2006
GREATER SAGE-GROUSE JOB COMPLETION REPORT

Charles W. Schwartz

June 1, 2006 – May 31, 2007

Wyoming Game and Fish Department
Cheyenne, WY

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Sage-Grouse Job Completion Report

YEAR: 2006 **PERIOD COVERED: 6/1/06 - 5/31/07**
WORKING GROUP: Statewide **PREPARED BY: Christiansen**

1. LEK ATTENDANCE SUMMARY (OCCUPIED LEKS)

a. Leks Counted

Year	Known	Counted	Percent Counted	Max Totals Males	Max Totals Females	Avg./Active Lek Males	Avg./Active Lek Females
1998	1453	211	14.5	5230	1613	24.8	7.6
1999	1496	251	16.8	7454	2200	29.7	8.8
2000	1557	273	17.5	8173	2895	29.9	10.6
2001	1624	323	19.9	8445	2725	26.1	8.4
2002	1651	351	21.3	7218	2773	20.6	7.9
2003	1685	435	25.8	8956	3468	20.6	8.0
2004	1753	469	26.8	9878	2393	21.1	5.1
2005	1831	468	25.6	16116	3853	34.4	8.2
2006	1897	484	25.5	21887	5278	45.2	10.9
2007	1947	526	27.0	21680	3655	41.2	6.9

b. Leks Surveyed

Year	Known	Surveyed	Percent Surveyed	Max Total Males	Avg Males/ Active Lek
1998	1453	513	35.3	5938	18.9
1999	1496	595	39.8	8408	23.4
2000	1557	716	46.0	12427	28.5
2001	1624	696	42.9	8807	21.2
2002	1651	734	44.5	7886	19.0
2003	1685	801	47.5	8978	19.6
2004	1753	835	47.6	9930	20.4
2005	1831	928	50.7	18795	31.7
2006	1897	1011	53.3	21381	33.7
2007	1947	1043	53.6	20026	31.8

c. Leks Checked

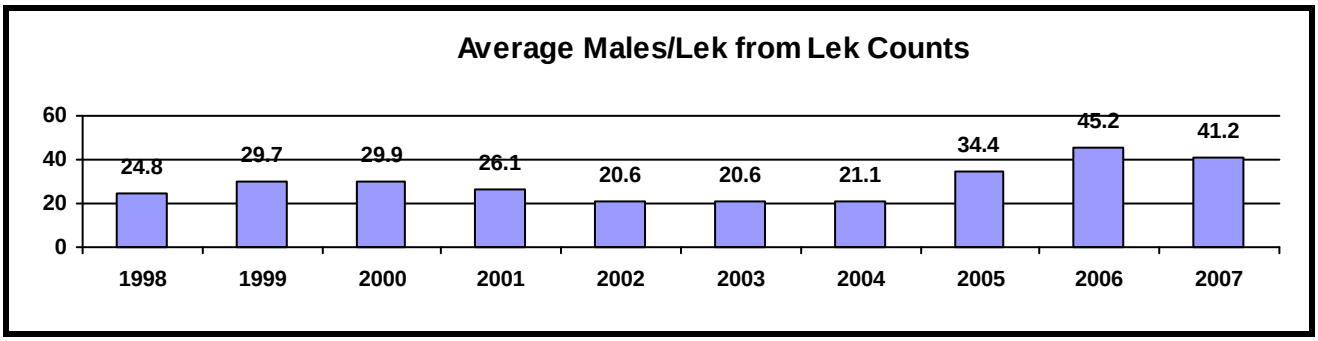
Year	Known	Checked	Percent Checked	Max Total Males	Avg Males/ Active Lek
1998	1453	713	49.1	10977	21.3
1999	1496	829	55.4	15611	26.0
2000	1557	969	62.2	20399	29.3
2001	1624	986	60.7	16716	23.3
2002	1651	1061	64.3	14914	19.9
2003	1685	1192	70.7	17601	20.3
2004	1753	1253	71.5	19623	21.2
2005	1831	1376	75.2	34661	33.0
2006	1897	1483	78.2	43102	38.8
2007	1947	1546	79.4	41491	36.5

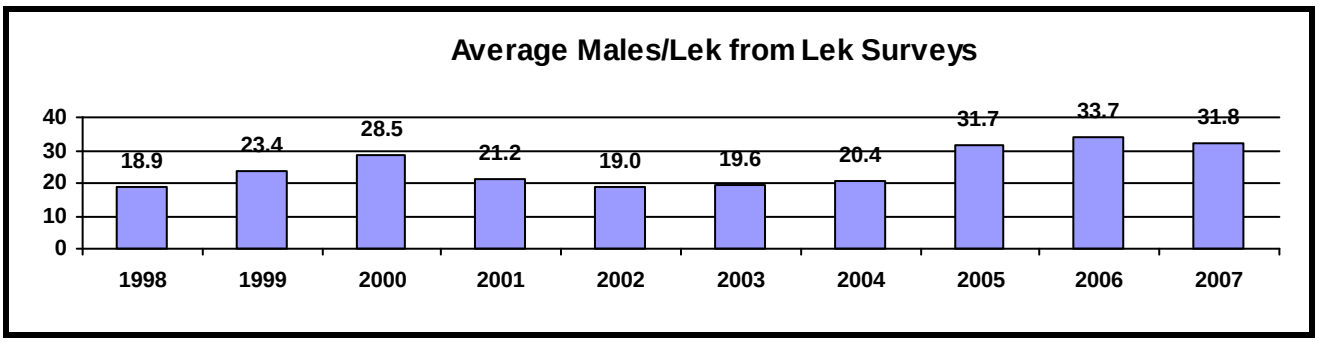
d. Lek Status

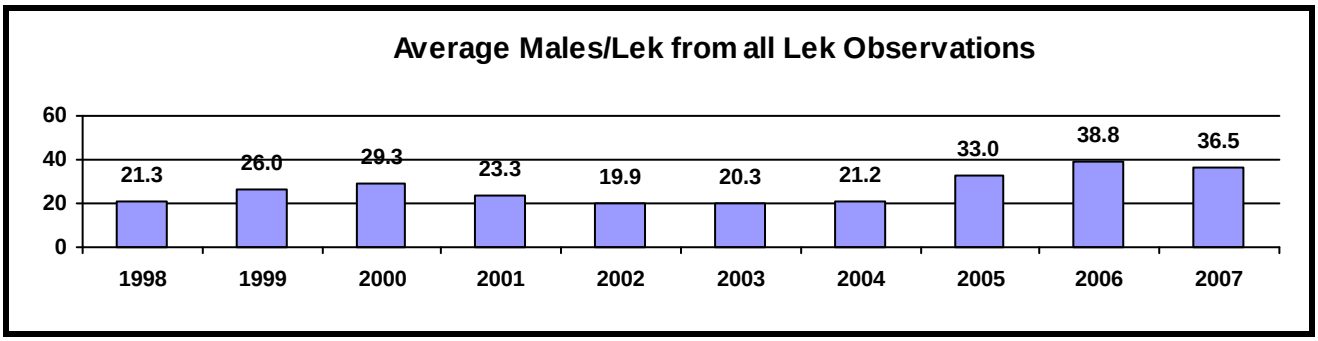
Year	Active	Inactive	Not Located	Unknown	Total	Confirmed Status Active	Confirmed Status Inactive
1998	496	55	12	890	551	90.0%	10.0%
1999	598	53	15	830	651	91.9%	8.1%
2000	733	40	24	760	773	94.8%	5.2%
2001	729	72	17	806	801	91.0%	9.0%
2002	727	115	20	789	842	86.3%	13.7%
2003	813	159	19	694	972	83.6%	16.4%
2004	841	186	7	719	1027	81.9%	18.1%
2005	998	132	8	693	1130	88.3%	11.7%
2006	1076	155	7	659	1231	87.4%	12.6%
2007	1100	191	4	652	1291	85.2%	14.8%

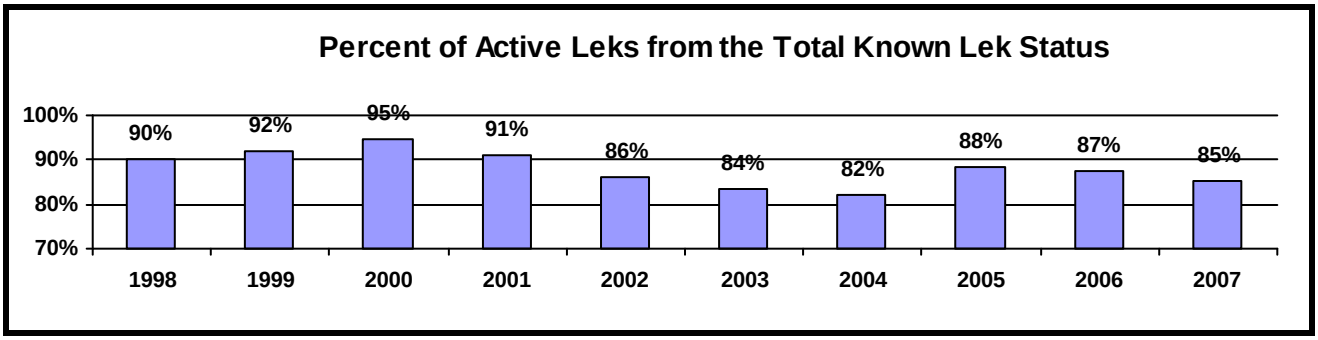
SAGE-GROUSE LEK ATTENDANCE SUMMARY

WORKING GROUP: Statewide Summary **Area(s):** All









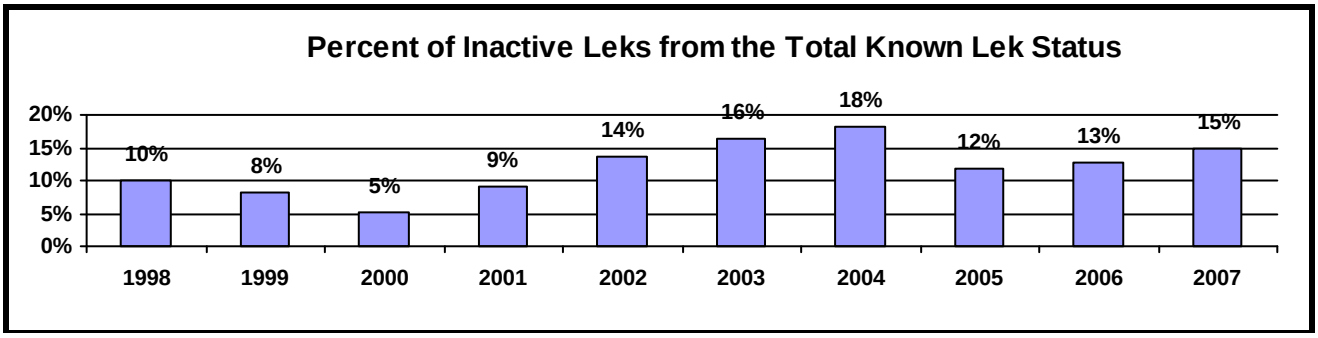


Table3. Summary of unoccupied (historic) leks and lek complexes.

a. Unoccupied Leks

Year	Total Number of Leks: Abandoned	Total Number of Leks: Destroyed	Number of abandoned leks checked
1998	166	25	44
1999	172	25	43
2000	182	27	61
2001	190	28	68
2002	192	31	71
2003	203	31	130
2004	198	34	64
2005	205	31	70
2006	216	32	108
2007	229	34	73

Wyoming Sage Grouse Lek Characteristics

Region	Number	Percent
Casper	264	12.0%
Cody	283	12.9%
Green River	465	21.2%
Jackson	147	6.7%
Lander	424	19.3%
Laramie	235	10.7%
Sheridan	380	17.3%

Working Grouse Area	Number	Percent
Bates Hole	313	14.2%
Big Horn Basin	283	12.9%
Northeast	516	23.5%
South Central	356	16.2%
Southwest	368	16.7%
Upper Green River	131	6.0%
Upper Snake River Basin	16	0.7%
Wind River/Sweetwater	215	9.8%

Classification	Number	Percent
Occupied	1,841	83.8%
Unknown	86	3.9%
Unoccupied	271	12.3%

Unoccupied Leks	Number
Abandoned	236
Destroyed	34
N/A	259

BLM Office	Number	Percent
Buffalo	359	16.3%
Casper	195	8.9%
Cody	99	4.5%
Kemmerer	180	8.2%
Lander	220	10.0%
Newcastle	101	4.6%
Pinedale	135	6.1%
Rawlins	508	23.1%
Rock Springs	213	9.7%
Worland	187	8.5%

County	Number	Percent
Albany	76	3.5%
Big Horn	42	1.9%
Campbell	186	8.5%
Carbon	361	16.4%
Converse	56	2.5%
Crook	19	0.9%
Fremont	205	9.3%
Hot Springs	54	2.5%
Johnson	131	6.0%
Laramie	2	0.1%
Lincoln	120	5.5%
Natrona	149	6.8%
Niobrara	15	0.7%
Park	96	4.4%
Platte	7	0.3%
Powder River, MT	1	0.0%
Sheridan	32	1.5%
Sublette	147	6.7%
Sweetwater	255	11.6%
Teton	16	0.7%
Uinta	65	3.0%
Washakie	98	4.5%
Weston	65	3.0%

Land Status	Number	Percent
BLM	1074	48.9%
BLM/Private	13	0.6%
BOR	7	0.3%
National Park	12	0.6%
Not Determined	5	0.2%
Private	836	38.0%
Reservation	61	2.8%
State	129	5.9%
State/Private	1	0.0%
USF&WS	2	0.1%
USFS	47	2.1%

Table 4. Sage-grouse hunting seasons and harvest data.

a. Season

Year	Season Dates	Length	Bag/Possession Limit
1997	Sept 20-Oct 5	16	3/6
1998	Sept 19-Oct 4	16	3/6
1999	Sept 18-Oct 3	16	3/6
2000	Sept 16-Oct 1	16	3/6
2001	Sept 22-Oct 7	16	3/6
2002	Sept 28-Oct 6	9	2/4
2003	Sep 27-Oct 5	9	2/4
2004	Sept 23-Oct 3	11	2/4
2005	Sept 23-Oct 3	11	2/4
2006	Sept 23-Oct 3	11	2/4

b. Harvest

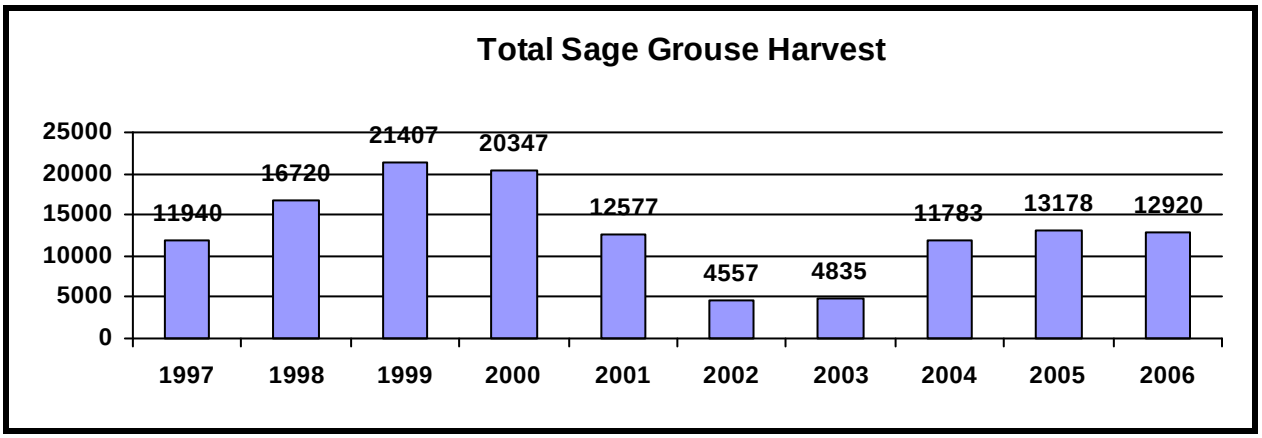
Year	Harvest	Hunters	Days	Birds/ Day	Birds/ Hunter	Days/ Hunter
1997	11,940	5,131	14,536	0.8	2.3	2.8
1998	16,720	5,862	15,652	1.1	2.9	2.7
1999	21,407	7,591	21,542	1.0	2.8	2.8
2000	20,347	8,498	20,761	1.0	2.4	2.4
2001	12,577	5,447	14,091	0.9	2.3	2.6
2002	4,557	2,723	6,635	0.7	1.7	2.4
2003	4,835	2,355	5,705	0.8	2.1	2.4
2004	11,783	5,436	13,229	0.9	2.2	2.4
2005	13,178	5,230	12,175	1.1	2.5	2.3
2006	12,920	5,412	11,981	1.1	2.4	2.2
Avg.	13,026	5,369	13,631	0.9	2.4	2.5

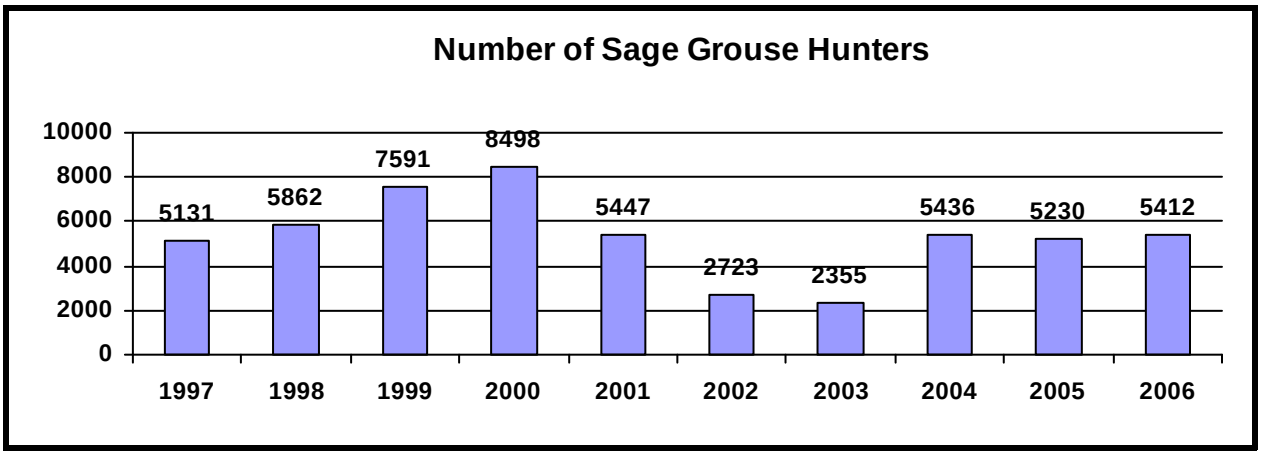
Table 5. Composition of harvest by wing analysis.

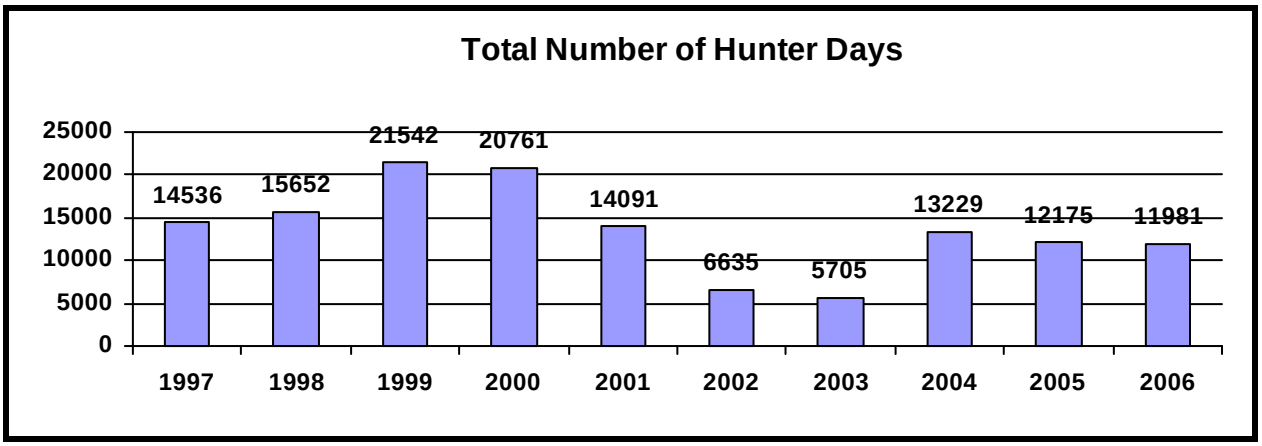
Year	Sample Size	Percent Adult		Percent Ylg		Percent Young		Chicks/Hen
		Male	Female	Male	Female	Male	Female	
1997	2101	9.4	18.2	4.3	11.9	23.4	32.7	1.9
1998	2330	8.5	18.5	3.9	7.6	25.8	35.8	2.4
1999	3377	9.0	21.1	5.0	9.9	22.8	32.0	1.8
2000	2903	12.6	28.3	5.7	11.5	17.4	24.6	1.1
2001	2556	9.6	29.1	1.8	5.9	20.9	32.7	1.5
2002	1689	10.1	27.1	2.4	6.9	18.5	35.1	1.6
2003	1519	12.8	27.3	1.6	6.2	22.1	30.0	1.6
2004	2058	9.4	21.6	1.0	3.8	31.5	32.6	2.5
2005	2586	13.4	21.0	3.6	6.1	24.5	31.4	2.1
2006	1877	19.6	28.6	3.9	6.1	17.8	24.0	1.2

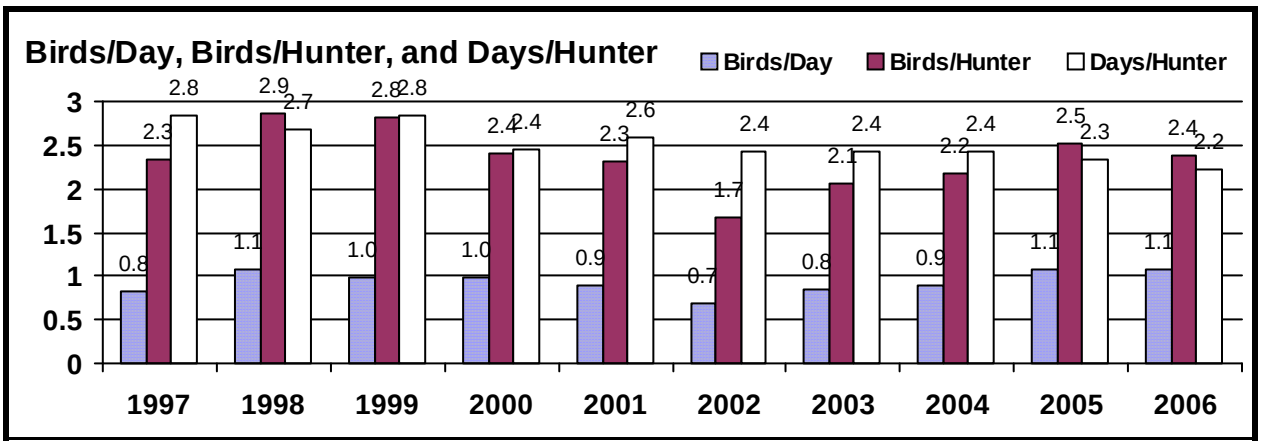
SAGE-GROUSE HARVEST SUMMARY

WORKING GROUP: Statewide Summary **Area(s): All**





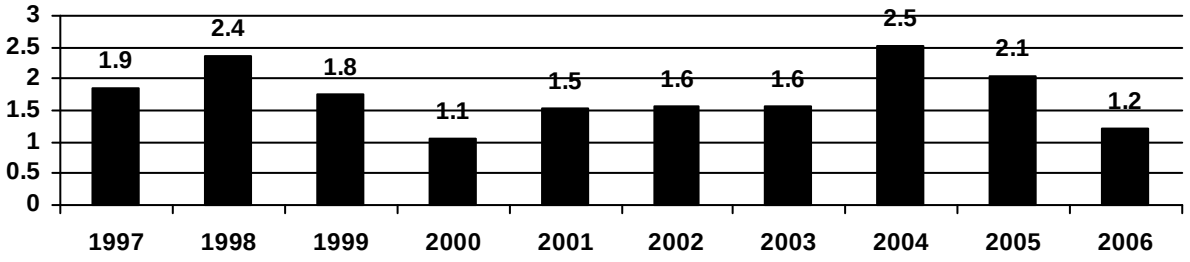




Statewide Sage-grouse Wing Analysis Summary 2006

Adult Males:	368	**Percent of All Wings:**	19.6%
Adult Females:	536	**Percent of All Wings:**	28.6%
Adult Unknown:	0	**Percent of All Wings:**	0.0%
Total Adults:	904		
Yearling Males:	73	**Percent of All Wings:**	3.9%
Yearling Females:	115	**Percent of All Wings:**	6.1%
Yearling Unknown:	0	**Percent of All Wings:**	0.0%
Total Yearlings:	188		
Chick Males:	335	**Percent of All Wings:**	17.8%
Chick Females:	450	**Percent of All Wings:**	24.0%
Chick Unknown:	0	**Percent of All Wings:**	0.0%
Total Chicks:	785		
Unknown Sex/Age:	0	**Percent of All Wings:**	0.0%
Total for all Sex/Age Groups:	1877		
Chick Males:	335	**Percent of All Chicks:**	42.7%
Yearling Males:	73	**Percent of Adult and Yearling Males:**	16.6%
Adult Males:	368	**Percent of Adult and Yearling Males:**	83.4%
Adult and Yearling Males:	441	**Percent of Adults and Yearlings:**	40.4%
Total Males:	776	**Percent of All Sex/Age Groups:**	41.3%
Chick Females:	450	**Percent of All Chicks:**	57.3%
Yearling Females:	115	**Percent of Adult and Yearling Females:**	17.7%
Adult Females:	536	**Percent of Adult and Yearling Females:**	82.3%
Adult and Yearling Females:	651	**Percent of Adults and Yearlings:**	59.6%
Total Females:	1101	**Percent of All Sex/Age Groups:**	58.7%
Chicks:	785	**Percent of All Wings:**	41.8%
Yearlings:	188	**Percent of All Wings:**	10.0%
Adults:	904	**Percent of All Wings:**	48.2%
Chicks/Hen:	**1.2**		

Chicks/hen calculated from wings of harvested sage-grouse.



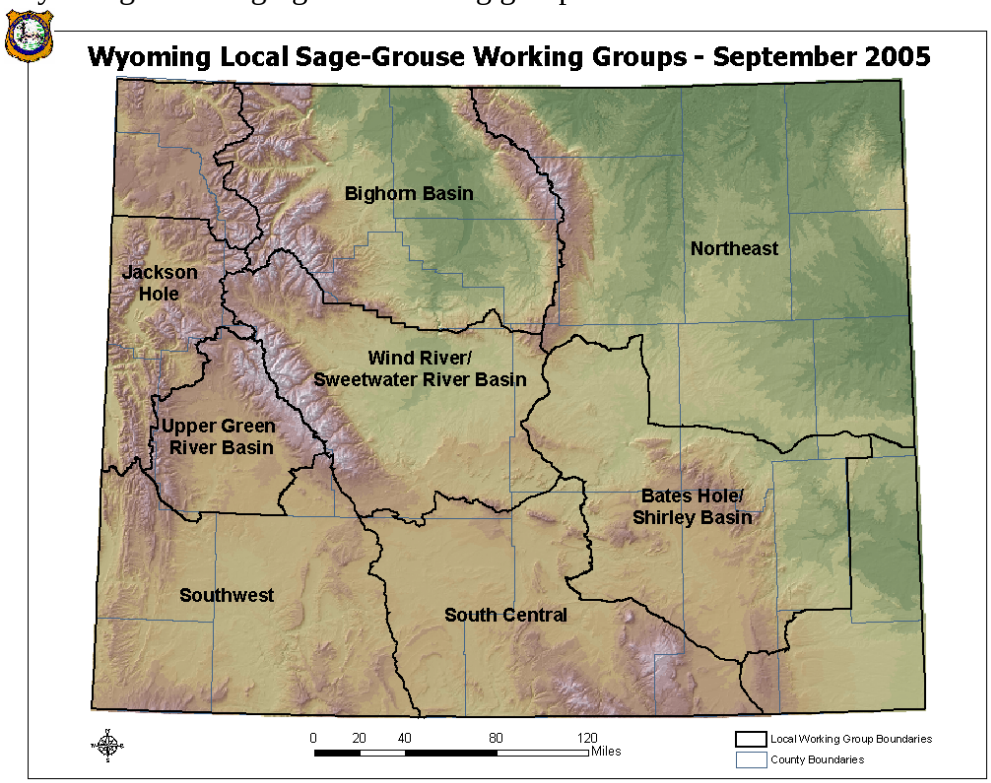
Sage-Grouse Job Completion Report

Conservation Plan Area: **Statewide Summary**
Period Covered: **6/1/2006 – 5/31/2007**
Prepared by: **Tom Christiansen – Sage-grouse Program Coordinator**

INTRODUCTION

Prior to 2004, Job Completion Reports (JCRs) for greater sage-grouse in Wyoming were completed at the WGFD Regional or management area level. In 2003 the WGF Commission approved the Wyoming Greater Sage-Grouse Conservation Plan (2003) (State Plan) and a Sage-Grouse Program Coordinator position was created within the WGFD. The State Plan directed local conservation planning efforts to commence. In order to support the conservation planning efforts, JCRs across the State changed from reporting by Wyoming Game & Fish Dept. regional boundaries to those of the eight plan area boundaries (Figure 1). The 2004 JCR reviewed and summarized prior years' data in order to provide a historical perspective since that document was the first statewide JCR in memory.

Figure 1. Wyoming Local sage-grouse working group boundaries.



In general, sage-grouse data collection efforts across Wyoming have increased over the past decade due to the increasing concerns for sage-grouse and their habitats. Results of this and prior monitoring suggest sage-grouse populations in the Wyoming were at their lowest levels ever recorded in the mid-1990s. Grouse numbers then responded to increased precipitation during the late 1990's with some individual leks seeing three fold increases in the number of males counted

between 1997 and 1999. The return of drought conditions in the early 2000's led to decreases in chick production and survival and therefore population declines, although the population did not decline to mid-1990s levels. Improved habitat conditions due to timely precipitation in 2004 led to high chick production and survival. This resulted in 2006's counts and surveys having the highest recorded average males per lek since 1978. A return to a dry spring and summer in 2006 reduced recruitment in 2006 and the average males per lek declined slightly in 2007.

Primary issues of concern for sage-grouse in Wyoming include: increasing natural gas development, drought, livestock grazing practices, vegetation treatment practices and West Nile virus. Public concerns that are often expressed include effects of predation and hunting.

BACKGROUND

The greater sage-grouse is the largest species of grouse in North America and is second in size only to the wild turkey among all North American game birds. It is appropriately named due to its year-round dependence on sagebrush for both food and cover. Insects and forbs also play an important role in the diet during spring and summer and are critical to the survival of chicks. In general, the sage-grouse is a mobile species, capable of movements greater than 50 km between seasonal ranges. Despite this mobility, sage-grouse appear to display substantial amounts of fidelity to seasonal ranges. Sage-grouse populations are characterized by relatively low productivity and high survival. This strategy is contrary to other game birds such as pheasants that exhibit high productivity and low annual survival. These differences in life history strategy have consequences for harvest and habitat management.

Greater sage-grouse once occupied parts of 12 states within the western United States and 3 Canadian provinces (Figure 2). Populations of greater sage-grouse have undergone long-term population declines. The sagebrush habitats on which sage-grouse depend have experienced extensive alteration and loss. Consequently, concerns rose for the conservation and management of greater sage-grouse and their habitats resulting in petitions to list greater sage-grouse under the Endangered Species Act. In January 2005 the U.S. Fish and Wildlife Service determined the Greater Sage-Grouse was not warranted for listing under the ESA. Due to the significance of this species in Wyoming, meaningful data collection, analysis and management is necessary whether or not the species is a federally listed species.

Sage-grouse are relatively common throughout Wyoming, especially southwest and central Wyoming, because sage-grouse habitat remains relatively intact compared to other states (Figures 2 and 3). However, available data sets and anecdotal accounts indicate long-term declines in Wyoming sage-grouse populations over the last five decades.

Figure 2. Current distribution of sage-grouse and pre-settlement distribution of potential habitat in North America (Schroeder 2004). For reference, Gunnison sage-grouse in SE Utah and SW Colorado are shown.

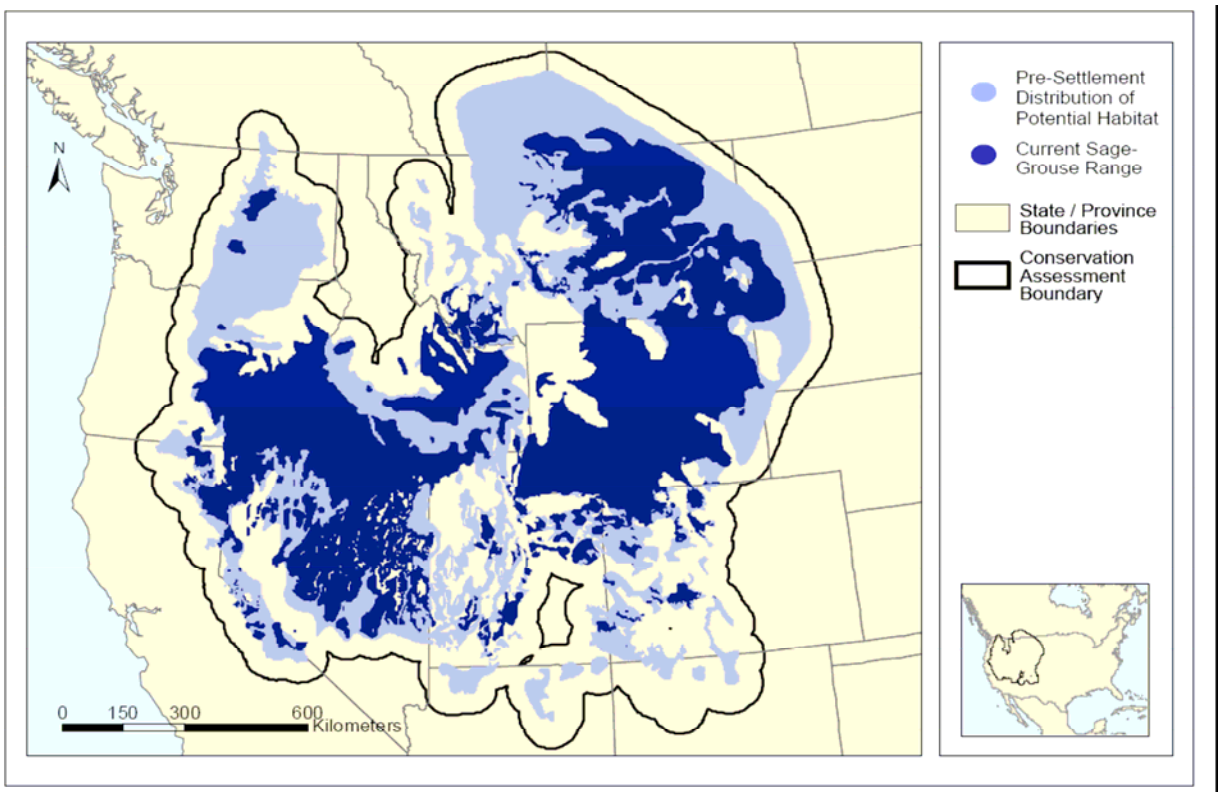
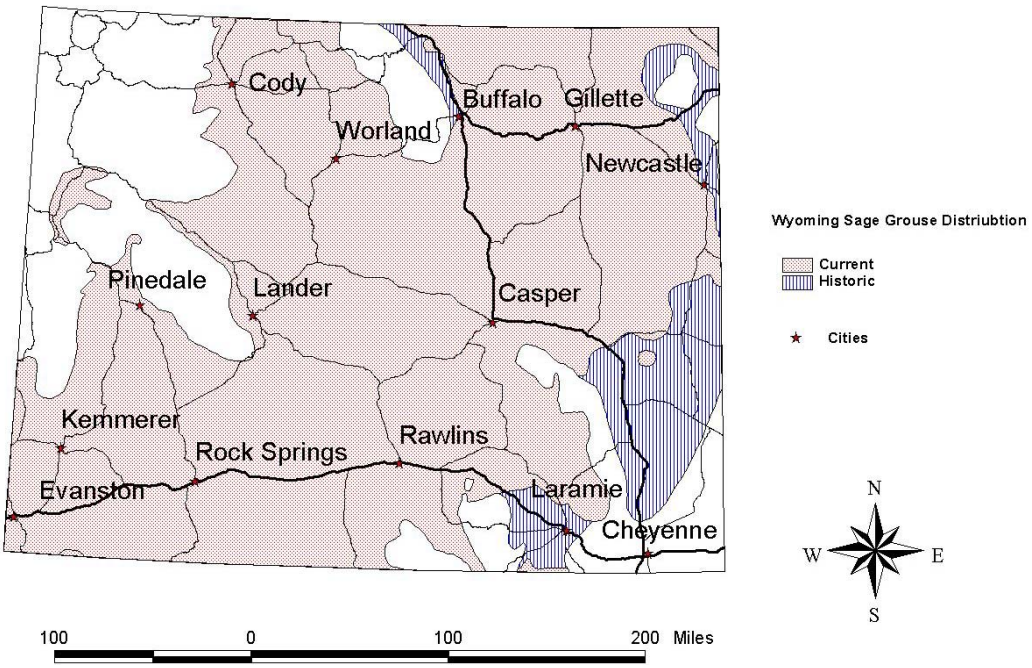


Figure 3. Sage-grouse distribution in Wyoming.



Past management of sage-grouse in Wyoming has included:

- Population monitoring via lek counts and surveys, harvest statistics, and data derived from wing collections from harvested birds. Lek counts and surveys have been conducted in Wyoming since 1949.

- The protection of lek sites and nesting habitat on BLM lands by restricting activities within ¼ mile of a sage-grouse lek and restricting the timing of activities within a 2-mile radius of leks.

- The authorization and enforcement of hunting regulations.

- Habitat manipulations, including water development.

- Conducting applied research.

METHODS

Methods for collecting sage-grouse data are described in the sage-grouse chapter of the WGFD Handbook of Biological Techniques (Christiansen 2007), which is largely based on Connelly et al (2003).

