie Provinces east to the Atlantic, south to the Ohio River valley, west to central New Mexico/Arizona to Nevada (Smith and Keinath 2007). Its range includes the northern half of Nebraska and the state of South Dakota. The state heritage programs in Nebraska and South Dakota consider it to be secure (S5) (Smith and Keinath 2007). There has recently been a petition for all Northern Leopard Frog populations west of the Mississippi River to be put on the Endangered Species List. Currently the Fish and Wildlife Service (FWS) is pulling together information to do a review of the species.

The plains leopard frog's range centers on the plains of southeastern Nebraska, Kansas, northern Missouri, and Illinois (Smith and Keniath 2005). The eastern plains of Colorado and the western plains of Nebraska and Kansas are at the limits of this species' range, as is northern Texas (Smith and Keniath 2005). In Region 2, the plains leopard frog is only likely to occur in eastern and southern Nebraska, Kansas, and southeastern Colorado (Smith and Keniath 2005). Although considered globally secure (G5) by NatureServe (2012), the plains leopard frog receives varying levels of concern at regional and local

scales. It is considered secure (S5) within the Great Plains states in the heart of its range (Smith and Keniath 2005).

Habitat: Northern leopard frogs require breeding/tadpole habitat, adult upland habitat, and adult over wintering habitat (Smith and Keinath 2007). They use small (usually less than 5 ha) ponds in which to breed (Smith and Keinath 2007). In the grasslands northern leopard frogs mostly use stock dams for breeding which were primarily created for the purposes of providing water for cows. These ponds essentially need to be fishless (Smith and Keinath 2007). Adults use upland habitat for foraging in the summer (Smith and Keinath 2007). They spend the winter on the bottoms of flowing streams and ponds that do not freeze solid (Smith and Keinath 2007). Leopard frog tadpoles eat various species of free-floating green algae and bluegreen algae (Smith and Keinath 2007). They become carnivorous at metamorphosis (Smith and Keinath 2005), feeding primarily on insects, spiders, mollusks, crustacean, and other arthropods (Smith and Keinath 2005).

Little is known about the habitat preferences of plains leopard frogs (Smith and Keinath 2005). They hibernate in larger bodies of water or on stream bottoms and presumably breed in smaller ponds, but their habitat requirements have not been carefully characterized (Smith and Keinath 2005). They might be found in all types of water bodies and frequently wander far from water (Smith and Keinath 2005). After breeding, they probably forage in areas around the breeding ponds, similar to northern leopard frogs (Smith and Keinath 2005), but since their habitat and movements have not been characterized, this is an assumption based on knowledge of other congenerics (Smith and Keinath 2005). Given their predilection for movement far from water, this assumption may be incorrect, and they may range farther from water than other ranids. It can be presumed that they tolerate drier conditions than northern leopard frogs, but how this affects their habitat requirements is unknown (Smith and Keinath 2005).

Conservation Status
Northern Leopard Frog
ESA –None
Global-G5
Nebraska-S5
South Dakota-S5
Forest Service , Region 2- Sensitive
Plains Leopard Frog
ESA –None
Global-G5
Nebraska-S5
South Dakota-S3S4
Forest Service , Region 2- Sensitive

Status definitions can be viewed at http://www.natureserve.org/explorer/ranking.htm

Existing Conditions: Northern leopard frogs occur throughout the OGA & WGA. During a 2009 herpetological survey on Fall River Ranger District a total of 710 amphibian species were surveyed with 282 northern leopard frogs found (Grant 2009). One dam in particular (5 miles north of the Nebraska/South Dakota border) had 80 northern leopard frog metamorphs alone. A herpetological survey conducted on the OGA in 1996 did not identify the presence of northern leopard frogs at any of the study

sites, but they have been seen on the OGA during the course of other surveys. Leopard frogs are abundant on the WGA and are present on the Fall River West and Oglala Geographical Areas.

Plains leopard frog has not been found on Nebraska National Forest. Several surveys have been done with no plains leopard frogs found.

Direct, Indirect, and Cumulative Effects: Livestock hooves trample leopard frogs, especially when adult frogs are foraging in uplands. Livestock also trample all life stages of this species in aquatic habitats. Vehicle tires smash frogs on trails and roads. Erosion results in sediments that could smother leopard frog eggs in wetlands. Stocked fish depredate leopard frogs. Human movements in wetland environments introduce diseases harmful to leopard frogs, such as chytridionmyhcosis and ranavirus (Smith and Keinath 2007). Pesticides, excess fertilizers, metals, acids, fish poisons, PCB's, arsenic, and sediments could also kill leopard frogs when these substances enter aquatic habitats (Smith and Keinath 2007). A wide variety of developments that fragment or destroy wetlands would harm this species.

Determination of Effect and Rationale for Leopard Frogs (Northern & Plains)

Alternative 1: No Action (No Grazing)

The determination for leopard frogs (northern & plains) under this alternative is *beneficial impact.*

Rationale: There would be no anticipated livestock impact or human activities associated with livestock management to directly or indirectly harm the amphibians. Leopard frog habitat would improve under this alternative. Attaining or approaching Land and Resource Management Plan objectives for high structure vegetation would provide better protection of the aquatic habitat.

Alternative 2: Current Management

The determination for leopard frogs (northern & plains) under this alternative is *may adversely impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rationale: Some frogs could be killed by livestock hooves or by vehicles being driven by people who are managing livestock. Indirectly, livestock trampling could produce sediments that would smother frog eggs in some locations. However, these impacts would not be severe enough to adversely affect all leopard frogs on OGA & WGA.

Alternative 3: Proposed Action (Adaptive Management)

The determination for leopard frogs (northern & plains) under this alternative is *may adversely impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rationale: Some frogs could be killed by livestock hooves or by vehicles being driven by people who are managing livestock. Indirectly, livestock trampling could produce sediments that would smother frog eggs in some locations. However, these impacts would not be severe enough to adversely affect all leopard frogs on OGA & WGA. Leopard frog habitat would improve under this alternative. Attaining or approaching Land and Resource Management Plan objectives for high structure vegetation would provide better protection of the aquatic habitat.

Flathead Chub *Platygobio gracilis*

Distribution and Status: The flathead chub has a wide native distribution in the central region of North America, occurring in the four major river systems that flow eastward from the continental divide: the Mackenzie, Saskatchewan, Missouri-Mississippi, and Rio Grande. The species' extensive range includes the Northwest Territory of Canada south to New Mexico, Texas, and Louisiana. In the United States

flathead chubs occur in the western drainages of the Mississippi River. Flathead chubs are not frequently found in the mainstem of the Mississippi River north of the confluence of the Missouri River; however, flathead chub populations south of Illinois are restricted mainly to the mainstem of the Mississippi River (Rahel and Thel 2004a).

The major threats to the flathead chub involve habitat alterations associated with the development and operation of reservoirs on large rivers. These include conversion of riverine habitat to standing water habitat via dams, reduction of turbidity, and fragmentation of once continuous rivers into small, free-flowing reaches isolated from other such reaches by dams and reservoirs (Rahel and Thel 2004a).

In Nebraska, the flathead chub occurred most commonly in large rivers such as the Missouri, Platte, Republican, Elkhorn, and Niobrara (Rahel and Thel 2004a). The species may also inhabit parts of the Snake River drainage but it is highly unlikely (USFS and Nebraska Game and Parks Commission 2003).

In South Dakota, the flathead chub was common and characterized as the dominant minnow species in the western tributary rivers and larger streams of the Missouri River watershed. To the north and east of the Missouri River, the species occurred only in the lower portions of larger tributaries (Rahel and Thel 2004a). Flathead chubs are considered common in the rivers and larger streams of western South Dakota.

Habitat: The flathead chub is associated with turbid rivers and their tributaries. Flathead chubs prefer moderate-to-fast currents and sand or gravel substrate (Rahel and Thel 2004a).

Spawning has not been described for this species, and it is unknown if they make spawning migrations. It has been suggested flathead chubs migrate into smaller streams to spawn. Several studies observed flathead chub in tributaries of large rivers during the breeding season. Use of refugia by flathead chubs in high or low flows or during winter is unknown (Rahel and Thel 2004a).

Conservation Status
ESA –None
Global-G5
Nebraska-S5
South Dakota-S5
Forest Service , Region 2- Sensitive

Status definitions can be viewed at http://www.natureserve.org/explorer/ranking.htm

Existing Conditions: In September 1993 flathead chubs were found in 2 of 6 sampling points along Cottonwood Creek southeast of Edgemont on the WGA. No sampling has occurred since. It is not known if these fish still inhabit the creek. Approximately 1.5 miles of Cottonwood Creek is located on Federal lands. The entire length is located on the Miller 514 Allotment - Winter Pasture. The allotment is currently managed as a woody draw pasture and only grazed in the winter.

On the OGA, one flathead chub was identified at a survey point on Hat Creek in 1987. There are no other records for the species on the OGA since then (NGPC 2005).

Direct, Indirect, and Cumulative Effects:

Individuals or nests would be directly affected if trampled by cattle or people tending livestock within stream channels.

Indirect effects can be manifested through overgrazing, especially in the semi-arid regions that are common throughout the species' range. Overgrazing can increase stream width, decrease depth, and increase the likelihood of streams becoming intermittent. Accumulation of animal wastes in pools of streams having low or no flow in late summer can result in low oxygen concentrations and high ammonia concentrations that are detrimental to aquatic organisms (Rahel and Thel 2004a).

Determination of Effect and Rationale for the Flathead Chub

Alternative 1: No Action (No Grazing)

The determination for the flathead chub under this alternative is *no impact.*

Rationale: There would be no anticipated livestock impact or human activities associated with livestock management to directly or indirectly harm the fish. With the removal of livestock the threat to the stream banks and riparian vegetation is also removed and the flathead chub habitat would improve under this alternative.

Alternative 2: Current Management

The determination for the flathead chub under this alternative is *may adversely impact individuals, but is not likely to result in a loss of viability in planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rationale: Currently some the flathead chubs could possibly be killed by livestock or vehicles in the stream channel. Indirectly, livestock trampling could affect the stream banks and water quality. Cottonwood Creek is the only place in the project area that the flathead chub is found. The stretch of Cottonwood Creek affected by this decision is moderately stocked by livestock and only grazed in the winter. It follows that the effects of implementing alternative 2 would be minimal.

Alternative 3: Proposed Action (Adaptive Management)

The determination for flathead chub under this alternative is *may adversely impact individuals, but is not likely to result in a loss of viability in planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rationale: Currently some the flathead chubs could possibly be killed by livestock or vehicles in the stream channel. Indirectly, livestock trampling could affect the stream banks and water quality. Under the adaptive management alternative there is no plan to change the management of Cottonwood Creek (the location of the flathead chub). If monitoring reveals a need to change the management to favor the chub population changes can be made. Because of this, alternative 3 is likely to result in a slightly better situation for the flathead chub when compared to alternative 2.

Plains Minnow *Hybognathus placitus*

Distribution and Status:

Native populations of the plains minnow are present in 15 states in the central and Rocky Mountain regions of the United States. Plains minnows have been introduced into Utah. Throughout their range the populations have experienced range restrictions and population declines. In some watersheds populations in tributary streams have been extirpated restricting populations to larger rivers. In other systems, water development in large rivers restricts populations to less-developed tributary streams (Rees et. al. 2005).

Flood-control programs, navigational developments, and impoundments have resulted in reduced turbidity and the stabilization of the historically shifting braided channel. The elimination of flood events

in streams that contain the plains minnow has removed the historical cues for spawning and reduced the quality and quantity of available spawning habitat (Rees et. al. 2005).

Habitat: The plains minnow typically inhabits channels of shallow, fluctuating streams with shifting sand substrates. The species can be found in both turbid and clear streams. The plains minnow thrives in harsh environments in the southwest when few competing species are present. It typically inhabits large, often-turbid rivers that have exposed shallow, sand-filled channels. Preferred habitats include backwaters and gentle eddies. Backwater areas may be important nursery grounds for plains minnows because food is often abundant and available there (Rees et. al. 2005).

The headwaters of many plains streams are characterized by cycles of flooding followed by low flows caused by low rainfall. During times of low flow, the streams often become a series of isolated pools. The plains minnow possesses adaptations for survival in extreme environments (Rees et. al. 2005).

The plains minnow spawns from April to August (Rees et. al. 2005).

Conservation Status
ESA –None
Global-G4
Nebraska-S4
South Dakota-S5
Forest Service , Region 2- Sensitive

Status definitions can be viewed at http://www.natureserve.org/explorer/ranking.htm

Existing Conditions: In September of 1993 plains minnows were found in 1 of 6 sampling points along Cottonwood creek southeast of Edgemont. While no sampling has occurred since 1993 we assume plains minnow are still present in Cottonwood Creek.

Approximately 1.5 miles of Cottonwood Creek is located on Federal lands. The entire length is located on the Miller 514 Allotment - Winter Pasture. The allotment is currently managed as a woody draw pasture and only grazed in the winter.

Direct, Indirect, and Cumulative Effects:

Individuals or spawning beds would be directly affected if trampled by cattle or people tending livestock within stream channels.

Indirect and cumulative effects are a result of habitat modification. Habitat modification occurs when stream channels are modified due to channelization, scouring, or sedimentation resulting from land use practices, when the natural temperature and flow regimes are altered, or when water chemistry changes due to pollution. Land use practices that can impact stream channels include construction of roads through highly erodible soils, irrigation diversion and return flows, and overgrazing in riparian areas. These can all lead to an increased sediment load in the system and a subsequent change in stream channel geometry (e.g., widening, incision)(Rees et. al. 2005).

Determination of Effect and Rationale for the Plains Minnow

Alternative 1: No Action (No Grazing)

The determination for plains minnows under this alternative is *no impact.*

Rationale: There would be no anticipated livestock impact or human activities associated with livestock management to directly or indirectly harm the fish. With the removal of livestock the threat to the stream banks and riparian vegetation is also removed and plains minnow habitat would improve under this alternative.

Alternative 2: Current Management

The determination for plains minnows under this alternative is *may adversely impact individuals, but is not likely to result in a loss of viability in planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rationale:

Currently some plains minnows could possibly be killed by livestock or vehicles in the stream channel. Indirectly, livestock trampling could affect the stream banks and water quality. Cottonwood Creek is the only place in the project area that the plains minnow is found. The stretch of Cottonwood Creek affected by this decision is moderately stocked by livestock and only grazed in the winter. It follows that the effects of implementing alternative 2 would be minimal.

Alternative 3: Proposed Action (Adaptive Management)

The determination for plains minnow under this alternative is *may adversely impact individuals, but is not likely to result in a loss of viability in planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rationale: Currently some plains minnows could possibly be killed by livestock or vehicles in the stream channel. Indirectly, livestock trampling could affect the stream banks and water quality. Under the adaptive management alternative there is no plan to change the management of Cottonwood Creek (the location of the plains minnow). If monitoring reveals a need to change the management to favor the minnow population changes can be made. Because of this, alternative 3 is likely to result in a slightly better situation for plains minnows when compared to alternative 2.

Ottoe Skipper *Hesperia ottoe*

Distribution and Status: The Ottoe skipper is a large, stout-bodied skipper with a wingspan ranging from 2.9 to 4.3 cm (1.14 to 1.69 inches). The entire range for the Ottoe skipper is concentrated in the central to north-central portion of the United States, with a few populations just across the border in Manitoba, Canada (Selby 2005).

Global status for the species is G3: vulnerable. The reason for the vulnerable listing is the populations are generally small and localized and they are not a common species throughout their range.

Habitat: Ottoe skipper habitat is mixed-grass prairie (e.g., dry-mesic to mesic prairie dominated by mixed grasses such as little bluestem [*Schizachyrium scoparium*] and sideoats grama [*Bouteloua curtipendula*]), or dry-mesic tallgrass prairie (e.g., drier portions of tallgrass prairies where mixed grasses are favored over tall grasses) (Selby 2005).

The predominant nectar source for the Ottoe skipper throughout most of its range is purple coneflower (*Echinacea angustifolia*). Larval foodplants for Ottoe skipper include big bluestem, little bluestem, sideoats grama, and fall witchgrass (*Leptoloma cognatum*) (Selby 2005).

Conservation Status
ESA –None
Global-G3
Nebraska-S2
South Dakota-S2
Forest Service , Region 2- Sensitive

Status definitions can be viewed at http://www.natureserve.org/explorer/ranking.htm

Existing Conditions: In Nebraska, National Forest System lands in counties with Ottoe records include Oglala National Grassland and Nebraska National Forest (Pine Ridge District) in Dawes County, Nebraska National Forest (Bessey District) in Blaine County, and Samuel R. McKelvie National Forest in Cherry County. In 1995, butterfly surveys focused on the tawny crescent (*Phycoides batesii*) and the regal fritillary (*Speyeria idalia*) were conducted on Nebraska National Forest units in the state of Nebraska. No Ottoe skipper observations are documented in the report, but it was noted that they should occur in the Samuel R. McKelvie National Forest (Selby 2005).

Buffalo Gap National Grassland unit of the Nebraska National Forest includes parts of Custer, Fall River, and Pennington counties. Ottoe skippers have been documented from each of those counties, and the Fall River County record appears to fall within the national grassland unit, but there are no other confirmed records from USFS lands in South Dakota (Selby 2005).

Direct, Indirect, and Cumulative Effects: There is a chance that Ottoe skippers or their larvae could be trampled by livestock or run over by vehicles used to manage livestock grazing. Grazing has been identified as a primary disturbance to Ottoe skippers and they tend to be absent from grazed prairies in North Dakota (Selby 2005). Light grazing may not be a threat to the long-term survival of prairie-specialist butterflies, especially if there is some contiguous ungrazed habitat, but heavy grazing is a threat (Selby 2005). Reduced availability of nectar resources is likely the primary factor, but changes to vegetative structure, removal of larval host plants, and trampling eggs and larvae may also be factors (Selby 2005).

Historic loss, degradation, and fragmentation of the prairie landscape have been the primary factors contributing to the decline and current vulnerability of Ottoe skipper populations, and continued habitat loss, degradation, and fragmentation are the greatest potential threats to future populations. Activities that threaten further habitat loss include row crop agriculture, urban development and housing construction, road construction and maintenance, gravel mining, and wind generators. Threats to habitat quality and the availability of critical resources (e.g., nectar plants, larval food plants) include indiscriminant use of herbicides, invasive exotic species, and encroachment by woody vegetation (native and exotic). Fire, grazing, and haying can play important roles in maintaining and shaping prairie ecosystems, so the complete absence of these processes could constitute a threat to the extent and quality of prairie remnants. However, they could also pose direct and indirect threats to Ottoe skippers depending on their timing and intensity. Larvae are extremely vulnerable to direct mortality from fires when they are using aboveground shelters, and improperly timed fires, grazing, and haying could impact the availability of nectar and larval food resources at critical times. Other more direct threats to Ottoe skippers can include extreme weather (e.g., harsh winters, late frosts, unusually cool and wet growing seasons, and severe storms), indiscriminant use of insecticides, disease, and predation. A reduction in fitness resulting from genetic isolation may also pose a long-term threat (Selby 2005).

Determination of Effect and Rationale for the Ottoe Skipper

Alternative 1: No Action (No Grazing)

The determination for Ottoe skipper under this alternative is *beneficial impact.*

Rational: There would be no livestock grazing so there will be no direct mortality. In general Ottoe skipper numbers tend to be reduced or absent in grazed areas (Selby 2005). No grazing should result in optimum habitat at least initially.

Alternative 2: Current Management

The determination for Ottoe skipper under this alternative is *may adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rationale: There is a chance that Ottoe skippers or their larvae could be trampled by livestock or run over by vehicles used to manage livestock grazing. In general Ottoe skipper numbers tend to be reduced or absent in grazed areas (Selby 2005). This alternative allows the greatest amount of grazing and the result is low structure and early seral stages that do not meet revised LRMP direction.

Alternative 3: Proposed Action (Adaptive Management)

The determination for Ottoe skipper under this alternative is *may adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rational: There is a chance that Ottoe skippers or their larvae could be trampled by livestock or run over by vehicles used to manage livestock grazing. In general Ottoe skipper numbers tend to be reduced or absent in grazed areas (Selby 2005). This alternative allows the less grazing than Alternative 2, and more flexibility in make changes should monitoring indicate that the Ottoe skipper is being negatively impacted.

Regal Fritillary *Speyeria idalia*

Distribution and Status: These colorful butterflies historically occurred in the central and northeast United States, although they have rapidly declined from the eastern portion of the range in recent years. Regal fritillaries occupy suitable habitat statewide in South Dakota (Selby 2007).

Habitat: These insects inhabit wet meadows and tall grass prairie, in addition to undisturbed prairies in western South Dakota. Males emerge in late June, followed by females who lay eggs near violets (*Viola spp.*) during late August through early September. Generally in about three weeks, upon hatching, larvae crawl to ground where they soon enter hibernation after sheltering themselves with leaves and duff. In spring, larvae feed on emergent violet leaves. On the Northern Prairie, larvae are thought to feed on Nuttall violet (*Viola nutallii*), which grows in prairie sod. For feeding adults, nectar sources are long-headed coneflower (*Ratibida columnifera*), purple coneflower (*Echinacera pallida* or *A. angustifolia*), fleabanes (*Erigeron spp.*), black-eyed susans (*Rudbeckia spp.*), gaillardias (*Gaillardia spp.*), milkweeds (*Asclepias spp.*), thistles (*Cirsium spp.*), bergamots (*Monarda spp.*), and blazing stars (*Liatris spp.*). Native prairie with abundant wild flowers provide habitat for the butterflies while re-seeded rangelands without flowers may not. The species is always associated with open prairie or ungrazed, reverted pastures, generally in moist tallgrass virgin prairie. Conversion of prairie to cropland, herbicide or pesticide application, overgrazing, and invasion of introduced plants threaten most remaining habitats (Selby 2007).