RESULTS

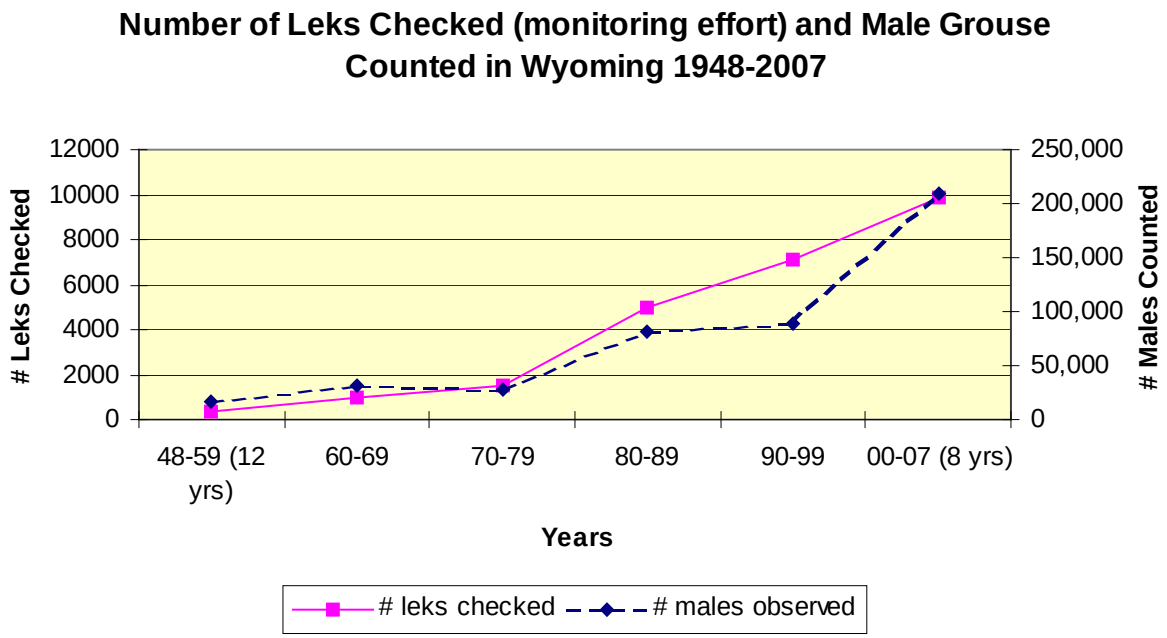
Lek monitoring

While lek counts and surveys have been conducted in Wyoming since 1948, the most consistent data were not collected until the mid-1990s. The number of leks checked in Wyoming has increased markedly since 1949. However, data from the 1950s through the 1970s is unfortunately sparse and by most accounts this is the period when the most dramatic declines of grouse numbers occurred. Some lek survey/count data were collected during this period as the historical reports contain summary tables but the observation data for individual leks are missing making comparisons to current information difficult. Concurrent with increased monitoring effort over time, the number of grouse (males) has also increased (Figure 4). The increased number of grouse counted is not necessarily a reflection of a population increase, rather it is resultant of increased monitoring efforts.

More recently, the average number of males counted/lek decreased through the 1980s and early 90s to an all time low in 1995, and has since recovered to a level similar to the late 1970s (Figure 5). Again, fluctuations in the number of grouse observed on leks are largely due to survey effort not to changes in grouse numbers exclusively, but certainly the number of male grouse counted on leks has exhibited significant recovery since 1995 as the average size of leks has increased (Figures 5 & 6) and is generally interpreted to reflect an increasing population. The same is true for the most recent three-year period (Figure 7). Thus, there has been a long-term decline but mid- and short-term increases in the statewide sage-grouse population. The mid- and short-term trends in statewide populations are largely weather related. In the late 1990s, and again in 2004-05, timely precipitation resulted in improved habitat conditions allowing greater numbers of sage-grouse to hatch and survive. Drought conditions from 2000-2003 are believed to have

caused lower grouse survival leading to population declines. These trends are valid at the statewide scale. Trends are more varied at the local scale. Sub-populations more heavily influenced by anthropogenic impacts (sub-divisions, intensive energy development, large-scale conversion of habitat from sagebrush to grassland or agriculture, Interstate highways, etc.) have experienced declining populations or extirpation. Figures 8 and 9 illustrate the largely increasing sage-grouse proportional densities based on 2000-2002 and 2005-2007 lek counts and surveys in Wyoming.

Figure 4.



Lek monitoring data for the 2007 breeding seasons are summarized in JCR Data Tables 1 a-d. Male attendance at all leks visited (counts and surveys) averaged 37 males per lek during spring 2006, a 5-6% decrease over the 39 males/lek observed in 2006 (which was the highest average males per lek figure recorded since 1978). For the 10-year period (1998-2007), average male lek attendance ranged from 16 males/lek in 1997, to 39 males/lek in 2006. We believe good chick production and survival in 2004 and 2005 due to improved habitat resulting from timely precipitation caused the increase from 2004 to 2006. A return to a dry spring and summer in 2006 reduced recruitment in 2006 and the average males per lek declined slightly in 2007.It is important to note that the number of leks sampled increased significantly over the 10-year period and the same leks were not checked from year to year. However leks that were checked consistently over the same period demonstrated the same trends except in some local areas as described in the local JCRs.

Small changes in the statistics reported in Tables 1a-d between annual JCRs are due to revisions and/or the submission of data not previously available for entry into the database (late submission of data, discovery of historical data from outside sources, etc). These changes have not been significant and interpretation of these data has not changed.

Figure 5.

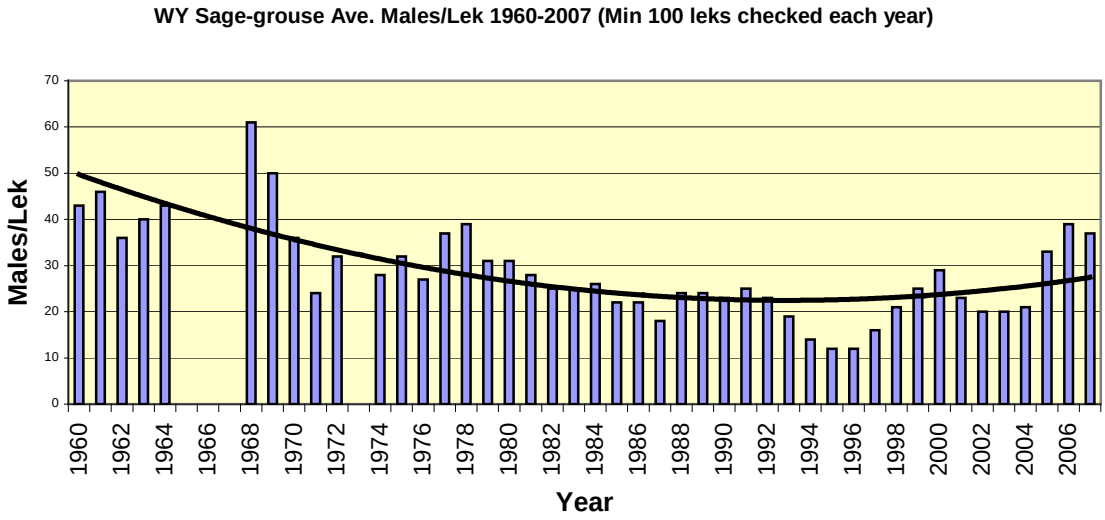


Figure 6.

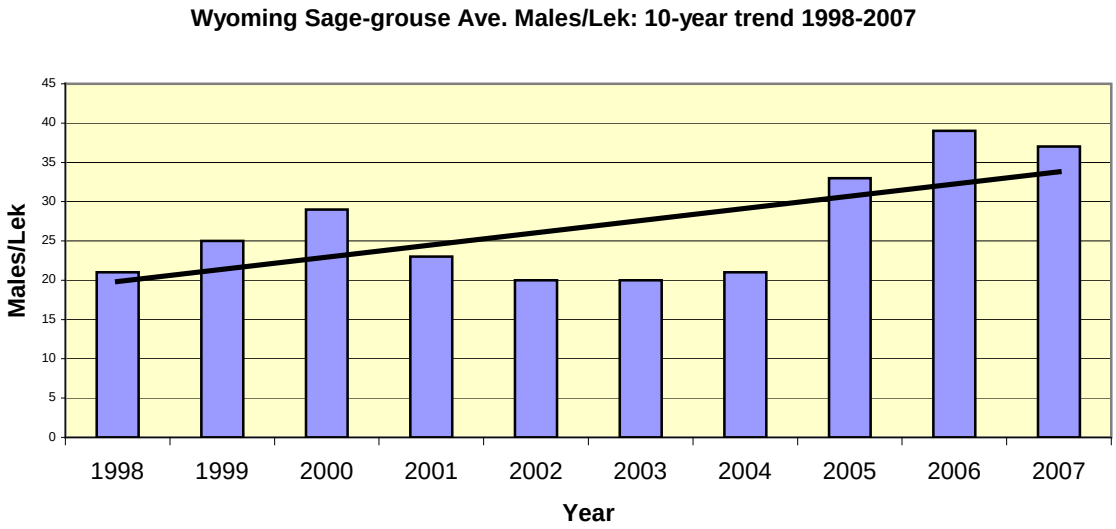
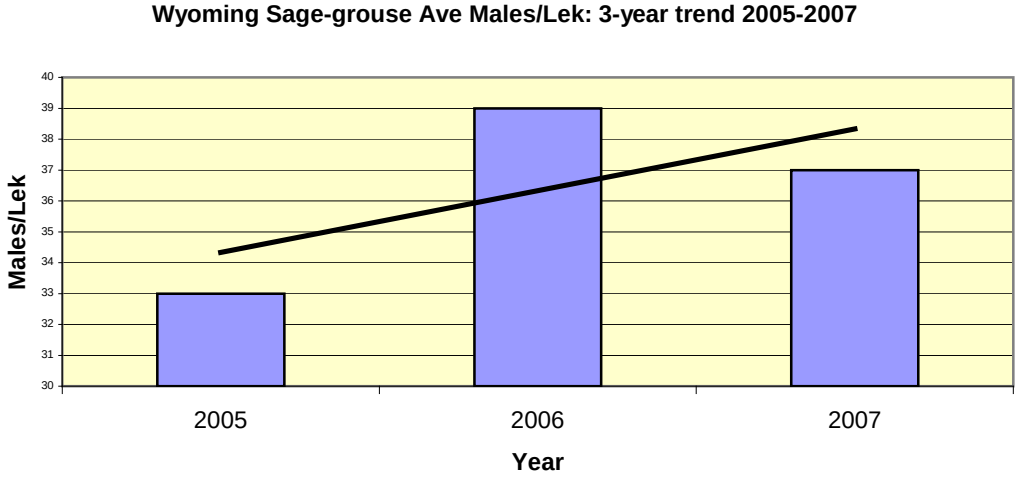
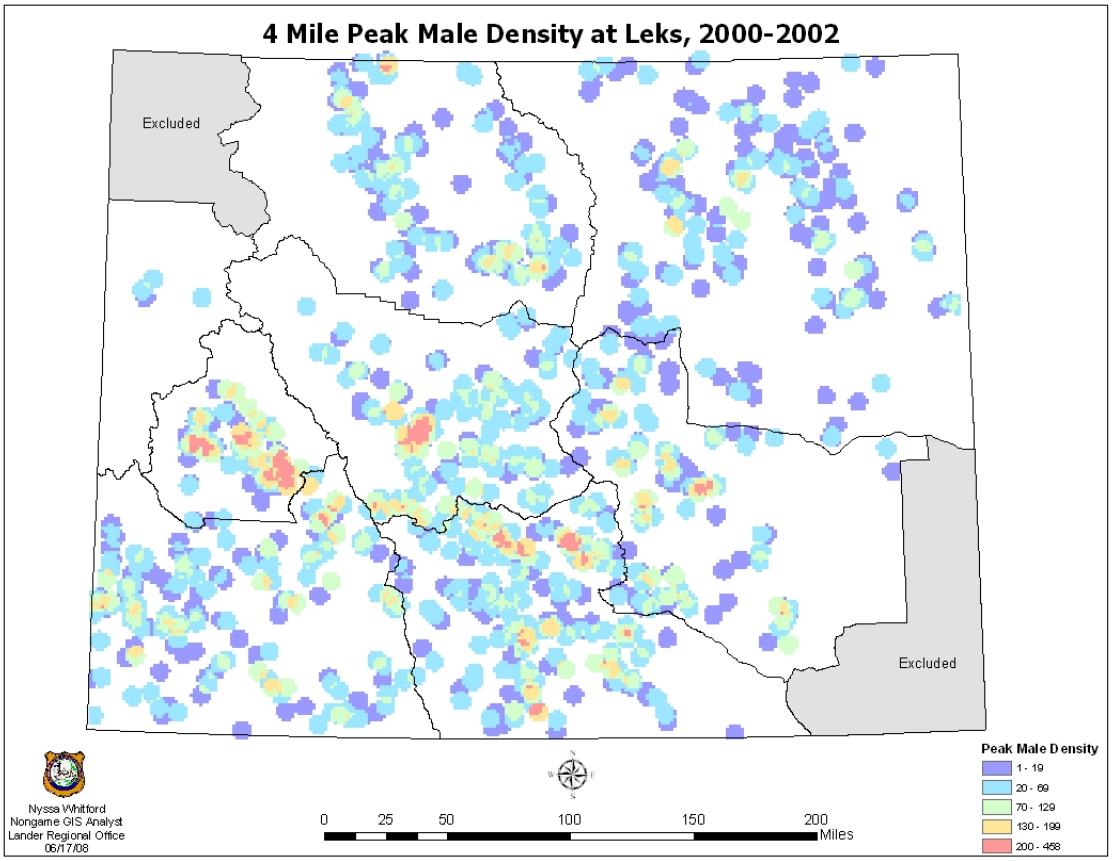
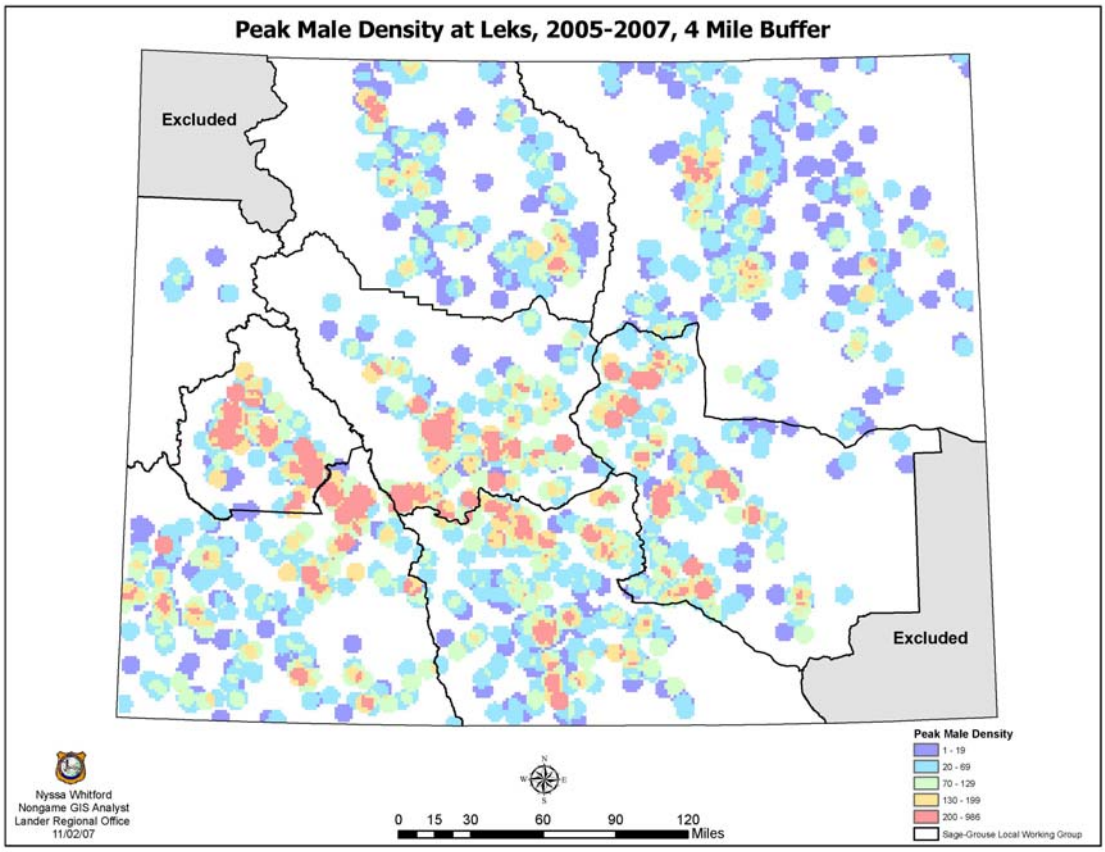


Figure 7.



Figures 8 and 9. Comparison of male densities between 2000-2002 and 2005-2007.





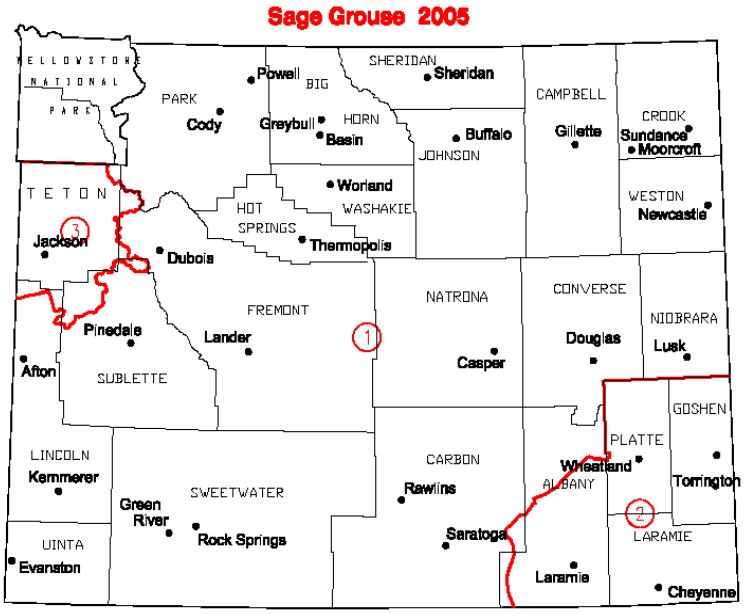
While a statistically valid method for estimating population size for sage-grouse does not yet exist, monitoring male attendance on leks provides a reasonable index of relative change in abundance in response to prevailing environmental conditions over time. However, lek data must be interpreted with caution for several reasons: 1) the survey effort and the number of leks surveyed/counted has varied over time, 2) not all leks have been located, 3) sage-grouse populations often cycle over approximately a 10 year period, 4) the effects of unlocated or unmonitored leks that have become inactive cannot be quantified or qualified, and 5) lek locations may change over time. Both the number of leks and the number of males attending these leks must be quantified in order to estimate population size.

The range-wide Conservation Assessment of Greater Sage-grouse and Sagebrush Habitat (Connelly et al. 2004) assessed changes in long-term sage-grouse populations at rangewide, statewide, population and sub-population levels. Portions of this document relevant to Wyoming were appended the 2004 Statewide JCR (Christiansen 2004). These or similar methods of analysis should be incorporated into Wyoming's JCRs as they mitigate some of the limitations of using only average males/lek to determine population trend.

Hunting season and harvest

Hunting seasons in Wyoming are shown in JCR Data Table 4a. In 1995, the opening of sage-grouse season was moved to the third Saturday in September. Research suggested that hens and broods were more dispersed and less vulnerable to hunting with the later opening date. Due to concerns over low populations the statewide hunting season was shortened to nine days and the daily bag limit decreased to two sage-grouse, in 2002. The opening date was also changed to the fourth Saturday in September. Hunting seasons for all upland and small game were established for 3-year periods beginning in 2004. Overall, the season remained conservative with 11 days of hunting and limits of 2 sage-grouse daily and 4 in possession. Two areas, southeast Wyoming and the Snake River Drainage in northwest Wyoming are closed to sage-grouse hunting (Figure 10).

Figure 10. Sage-grouse hunt area map 2004-2006. Areas 2 and 3 are closed to sage-grouse hunting.



Delaying and shortening the season and decreasing the bag limit dramatically decreased the numbers of sage-grouse hunters and their harvest in 2002 and 2003 (JCR Data Table 4a and b). Hunters were also sensitive to the plight of grouse populations and did not take the opportunity to hunt sage-grouse as much as they had in the past. But since 2004, hunter numbers and harvest have rebounded as a result of increased sage-grouse numbers. From 2005 to 2006 harvest statistics were nearly identical which is suggestive of a relatively stable population. These statistics are not surprising given that while the number of adult birds increased between 2005 and 2006 as a result of 2005's high chick production, chick production was much lower in 2006.

In 2005, 2,790 sage-grouse wings were collected from hunters in Wyoming (JCR Data Table 5) but in 2006 the number of wings collected declined to 1,877. Again, the decrease is due to smaller numbers of chicks available in the harvest. The 1,877 wings are about 15% of the 2005 estimated harvest of 12,920. While the harvest is very near the 10-year (1997-2006) average annual harvest of 13,026, the proportion of wings collected/harvest is lower than the 10-year average of 18%.

The 2006 chick:hen ratio (based on harvested wing analysis) was 1.2 chicks per hen. This level of productivity is typically associated with a decreasing population. This was confirmed by the 2006 lek data (all lek checks), which indicated a 5-6% decrease in the average numbers of males on leks (Table 1). When average males per lek were increasing from 1997-2000 and 2005-2006, the proceeding years' chick:hen ratio averaged 2.1. Conversely, when the chick:hen ratio dropped to 1.1:1 in 2000, the 2001 average males:lek decreased 20%. Relatively small changes in average males/lek observed in 2002 (+3%) and 2003 (+4%) were proceeded by chick:hen ratios of 1.6:1and 1.5:1 respectively. The 57% increase in average males/lek observed in 2005 was preceded by a statewide chick:hen ratio of 2.4:1 in 2004. In general it appears that chick:hen ratios of about 1.5:1 result in relatively stable lek counts the following spring, while chick:hen ratios of 1.8:1 or greater result in increased lek counts and ratios below 1.2:1 result in declines. Additional data are required to strengthen the statistical strength of these analyses.

Prior to 1997, wing analysis results may be questioned in some parts of the state since most personnel were not well trained in techniques. A notable exception would be for the Lander Region where the Rawlins wildlife biologist, Greg Hiatt, has read wings consistently and accurately since the early 1980's. In 1997, the Department created its internal Sage-grouse Working Group which began hosting an annual wing-bee where training was provided and accuracy of wing reading efforts improved.

Table 1. Potential influence of chick production, based on wings from harvested birds, on population trend as measured by male lek attendance.

Year	Chicks:Hen (based on wings from harvested birds)	Change in male lek attendance the following spring
1997	1.9	+36%
1998	2.4	+21%
1999	1.8	+13%
2000	1.1	-20%
2001	1.6	-15%
2002	1.6	+3%
2003	1.5	+4%
2004	2.4	+57%
2005	2.0	+17%
2006	1.2	-5%

Long-term harvest analysis

Hunter and harvest statistics provide some insight to the status or trends in wildlife populations. When consistent hunting seasons are maintained between years, total harvest is strongly correlated with population trends. Harvest data collected prior to 1982 was recorded by county and not by today's small/upland game management areas (Figure 11). Harvest data for sage-grouse in the Wyoming show downward trends in hunter numbers, total harvest and birds/day/hunter (Figures 12 and 13). Estimated harvest peaked in 1988 at over 59,000 birds and then steadily and dramatically declined to a low of about 12,000 in 1997. A modest rebound was observed the next two years and then another decline to only 4,557 in 2002. Since 2002, harvest has again increased modestly.

Harvest trends show declines of similar magnitude to lek attendance data from 1983-94 (Figure 13). But while the lek attendance trend increased after 1995, the trend in harvest continued to decline. This is explained by changes in the hunting regulation implementing a later hunt and decreased bag and possession limits. Hunter participation and harvest declined dramatically when the Wyoming Game and Fish Commission reduced the bag limit and shortened the hunting season in 2002. A similar reduction occurred in 1995 when the season was moved later into September. We are not currently able to quantify the population effects of the reduced harvest levels. While some positive effect is suspected it is not likely to have been significant when compared to the impacts of weather on sage-grouse habitat.

Figure 11.

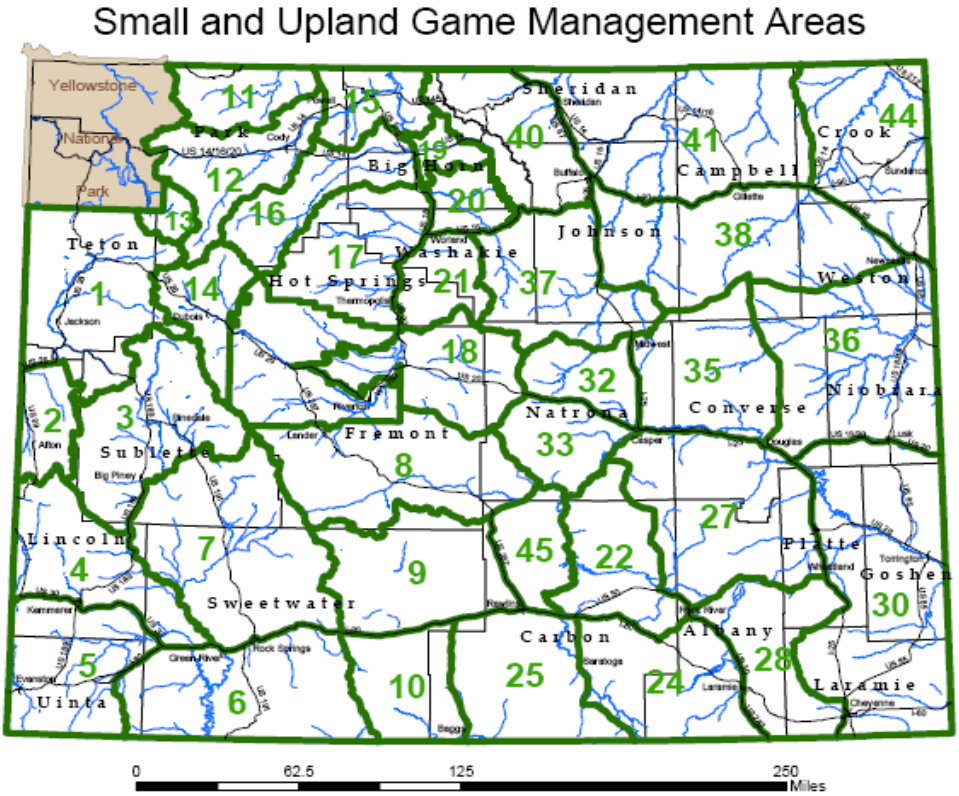


Figure 12.

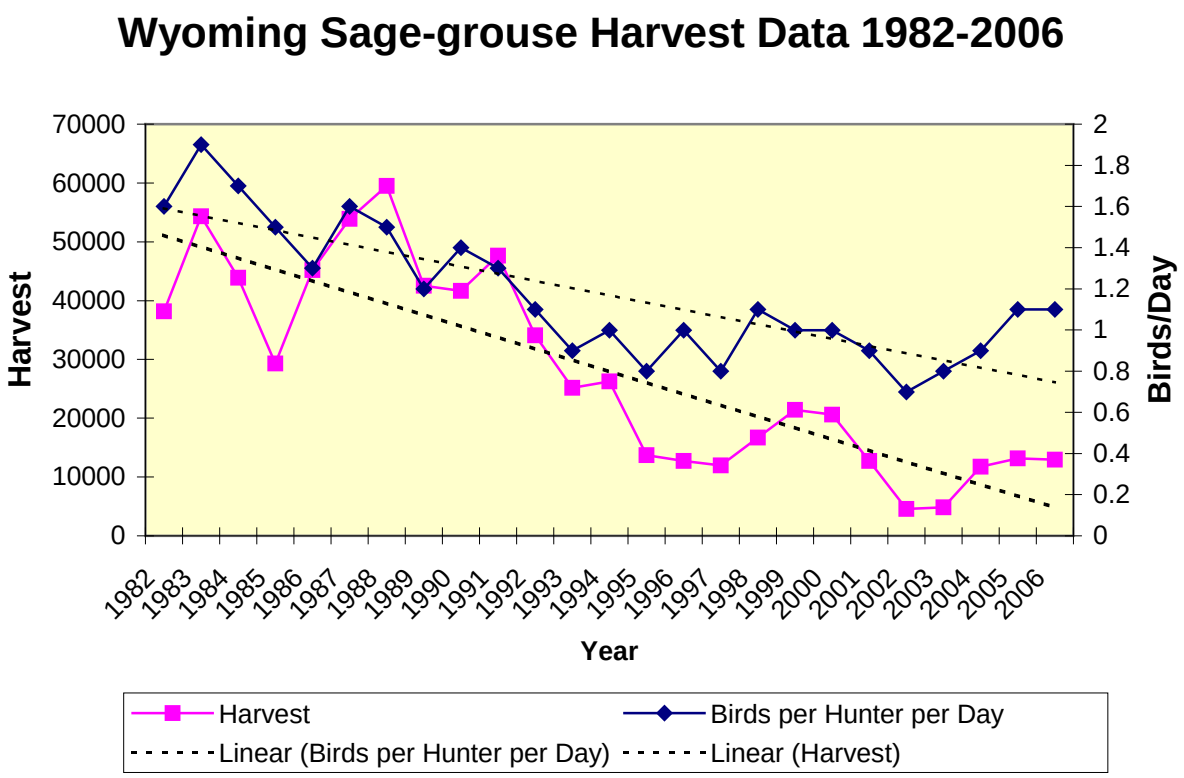


Figure 13.

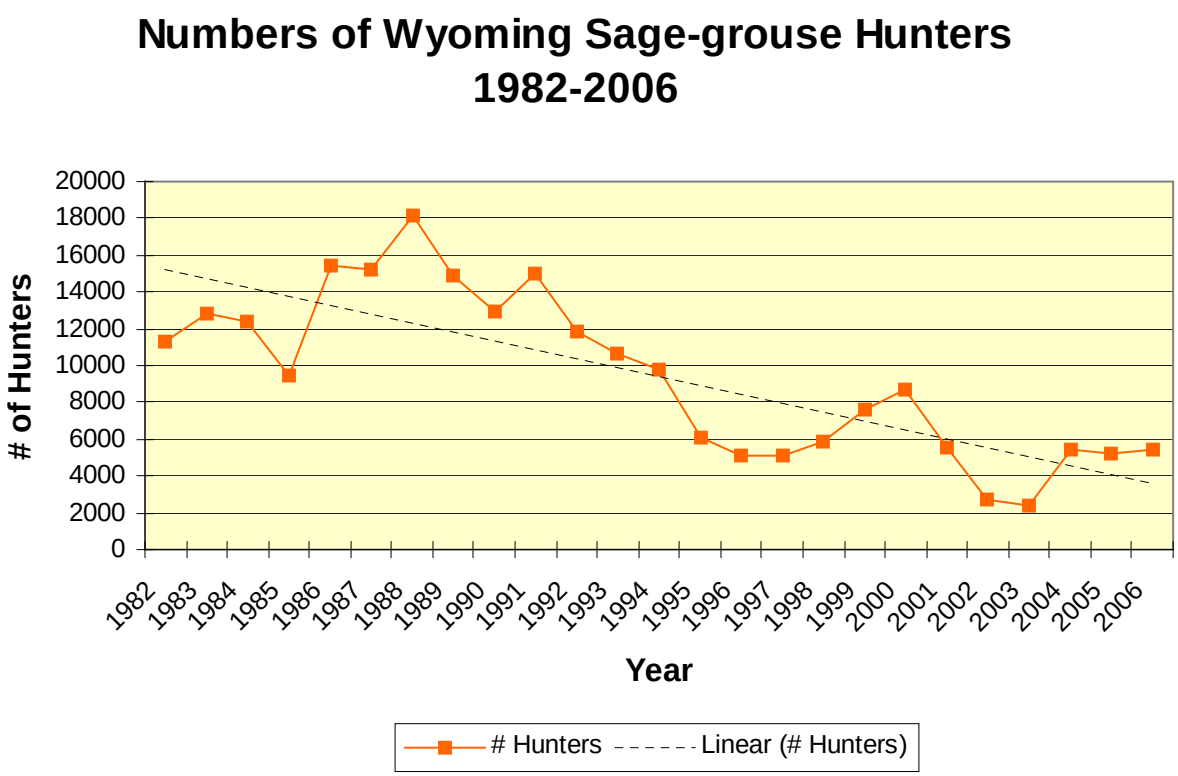
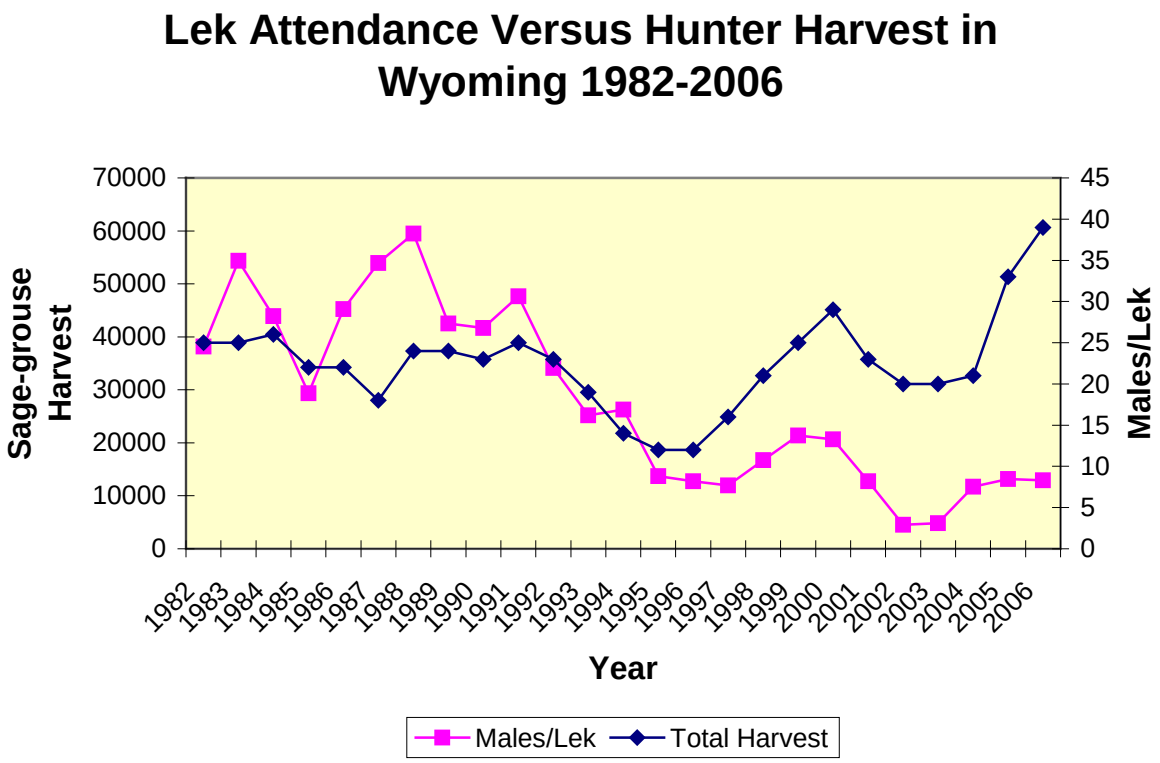


Figure 14.



Weather and Habitat

Sage-grouse nest success and chick survival have been linked to habitat condition, specifically shrub height and cover, live and residual (remaining from the previous year) grass height and cover, and forb cover. The shrubs (primarily sagebrush) and grasses provide screening cover from predators and weather while the forbs provide food in the form of the plant material itself and in insects that use the forbs for habitat. Spring precipitation is an important determinant of the quantity and quality of these vegetation characteristics. Residual grass height and cover depends on the previous year's growing conditions and grazing pressure while live grass and forb cover are largely dependant on the current year's precipitation. Most of the Local Conservation Planning Area JCRs include sections on weather and sage-grouse relationships. In general spring precipitation is linked to chick:hen ratios, which is in turn linked to the following year's lek counts of males.

A more through statistical analysis of these and other weather effects is recommended. A graduate student from the University of Wyoming Department of Statistics is currently conducting such an analysis.

Habitat and seasonal range mapping. While we believe that most of the currently occupied leks (1,800+) in Wyoming have been documented, other seasonal habitats such as nesting/early brood-rearing and winter concentration areas have not been identified. Efforts to map seasonal ranges for sage-grouse will continue by utilizing winter observation flights and the on-going land cover mapping efforts of the BLM, WGF, WYGIS of the University of Wyoming and others.

CONSERVATION PLANNING

In July of 2000, the Wyoming Sage-Grouse Working Group was formed to develop a statewide strategy for conservation of sage-grouse in Wyoming. The working group consisted of 18 Wyoming citizens from diverse backgrounds including agricultural, industrial, governmental, environmental, hunting and tribal interests. This group met for three years resulting in The Wyoming Greater Sage-Grouse Conservation Plan (State Plan) being approved by the Wyoming Game and Fish Commission in June 2003 (WGFD 2003). The State Plan is largely reliant on implementation by local working groups. The State Plan originally recommended eleven local working groups (LWGs) initiated over a three-year period. However, because of U.S. Fish & Wildlife Service's pending decision on whether or not to list greater sage-grouse as a threatened or endangered species and because of the potential negative impacts a decision to list would have on economic interests in Wyoming and across the range of sage-grouse, there was intense interest in conducting measures that benefit sage-grouse thereby precluding the need to list. One of the actions suggested was to accelerate the conservation planning process in Wyoming and form all working groups prior to the end of 2004. In order to implement such an action, originally recommended eleven LWGs were consolidated into eight (Figure 1), Wyoming Game and Fish Department work schedules were altered, and additional funding and personnel secured. All eight LWGs were operational in 2004. The status of local conservation planning efforts is shown in Table 2.

Table 2. Status of local sage-grouse conservation planning efforts as of May 31, 2007.

Local Working Group	**Plan Status**
Northeast Wyoming	Complete – August 2006
Bates Hole – Shirley Basin	Complete – January 2007
South-Central	Complete – March 2007
Upper Green River Basin	Complete – May 2007
Big Horn Basin	Draft plan to public in April 2007 Completion anticipated prior to July 2007
Southwest Wyoming	Draft near completion Completion anticipated prior to August 2007
Wind River/Sweetwater River	Draft near completion Completion anticipated prior to August 2007
Upper Snake River Basin	Draft near completion Completion anticipated prior to August 2007

Local Working Groups also implemented 20 sage-grouse conservation projects in 2005-2006 utilizing approximately $425,000 of a supplemental budget appropriation from the State of Wyoming (Table 3). The LWGs are currently evaluating and/or implementing over 30 additional projects that will utilize another $1 million appropriation prior to the end of 2008. Projects include habitat treatments/restoration, improved range management infrastructure and grazing management plans, applied research, inventories, monitoring and public outreach.

The State Plan had several goals and Recommended Management Practices (RMPs) that require WGF implementation. Aside from establishing and administering the LWGs, those goals and RMPs that the WGF has direct responsibility over and addressed in 2006-2007 include:

Goals from the WY Greater Sage-grouse Conservation Plan (2003) Addressed in 2006-2007

Population and Population Monitoring Goal #1) Maintain or increase cyclical peak sage-grouse numbers as measured by a consistently applied monitoring protocol using data from the year 2000 as a baseline (28 males/count lek).

Action: 526 leks were monitored at the intensity required to be "count" leks.
Status: 2007 males/count lek = 41

Population and Population Monitoring Goal #2) Do not allow the average number of males/count lek to decline below 10 during cyclical lows.

Action: 526 leks were monitored at the intensity required to be "count" leks.
Status: 2003 males/count lek = 20 (most recent "low")

Population and Population Monitoring Goal #3) Maintain or increase active sage-grouse leks at or above the number of known leks in 2002 (1,650-1,700).

Action: Leks continue to be documented and monitored regularly.
Status: 2006 occupied leks = 1,841

Population and Population Monitoring Goal #4) Provide for the long-term and short-term monitoring of sage-grouse in Wyoming.

Action: Revision/update of the WGFD Wildlife Techniques Manual sage-grouse section.
Status: Completed in 2007 (Christiansen 2007)

Population and Population Monitoring Goal #5) Reflect as accurately as possible the historic distribution and status of sage-grouse.

Action: Participation in the development of the Rangewide Conservation Assessment of Greater Sage-grouse and Sagebrush Habitats (Connelly et al. 2004)
Status: Completed – 2004

Action: Preparation of local and statewide JCRs.
Status: On-going annually.

Population and Population Monitoring Goal #6) Continue to implement established protocols for future population monitoring and record keeping, including mechanisms to insure consistent implementation.

Action: See #4 above. Also, member of Western Association of Fish & Wildlife Agencies Sage-Grouse Technical Team which coordinates this task across the range.
Status: On-going, continuous.

Action: Attended a WAFWA sage-grouse population monitoring workshop in Pocatello, ID in May 2005. An ad hoc committee was assigned to update monitoring protocols using the best available science.

Status: In progress.

Conflicting Wildlife and Wild Horse Management Goal #1) Minimize negative impacts to sage-grouse caused by management practices and habitat improvement projects intended for other species.

Action: Since release of the State Plan, the Sage-Grouse Management Guidelines and other documents demonstrating concern for sage-grouse increased attention has been given to the potential effects of wildlife population and habitat management practices to sage-grouse. The patch sizes of some habitat treatments have been modified to better accommodate sage-grouse needs.
Status: On-going; need to quantify/qualify the results.

Hunting Goal #1) Conduct hunting of sage-grouse in a manner that is compatible with maintaining robust populations and allows depressed population to increase.

Action: Hunting seasons have been set in accordance with the RMPs designed to achieve this goal.
Status: On-going, continuous.

Parasites and Disease Goal #1) Minimize impacts of parasites or disease on sage-grouse in Wyoming.

Action: Continued to monitor sage-grouse for West Nile virus impacts.
Status: On-going, no major outbreaks documented in 2006.

Action: Participated in various multi-agency research and monitoring projects seeking to better quantify and qualify the effects of WNv on sage-grouse.
Status: On-going; Results reported in peer-reviewed publication (Walker et al. 2005).

Vegetation Management Goal #1) Restore, maintain and/or enhance sagebrush ecosystem health and ecological processes and functions including associated riparian systems.

Vegetation Management Goal #2) Maintain or enhance natural patterns (e.g. seasonal migrations), functions (e.g. cover/food), and processes (e.g. fire).

Vegetation Management Goal #3) Maintain sagebrush habitats with a healthy understory of native grasses and forbs, diversity of species, diversity of age classes, and patches of varying size and density.

Action: These goals are long-standing ones of the WGF when conducting habitat treatments. Since release of the State Plan, the Sage-Grouse Management Guidelines and other documents demonstrating concern for sage-grouse increased attention has been given to the potential effects of wildlife habitat management practices to sage-grouse. The patch sizes of some habitat treatments have been modified to better accommodate sage-grouse needs.

Status: On-going

Weather Goal #1) Better define weather and climate related effects on sage-grouse populations and their interactions with other limiting factors in order to correctly understand and assess fluctuations in sage-grouse populations.

Weather Goal #2) Determine cause and effect relationships between forage drought, multiple uses, and sage-grouse recruitment.

Action: The JCRs have weather sections that, in part, address these goals.
Status: On-going. A graduate student from the University of Wyoming Department of Statistics is conducting such an analysis.

Implementation of Recommended Mgt Practices (RPMs) From the WY Greater Sage-grouse Conservation Plan (2003)

Population RMP #1) Prepare local and statewide annual summaries of sage-grouse data utilizing the primary database that includes information on the location and status of all known leks, hunter harvest and wing data.

Action: Preparation of local and statewide JCRs.
Status: On-going annually.

Population RMP #2) Develop a monitoring protocol that would more accurately document long-term population trends.

Action: See Population Goals #4-6 above.
Status: See Population Goals #4-6 above.

Population RMP #3) Develop and refine techniques to measure productivity where wing data are unavailable.

Action: Brood surveys are conducted in Northeast Wyoming, the Big Horn Basin where sample sizes of wing data are low.
Status: On-going

Population RMP #4) Review population data annually to determine three and ten year trends.

Action: See Figures 6 and 7.
Status: On-going; complete to date

Winter Habitat RMP #1) Use aerial photos, surveys, other remote sensing techniques, local knowledge and anecdotal information to identify winter habitat.

Action: All of the above techniques are being implemented around the state to accomplish this goal.
Status: On-going, not complete

Breeding Habitat RMP #1) Limit distribution of lek site information to avoid stressing birds. Avoid disturbance on lek sites while birds on the lek, generally from March through May.

Action: Lek sites are not made available for easy public access, but rather the info is available as needed to assist project planners and others avoid impacts. A lek viewing guide was developed and distributed (hard copies and electronic download) prior to the 2007 lek viewing season.
Status: On-going

Breeding Habitat RMP #2) Identify and map lek and lek-associated habitats.

Action: Lek sites are mapped. Mapping of lek perimeters has begun.
Status: Point data are mapped but perimeter mapping is not complete and will likely take several years to complete.

Landscape Habitat RMP #4) Within three years, identify and map seasonal sage-grouse habitats statewide.

Action: Some seasonal habitats, especially lek and winter habitats have been or are being mapped.
Status: On-going. Because of limitations of current remote sensing technology, this task will take longer than three years to complete.

Conflicting Wildlife and Wild Horse Management RMP #1) Evaluate effects to sage-grouse caused when managing for other wildlife species.

Conflicting Wildlife and Wild Horse Management RMP #4) Document areas where conflicting species management goals may negatively impact sage-grouse.

Conflicting Wildlife and Wild Horse Management RMP #6) When planning mitigation projects, avoid negative impacts to sage-grouse.

Conflicting Wildlife and Wild Horse Management RMP #7) Review big game herd goals and modify and implement special big game seasons to meet harvest objectives as necessary to improve habitat conditions for sage-grouse.

Conflicting Wildlife and Wild Horse Management RMP #8) Incorporate sage-grouse needs into management plans for wildlife, especially big game.

Action: All these RMPs are being considered or implemented as recommended on an as needed basis.
Status: On-going.

Hunting RMP #1) In stable to increasing populations (based on lek count information) maintain a 2 to 4 week hunting season with a 3 bird daily bag limit beginning no earlier than September 15.

Hunting RMP #2) If populations are declining (for 3 or more consecutive years based on lek count information) implement more conservative regulations that might include:

reduced bag limits, adjusted season dates, limited quota seasons or closed seasons.

Hunting RMP #3) Populations should not be hunted where less that 300 birds comprise the breeding populations (i.e. less than 100 males are counted on the leks).

Hunting RMP #4) Collect hunter harvest data via hunter surveys and wing barrels.

Action: All the hunting RMPs are being conservatively implemented.
Status: On-going and continuous.

Parasites and Diseases RMP #1) Investigate and record deaths that could be attributed to parasites or disease.

Action: WGF field personnel are encouraged to submit carcasses of dead sage-grouse (other than roadkills or harvested birds) to the Wyoming State Vet Lab for necropsy to determine cause of death. This practice was emphasized with the Northeast Wyoming outbreak of West Nile virus in 2003.
Status: On-going, continuous. No major outbreaks documented in 2006.

Parasites and Diseases RMP #2) Develop and implement strategies to deal with disease outbreaks where appropriate.

Action: WGF closed the sage-grouse hunting season in northeast Wyoming in 2003 as a precautionary measure when significant numbers of sage-grouse mortalities were documented
Status: Complete, continued monitoring will determine future needs.

Recreation RMP #7) Agencies should generally not provide all lek locations to individuals simply interested in viewing birds.

Action: Lek sites are not made available for easy public access. Sites of well-known individual lek sites are provided to those that request information on where to view leks. A lek viewing guide was developed and distributed (hard copies and electronic download) prior to the 2007 lek viewing season.
Status: On-going, viewing guide complete and available.

Vegetation Management RMPs #1-22) see State Plan

Action: Virtually all these RMPs are considered/implemented when WGF personnel conduct vegetation treatments.
Status: On-going.

Weather RMP #1) Correlate, on a local level, historical and present weather data with historical and present sage-grouse population data to determine weather impacts to sage-grouse populations and habitat.

Action: The local JCRs incorporate these analyses.
Status: On-going. Additional efforts needed. A graduate student from the University of Wyoming Department of Statistics is currently conducting such an analysis.

Table 3. Sage-grouse conservation projects implemented 2005-2006 with Wyoming General Fund 2005 Supplemental Budget Appropriation.

Project Name	Responsible Parties	Local Working Group	LWG SG $	Project Description	Status
1 - Martin Ranch Range Improvement (phase I)	Thomas Haygood - Martin Ranch, Rory Karhu - NRCS	Bates Hole/ Shirley Basin	$19,501 requested/approved, $19,633.44 spent	Fence construction to implement 3 pasture rotation grazing system and mosaic prescribed fire in Mountain Big Sagebrush to improve forage including forbs and insects.	Complete
2 - 7E Ranch	Medicine Bow Conservation District, Ron Heward - 7E Ranch	Bates Hole/ Shirley Basin	$44,990 requested/approved, $44,990 spent	Fence construction and water development to implement a 4-pasture rest-rotation grazing system.	Complete
3 - PW Spring Restoration	Spring Gulch Cattle Co. - Dee Hillberry, BLM Worland FO- Tim Stephens	Bighorn Basin	$10,000 requested/approved, $8,150 spent	Spring development and protection.	Complete
4 - Heart Mtn SG Habitat Enhancements	WGFD - Jerry Altermatt, The Nature Conservancy - Maria Sonnet	Bighorn Basin	$38,000 requested/approved, $32,226.15 spent	Spring protection and small mosaic sagebrush treatments with mowing and prescribed fire.	Complete
5 - YU Bench SG Habitat Enhancements	WGFD - Jerry Altermatt, BLM - Cody FO - Jack Mononi	Bighorn Basin	$15,000 requested/approved; $14,493 spent	Mosaic sagebrush mowing and fenced forb seedings.	Complete
6 - Jackson Hole Plant Species Composition & Structure	Teton Science School - Doug Wachob, National Elk Refuge - Eric Cole, USGS - Geneva Chong	Jackson Hole	$26,250 requested/approved/spent	GIS sage-grouse winter habitat inventory and monitoring.	Complete
7 - DeSmet Conservation District Community-Based Approach to Restore Sagebrush	DeSmet Conservation District - Nikki Lohse	Northeast	$90,000 requested/approved/spent	Habitat restoration, development/implementation of grazing and CBM BMPs, habitat mapping, landowner outreach.	Complete/ On-going
8 - University of MT SG and Energy Development: Planning Tools	University of Montana - Dr. David Naugle	Northeast	$35,000 requested/approved; $34,993.40 spent	Research to develop conservation planning tools (i.e. maps), determine energy development impacts, and determine West Nile virus impacts to sage grouse.	Complete
9 - Sixteen Mile-Atlantic Rim Water Developments	BLM Rawlins FO - Christopher Otto	South-Central	$20,000 requested/approved; $19,996.85 spent	Spring development and protection.	Complete/ On-going

Table 3. Continued					
Project Name	**Responsible Parties**	**Local Working Group**	**LWG SG $**	**Project Description**	**Status**
10 - Seminoe Allotment Water Developments	BLM Rawlins FO - Mike Murray	South-Central	$6,500 requested/approved/spent	Spring development and protection.	Complete
11 - Carbon County Seeding	Carbon County Road and Bridge - Bill Nation	South-Central	$2,000 requested/approved; $1,982.31 spent	Forb seedings in wet areas along low volume county roads.	Complete
12 - SG & Sagebrush Conservation I&E	WGFD - Lucy Wold	Southwest	$2,600 requested/approved; $2,597.00 spent	Educational displays including taxidermy mounts and restaurant activity placemats for youth.	Complete
13 - South LaBarge Weed Control	Sublette Co. Weed & Pest - Adrianne Petersen	Southwest	$5,000 requested/approved/spent	Invasive/noxious weed control.	Complete
14 - Rock Creek Prescribed Burn	BLM - Kemmerer FO - Gavin Lovell	Southwest	$20,000 requested; $6,200 approved/spent	Prescribed burning of aspen, mountain shrub and mountain big sagebrush to improve habitat conditions for all wildlife including sg.	Complete
15 - Winter Closure Signs	BLM - Kemmerer FO - Gavin Lovell, WGFD - Ron Lockwood	Southwest	$2,000 requested/approved; $1,674.75 spent	Improve effectiveness of existing public land big game and sage grouse winter range closures via new signing.	Complete
16 - SG Seasonal Habitat and Demo Documentation	Wyoming Wildlife Consultants LLC - John Dahlke	Upper Green River	$49,739 requested/approved/spent	Research documenting pre-development/baseline seasonal distribution of sage grouse.	Complete/ On-going
17 - Examining Noise Effects from Energy Devel.	University of California - Davis - Dr. Gail Patricelli	Upper Green & Wind/ Sweetwater	$20,000 requested/approved/spent	Research examining the effects of noise resulting from energy exploration and development.	Complete/ On-going
18 - Enhanced GIS Data on Sagebrush Habitats	Wyoming Wildlife Consultants LLC - John Dahlke	Upper Green River	$10,000 requested/approved/spent	Collate and link all past and on-going research, mapping, and habitat treatments conducted in the Upper Green River Basin into a single, accessible GIS database.	Complete
19 - Government Draw SG Habitat Improvement	BLM Lander FO - Sue Oberlie	Wind River/ Sweetwater	$15,000 requested, $0 approved. Proposal requested funding for contracting the equipment and labor. With the purchase of the mower (below), WGF will conduct the mowing and therefore contracting will not be required.	Habitat treatments using mower and Lawson aerator.	Complete/ On-going
20 - John Deere CX20 Rotary Cutter	WGFD - Scot Kofron	Wind River/ Sweetwater	$22,149 requested/approved; $20,532.00 spent	Purchase of mower for statewide use in sagebrush habitat treatments resulting from sage grouse conservation planning efforts around the state.	Complete

OTHER ISSUES

West Nile Virus

West Nile virus (WNv) was first confirmed in sage-grouse in 2003 in the northern Powder River Basin and is now considered a potential threat to sage-grouse populations. Research efforts have resulted in several published papers that describe the disease and it's potential impact to sage-grouse populations (Naugle et al. 2004, Naugle et al. 2005, Walker et al. 2004, Zou et al. 2006). The Zou et al. (2006) paper was published during the current reporting period. A key result of this research was the documentation of a 75% increase in potential mosquito (WNv vector) larval habitats from 1999 to 2004 in Sheridan, Johnson and Campbell Counties (Powder River Basin), primarily because of the increase in coalbed methane water discharge ponds.

Monitoring efforts in 2006 in Wyoming included: 1) intensive monitoring of radio-collared sage-grouse during the late summer on study sites across Wyoming, 2) WGF field personnel were directed to collect late summer sage-grouse mortalities and submit them for testing, and 3) press releases were distributed requesting the general public, especially landowners, to report late summer sage-grouse mortalities.

Three WNv mortalities were documented in the Powder River Basin in 2006 with results unavailable for three other birds (Brett Walker, pers. com.). Additionally, three WNv mortalities were documented just north of the Wyoming border in Bighorn County, Montana. These mortalities were all radio-marked birds from the University of Montana research project.

Lower altitudes (<6,000 ft.) typically have warmer temperatures that favor the development of the disease in the mosquito vector. However, 5 radio-collared grouse from a Colorado study being conducted near the Colorado-Wyoming border south of Rock Springs died from WNV at altitudes above 6,000 feet. One of these grouse died in Wyoming near Pine Mountain, south of Rock Springs. This study is on-going.

Although unconfirmed, WNv is also suspected to have caused sage-grouse mortality on the Wind River Reservation near Lander (Pat Hnilicka, pers. comm.). Fremont County was a hotspot for WNv activity in humans in 2006 and four of the reservation's 25 radio-marked birds died in August during the human outbreak. All of the dead birds were found at low elevation compared to the surviving birds. Unfortunately the carcasses were not collected soon enough to allow the WY State Vet Lab to detect WNv.

Range-wide Conservation Assessment and Strategy

Due to the concerns for sage-grouse across the western U.S. the Western Association of Fish & Wildlife Agencies (WAFWA) entered into a contract with the U.S. Fish & Wildlife Service (USFWS) to assimilate and analyze sage-grouse and sagebrush habitat data from around the West. The result of that effort was the "Conservation Assessment of Greater Sage-Grouse and Sagebrush Habitats" (Connelly et al. 2004). This document is the first detailed assessment of range-wide population and habitat data for greater sage-grouse.

The next phase of the contract called for WAFWA to produce a conservation strategy. The "Greater Sage-grouse Comprehensive Conservation Strategy" (Stiver et al. 2006) was delivered in December 2006. The overall goal of the Strategy "is to maintain and enhance populations and

distribution of sage-grouse by protecting and improving sagebrush habitats and ecosystems that sustain these populations".

Furthermore, "the overall strategy for the management and/or conservation of greater sage-grouse is to develop the associations among local, state, provincial, tribal and federal agencies, non-governmental organizations, and individual citizens necessary to design and implement cooperative actions to support robust populations of sage-grouse and the landscapes and habitats upon which they depend".

WAFWA member agency directors, including Terry Cleveland of the Wyoming Game and Fish Department, are signatories to the Strategy.

Energy Development

The issue of energy development and its effects to sage-grouse and sagebrush habitats continues to be a major one in many portions of the state. The topic is of major interest in Local Working Group efforts and the JCRs for the local conservation areas contain additional detail on the issue. Research efforts continue to focus on this issue and during this reporting period a University of Wyoming MS thesis was completed that examined the issue (Kaiser 2006).

Among the findings of this research were:

- Yearling males tended to avoid leks in developing gas fields.
- Less recruitment was seen on leks as distance from leks to the nearest drilling rig decreased.
- Females that bred or nested in gas fields had later nest hatching dates and fewer and smaller broods than birds outside the fields.
- Both males and females showed low fidelity to natal leks and nest sites. Determining the cause of these low rates of fidelity was not feasible due to low sample sizes.
- Results indicated approximately 50% brood mixing 10 weeks post hatch.

These results build upon those of Lyon (2000), Lyon and Anderson (2003) and Holloran (2005).

Zou et al. (2006) was published during the current reporting period. A key result of this research was the documentation of a 75% increase in potential mosquito (WNv vector) larval habitats from 1999 to 2004 in Sheridan, Johnson and Campbell Counties (Powder River Basin), primarily because of the increase in coalbed methane water discharge ponds.

On-going research efforts include continuing University of Wyoming research on the effects of conventional natural gas development in the Upper Green River Basin and the University of Montana is studying coal-bed methane development impacts to sage-grouse in the Powder River Basin. The University of California-Davis has also initiated research specifically designed to assess the effects of noise generated by natural gas development on sage-grouse.

The results of these research efforts should inform and guide future management actions where energy development occurs in sage-grouse habitat. This includes updating the Recommendation for Development of Oil and Gas Resources within Crucial and Important Wildlife Habitats document (Wyoming Game and Fish Department 2004).

PAST RESEARCH/STUDIES

See Appendix A.

CONCLUSIONS AND RECOMMENDATIONS

1) Continue to implement actions that meet the goals of the Wyoming Greater Sage-grouse Conservation Plan (2003).

2) Complete and implement local conservation plans in all 8 planning areas utilizing local working groups.

3) Map lek locations using the Global Positioning System (GPS) map datum of NAD83. Some leks are still being reported in other datums.

4) Map lek perimeters and integrate these data into the WGF lek database. Priority for this effort should be based on the lek size of lek and impending development actions that may impact leks.

5) Personnel monitoring leks should review and consistently follow established lek monitoring protocol each year.

6) Map seasonal habitats (nesting/early brood rearing, winter concentration areas) for sage-grouse using data from the on-going land cover mapping project and sage-grouse observations.

7) Appropriately adjust management recommendations for oil and gas development in sage-grouse habitats as research results become available.

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Appendix A.
Wyoming Sage-Grouse Research Reports

The following list includes final research reports from WGF sage-grouse research or theses and dissertations from University research efforts. It does not include annual agency monitoring reports or popular press articles.

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Boyce, M. S. 1990. The red queen visits sage-grouse leks. American Zoologist 30:263-270.

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Narrative Report

Species: **Sage-grouse** Period covered: **6/1/2006 – 5/31/2007**
Region: **Cody** Local Working Group area: **Bighorn Basin**
Management areas: **11, 12, 15, 16, 17, 19, 20, 21, and western portions 37, 40**
Prepared by: **Tom Easterly, Greybull Wildlife Biologist**

INTRODUCTION

Wyoming has the highest population of greater sage-grouse (sage-grouse) and the most intact sagebrush steppe habitats of all the western states. Sagebrush habitat and sage-grouse populations have been declining across the west, including Wyoming. Concern over declining sage-grouse populations has focused more attention on the species and between 1999 and 2003, seven petitions were filed to list the greater sage-grouse for protection under the Endangered Species Act. In December 2004, the U.S. Fish and Wildlife Service determined that the greater sage-grouse was not warranted for listing at that time.

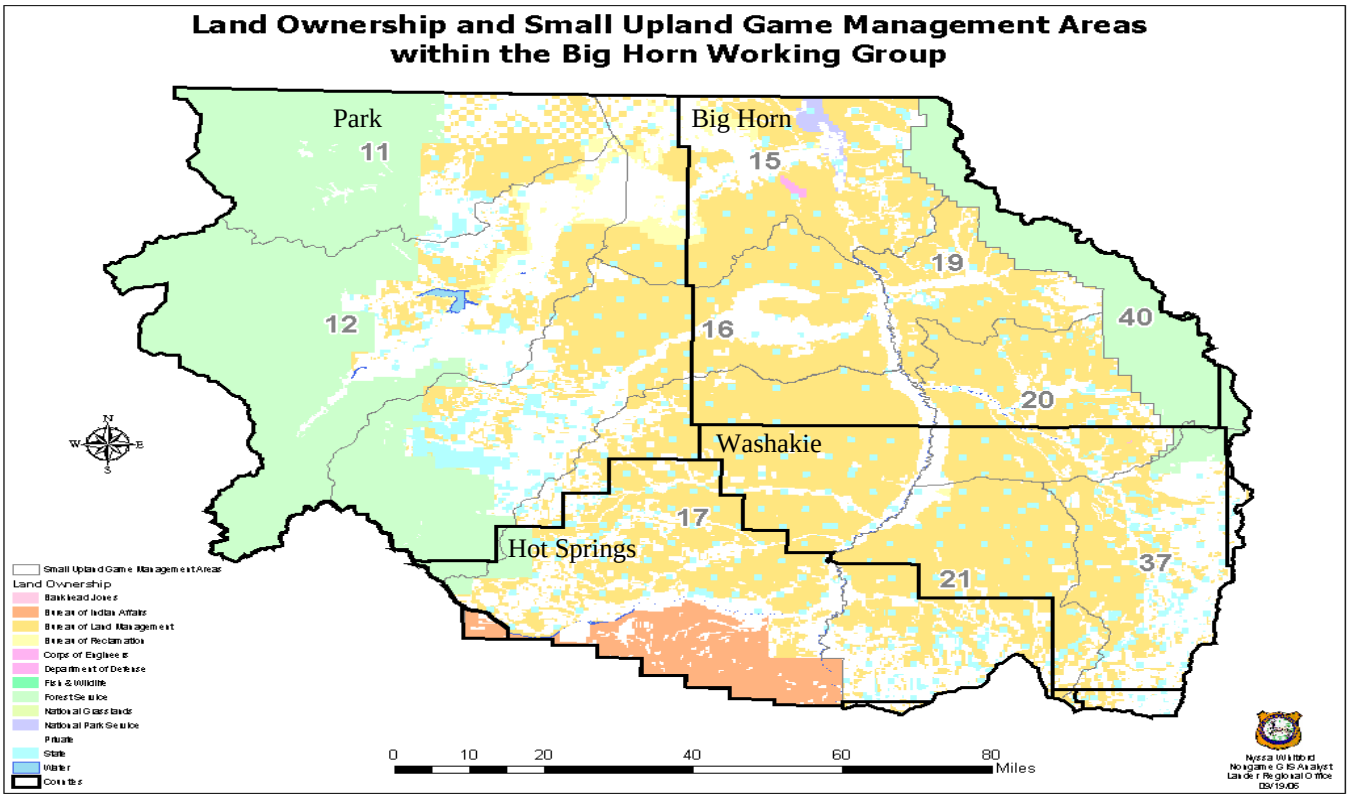
Within Wyoming, eight Local Working Groups (LWG) were established to prepare conservation plans to address localized situations. LWGs consist of members of the public and government agencies with an interest in sage-grouse either from personal or occupational perspectives, or both. The Big Horn Basin Local Working Group completed their conservation plan and the Game & Fish Commission formally accepted it on 15 November 2007. This annual report summarizes data collected in the Basin during the 2006 biological year (1 June 2006 – 31 May 2007), including the 2007 breeding season, which is not included in the Conservation Plan. This and future annual reports will provide updates of the Big Horn Basin LWG's conservation efforts.

STUDY AREA

The Bighorn Basin (Basin) is subdivided into various political jurisdictions and ownership patterns (Fig 1). Counties within the Basin include Big Horn, Hot Springs, Park, and Washakie. The Basin encompasses WGFD's Small/Upland Game Management Areas 11, 12, 15, 16, 17, 19, 20, 21, and a portion of 37 and 40. Management Areas do not correspond to sage-grouse sub-population boundaries; they are used for general data collection and reporting for all small and upland game species. The Basin is mostly public land managed by the BLM (40%), Forest Service (25%), state (5%), or other federal agencies (>1%; Bureau of Reclamation, National Park Service, Department of Defense). Private land represents 25% of the Basin. There have been land sales and exchanges between federal agencies and private interests that are not reflected on Figure 1 (i.e., Little Mountain). Primary land uses in the Basin include: livestock grazing, dry-land and irrigated crop production, oil and gas

development, bentonite mining, urban and suburban developments, recreation and wildlife habitat.

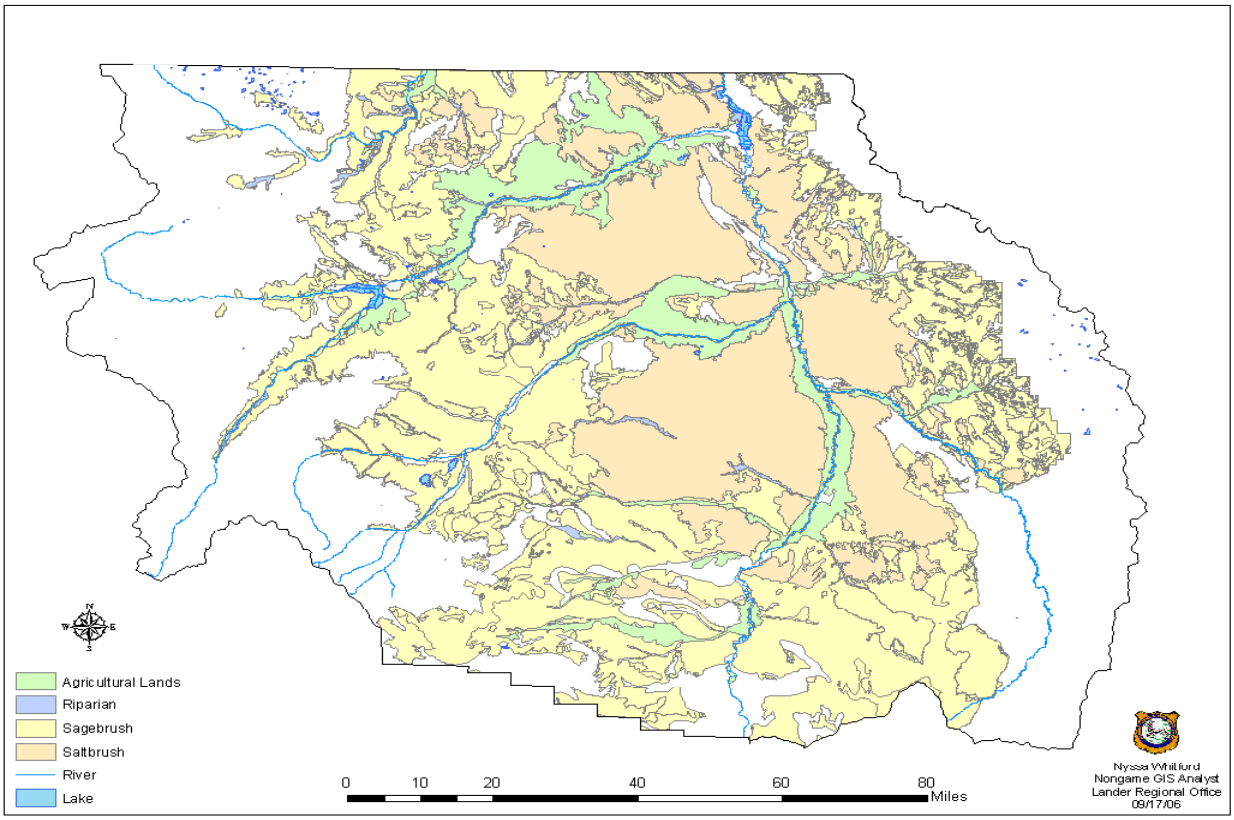
Figure 1. Geopolitical subdivisions and land ownership patterns in the Bighorn Basin, 2006.



Habitats within the Bighorn Basin are diverse and vary depending upon such factors as soil type, annual precipitation, and elevation. Major habitat types within the plan area include: sagebrush/grassland, salt desert shrub, agricultural crops and pasture lands, mixed mountain shrub, mixed conifer forests at higher elevations with interspersed aspen stands, cottonwood-riparian corridors, and urban areas. King (1992) provides a more complete description of plant communities within the Bighorn Basin defined by precipitation zone (6-9, 10-14, 15-19, and 20+ inches).

Habitats that may be most important to sage-grouse are presented in Figure 2 (Wyoming GAP Analysis Land Cover Map). GAP data used to construct this habitat map were often incorrect, based upon expert opinions of landowners and managers familiar with the Basin. For example, the southeast corner of the Basin actually does contain considerable sagebrush not shown on Figure 2. Also, there are sagebrush habitats interspersed with conifer forests on mountain ranges (often used by sage-grouse) that were not detected. No formal statewide validation of the Wyoming GAP land cover map has been done, however, field resource specialists from BLM, WGFD, FS, and NRCS reviewed and edited these maps based on field knowledge of existing conditions. Land cover classification is currently under way to improve habitat maps.

Figure 2. Selected habitat types used by sage-grouse within the Bighorn Basin.



Sage-grouse in the Basin represent an almost isolated population. Connelly et al. (2004) recognized these sage-grouse as a distinct sub-population (Fig 3). Mountain ranges to the east and west restrict most sage-grouse movement due to unsuitable habitat types. Grouse movements in the north and southeast portions of the Bighorn Basin have not been well documented. There are several leks on both sides of the Wyoming-Montana state line, and movement between states is suspected. Suitable habitat on Copper Mountain, the Owl Creek Mountains and the southern Bighorn Mountains may serve as travel corridors to other areas where sage-grouse populations occur (e.g., the South Fork of the Powder River Basin).

As of 2007, there were 250 known, occupied sage-grouse leks in the Bighorn Basin (Fig 4). Several leks have changed locations, however, maps have not been updated in recent years. Thirty-three additional lek sites were unoccupied ("abandoned" or "historical"); three of which were abandoned due to destruction of the lek site. Several leks have not been active in recent years, but have not been surveyed adequately to categorize as unoccupied. (Appendix C provides definitions of lek status terms.) There are probably leks within the Basin that have not been discovered. A majority of the leks (69%) occur on BLM managed land (Table 1).

Figure 3. Discrete populations and subpopulations of sage-grouse in western North America, highlighting (red) the Bighorn Basin sub-population. (Adapted from Connelly et. al. 2004).

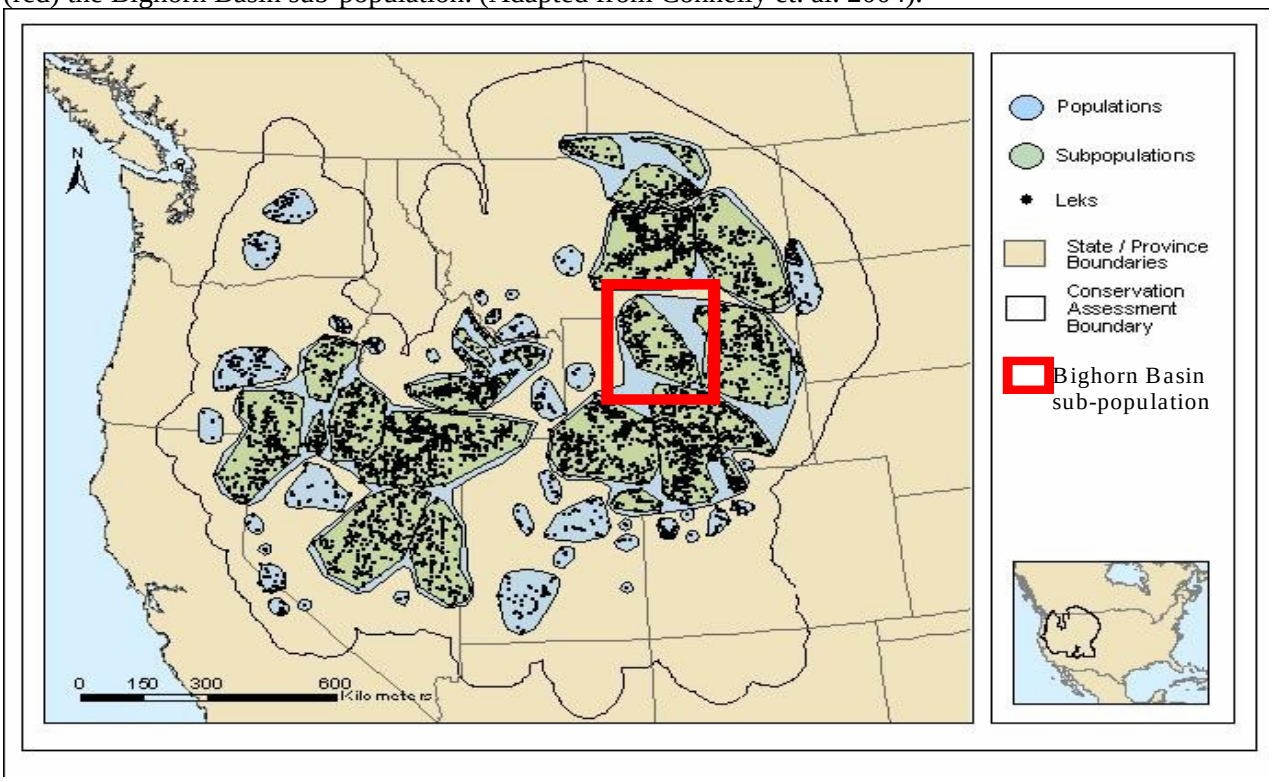


Table 1. Distribution of the 277 sage-grouse leks within the Bighorn Basin based on various geopolitical subdivisions, 2006.

BLM Office	Number	Percent
Cody	98	35.4%
Worland	179	64.6%

County	Number	Percent
Bighorn	40	14.4%
Hot Springs	48	17.3%
Park	94	33.9%
Washakie	95	34.3%

WGFD Biologist District	Number	Percent
Cody	79	28.5%
Greybull	38	13.7%
Thermopolis	160	57.8%

FS Office	Number	Percent
Bighorn	0	0
Shoshone	0	0

Land Status	Number	Percent
BLM	191	69.0%
BOR	1	0.4%
Private	66	23.8%
State	19	6.9%

WGFD Game Warden district	Number	Percent
Greybull	25	9.0%
Lovell	17	6.1%
Meeteetse	36	13.0%
North Cody	22	7.9%
Powell	13	4.7%
South Cody	18	6.5%
Ten Sleep	46	16.6%
Thermopolis	41	14.8%
Worland	59	21.3%

WGFD Management Area	Number	Percent
11	13	4.7%
12	25	9.0%
15	17	6.1%
16	37	13.4%
17	59	21.3%
19	16	5.8%
20	12	4.3%
21	48	17.3%
37	50	18.1%

METHODS

Since the late 1990's, data on numbers of sage-grouse attending leks were collected in two ways: lek surveys and lek counts. Lek surveys were defined as at least one visit to a lek during the breeding season (mid March-mid May) to determine if the lek was active. Lek counts consisted of three or more visits (separated by about 7-10 days) to a lek during the peak of strutting activity (early April-early May) to obtain the maximum number of males in attendance. Some leks in the Basin have been surveyed since the late 1950's-early 1960s. The procedure for conducting more intensive lek counts was established in 1998. Until recently, few leks had been "counted" in the Bighorn Basin. The majority of the data collected were lek surveys. All leks in a complex must be checked on the same mornings to get a reliable count of the number of birds in the area. Data from counts of all leks in a complex can be used as an index of trends in sage-grouse populations.