Conservation Status
ESA –None

Global-G3
Nebraska-S3
South Dakota-S3
Forest Service , Region 2- Sensitive

Status definitions can be viewed at http://www.natureserve.org/explorer/ranking.htm

Existing Conditions: Regal fritillaries have been documented from 91 of the 93 counties in Nebraska, but they are generally more abundant in the eastern part of the state (Selby 2007).

The Buffalo Gap National Grassland units of the Nebraska National Forest include parts of Custer, Fall River, Jackson, and Pennington counties in the southwest corner of South Dakota. There are documented regal fritillary occurrences from each of these counties. Western portions of the Buffalo Gap National Grassland are near the western extent of the regal fritillary range. Historic records from western portions of the grassland might not represent breeding colonies, but eastern portions are well within the range and are more likely to contain breeding colonies (Selby 2007).

Direct, Indirect, and Cumulative Effects: There is a chance that regal fritillary butterflies or their larvae could be trampled by livestock or run over by vehicles used to manage livestock grazing. In general regal fritillary butterfly numbers tend to be reduced in direct proportion to increasing grazing intensity (Selby 2007).

Cumulatively, the loss of native prairies and grasslands to agriculture and urban development has been a common impact on habitat. The spread of exotic species can have an effect the habitat of the butterfly as the exotic plant species out competed the native vegetation that is important to the survival of the butterfly. Pesticides have an obvious effect on the butterflies. Prescribed and wild fire could affect the regal fritillary butterfly. Fire can benefit these butterflies by helping to control habitat loss to cool-season exotics and woody vegetation, increasing the vigor of native species (including larval food plants), and increasing flowering rates of important nectar sources. However, to reap these benefits, the butterflies must either survive the fire or recolonize burned areas from an adjacent source. Fires that are overly extensive (e.g., burning all or most of the regal fritillary habitat at one time) or excessively frequent (e.g., every one to two years) would negatively affect regal fritillary populations (Selby 2007).

Determination of Effect and Rationale for the Regal Fritillary

Alternative 1: No Action (No Grazing)

The determination for regal fritillary under this alternative is *beneficial impact.*

Rational: There would be no livestock grazing so there will be no direct mortality. In general regal fritillary butterfly numbers tend to be reduced in direct proportion to increasing grazing intensity (Selby 2007). No grazing should result in optimum habitat at least initially.

Alternative 2: Current Management

The determination for regal fritillary under this alternative is *may adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rationale: There is a chance that regal fritillary butterflies or their larvae could be trampled by livestock or run over by vehicles used to manage livestock grazing. In general regal fritillary butterfly numbers tend to be reduced in direct proportion to increasing grazing intensity (Selby 2007). This alternative allows the greatest amount of grazing and the result is low structure and early seral stages that do not meet revised LRMP direction.

Alternative 3: Proposed Action (Adaptive Management)

The determination for regal fritillary under this alternative is *may adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend to federal listing or a loss of species viability range wide.*

Rational: There is a chance that regal fritillary butterflies or their larvae could be trampled by livestock or run over by vehicles used to manage livestock grazing. In general regal fritillary butterfly numbers tend to be reduced in direct proportion to increasing grazing intensity (Selby 2007). This alternative allows less grazing than alternative 2, and more flexibility in make changes should monitoring indicate that the regal fritillary butterfly is being negatively impacted by current grazing strategies.

Summary of Biological Determinations

Table 20. Biological Determinations

	ALTERNATIVES		
Common Name	**#1: No Grazing**	**#2: Current Management**	**#3: Adaptive Management**
Threatened, Endangered or Candidate Species			
Black-Footed Ferret	NE	NE	NE
Gray Wolf	NE	NE	NE
Whooping Crane	NE	NE	NE
Ute Ladies'-tresses	NE	NE	NE
Greater Sage Grouse	NI/NEU	MAII/NEU	MAII/NEU
Sprague's Pipit	NI	NI	NI
USFS Region 2 Sensitive Species			
Black-tailed Prairie Dog	NI/NEU	NI/NEU	NI/NEU
Townsend's Big-eared Bat	NI	NI	NI
Hoary Bat	MAII	MAII	MAII
Fringed Myotis	NI	NI	NI
Rocky Mountain Bighorn Sheep	NI	NI	NI
Swift Fox	MAII	MAII	MAII
Northern Goshawk	NI	NI	NI
Grasshopper Sparrow	BI	MAII	MAII
Short-eared Owl	BI	MAII	MAII

	ALTERNATIVES		
Common Name	**#1: No Grazing**	**#2: Current Management**	**#3: Adaptive Management**
Burrowing Owl	NI	NI	NI
American Bittern	NI	NI	NI
Ferruginous Hawk	MAII	MAII	MAII
McCown's Longspur	LRLV	MAII	MAII
Chestnut-collared Longspur	MAII	MAII	MAII
Mountain Plover	NI	NI	NI
Black Tern	NI	NI	NI
Northern Harrier	BI	MAII	MAII
Yellow-billed Cuckoo	NI	NI	NI
Trumpeter Swan	NI	NI	NI
American Peregrine Falcon	NI	NI	NI
Bald Eagle	NI	NI	NI
Loggerhead Shrike	MAII	MAII	MAII
Lewis's Woodpecker	NI	NI	NI
Long-billed Curlew	LRLV	MAII	MAII
Brewer's Sparrow	MAII	MAII	MAII
Sharp-tailed Grouse	POS	NEU	NEU
Northern Leopard Frog	BI	MAII	MAII
Plains Leopard Frog	BI	MAII	MAII
Plains Minnow	NI	MAII	MAII
Sturgeon Chub	NI	NI	NI
Flathead Chub	NI	MAII	MAII
Regal Fritillary	BI	MAII	MAII
Ottoe Skipper	BI	MAII	MAII

	ALTERNATIVES		
Common Name	**#1: No Grazing**	**#2: Current Management**	**#3: Adaptive Management**
Plants			
Dicots			
Visher's Buckwheat	NI	NI	NI
Barr's Milkvetch	NI	NI	NI

Responsibility for a Revised Biological Evaluation

This Biological Evaluation was prepared based on presently available information. If the action is modified in a manner that causes effects not considered, or if new information becomes available that reveals that the action may impact endangered, threatened, proposed, or sensitive species that in a manner or to an extent not previously considered, a new or revised Biological Evaluation may be required. This project was found to be consistent with the viability analyses and other analyses associated with the 2001 Revised Land and Resource Management Plan for the Nebraska National Forest and the Northern Great Plains Final Environmental Impact Statement.

References

Abele, S.C., V.A. Saab, and E.O. Garton. 2004. Lewis's Woodpecker (*Melanerpes lewis*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/lewisswoodpecker.pdf

Allardyce D. & M. A. Sovada 2003. A Review of Ecology, Distribution, and Status of Swift Fox in the United States. pp 3-18 In M Sovada & L Carbyn editors. The Swift Fox: Ecology and Conservation of Swift Foxes in a Changing World. Canadian Plains Research Center, University of Regina. Regina, Saskatchewan Canada.

Anderson, Michelle D. 2004. Sarcobatus vermiculatus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ .

Anderson, R.M. 1976. Shrikes feed on prey remains left by hawks. Condor 78:269.

Ashton, D.E., and E.M. Dowd. 1991. Fragile legacy; endangered, threatened and rate animals of South Dakota. South Dakota Dept. of Game, Fish and Parks. Rep. 91-04. 150pp.

Bechard, M. J., and J. K. Schmutz. 1995. Ferruginous hawk (Buteo regalis). in Poole, A., And F. Gill, eds. The birds of North America. Academy of Natural Sciences and American Ornithological Union, Washington D.C.

Chung-MacCoubrey, A. L. 1996. Grassland bats and land management in the Southwest. Pp. 54-63 in D. M. Finch, ed. Ecology and management of western grassland ecosystems. Gen. Tech. Rep. RM-GTR-285. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 82p.

Clark, R. J. 1975. A field study of the short-eared owl, Asio flammeus (Pontoppidan), in North America. Wildl. Monogr. 47. 67pp.

Collins, C.P. and T.D. Reynolds. 2005. Ferruginous hawk (*Buteo regalis*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/ferruginoushawk.pdf .

Connelly, J. W., M. A. Schroeder, A. R. Sands, and C. E. Braun. 2000. Guidelines to Manage Sage Grouse Populations and their Habitats. Wildlife Society Bulletin 2000, 28(4): 967-985.

Connelly, J. W., S. T. Knick, M. A. Schroeder, and S.J. Stiver. 2004. Conservation Assessment of Greater Sage-grouse and Sagebrush Habitat. Western Association of Fish and Wildlife Agencies. Unpublished Report. Cheyenne, Wyoming.

Crawford, J. A., R.A. Olson, N.E. West, J.C. Mosley, M.A. Shroeder, T. D. Whitson, R.F. Miller, Gregg and C. S. Boyd. 2004. Synthesis paper: Ecology and management of sage-grouse. J. Range Manage. 57: 2-19.

Czaplewski, N.J., J.P. Farney, J.K. Jones, Jr., and J.D. Druecker. 1979. Synopsis of bats of Nebraska. Occasional Papers, The Museum, Texas Tech University61:1–24.

Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, A. L. Zimmerman, and B. R. Euliss. 2003a. Effects of management practices on grassland birds: American Bittern. Northern Prairie Wildlife Research Center, Jamestown, ND. Northern Prairie Wildlife Research Center Online. http://www.npwrc.usgs.gov/resource/literatr/grasbird/ambi/ambi.htm [Accessed Nov. 2012].

Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, M. P. Nenneman, and B. R. Euliss. 2003b. Effects of management practices on grassland birds: chestnut collared longspur. Northern Prairie Wildlife Research Center, Jamestown, ND. Jamestown, ND: Northern Prairie Wildlife Research Center Home Page. http://www.npwrc.usgs.gov/resource/literatr/grasbird/index.htm#species

Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, M. P. Nenneman, and B. R. Euliss. 2003c. Effects of management practices on grassland birds: McCown's longspur. Northern Prairie Wildlife Research Center, Jamestown, ND. Jamestown, ND: Northern Prairie Wildlife Research Center Home Page. http://www.npwrc.usgs.gov/resource/literatr/grasbird/index.htm#species

Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, M. P. Nenneman, and B. R. Euliss. 2003d. Effects of management practices on grassland birds: short-eared owl. Northern Prairie Wildlife Research Center, Jamestown, ND. Jamestown, ND: Northern Prairie Wildlife Research Center Home Page. http://www.npwrc.usgs.gov/resource/literatr/grasbird/index.htm#species

Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, M. P. Nenneman, and B. R. Euliss. 2003e. Effects of management practices on grassland birds: grasshopper sparrow. Northern Prairie Wildlife Research Center, Jamestown, ND. Jamestown, ND: Northern Prairie Wildlife Research Center Home Page. http://www.npwrc.usgs.gov/resource/literatr/grasbird/index.htm#species

Degraaf, R. M., V. E. Scott, R. H. Hamre, L. Ernst, and S. H. Anderson. 1991. Forest and rangeland birds of the United States – Natural History and Habitat Use. In: USDA Forest Service, Agriculture Handbook 688pp.

Dinsmore, S. J. 2003. Mountain Plover (*Charadrius montanus*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/mountainplover.pdf

Duebbert, H. F. and J. T. Lokemoen. 1977. Upland nesting of American bitterns, marsh hawks, and short-eared owls. Prairie Naturalist 9:33-40.

Fertig, W., R. Black, and P. Wolken. (2005, September 30). Rangewide status review of Ute Ladies'-Tresses (*Spiranthes diluvialis*). [Online]. US Fish and Wildlife Service and Central Utah Water Conservancy District. Available: http://efotg.sc.egov.usda.gov//references/public/WY/UtesRangewideStatusReview2005byFertig.pdf [Accessed May 2012].

Freeman, P. W., K.N. Geluso, and J. S. Altenbach. 1997. Nebraska's Flying Mammals. Museum, University of Nebraska state Mammalogy Papers: University of Nebraska State museum. University of Nebraska Lincoln Available at: http://digitalcommons.unl.edu/museummammalogy/30

Fritcher, S. C. 1998. Bird and small mammal populations in relation to seral stage of mixed-grass prairie, Fort Pierre National Grassland, South Dakota. M.S. Thesis, South Dakota State Univ., Brookings. 128pp.

Gruver, J. C. and D. A. Keinath (2006). Townsend's Big-eared Bat (*Corynorhinus townsendii*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/townsendsbigearedbat.pdf .

Harrison R. L. and J. Whitaker-Hoagland. 2003. A Literature Review of Swift Fox habitat and Den Selection. pp 79-89 In M Sovada & L Carbyn editors. The Swift Fox: Ecology and Conservation of

Swift Foxes in a Changing World. Canadian Plains Research Center, University of Regina. Regina, Saskatchewan Canada.

Higgins, K. F., E. Dowd Stukel, J. M. Goulet, and D. C. Backlund. 2000. Wild mammals of South Dakota. South Dakota Department of Game, Fish and Parks, Pierre, South Dakota, USA.

High Plains Regional Climate Center (HPRCC). 2012. Edgemont and Harrison precipitation data. 713 Hardin Hall; 3310 Holdrege Street; Lincoln, NE 68583-0997. Available: http://www.hprcc.unl.edu/data/historical/index.php?state=sd&action=select_state&submit=Select+State [Accessed Nov 2012].

Hodorff, R. 2005. Final Report: Habitat Assessment and Conservation Strategy for Sage Grouse and Other Selected Species on Buffalo Gap National Grassland. On File: O:\NFS\Nebraska\Program\2600WildlifeMgmt\FRRD\2620WildlifePlng\2620-2StudiesAministrative\2004SagebrushProject\2004Report. 50 pp

Hodorff, R. 2009. Summary of Prairie Dog Inventory and Control Fall River Ranger District Buffalo Gap National Grassland 1996-2009. On File: O:\NFS\Nebraska\Program\2600WildlifeMgmt\FRRD\2660WildlifeAdmin\2660-1Reports\WldSurveyReports\Prairie Dog\Summary

Hodorff, R. 2011. Report: MA3.64 Special Plant and Wildlife Habitat: Sage Grouse Prairie Grouse Lek Surveys1991-2011. On File: O:\NFS\Nebraska\Program\2600WildlifeMgmt\FRRD\2660WildlifeAdmin\2660-1Reports\WldSurveyReports\GrouseLeks\MA364SageGrouse

Holmes, J. A. and M. J. Johnson. 2005. Brewer's Sparrow (*Spizella breweri*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/brewerssparrow.pdf.

Holt, D. W., and S. M. Leasure. 1993. Short-eared owl (Asio flammeus). in Poole, A., and F. Gill, eds. The birds of North America. Acad. of Nat. Sci., Phil., PA, and American Ornithological Union, Washington D.C.

Johnsgard, P.A. 1990. Hawks, eagles and falcons of North America. Smithsonian Institution Press. Washington and London. 403p.

Jones, J. K., Jr., D. M. Armstrong, R. S. Hoffman and C.Jones. 1983. Mammals of the Northern Great Plains. Univ. of Nebraska Press. Lincoln and London. 379p.

Jones, S. L. 2010. Sprague's Pipit (*Anthus spragueii*) conservation plan. U.S. Department of Interior, Fish and Wildlife Service, Washington, D.C.

Kantrud, H. A. and K. F. Higgins. 1992. Nest and nest site characteristics of some ground-nesting, non-passerine birds of northern grasslands. Prairie Nat. 24:67-84.

Keinath, D. A. 2004. Fringed Myotis (*Myotis thysanodes*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/fringedmyotis.pdf

Kostal, G.M., R.L. Hartman, and B.E. Nelson. 2006. Floristic survey of the Buffalo Gap National Grassland and Oglala National Grassland. Final report. Rocky Mountain Herbarium, Department of Botany, University of Wyoming, Laramie, Wyoming. 74 p.

Kostel, G.M. 2009. *Astragalus barrii* Barneby (Barr's Milkvetch) survey on the Oglala National Grassland for the Nebraska Game and Parks Commission and Nebraska National Forest. Final

report. BHSU Herbarium, Spearfish, South Dakota. 11 p.

Ladyman, J. A. R. 2006a. *Astragalus barrii* Barneby (Barr's milkvetch): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/astragalusbarrii.pdf

Ladyman, J. A. R. 2006b. *Eriogonum visheri* A. Nelson (Visher's buckwheat): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/eriogonumvisheri.pdf

Lewis, J.C. 1995. Whooping crane (*Grus americana*) *in* The birds of North America, No. 153 (A. Poole and F. Gill, eds.). The Acad. of Nat. Sci, Philadelphia, and The American Ornithological Union, Washington, D.C.

MacWhirter, R. B., and K. L. Bildstein. 1996. Northern harrier (Circus cyaneus) in Poole, A., and F. Gill, eds. The birds of North America. Acad. of Nat. Sci., Phil., PA, and American Ornithological Union, Washington D.C.

Marks, R. (February 2007). Sharp-tailed Grouse (*Tympanuchus phasianellus*): Fish and Wildlife Management Leaflet. Number 40. NRCS and the Wildlife Habitat Council.

McDonald, D., N. M. Korfanta, and S. J. Lantz. 2004. The Burrowing Owl (*Athene cunicularia*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/burrowingowl.pdf

Michigan Department of Natural Resources (MIDNR). (2008, July 10). Michigan Wolf Management Plan. Lansing, MI, USA. Available: http://www.michigan.gov/documents/dnr/Draft_Wolf_Management_Plan_030708_227742_7.pdf [Accessed November 2012].

NatureServe. 2012. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer.

Naugle, D.E. 2004. Black Tern (*Chlidonias niger surinamensis*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available:

Nebraska Game and Parks Commission. 2005. White/Hat basins – fishes – Ogallala National Grasslands. Fish survey data 7pp.

North American Bird Conservation Initiative, U.S. Committee, 2009. The State of the Birds, United States of America, 2009. U.S. Department of Interior: Washington, DC. 36 pages.Available: http://www.stateofthebirds.org/2009

Olendorff, R. R. 1993. Status, biology, and management of ferruginous hawks: a review. Raptor Res. And Tech. Asst. Cen., Spec. Rep. USDI Bureau of Land Management L.M., Boise, ID.

Orabona, A., S. Patla, L. Van Fleet, M. Grenier, B. Oakleaf, and Z. Walker. 2009. Atlas of Birds, Mammals, Amphibians, and Reptiles in Wyoming. Wyoming Game and Fish Department Nongame Program, Lander. 227pp.

Peterson, R. A., compiler. 1993. Birds of the Nebraska Pine Ridge. Nebraska National Forest (Pine Ridge Ranger District) and Oglala National Grassland. Field Checklist. USDA Forest Service.

Peterson, R. A. 1995. The South Dakota breeding bird atlas. S. D. Ornithologists' Union, Northern State Univ., Aberdeen. 276pp.

Rahel, F. J. and L. A. Thel. 2004a. Flathead Chub (*Platygobio gracilis*): a technical conservation

assessment. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/flatheadchub.pdf

Rahel, F. J. and L. A. Thel. 2004b. Sturgeon Chub (*Macrhybopsis gelida*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/sturgeonchub.pdf [Accessed Nov. 2012].

Real West Natural Resource Consulting. 2002. Wyoming Bureau of Land Management Statewide Programmatic Biological Assessment for Whooping Cranes (*Grus americana*). United States Department of the Interior Bureau of Land Management Cheyenne, Wyoming. Available at : http://www.blm.gov/pgdata/etc/medialib/blm/wy/wildlife/whoopingcrane.Par.45934.File.dat/wcrane-ba.pdf

Rees, D. E., R. J. Carr, and W. J. Miller. 2005. Plains Minnow (*Hybognathus placitus*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/plainsminnow.pdf

Rich, T. D., C. J. Beardmore, H. Berlanga, P. J. Blancher, M. S. W. Bradstreet, G. S. Butcher, D. W. Demarest, E. H. Dunn, W. C. Hunter, E. E. Iñigo-Elias, J. A. Kennedy, A. M. Martell, A. O. Panjabi, D. N. Pashley, K. V. Rosenberg, C. M. Rustay, J. S. Wendt, T. C. Will. 2004. Partners in Flight North American Landbird Conservation Plan. Cornell Lab of Ornithology. Ithaca, NY. Available: http://www.pwrc.usgs.gov/pif/cont_plan/

Rowland, M. M. 2004. Effects of management practices on grassland birds: Greater Sage-Grouse. Northern Prairie Wildlife Research Center, Jamestown, ND. Northern Prairie Wildlife Research Center Online. http://www.npwrc.usgs.gov/resource/literatr/grasbird/grsg/grsg.htm (Version 12AUG2004).

Russel, T. A. 2006. Habitat Selection by Swift Foxes in Badlands National Park and the Surrounding Area. MS Thesis. South Dakota State University. Brookings, SD. 104 pp.

Schmutz, J. K., and D. J. Hungle. 1989. Population of ferruginous and Swainson's hawks increase in synchrony with ground squirrels. Can J. Zool. 67:2596-2601.

Sedgwick, J.A. 2004a. Chestnut-collared Longspur (*Calcarius ornatus*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/chestnutcollaredlongspur.pdf

Sedgwick, J.A. 2004b. McCown's Longspur (*Calcarius mccownii*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/mccownslongspur.pdf

Sedgwick, J.A. 2006. Long-billed Curlew (*Numenius americanus*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/longbilledcurlew.pdf

Selby, G. 2005. Ottoe Skipper (*Hesperia ottoe* W.H. Edwards): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/ottoeskipper.pdf

Selby, G. 2007. Regal Fritillary (*Speyeria idalia* Drury): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/regalfritillary.pdf

Sibley, D. A. 2000. The Sibley guide to birds. National Audubon Society. Alfred A. Knopf, New York, N.Y. 545pp.