Brood surveys and seasonal distribution surveys were conducted sporadically during July and August. No consistent methodology has been established, but usually consisted of a person (with or without dogs) walking or driving in areas thought to be occupied by sage-grouse. Data on the number of chicks, adult hens, and adult males were collected. Locations (UTM coordinates) and habitat type were also recorded to help delineate brood rearing areas.

Harvest information was obtained through a mail questionnaire of bird hunters. Starting in 1982, data have been compiled by Upland Game Management Area. Management Areas in the Bighorn Basin include Areas 11, 12, 15, 16, 17, 19, 20, and 21 (Figure 1). Only a portion of Management Areas 37 and 40 lie within the Bighorn Basin. Data from lek and brood surveys on the west side of Area 37 are included here. No leks are known to occur on the west side of Area 40. Harvest data for Areas 37 and 40 have been included in the Northeast LWG/Sheridan Region annual reports and are not included in this summary. Little harvest occurs on the east side of Area 37 (D. Thiele pers. comm.) and few sage-grouse are harvested from the west side of Area 40.

RESULTS

Habitat conditions. Between 2000-2004, parts of the Bighorn Basin were more than 30% below long-term average precipitation. Average precipitation, measured at remote weather stations located throughout the Basin, was approximately 30% below long-term averages (1963-2000). Little or no herbaceous vegetation production occurred in the interior of the Basin and some areas had minimal or no annual production of sagebrush and saltbush. Long-term drought resulted in mortality of sagebrush throughout the Basin. Individual plants appeared to have died, although it is doubtful that any large stands of sagebrush were killed. Some stands contained as much as 50% dead sagebrush plants (N. Marymor unpubl. report 2005). Resulting decreased density of older sagebrush and increased overall plant diversity may have long-term benefits for sage-grouse habitat. Vegetation on interior portions of the Basin was impacted by drought to a greater extent than on mountain foothills surrounding the Basin. Fortunately, the past several winters (2003-04, 2004-05, and 2005-06) were mild with below average snow depth and above average temperatures. Increased precipitation

(during spring and summer 2005) allowed for increased growth of herbaceous vegetation, sagebrush, and other shrub species. Unfortunately, favorable weather patterns were short-lived and drought conditions returned in 2006.

Lek monitoring. Sampling protocols for lek counts and surveys need to be followed more closely than they have been in recent years. Standardized protocol for a "count" requires a minimum of three visits to leks, separated by 7-10 days, during the peak of male attendance at the lek (early April to early May). Peak male attendance usually occurs after peak breeding and female attendance. Lek surveys can occur in mid-March to mid-May. All leks and satellite leks within the same complex need to be visited on the same morning in order to use data as an index to population trend. Leks and complexes assigned for counts must remain the same over the long term, to make valid comparisons of data from year to year. Leks not being intensively counted do not need to be visited more than once, if birds were at a site on the first visit. Coordination between observers has been improving, but different observers are still visiting several leks, even on the same day. More attention needs to be given to recording accurate locations for leks. Lek names (or codes) need to be standardized so all data are compiled accurately. Locations where males are observed strutting require more than one visit to be considered a new lek. If no birds were observed at a given lek on several visits, the observer should walk out to the lek site, late in the breeding season, to look for fresh sign of grouse presence (droppings, feathers, etc).

Lek monitoring data for the 2007 breeding season are summarized in Table 2 (A-D), Figure 4, and Appendix A. Data from 1997-2006 are given for comparison and trend. Male attendance at all leks visited (counts and surveys) averaged 24 males per lek during spring 2007. There was a slight decline in average male attendance from last year's average of 25 males/lek. The ten-year (1997-2006) average was 18.2 males/lek. Average male attendance was calculated using only those leks where one or more males were present (active leks).

Each year every lek is classified to it's status under several categories: checked or not checked, surveyed or counted, and active or inactive or unknown. Clarifications to classifications of leks and not individual observations may have resulted in different values occurring in Table 2 (A-D) in this report compared to similar tables in previous years' reports. In past years, individual observations of a lek were placed in the active, inactive or unknown category based on the presence of two or more males at the lek. This led to the reporting of some leks as active and inactive within the same year. The lek database has been corrected so that if males (2 or more) were observed at any time during the breeding season, that lek was considered active for that year. Likewise, if lek observations met criteria to be classified as a "count", all observations to a lek in that year were considered a "count" even if some observations did not meet the criteria (e.g., observations on consecutive days or before peak breeding activity).

Of the 146 lek complexes thought to exist in the Bighorn Basin, 111 (76%) were monitored in 2006. Data by complex are presented in Table 3 (a-d), Figure 5 and Appendix B. Only 30% of the known complexes were monitored to meet the criteria for a count of the entire complex. Proper count procedures were again not followed for many complexes that were scheduled to be intensively monitored. Counts of all leks

Table 2 (A – D). Lek attendance summary (occupied leks) for the Big Horn Basin Conservation Area, 1997-2007.

A. Leks Counted

Year	Known	Counted	Percent counted	Max totals Males	Max totals Females	Avg./active lek Males	Avg./active lek Females
1997	235	0	0				
1998	236	6	2.5	112	36	18.7	6.0
1999	235	28	11.9	805	199	28.8	7.1
2000	238	47	19.7	1141	418	24.3	8.9
2001	238	43	18.1	787	300	18.3	7.0
2002	236	58	24.6	773	394	13.3	6.8
2003	237	64	27.0	1023	438	16.0	6.8
2004	244	58	23.8	1121	241	19.3	4.2
2005	247	81	32.8	1728	595	21.3	7.3
2006	255	62	24.3	1680	540	27.1	8.7
2007	254	69	27.2	1846	526	26.8	7.6

B. Leks Surveyed

Year	Known	Surveyed	Percent surveyed	Maximum total males	Avg males/ active lek
1997	235	83	35.3	747	12.9
1998	236	70	29.7	895	15.4
1999	235	57	24.3	1129	22.1
2000	238	64	26.9	1123	23.4
2001	238	86	36.1	1317	19.4
2002	236	73	30.9	572	10.2
2003	237	95	40.1	652	10.2
2004	244	97	39.8	975	14.3
2005	247	98	39.7	1237	18.2
2006	255	110	43.1	1717	23.2
2007	254	100	39.4	1573	22.2

C. Leks Checked

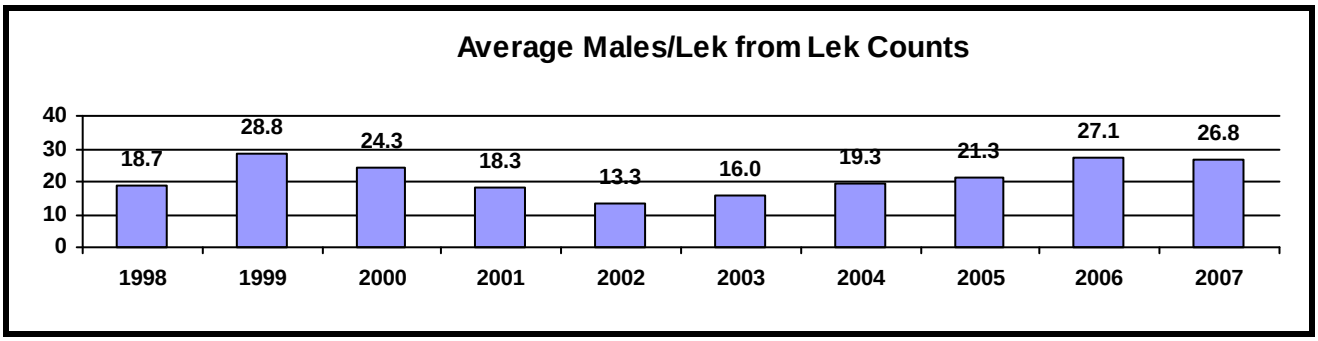
Year	Known	Checked	Percent checked	Maximum total males	Avg males/ active lek
1997	235	83	35.3	747	12.9
1998	236	77	32.6	1007	15.7
1999	235	85	36.2	1934	24.5
2000	238	111	46.6	2264	23.8
2001	238	129	54.2	2104	19.0
2002	236	131	55.5	1345	11.8
2003	237	159	67.1	1675	13.1
2004	244	156	63.9	2096	16.6
2005	247	180	72.9	2965	19.9
2006	255	172	67.5	3397	25.0
2007	254	169	66.5	3394	24.2

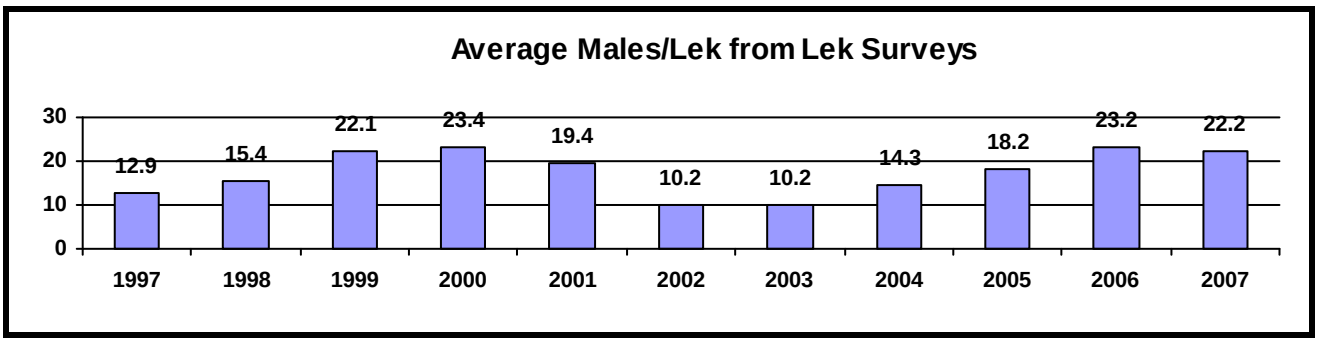
D. Lek Status

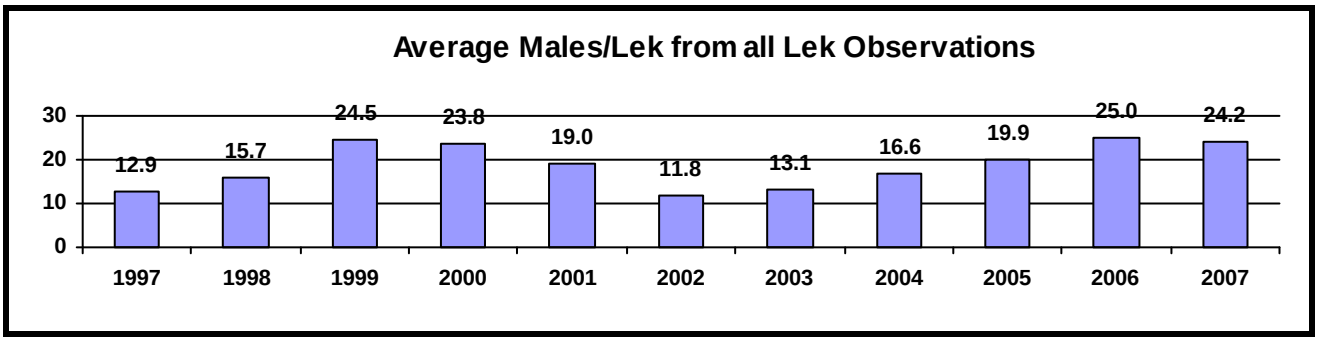
Year	Active	Inactive	Not located	Unknown	Confirmed status Total	Confirmed status Active	Confirmed status Inactive
1997	59	3	2	171	62	95.2%	4.8%
1998	64	7	0	165	71	90.1%	9.9%
1999	77	3	0	155	80	96.3%	3.8%
2000	93	5	2	138	98	94.9%	5.1%
2001	108	10	2	118	118	91.5%	8.5%
2002	101	15	5	115	116	87.1%	12.9%
2003	116	20	4	97	136	85.3%	14.7%
2004	114	22	5	103	136	83.8%	16.2%
2005	134	17	1	95	151	88.7%	11.3%
2006	126	12	1	116	138	91.3%	8.7%
2007	134	9	1	110	143	93.7%	6.3%

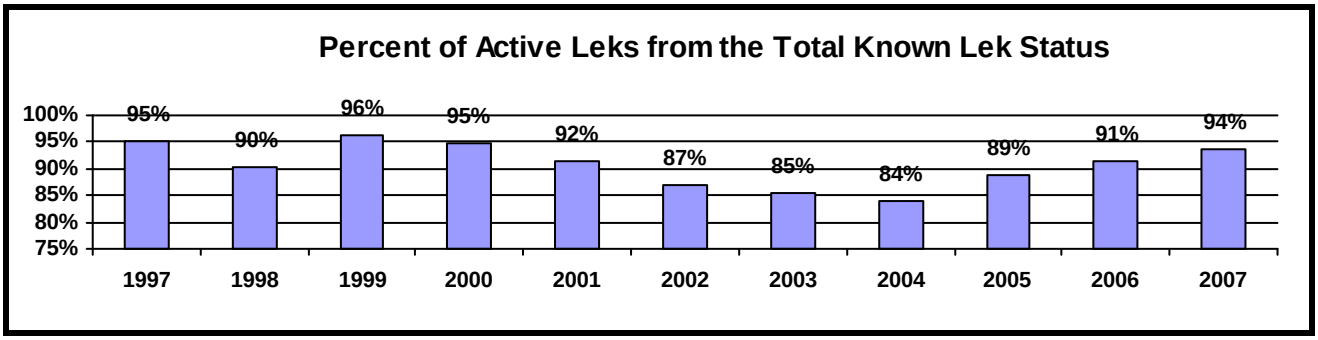
Figure 4. Sage-grouse lek attendance summary for the Bighorn Basin, 1997-2007.

WORKING GROUP: Big Horn Basin **Management Area(s): All**









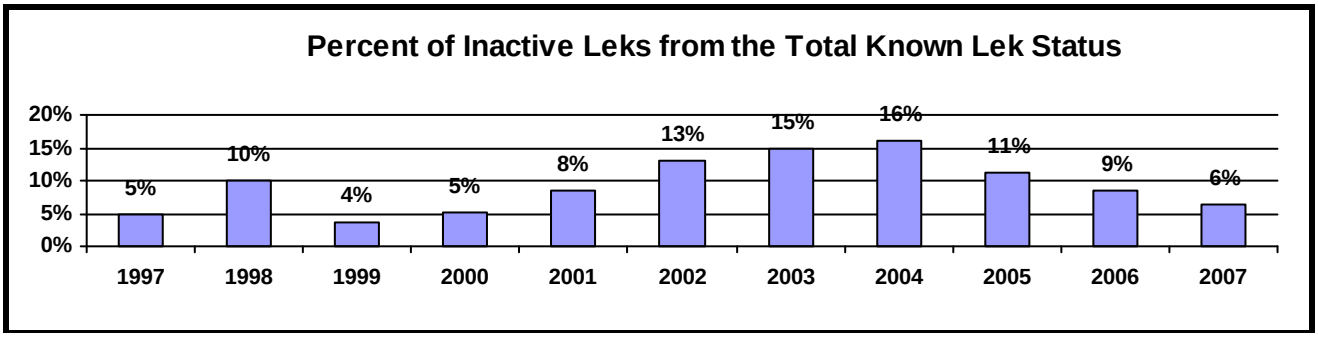


Table 3. Lek complex attendance summary (occupied complexes) for the Big Horn Basin Conservation Area, 1997-2007.

a. Lek Complexes Counted

Year	Number of Complexes	Maximum Totals Males	Maximum Totals Females	Avg./Active Complex Males	Avg./Active Complex Females	Number of Leks
1998	5	152	37	30.4	7.4	14
1999	23	785	214	34.1	9.3	45
2000	38	1214	441	31.9	11.6	79
2001	33	844	326	25.6	9.9	68
2002	43	782	378	18.2	8.8	87
2003	47	1098	455	23.4	9.7	93
2004	49	1238	288	25.3	5.9	96
2005	56	1744	568	31.1	10.1	119
2006	44	1801	535	40.9	12.2	89
2007	49	1936	590	39.5	12.0	100

b. Lek Complexes Surveyed

Year	Number Complexes	Max. Total Males	Avg. Males/ Active Complex	Number of Leks
1997	59	757	16.1	110
1998	47	848	19.7	99
1999	41	1110	28.5	75
2000	43	960	28.2	79
2001	54	1123	23.9	100
2002	45	490	12.3	80
2003	54	565	13.1	103
2004	59	780	17.3	104
2005	58	1045	20.9	101
2006	68	1561	28.4	123
2007	56	1236	26.9	107

c. Lek Complexes Checked

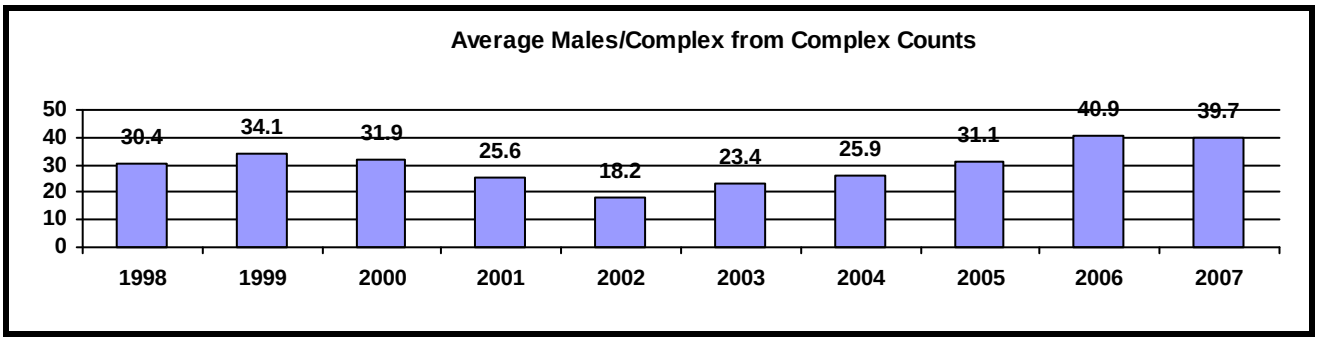
Year	Number Complexes	Max. Total Males	Avg. Males/ Active Complex	Number of Leks
1997	59	757		110
1998	52	1000	20.8	113
1999	64	1895	30.6	120
2000	81	2174	30.2	158
2001	87	1967	24.6	168
2002	88	1272	15.3	167
2003	101	1663	18.5	196
2004	108	2018	21.5	200
2005	114	2789	26.3	220
2006	112	3362	34.0	212
2007	105	3172	33.4	207

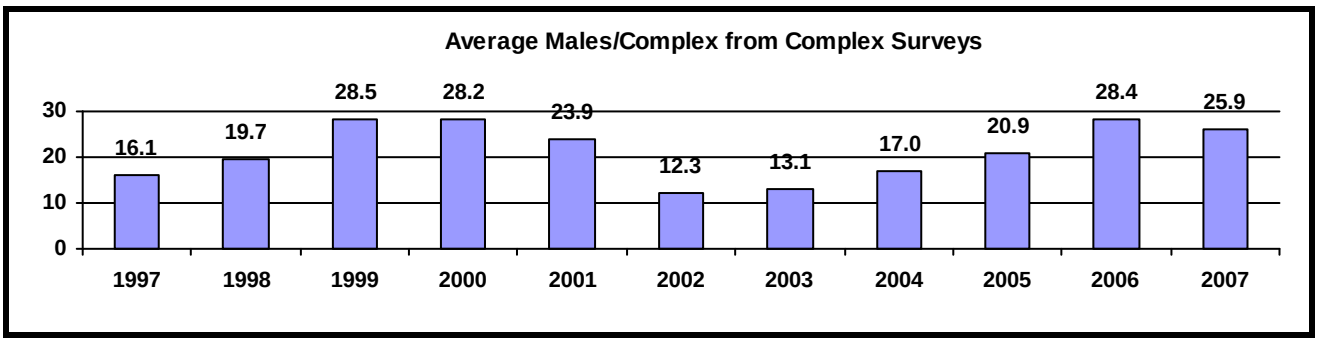
d. Lek Complex Status

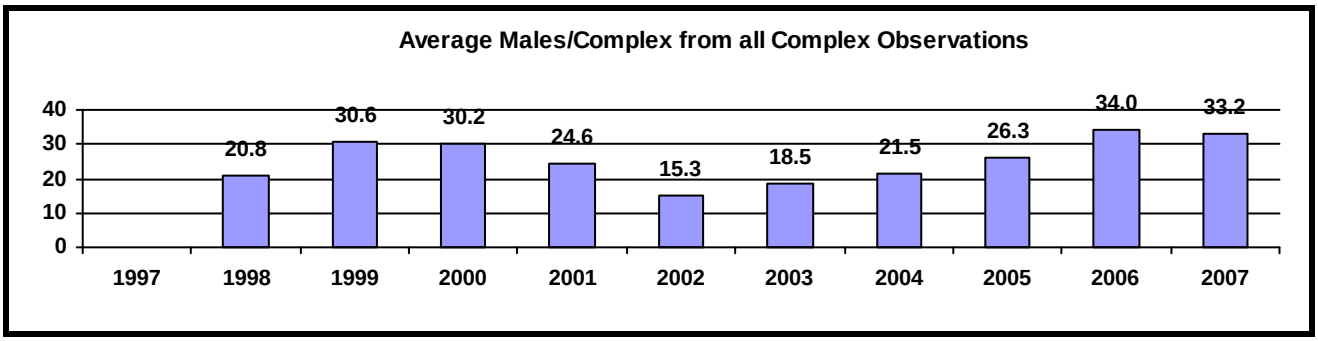
Year	Number of Occupied Complexes: Active	Inactive	Unknown	Total	Known Status: Total	Active	Inactive
1997	47	2	90	139	49	95.9%	4.1%
1998	48	3	89	140	51	94.1%	5.9%
1999	61	3	76	140	64	95.3%	4.7%
2000	72	2	67	141	74	97.3%	2.7%
2001	78	4	60	142	82	95.1%	4.9%
2002	78	5	58	141	83	94.0%	6.0%
2003	88	9	42	139	97	90.7%	9.3%
2004	86	12	43	141	98	87.8%	12.2%
2005	98	8	38	144	106	92.5%	7.5%
2006	95	5	49	149	100	95.0%	5.0%
2007	94	4	50	148	98	95.9%	4.1%

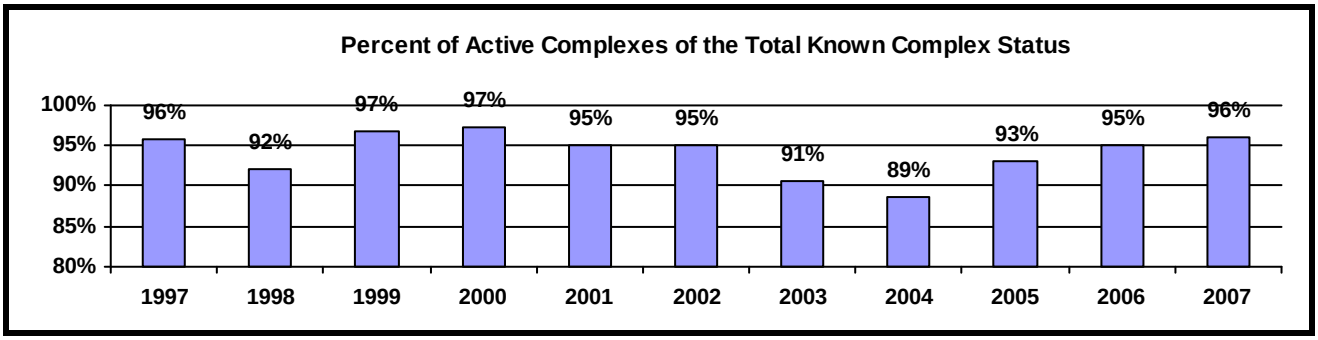
Figure 5. Sage-grouse lek complex attendance summary for the Bighorn Basin, 1997-2007.

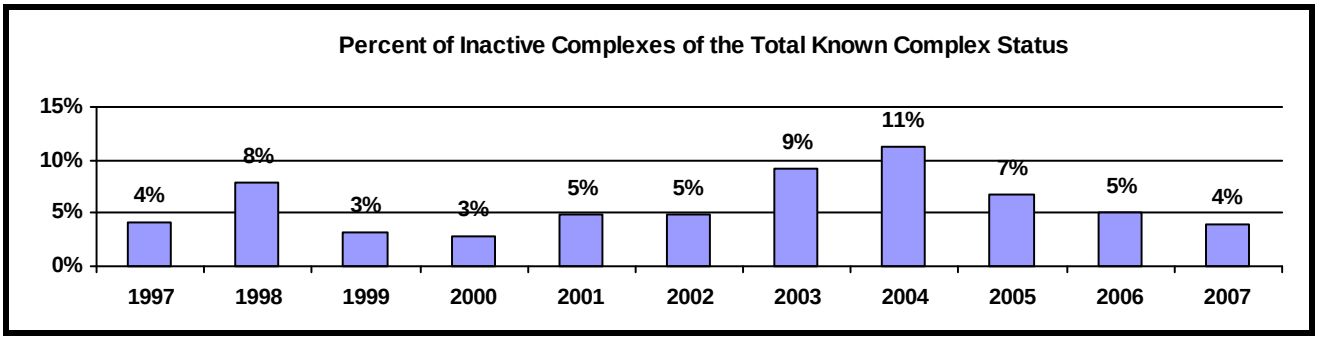
WORKING GROUP: Big Horn Basin **Area(s): All**











within a complex did not always occur. Many leks were visited less than three times, visits were made before the peak in male attendance, or visits were not separated by at least seven days.

Brood surveys. Since 2000, brood surveys have been included on work schedules for Cody region Game & Fish Department personnel, resulting in more effort to locate sage-grouse during this critical period. During July and August 2006, all sage-grouse observed by WGFD personnel were entered into the Department's Wildlife Observation System (WOS). Twenty-three groups of sage-grouse (hens with or without chicks only) were observed (Table 4). Groups of grouse recorded as only males, only unknown adults, or unknown sex/age were not included. When evaluated by date (Table 4), no trend was apparent in chick mortality over summer (e.g., larger brood size early in summer and small broods late in summer). Most broods were observed in sagebrush-grassland habitats.

Table 4. Sage-grouse brood surveys for the Bighorn Basin, July–August 2006.

Date	Area	Hens	Chicks	Habitat	Location
7/3	21	1	7	sagebrush	Buffalo Ck-southeast of Thermopolis
7/3	21	1	3	sagebrush	Buffalo Ck-southeast of Thermopolis
7/3	21	2	5	sagebrush	Buffalo Ck-southeast of Thermopolis
7/7	20	1	6	sagebrush	northeast of Hyattville
7/20	40	1	4	sagebrush	Battle Creek-Trapper Creek tributary
7/21	12	1	1	sagebrush	Cottonwood Creek-Lundvall Ranch
7/21	12	1	7	sagebrush	Cottonwood Creek-Lundvall Ranch
7/21	12	1	5	sagebrush	Cottonwood Creek-Lundvall Ranch
7/21	12	1	4	sagebrush	Cottonwood Creek-Lundvall Ranch
7/22	12	1	5	rabbitbrush	Heart Mountain Canal
7/23	16	12	4	irrigated meadow	Wood River
7/26	37	1	1	sagebrush	Lost Creek-Nowood River tributary
7/28	17	1	3	sagebrush	Grass Creek
7/28	12	1	7	grassland	Pat O'Hara Creek
7/28	12	1	3	sagebrush	Pat O'Hara Creek
8/10	40	2	8	mtn. grassland	Porcupine Creek
8/10	37	1	2	sagebrush	Bighorn Mtn-Nowood Ck drainage
8/13	12	1	5	sagebrush	McCullough Peaks
8/13	12	1	4	sagebrush	McCullough Peaks
8/14	15	2	3	sagebrush	Dugan Bench
8/14	15	1	2	sagebrush	Dugan Bench
8/16	12	1	4		Paint Creek-Pat O'Hara Creek trib.
8/18	11	2	6		Alkali Creek-Heart Mtn Canal
Total		38	99		

WGFD personnel coded 86 hours to sage-grouse "population studies" (activity code 512); including travel time to and from possible brood rearing areas. As the amount of time put in surveying for grouse broods increased, the number of broods observed also increased (Table 5). Little data were collected for any one management area, so all observations for the entire Bighorn Basin were combined in calculations of brood size. On average in 2006, observations totaled 4.1 chicks per brood and 2.6 chicks per hen (successful and unsuccessful hens). Between 1996-2005 grouse production averaged 4.7 chicks/brood and 2.8 chicks/hen. Increased precipitation in 2005 resulted in better production of food and cover, resulting in higher chick survival and higher counts of

males on leks during spring 2006. Lower brood sizes in 2006 probably resulted in lower average males per lek in 2007.

Table 5. Brood survey data collected by Wyoming Game & Fish Department personnel in the Bighorn Basin, 1996-2005.

Year	Hours of survey (WGFD)	Groups observed	Broods	Chicks	Hens	Chicks/ brood	Chicks/ hen
1996			8	44	12	6.3	3.7
1997			8	52	10	6.3	5.2
1998			3	15	5	5.0	3.0
1999			19	83	48	4.4	1.7
2000	124	24	25	85	32	4.3	2.7
2001	128	22	14	51	24	3.6	2.1
2002	56	12	10	35	16	3.5	2.2
2003	92	22	24	103	30	4.3	3.4
2004	112	14	17	71	73	4.2	1.0
2005	119	27	23	123	41	5.3	3.0
2006	86	23	24	99	38	4.1	2.6
1996-2005 Average	105	20	15	66	29	4.7	2.8

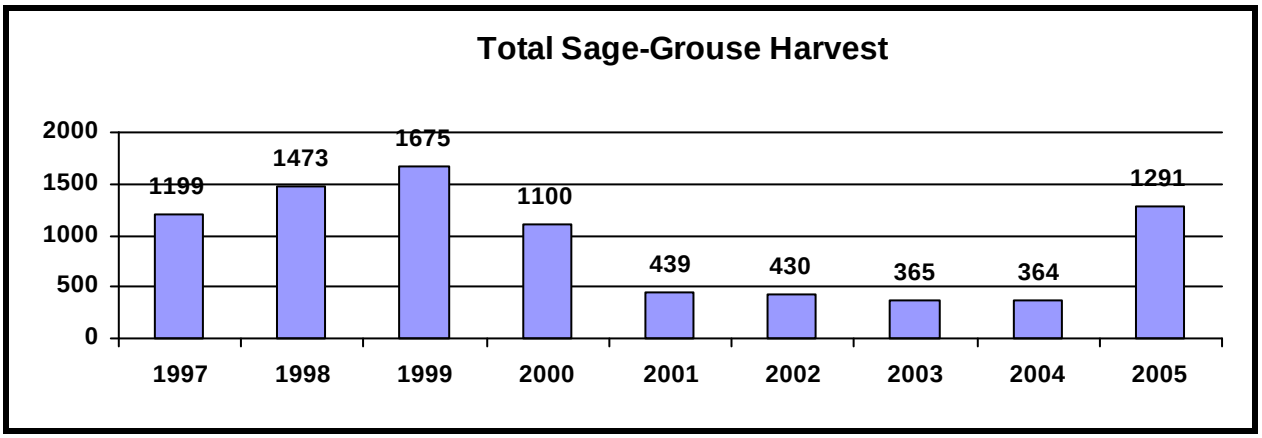
Interpretation of brood survival from a few observations is inappropriate. Most brood data were based on small samples (<25 groups) and may not be an accurate representation of actual conditions. Observers may not accurately classify grouse to sex and age class. Additionally, past errors in WOS data entry have result in misidentification of species, sex, location, and/or habitat type.

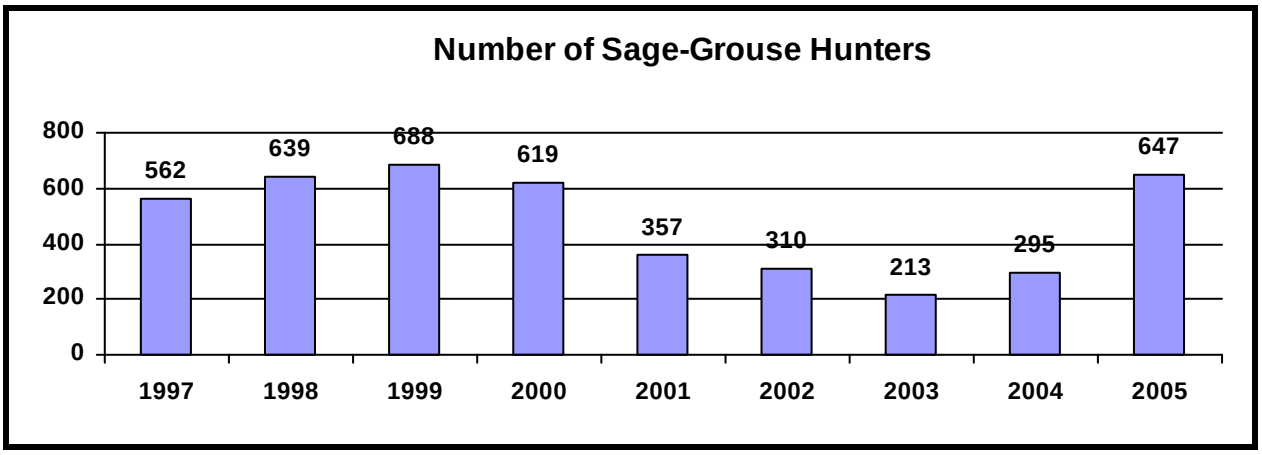
Hunting season and harvest. Hunting seasons in the Bighorn Basin were similar to most of the rest of the state. Beginning in 1995, the opening day of sage-grouse season was moved from 1 September to the third Saturday in September. Research suggested that hens and broods were more dispersed and less vulnerable to hunting with the later opening date. Due to concerns over low populations, in 2002 the opening date was changed to the fourth Saturday in September and the daily bag limit decreased from three to two sage-grouse. Between 2004-06, the hunting season for sage-grouse was open from 23 September – 3 October (11 days), with daily and possession limits of 2 and 4, respectively. Between 1982-94, hunting seasons averaged 25 days long (range 16-31 days).

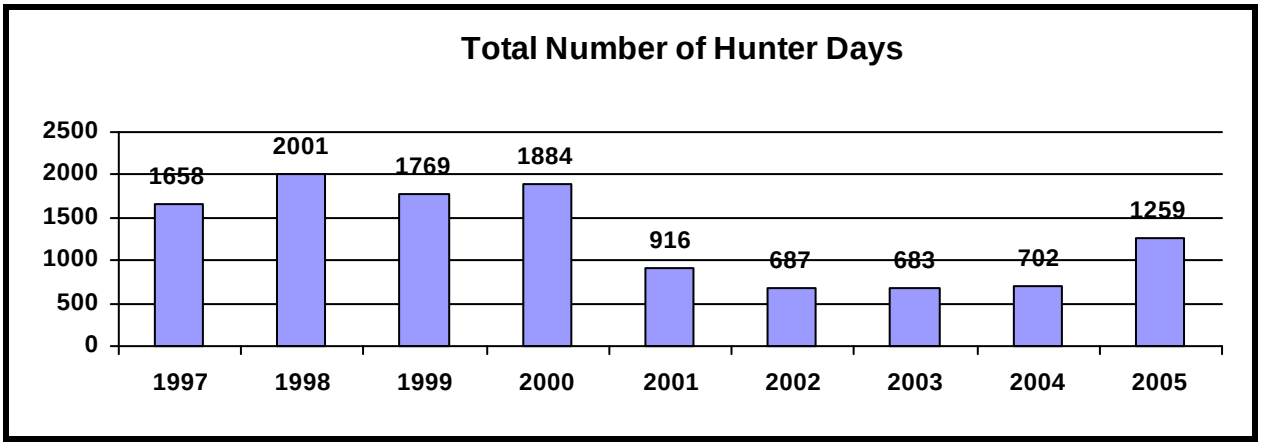
Shortening the season and decreasing the bag limit had decreased the number of sage-grouse harvested and the number of hunters in the Bighorn Basin until 2005 (Table 6 and Fig. 6). Annual average harvest between 1982-1994 in the Bighorn Basin was 3,756 sage-grouse taken by 1,300 hunters during 3,118 hunter days (2.8 birds/hunter, 2.4 days/hunter). Following changes to the hunting season opening date (1995-2001), an average of 549 hunters took 1,056 sage-grouse during 1,567 days of hunting (1.9 birds/hunter, 2.8 days/hunter). Since the last changes to the hunting seasons (2002-2006), hunters averaged 1.5 birds/hunter and 2.4 days/hunter. In 2006, harvest, hunter numbers and total recreation days declined from 2005. Success (birds/day, birds/hunter) decreased, however, each hunter spent more days afield (increased days/hunter) than in 2005.

Figure 6. Sage-grouse harvest summary for the Bighorn Basin, Wyoming, 1997-2007

WORKING GROUP: Big Horn Basin **Area(s): All**







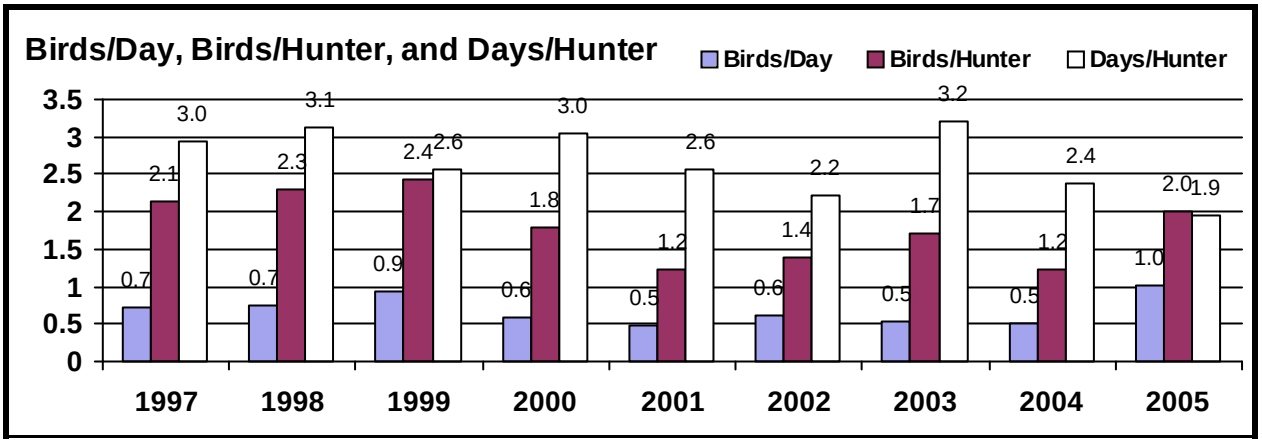


Table 6. Sage-grouse harvest data from management areas in the Bighorn Basin (11, 12, 15, 16, 17, 19, 20, 21), 1996-2006.

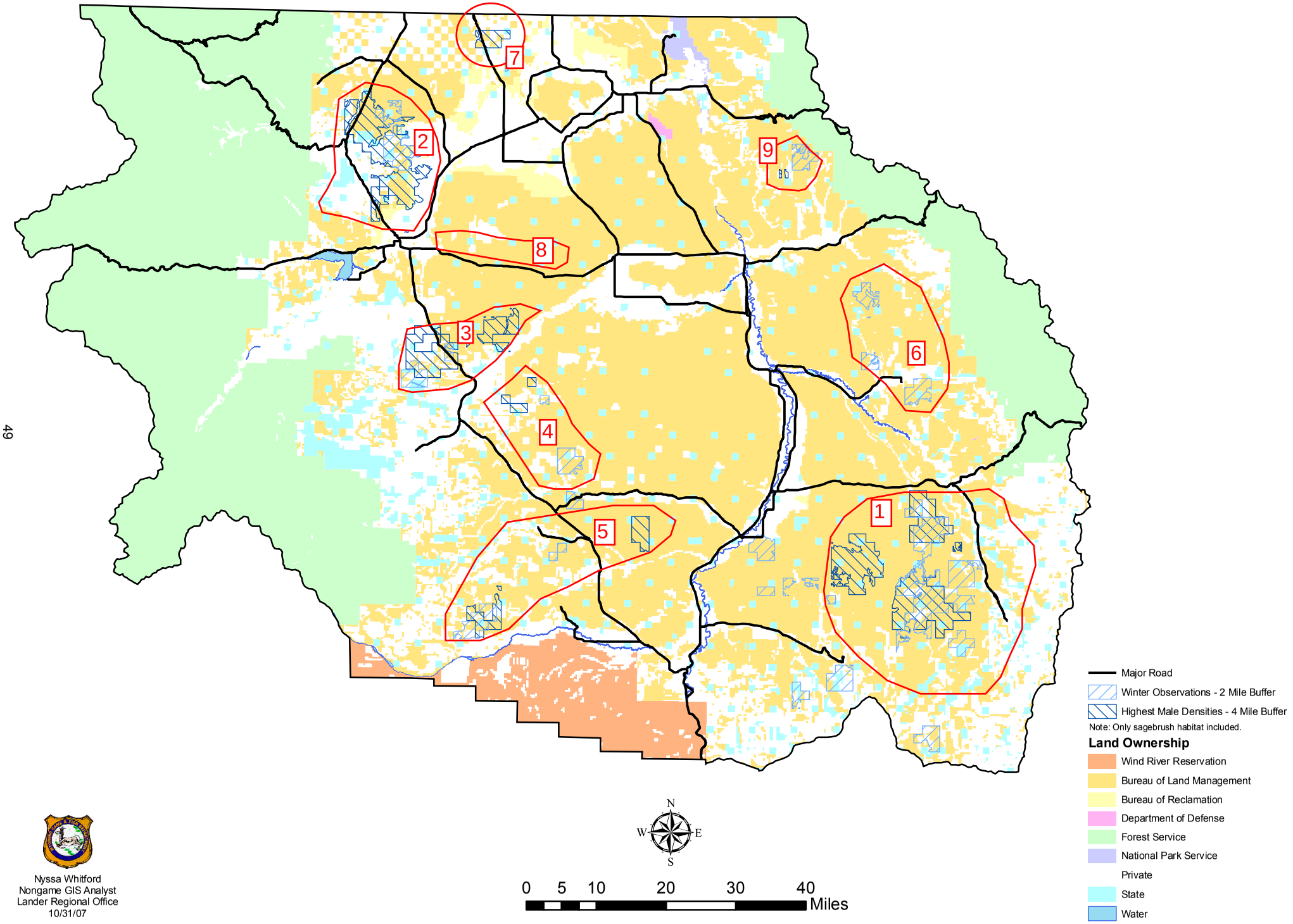
Year	Harvest	Hunters	Recreation Days	Birds/ Day	Birds/ Hunter	Days/ Hunter
1996	781	446	1,203	0.6	1.8	2.7
1997	1,199	562	1,658	0.7	2.1	3.0
1998	1,473	639	2,001	0.7	2.3	3.1
1999	1,675	688	1,769	0.9	2.4	2.6
2000	1,100	619	1,884	0.6	1.8	3.0
2001	439	357	916	0.5	1.2	2.6
2002	430	310	687	0.6	1.4	2.2
2003	365	213	683	0.5	1.7	3.2
2004	292	265	545	0.5	1.1	2.1
2005	1,016	540	1,055	1.0	1.9	2.0
2006	421	269	672	0.6	1.6	2.5
1996-2005 Average	877	464	1,240	0.7	1.8	2.7

Since 1982, WGFD has compiled and reported harvest data by management area. As previously noted, management area 37 is located on both sides of the Bighorn Mountain divide. Harvest data for area 37 was summarized in the Sheridan Region/Northeast Wyoming local working group. To obtain a more accurate estimate of harvest of grouse taken from the Bighorn Basin, a new management area was created to encompass lands west of the Bighorn Mountain divide. This change may not have been proposed soon enough for the 2007 harvest reporting, but will be in place by the 2008 hunting season. No changes were recommended for management area 40.

Habitat and seasonal range mapping. We believe that most of the leks in the Bighorn Basin have been documented, however, other critical habitats have not been identified. In 2003 and 2004, efforts began to identify areas important to sage-grouse during winter and brood rearing. In 1988, the BLM (Worland field office) had documented and mapped several sites used as brood rearing and winter areas. Specific criteria used to identify these areas were not available. Data from WGFD's WOS were queried for winter (December-February) and brood-rearing (July-August) observations. These data have been mapped, but few high-use areas were evident. Since 1992-93, mild winters with little snow have delayed work to document winter ranges. The BLM and WGFD are collaborating on a land cover mapping project for the Bighorn Basin. The final maps are expected by December 2008.

WGFD personnel were asked to identify those areas throughout the state that are most important to sage-grouse. Mapping of "core areas" was based on density of males on leks, high number of wintering birds and intact sagebrush habitat. Nine areas were identified and prioritized in the Bighorn Basin (Fig. 7). This exercise was conducted on a statewide scale and some smaller/lower priority areas identified in the Basin may not be depicted on the statewide version of core area maps. This map was the first attempt to identify core areas and will be revised as more information is collected.

Figure 7. Core sage-grouse habitat within the Bighorn Basin.



Conservation planning. The Wyoming Greater Sage-grouse Conservation Plan, written in 2003, recommended formation of local working groups (LWG) to write conservation strategies for different regions around the state. The Bighorn Basin LWG was formed in September 2004, to develop and facilitate implementation of a local conservation plan for the benefit of sage-grouse and, whenever feasible, other species that use sagebrush habitats. The LWG consisted of representatives from industry (bentonite mining and oil/gas), agriculture, hunters/conservation, local (county) government, federal land managers (BLM, NRCS) and the WGFD.

The Sage-grouse Conservation Plan for the Big Horn Basin was completed 31 August 2007 and formally accepted by the Game & Fish Commission on 15 November 2007. The Plan identified several factors that may influence sage-grouse populations in the Big Horn Basin. A brief description of each factor and impacts to grouse or their habitats were discussed. Impacts of each factor were addressed in the Conservation Strategy section of the Plan. Goals and objectives were formulated to address 1) habitats, 2) populations, 3) research and 4) education. Strategies and commitments in the Plan were designed to improve sage-grouse habitats and populations in the Big Horn Basin. Specific actions, recommended management practices, and commitments to achieve goals and objectives were presented. The Plan can be viewed at the WGFD website: http://gf.state.wy.us/wildlife/wildlife_management/sage-grouse/BigHornBasin.

Due to on-going conservation efforts, funding for sage-grouse conservation has increased. In 2005, the state Legislature passed the Governor's supplemental budget that included $500,000 to be spent by LWGs on habitat projects. The Legislature included another $1.1 million appropriation for sage-grouse conservation for the current fiscal biennium (1 July 2006 – 30 June 2008). Another legislative appropriation is expected for the next biennium. Marathon Oil Company donated a total of $30,000 to the Wildlife Heritage Foundation of Wyoming for sagebrush habitat work in the Basin, preferably near their production facilities. A recent settlement between a Laramie-based conservation group and an oil/gas exploration company resulted in $25,000 being allocated for sage-grouse projects near Meeteetse. These monies have funded, and will continue to fund, projects designed to accomplish goals and objectives of the Conservation Plan.

Nearly half of the 2006-08 Legislative appropriation to Big Horn Basin LWG was earmarked for a major sage-grouse research project in the Basin. A request for proposals was sent to major universities in Wyoming and adjacent states. Only two research proposals were submitted. The LWG chose not to fund either project. The remaining Legislative appropriation will be dedicated to habitat projects and a new request for proposals will be sent. Project proposals will be due to the LWG by 15 February 2008.

CONCLUSIONS AND RECOMMENDATIONS

In the Bighorn Basin, as a whole, sage-grouse numbers have increased over the past decade. Counts of males on leks have increased each year since 2002. In 2005 and again in 2006, record high numbers of males were observed at some leks. Although the average number of males at leks declined slightly in 2007, grouse populations appear robust. Larger increases in number of males near mountain foothills may be masking declining grouse numbers in the interior portions of the Basin. Drier conditions and marginal habitat may be delaying a population recovery in the Basin that the foothills areas have experienced. An attempt should be made to analyze male attendance at "interior" leks versus foothills leks.

The amount of data collected through intensive lek monitoring needs to be increased. Lek counts need to be properly conducted so that data are consistent. The correct techniques for lek surveys, searches, and counts need to be followed. More effort will be expended next spring to instruct biologists, wardens, range conservationists, and other volunteers as to the proper procedures. The methodology used to perform lek and complex counts needs to continue in the same manner from year to year to provide a good index to population trend, and to make data comparable across the entire state.

Monitoring hen and brood survival should be investigated using established research protocols with radio telemetry. Brood surveys and wing analysis are designed to provide information on production and survival of chicks. These data are important to understanding possible limiting factors of sage-grouse populations. Unfortunately, inadequate amounts of production data were collected from which we could make any valid inferences. The internal WGFD sage-grouse working group should develop standard methodology and guidelines for brood surveys. Volunteers could then be used to collect more data on brood size and use areas, similar to lek surveys. Due to low numbers of wings collected in past attempts, barrels were not set out for the 2007 season. News releases have not increased the number of wings collected in barrels or through direct hunter contacts in the Bighorn Basin.

Harvest data from the entire Bighorn Basin should be compiled in this report. One recommendation in the LWG Conservation Plan was to split management area 37 so that all sage-grouse harvest from the Big Horn Basin can be included in annual summaries. New area boundaries have been submitted and will aid in future harvest data collection.

The Bighorn Basin contains the only major sub-population of sage-grouse in Wyoming that has not had research conducted to assess life history parameters. Survival, reproductive rates, food habits, seasonal habitat use, predation rates, and migration patterns in the Basin are unknown. It was difficult for the LWG to assess needs of these sage-grouse without the knowledge of potential limiting factors and population levels. The Conservation Assessment of Greater Sage-grouse and Sagebrush Habitats (Connelly et. al. 2004) recognized the Bighorn Basin as a distinct sub-population. As a distinct sub-population, these birds may have different behavior and/or habitat use patterns than grouse in those areas of Wyoming and Montana that have been researched. There are differences in habitat between the Bighorn Basin and areas with

other sage-grouse sub-populations. Topics that could be investigated include: impacts of non-native predators (raccoon, red fox) and increased native predators (corvids) on sage-grouse survival; evaluation of grazing regimes and habitat treatments (mowing, burning) on sage-grouse nest success and brood survival; or development of a population estimation technique and testing of the validity of using lek counts as an indices to population trend.

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Bates Hole/Shirley Basin Conservation Area (BHSBCA)
Job Completion Report

Species: **Sage-grouse**
Period Covered: **June 1, 2006 – May 31, 2007**
Mgmt. Areas: **22, 24, 27, 28, 30, 32, and 33**
Prepared by: **Justin Binfet**

Introduction

Sage-grouse are found throughout the Bates Hole/Shirley Basin Conservation Area (BHSBCA) in the sagebrush/grassland habitats of Bates Hole, Shirley Basin, the Rattlesnake Hills, the south end of the Bighorn Mountains, foothills of the Laramie Range, and in northern Platte/southern Niobrara Counties. Occupied habitat is fairly contiguous throughout much of Bates Hole and the Shirley Basin. Habitats within the Rattlesnake Hills and the south end of the Big Horns are more fragmented by changes in habitat type and oil and gas development. Sage-grouse habitat in the Laramie Range is primarily limited to the west slope including portions of the Laramie Plains. Large, contiguous blocks of sagebrush/grassland communities east of the Laramie Range have, for the most part, been eliminated.

Occupied habitat for sage-grouse within the BHSBCA is approximately evenly split between private and public ownership. Approximately 51% of the known leks are found on private land with the remaining 49% found on Forest Service, Bureau of Land Management, Bureau of Reclamation, and Wyoming State Trust lands.

Management data collected by the WGFD for sage-grouse have focused on lek counts and surveys, harvest statistics, and data derived from wings collected from harvested birds. Lek counts and surveys have been conducted within the BHSBCA since the 1950s. Lek counts are conducted in April and early May. Individual leks are counted 3 or more times at 7 – 10 day intervals. Lek counts are conducted to estimate trends in the population based on peak male attendance. Lek surveys are also conducted in the spring, but generally are only conducted one time per lek to determine general lek activity status (i.e., active/inactive). Some sage-grouse brood data has also been collected and documented, typically during August. These brood counts provide some indication of population trends, although their use is limited in estimating recruitment because the surveys are not conducted in a systematic or consistent manner and sample sizes are small. Emphasis on brood counts has decreased over the past few years because of their limited use as an indicator of recruitment and population trend. When available, wing data provide a much more reliable indicator of recruitment.

Past management of sage-grouse within the BHSBCA has focused mainly on the protection and/or enhancement of their habitats and protection of leks from surface disturbing activities during the breeding season. Protection efforts have primarily occurred through the project review process conducted by State and Federal agency personnel and more recently through the on-going revision of the BLM's Resource Management Plans in the Casper and Rawlins Field Offices. Sage-grouse have been given increasing consideration through the project review process with emphasis on minimizing disturbance during the breeding season within and around the lek sites and protections for sage-grouse nesting and early brood rearing habitats.

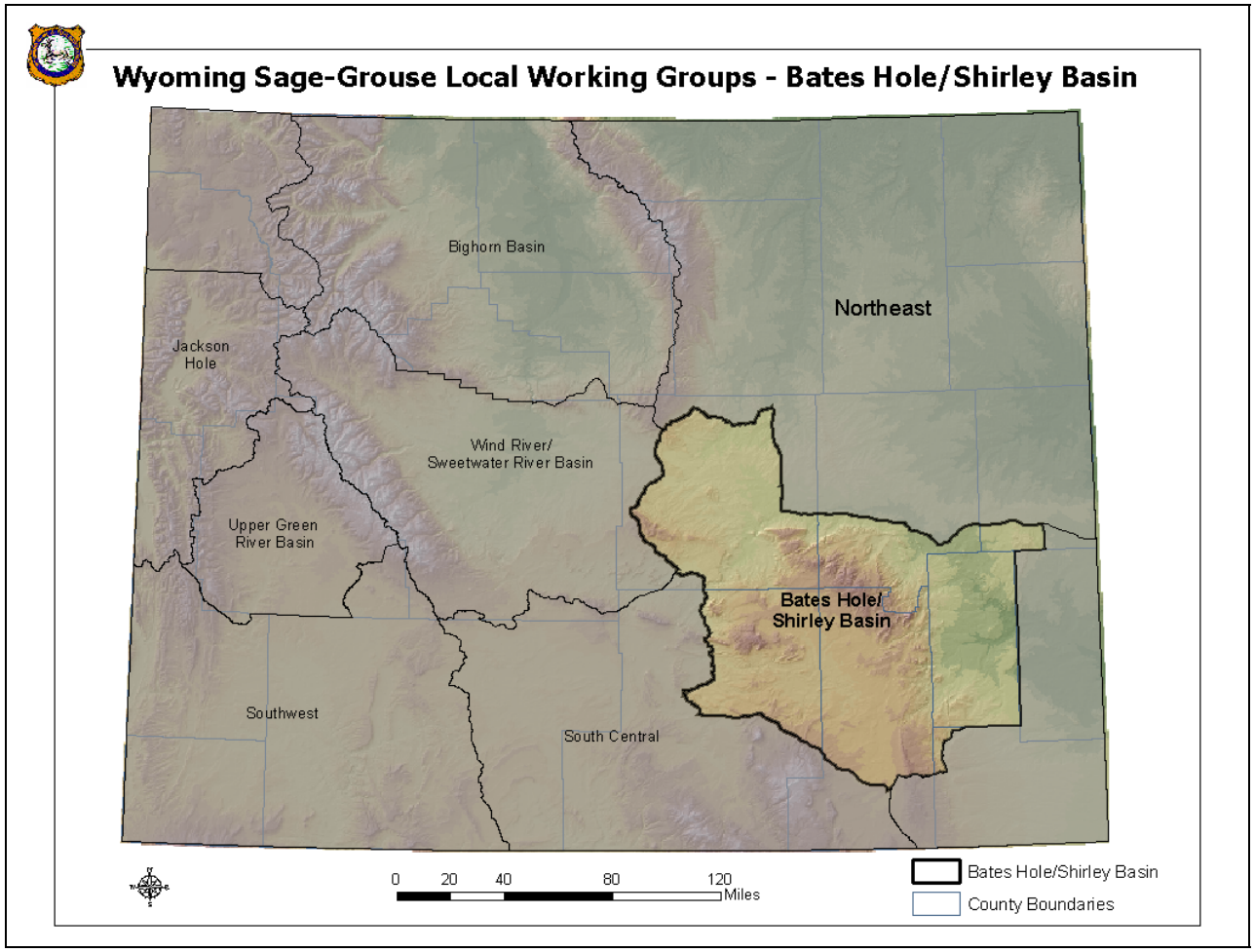
Most sage-grouse populations in Wyoming are hunted, though some portions of the state have been closed to sage-grouse hunting to protect particularly small, isolated populations (i.e., in the southeast and northwest portions of the state). That portion of the BHSBCA on the Laramie Plains is closed to hunting for this reason. Grouse numbers are very low and distribution is sporadic in this area because they exist on the fringe of sage-grouse range where sagebrush communities, at best, provide small islands of suitable habitat isolated from the core sage-grouse habitats within the BHSBCA.

Historically, sage-grouse hunting seasons opened in early September. Research into the potential impact of hunting on sage-grouse indicated a late September opener had less negative impact on hen survival and may increase recruitment compared to an early September season (Braun and Beck 1996, Heath et al. 1997, Connelly et al. 2000). Sage-grouse seasons in Wyoming currently open in late September and close in early October. Since 1982, bag and possession limits have been 3/day and 6 in possession or 2/day with 4 in possession (the current limitations).

Conservation Area

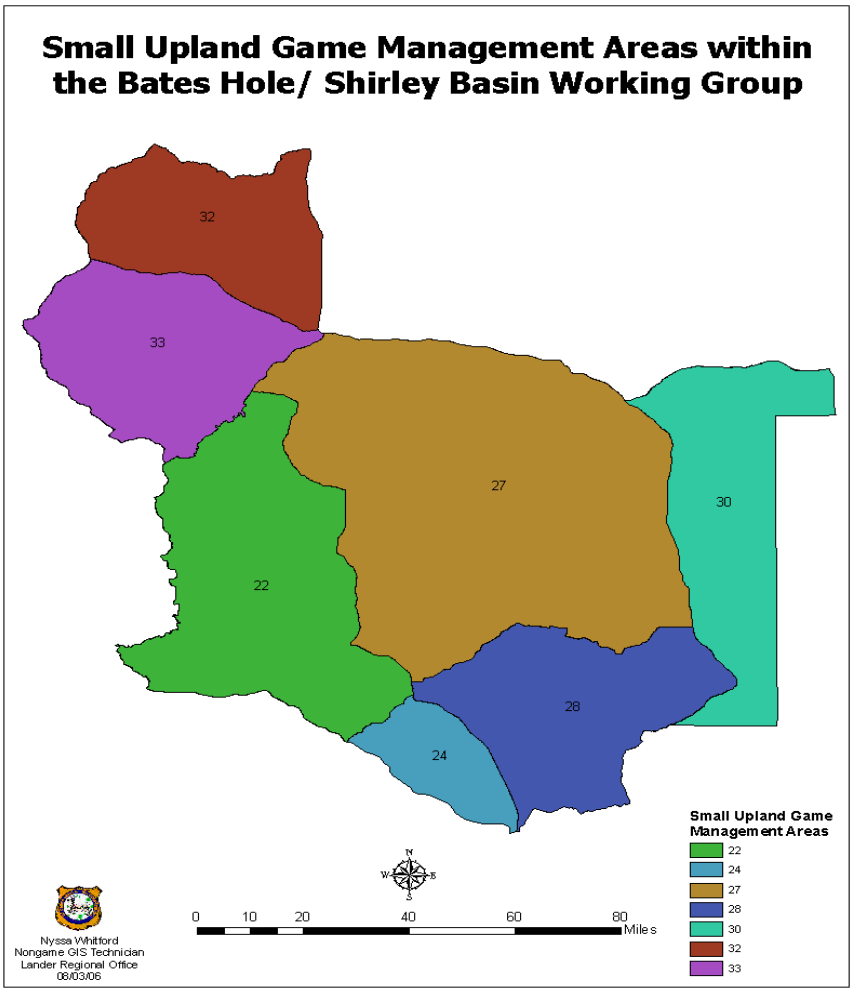
The BHSBCA includes Bates Hole, the Shirley Basin, the Rattlesnake Hills, the southern Bighorn Mountains, the Laramie Range, and isolated occupied habitats in southern Niobrara and Platte County (Figure 1). Political jurisdictions include Albany, Carbon, Converse, Laramie, Natrona, Niobrara, and Platte counties. This area is managed by: the Bureau of Land Management (primarily the Casper and Rawlins Field Offices), the Bureau of Reclamation, the USDA Forest Service (Medicine Bow National Forest), the State of Wyoming, and private landowners. Major habitat types within the plan area include: sagebrush/grassland, salt desert shrub, mixed mountain shrub, grasslands, mixed forests (conifers and aspen), agricultural crops, riparian corridors, and urban areas. Primary land uses in the BHSBCA include: oil and gas development, coal mining, wind energy complexes, livestock grazing, dry-land and irrigated crop production, urban expansion, and wildlife habitat.

Figure 1. The Bates Hole/Shirley Basin Conservation Area.



The BHSBCA encompasses all or a portion of WGFD Small/Upland Game Management Areas 22, 24, 27, 28, 30, 32, and 33 (Figure 2). The management areas do not correspond to sage-grouse population boundaries. Instead, management areas are used for general data collection and reporting for all small and upland game species. Further, the BHSBCA area is not aligned on the boundary for Area 24. Because harvest data is recorded by these management areas and not by the outlined Conservation Area, analyses/statistics reported include some information outside of the BHSBCA.

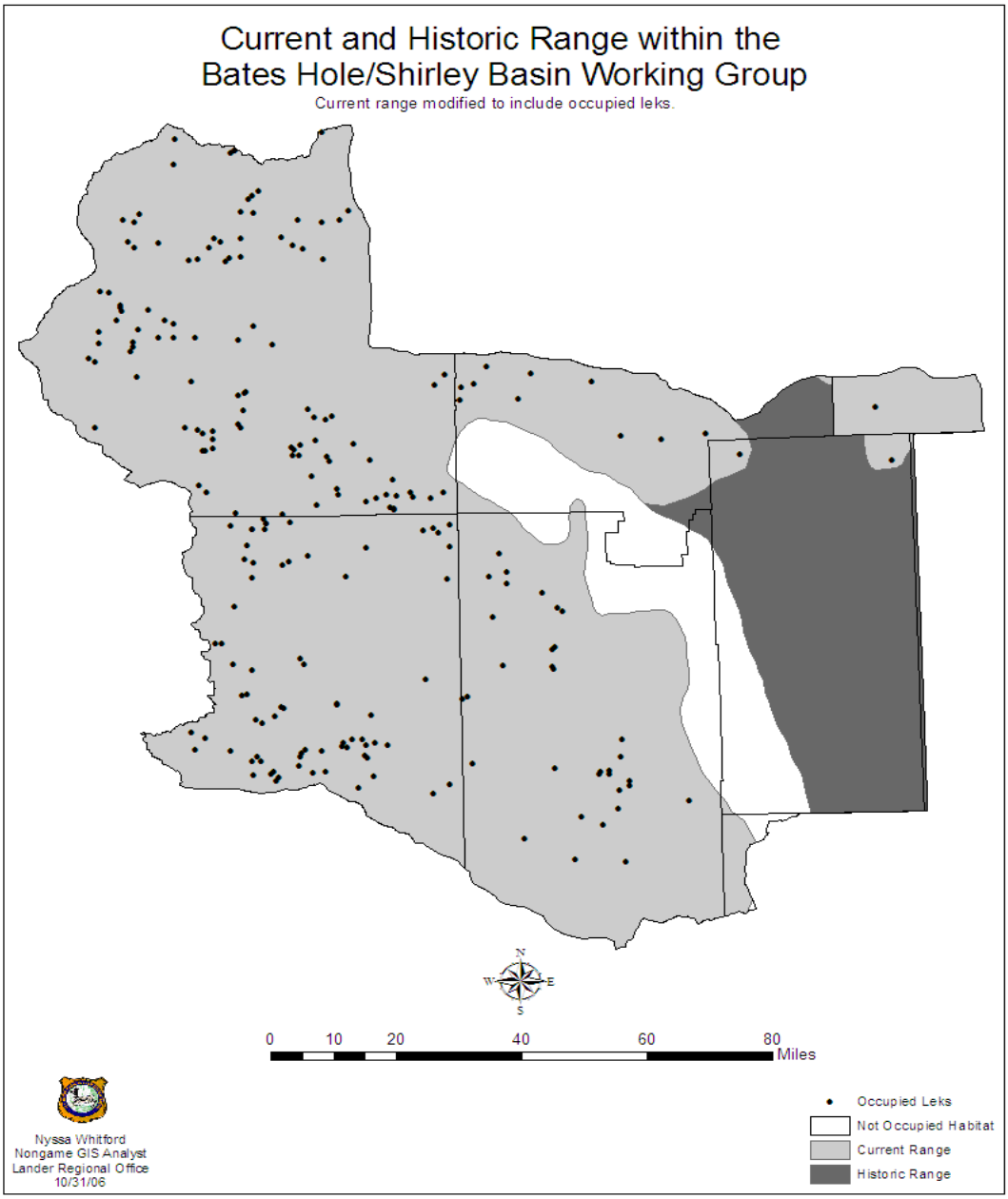
Figure 2. The Bates Hole/Shirley Basin Conservation Area and WGFD small and upland game management areas.



The Wyoming Game and Fish Department, federal agencies, and volunteers have conducted lek counts and surveys each spring within the BHSBCA for over forty years, providing the best long-term management data currently available for sage-grouse. Lek counts include those lek observations conducted three to four times each spring, about a week to 10 days apart. Lek counts are conducted to provide trends in the population based on the average peak male attendance. Lek surveys typically consist of only one spring visit and are intended to determine general lek status. Occupied lek and sage-grouse range distribution within the BHSBCA are represented in Figure 3.

Some sage-grouse brood data have been collected and documented during July and early August. Brood data provide some indication of population trend based on production. In some years, brood data are limited because of low sample size due to a low population or conflicting work schedule demands. When available, harvest wing data provide a much more reliable indicator of recruitment than do brood data. Four wing barrels placed in Bates Hole typically provide significant wing data due to relatively high numbers of sage-grouse hunters in the Casper area.

Figure 3. Current and historic range of sage-grouse and occupied leks within the Bates Hole/ Shirley Basin Conservation Area (Source: Wyoming Greater Sage-grouse Conservation Plan).



Leks and Lek Complexes

Figure 4 presents the demographics of sage-grouse leks within the BHSBCA as of May 2007. The Wyoming Game and Fish Department summarizes lek survey data each year. As of spring 2007, there are 229 known occupied leks and 56 unoccupied leks. Fifty-four of the 56 unoccupied leks are abandoned leks and two have been destroyed. Undoubtedly, there are leks within the BHSBCA that have not yet been identified. Similarly, there are leks that have been abandoned or destroyed which are not known.

Sage-grouse lek sites in the BHSBCA are located within three WGFD regions (Laramie, Casper and Lander), six Biologist and 11 Game Warden Districts, four BLM field offices, and seven counties.

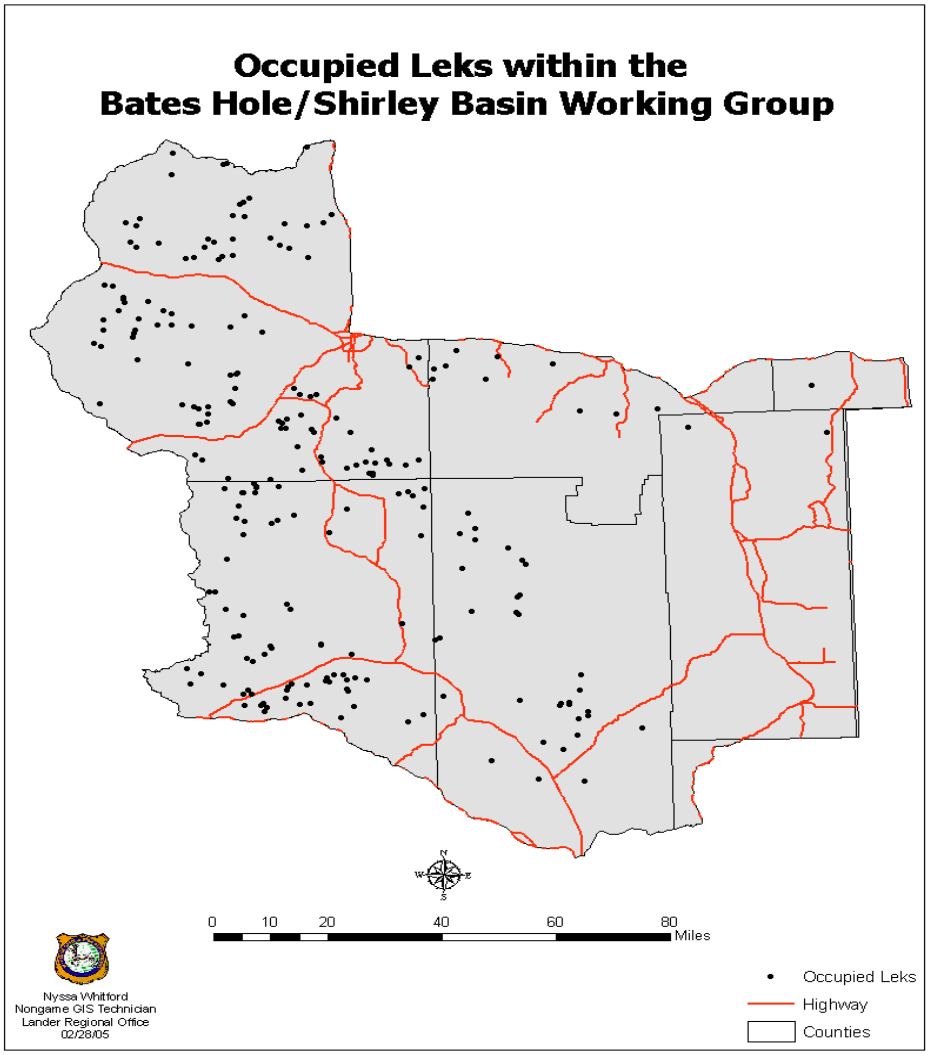
Locations of occupied sage-grouse leks within the plan area are shown in Figure 5. Sage-grouse are generally found throughout the BHSBCA with the exception of the more heavily forested/mountainous, agriculturally developed (i.e. Platte County), and urbanized areas.

Figure 4. Sage-grouse lek demographics by various categories within the Bates Hole/Shirley Basin Conservation Area.

General Category	Lek Count	Percent of Category
BHSB Area Total	313	100.0
Classification		
Occupied	229	73.2
Unknown	28	8.9
Unoccupied	56	17.9
(Abandoned)	54	--
(Destroyed)	2	--
Land Ownership		
BLM	115	36.7
BLM/Private	2	0.6
BOR	1	0.3
Undetermined	3	1.0
Private	163	52.1
State	25	8.0
USF&WS	1	0.3
County		
Albany	71	22.7
Carbon	110	35.1
Converse	10	3.2
Laramie	2	0.6
Natrona	112	35.8
Niobrara	1	0.3
Platte	7	2.2
BLM District		
Casper	128	40.9
Lander	1	0.3
Newcastle	1	0.3
Rawlins	183	58.5

Game & Fish Category	Lek Count	Percent of Category
G&F Region		
Casper	128	40.9
Laramie	183	58.5
Lander	2	0.6
Biologist District		
Casper	121	38.7
Douglas	7	2.2
Laramie	102	32.6
Rawlins	2	0.6
Saratoga	1	0.3
Wheatland	80	25.6
Game Warden		
Cheyenne	1	0.3
Douglas	2	0.6
East Casper	39	12.5
East Rawlins	2	0.6
Elk Mountain	72	23.0
Glenrock	8	2.6
Lusk	1	0.3
Medicine Bow	68	21.7
North Laramie	37	11.8
West Casper	76	24.3
Wheatland	7	2.2
Management Area		
#22	118	37.7
#24	4	1.3
#27	78	24.9
#28	32	10.2
#30	3	1.0
#32	32	10.2
#33	46	14.7

Figure 5. Locations of occupied sage-grouse leks within the Bates Hole/Shirley Basin Conservation Area, May 2005.



Lek counts and lek surveys have been conducted within the area since the late 1950's, although only on a small number of leks. Since 1998, lek monitoring effort has expanded significantly, resulting in consistent data sets over the last nine years. In 2007, personnel checked 208 of the known 313 (67%) leks in the BHSBCA (includes occupied and unoccupied leks). Of the 257 occupied and unknown leks identified, personnel checked 178 (69%) in 2007. Of those checked in 2007, 55 were counted and 123 were surveyed. Of the leks checked and where status was confirmed, 123 (94%) were active and 8 (6%) were inactive. It is important to note the high percentage of active leks is biased since personnel concentrate searches on leks known or thought to be active. Of the 56 unoccupied leks, 30 (54%) were checked with no new signs of activity being documented.

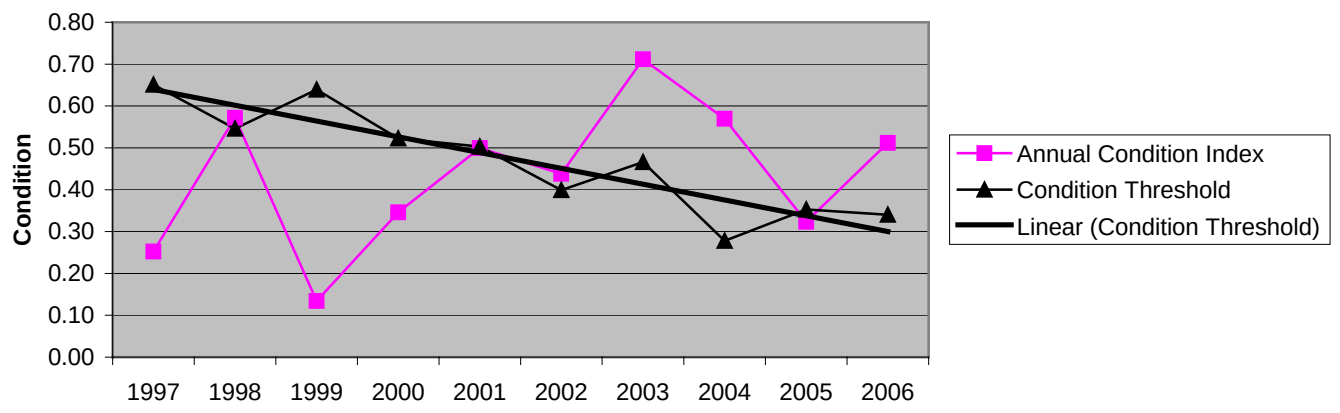
Habitat

There is little doubt sage-grouse habitat quality throughout the BHSBCA has declined over the past several decades. Ongoing drought has impacted herbaceous and woody forage production throughout the BHSBCA. Increased human-caused disturbance (i.e., oil/gas, coal, wind energy, and improper grazing by livestock and wildlife) combined with sagebrush eradication programs and drought has

negatively impacted sage-grouse and their habitats. As the level of concern for sage-grouse has risen, some habitat improvement projects have been planned and/or implemented throughout the BHSBCA. In addition, remote sensing designed to map changes in vegetative communities throughout most of the BHSBCA is underway.

Department personnel monitor productivity and utilization of key sagebrush communities in the Laramie Range, Shirley Basin, Bates Hole and the Rattlesnake Hills. Annual growth has been very low due to plant age and vigor and ongoing drought. In many portions of the BHSBCA in recent years, such as in Bates Hole, measured utilization versus productivity rates (of current year's leader growth) has exceeded the threshold (35%) to sustain long-term plant productivity and health (Figure 6) (Winward 2004). The majority of this utilization has been attributed to big game, particularly pronghorn (*Antilocapra americana*), although domestic livestock utilization of sagebrush is significant in some areas. Continued long-term over-utilization of these sagebrush stands can lead to sagebrush mortality and an overall decline in stand health. Where sagebrush communities remain in the BHSBCA, this ongoing trend is a primary concern and focus for both Department managers and the BHSBLWG.

Figure 6. Sagebrush condition based on utilization and productivity in the Bates Hole portion of the Bates Hole/ Shirley Basin Conservation Area, 1997–2007.