Slater, G. L. 2004. Grasshopper Sparrow (Ammodramus Savannarum): A technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/grasshoppersparrow.pdf

Slater, G. L. (2006, August 17). Trumpeter Swan (*Cygnus buccinator*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/trumpeterswan.pdf

Slater, G. L. and C. Rock. 2005. Northern Harrier (*Circus cyaneus*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/northernharrier.pdf

Smith, B. E. and D. A. Keinath 2005. Plains Leopard Frog (*Rana blairi*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/plainsleopardfrog.pdf

Smith, B. E. and D. A. Keinath. 2007. Northern Leopard Frog (*Rana pipiens*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/northernleopardfrog.pdf

South Dakota Bat Working Group. 2004. The South Dakota Bat Management Plan. South Dakota Game Fish and Parks Wildlife division report 2004-2008. Available at: http://gfp.sd.gov/wildlife/docs/bat-managment-plan.pdf

Stephens, R. M. and S. H. Anderson. 2005. Swift Fox (*Vulpes velox*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/swiftfox.pdf

Tallman, D. A., D. L. Swanson, and J. S. Palmer. 2002. Birds of South Dakota. South Dakota Ornithological Union, Northern State Univ., Aberdeen. 441pp.

Tigner, J. and E. Dowd-Stukel 2003. Bats of The Black Hills a Description of Status and Conservation Needs. South Dakota Department of Game, Fish And Parks Wildlife Division Report 2003-05. Available: http://gfp.sd.gov/wildlife/management/diversity/docs/battechreport.pdf

Tigner, J. 2007. Bats Surveys Buffalo Gap National Grassland 2007. Report to South Dakota Department of Game Fish and Parks, Rapid City South Dakota.42pp.

Tucker, R. and M. Wollesen. 2009. 2009 Pine Ridge bighorn sheep annual progress report. Nebraska Game and Parks Commission. Pine Ridge Field Office, Crawford, NE.

U.S. Fish and Wildlife Service. 2000. Endangered and Threatened Wildlife and Plants; 12-month finding for a petition to list the black-tailed prairie dog as threatened. FederalRegister 65(24). Available: http://ecos.fws.gov/docs/federal_register/fr3537.pdf

U.S. Fish and Wildlife Service. 2004. Endangered and threatened wildlife plants; finding for the resubmitted petition to list the black-tailed prairie dog as threatened. Federal Register 69 (159):51217-51226. Available: http://ecos.fws.gov/docs/federal_register/fr4296.pdf

U.S. Fish and Wildlife Service. 2010. Endangered, Threatened, Proposed, and Candidate Species in Nebraska Counties. Available: http://www.fws.gov/mountain%2Dprairie/endspp/CountyLists/Nebraska.pdf

U.S. Fish and Wildlife Service. 2011. Endangered Species Program. Available: http://www.fws.gov/southdakotafieldoffice/endangered_species_newVersionP2.htm

U.S. Forest Service. and Nebraska Game and Parks Commission. 2003. Steer Creek fish survey on the McKelvie National Forest. Bessey Ranger District. Halsey, NE. Unpublished report. Unpublished report. Nebraska National Forest. Halsey, NE. 8p.

USDA Forest Service. 1996. Rangeland Analysis and Management Training Guide. Rocky Mountain Region, Denver CO. Available: https://fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5172123.pdf

USDA Forest Service. 2001. Updated Land and Resource Management Plan for Nebraska National Forest and Associated Units. As amended 2009. Available: http://www.fs.usda.gov/detail/nebraska/landmanagement/planning/?cid=fsm9_028050

USDA Forest Service. 2001a. Appendix H Biological assessment and evaluation. Final environmental impact statement for the Northern Great Plains management plans revision. Available: http://www.fs.fed.us/ngp/plan/feis.htm

USDA Forest Service. 2012. Regional Forester's Sensitive Species List Available: http://fsweb.r2.fs.fed.us/rr/R2_TES_Site_2007/sensitive.html#list

USDA Natural Resource Conservation Service. 2010. Fence Considerations in Sage-Grouse Habitat [web application]. Available: http://www.or.nrcs.usda.gov/programs/sage-grouse/fy10/data/SGI_Fence-Considerations_Fact_Sheet.pdf

USDA Natural Resource Conservation Service. 2011a. Field Office Technical Guide [web application]. Available http://efotg.sc.egov.usda.gov/efotg_locator.aspx

USDA Natural Resource Conservation Service. 2011b. Plants Data Base [web application]. Available http://plants.usda.gov/java/.

USGS Patuxent Wildlife Research Center. 2012. North American breeding bird survey. Available: https://www.pwrc.usgs.gov/BBS/PublicDataInterface/index.cfm [Accessed January 2012].

Vickery, P. D. 1996. Grasshopper sparrow (Ammodramus savannarum). in Poole, A., and F. Gill, eds. The birds of North America. Acad. of Nat. Sci., Phil., PA, and American Ornithological Union, Washington, D.C.

Walker, B. 2004. Effects of management practices on grassland birds: Brewer's Sparrow. Northern Prairie Wildlife Research Center, Jamestown, ND. Northern Prairie Wildlife Research Center Online. http://www.npwrc.usgs.gov/resource/literatr/grasbird/brsp/brsp.htm (Version 12AUG2004).

Wallestad, R. 1975. Life history and habitat requirements of sage grouse in central Montana. Game Management Division, Montana Department of Fish and Game, Helena, Montana.

Wiggins, D.A. 2004. Short-eared owl (Asio flammeus): a technical conservation assessment. (Online). USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/shortearedowl.pdf

Wiggins, D. 2005a. Loggerhead Shrike (*Lanius ludovicianus*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/loggerheadshrike.pdf .

Wiggins, D. 2005b. Yellow-billed Cuckoo (*Coccyzus americanus*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/yellowbilledcuckoo.pdf

Wiggins, D.A. 2006. American Bittern (*Botaurus lentiginosus*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/americanbittern.pdf

Wollesen, M. 2008. Fort Robinson bighorn sheep herd December 2008 quarterly report summary. Nebraska Game and Parks Commission. Pine Ridge Field Office, Crawford, NE.

Wollesen, M. 2009. Fort Robinson bighorn sheep herd quarterly report summary October - December, 2009. Nebraska Game and Parks Commission. Pine Ridge Field Office, Crawford, NE.

G05HOD01=DUS

Trader ✓

TO - Lit file

Agreement/Grant No.: 03-CS-11020700-014 M3

Cooperator/Recipients: South Dakota Game Fish and Parks

FS Unit : Nebraska National Forest – Fall River Ranger District

Program: Sage Grouse Habitat

Field Work

Completed by Richard Peterson

Start – April 2003
Ended – November 2004

Final Report

Prepared by Robert Hodorff

September 20, 2005

Hodorff 2005

Project Title:

Habitat Assessment and Conservation Strategy for Sage Grouse and Other Selected Species on Buffalo Gap National Grassland

INTRODUCTION

Sage grouse have been declining in distribution and numbers throughout their range. This trend has led to proposals for federal listing and designation of sage grouse as a sensitive species in Region 2 of the Forest Service. Along with the sensitive species designation, a 45,760 acre parcel of the Buffalo Gap National Grassland has been identified in the Nebraska National Forest Land and Resource Management Plan 2001 Revision (LRMP) as '3.64 Special Plant and Wildlife Habitat: Sage Grouse Area' SGA (Map 1). This area has had the only sage grouse lek found on the Buffalo Gap National Grassland. Also, Brewer's sparrows (a sagebrush obligate) are on the Region 2 sensitive species list and are known to inhabit this area. Another species that depends heavily on the sagebrush and is known to occur in this area is the sage thrasher. Sagebrush is critical for wintering pronghorn and mule deer also make extensive use of this habitat area.

Sage grouse are a relatively long-lived species with low reproductive rates. They are entirely dependent on sagebrush habitats for successful reproduction and winter survival. Sage grouse populations depend on relatively large expanses of sagebrush-dominated shrub steppe. However, the appropriate patch size needed for winter and breeding habitats used by sage grouse is uncertain. It is likely that this patch size is not a fixed amount but depends on various factors including migration patterns and productivity of the habitat (Connelly et al 2004).

Sage grouse display a variety of annual migratory patterns. Populations may have 1) distinct winter, breeding, and summer areas ; 2) distinct summer areas and integrated winter and breeding areas; 3) distinct winter areas and integrated summer and breeding areas ; or 4) well integrated seasonal habitats (non migratory populations) (Connelly et al 2000). No studies have been done the migratory patterns of the sage grouse in the SGA.

Annual habitat requirements for sage grouse have been partitioned into 3 categories. 1) Breeding habitat which includes lek attendance, nesting, and early brood rearing. These areas are sagebrush-dominated rangelands with a healthy herbaceous understory. 2) Summer habitats are characterized by relatively moist conditions with succulent forbs in or adjacent to sagebrush cover. These habitats are used by the sage grouse after the forbs begin to dry up in the upland sagebrush community. 3) Winter habitat which is sagebrush (Connelly et al 2000) .

VEGETATION

METHODS

Based on Connelly et al. (2000), the habitat variables that are important to assess in sage grouse habitat are: canopy coverage of sagebrush, height of the sagebrush, canopy coverage of grasses, canopy coverage of forbs, and height of grass-forbs during the nesting period. The optimum values for the key habitat variables are summarized in Table 1.

Cover-Frequency

To obtain information on canopy coverage and frequency of occurrence, a total of 72 (20 X 30 m) vegetative sampling plots were established throughout the SGA. See Map # 2 for locations of cover-frequency plots mapped using Global Positioning System (GPS).

Care was taken to ensure that the entire range of sagebrush densities were sampled. Each plot was oriented so the 20 x 30 meter rectangle could be established within fairly homogeneous sagebrush density. All plots were marked with a steel fence post and wooden stakes driven at the 4 corners. See Figure 1 for plot layout.

A 20 X 50 cm quadrate frame was used to determine canopy coverage. Quadrates were read at 1 meter intervals along two 30 meter transects for a total of 30 quadrates per transect and 60 per site (Figure 1.). Quadrates were read using methods described in Daubenmire (1959) and USDA (1996). Seven cover classes were used 0-1%, 1-5%, 5-25%, 25-50%, 50- 75%, 75-95%, and 95-100%. In each quadrate frame total cover (total cover was defined as anything in the frame that was not bare ground or rock), bare ground, litter (standing dead vegetation or dead vegetation that was level to the ground), total herbaceous (live plants that are a combination of grasses and forbs), total live grasses, total live forbs, total live shrubs, and canopy coverage for each species was estimated. Midpoints of the cover classes were used to calculate the mean canopy coverage for each transect. These plots were read between June 12 and August 13 of 2003.

Sagebrush canopy coverage was also measured using the line intercept method (USDA 1996) along both 30 meter sides of the Daubenmire plot. The line intercept method is the preferred method for determining shrub canopy cover (Connelly et al. 2003). Only live canopy was used to determine coverage. This measurement was taken at the same time that the canopy coverage quadrates were read.

Sagebrush Height

Height of the tallest shrub was also measured in each 20 X 50 cm. quadrate frame in which a shrub occurred.

Grass/forb height

Grass/forb height was measured in each of the plots in October of both 2003 and 2004. A 50 meter line was laid out between the two 30 meter cover frequency transects in each of the 72 macroplots used in the project (Figure 1). A 20 x 50 cm quadrate frame was positioned at one meter intervals along the 50 meter transect line and the droop height was measured for the tallest plant of each of the dominant grass species that occurred

within the quadrate frame. Droop height is defined in Connelly et al (2000) as the highest naturally growing portion of the plant. The grasses species that were measured in each frame, if they occurred, were needle and thread *(Hesperostipa comata)*, western wheatgrass *(Pascopyrum smithii)*, blue grama *(Bouteloua gracilis)*, Sandberg's bluegrass *(Poa secunda)*, Japanese brome *(Bromus japonicus)*, cheatgrass/downy brome (*Bromus tectorum*), green needle grass *(Nassella viridula)* and crested wheatgrass *(Agropyron cristatum)*. If a different grass or a forb species was the tallest plant within the quadrate frame, the species was recorded and the droop height was measured and used to calculate the maximum height for the transect. Although buffalograss (*Buchloe dactyloides)* is a dominate species, its droop height was only measured if it was the tallest plant in an individual frame.

Sagebrush Density Cover Map

Aerial photography was completed on linear transects 5,900 ft apart at an altitude of 5000 ft using a Kodak 14-megapixel digital camera with a 24mm Nikon lens. The photograph were taken in the spring and summer of 2003. After the photographs were downloaded they were georeferenced using ARCMAP software.

Based on Connelly et al. (2000), it was determined that the sagebrush in the area should be divided into 4 canopy cover categories: less than 1%, between 1 and 10%, between 10 and 30%, and greater than 30% (Table 1).

A cover map of sagebrush in the SGA was created by first looking at the photos in various scales and determining at which resolution the canopy coverage of sagebrush can be best differentiated. It was determined the best scale to work in was 1:2000. The GPS locations of the cover-frequency plots were then overlaid on the 1:2000 digital aerial photos. Each plot was studied and a set of photos was created to use as keys to differentiate the densities of sagebrush. The aerial photos were examined and lines were drawn separating the different cover classes using ARCMAP software. If there was difficulty in determining the big sagebrush cover class on the aerial photo, the location was noted and the area was ground truthed.

While completing the mapping process, it became evident that additional categories were necessary. The areas in which the dominate soil type was shale are characterized by sparse vegetation and a substantial amount of bare soil. The shale areas were then separated into two separate shrub canopy coverage classifications which were between 1 and 10% and 10 and 30%. Three other categories were created during the process 1). sand sagebrush *(Artemisia filifolia)*, 2) silver sagebrush (*Artemisia cana)*, and 3). greasewood *(Sarcobatus vermiculatus)*.

1992 Project

A similar study was conducted in 1992. The 1984 Land and Resource Management Plan (LRMP) listed pronghorn (*Antilocapra americana*) as the management indicator species (MIS) for the sagebrush habitat. The direction in the LRMP was to provide habitat for MIS at a level no lower than 40% of habitat potential. The objective of the 1992 study was to determine if sagebrush habitat was meeting the direction called for in the 1984 LRMP. The study area was limited to the northwest section of the SGA (Map 3). Canopy cover for sagebrush, grasses, and forbs were sampled using the same

methodology listed above. Droop height was not collected. A sagebrush canopy cover map was developed by taking maps and 1:24000 aerial photos to the field and drawing boundaries on the maps. The categories used for delineating the canopy cover of big sagebrush were different than this study <1% , 1- 5%, 5-15%, and >15% compared to <1% , 1- 10%, 10-30%, and >30%).

RESULTS

Canopy Coverage

The areas created using the different categories of canopy cover of sagebrush is displayed in Map #2. The number of acres in each category and the percent of each category of the total is presented in Table 2.

The less than 1% canopy coverage of the big sagebrush category occupies the largest area within the SGA. There were approximately 30,929 acres in this category which is roughly 65% of the total area (Table 2). Nine plots were sampled that lie within the category. The average canopy cover of the big sagebrush was .7% and no other species of shrubs were found. The average canopy coverage of grasses was 64%. The species with the highest canopy coverage was buffalograss (30%), followed by blue grama (11%), cheatgrass/downy brome (11%), Japanese brome (6%), and western wheatgrass (5%). The grass plant with the highest frequency of occurrence was western wheatgrass (76%), followed by Japanese brome (69%), buffalograss (60%), blue grama (44%) and cheatgrass/downy brome (32%) (Table 3) Other grass species found in this category are listed in Table 3. The average canopy coverage of forbs was 2%. The forb species with the highest canopy coverage was plains prickleypear *(Opuntia polyacantha)* (1%), followed by scarlet globemallow *(Sphaeralcea coccinea)*, and false pennyroyal *(Hedeoma hispida)* (both averaged less than 1%). The forb with the highest frequency of occurrence was scarlet globemallow (22%), followed by false pennyroyal (16%), and plains prickleypear (10%) (Table 3). Other forb species found in this category are listed in Table 3.

In the 1 - 10% big sagebrush canopy coverage category, there were approximately 9,980 acres, which is roughly 21% of the total area (Table 2). There were 23 plots sampled in this category. The average canopy cover of the big sagebrush was 6%, and there were no other species of shrubs found in this category (Table 4). The average canopy coverage of grasses was 48%. The species with the highest canopy coverage in this category was buffalograss (18%), followed by blue grama (11%), threadleaf sedge *(Carex filifolia)* (5%), and western wheatgrass (3%). The grass plant with the highest frequency of occurrence was western wheatgrass (59%), followed by Japanese brome (56%), blue grama (48%), buffalograss (34%), and needle and thread (30%) (Table 4). Other grass species found in this category are listed in Table 4.

The average canopy coverage of forbs was 2%. The species with the highest canopy coverage in this category was fringed sagewort *(Artemisia frigida)*, followed by plains pricklypear and false pennyroyal (all less than 1%). The forb with the highest frequency of occurrence was false pennyroyal (19%), followed by scarlet globemallow (14%), and Indianwheat *(Plantago patagonica)* (7%) (Table 4). Other forb species found in this category are listed in Table 4.

In the 11-30% big sagebrush canopy coverage category, there were approximately 2,760 acres which is roughly 6% of the total area (Table 2). There were 28 plots sampled that lie within the category. The average canopy cover of the big sagebrush was 18%. Rubber rabbitbrush *(Ericameria nauseosa)* was the other shrub recorded in this category and its cover averaged less than 1% (Table 5). The average canopy coverage of grasses was 40%. The species with the highest canopy coverage in this category was cheatgrass/downy brome (8%), followed by blue grama (8%), buffalograss (7%), Japanese brome (3%) and threadleaf sedge (3%). The grass plant with the highest frequency of occurrence was Japanese brome (53%), followed by western wheatgrass (46%), blue grama (39%), Sandberg's bluegrass (30%), and needle and thread (26%) (Table 5) Other grass species found in this category are listed in Table 5.

The average canopy coverage of forbs was 1%. The species with the highest canopy coverage in this category was plains prickleypear followed by fringed sagewort and false pennyroyal (all averaged less than 1%). The forb with the highest frequency of occurrence was false pennyroyal (15%), followed by plains prickleypear (8%), scarlet globemallow (7%), and Indianwheat (6%) (Table 5). Other forb species found in this category are listed in Table 5.

In the greater than 30% big sagebrush canopy coverage category there were approximately 223 acres which is less than 1% of the total area (Table 2). There were 7 plots sampled that lie within the category. The average canopy cover of the big sagebrush was 33% and there were no other species of shrubs found in this category (Table 6). The average canopy coverage of grasses was 32%. The species with the highest canopy coverage in this category was cheatgrass/downy brome (11%), followed by Japanese brome (5%), threadleaf sedge (3%), needle and thread (3%) and blue grama (2%). The grass plant with the highest frequency of occurrence was Japanese brome (67%), followed by cheatgrass/downy brome (49%) needle and thread (43%), Sandberg's bluegrass (37%) and western wheatgrass (30%), (Table 6) Other grass species found in this category are listed in Table 6. The average canopy coverage of forbs was 2%. The species with the highest canopy coverage in this category was plains prickleypear followed by false pennyroyal, and fringed sagewort(all averaged less than 1% canopy coverage). The forb with the highest frequency of occurrence was false pennyroyal (23%), followed by fringed sagewort (9%) plains pricklypear (7%), scarlet globemallow (6%), and Indianwheat (6%) (Table 6) . Other forb species found in this category are listed in Table 6.

The last categories in which plots were established were the shale banks. These areas were further separated into two groups 1-10% shrub cover and 11-30% shrub cover. In the 1-10% shrub cover category there were approximately 1,365 acres which is about 3% of the total area (Table 2). In the 11-30% shrub cover category there were approximately 222 acres which is less than 1% of the total area (Table 2). There were five plots sampled that lie within these categories (2 in the 1-10% category and 3 in the 11-30% category). Both of the areas were characterized as having high bare ground (greater than 66%) and low herbaceous cover (less than 11%). The average canopy cover of the big sagebrush was 4% and rubber rabbitbrush 5% in the 1-10% category. The average canopy cover of the big sagebrush was 13% and rubber rabbitbrush 4% in the 11-30% category (Tables 7 & 8). The average canopy coverage of grasses was 9% in both categories. The species

with the highest canopy coverage in this category was western wheatgrass in both categories. This was also the case for frequency of occurrence. Both shale categories had canopy coverage of forbs of less than 4%. Other forb species found in the shale banks are listed in Tables 7 & 8.

Three other categories were created during the process sand sagebrush, silver sagebrush, and greasewood. No plots were established in this cover type.

Height of Sagebrush

A summary of the number of sagebrush plants measured and their average height for each of the density categories is presented in Table 9. The average height of sagebrush for all areas combined was 44.2 cm. In the less than 1% sagebrush cover category, 14 plants were measured, and their average height was 32 cm. In the 1 to 10% sagebrush category, 223 plants were measured, and their average height was 39 cm. In the 10 to 30% sagebrush category, 675 plants were measured, and their average height was 44 cm. In the greater than 30% sagebrush cover category, 272 plants were measured, and their average height was 51 cm. With exception of the less than 1% cover category, all of the categories appear to meet the height guidelines suggested in Connelly et al (2000) for productive sage grouse habitat, which is a minimum of 40 cm.

Height of the Herbaceous Vegetation

The height of the dominant plants are presented in Table 10, and the results are displayed in Figure 2. There was very little difference in the height of each species between sagebrush cover types, but there is a considerable difference between plants measured in 2003 and 2004. The average height for western wheatgrass across all sagebrush canopy coverage types in 2003 was 24.8 cm compared to 12.4 cm in 2004, for Japanese brome it was 24.9 cm in 2003 compared to 15.3 cm in 2004, for Sandberg's bluegrass it was 28.3 cm in 2003 compared to 14.3 cm in 2004, for needle and thread it was 37.3 cm in 2003 compared to 15.7 cm in 2004, for blue grama it was 19.7 cm in 2003 compared to 14.6 cm in 2004, for crested wheatgrass it was 41.5 cm in 2003 compared to 18.8 cm in 2004, and for green needlegrass it was 53.5 cm in 2003 compared to 18.8 cm in 2004. The average maximum height measured for each plot was 33.0 cm in 2003 compared to 10.2 cm in 2004.

Range sites

The sagebrush cover map (Map 2) shows an apparent belt of sagebrush that runs from the northwest corner of the SGA to the south central portion. Using ARCVIEW software and placing the sagebrush cover layer over a range site cover layer of the SGA, it appears most of the sagebrush is located in the shallow, shallow clay, grummit shallow clay and thin upland range sites (Map 4). We do not have the expertise to do an analysis of the data and relate it back to soils, but it is notable that most of the sagebrush occurs on the less productive soils.

Comparison of 1992 study

The results of the 2003 study compared to the 1992 study are very similar. Even though the categories used to classify the canopy coverage of sagebrush were different, the measured value for the canopy coverage of sagebrush within each category was similar

(Figure 3). For this reason it was decided to put the 1992 values into the 2003 classification categories and use a direct comparison.

The height of the sagebrush was greater in all categories in 2003 compared to 1992 (Figure 4). The canopy coverage of grasses (Figure 5) and forbs (Figure 6) were slightly higher in 1991 compared to 2003. The percent of the area in the different canopy coverage classifications are similar (Figure 7). Although no statistics have been completed on any of these variables, it is very doubtful that there are any significant differences between the two different studies. It appears the sagebrush community within the SGA has not change significantly in 11 years.

DISCUSSION

Annual habitat requirements for sage grouse have been partitioned into 3 categories breeding habitat, brood rearing habitat, and winter habitat. Table 11 summarizes the data collected and presents the optimum habitat characteristics for productive sagebrush habitat for the different sage grouse habitat categories (Connelly et al. 2000). A cursory look at the data indicates the SGA was lacking in amount of sagebrush that contains the optimum canopy coverage of sagebrush, canopy coverage of forbs, and droop height in 2004. The height of the sagebrush, canopy coverage of grasses and droop height of herbaceous vegetation in 2003 fell within the optimum values for productive sage grouse habitat.

In the 11-30% and greater than 30% categories, all of the optimum habitat values are met with the exception of percent canopy coverage of forbs and droop height of the grass-forb component in 2004. The problem is there is not enough of the area in these categories. Connelly et al (2000) states that a minimum of 80% of an area should meet these criteria in the breeding season and winter and a minimum of 40% of an area should meet these criteria during brood-rearing.

The optimum values for canopy coverage of sagebrush is 15-25% for breeding habitat, 10-25% for brood rearing habitat and 10-30% for winter habitat. Only 7% of the total area of the SGA was classified to have canopy coverage of sagebrush that is 10% or greater. If the 1-10% sagebrush cover category were added it would bring the total to 35% of the total area. This would bring the area close to providing enough habitat for brood rearing (40% of the total area) but still falls far below values required for breeding and winter habitat (80% of the total area). This points out the limiting factor for sage grouse productivity in the SGA is amount of sagebrush.

The SGA is located on the eastern edge of the dominant sagebrush communities. It is difficult to assess if the lack of sagebrush in the area is a result of management or if it is a natural occurring phenomena that occurs as sagebrush community melds into the adjoining grasslands community.

The optimum herbaceous cover for breeding habitat is greater than 25% and for brood rearing habitat is greater than 15%. The entire sage grouse management area meets these minimum with the exception of the shale areas (greasewood, sand sagebrush and silver sagebrush areas were not measured but it is reasonable to assume they will have greater than 25% herbaceous cover). The problem is there are not enough forbs in the SGA. Connelly et al. (2000) states that herbaceous cover should exceed 15% for perennial

grasses and 10% forbs in breeding or brood rearing habitat. The highest canopy coverage of forbs occurred on the shale area and was 3.27%. All the rest of the canopy coverage of forbs were less than that.

The optimum height of the herbaceous cover in breeding habitat is droop height that is greater than 18 cm (Connelly et al 2000). The droop height obtained in 2003 are considerably higher than the minimum value of 18 cm needed for productive sagebrush habitat (Connolly et al 2000) (Figure 2 & Table 10). The droop heights of herbaceous vegetation in the areas which meet the Connelly et al (2000) criteria as have sufficient sagebrush cover to be classified as productive sage grouse habitat (11-30% and >30% sagebrush canopy cover) are nearly twice as high (34.4 & 38.8 cm respectively) as the optimum value (18 cm). Considering that precipitation measured in Edgemont in 2003 was 1.38 inches below average (Figure 8), it would follow that plant production in 2003 was below average. It can be surmised that in years when the precipitation is at or above average the 18 cm value for droop height will be exceeded which should lead to adequate cover for nesting and brood rearing.

The cover values obtained in 2004 are lower than the minimum value 18 cm needed for productive sagebrush habitat (Figure 2 & Table 10). In 2004, the Edgemont rain gauge recorded 11.68 inches of precipitation, which is 4.39 inches below average (Figure 8). It is safe to assume that in years of low precipitation, the plant production will be low which is reflected in the low droop height measurements. This will affect sage grouse ability to hide their nests and raise their young.

There are some inherent problems with the data collected on this study when it is compared to the data presented in Connelly et al (2000). It is traditional to measure droop height in late May and early June, which coincides with hatching of the sage grouse Connelly et al (2003). Because of personnel limitations we chose to do this measurement in October. Comparing visual obstruction data collected using a Robel pole in the fall to data collected in the spring, there is a correlation of Spring VOR = (.47 X Fall VOR) + .93 (USFS unpublished data). The spring Robel data was collected at nest initiation which was early in the spring before green up. This could influence the data. All things considered, it appears that in years of at or above average precipitation there will be ample cover for breeding and early brood rearing activities.

Appendix A displays pictures of the plots taken in 2003 and 2004. The difference in cover between the two years is obvious. The real questions are: what are the proper stocking rates for the area, and what adjustments should be made in below average precipitation years? It will take some long term studies to determine this information.

WILDLIFE

METHODS:

Grouse leks

Grouse lek surveys for both sage grouse and sharp-tailed grouse were conducted in the spring during mating season when male grouse are actively displaying on the leks. The surveys started about ½ hour before sunrise and ended 2-3 hours after sunrise. The SGA was surveyed from a sports utility vehicle seeking out areas with good vantage points and looking and listening for birds. Care was taken to see all of the areas in the SGA. A parabolic microphone was used to listen for the characteristic sounds made by the males on the display grounds. Observation was aided by the use of 8X40 binoculars and a 45X60 spotting scope. When a lek was found the numbers of birds and activity level were recorded.

Also, known lek locations in the area were visited and the number of birds on each lek was recorded and activity level noted. If there were no birds in the lek area it was walked looking for sign of bird activity (scat, feathers, etc.).

Before 1991, there was one known sage grouse lek in the SGA that was visited periodically by various people, but to our knowledge no formal surveys were conducted. In 1991 & 1992 a cooperative sagebrush study between the South Dakota Game Fish and Parks and the Forest Service was completed and the area was searched methodically looking for additional leks. Starting in 1993 and continuing until 1998 the established lek sites located in the 1991 & 92 surveys were visited at least once a year. While driving between lek sites any grouse (sage or sharp-tailed) encountered were recorded but no attempt was made to do a systematic search of the area. In 1999 a thorough search of the SGA was once again conducted. From 2000-2002 the leks that were found in the 1999 surveys were visited at least once a year. In 2003 this study was initiated and complete surveys of the area were conducted in the spring of 2003, 2004, and 2005.

Results

Sage Grouse

Before 1991 there was an established sage grouse lek that was checked periodically by different individuals. This lek was located in the vicinity of 48GL002 (Map 5). Between 3 and 8 birds were observed on the lek at different times. A summary is presented in Table 12.

During the 1991-2, survey there were no birds found at or near lek site 48GL002. However, 17 sage grouse were observed at a lek site approximately ¾ of a mile to the north (this site is labeled 49GL004 on Map 5). One other sage grouse was seen displaying in 1991 (this site is labeled 48GL001 on Map 5).

Sage grouse numbers at lek 49GL004 reached a high of 17 in 1991 and varied between 14 and 2 until 2003 at which time 0 birds were observed (Table 13). In 2003 a total of four sage grouse hens were observed in the study area (not at lek) and one sage grouse dropping (not fresh) was found on the current sage grouse lek (49GL004 Map 5) on April 9. No males were seen. In 2004 no sage grouse were observed anywhere in the

study area during the courtship and nesting seasons. In 2005 one male was seen displaying. (48GL005 Map 5) .

Sharp-tailed grouse

No sharp-tailed grouse leks were located during the 1991-2 surveys. There was one bird that was believed to be a sage/sharp-tailed hybrid displaying on lek 49GL004 (Map 5) in 1991. In 1998, two sharp-tailed grouse leks were located in the SGA while doing the sage grouse lek surveys. In 1999, when the complete search was repeated, 7 leks were located, and a total of 43 birds were observed on these leks. In 2003, 9 leks were found, and a total of 52 sharp-tails were observed on the display grounds. In 2004, 5 leks were found, and a total of 25 sharp-tails were observed on the display grounds. In 2005, 4 leks were found, and a total of 22 sharp-tails were observed on the display grounds (Table 14) (Map 6).

DISCUSSION

Sage grouse

Sage grouse have been on the decline across their range for a considerable amount of time and the grouse population within the SGA seems to have followed the same trend. The highest number of sage grouse observed on any lek occurred in 1991 (49GL004 -17 sage grouse), which was the first year that a documented survey took place. In 2003 with the exception of a few incidental sightings, sage grouse had disappeared from the area.

It is impossible to determine the cause of the disappearance of sage grouse from the area. It could be management of the area or a natural occurrence. A Range Allotment Management Plan was written in May of 1991. Within this plan, there was a slight reduction in overall Animal Unit Months authorized for grazing (Approximately 650 AUM's or 4%). There were some season of use changes, turn out date changes, and livestock rotation changes. All of the changes were made with the objective of improving the overall health of the range and to bringing the area into compliance with the LRMP written in 1984. Comparing vegetation data collected in 1992 to data collected in 2003, the changes were slight, with the only difference that could have an impact on sage grouse population being the reduction in forbs. Considering that in both years the canopy coverage of forbs is below the optimum value it is doubtful that canopy cover of forbs is a major factor in the disappearance of sage grouse. One coinciding event that occurred in western South Dakota with the disappearance of sage grouse was an outbreak of the West Nile Virus, which has been known to affect sage grouse.

Sharp-tailed grouse

The SGA is marginal sharp-tailed grouse habitat. The optimal habitat in South Dakota lies in the central part of the state where the average annual precipitation is around 18 inches, which is about 2 inches more that in the SGA (16 inches) (Figure 8). A sharp-tailed grouse nesting study conducted on the Fort Pierre National Grassland found the birds need a minimum of 1350 lbs / acre production to hide their nests (unpublished report). Sixty nine percent of the SGA is comprised of soils that are not capable of producing this much vegetation unless growing conditions are ideal (ample moisture

during the growing season) (USDA Soil Conservation Service & Forest Service 1980) (Table 15).

From 1984 -1989, 4 of the 5 years were below average precipitation (Figure 8) and most likely resulting in below average plant production. It would follow that sharp-tailed grouse numbers would be low and no sharp-tailed grouse were found on the SGA when thorough searches were conducted in 1991 & 1992. In the 1990's, in 7 out of 10 years, the SGA received above average precipitation. The average annual precipitation from 1990-1999 at the Edgemont rain gage was 17.76 (maximum for the period occurred in 1998 which was 24.28 inches and the minimum occurred in 1994 which was 12.19 inches) (Figure 8). We do not have production data on the area but the result of high moisture would be high vegetative production, which was beneficial to sharp-tailed grouse and resulted in significant population increases. The precipitation 2002 – 4 has been less than average, and we have started to see a decline in the sharp-tailed grouse numbers.

Sharp-tailed grouse did not just mysteriously appear in the SGA in 1998. Local people reported seeing sharp-tailed grouse regularly in their shelterbelts in the winter prior to 1998 and have seen them periodically on their pastures in the summer. It appears that sharp-tailed grouse have always lived in the area and are able to expand when favorable condition are present.

BIRD POINT COUNTS

Methods

Bird point counts were completed on all 72 of the established sagebrush plots in 2003 & 2004. Counts were conducted from 5:00 AM – 7:30 AM MDT from June 5 –June 19, 2003 and from June 8 – June 24, 2004. Counts were kept for birds observed at less than 50 meters and greater than 50 meters and for 3 minutes and 3 – 5 minutes periods. Those birds flying over were recorded separately. An attempt was made to only count birds observed in vegetation similar to the plot vegetation.

Results

In both 2003 & 2004 the western meadowlark was the most common bird detected on all of the different sagebrush canopy coverage types (Tables 16-19). In the less than 1% sagebrush canopy coverage type, the grasshopper sparrow was the next most common species, followed by the lark bunting and horned lark (Table 16). In the 1 – 10% sagebrush canopy coverage type, the lark bunting was the next most common species, followed by the grasshopper sparrow and Brewer's sparrow (Table 17). In the 10-30% sagebrush canopy coverage type, the lark bunting was the next most common species, followed by the Brewer's sparrow and grasshopper sparrow (Table 18). In the greater than 30% sagebrush canopy coverage type, the lark bunting was the next most common species followed by the Brewer's sparrow and brown-headed cowbird. (Table 19).

Discussion

The western meadowlark and the grasshopper sparrow numbers decrease as the sagebrush canopy increases, and the opposite is true for the Brewer's sparrow and the lark bunting (Figure 9).

There were more total birds observed in 2003 than 2004 (883 in 2003 compared to 601 in 2004). The notable difference was a decrease in grasshopper sparrow observations (86 in 2003 to 7 in 2004) and an increase in horned lark observations (4 in 2003 and 16 in 2004). Grasshopper sparrows prefer high cover grasslands and responded negatively to the lack of production caused by the low precipitation in 2004. The opposite is true for the horned lark.

MANAGEMENT RECOMMENDATIONS

Dominant factors that influence the sagebrush ecosystem that are relevant in the SGA include fire (prescribed & wild), brush control (includes applications of herbicides and mechanical), pesticides, invasive species (the most prevalent being cheatgrass/downy brome), energy development (coal, oil, and natural gas) and livestock grazing (includes infrastructure built to accommodate grazing).

Rather than repeat management recommendations that are listed in the 2001 LRMP, all of the references to the sagebrush habitat and sage grouse that are in the plan are listed in Appendix B. The appropriate references to the 2001 LRMP are provided at the end of each section.

Fire

In general, fire reduces the sagebrush, at least in the short term. Most sagebrush species are intolerant of fire and are killed, with the exception of threetip (*Artemisia tripartita*) and silver sagebrush, which are sprouters. Re-establishment of sagebrush on a site after fire requires available seed, appropriate conditions for germination and survival of a seedling. Recovery of sagebrush canopy cover to pre-burn levels may require 20 years or longer.

Fire may benefit sage grouse by enhancing nesting and brood-rearing habits and increase forb production. Considering that canopy coverage of sagebrush is most likely the limiting factor for sage grouse in the SGA, short-term benefits such as increased forb production may not balance the loss of sagebrush canopy required by sage grouse during the nesting season and winter.

Wildfire in the SGA should be suppressed as soon as possible, and prescribed burning for managing sage grouse habitat should be used cautiously and on a site-by-site basis if at all.

2001 LRMP Reference-Chapter 2-page 38 (Appendix B).

Brush control

Brush control methods, both mechanical and the application of herbicide, have been used widely to eliminate sagebrush across the sagebrush ecosystem. Within the SGA, there are definite strips on the ground where there is a conspicuous absence of sagebrush and it is obvious that some type of control has been applied. After some research, it was discovered that these areas had been sprayed with chemical herbicide with the objective of eliminating sagebrush to increase grass production. The actual spraying records cannot be found, so it is not possible to document the exact dates, locations, or chemicals used. Conversations with landowners have verified the spraying, and there are photographs of a helicopter with the spraying units attached in the Forest Service files.

Connelly et al (2002) states the effects of spraying seemed more severe if the treated area was subsequently seeded to crested wheatgrass. There are several areas in the SGA that have been reseeded to crested wheatgrass.

Taking into account that canopy coverage and density of sagebrush is most likely the limiting factor for sage grouse in the SGA, no chemical herbicide should be applied to the area with the objective of eliminating sagebrush, and care should be taken by spray crews that are attempting to kill noxious weeds to avoid killing sagebrush.

Mechanical control is applied to areas in which the brush has become too thick. There are only 223 acres of sagebrush within the SGA that hve a canopy coverage over 30%. The average canopy coverage of these areas is 32.7%, which is a few percentage points over the optimum value for winter sage grouse habitat (30%). No mechanical control of sagebrush will be needed in the SGA.

2001 LRMP Reference-Chapter 2-page 2-38 (Appendix B).

Pesticides

Application of pesticides, often for grasshopper (Orthoptera) control, may affect sage grouse by decreasing available prey (Rowland 2004). Sage grouse chicks require insects for survival during the first few weeks of life, and the quantity of insects available is related to both survival and growth of chicks. Pesticides also poison birds through ingestion of contaminated insects or plant materials treated as bait. Spraying of herbicides not only eliminates large blocks of sagebrush, leading to increased habitat fragmentation, but also may poison insects and other invertebrates eaten by sage grouse. Application of herbicides or pesticides in sage grouse habitats, particularly during nesting or brood-rearing periods, should be avoided.

Invasive species

An invasive species is defined as a species that is non-native to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health. Although other invasive species occur in the SGA (e g Canadian thistle) cheatgrass/downy brome posses the greatest threat within the sagebrush community. Cheatgrass/downy brome readily out-competes native plant species for water and nutrients (Connelly et al, 2004). The density and structure of standing dead cheatgrass/downy brome results in increased flammability when compared to native species and leads to increased fire intensity and frequency.

Cheatgrass/downy brome is abundant on the SGA. It varied from a 1% canopy coverage and 8% frequency of occurrence in the 1-10% sagebrush canopy category to 11% canopy coverage and 49% frequency of occurrence in the greater than 30% sagebrush canopy category.

Connelly et al. (2004) sites Billings who states that it is not possible to remove or control cheatgrass/downy brome once it dominates a sagebrush community. At the present time the only way to attempt to keep cheatgrass/downy brome under control is through sound livestock management.

Energy development and construction.

Resource extraction for energy development has been widespread throughout sagebrush-steppe habitats. Negative impacts on sage grouse populations could occur as a result of the construction of refineries, pumping stations, and other facilities associated with mineral development (Rowland 2004).

Currently there is one producing oil well within the SGA. There are standards in the Revised LRMP that apply to construction projects, and oil and natural exploration and production.

2001 LRMP Reference-Chapter 2-page 2-38 (Appendix B).

2001 LRMP Reference-Appendix D page D-9 & d-16 (Appendix B).

Livestock grazing.

Grazing by livestock has occurred over virtually the entire range of sage grouse and its influence on sage grouse habitat is perhaps the most pervasive of any land management practice (Rowland 2004). Before European man arrived on the continent, in northern, eastern, and more mesic regions of the sagebrush biome grazing by buffalo was the primary agent disturbance. This makes this area more compatible with livestock grazing than other areas in the sagebrush biome. However, introduction of domestic livestock by European man did increase, at the least, the frequency of grazing.

Grazing and its effects on the density and canopy of sagebrush is controversial, and there is little direct experimental evidence linking grazing practices to sage grouse population levels (Connelly et al 2004). However, grass height and cover affect sage grouse nest site selection and success. Thus, indirect evidence suggests grazing by livestock or wild herbivores that significantly reduce the herbaceous understory in breeding habitat may have negative impacts on sage grouse populations (Connelly et al 2000). Improper grazing can also facilitate invasions by exotic plants species (Connelly et al 2004).

All of the units within the SGA are permitted for grazing. A map of the individual allotments and pastures is displayed on Map 7. An Allotment Management plan was prepared in 1991 (on file at the Fall River Ranger District) which brought the area into compliance with the 1984 LRMP. Specific grazing plans for each allotment are contained in the plan, and actual use records are on file at the Fall River Ranger District. Appendix C lists all of the allotments and pastures in the SGA and the number of acres and percentage of the pasture in each sagebrush canopy cover category.

The revised LRMP set the criteria for which pastures sagebrush management should be emphasized:

Pastures will be managed for sage grouse/big sagebrush only if they contain 5% or more canopy cover of big sagebrush. **Guideline**

To determine the percent sagebrush in each pasture a weighted mean was calculated using the average sagebrush canopy cover value for each category and the number of acres present in each pasture in each category. Eleven pastures were identified (Map #8) (Appendix C).

A revised LRMP was signed in 2001 and a new Allotment Management Plan will be prepared.

The first objective in the management of the area has to be to increase or maintain the amount of sagebrush on the area.