Annual Condition Index = % Leaders Browsed (ocular estimate) / Current Years Growth. The Condition Threshold = 1 – [35% use / Running 5-year Avg. Current Years Growth]. Years with points above the Condition Threshold indicate excessive utilization relative to the amount of productivity measured.

Population Trend

Monitoring male attendance on leks provides a reasonable index of change in sage-grouse abundance over time in response to prevailing environmental conditions. Nevertheless, this data must be viewed and interpreted with caution for several reasons described in the Wyoming Greater Sage-grouse Conservation Plan (2003). Fluctuations over time in the number of grouse observed on leks are not exclusively due to changes in grouse numbers. These data also reflect changes in lek survey effort. In addition, some discrepancies within the sage-grouse database for the BHSBCA have been noted due to errors in data entry in previous years. Correction of these errors has resulted in some inconsistencies in data reporting across years.

Lek counts and/or surveys have been conducted within the BHSBCA since the late 1950s. However, the most consistent data collection efforts started in 1998. The number of leks counted within the

BHSBCA has increased markedly since 1958 (Figure 7). Concurrent with increased monitoring effort, the number of observed grouse (males) has also increased. The average number of males per count lek was substantially higher in the 1950's and 1960's than it is today. However, these data are not presented here as they are based on extremely small sample sizes (less than three leks per year in many years) and should be considered with caution. Since intensive lek monitoring began in 1998, the average number of males observed per count lek increased from 27.8 in 1998 to 58.1 in 2006, but then declined to 42.6 in 2007 (Figure 8). Male lek attendance declined considerably in 2007, which was likely due to poor recruitment and survival in 2006 due to extreme drought conditions (see discussion below). However, the average number of males observed per count lek in 2007 still represents a 53% increase since 1998.

Figure 7. Total number of count leks and males observed on count leks (per year) by decade within the Bates Hole/Shirley Basin Conservation Area, 1958 – 2007.

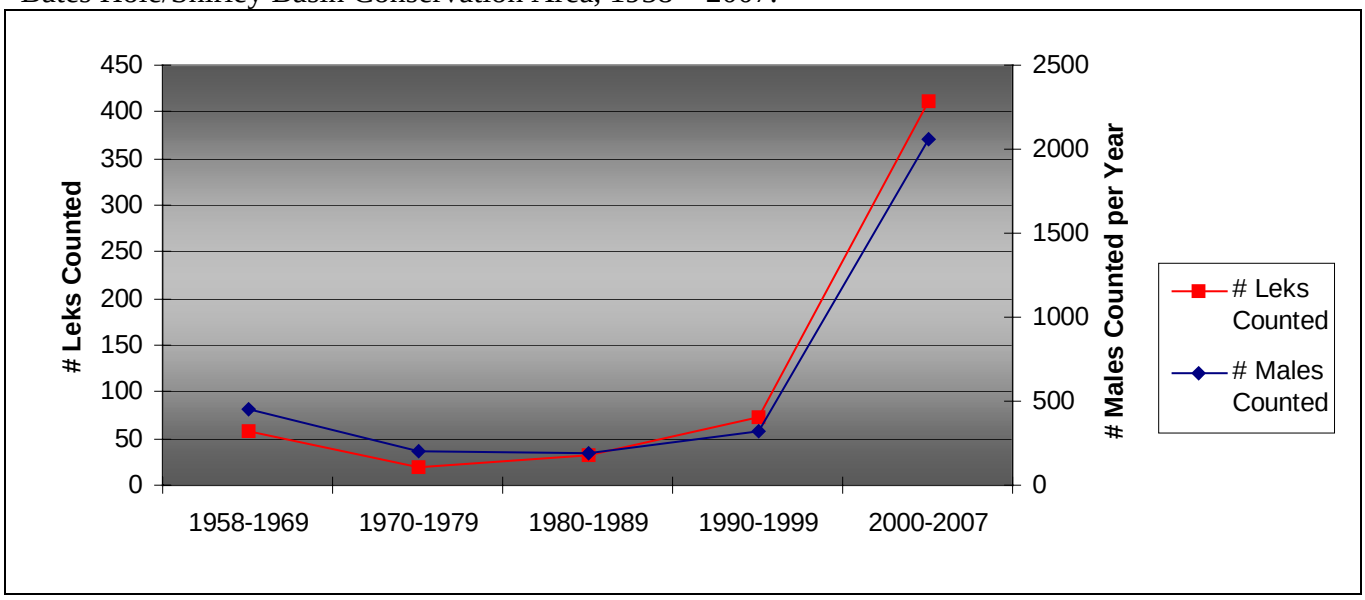
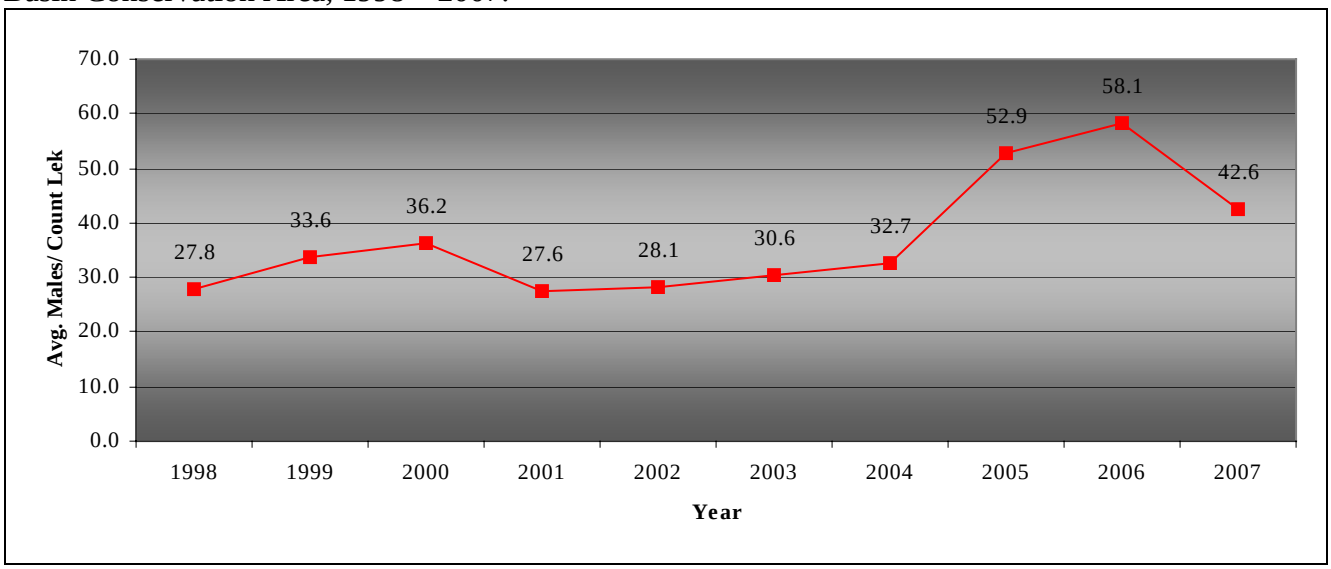
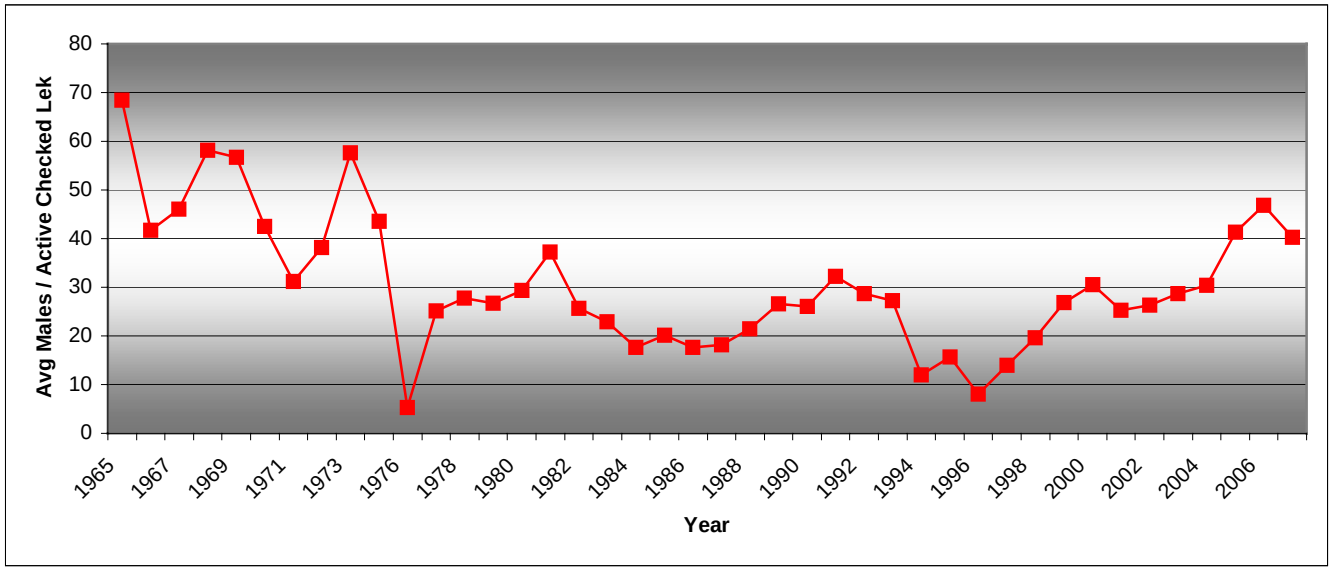


Figure 8. Average number of males/lek observed during lek counts within the Bates Hole/Shirley Basin Conservation Area, 1998 – 2007.



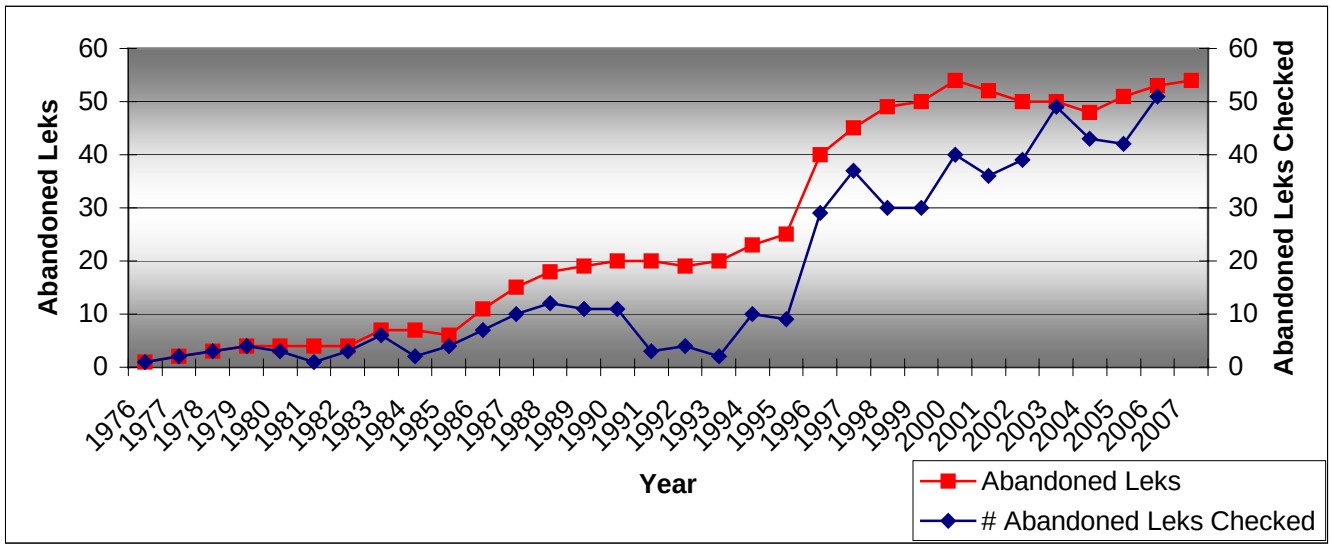
From 2001 through 2006, the observed number of males per count lek, and therefore minimum population size, consistently increased within the BHSBCA. While this trend was encouraging, the minimum sage-grouse population may still be smaller than that of the late 1960's through the mid-1970's based on historic male lek attendance per active lek (Figure 9). It is important to note the average male lek attendance figures depicted in Figure 9 are based on all leks checked and was not limited to more intensive lek counts. As previously mentioned, lek count sample sizes are too small prior to 1998 for reasonable data analyses. However, lek check data constitutes the best long-term data set available relative to sage-grouse population trends within the BHSBCA and should be considered. Certainly, since data collection was standardized in 1996, and monitoring effort was elevated in 1998, the number of male grouse counted on leks has increased within the BHSBCA.

Figure 9. Average number of males per active lek observed during lek surveys within the Bates Hole/Shirley Basin Conservation Area, 1965 – 2007.



Within the BHSBCA, 54 leks have been documented as being abandoned. The number of leks documented/confirmed to be abandoned has increased dramatically since more intensive monitoring and data analyses began in 1996 (Figure 10). The timing in which these leks were abandoned is often difficult to determine due to gaps in data collection, although the recent increase in designations of abandonment was due to more rigorous data collection and analysis over the last ten years. Reasons for abandonment are unknown for most historic leks. It is unclear whether the high number of abandoned leks within the BHSBCA stems from sage-grouse population fluctuations over time, which are a function of weather, habitat conditions, etc., or from anthropogenic disturbances such as natural resource development, hunting, or recreation. Since 1996, most abandoned leks have been monitored, resulting in a few leks again becoming active. This renewed activity may be due to a number of variables such as increased effort in locating the lek, lek movements, and upward trending populations resulting in marginally attended leks again becoming active.

Figure 10. Cumulative number and monitoring of abandoned leks across years within the Bates Hole/Shirley Basin Conservation Area, 1976 – 2007.



Productivity

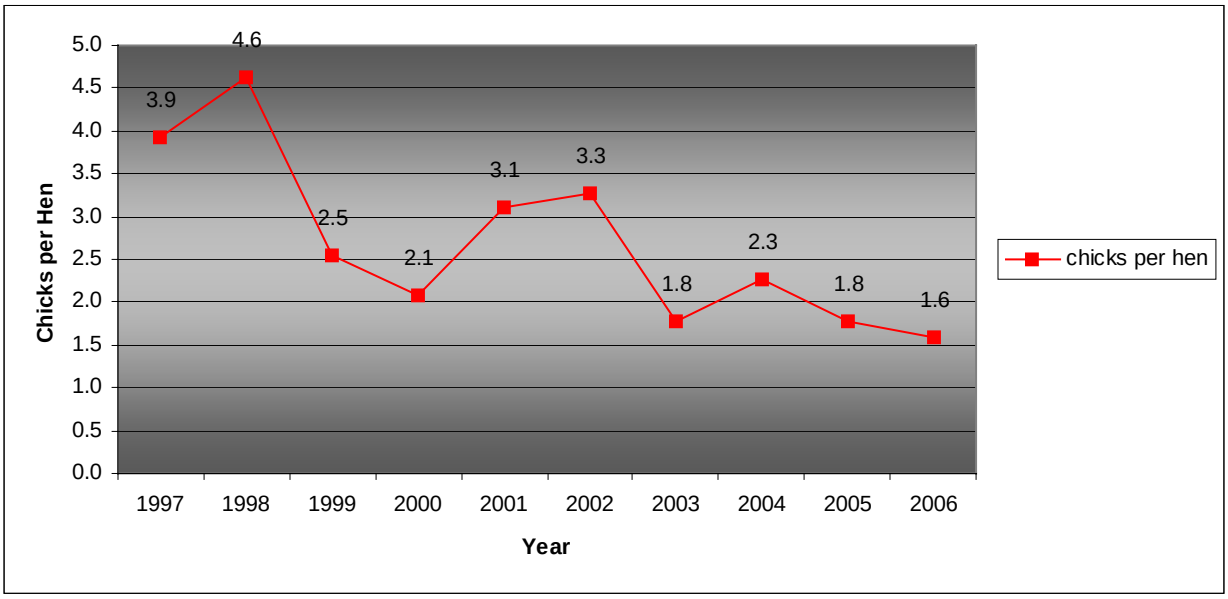
Observations of late summer broods and analysis of wings from harvested sage-grouse can yield information on population productivity. Brood surveys reflect all barren hen groups observed in addition to hens with broods. Historically, brood counts have not been regularly conducted under a set protocol throughout the BHSBCA. Over the last ten years, observed brood count data has often contradicted data obtained from analysis of wings from harvested sage-grouse (Figure 11). Wing data likely provides a more accurate estimate of trends in sage-grouse productivity due to increased sample sizes and more standardized data collection. Wing analysis comes from harvested birds, which occur in mixed groups (including both barren and brood-rearing hens) during fall hunting seasons. Sampling bias is theoretically minimized when considering barren hens are just as susceptible to harvest as brood-rearing hens and chicks in late September. During summer brood surveys, many observations of sage-grouse are focused along riparian areas, which may under-represent the number of barren hens occurring on uplands, thus biasing the actual chick:hen ratio. In addition, wing data is collected during a shorter and more consistent time frame every year (since season dates moved to late September) while brood surveys are conducted over a two-month period. By standardizing and narrowing the window of data collection associated with wing analysis, more accurate comparisons can be made when analyzing trends across years. Based on wing data, chick productivity was estimated to be 1.6 chicks per hen in 2006, which represents the lowest estimate obtained from wing data over the last ten years and represents an 11% decrease since 2005 (Figures 11 and 12). It is unknown whether the low number of chicks observed in the 2006 harvest was due to poor nest success or chick survival, although both were likely suppressed given the extreme drought conditions observed in 2006 resulting in extremely poor vegetative production. Over the last ten years, productivity has fluctuated from 1.6 chicks/hen in 2006 to 4.6 chicks/hen in 1998. Although these data provide some insight into trends in chick production/survival across years, they must be analyzed with caution given a lack of statistical adequacy.

Figure 11. Estimated average brood size for sage-grouse using two sampling methodologies within the Bates Hole/Shirley Basin Conservation Area, 1997 – 2006.

	Year									
Method	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Brood Surveys*	3.3	4.1	--	1.2	2.0	2.4	3.1	1.1	2.9	2.7
Sample size (hens and chicks)	*13*	*51*	*9*	*213*	*121*	*147*	*290*	*412*	*428*	*249*
Wing Data	3.9	4.6	2.5	2.1	3.1	3.3	1.8	2.3	1.8	1.6
Sample size (hens and chicks)	*508*	*507*	*237*	*179*	*456*	*525*	*150*	*249*	*267*	*178*

* Brood survey data are based on Wyoming Game & Fish Dept. Wildlife Observation System query of adult hens and juveniles from July 10th to August 10th of each year.

Figure 12. Productivity rates for sage-grouse within the Bates Hole/Shirley Basin Conservation Area based on wing data analysis, 1996 – 2006.

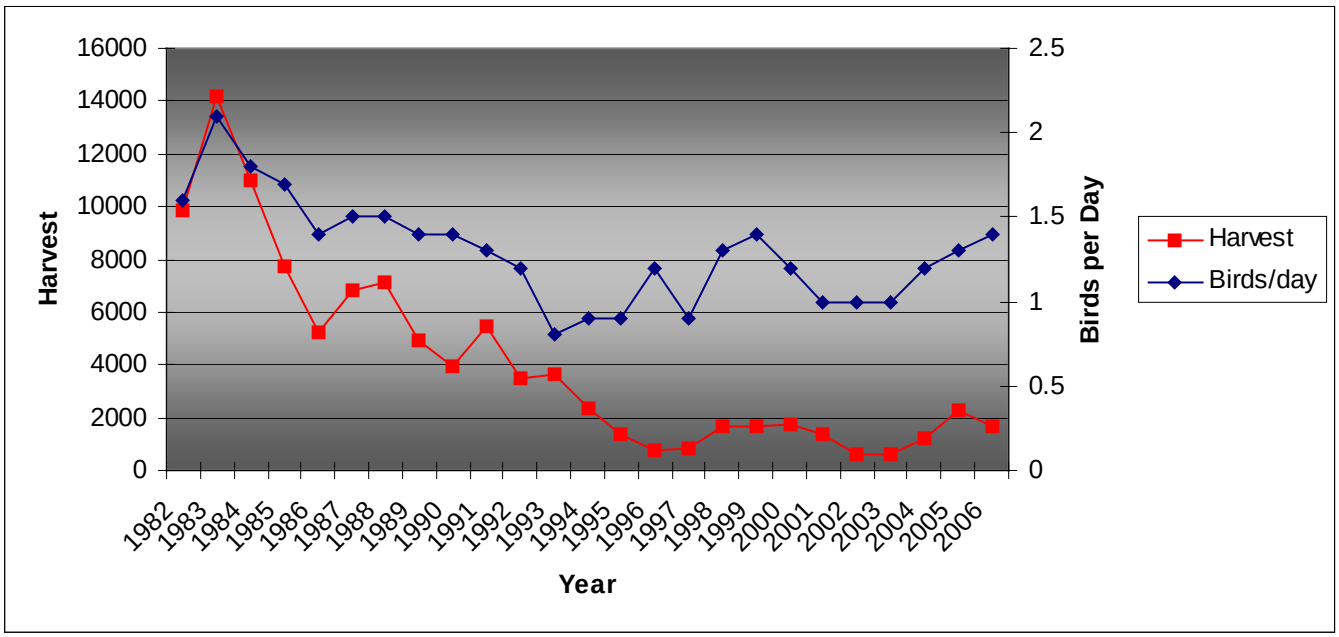


Harvest

Hunter and harvest statistics provide some insight into the status or trends in wildlife populations. Typical of upland game bird populations, there is usually a direct correlation between sage-grouse numbers and hunter effort/harvest. As sage-grouse numbers decrease, hunter harvest generally declines. Conversely, when populations increase, sage-grouse hunting effort and harvest generally increases. Harvest data specific to the BHSBCA was obtainable starting in 1982. Prior to 1982, harvest data was recorded by county and not by the current small/upland game management areas. Trends observed in harvest data generally mirror those observed in male lek attendance within the BHSBCA (Figure 13). Since 1982, annual harvest has averaged 3,088 grouse. Harvest peaked in 1983 at 14,180 birds and subsequently declined to a low of 588 in 2002. Since then, harvest has increased to a high of 2,304 in 2005 but then declined to 1,672 in 2006. Hunter effort (birds/day) has not changed significantly over the last ten years, although hunters have been harvesting more birds/day over the last four years.

Hunter participation and harvest declined dramatically in Wyoming when the Wyoming Game and Fish Commission reduced the bag limit and shortened the hunting season in 2002. A similar reduction occurred in 1995 when the season was moved later into September. This decline occurred in spite of a concurrent population increase (based on males/lek), demonstrating the effects of increasingly conservative hunting seasons over the last ten years to hunter numbers and harvest. When consistent hunting seasons are maintained from year to year, total harvest is strongly correlated with population trends. Managers are not currently able to quantify any population effects resulting from reduced harvest levels. Although some positive population response is suspected to result, any effect at a population level is likely insignificant when compared to the impacts of weather and habitat condition.

Figure 13. Total sage-grouse harvested per year and birds per day within the Bates Hole/Shirley Basin Conservation Area, 1982 – 2006.



Weather

The climatic regime in the BHSBCA can largely be characterized by a continuing long-term drought with generally warmer than normal temperatures and mild winter conditions over the last seven years (Figures 14 – 17). Despite the continuing severe drought since 2001, weather conditions were generally favorable for sage-grouse from 2003 through 2005, which permitted sage-grouse populations to significantly increase within the BHSBCA. Substantial spring precipitation received in 2003 and 2005 helped ameliorate the impact of the drought on sage-grouse habitats for two of the seven years by improving range conditions. Although early spring growing season precipitation has been generally poor within the BHSBCA for the remaining years, periods between late May/early June, along with winters, have been generally mild. Mild climatic conditions during early brood rearing periods generally result in increased chick survival. During this period, cold wet weather can cause significant mortality on newly hatched sage-grouse chicks. However, spring moisture is generally considered to benefit sage-grouse and sagebrush habitats far more than any deleterious effects of cold wet weather during early brood rearing periods.

The extreme drought of 2006 resulted in very poor vegetative production as it pertains to spring/summer forb production and residual herbaceous nesting cover for the spring of 2007. Such

poor moisture during the growing season, coupled with high temperatures, likely resulted in poor chick survival in 2006 and poor nesting success in 2007. According to wing data, 2006 was the poorest chick production/survival year in the last ten years. Lek attendance did decline significantly in 2007 which was likely a result of poor recruitment of yearling sage-grouse. The spring growing season of 2007 experienced excellent precipitation. Both herbaceous and woody shrub production substantially improved, which should increase chick survival over the following summer and residual grass cover for the 2008 nesting season.

Figure 14. Palmer Drought Severity Index. Information from NCDC records, Division 8; Wyoming – Wyoming portion of North Platte River Drainage. (http://www.ncdc.noaa.gov/oa/ncdc.html).

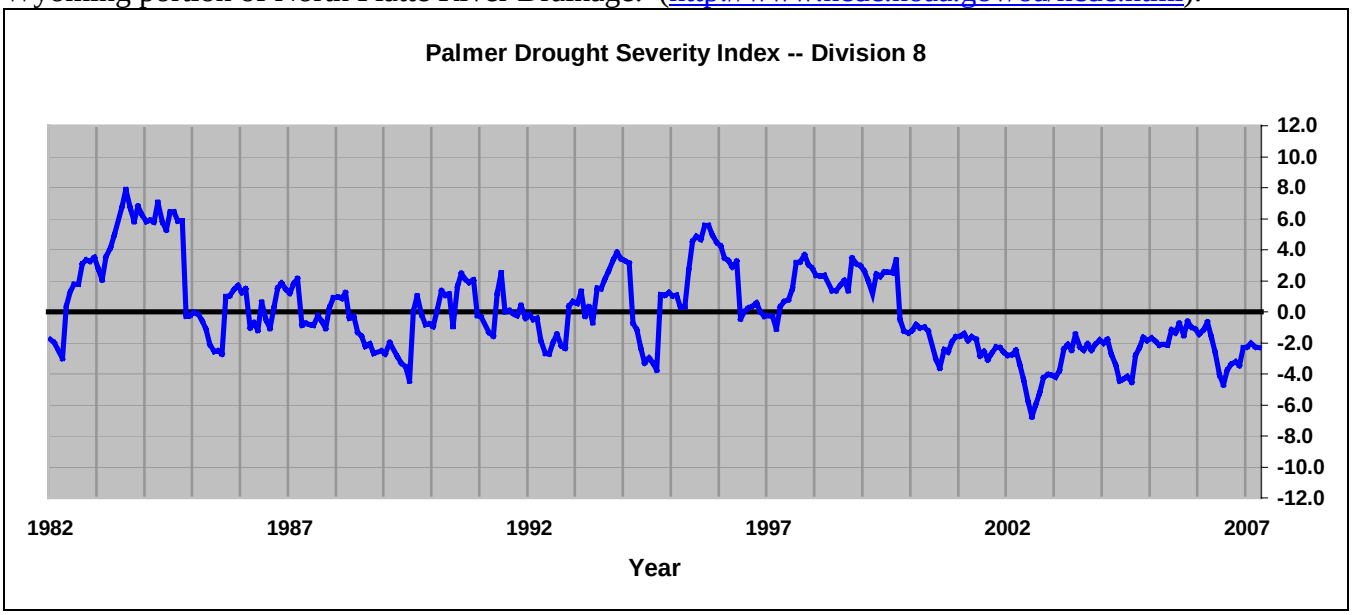


Figure 15. Average monthly maximum temperatures for the 2006 biological year and the 30-year average for all weather stations within the Bates Hole/Shirley Basin Conservation Area. (Source: http://www.wrcc.dri.edu/summary/climsmwy.html).

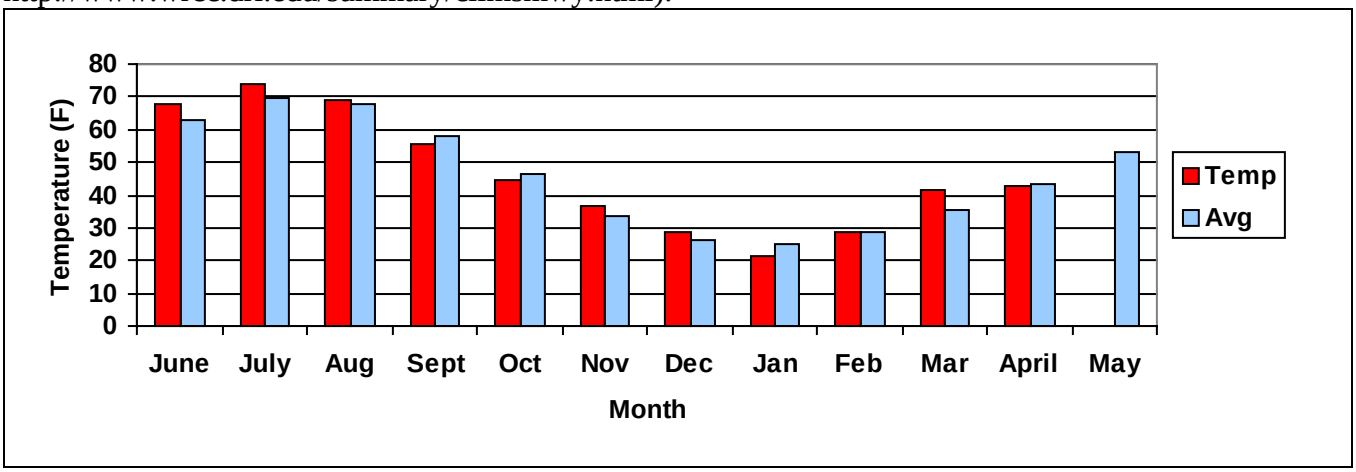


Figure 16. Average monthly precipitation for the 2006 biological year and the 30-year average for all weather stations within the Bates Hole/Shirley Basin Conservation Area.
(Source: http://www.wrcc.dri.edu/summary/climsmwy.html).

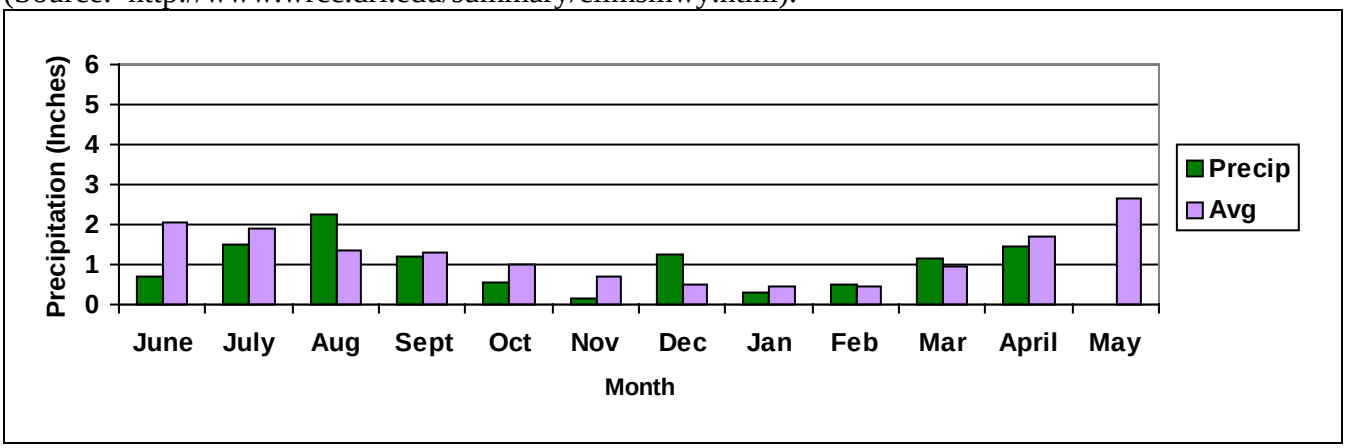
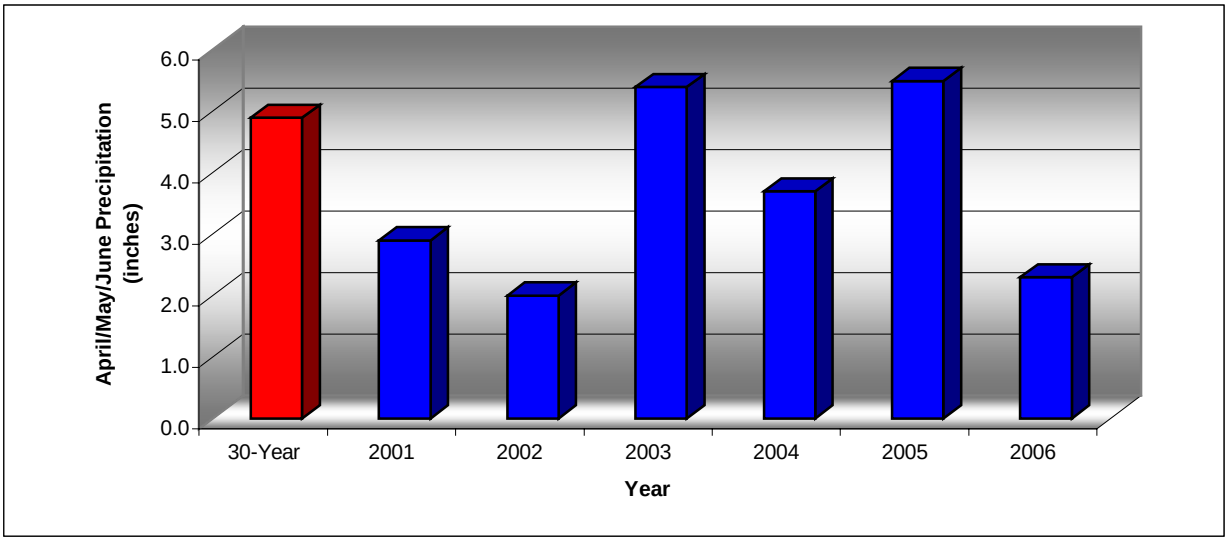


Figure 17. Spring (April/May/June) precipitation for all weather stations within the Bates Hole/Shirley Basin Conservation Area from 2001 – 2006 and averaged over the last 30 years. Spring 2007 data was not yet available. (Source: http://www.wrcc.dri.edu/summary/climsmwy.html)



Special Studies

The Hat Six Sage-grouse Habitat Use Research Project (Pilot Study) was initiated during the breeding season of 2006. In 2006, 30 sage-grouse (19 females and 11 males) were radio-collared from the Hat Six and Altmann Leks in the Hat Six area southeast of Casper to determine seasonal habitat selection and sage-grouse survival. An additional 16 sage-grouse (11 hens and 5 males) were collared during the spring of 2007 to augment the remaining sample size. This research project will continue into 2008 with additional sage-grouse locations being obtained through the early summer. A project description is provided in Appendix I. Results of this study will not be available until 2008.

Descriptions of ongoing sage-grouse conservation projects which have been (partially) funded by the BHSBLWG are provided in Appendix II.

Diseases
West Nile Virus was again detected in sage-grouse in 2006 and 2007 in Wyoming, although the disease was not confirmed in sage-grouse within the BHSBCA.

The impact of populations exposed to West Nile Virus was analyzed by looking at survival of radio-collared adult female sage grouse from 12 studies across their range (Naugle et al. 2005). Late summer survival (July 1 – September 30) for birds from populations with West Nile Virus was 10% lower (86% survival) than for birds from populations with no West Nile Virus (96%).

Recommendations

1. Implement the Bates Hole/Shirley Basin LWG Conservation Plan, which was approved by the Wyoming Game and Fish Commission in February of 2007.

2. Continue efforts to document all seasonal habitat use throughout the BHSBCA, with emphasis on nesting, early-brood rearing, and winter habitats.

3. Continue, and perhaps expand, sagebrush monitoring throughout the BHSBCA to ensure adequate data is collected to document use and productivity. Where appropriate, wildlife managers should use this data to ensure proper utilization by big-game, primarily pronghorn.

4. Attempt to increase the number of grouse wings collected in under-represented management areas, so better comparisons of productivity and harvest can be made across the BHSBCA.

5. The BHSBLWG should continue to solicit habitat projects that will benefit sage-grouse. These might include riparian corridor protection, water development, and different livestock grazing regimes.

6. Ensure monitoring of all count leks/complexes is conducted properly and consistently on an annual basis. Continuity is very important to detect population change.

7. Attempt to check leks that have not been monitored for many years to determine their status. If possible, attempt to at least survey all leks each year. Encourage the public, volunteers, and especially landowners to report lek activity and assist with lek surveys and counts. Begin monitoring inactive or unoccupied leks to adjust classification as appropriate.

8. Continue to update and refine UTM coordinates (using NAD83) of leks and map lek perimeters.

9. Continue to assist with the development of a proposed seasonal habitat selection study of sage-grouse in the Wallace Creek area west of Casper. This study will primarily be funded by BLM with a graduate student as a project lead.

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Appendix I. Project proposal for the Hat Six Sage-grouse Habitat Use Research Project (Pilot Study).

PROJECT PROPOSAL (AUGUST 2005)

PROJECT TITLE: Hat Six Sage-grouse Habitat Use Research Project (Pilot Study)

SUBMITTED BY: Rebecca Schilowsky, Daryl Lutz

STUDY AREA: Casper Biologist District. The primary study area will consist of those areas within a 10-mile radius of the Hat Six and Altmann sage-grouse leks, located in small and upland game management units 27 and 35. However, if radio-collared sage-grouse disperse out of the primary area, the study area will expand to include their movements.

> **Land Status:** Intermixed public (BLM, State) and private. Land use patterns include domestic livestock grazing, farming, recreational activities, and urban expansion/development.
>
> **Present Habitats:** At lower elevations, dominant species include cottonwood (*Populus sp.*), willow (*Salix sp.*), and agricultural croplands and pastures. Intermediate elevations are dominated by Wyoming big sagebrush (*Artemisia tridentata wyomingensis*), rabbitbrush (*Chrysothamnus spp.*), black greasewood (*Sarcobatus vermiculatus*), and mountain mahogany (*Cercocarpus montanus*). Higher elevations are dominated by limber pine (*Pinus flexilis*), ponderosa pine (*Pinus ponderosa*), lodgepole pine (*Pinus contorta*), and aspen (*Populus tremuloides*).
>
> **Topography:** Topography in the primary study area ranges from flats, rolling hills, benches, and draws at lower elevations to mountainous terrain (slopes, ridges, and canyons) at higher elevations. Elevation ranges from 1,400 to 2,200 meters.
>
> **Water:** Water in the primary study area varies from limited to abundant, based on physiographic location, and is primarily in the form of stock ponds, springs, and streams.