2001 LRMP Reference-Chapter 1-page 1-7 (Appendix B).

2001 LRMP Reference-Chapter 2-Objectives-Composition-page 2-35 & 2-36 (Appendix B).

2001 LRMP Reference-Chapter 2-Standards and Guidelines-Vegetation page 2-37 (Appendix B).

2001 LRMP Reference-Chapter 2-Standards and Guidelines-Sage grouse page 2-39 (Appendix B).

2001 LRMP Reference-Appendix H-page H-5 & H-6 (Appendix B).

The second is objective to increase the amount of forb cover and herbaceous cover for nesting and brood rearing.

2001 LRMP Reference-Chapter 2-Objectives-Structure-page 2-36 (Appendix B).

2001 LRMP Reference-Chapter 2-Objectives-Rest-page 2-37 (Appendix B).

2001 LRMP Reference-Appendix H-page H-5 & H-6 (Appendix B).

An additional effect that livestock have on the landscape which can effect sage grouse is the infrastructure that is built to facilitate the animals. These include fences, water developments, feeders etc.

2001 LRMP Reference-Chapter 2-Standards and Guidelines-Infrastructure page 2-38 (Appendix B).

LITERATURE CITED

Connelly J. W., M. A. Schroeder, A. R. Sands, and C. E. Braun. 2000. Guidelines to Manage Sage Grouse Populations and their Habitats. Wildlife Society Bulletin 2000, 28(4): 967-985.

Connelly J. W., K. P. Reese, and M. A. Schroeder. 2003. Monitoring of Greater Sage-grouse Habitats and Populations. No. 979 of the College of Natual Resources Experiment Station, Colledge of Natuala resouses, University of Idaho, Moscow, ID 50 pp.

Connelly J. W., S. T. Knick, M. A. Schroeder, and S.J. Stiver. 2004. Conservation Assessment of Greater Sage-grouse and Sagebrush Habitat. Western Association of Fish and Wildlife Agencies. Unpublished Report. Cheyenne, Wyoming.

Rowland, M. M. 2004. Effects of management practices on grassland birds: Greater sage-grouse. Northern Prairie Wildlife Research Center, Jamestown, ND. Northern Prairie Wildlife Research Center Online. http://www.npwrc.usgs.gov/resource/literatr/grasbird/grsg/grsg.htm (Version 12AUG2004).

U.S. Forest Service 1984. Land and Resource Management Plan, Nebraska National Forest and Associated Units, Rocky Mountain Region.

U.S. Forest Service 2001. Land and Resource Management Plan, Nebraska National Forest and Associated Units, Rocky Mountain Region.

USDA Soil Conservation Service & Forest Service. 1980. Soil Survey of Fall River County, South Dakota. United States Department of Agriculture, Soil Conservation Service and Forest Service. 192 pp.

Tables.

Table 1. Characteristics of big sagebrush rangeland needed for productive sage grouse habitat (Connelly et al 2000).

	Breeding		**Brood-rearing**		**Winter**	
	Height(cm)	Canopy(%)	Height(cm)	Canopy(%)	Height(cm)	Canopy(%)
Mesic sites[a]						
Sagebrush	40-80	15-25	40-80	25-Oct	25-35 e	30-Oct
Grass-forb	>18 [c]	≥25 [d]	variable	>15	N/A	N/A
Arid sites [a]						
Sagebrush	30-80	15-25	40-80	25-Oct	25-35	30-Oct
Grass-forb	>18 [c]	≥15	variable	>15	N/A	N/A
Area [b]	>80		>40		>80	

[a] Mesic and arid sites should be defined on a local basis; annual precipitation, understory, and soils should be considered (The SGA is a mesic area)

[b] Percentage of seasonal habitat needed with indicated conditions.

[c] Measured as "droop height"; the highest naturally growing portion of the plant.

[d] Coverage should exceed 15% for perennial grasses and 10% for forbs; values should be substantially greater if most sagebrush has a growth form that provides little lateral growth.

[e] Values for height and canopy coverage are for shrubs exposed above the snow.

Table 2. Summary of big sagebrush canopy coverage in the sagebrush management area.

Sagebrush Density Classification	Acres	% of the area
<1 %	30,929	64.5
1-10%	9,979	20.8
11-30%	2,764	5.8
>30%	223	0.5
Shale Breaks 11-30%	222	0.5
Shale Breaks 1-10%	1,365	2.8
Silver sagebrush	141	0.3
Sand sagebrush	14	0.0
Greasewood	2,335	4.9
Grand Total	47,971	100.0

Table 3. Canopy coverage of plants in the less than 1 % big sagebrush category (9 areas sampled)

Common Name	Scientific Name	Average Cover	% Frequency
Total Coverage		85.38	100.00
Bare Ground		14.55	98.70
Litter		84.51	100.00
Total Herbaceous		65.54	99.81
Total Grass		63.72	99.81
Total Forb		2.14	42.59
Total Shrub *		0.68	
Shrubs			
Big sagebrush*	*Artemisia tridentata*	0.68	
Grasses and Grasslike			
Buffalograss	*Buchloe dactyloides*	29.71	60.37
Blue grama	*Bouteloua gracilis*	10.78	44.44
Downy brome(cheatgrass)	*Bromus tectorum*	10.58	32.41
Japanese brome	*Bromus japonicus*	6.22	68.70
Western wheatgrass	*Pascopyrum smithii*	4.53	75.56
Sandberg's bluegrass	*Poa secunda*	1.58	27.04
Needle and thread	*Hesperostipa comata*	0.45	10.74
Sixweeks fescue	*Vulpia octoflora*	0.44	27.22
Crested wheatgrass	*Agropyron cristatum*	0.35	8.89
Needleleaf sedge	*Carex duriuscula*	0.31	8.33
Threadleaf sedge	*Carex filifolia*	0.17	0.74
Red threeawn	*Aristida purpurpea*	0.09	2.22
Green needlegrass	*Nassella viridula*	0.05	3.89
Prairie Junegrass	*Koeleria macrantha*	0.01	0.37
Sand dropseed	*Sporobolus crytandrus*	0.00	0.19
Forbs			
Plains pricklypear	*Opuntia polyacantha*	1.05	10.37
Scarlet globemallow	*Sphaeralcea coccinea*	0.63	22.04
False pennyroyal	*Hedeoma hispida*	0.47	15.56
Fringed sagewort	*Artemisia frigida*	0.08	2.22
Prairie goldenpea	*Thermopsis rhombifolia*	0.05	1.30
Dandelion	*Taraxacum officinale*	0.03	3.15
Manyflower stickseed	*Hackelia floribunda*	0.02	1.67
Slimflower scurfpea	*Pediomelum tenuiflora*	0.01	0.56
Indianwheat	*Plantago patagonica*	0.01	2.04
Tall breadroot scurfpea	*Pediomelum cuspidata*	0.01	0.37
Wavyleaf thistle	*Cirsium undulatum*	0.00	0.19
Missouri pincushion	*Coryphantha missouriensis*	0.00	0.19
Rush skeletal plant	*Lygodesmia juncea*	0.00	0.56

Fragile pricklypear	*Opuntia fragilis*	0.00	0.56
Rock jasmine	*Androsace septentrionalis*	0.00	0.37
Salsify	*Tragopogon dubius*	0.00	0.37
Horseweed	*Conyza canadensis*	0.00	0.19
Scarlet gaura	*Gaura coccinea*	0.00	0.19
Stiffstem flax	*Linum rigidum*	0.00	0.19

* Cover was measured using Line Intercept

Table 4. Canopy coverage of plants in the 1-10 % big sagebrush category (23 areas sampled).

Common Name	Scientific Name	Average Cover	% Frequency
Total Coverage		78.52	100.00
Bare Ground		21.06	99.93
Litter		77.93	100.00
Total Herbaceous		50.38	99.93
Total Grass		48.25	99.64
Total Forb		2.32	52.61
Total Shrub *		5.60	
Shrubs			
Big sagebrush*	*Artemisia tridentata*	5.60	
Grasses and Grasslike			
Buffalograss	*Buchloe dactyloides*	18.40	33.99
Blue grama	*Bouteloua gracilis*	9.09	48.04
Threadleaf sedge	*Carex filifolia*	4.67	24.57
Western wheatgrass	*Pascopyrum smithii*	3.23	59.13
Japanese brome	*Bromus japonicus*	2.94	56.38
Needle and thread	*Hesperostipa comata*	2.31	29.64
Crested wheatgrass	*Agropyron cristatum*	1.07	4.93
Sandberg's bluegrass	*Poa secunda*	1.04	28.12
Green needlegrass	*Nassella viridula*	0.83	11.88
Red threeawn	*Aristida purpurpea*	0.81	8.26
Sideoats grama	*Bouteloua curtipendula*	0.60	2.90
Downy brome(cheatgrass)	*Bromus tectorum*	0.47	8.26
Prairie Junegrass	*Koeleria macrantha*	0.23	6.30
Sixweeks fescue	*Vulpia octoflora*	0.17	11.96
Needleleaf sedge	*Carex duriuscula*	0.11	5.14
Squirreltail	*Elymus elymoides*	0.06	0.72
Inland saltgrass	*Distichlis spicata*	0.04	3.91
Alkali sacaton	*Sporobolus airoides*	0.04	0.72
Indian ricegrass	*Achnatherum hymenoides*	0.02	0.22
Sand dropseed	*Sporobolus crytandrus*	0.02	0.43
Little barley	*Hordeum pusillum*	0.01	0.43
Tumblegrass	*Schedonnardus paniculatus*	0.00	0.07
Bluebunch wheatgrass	*Pseudoroegneria spicata*	0.00	0.07

Forbs			
Fringed sagewort	*Artemisia frigida*	0.55	5.72
Plains pricklypear	*Opuntia polyacantha*	0.49	7.03
False pennyroyal	*Hedeoma hispida*	0.37	19.20
Scarlet globemallow	*Sphaeralcea coccinea*	0.31	14.20
Indianwheat	*Plantago patagonica*	0.15	7.25
Hood's phlox	*Phlox hoodii*	0.12	5.87
Broom snakeweed	*Gutierrezia sarothrae*	0.10	3.12
Dwarf alyssum	*Alyssum desertorum*	0.06	4.13
Heath aster	*Symphiotrichum ericoides*	0.05	2.25
Stiffstem flax	*Linum rigidum*	0.05	5.00
Tufted milkvetch	*Astragalus spatulatus*	0.03	0.14
Stemless hymenoxys	*Hymenoxys acaulis*	0.03	0.80
American vetch	*Vicia americana*	0.03	2.03
Salsify	*Tragopogon dubius*	0.02	0.87
Dotted gayfeather	*Liatris punctata*	0.01	0.29
Lacy tansyaster	*Machaeranthera pinnatifida*	0.01	0.22
Dandelion	*Taraxacum officinale*	0.01	0.43
Missouri pincushion	*Coryphantha missouriensis*	0.01	0.36
Littleleaf eriogonum	*Eriogonum pauciflorum*	0.01	0.36
Curlycup gumweed	*Grindelia squarrosa*	0.01	0.51
Creamy poison vetch	*Astragalus racemosus*	0.01	0.22
Fineleaf hymenopappus	*Hymenopappus filifolius*	0.01	0.22
Missouri milkvetch	*Astragalus missouriensis*	0.00	0.14
Bastard toadflax	*Commandra umbellata*	0.00	0.43
Rock jasmine	*Androsace septentrionalis*	0.00	0.29
Slimflower scurfpea	*Pediomelum tenuiflora*	0.00	0.29
Fleabane	*Erigeron pumilus*	0.00	0.22
Meadow death camas	*Zigadenus venenosus*	0.00	0.22
Scarlet gaura	*Gaura coccinea*	0.00	0.22
Horseweed	*Conyza canadensis*	0.00	0.14
Hoary tansyaster	*Machaeranthera canescens*	0.00	0.07
silverleaf scurfpea	*Pediomelum argophylla*	0.00	0.29
Tall breadroot scurfpea	*Pediomelum cuspidata*	0.00	0.22
Hairy goldaster	*Heterotheca villosa*	0.00	0.14
Wavyleaf thistle	*Cirsium undulatum*	0.00	0.07
Purple prairie clover	*Dalea purpurea*	0.00	0.07
Winged four o'clock	*Mirabilis alipes*	0.00	0.07
Leafy wildparsley	*Musineon divaricatum*	0.00	0.07
Fragile pricklypear	*Opuntia fragilis*	0.00	0.07

* Cover was measured using Line Intercept

Table 5. Canopy coverage of plants in the 11-30 % big sagebrush category (28 areas sampled).

Common Name	Scientific Name	Average Cover	% Frequency
Total Coverage		73.34	99.35
Bare Ground		26.54	100.00
Litter		71.46	99.23
Total Herbaceous		41.66	98.69
Total Grass		40.24	98.45
Total Forb		1.39	39.11
Total Shrub *		18.33	0.00
Shrubs			
Big sagebrush *	*Artemisia tridentata*	17.96	0.00
Rubber rabbitbrush *	*Ericameria nauseosa*	0.38	0.00
Grasses and Grasslike			
Downy brome(cheatgrass)	*Bromus tectorum*	8.38	24.88
Blue grama	*Bouteloua gracilis*	8.05	39.17
Buffalograss	*Buchloe dactyloides*	7.13	16.13
Japanese brome	*Bromus japonicus*	3.20	52.74
Threadleaf sedge	*Carex filifolia*	3.06	19.64
Sun sedge	*Carex inops*	1.88	5.77
Western wheatgrass	*Pascopyrum smithii*	1.88	45.77
Needle and thread	*Hesperostipa comata*	1.47	26.31
Sandberg's bluegrass	*Poa secunda*	1.13	30.24
Red threeawn	*Aristida purpurpea*	0.74	6.07
Crested wheatgrass	*Agropyron cristatum*	0.68	4.52
Green needlegrass	*Nassella viridula*	0.47	11.67
Sixweeks fescue	*Vulpia octoflora*	0.38	12.20
Prairie Junegrass	*Koeleria macrantha*	0.32	6.07
Needleleaf sedge	*Carex duriuscula*	0.10	3.51
Sand dropseed	*Sporobolus crytandrus*	0.09	2.44
Little bluestem	*Schizachyrium scoparium*	0.04	0.48
Squirreltail	*Elymus elymoides*	0.03	1.67
Sideoats grama	*Bouteloua curtipendula*	0.01	0.18
Indian ricegrass	*Achnatherum hymenoides*	0.01	0.12
Prairie sandreed	*Calamovilfa longifolia*	0.00	0.48
Kentucky bluegrass	*Poa pratensis*	0.00	0.12
Forbs			
Plains pricklypear	*Opuntia polyacantha*	0.52	7.68
Fringed sagewort	*Artemisia frigida*	0.30	5.24
False pennyroyal	*Hedeoma hispida*	0.18	14.76
Scarlet globemallow	*Sphaeralcea coccinea*	0.13	6.79
Hood's phlox	*Phlox hoodii*	0.08	4.11
Indianwheat	*Plantago patagonica*	0.06	5.95

Slimflower scurfpea	*Pediomelum tenuiflora*	0.05	0.83
Heath aster	*Symphiotrichum ericoides*	0.04	0.77
Stiffstem flax	*Linum rigidum*	0.02	3.10
Littleleaf eriogonum	*Eriogonum pauciflorum*	0.02	0.24
Dwarf alyssum	*Alyssum desertorum*	0.02	2.56
Curlycup gumweed	*Grindelia squarrosa*	0.02	0.42
Winterfat	*Krashkinninikovia lanata*	0.01	0.12
prairie goldenpea	*Thermopsis rhombifolia*	0.01	0.65
American vetch	*Vicia americana*	0.01	0.95
Salsify	*Tragopogon dubius*	0.01	0.71
Creamy poison vetch	*Astragalus racemosus*	0.01	0.36
Dandelion	*Taraxacum officinale*	0.01	0.48
Scarlet gaura	*Gaura coccinea*	0.01	0.89
Drummond's milkvetch	*Astragalus drummondii*	0.00	0.18
Needleleaf sedge	*Carex duriuscula*	0.00	0.30
Horseweed	*Conyza canadensis*	0.00	0.48
Bastard toadflax	*Commandra umbellata*	0.00	0.18
Rush skeletal plant	*Lygodesmia juncea*	0.00	0.12
Hoary tansyaster	*Machaeranthera canescens*	0.00	0.24
Fragile pricklypear	*Opuntia fragilis*	0.00	0.36
Penstemon	*Penstemon spp.*	0.00	0.12
Small-leaf pussytoes	*Antennaria parvifolia*	0.00	0.06
Wavyleaf thistle	*Cirsium undulatum*	0.00	0.06
Stemless hymenoxys	*Hymenoxys acaulis*	0.00	0.24
Tall breadroot scurfpea	*Pediomelum cuspidata*	0.00	0.06
Foothill bladderpod	*Lesquerella ludoviciana*	0.00	0.24
Western wallflower	*Erysimum asperum*	0.00	0.12
False dandelion	*Agoseris glauca*	0.00	0.06
White sage	*Artemisia ludoviciana*	0.00	0.06
Downy paintbrush	*Castilleja sessiliflora*	0.00	0.06
Missouri pincushion	*Coryphantha missouriensis*	0.00	0.06
fleabane	*Erigeron pumilus*	0.00	0.06
Yellow sweetclover	*Melilotus officinale*	0.00	0.06
Missouri goldenrod	*Solidago missouriensis*	0.00	0.06

* Cover was measured using Line Intercept

Table 6. Canopy coverage of plants in the greater than 30 % big sagebrush category (7 areas sampled)

Common Name	Scientific Name	Average Cover	% Frequency
Total Coverage		80.82	100.00
Bare Ground		18.94	100.00
Litter		80.24	100.00
Total Herbaceous		33.75	100.00
Total Grass		32.30	100.00
Total Forb		1.60	40.00
Total Shrub *		32.74	
Shrubs			
Big sagebrush *	*Artemisia tridentata*	32.74	
Grasses and Grasslike			
Downy brome(cheatgrass)	*Bromus tectorum*	10.84	49.29
Japanese brome	*Bromus japonicus*	4.61	66.67
Threadleaf sedge	*Carex filifolia*	3.11	14.29
Needle and thread	*Hesperostipa comata*	2.54	43.33
Blue grama	*Bouteloua gracilis*	2.13	20.24
Sandberg's bluegrass	*Poa secunda*	2.12	37.38
Buffalograss	*Buchloe dactyloides*	2.08	5.95
Western wheatgrass	*Pascopyrum smithii*	1.61	30.24
Red threeawn	*Aristida purpurpea*	0.52	8.57
Green needlegrass	*Nassella viridula*	0.29	8.33
Crested wheatgrass	*Agropyron cristatum*	0.28	2.86
Sixweeks fescue	*Vulpia octoflora*	0.29	16.43
Prairie Junegrass	*Koeleria macrantha*	0.18	5.71
Squirreltail	*Elymus elymoides*	0.11	5.00
Sand dropseed	*Sporobolus crytandrus*	0.08	2.62
Forbs			
Plains pricklypear	*Opuntia polyacantha*	0.42	7.38
False pennyroyal	*Hedeoma hispida*	0.40	23.33
Fringed sagewort	*Artemisia frigida*	0.38	8.57
Small-leaf pussytoes	*Antennaria parvifolia*	0.14	0.95
Indianwheat	*Plantago patagonica*	0.09	5.71
Horseweed	*Conyza canadensis*	0.07	2.62
Scarlet globemallow	*Sphaeralcea coccinea*	0.08	6.43
Stiffstem flax	*Linum rigidum*	0.02	2.86
Dwarf alyssum	*Alyssum desertorum*	0.02	1.43
Scarlet gaura	*Gaura coccinea*	0.02	1.19
fleabane	*Erigeron pumilus*	0.01	0.71
Dandelion	*Taraxacum officinale*	0.01	0.48
Western marsh cudweed	*Gnaphalium palustre*	0.01	0.71
Slimflower scurfpea	*Pediomelum tenuiflora*	0.01	0.24

Lacy tansyaster	*Machaeranthera pinnatifida*	0.00	0.24
Yellow sweetclover	*Melilotus officinale*	0.00	0.24
Salsify	*Tragopogon dubius*	0.00	0.24
Smooth woodyaster	*Xylorhiza glabriuscula*	0.00	0.24
Meadow death camas	*Zigadenus venenosus*	0.00	0.24

* Cover was measured using Line Intercept

Table 7. Canopy coverage of plants in the 1-10 % shale breaks category (2 areas sampled).

Common Name	Scientific Name	Average Cover	% Frequency
Total Coverage		29.12	82.50
Bare Ground		70.29	100.00
Litter		14.73	74.17
Total Herbaceous		10.59	75.00
Total Grass		9.45	68.33
Total Forb		3.27	46.67
Total Shrub *		8.46	0.00
Shrubs			
Big sagebrush *	*Artemisia tridentata*	4.13	0.00
Rubber rabbitbrush *	*Ericameria nauseosa*	4.83	0.00
Grasses and Grasslike			
Western wheatgrass	*Pascopyrum smithii*	6.09	68.33
Red threeawn	*Aristida purpurpea*	0.46	2.50
Sandberg's bluegrass	*Poa secunda*	0.28	4.17
Japanese brome	*Bromus japonicus*	0.24	14.17
Green needlegrass	*Nassella viridula*	0.06	2.50
Foxtail barley	*Hordeum jubatum*	0.02	0.83
Sixweeks fescue	*Vulpia octoflora*	0.01	1.67
Indian ricegrass	*Achnatherum hymenoides*	0.00	0.83
Downy brome(cheatgrass)	*Bromus tectorum*	0.00	0.83
Forbs			
Littleleaf eriogonum	*Eriogonum pauciflorum*	2.13	17.50
American vetch	*Vicia americana*	0.77	27.50
Broom snakeweed	*Gutierrezia sarothrae*	0.17	3.33
Hood's phlox	*Phlox hoodii*	0.13	2.50
Prairie goldenpea	*Thermopsis rhombifolia*	0.09	7.50
Dwarf alyssum	*Alyssum desertorum*	0.05	10.83
Indianwheat	*Plantago patagonica*	0.02	4.17
Salsify	*Tragopogon dubius*	0.00	0.83

* Cover was measured using Line Intercept

Table 8. Canopy coverage of plants in the 11-30 % shale breaks category (3 areas sampled).

Common Name	Scientific Name	Average Cover	% Frequency
Total Coverage		33.42	91.67
Bare Ground		66.19	100.00
Litter		32.72	83.33
Total Herbaceous		9.74	82.78
Total Grass		9.23	79.44
Total Forb		0.82	30.00
Total Shrub *		16.37	0.00
Shrubs			
Big sagebrush *	*Artemisia tridentata*	12.70	0.00
Rubber rabbitbrush *	*Ericameria nauseosa*	3.67	0.00
Grasses and Grasslike			
Western wheatgrass	*Pascopyrum smithii*	7.47	81.11
Sandberg's bluegrass	*Poa secunda*	0.81	21.67
Japanese brome	*Bromus japonicus*	0.49	27.78
Green needlegrass	*Nassella viridula*	0.16	4.44
Indian ricegrass	*Achnatherum hymenoides*	0.09	1.11
Crested wheatgrass	*Agropyron cristatum*	0.02	1.67
Sixweeks fescue	*Vulpia octoflora*	0.02	1.67
Threadleaf sedge	*Carex filifolia*	0.02	1.11
Red threeawn	*Aristida purpurpea*	0.01	0.56
Downy brome(cheatgrass)	*Bromus tectorum*	0.01	1.11
Prairie Junegrass	*Koeleria macrantha*	0.00	0.00
Forbs			
Fragile pricklypear	*Opuntia fragilis*	0.17	1.11
prairie goldenpea	*Thermopsis rhombifolia*	0.14	7.22
Hood's phlox	*Phlox hoodii*	0.11	2.22
False pennyroyal	*Hedeoma hispida*	0.10	8.33
Littleleaf eriogonum	*Eriogonum pauciflorum*	0.08	0.56
Plains pricklypear	*Opuntia polyacantha*	0.07	3.33
Dwarf alyssum	*Alyssum desertorum*	0.05	7.78
Dandelion	*Taraxacum officinale*	0.03	1.67
American vetch	*Vicia americana*	0.02	1.67
Scarlet globemallow	*Sphaeralcea coccinea*	0.01	1.67
Salsify	*Tragopogon dubius*	0.01	1.11
Flixweed tansymustard	*Descuriania sophia*	0.00	0.56
Curlycup gumweed	*Grindelia squarrosa*	0.00	0.56
Stiffstem flax	*Linum rigidum*	0.00	0.56
Desert biscuitroot	*Lomatium foeniculaceum*	0.00	0.56

* Cover was measured using Line Intercept

Table 9. Height of big sagebrush in the different sagebrush canopy coverage classifications.

Sagebrush Density Classification	# of shrubs Measured	Average Height (cm)
<1 %	14	31.6
1-10%	223	39.3
11-30%	675	43.7
>30%	272	51.4
Shale Breaks 11-30%	59	40.9
Shale Breaks 1-10%	10	29.1
Silver sagebrush	No plots	
Sand sagebrush	No plots	
Greasewood	No plots	
Grand Total	1253	44.2

Table 10. Droop height of the dominant grasses in the different sagebrush canopy coverage classifications.

		< 1 % Sagebrush Cover Droop Ht (cm)		1 to 10 % Sagebrush Cover Droop Ht (cm)		11 to 30 % Sagebrush Cover Droop Ht (cm)		> 30 % Sagebrush Cover Droop Ht (cm)		Average Sagebrush Cover Droop Ht (cm)	
Common Name	Scientific Name	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
Western wheatgrass	*Pascopyrum smithii*	23.0	10.0	22.7	12.7	26.0	12.5	27.7	14.4	24.8	12.4
Japanese brome	*Bromus japonicus*	22.2	17.1	21.8	18.2	25.3	12.2	30.4	13.7	24.9	15.3
Sandberg's bluegrass	*Poa secunda*	23.2	10.2	26.0	11.2	30.3	14.5	33.7	21.2	28.3	14.3
Needle and thread	*Hesperostipa comata*	32.0	15.9	36.6	15.4	36.3	16.1	44.1	15.3	37.3	15.7
Blue grama	*Bouteloua gracilis*	21.7	11.2	18.2	16.5	20.2	15.1	18.7	15.6	19.7	14.6
Crested wheatgrass	*Agropyron cristatum*	35.2	18.4	33.1	20.1	44.6	18.7	53.0	18.1	41.5	18.8
Green needlegrass	*Nassella viridula*			48.5	19.1	56.2	21.7	55.9	15.7	53.5	18.8
Maximum Height		27.5	7.2	31.0	12.4	34.4	10.6	38.8	10.6	33.0	10.2

Table 11. Summary of the actual measurements obtained for the different habitat variable compare to the optimum values.

		Sagebrush		Grass-forb		Grass-forb	Grass	Forb	
	# of plots	Height (cm)	Canopy(%)	Droop Height (cm)		Canopy (%)	Canopy (%)	Canopy (%)	% of the area
				2003	2004				
<1 % Big Sagebrush Cover	9	31.6	0.7	27.5	7.2	65.5	63.7	2.1	64.5
1- 10 % Big Sagebrush Cover	23	39.3	5.6	31.0	12.4	50.4	48.2	2.3	20.8
11- 30 % Big Sagebrush Cover	28	43.7	18.3	34.4	10.7	41.7	40.2	1.4	5.8
>30 % Big Sagebrush Cover	7	51.4	32.7	38.8	10.6	33.7	32.3	1.6	0.5
Shale 1- 10 % Shrub Cover	2	29.1	4.1			10.6	9.5	3.3	2.8
Shale 11-30 % Shrub Cover	3	40.9	12.7			9.7	9.2	0.8	0.5
Optimum									
Mesic									
Breeding		40-80	15-25	>18	>18	≥25	≥15	≥10	>80
Brood-rearing		40-80	10-25	Variable	Variable	>15	N/A	N/A	>40
Winter		25-35	10-30	N/A	N/A	N/A	N/A	N/A	>80

Table 12. Previously Reported Observations of Sage Grouse Leks in SGA.

Date	No. of Males	Observer
4/25/1980	8	Richard C. Rosche
4/14/1984	8	Richard A. Peterson
4/15/1985	4	Richard A. Peterson
5/3/1986	6	Richard A. Peterson
4/11/1987	3	Richard A. Peterson

Table 13. Sage grouse leks in the SGA.

	YEAR														
Lek ID Number	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
48GL001		1													
48GL002*	0	0							0	0	0	0	0	0	0
48GL005															1
49GL001**	0	0											0	0	
49GL002**	0	0											0	0	
49GL004	17	8	4	2	6	10	10	11	14	11	4	4	0	0	0
Total # of Leks	1	2	1	1	1	1	1	1	1	1	1	1	0	0	1
Total # of Birds	17	9	4	2	6	10	10	11	14	11	4	4	0	0	1

* Sage grouse were reported displaying in this general location 1980-1987.

** These locations were given to the District by the local Game Warden (Owen Meadows) as possible display grounds. There are no records of birds being counted at these sights.

Table 14. Sharp-tailed grouse leks in the SGA.

	YEAR														
Lek ID Number	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
48GL001									6		3		0	0	0
48GL003								10	20	13	4	0	0	0	0
48GL004													3	0	0
49GL001	0	0											4	2	2
49GL005								6					7	9	0
49GL006									9	6	0	0	0	2	0
49GL007									3				0	0	0
49GL008										9		7	9	3	0
49GL009									3	8	4	7	0	0	0
49GL010									11	16	14	9	14	9	13
49GL011									17	9	8	6	0	0	3
49GL012													1	0	0
49GL013													2	0	0
49GL014													3	0	0
60GL004												11	12	0	4
Total # of Leks	0	0	0	0	0	0	0	2	7	6	5	5	9	5	4
Total # of Birds	0	0	0	0	0	0	0	6	43	48	26	40	52	25	22

Table 15. Summary of the range sites present in the SGA and their potential production.

Range Site	% of the area	Total potential production lbs/ acre *		
		Low	RV	High
High prodution				
Clayey Overflow	1	1900	2500	3100
Loamy terrace	2	1700	2500	3300
Closed Depression	0	1400	2200	4000
Silty	1	1200	1900	2400
Clayey	21	900	1800	2500
Sandy	7	1200	1800	2400
Total	31			
Low production				
Shallow Clay	11	100	1190	1510
Thin upland	36	870	1155	1900
Dense Clay	2	800	1105	1530
Thin Claypan	3	500	900	1200
Shallow	16	450	800	1100
Total	69			

*http://www.sd.nrcs.usda.gov/
This number is the potential production of the range site if it were in climax condition
RV = Representative value

Table 16. Birds observerd in the less than 1 % sagebrush category.

	2003		2004		Total	
Bird Species	Total Observed	Average # per plot	Total Observed	Average # per plot	Total Observed	Average # per plot
Western Meadowlark	68	7.6	47	5.2	115.0	6.4
Grasshopper Sparrow	18	2.0	2	0.2	20.0	1.1
Lark Bunting	7	0.8	12	1.3	19.0	1.1
Horned Lark	0	0.0	4	0.4	4.0	0.2
Brewer's Sparrow	2	0.2	0	0.0	2.0	0.1
Brown-headed Cowbird	2	0.2	0	0.0	2.0	0.1
Killdeer	0	0.0	1	0.1	1.0	0.1
Common Nighthawk	0	0.0	1	0.1	1.0	0.1
# of plots	9					

Table 17. Birds observerd in the 1 to 10% sagebrush cover category.

	2003		2004		Total	
	Total Observed	Average # per plot	Total Observed	Average # per plot	Total Observed	Average # per plot
Western Meadowlark	159	6.9	92	4.0	251	5.5
Lark Bunting	34	1.5	35	1.5	69	1.5
Grasshopper Sparrow	39	1.7	0	0.0	39	0.8
Brewer's Sparrow	11	0.5	16	0.7	27	0.6
Lark Sparrow	6	0.3	3	0.1	9	0.2
Vesper Sparrow	6	0.3	3	0.1	9	0.2
Horned Lark	3	0.1	6	0.3	9	0.2
Mourning Dove	2	0.1	6	0.3	8	0.2
Brown-headed Cowbird	3	0.1	4	0.2	7	0.2
Rock Wren	2	0.1	0	0.0	2	0.0
Red-winged Blackbird	0	0.0	2	0.1	2	0.0
Upland Sandpiper	0	0.0	1	0.0	1	0.0
Loggerhead Shrike	0	0.0	1	0.0	1	0.0

# of plots 23

Table 18. Birds observerd in the 11-30% sagebrush cover category.

	2003		2004		Total	
	Total Observed	Average # per plot	Total Observed	Average # per plot	Total Observed	Average # per plot
Western Meadowlark	181	6.5	122	4.4	303	5.4
Lark Bunting	85	3.0	57	2.0	142	2.5
Brewer's Sparrow	58	2.1	31	1.1	89	1.6
Grasshopper Sparrow	21	0.8	4	0.1	25	0.4
Vesper Sparrow	10	0.4	5	0.2	15	0.3
Brown-headed Cowbird	7	0.3	8	0.3	15	0.3
Lark Sparrow	2	0.1	7	0.3	9	0.2
Mourning Dove	3	0.1	5	0.2	8	0.1
Horned Lark	1	0.0	3	0.1	4	0.1
Killdeer	1	0.0	1	0.0	2	0.0
Upland Sandpiper	0	0.0	1	0.0	1	0.0
Northern Harrier	0	0.0	1	0.0	1	0.0
Long-billed Curlew	0	0.0	1	0.0	1	0.0

# of plots 28

Table 19. Birds observerd in the greater than 30% sagebrush cover category.

	2003		2004		Total	
	Total Observed	Average # per plot	Total Observed	Average # per plot	Total Observed	Average # per plot
Western Meadowlark	49	7.0	27	3.9	76	5.4
Lark Bunting	17	2.4	25	3.6	42	3.0
Brewer's Sparrow	22	3.1	14	2	36	2.6
Brown-headed Cowbird	1	0.1	13	1.9	14	1.0
Grasshopper Sparrow	8	1.1	1	0.1	9	0.6
Vesper Sparrow	2	0.3	2	0.3	4	0.3
Mourning Dove	2	0.3	0	0.0	2	0.1
# of plots	7					

FIGURES

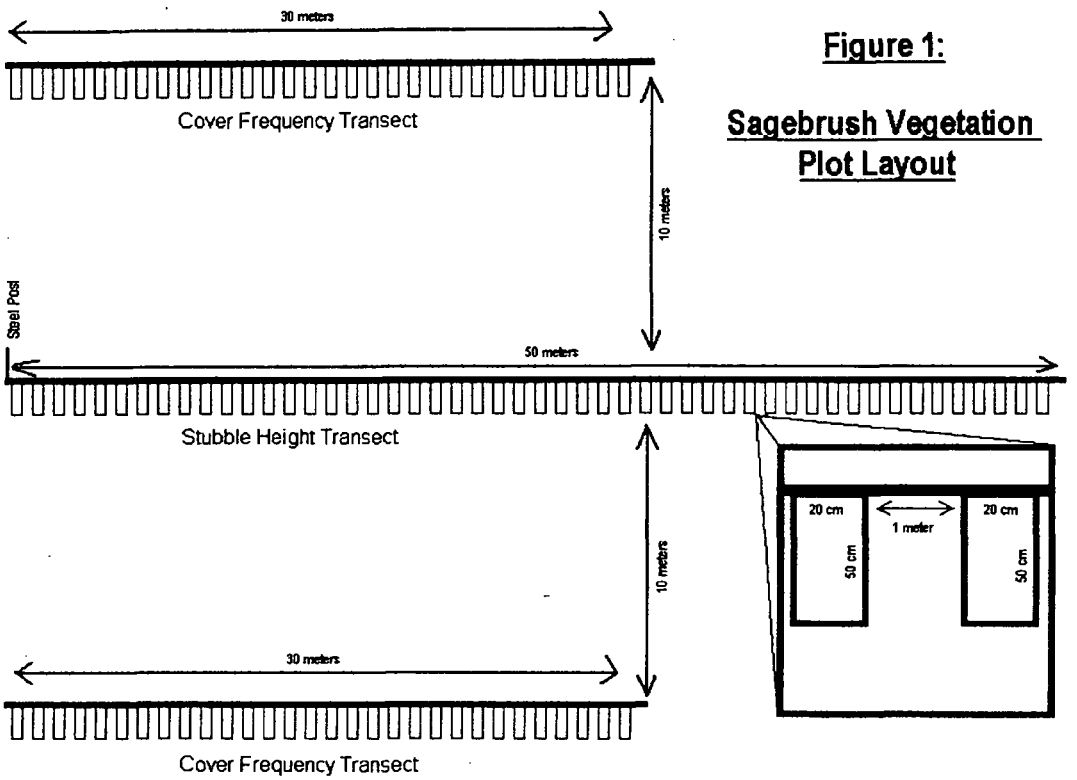


Figure 1:

Sagebrush Vegetation Plot Layout

Figure 2. Maximum Average Droop Ht of Vegetation within the Sagebrush Plots

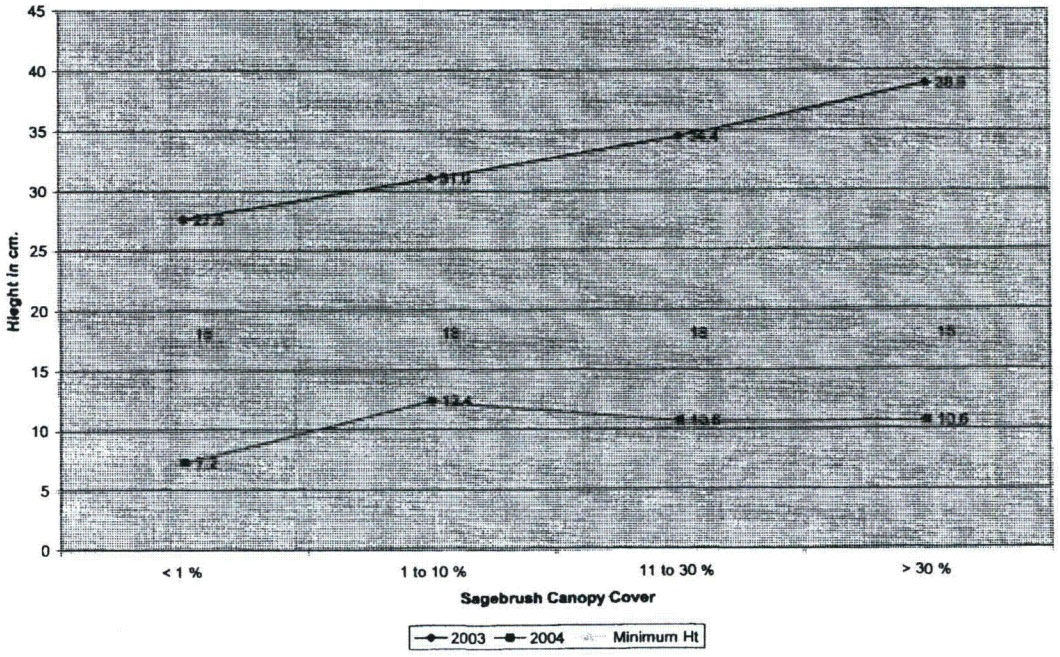


Figure 3. Comparison of Sagebrush Canopy Cover Between 1992 & 2003

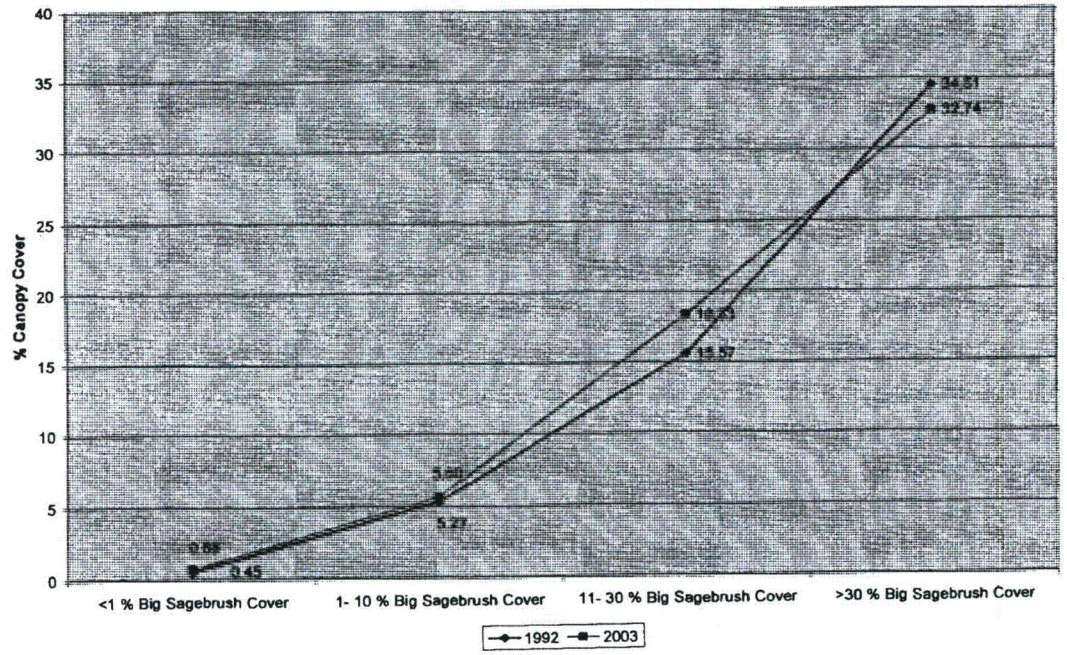


Figure 4. Comparison of Sagebrush Height Between 1992 & 2003

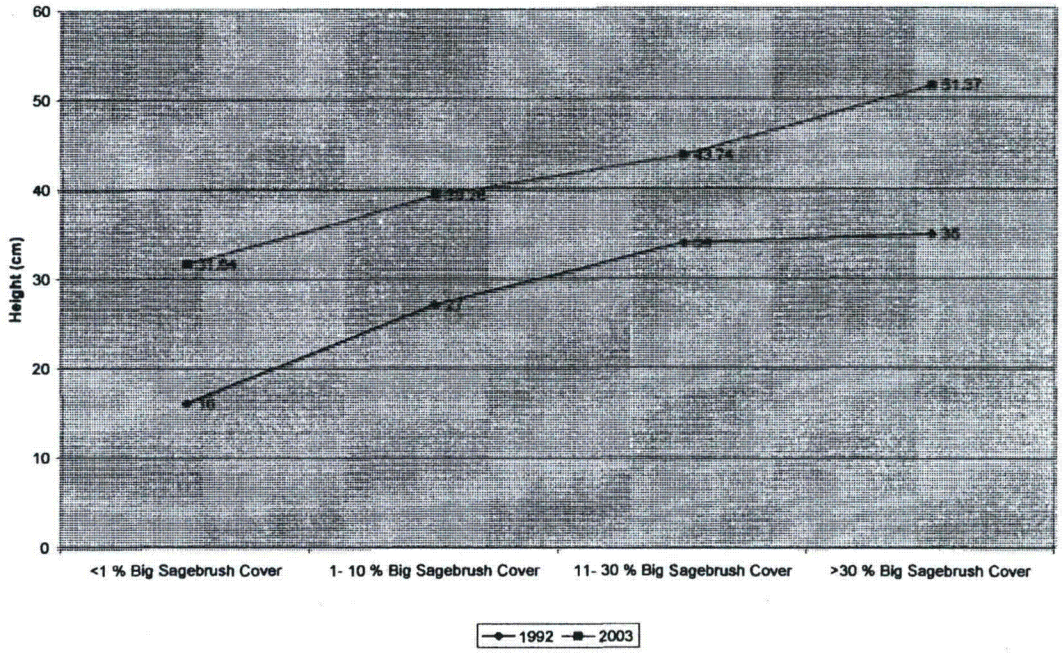


Figure 5. Comparison of Percent Canopy Cover of Grasses Between 1992 & 2003

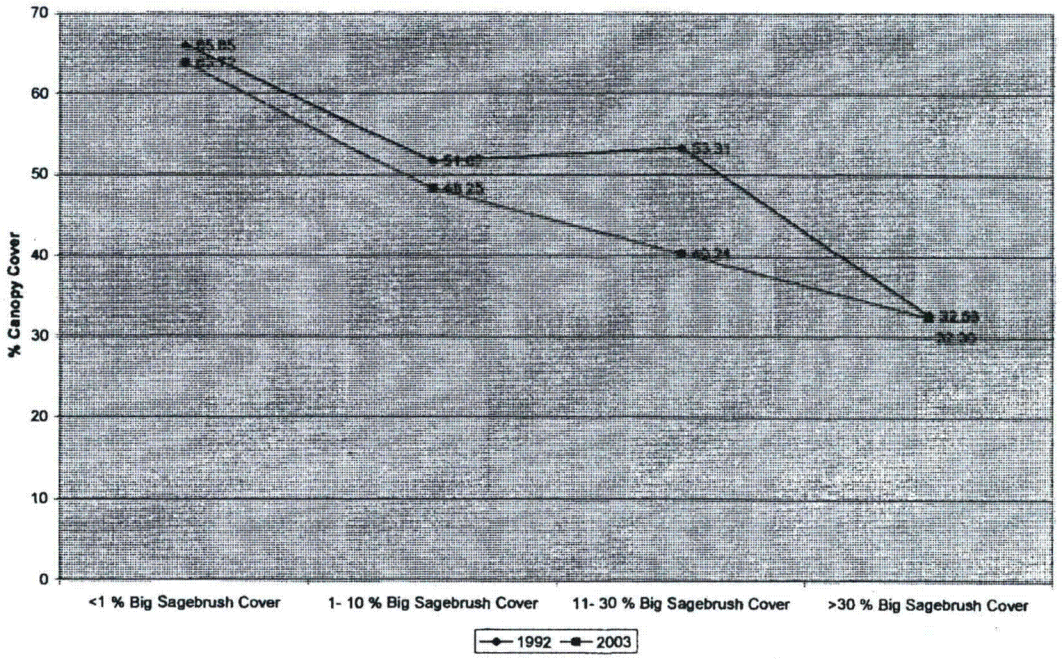


Figure 6. Comparison of Percent Canopy Cover of Forbs Between 1992 & 2003

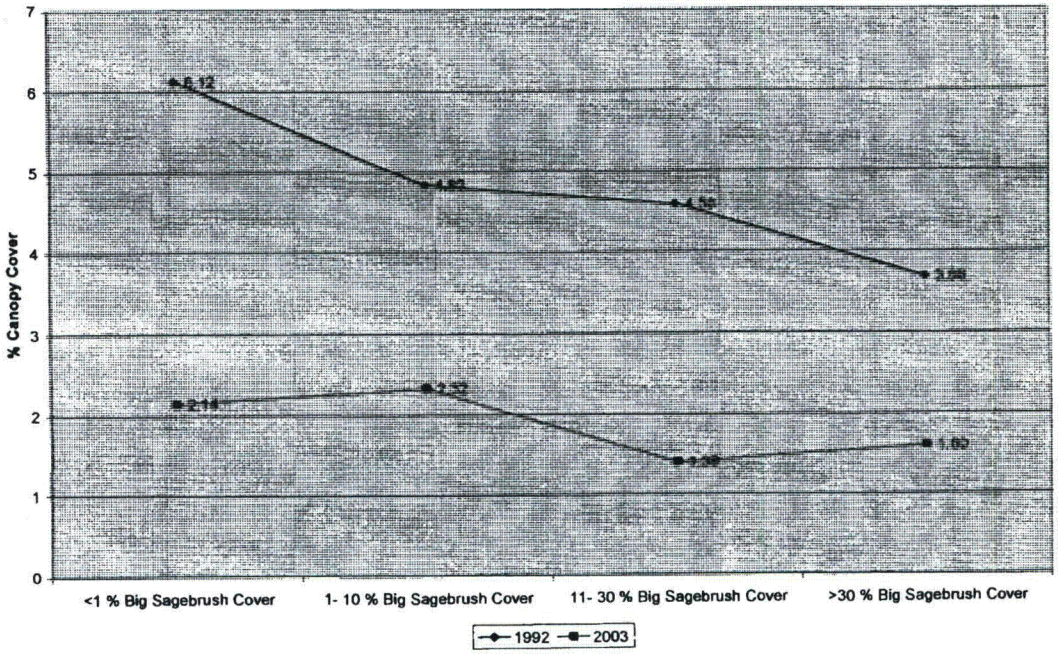


Figure 7. Comparison of the Percent of the Area in the Different Sagebrush Canopy Cover Classifications Between 1992 & 2003

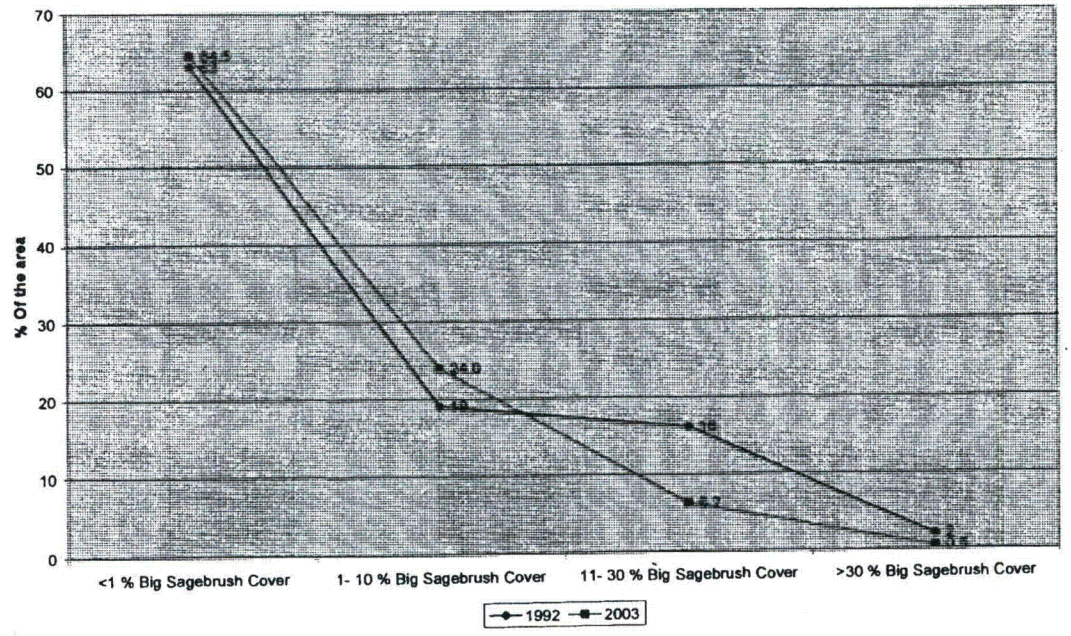


Figure 8. Precipitation Measured at the Edgemont Rain Gauge (High Plains Regional Climate Center)

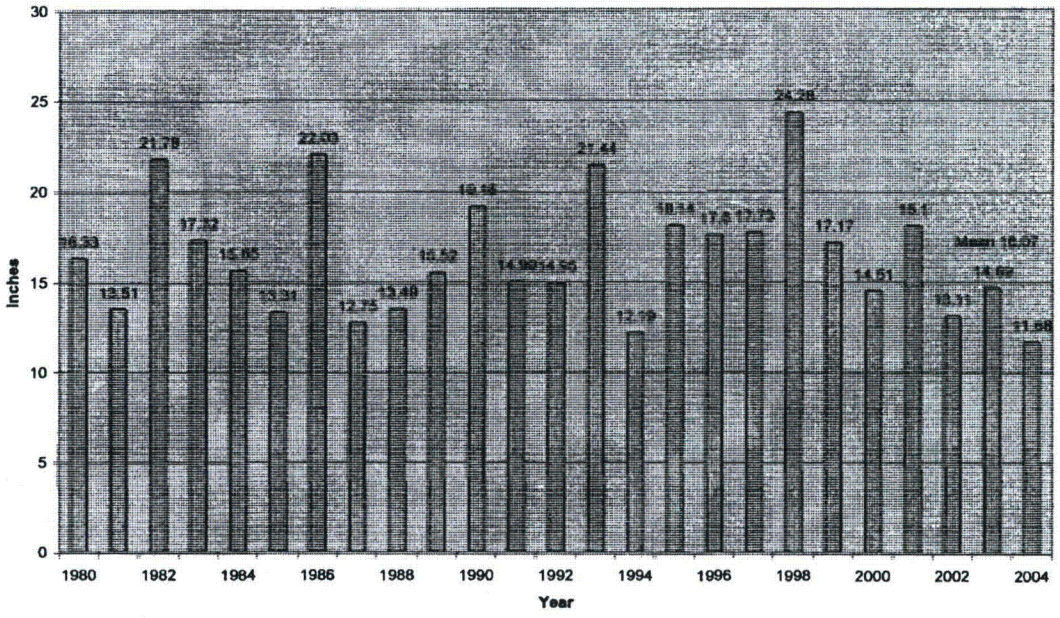
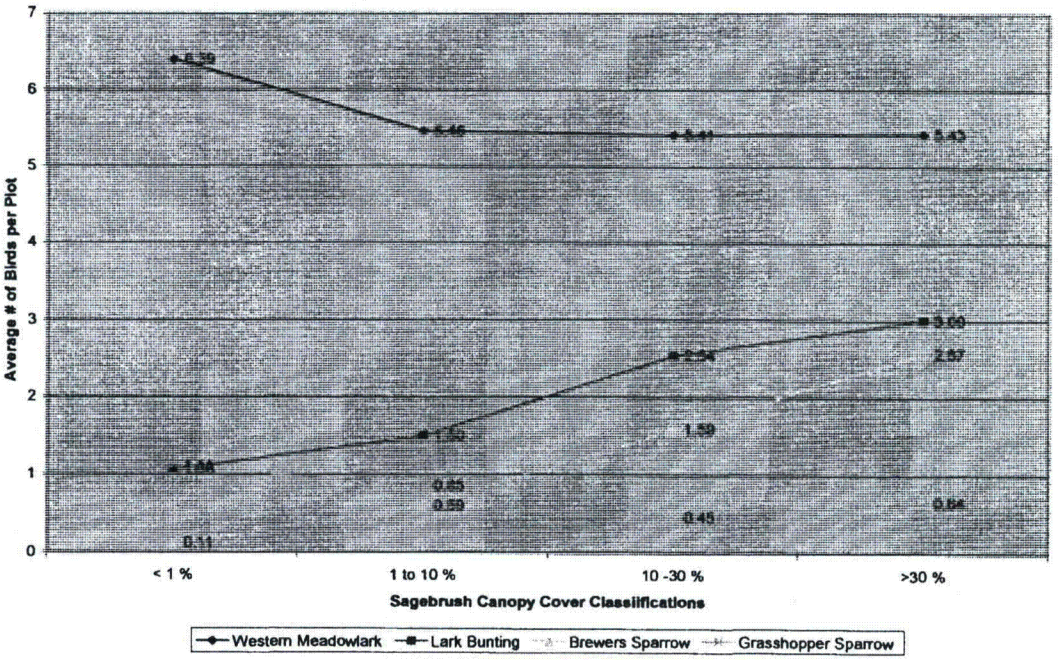
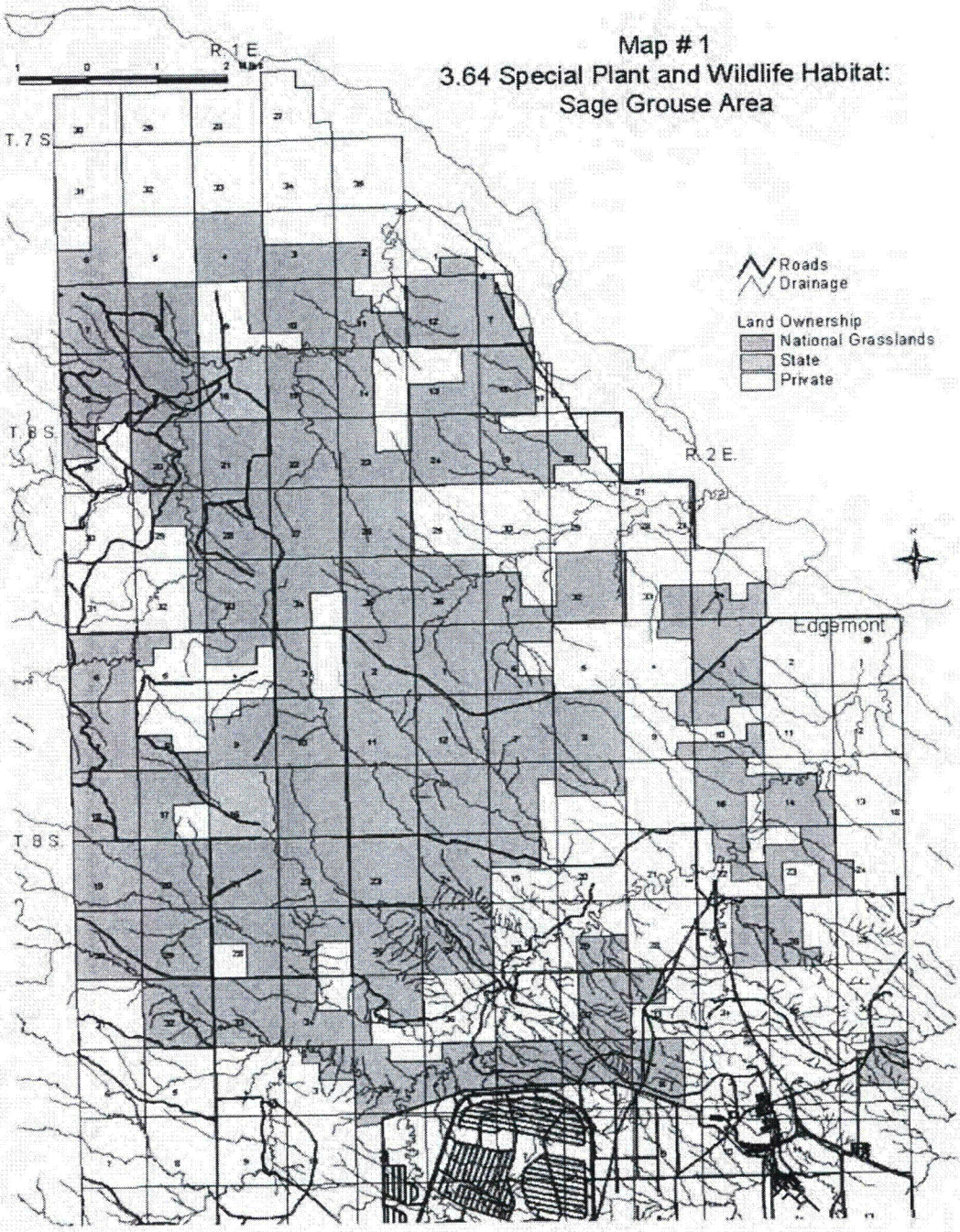
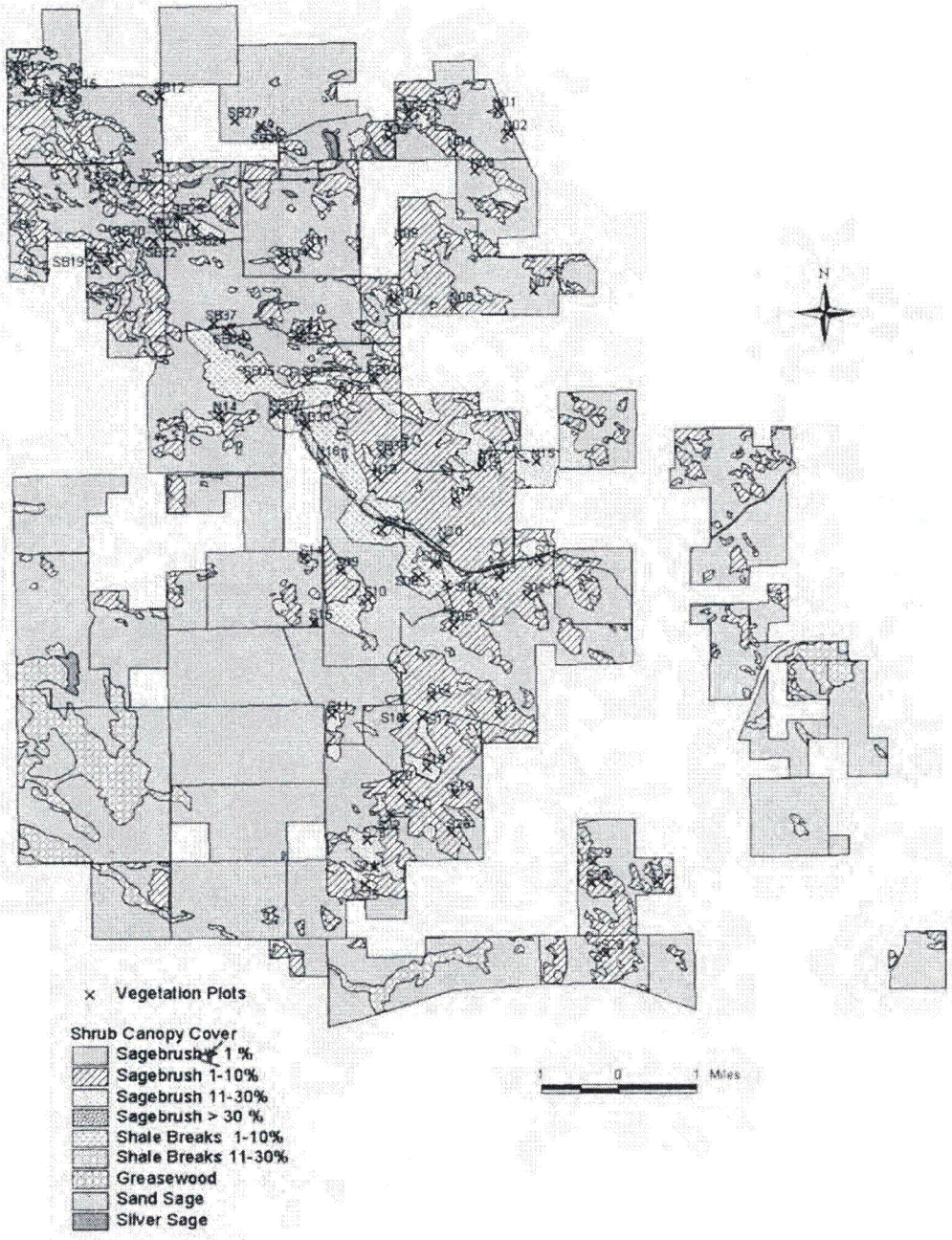