PROJECT DESCRIPTION: This two-year pilot project is designed to incorporate radio telemetry to identify existing movements and preferred nesting, brood rearing, and winter habitats of sage-grouse (*Centrocercus urophasianus*) associated with the Hat Six and Altmann leks located outside of Casper, Wyoming. Once these habitats are identified, a plan for protection of the habitat may be pursued. As the city continues to expand, these leks and the surrounding habitats may be altered. A better understanding of the movements and habitat use of these sage-grouse may lead to improvements in management/planning in other areas of Wyoming where development/expansion threatens sage-grouse habitats.

Objectives for this pilot project are to: (1) document nesting, brood rearing, barren hen summering habitat, and winter habitats through the use of radio telemetry to identify seasonal movements from the Hat Six and Altmann sage-grouse leks. This is the primary objective of this pilot project. Along with this objective, additional information such as nesting site habitat selection, nesting success, and identification of nest predators will be gathered where feasible. (2) Monitor sage-grouse responses to vehicle observer activity, and (3) Use GIS technology to document changes to habitat within a 4-mile

radius of these leks over the past 30 years or as image availability allows. This objective may be linked to a remote sensing project being conducted for Keith Schoup (Casper Habitat Biologist) and may only require a detailed analysis of the project area in relation to objective 1.

Methodology:

Objective 1:
Similar to techniques used by Holloran (1999), during the spring breeding season (15 March – 30 April) of 2006, 20 female and 10 male sage-grouse in the vicinity of the Hat Six and Altmann leks will be captured using night-lighting techniques and affixed with a necklace-type, mortality-sensing radio transmitter. Seasonal movements and habitat use data will be collected by tracking the radio-collared birds throughout the year. Using the homing technique, the birds will be located during the spring, summer, fall (and winter when ground access is possible), and when a mortality signal is transmitted, with a hand-held, 3-element Yagi antenna and ATS receiver (Advanced Telemetry Systems, Isanti, MN). A telemetry-equipped fixed-wing aircraft will be used to locate the birds during the winter (weekly) when ground access is not possible, and as necessary to document long distance movements. Nesting sites will be located and the area marked. Nesting success will be determined when the hen abandons the site. Unsuccessful nests will be investigated to determine the cause of the nest failure, (i.e. predation, abandonment, nonviable eggs, etc.).

Objective 2:
Radio-collared male and female sage-grouse from both the Hat Six lek (treatment) and the Altmann lek (control) will be observed for responses to vehicle activity. The Altmann lek is not situated near a road, thus serving as the control. Road vehicle counters will be used to document daily traffic during the period when sage-grouse are occupying the lek. Lek viewing data will be documented during lek counts. Data such as daily male lek attendance, amount of time per day males spend on the lek, and the number of predator visits (human presence could potentially decrease the impact of eagles on the lek) can be compared between the two leks and can be obtained from observing the collared birds. Furthermore, differences in lek-to-nest distance, nest initiation, and nesting success data collected from the collared hens will be analyzed to estimate any female sage-grouse response to increased human activity.

Objective 3:
As stated above, this objective would be best achieved in conjunction with a detailed analysis of the project area as a subcategory of the remote sensing vegetation analysis project currently underway. Work associated with this objective will begin the summer of 2005, as data from sagebrush-grassland vegetation transects---such as percent canopy cover of grasses and forbs, and percentage of live sagebrush---will be collected by an intern working with Keith Schoup.

PURPOSE AND NEED

Sage-grouse attendance at the Hat Six lek has declined in recent years. Public viewing opportunities are excellent at this lek, as it lies adjacent to a well-maintained county road within a 15-mile drive of Casper. The lek and associated nesting habitats occupy private and state lands. Habitat alterations in the form of subdivisions, agricultural croplands, and sagebrush removal treatments have likely affected the number of birds attending this lek and the nearby Altmann lek. In addition, there may be some affect from increased vehicle traffic from observers watching the strutting activity. Major subdivision

development appears imminent along the Hat Six Road corridor as the City of Casper increases development easterly. The goal of this pilot project will be to provide guidance in protection of crucial habitats utilized by sage-grouse from this lek complex and to assist Natrona and Converse County planning efforts in identifying this important area.

SPECIFIC QUANTIFIABLE WILDLIFE BENEFITS: The results of this pilot study will help enable land and wildlife managers to better understand the distribution and habitats used by this relatively isolated grouse population. As urban development continues to encompass remaining grouse habitats, primarily on State of Wyoming lands, this data should increase our ability to more effectively conserve and perhaps improve critical habitats for this sub-population.

PROJECT GOALS: The goals of this pilot project are: (1) Determine survival, seasonal movements and habitat use of sage-grouse utilizing the Hat Six and Altmann leks to better understand this relatively isolated sage-grouse population, (2) determine potential habitat-related limiting factors to sage-grouse in this population, and (3) create a baseline for comparison of possible effects of urban development on this sage-grouse population.

PROJECT WORK PLAN/TIME LINES:

July 2005 – February 2006: Initiate pilot project, write study plan, obtain necessary equipment (i.e. radio-collars, telemetry equipment, traffic counters, etc.) for the project, and begin organization of personnel for project. Initiation of the remote sensing project via Keith Schoup, the Casper Habitat Biologist.

March – April 2006 (Spring Breeding Season): Initiate pilot project, capture and radio-collar sage-grouse, begin tracking radio-collared birds to evaluate survival, movements, and habitat use. Begin monitoring responses of sage-grouse to vehicle observer activity.

May 2006– February 2007: Track radio-collared birds to evaluate survival, seasonal movements, habitat use during nesting, brood rearing, summering, and wintering periods, nest initiation, and nesting and brood rearing success. Identify causes of mortalities and nesting failures.

March – April 2007 (Spring Breeding Season): Capture and radio-collar additional grouse to bring sample size back up, continue tracking radio-collared birds to evaluate survival, movements, and habitat use. Continue monitoring responses of sage-grouse to vehicle observer activity.

May 2007 – June 2008: Track radio-collared birds to evaluate survival, seasonal movements, habitat use during nesting, brood rearing, summering, and wintering periods, nest initiation, nesting and brood rearing success. Identify causes of mortalities and nesting failures. Complete analysis and summarize all collected data. Complete and publish final report.

Literature Cited

Holloran, M. J. 1999. Sage-grouse (*Centrocercus urophasianus*) seasonal habitat use near Casper, Wyoming. M.S. Thesis. Univ. of Wyoming. 130pp.

Appendix II. Descriptions of ongoing conservation projects within the BHSBCA funded through the Wyoming Governor's Sage-grouse Conservation Fund (via the BHSBLWG).

Martin Ranch Project

The Martin Ranch Project aims to increase the herbaceous forage component available to wildlife and livestock through prescribed fire and fencing. The project area comprises 3,735 acres dominated by mountain big sagebrush and Idaho fescue. Approximately 40% of the project area contains mountain big sagebrush with a live canopy cover between 25% - 40%. In 2006, 130 acres of this dense sagebrush were burned and approximately 22,000 ft of high tensile electric fence was installed. Another 200 - 400 acres are scheduled to be burned in the spring of 2007 with plans to expand the project further in coming years. Sage-grouse use the area for nesting, early brood-rearing, and late brood-rearing. This area also receives summer and fall pronghorn use, yearlong mule deer use, and primarily winter elk use. The anticipated increase in diversity of native forbs and insects is intended to increase the quality and quantity of forage available for sage-grouse chicks. Meanwhile, the anticipated increase in grass and forb production and young sagebrush plants will provide a greater quantity and quality of forage for mule deer, elk, and pronghorn. Finally, the fencing will provide greater control of livestock and allow for more effective grazing management which should improve rangeland health over the long term.

7E Ranch Project

The 7E Ranch Project aims to increase the herbaceous forage component available to wildlife and livestock through the implementation of a rotational grazing system. The project requires cross-fencing and water development for up to six pastures covering approximately 16,000 acres in Shirley Basin. Upon establishment of the rotational grazing system, the project intends to conduct sagebrush management practices through prescribed burning and Lawson aeration (if available) to revitalize sagebrush communities on the ranch. This area also receives summer and fall pronghorn use, yearlong mule deer use, and some winter elk use. The anticipated increase in diversity of native forbs and insects is intended to increase the quality and quantity of forage available for sage-grouse chicks. Meanwhile, the anticipated increase in grass and forb production and young sagebrush plants will provide a greater quantity and quality of forage for mule deer, elk, and pronghorn. Finally, the fencing will provide greater control of livestock and allow for more effective grazing management which should improve rangeland health over the long term.

M & D Land (Dennis Sun) Wildlife Inventory Project

This program involves using SG inventory methods that have been tested in the Powder River Basin to provide SG biological information for decision making in a rapid and efficient manner. Researchers use birddog surveys, where grouse are flushed and classified, to determine differential habitat selection by SG. A Wyoming SG specialist and his trained English setters will be hired to search the property several times throughout the year. The dogs are trained to search large areas and are thus fitted with radio collars that transmit their locations and activity, or lack there of. When a setter goes on point (no activity), triangulation is used to locate it. The consultants can then flush and classify the SG. Locations are collected with a global positioning system (GPS) and installed in a geographic information system (GIS). The sagebrush patch where the birds flushed from is then searched and SG pellets are examined to determine the season of use. Pellets containing mostly sagebrush are from wintering SG. If forbs make up the pellets, the areas will be classified as spring-summer-fall habitat. The size of the pellets will determine if it is important brood-rearing habitat or not. The consultant will

sample enough pellets to determine if the area should be classified as a certain seasonal range. This data gathering will coincide with increased lek monitoring in the area during lekking periods.

In addition to classifying sagebrush based on SG use, the consultant will use a scorecard to measure the ecological condition of the sagebrush community. The patch will be delineated on aerial photography and on-the-fly digitizing will install and attribute it in a GIS. It should be possible to map most SG occupied habitat on the ranch using these methods. Future rangeland management decisions will take this information into consideration.

Dr. Roy Roath, a renowned range extension specialist with Colorado State University, will use collected vegetation and wildlife inventory data to assist with future grazing management planning and will provide consultation regarding future rangeland improvement practices. Dr. Roath has developed the Grazing Response Index (GRI), an easy to administer method of developing, evaluating, and monitoring prescribed grazing systems. Numerous agencies and individuals have employed his GRI with success. Dennis will be responsible for follow-up monitoring, but Dr. Roath will assist in modifying his current grazing plan and provide training in understanding plant physiology and plant responses to grazing. Some amount of training and consultation will also be available to other working group area landowners.

L3 Cattle Company (Harris) Pasture Fence & Spring Development

Describe what actions the project will undertake to address the problem(s) identified and meet the stated goals and objectives. For projects involving habitat manipulation/treatment identify the post-treatment management strategies to be implemented e.g. livestock grazing plans, weed control, infrastructure maintenance, etc..

Planned Practices:

Install 1.50 miles of 4-wire barbed fence to divide a current 2,474 acre pasture into two comparable sized pastures (1,200+/- acres per). Complete a spring development in one of the newly created pastures to provide a more reliable water source for livestock and an accessible / “friendly” source for wildlife. This water source is necessary to allow for pasture division. The spring development will also include approximately 300’ of pipeline and a tire stock tank (with wildlife access modifications included).

After the practices have been installed, the L3 Cattle Company plans to defer livestock grazing during the growing season / sage grouse nesting and brood rearing period on 1/3 of the acreage, 1,200 acres +/- per year in their 3 pasture system.

Schnoor/Flat Top Big Sagebrush Restoration

This project is intended to restore big sagebrush communities because there has been a decline in the extent, distribution and quality of these communities over the past 20 to 40 years. The remaining communities are in advanced seral stages with very little, if any, young plant recruitment. The big sagebrush communities have poor herbaceous understory diversity, juniper encroachment is increasing, and prickly-pear cactus and cheatgrass have increased in frequency over this same timeframe. During this timeframe, big game and sage grouse populations have declined. Populations following extreme climatic conditions, primarily severe winters and extended droughts, have not recovered to levels recorded in the 1960’s and 1970’s, which may be indicative of habitat conditions.

Restoration efforts will be accomplished through chemical, mechanical and prescribed fire treatments. Plateau® and Tordon® will be applied to control cheatgrass and prickly-pear cactus infestations, mechanical treatments will include mowing big sagebrush and utilizing the Lawson aerator, prescribed burns, and inter-seeding grasses and forbs where this component is either missing or has been significantly reduced due to non-native, invasive plant species.

Three Man Ranch Upland Habitat Improvement Project

This project will increase the abundance and cover of native grasses and forbs within Wyoming big sagebrush and basin big sagebrush plant communities on the Three Man Ranch located east of Pathfinder Reservoir. The Three Man Ranch is comprised of 28,629 acres of which 4,909 are deeded to Mr. Swanson. Mr. Swanson will accomplish the proposed habitat improvement by installing a multi-tank, multi-pasture, livestock watering system, comprised of one well, seven livestock watering tanks (with escape ramps) and over 5 miles of pipeline. This watering system will enable him to use a rest-rotation grazing system. This system will allow him to rest the range and/or provide for the re-growth of vegetation (grazing early and then resting the pasture until the next growing season) on approximately 800-1,400 acres of sagebrush range each year (depending on which pasture/s are rested). The rested pastures will provide improved nesting and foraging habitat for sage grouse, sage sparrows, and Brewer's sparrows, and add complexity and heterogeneity back into the local sagebrush system. In addition to the above described resting of pastures, Mr. Swanson will be rotating his livestock through his remaining pastures.

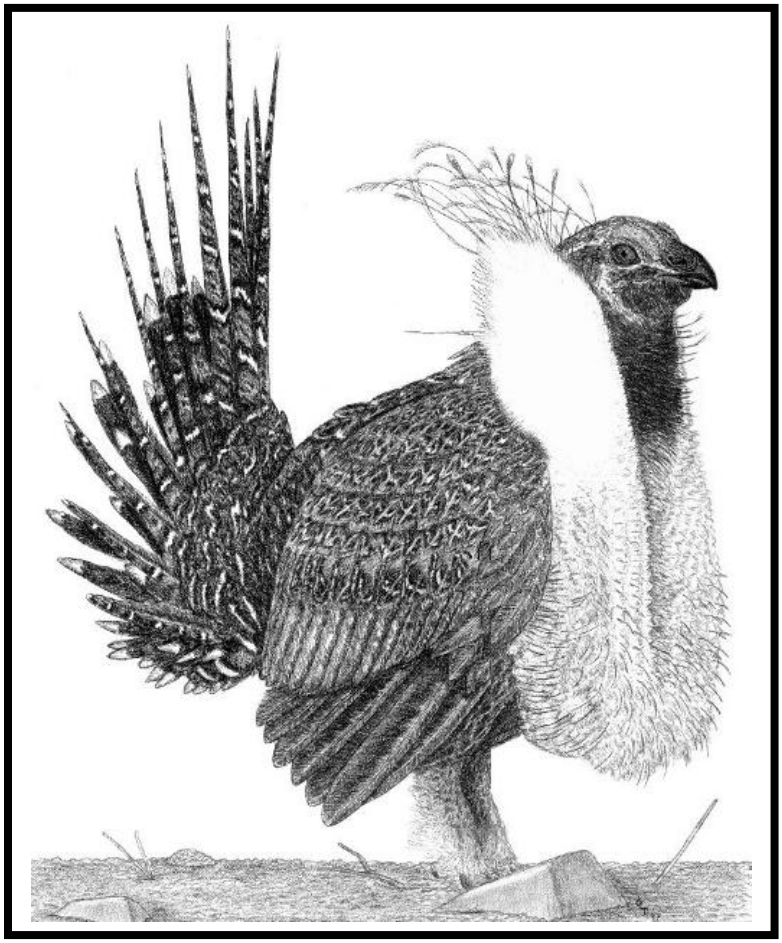
Mr. Swanson is also interested in providing water developments for sage grouse. He would install at least two water developments that are several acres in size and designed specifically for sage grouse. These water developments will use water supplied from the pipeline and deliver it to the designated area via a short spur pipeline and metered out to create a small wetland area in the middle of a several-acre livestock exclusion. Livestock will be excluded from these developments with the use of fencing. All fencing around the water developments will be marked appropriately to increase their visibility to sage grouse. Grazing will be conducted during one out of every five years in these water development areas to remove the decadent vegetation. Grazing will not occur simultaneously in all of the water developments. These water developments will provide important habitat niches within the sagebrush landscape and valuable habitat for sage grouse foraging during mid- to late summer when the rest of the range has dried up.

In addition, Mr. Swanson will annually shut one or more water tanks off where possible varied by year and pasture. This will vary the pasture's grazing patterns to promote heterogeneity and localized habitat niches. When allowed appropriate rest, areas around water tanks can flush substantial vegetation growth due to the extra nutrients from the livestock concentration. This vegetation will provide abundant insects for sage-grouse foraging and will increase sage grouse hens pre-nesting condition and overall chick condition due to the increase of available protein.

In addition to managing the grazing on his property, Mr. Swanson is working with Jason Hunter (Medicine Bow Game Warden) to mange the wild herbivore grazing as well. He will allow public access for limited hunts for pronghorn in order to decrease pronghorn use of sagebrush.

Northeast Wyoming Working Group

2006 ANNUAL SAGE-GROUSE COMPLETION REPORT



Prepared By:

Dan Thiele
District Wildlife Biologist, Buffalo
Wyoming Game and Fish Department

Sage-Grouse Job Completion

YEAR: 2006 **PERIOD COVERED: 6/1/2006 - 5/31/2007**
WORKING GROUP: Northeast **PREPARED BY: Dan Thiele**

1. LEK ATTENDANCE SUMMARY (OCCUPIED LEKS)

a. Leks Counted

Year	Known	Counted	Percent Counted	Max Totals Males	Max Totals Females	Avg./Active Lek Males	Avg./Active Lek Females
1998	239	49	20.5	473	117	9.7	2.4
1999	255	57	22.4	586	81	10.3	1.4
2000	267	77	28.8	1246	294	16.2	3.8
2001	305	91	29.8	1176	345	12.9	3.8
2002	320	101	31.6	794	461	7.9	4.6
2003	346	102	29.5	783	361	7.7	3.5
2004	382	145	38.0	999	245	6.9	1.7
2005	430	105	24.4	1469	484	14.0	4.6
2006	459	87	19.0	1745	549	20.1	6.3
2007	478	114	23.8	2016	340	17.7	3.0

b. Leks Surveyed

Year	Known	Surveyed	Percent Surveyed	Max Total	Avg Males/ Active Lek
1998	239	60	25.1	300	13.6
1999	255	82	32.2	611	17.0
2000	267	116	43.4	872	16.5
2001	305	103	33.8	794	13.2
2002	320	111	34.7	505	9.5
2003	346	128	37.0	687	9.8
2004	382	202	52.9	899	9.2
2005	430	205	47.7	2008	15.9
2006	459	262	57.1	3170	18.9
2007	478	299	62.6	3250	19.6

c. Leks Checked

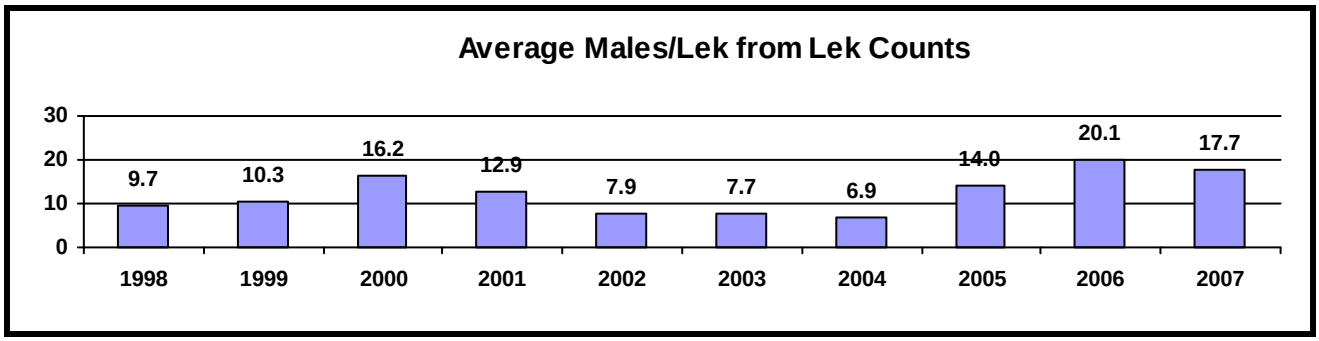
Year	Known	Checked	Percent Checked	Max Total	Avg Males/ Active Lek
1998	239	109	45.6	773	10.9
1999	255	137	53.7	1186	12.9
2000	267	188	70.4	2102	16.7
2001	305	178	58.4	1882	13.3
2002	320	198	61.9	1237	8.7
2003	346	202	58.4	1372	8.7
2004	382	300	78.5	1763	8.1
2005	430	310	72.1	3477	15.1
2006	459	349	76.0	4915	19.3
2007	478	413	86.4	5266	18.8

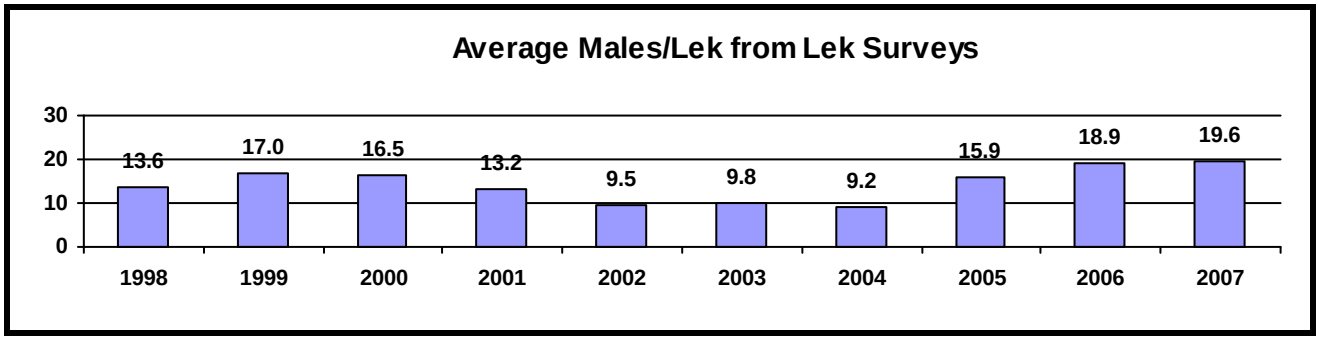
d. Lek Status

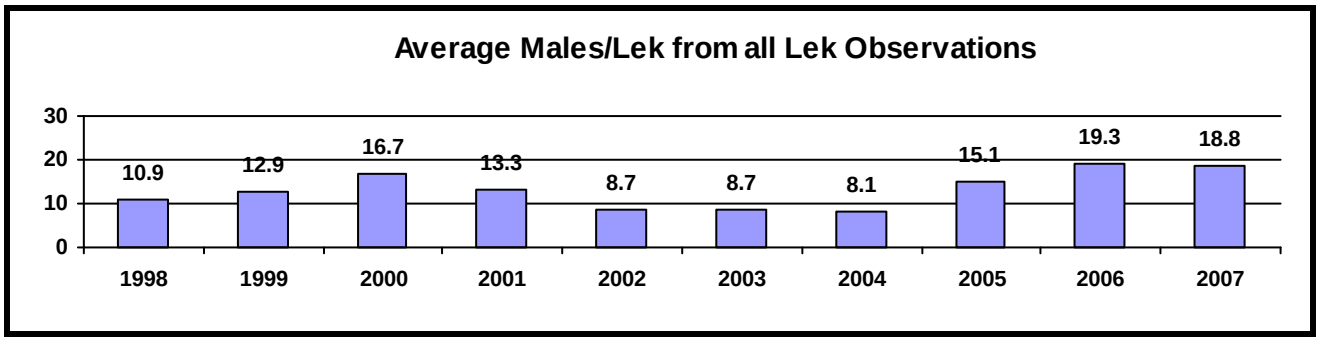
Year	Active	Inactive	Not Located	Unknown	Total	Confirmed Status Active	Confirmed Status Inactive
1998	52	19	10	158	71	73.2%	26.8%
1999	70	20	15	150	90	77.8%	22.2%
2000	111	19	22	115	130	85.4%	14.6%
2001	125	25	7	148	150	83.3%	16.7%
2002	117	35	2	166	152	77.0%	23.0%
2003	124	35	1	186	159	78.0%	22.0%
2004	158	66	2	156	224	70.5%	29.5%
2005	206	34	3	187	240	85.8%	14.2%
2006	233	30	6	190	263	88.6%	11.4%
2007	247	84	3	144	331	74.6%	25.4%

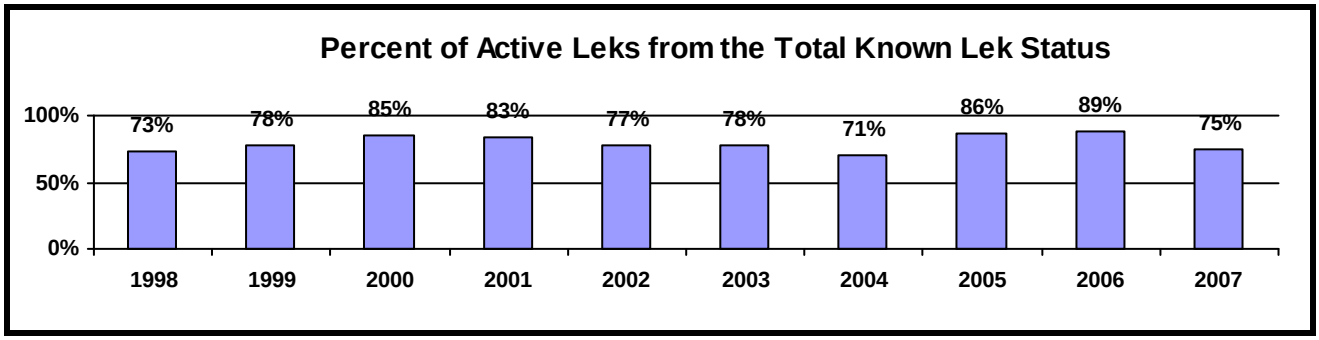
SAGE-GROUSE LEK ATTENDANCE SUMMARY

WORKING GROUP: Northeast **Area(s): All**









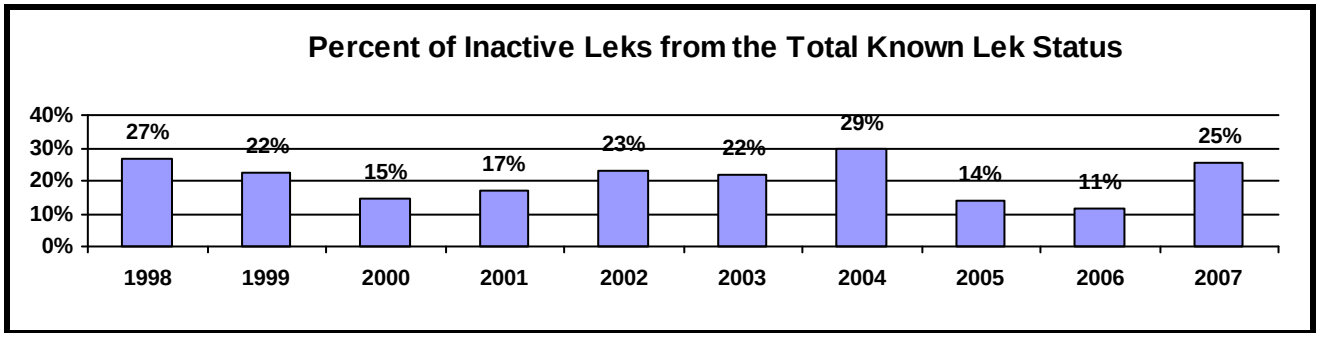


Table 4. Sage-grouse hunting seasons and harvest

a.

Year	Season Dates	Length	Bag/Possession Limit
1997	Sept 20-Oct 5	16	3/6
1998	Sept 19-Oct 4	16	3/6
1999	Sept 18-Oct 3	16	3/6
2000	Sept 16-Oct 1	16	3/6
2001	Sept 22-Oct 7	16	3/6
2002	Sept 28-Oct 6	9	2/4
2003	Sept 27-Oct 5	9	2/4
2004	Sept 23-Oct 3	11	2/4
2005	Sept 23-Oct 3	11	2/4
2006	Sept 23-Oct 3	11	2/4

b.

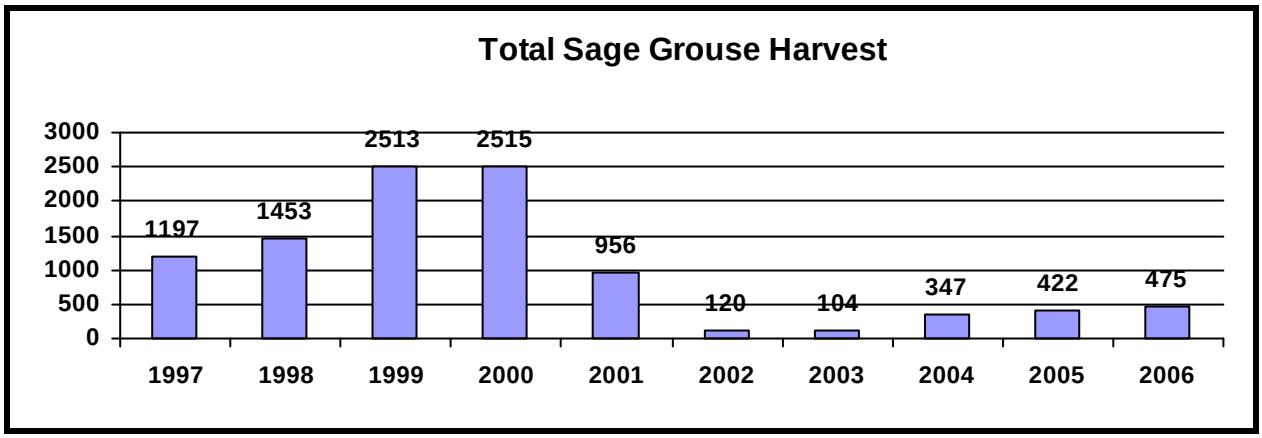
Year	Harvest	Hunters	Days	Birds/ Day	Birds/ Hunter	Days/ Hunter
1997	1,197	619	1,549	0.8	1.9	2.5
1998	1,453	399	1,638	0.9	3.6	4.1
1999	2,513	981	4,233	0.6	2.6	4.3
2000	2,515	1,170	3,743	0.7	2.1	3.2
2001	956	518	1,414	0.7	1.8	2.7
2002	120	210	712	0.2	0.6	3.4
2003	104	80	168	0.6	1.3	2.1
2004	347	271	471	0.7	1.3	1.7
2005	422	342	1,649	0.3	1.2	4.8
2006	475	283	509	0.9	1.7	1.8
Avg	1,010	487	1,609	0.6	1.8	3.1

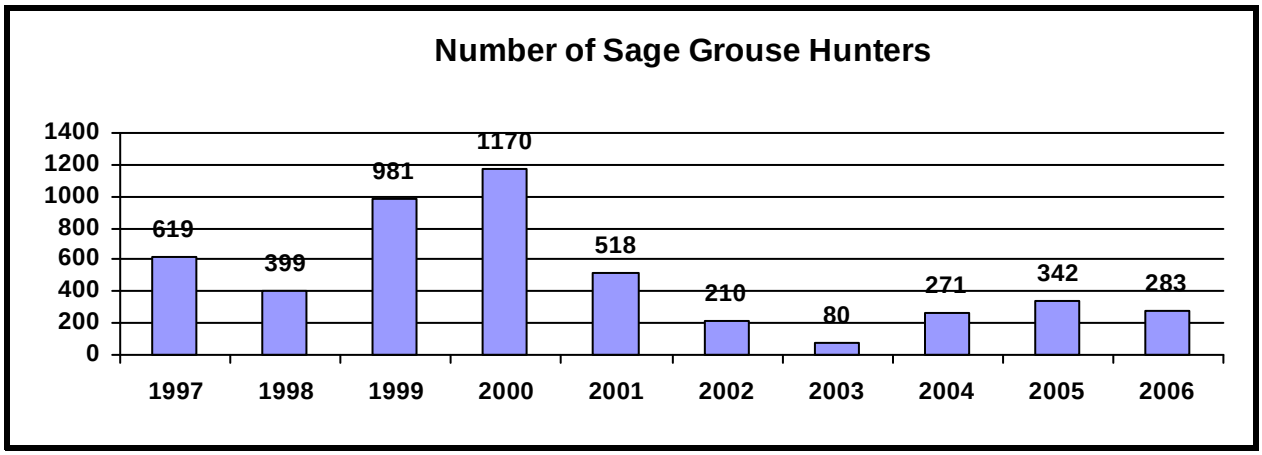
Table 5. Composition of harvest by wing

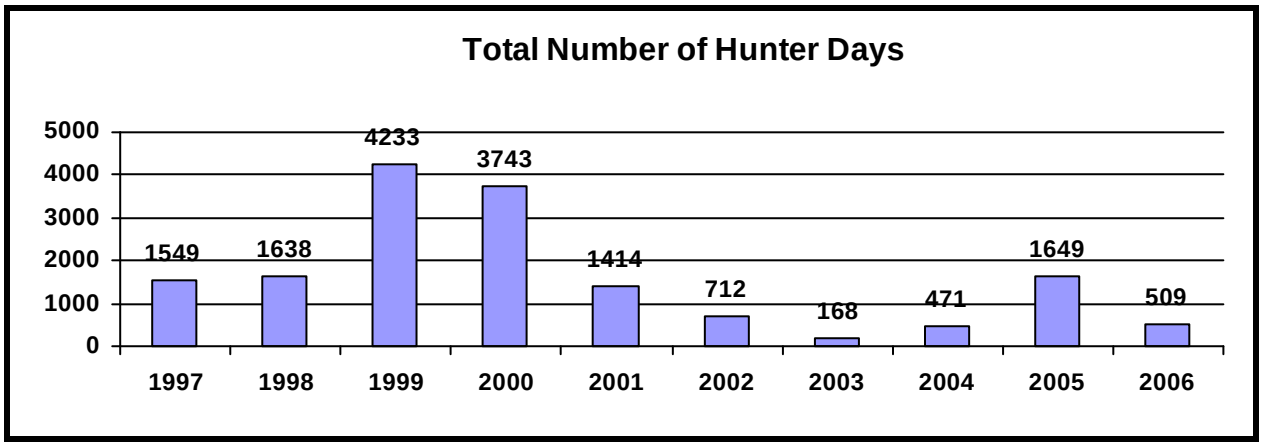
	Sample	Percent Adult		Percent Ylg		Percent Young		Chicks/Hen	
Year	Size	Male	Female	Male	Female	Male	Female	All	Suc.
1997									
1998	41	2.4	14.6	0.0	14.6	26.8	41.5	2.3	0.0
1999	35	5.7	11.4	8.6	5.7	31.4	37.1	4.0	0.0
2000	116	11.	19.8	0.9	19.8	29.3	19.0	1.2	5.6
2001	61	14.	26.2	0.0	11.5	18.0	29.5	1.3	7.3
2002	23	4.3	52.2	0.0	13.0	0.0	30.4	0.5	1.4
2003	11	9.1	9.1	9.1	9.1	27.3	36.4	3.5	7.0
2004	36	11.	11.1	22.2	13.9	30.6	11.1	1.7	2.1
2005	58	6.9	15.5	5.2	15.5	27.6	29.3	1.8	2.8
2006	28	3.6	14.3	17.9	21.4	28.6	14.3	1.2	

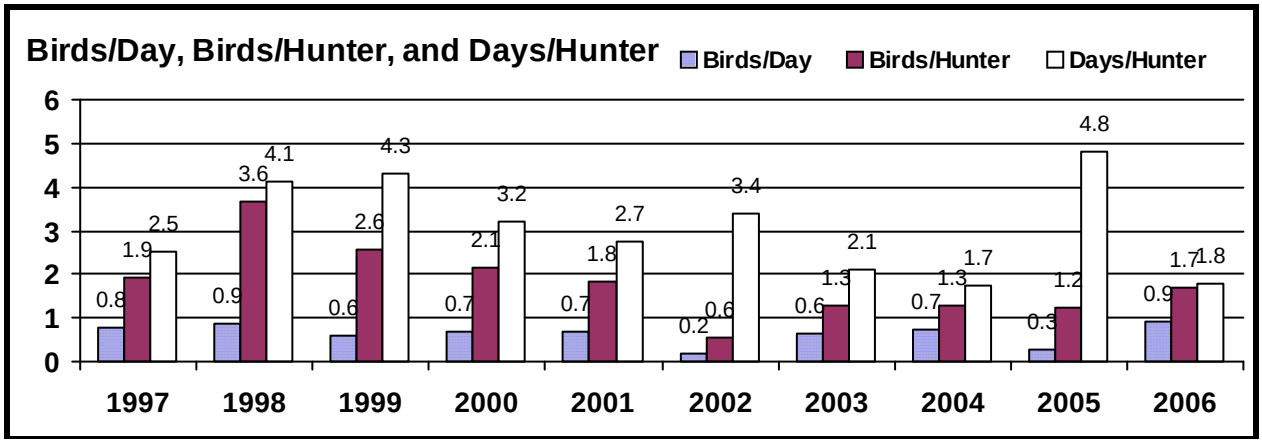
SAGE-GROUSE HARVEST SUMMARY

WORKING GROUP: Northeast **Area(s): All**









HUNTING SEASONS AND HARVEST BY MANAGEMENT AREA FOR 2006

Area	Season Dates	Length	Limit	Harvest	Hunters	Days	Birds/Day	Birds/Hunter	Days/Hunter		Comments
35	Sept 23-Oct 3	11	2/4	19	29	39	0.5	0.7	1.3	Any Sage-grouse	
36	Sept 23-Oct 3	11	2/4	146	49	91	1.6	3.0	1.9	Any Sage-grouse	
Casper Region Totals				**165**	**78**	**130**	**1.3**	**2.1**	**1.7**		

Area	Season Dates	Length	Limit	Harvest	Hunters	Days	Birds/Day	Birds/Hunter	Days/Hunter		Comments
37	Sept 23-Oct 3	11	2/4	4	22	34	0.1	0.2	1.5	Any Sage-grouse	
38	Sept 23-Oct 3	11	2/4	64	29	55	1.2	2.2	1.9	Any Sage-grouse	
40	Sept 23-Oct 3	11	2/4	88	58	120	0.7	1.5	2.1	Any Sage-grouse	
41	Sept 23-Oct 3	11	2/4	113	66	119	0.9	1.7	1.8	Any Sage-grouse	
44	Sept 23-Oct 3	11	2/4	41	30	51	0.8	1.4	1.7	Any Sage-grouse	
Sheridan Region Totals				**310**	**205**	**379**	**0.8**	**1.5**	**1.8**		

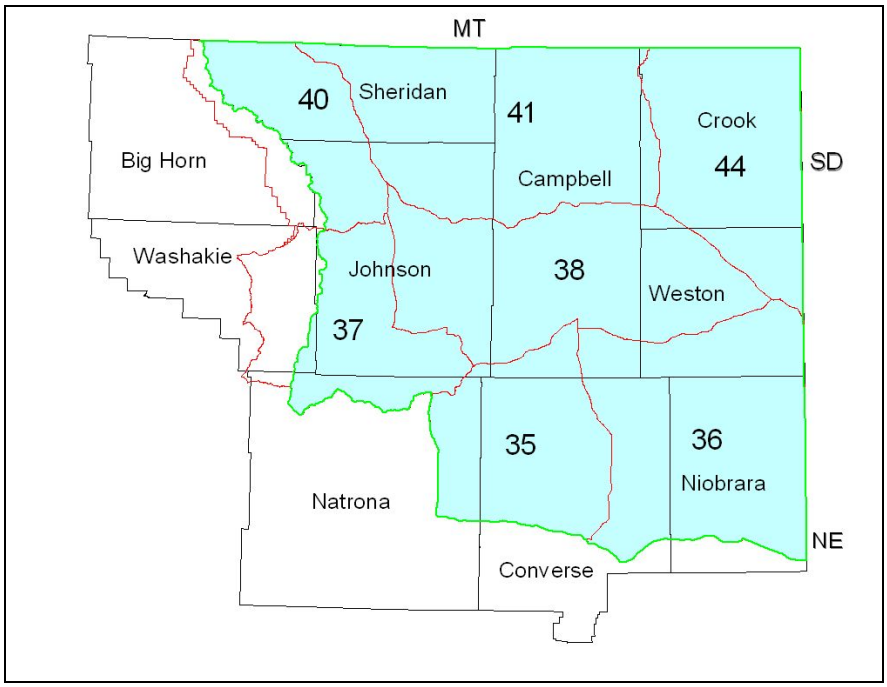
2006 JOB COMPLETION REPORT

Narrative
SPECIES: **Sage-grouse**
DAU NAME: **Northeast Wyoming Working Group Area**
MGMT AREAS: **35, 36, 38, 41, 44 and Portions of Areas 37 and 40**
Period Covered: **6/1/2006 – 5/31/2007**
Prepared by: **Dan Thiele, Wildlife Biologist**

INTRODUCTION

Sage-grouse data are reported for the area encompassed by the Northeast Wyoming Working Group which was formed in 2004 to develop and facilitate implementation of a local conservation plan for the benefit of sage-grouse, their habitats, and whenever feasible, other species that use sagebrush habitats. Prior to 2005, sage-grouse management was reported by Wyoming Game and Fish Department Region. The Northeast Wyoming Working Group Area covers northeast Wyoming from the Bighorn Mountain divide to South Dakota and from Montana to Interstate Highway 25 and U.S. Highway 20/26. The Area boundary encompasses the Wyoming Game and Fish Department Sheridan Region and a portion of the Casper Region and includes small game/upland game management Areas 35, 36, 38, 41, 44 and the portions of Areas 37 and 40 east of the Bighorn Mountain divide. Harvest data for Areas 37 and 40 are included in this reporting area since the bulk of these management areas lie east of the Bighorn Mountain divide. A proposal to change the west boundary of Area 37 to the Bighorn Mountain divide to correspond to the LWG area boundaries is currently being implemented. Sage-grouse management areas and county boundaries within the Northeast Wyoming Working Group Area are shown in Figure 1.