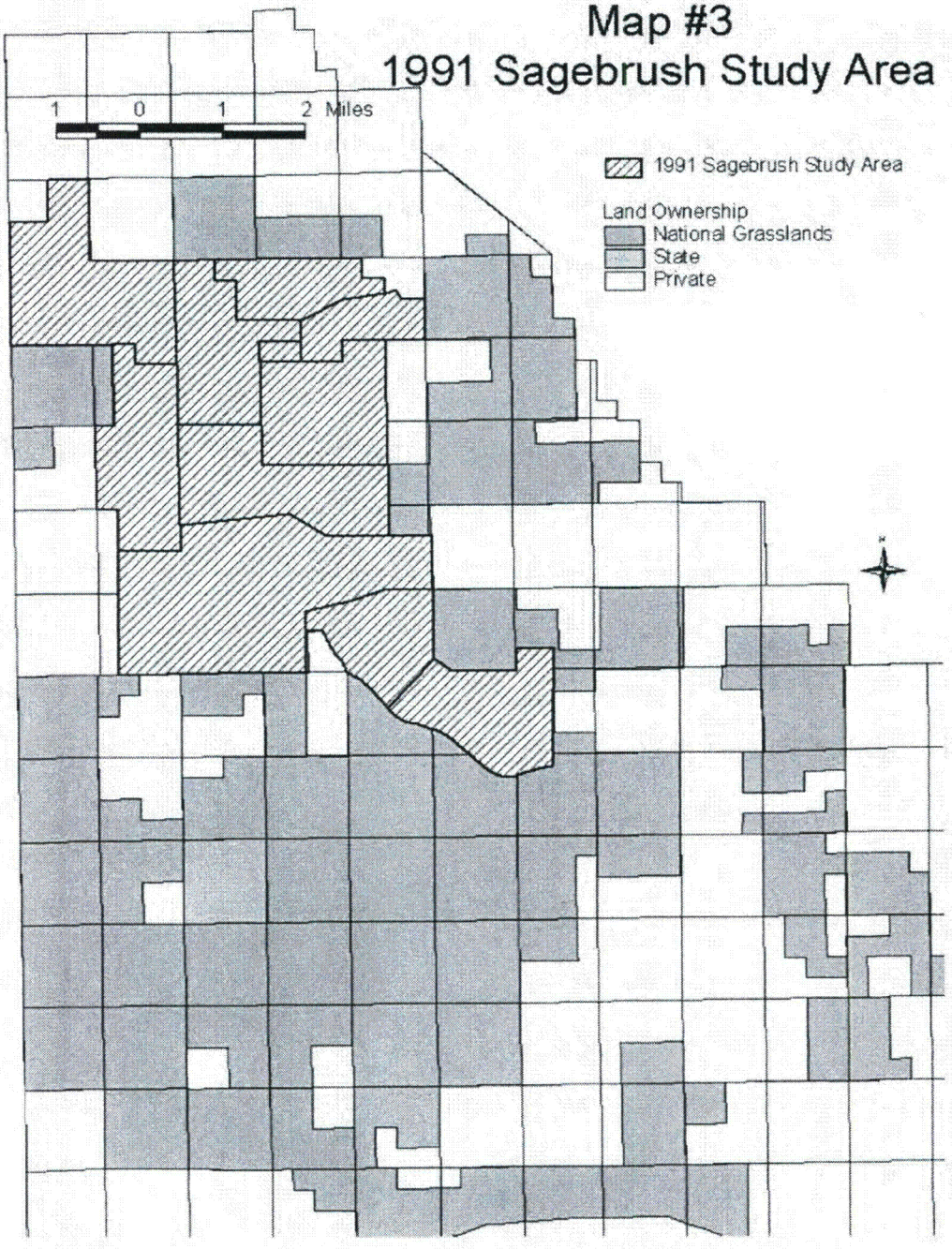
Figure 9. Sagebrush bird summary (2003 and 2004 combined)



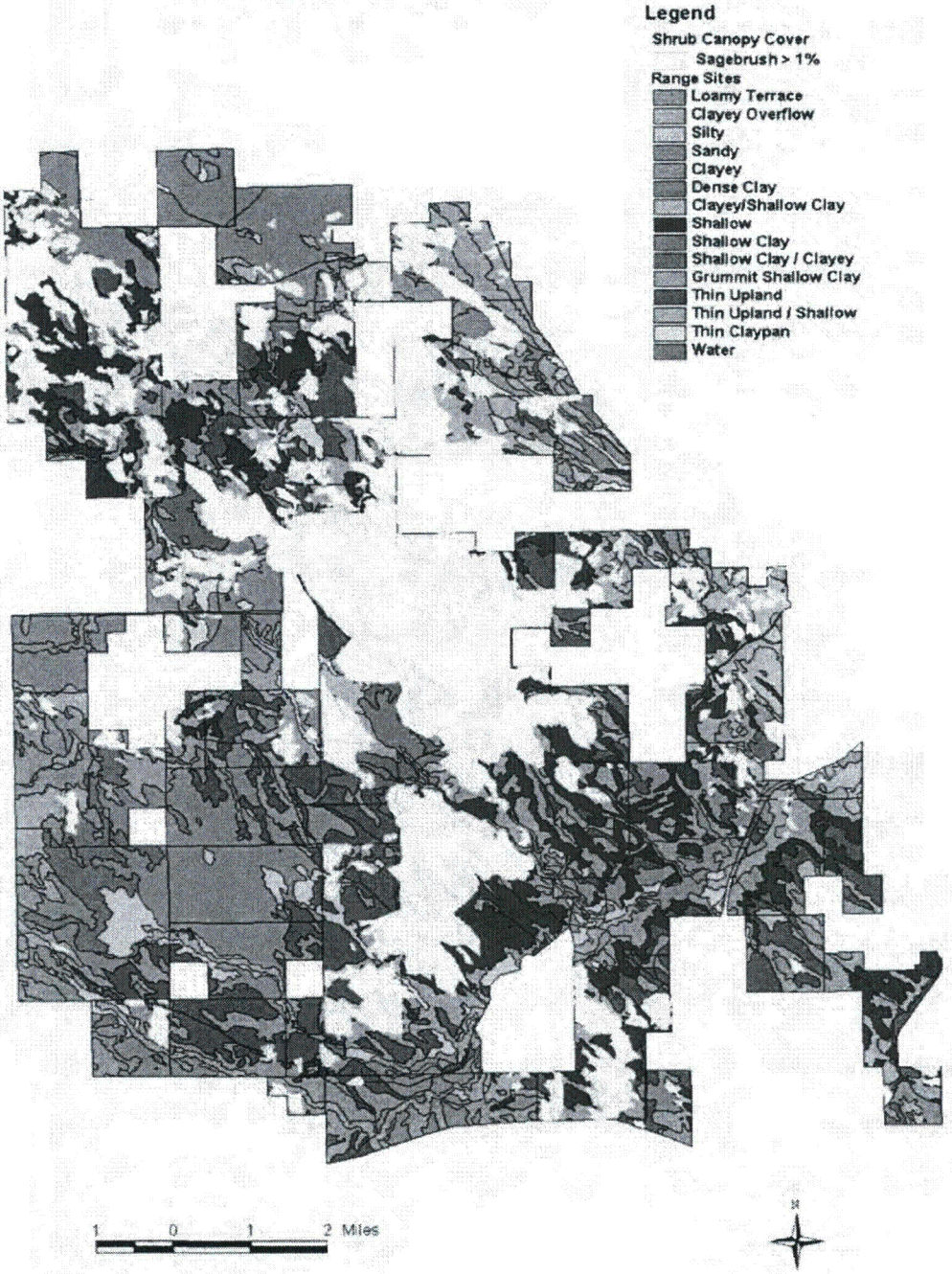

Map # 1
3.64 Special Plant and Wildlife Habitat:
Sage Grouse Area
R. 1 E.
T. 7 S.
T. 8 S.
R. 2 E.
Roads
Drainage
Land Ownership
National Grasslands
State
Private
Edgemont
T 8 S.

Map # 2
Sagebrush Management Area
Shrub Canopy Coverage

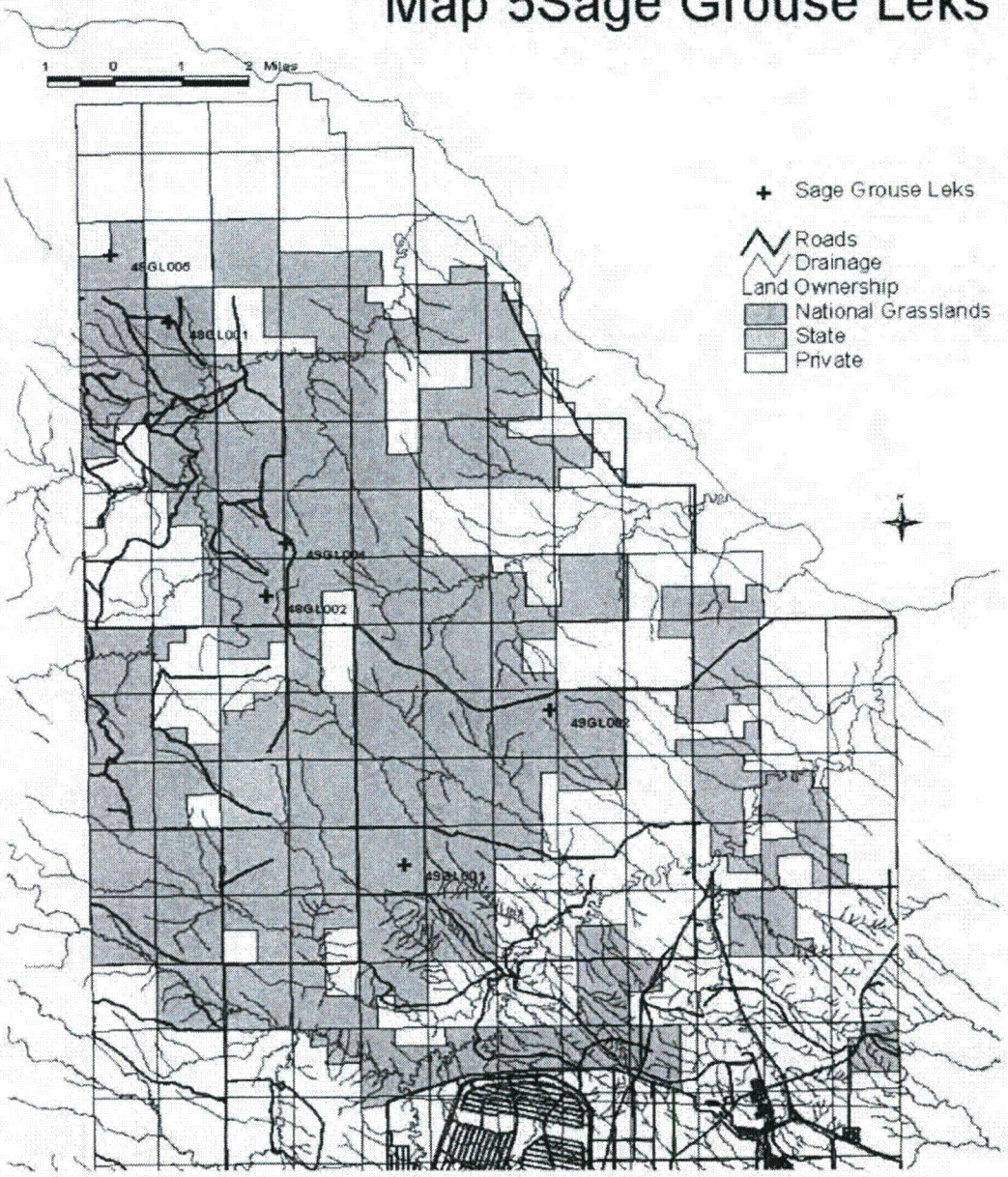



Map #3
1991 Sagebrush Study Area
1 0 1 2 Miles
1991 Sagebrush Study Area
Land Ownership
National Grasslands
State
Private

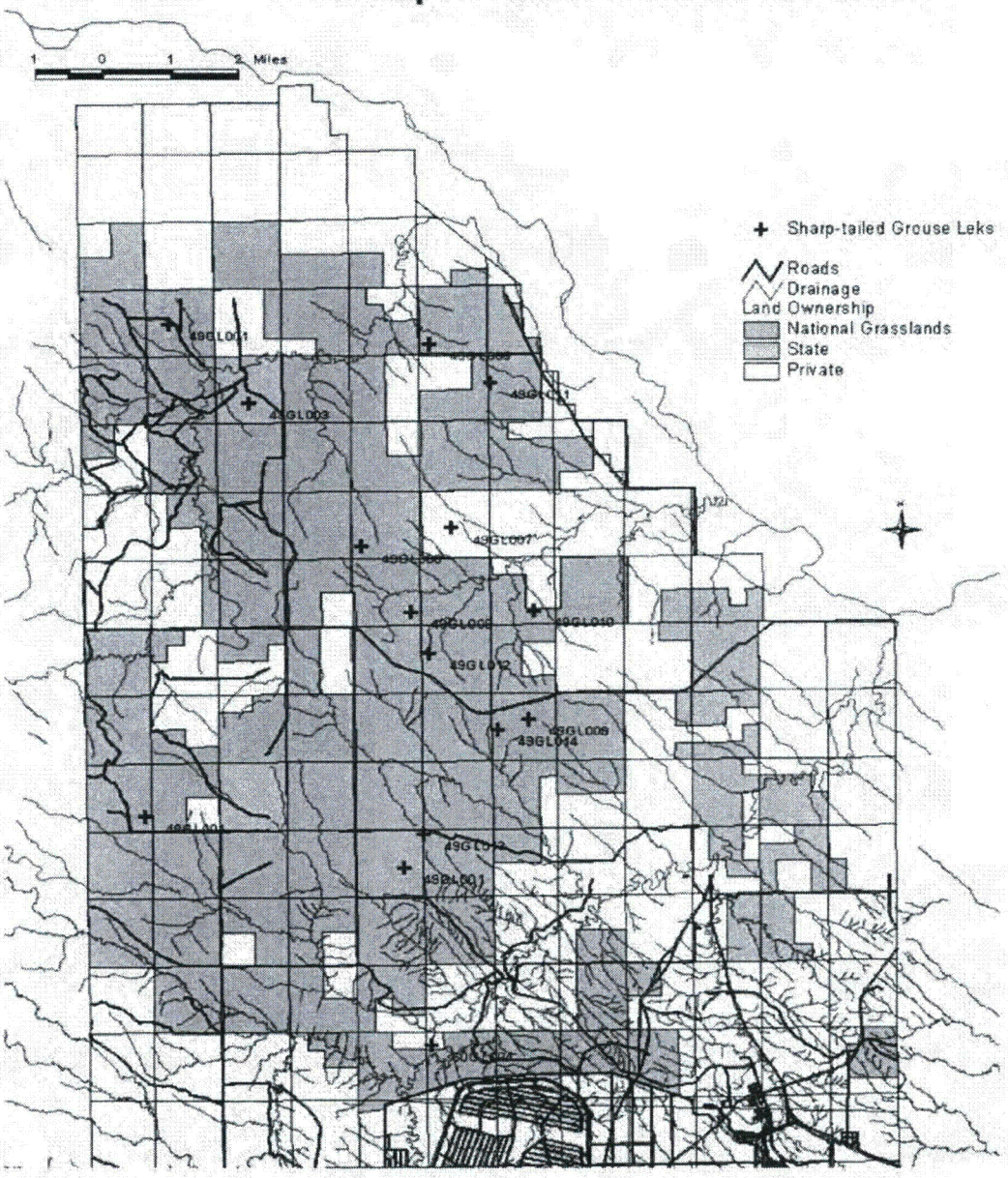
Map # 4
Sagebrush Management Area
Range Sites



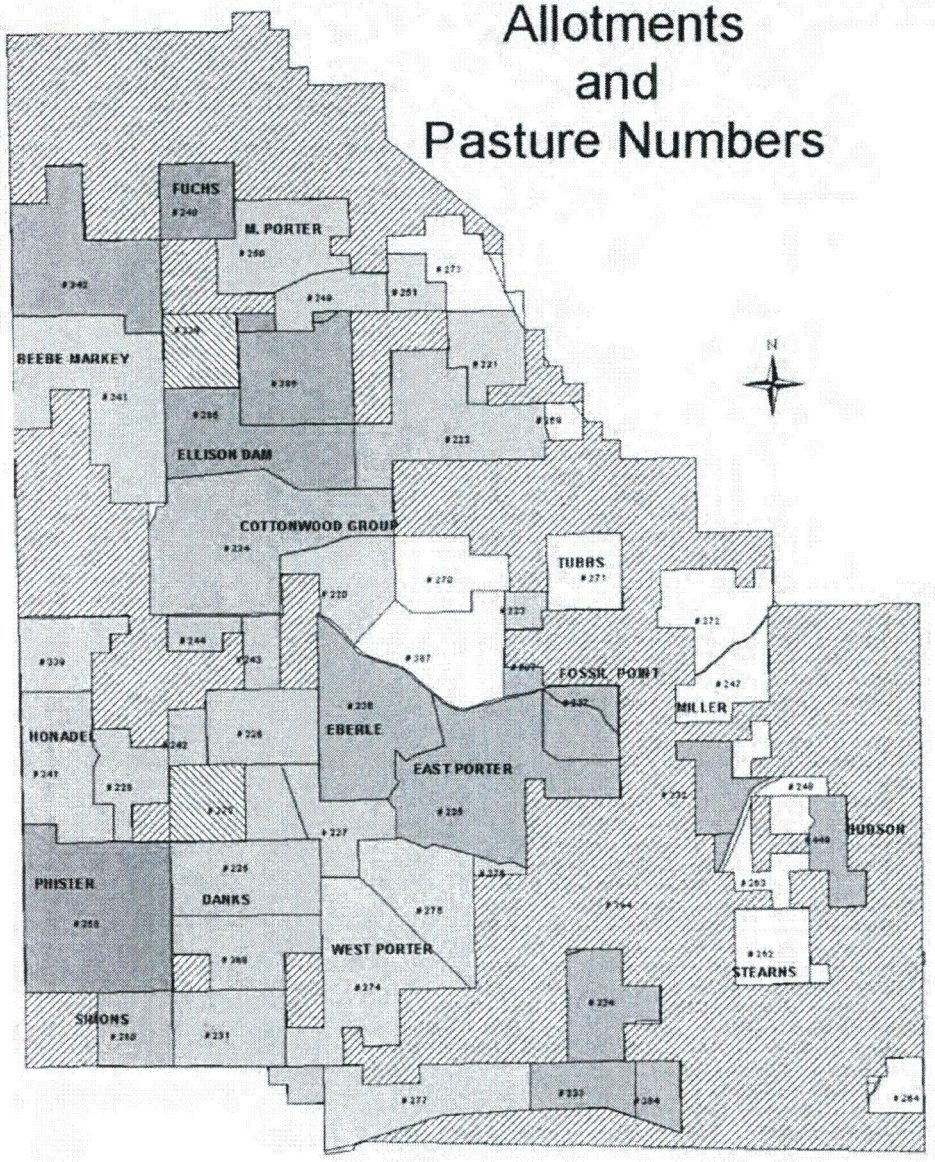
Map 5Sage Grouse Leks



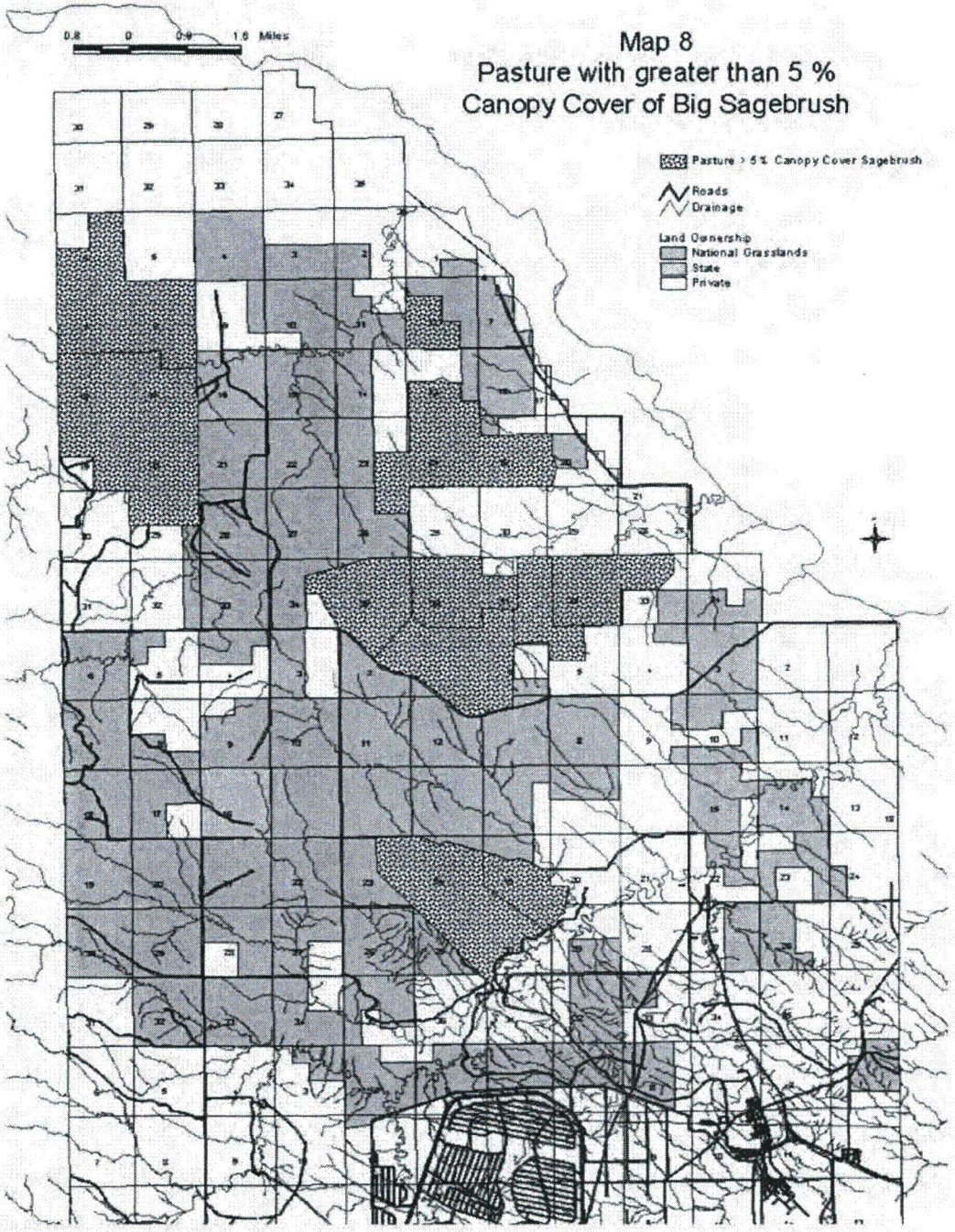
Map 6
Sharp-tailed Grouse Leks



Map # 7
Sagebrush Management Area
Allotments
and
Pasture Numbers



Land Ownership
- National Grasslands
- Private
- State


0.8 0 0.8 1.6 Miles
Map 8
Pasture with greater than 5 %
Canopy Cover of Big Sagebrush
Pasture > 5% Canopy Cover Sagebrush
Roads
Drainage
Land Ownership
National Grasslands
State
Private

Map of historic
locks created
by SD GFP Travis Runia