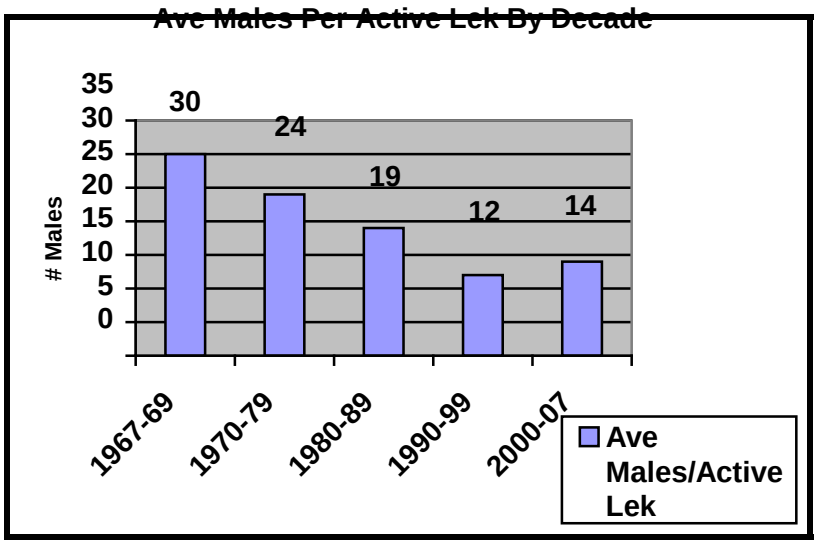
Figure 1. Sage-grouse management areas within the Northeast Wyoming Working Group Area.



Sage-grouse are found throughout sagebrush grassland habitats of northeast Wyoming. Occupied habitat is fairly contiguous east of the Bighorn Mountains to the Black Hills and the Wyoming-Nebraska state line with the exception of forested and highly developed agricultural lands. Sagebrush habitats are less continuous than western Wyoming, which contributes to lower sage-grouse densities. Northeast Wyoming has the lowest average male lek attendance in the state, averaging 15 males per active lek in 2005 compared to the statewide average of 33 males per active lek. Male lek attendance for the other working group areas ranged from 20 to 57 males per active lek. Most leks in northeast Wyoming are small with less than 20 males and less than 10% of the leks have greater than 50 males at peak count.

Average male lek attendance has decreased significantly over the years. Figure 2 shows the average number of males per active lek by decade since monitoring efforts began. Average male attendance has decreased by more than one-half over the last thirty years. A slight upswing has occurred since 2000, however, the long-term trend remains a concern.

Figure 2. Average Number of Males per Active Lek by Decade for Northeast Wyoming Leks.



Most of the occupied habitat for sage-grouse is held in private ownership. Approximately 70 percent of the known leks are found on private land with the remaining 30 percent found on Bureau of Land Management, U.S. Forest Service, and State owned lands. Because most sage-grouse are found on private land, little direct control exists to protect their important habitats, including breeding and nesting areas, brood rearing areas, and major wintering areas.

The primary economic uses of lands providing sage-grouse habitat are agriculture and energy. Livestock grazing, primarily cattle along with limited sheep production, is the primary agriculture use. Some crop production occurs as irrigated and dry land hay and some small grains. Vast coal reserves are being developed with surface pit mines in eastern Campbell County and northern Converse County. Oil and natural gas production has occurred in portions of the area since the early 20th century. An unprecedented energy boom began in the Powder River Basin in the late 1990's with the exploration and development of coalbed natural gas (CBNG) reserves. More than 50,000 wells have been approved with approximately 28,000 wells completed at this time. Wells, roads, power lines, produced water, activity and dust are components of development which are affecting sage-grouse habitat at a broad scale.

Considerable debate is occurring on the effects of energy development on sage-grouse. Peer reviewed research findings showing significant impacts have been challenged by other researchers whose work has yet to be peer reviewed. These conflicting findings have contributed to uncertainty in the public and political arenas as to the real effects of energy development. Furthermore, continued hunting of the species has been questioned by some in the energy industry given that they are being asked for increased mitigation measures in areas of development.

Data collection efforts on sage-grouse have focused on lek counts and surveys, which have been conducted each spring within the Area since at least 1967. Lek searches may have been conducted earlier; however, no records exist for data verification. Lek counts include those lek observations conducted three to four times each spring, about a week to 10 days apart. Lek counts are conducted to provide population trends based on the average peak male attendance. Lek surveys include lek attendance observations not following the count protocol, and are intended to determine general lek status.

Emphasis on lek searches has varied over the past 35 years with some periods receiving high emphasis and other years having only minimal search effort. During the late 1960s and early 1970s, nearly all known sage-grouse leks within the Area were monitored each spring. Sage-grouse work shifted to local personnel when the Department eliminated the upland game bird biologist positions in the mid-1970s. Sage-grouse search effort was then subject to competing demands and work scheduling of local biologists and game wardens.

With the increase in coal mining and mining regulations in the late 1970s, sage-grouse lek searches became a requirement for area coalmines. Private consultants typically conducted the work and the coal companies followed established lek count protocols. Lek count data from the coalmines provides the most reliable indicators in sage-grouse population trends from the late 1970's through the late 1990's. For most areas within the Northeast Working Group Area, the coalmine data set represents the only lek count data available during the 1980's.

Sage-grouse were not a high priority for the Department until the mid-1990's. Emphasis has again been placed on sage-grouse not only as a species, but also as an indictor of the quality of the sagebrush-grassland habitats the birds occupy. The Department has subsequently put greater emphasis on sage-grouse and completed a statewide sage-grouse conservation plan for Wyoming in 2003. Local sage-grouse conservation planning efforts were initiated in the spring of 2004. The Northeast Wyoming Working Group is one of eight local working groups formed in the state. The group has developed a local conservation plan for sage-grouse including projects and recommendations that will benefit the species. Several petitions to list the species under the federal Endangered Species Act have been filed within the Rocky Mountain west. In January 2004, the U.S. Fish and Wildlife Service issued a ruling that the Service would conduct a detailed review of the status of sage-grouse to determine if listing under the Endangered Species Act was warranted. In January 2005, the Service issued a finding that listing was not warranted. However, conservation efforts continued with the formation of local working groups across the west to address long term declines in sage-grouse populations and sagebrush habitats. Following a legal challenge by Western Watersheds Project on the Service's decision, the United States District Court for the District of Idaho reversed the U.S. Fish and Wildlife Service's decision and remanded the case back to the Service for further consideration (December 2007).

Some sage-grouse brood data have been collected and documented during July and early August. Brood data provides some indication of population trend based on production. The

Casper Region has emphasized brood surveys whereas only incidental sightings are recorded in the Sheridan Region due to manpower and access limitations. This limits the value of the data as it only represents a portion of the area. In some years, brood data are limited because of low sample size due to a low population or conflicting work schedule demands. When available, wing data provides a much more reliable indicator of recruitment.

A limited number of sage-grouse wings are collected during the hunting season, primarily in the eastern portion of the Area. Sample sizes are very small due to the low harvest and the difficulty to strategically place enough collection barrels along the many roads and highways within the Area.

In 2003, West Nile virus (WNv) was confirmed as the cause of death in several radio-collared and unmarked sage-grouse within Wyoming. The disease has since been less pronounced, likely due to lower summer temperatures that kept mosquito populations reduced. The disease was first detected in marked birds from a study in northeast Wyoming near Spotted Horse. The relatively high rate of mortality associated with the disease compared to other natural causes has resulted in new research into the possible population-level impacts of the disease on sage-grouse. Because the 2003 outbreak of WNv, the Wyoming Game and Fish Commission issued an emergency closure of the 2003 sage-grouse season in Sheridan, Johnson, and Campbell Counties. Lek surveys in 2004 indicated that although mortality caused by WNv was significant in some localized areas, most of the Powder River Basin population fared better and seasons were again implemented in 2004.

Management of sage-grouse within the Northeast Wyoming Working Group Area has focused mainly on the protection of lek and nesting areas during the breeding season. Protection efforts have primarily occurred through the environmental commenting process. All federal projects and some local projects are routed to regional personnel for review and commenting. Sage-grouse are given consideration through this process with recommendations emphasizing minimal disturbance during the breeding season at lek sites and associated nesting habitat. Although more than 70% of the Area's leks are found on private land, the split estate nature of the surface and mineral ownership provides for greater management influence by the BLM for oil and gas resource development.

Sage-grouse are hunted within Wyoming. Most of the state is open for hunting with the hunting season open from late September to early October. Some portions of the state have been closed to hunting because the estimated populations within those areas fell below that minimally recommended for hunting.

Historically, sage-grouse hunting seasons opened in early September. Research has shown that a late September opener had less negative impact on hen survival and may increase recruitment compared to an early September season (Braun and Beck 1996; Connelly et al. 2000). From 1995 to 2001, sage-grouse seasons in Wyoming opened the third Saturday in September with a 14-17-day season. Bag and possession limits were 3 and 6, respectively. In 2002 and 2003, agency concerns regarding the decline of sage-grouse within the state prompted the reduction of the sage-grouse season to the last weekend of September through the first weekend in October. Bag and possession limits were reduced to 2 and 4, respectively. Since 2004, the hunting season has opened September 23rd and closed October 3rd with the same bag and possession limits.

WEATHER

Weather trends have been warmer and drier since 2001 as the area continued to experience drought conditions including warm dry summers and mild winters. The first eight months of 2006 were very dry with precipitation at 44% of normal combined with warmer temperatures (Figure 2 and 3). The only months where precipitation approached or exceeded normal levels were September, February, March, April and May with the other months receiving considerably less than normal precipitation. The end of the 2006 biological year (Feb – May) saw much improved precipitation (111% of normal) resulting in excellent forage production. Average monthly high temperatures fluctuated above and below the normals. Excellent forage production followed with extended green up into July in parts of the Area. The dry summer of 2006 combined with improved September moisture resulted in an increased proliferation of cheat grass establishment throughout the area in 2007. Weather data provided is from the Buffalo weather station as Gillette data was incomplete. Weather data from this site is believed to provide a general indication of weather patterns over the entire working group area.

Figure 2. Monthly precipitation, June 2006 - May 2007 (http://www.wrcc.dri.edu/summary/Climsmwy.html).

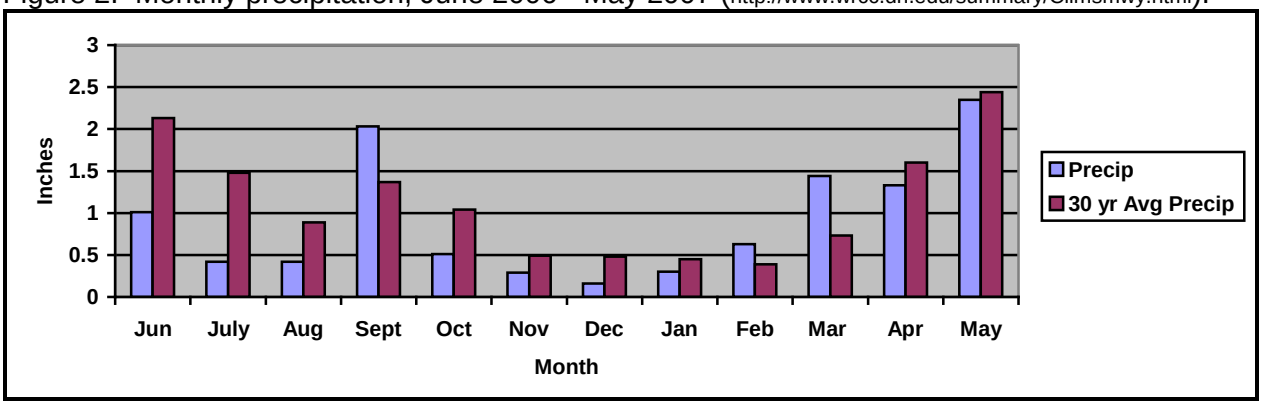
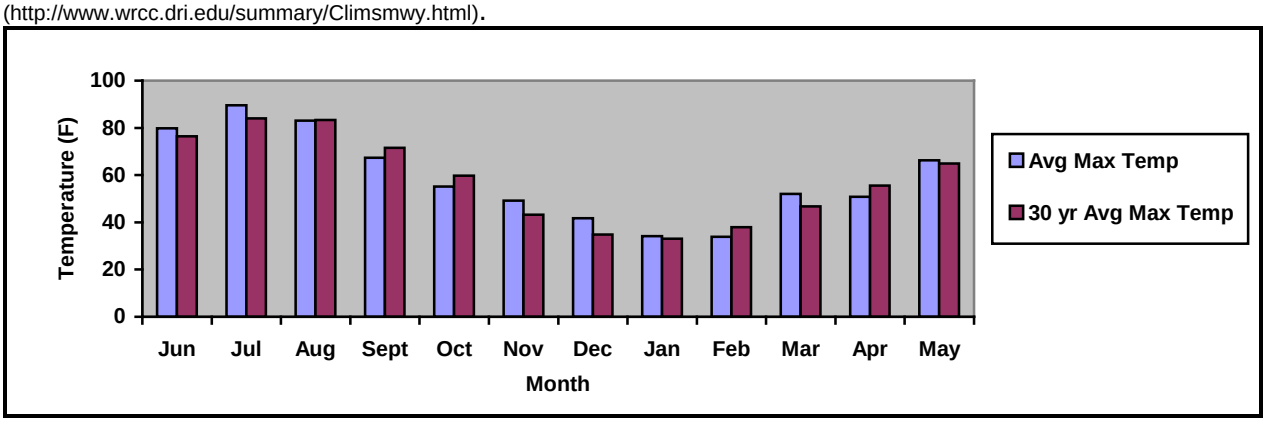


Figure 3. Average monthly maximum temperatures, June 2006 - May 2007 (http://www.wrcc.dri.edu/summary/Climsmwy.html).



RESULTS

Variation in this report from previous year's reports is expected because of new data added to the database. Old records are added each year as the data become available. Additionally, new leks discovered are added to existing complexes or create new complexes. New lek count routes may also be added. Data adjustments should be taken into consideration when the current report and tables are compared to previous editions.

West Nile Virus

Three WNv mortalities were documented in the Powder River Basin in 2006 with results unavailable for several other birds (Walker, pers. com.). Additionally, three WNv mortalities were documented just north of the Wyoming border in Bighorn County, Montana. These mortalities were all radio-marked birds from the University of Montana research project. The hot dry summer weather likely contributed to an increased occurrence of the disease.

Brood Surveys

Limited sage-grouse brood data have been collected in recent years. In 2006, a sample of 159 birds resulted in a chick to hen ratio of 3.4 chicks per female. This sample may not be representative of the Northeast Wyoming Working Group Area as the sample distribution was limited to the Casper Region with the entire sample collected in Weston County. Brood surveys the past two years yielded chick to hen ratios of 1.7 and 3.1 in 2004 and 2005, respectively. The 2004 and 2005 samples are comparable to the 2006 sample since they were collected in the same portion of the local working group area. The high 2006 ratio correlates to the continuing high bird numbers observed in the 2007 lek attendance. The brood survey produced a much higher chick to hen ratio than results of the wing analysis (1.2 chicks/female), however, the wing sample was small and from a limited portion of the analysis area.

Harvest Results

The 2006 sage-grouse hunting season in northeast Wyoming was September 23th through October 3rd, unchanged for the past three years. This season was two days longer than the 2002 and 2003 hunting seasons, but bag and possession limits were identical (2 and 4 birds, respectively). The 2006 harvest survey indicated that 475 sage-grouse were harvested by 283 hunters who spent a total of 509 days hunting sage-grouse within Management Areas 35, 36, 37, 38, 40, 41 and 44. The average number of birds harvested per hunter day was 0.9. The average number of sage-grouse harvested per hunter was 1.7 and the average number of days hunted was 1.8.

The total number of sage-grouse harvested increased 13% from 2005 when an estimated 422 birds were harvested. The five year average (2001-05) is 390 birds, with harvest ranging from a low of 104 birds in 2003 to a high of 965 birds in 2001. Harvest decreased precipitously in 2002 when the season length was shortened and the bag and possession limits were reduced. The 2003 total was the lowest on record due to a hunting season closure in Campbell, Johnson and Sheridan Counties due to concerns over WNv mortality. In 2006, hunter numbers totaled 283, down 17% from 342 hunters in 2005. Hunter numbers over the last five years (2001-05) have ranged from 80 hunters in 2003 to 518 hunters in 2001. Hunter days decreased dramatically (69%) even though the decrease in hunter numbers was only 17%. This is surprising given that

hunters were more successful in 2006 for the effort expended. Hunter days have ranged from 168 days in 2003 to 1,414 days in 2001.

Harvest has gradually increased over the last three seasons but remains well below the harvest recorded when the hunting season length and bag/possession limits were more liberal. Although the average number of males per active lek and the number of active leks suggest that sage-grouse numbers are higher over the last several years, there is less hunter interest. The more conservative season length and bag limit combined with increased publicity about the sage-grouse's plight likely contributes to these trends.

Portions of management areas 37 and 40 lie outside the Northeast Wyoming Working Group Area boundary. Area 37 contributed a harvest of four birds, well below the norm. Most of the harvest in this area is believed to occur east of the Bighorn Mountain divide in the Northeast Wyoming Working Group Area. The Area 40 harvest (n=88) is typically low and therefore the portion of the area outside the working group area does not contribute a significant problem with data analysis at the working group area scale.

Composition of harvest as determined by analysis of wings deposited by hunters in wing barrels is limited due to the small sample size of wings. Only 28 wings were collected in 2006, which was about 6% of the estimated harvest. A chick to hen ratio of 1.2 was ascertained. Wing samples were not collected randomly over the entire analysis area and therefore may, or may not, accurately reflect the harvest. Low sample sizes in previous years limit any valid interpretation of results.

Lek Monitoring Results

Lek monitoring efforts have increased substantially in recent years due to range wide declines in sage-grouse populations and the subsequent efforts of environmental groups to petition the U.S. Fish and Wildlife Service to list the species under the Endangered Species Act. Additionally, coalbed natural gas (CBNG) development in the Powder River Basin has resulted in extensive survey work to meet federal permitting requirements. The Wyoming Game and Fish Department, BLM, U.S. Forest Service, private consultants and volunteers participated in ground and aerial monitoring of leks.

Sage-grouse lek monitoring efforts are accomplished through lek counts, lek surveys and searches for new leks. The Sheridan Region received additional funds from the Bureau of Land Management for sage-grouse surveys for the eighth consecutive year. This funding was used for aerial surveys to monitor known leks and fly grid searches for new leks in those areas with seemingly adequate habitat, but no previously known leks.

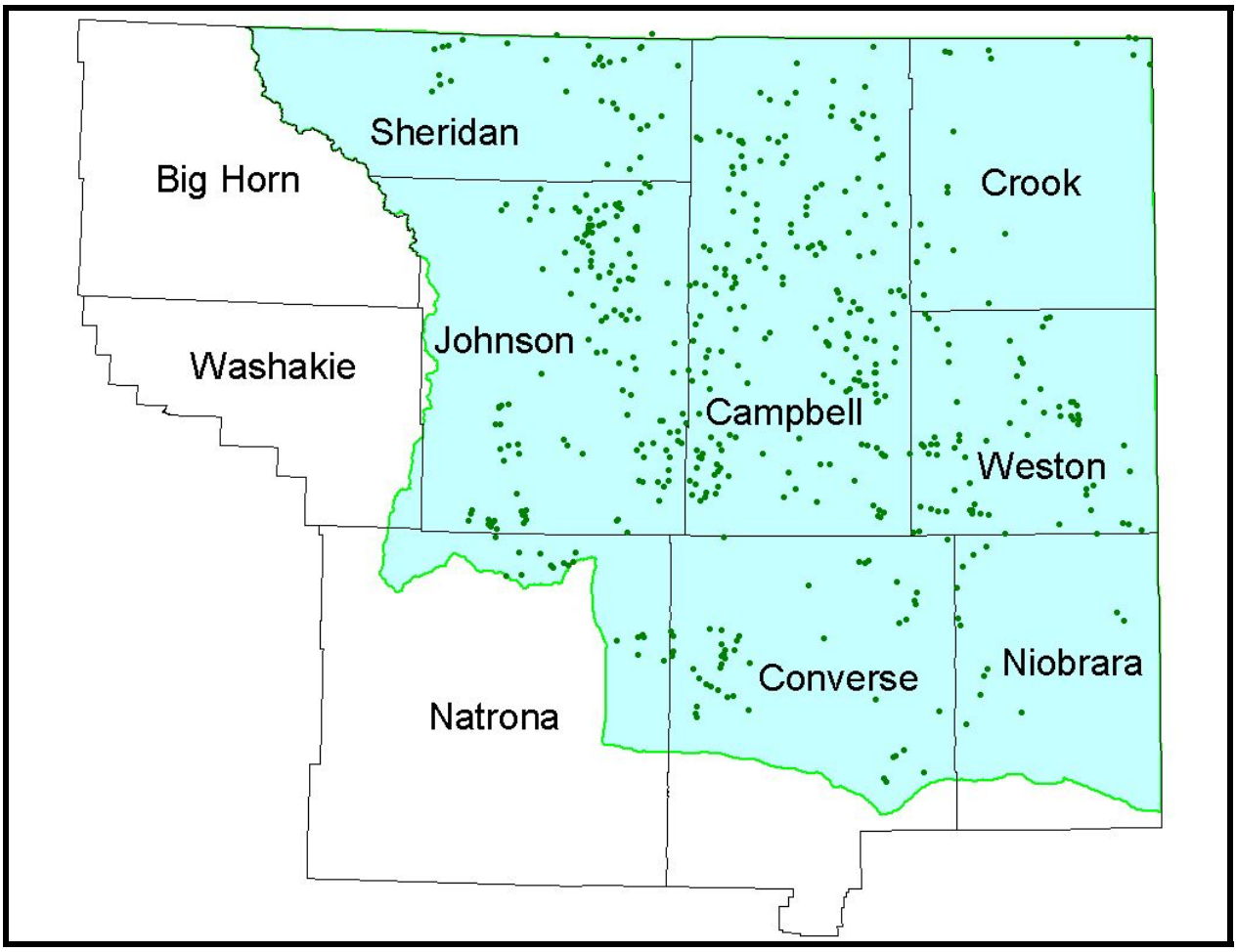
Following the 2007 lek monitoring period there are 516 documented leks in the Northeast Wyoming Working Group Area (Figure 4). Of this total, 478 are classified as occupied leks of which 44 leks have an undetermined status meaning they have not been documented active in the last ten years, but survey information is insufficient to designate the lek as unoccupied. Thirty-eight of the 516 leks are classified as unoccupied leks. Unoccupied leks have either been destroyed or abandoned and are not used by sage-grouse, however, abandoned leks should be monitored on occasion. See Appendix 1 for lek definitions.

During the 2007 breeding season 114 leks were counted, representing about 24% of known occupied leks (JCR Table 1a). The 478 known leks is less than the 516 total leks because unoccupied leks (abandoned or destroyed) are not considered potentially active. The average

number of males per active lek from these lek counts was 17.7. This is down slightly from the 20.1 males/active lek observed in 2006 and the second highest number of males/active lek over the last 10 years.

Lek count routes were established in 2000 to document the actual number of male sage-grouse attending a lek or complex of leks. Lek counts consist of at least three ground surveys of a lek following a stringent protocol to ensure accurate counts of male sage-grouse at lek sites. Count data, along with the lek counts from the private consultants and volunteers significantly improve the opportunity to better evaluate population trends. Thirty-eight official count routes covering 145 leks have been established in the Working Group Area.

Figure 4. Sage-grouse leks in the Northeast Wyoming Local Working Group Area.



The number of known occupied leks checked by lek counts and lek surveys combined was 413 leks or 86% of the known occupied leks (JCR Table 1c). In total, there were 2,222 recorded observations of sage-grouse leks in 2007. Two hundred forty-seven leks were documented as active with peak male attendance ranging from 1 to 106 males. Three leks topped 100 males, the Cooper (Area 35) and Cellars 7 (Area 38) Leks with 100 males each and the Keyton 7 Lek (Area 36) with 106 males. This was the first documentation of the Cooper Lek. The median peak male attendance was 15.0 males/active lek. The average number of males/active lek was 18.8 compared to 19.3 males/active lek in 2006. This was the second highest number of

males/active lek over the last 10 years. For the 10-year period, 1998-2007, the number of males/active lek has ranged from 8.1 in 2004 to 19.3 in 2006. These numbers and trends reflect the lek count data but at a slightly higher level.

Twenty previously unknown leks were documented and added to the sage-grouse database. One new lek was found in Area 35, 3 in Area 36, 8 in Area 38, 5 in Area 41 and 3 in Area 44. The maximum number of males observed on the newly discovered leks ranged from 1 to 106. These leks were primarily found in areas of CBNG development in the Powder River Basin due to the intensive survey work by private consultants. In addition, several suspected leks were noted but need further documentation of activity or location before being considered confirmed leks.

Lek status as determined from lek counts and lek surveys shows 331 leks with confirmed lek status. Seventy-five percent of the leks with confirmed status were determined to be active (JCR Table 1d), meaning strutting males or signs of strutting (feathers/droppings) were observed at the lek site. Eighty-four leks were determined to be inactive based on multiple ground visits and/or checks for sign (feathers/ droppings) late in the strutting season. Three leks were not located which indicates that an exact location of the lek site is not known. A large number of leks (n=144) have an unknown activity status. This category includes leks that were not checked or were surveyed but had no strutting activity. For a lek to be considered inactive, two ground visits separated by 7 days and conducted under ideal conditions, or a ground check of the exact lek site late in the strutting season that fails to find sign is needed. Many leks were checked one or more times but protocol to confirm inactivity was not met.

A review of the sage-grouse lek database was conducted to identify leks that lack adequate data to support a lek designation and reclassify the status of leks that lack habitat and strutting activity. Three leks in Area 38 and 8 leks in Area 41 were deleted from the database because documented strutting activity has been inadequate to designate these sites as leks based on the definition of a lek. These locations and observations will be maintained in a separate file should future strutting activity occur at these sites.

Some inconsistencies remain in complying with monitoring protocol and monitoring some leks on a regular basis. Some leks have not been documented as active in many years which may be due to inaccurate locations based on legal descriptions. Continued efforts at determining the exact location and status of these leks are needed. As birds on a lek are observed, UTM coordinates are recorded using GPS equipment. GPS locations for lek sites should make future surveys more efficient even with changes in personnel. Furthermore, with the high amount of activity around leks in areas of CBNG development, caution must be used to ensure that strutting activity represents an actual lek and not birds displaced from established leks.

Lek Characteristics

There are 516 sage-grouse leks within the Northeast Wyoming Working Group Area. Table 1 shows the demographics of leks with regard to WGFD Region, management area, county, biologist district, game warden district, land status, and historical status.

Population Trends

No reliable or cost effective method for estimating the sage-grouse population for the Northeast Wyoming Working Group Area exists at this time. However, the number of males/active lek provides a reasonable index of abundance of sage-grouse populations over time in response to

environmental conditions. However, it must be noted that that lek data must be interpreted with caution for several reasons: 1) the survey effort and the number of leks surveyed/counted has varied over time, 2) it is assumed that not all leks in the area have been located, 3) sage-grouse populations can exhibit cyclic patterns over approximately a decade, 4) the effects of unlocated or unmonitored leks that have become inactive cannot be quantified or qualified, and 5) lek sites may change over time. Both the number of leks and the number of males attending these leks must be quantified in order to estimate population size.

Figure 5 shows the average number of males/active lek for lek counts and all lek monitoring combined from 1967 to 2007 for the Northeast Wyoming Working Group Area. If the average number of males/active lek is reflective of the sage-grouse population, the trend suggests about a 10-year cycle of periodic highs and lows. Of concern, however, is that generally each subsequent peak in the population is usually lower than the previous peak. Additionally, each periodic low in the population is generally lower than the previous population low. The long term trend suggests a steadily declining sage-grouse population.

It appears that sage-grouse numbers reached a new peak in 2006, exceeding the previous peak of 2000. In fact, the trends suggest sage-grouse may be at their highest numbers since 1991. In spite of continued drought, WNv mortality and documented impacts from energy development, this population has increased based on male lek attendance and the number of active leks. The 2006 increase can be attributed to improved moisture conditions in 2005 and a mild 2005-06 winter. These factors led to improved recruitment and/or adult survival. In spite of extreme drought in 2006, it appears production and survival was relatively good resulting in comparable average male lek attendance in 2007.

Although the number of total leks, as well as active leks, has increased significantly over the last 10 years, this is primarily due to increased survey effort associated with CBNG activities. It is unknown whether the actual number of leks has increased, decreased or remained the same.

Figure 5. Northeast Wyoming LWG male sage-grouse lek attendance 1967- 2007.

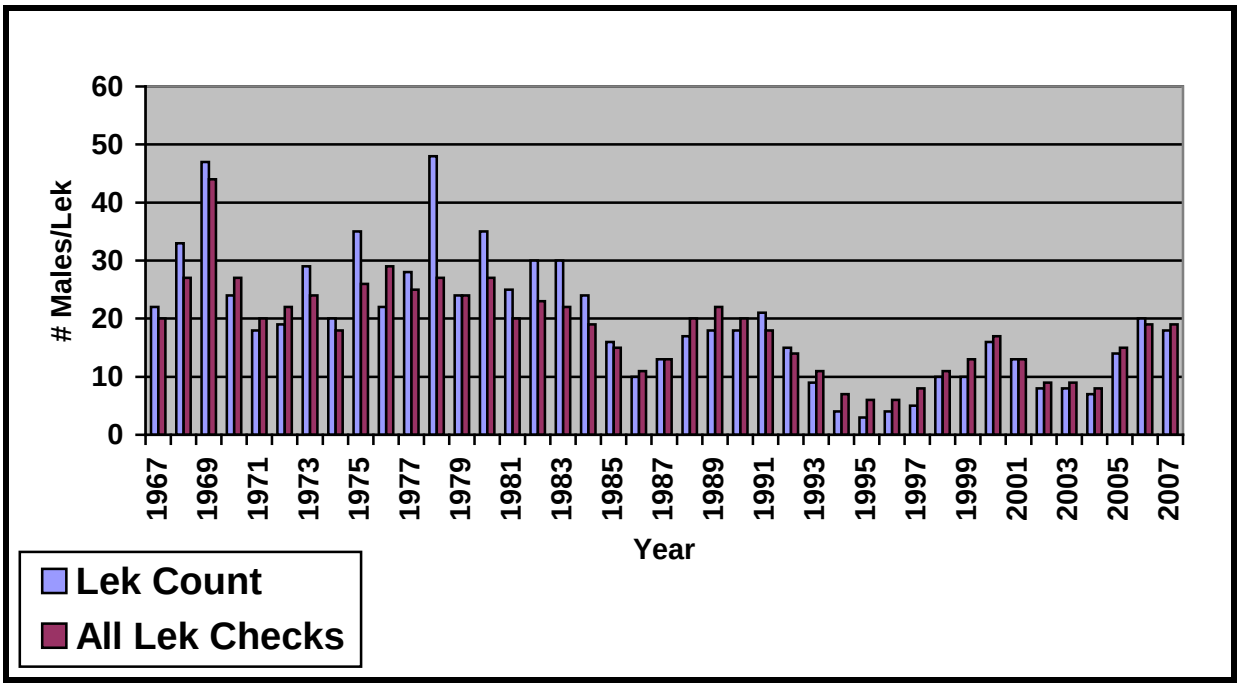


Table 1. Northeast Wyoming Working Group Area Sage-grouse Lek Site Characteristics.

Region	Number	Percent
Casper	136	26.4%
Sheridan	380	73.6%

Working Group	Number	Percent
Northeast	516	100.0%

Classification	Number	Percent
Occupied	478	92.6%
Unoccupied	38	7.4%

BLM Office	Number	Percent
Buffalo	359	69.6%
Casper	57	11.0%
Newcastle	100	19.4%

Unoccupied Leks	Number
Abandoned	24
Destroyed	14

Biologist District	Number	Percent
Buffalo	66	12.8%
Casper	33	6.4%
Douglas	35	6.8%
Gillette	228	44.2%
Newcastle	68	13.2%
Sheridan	86	16.7%

Game Warden	Number	Percent
Buffalo	70	13.6%
Dayton	17	3.3%
Douglas	17	3.3%
East Casper	10	1.9%
Glenrock	27	5.2%
Kaycee	52	10.1%
Lusk	15	2.9%
Moorcroft	47	9.1%
Newcastle	61	11.8%
North Gillette	64	12.4%
Sheridan	16	3.1%
South Gillette	114	22.1%
Sundance	6	1.2%

County	Number	Percent
Big Horn, MT	1	0.2%
Campbell	186	36.0%
Converse	46	8.9%
Crook	19	3.7%
Johnson	131	25.4%
Natrona	21	4.1%
Niobrara	14	2.7%
Powder River, MT	1	0.2%
Sheridan	32	6.2%
Weston	65	12.6%

Land Status	Number	Percent
BLM	55	10.7%
Private	374	72.5%
State	43	8.3%
USFS	41	7.9%

Management Area	Number	Percent
35	40	7.8%
36	66	12.8%
37	42	8.1%
38	178	34.5%
40	5	1.0%
41	169	32.8%
44	16	3.1%

HABITAT

Habitat Conditions

The general condition of native vegetation during the growing season was very poor in spring 2006 as the area experienced a return to drought conditions. Ample residual forage remained from the excellent moisture that was received the previous spring, which benefited nesting grouse. However, below normal precipitation resulted in limited green-up and poor forage production throughout most of the area. Improved fall moisture led to better cool season grass production late in the growing season. Unfortunately, it also spurred the establishment and proliferation of cheat grass stands in 2007. More normal precipitation patterns returned in spring 2007. Native grasses, forbs and shrubs showed excellent growth. Even so, drought remains the norm and several years of normal to above normal precipitation is needed to restore deep soil moisture.

Winter conditions were generally mild with above normal temperatures and below normal precipitation leading to another open winter. A severe snowstorm hit northeast Wyoming in late March. Sagebrush stands benefited from drifted wet snow, especially those stands on leeward slopes.

Habitat Impacts

Sage-grouse are influenced by many factors, both individually and cumulatively. Habitat loss and fragmentation, direct mortality and disturbance affect sage-grouse populations. The Northeast Wyoming Sage-grouse Working Group identified and ranked those factors believed to be most influencing the northeast Wyoming sage-grouse population, as well as those factors that might most effectively be addressed to provide the greatest benefit for sage-grouse conservation in northeast Wyoming. Nearly all top ranking factors were directly related to, or indirectly related to, habitat. The working group felt oil, gas, and coal bed natural gas (CBNG) development, weather, vegetation management, invasive plants, and parasites and diseases were the most important influences on the northeast Wyoming sage-grouse population. In the opinion of the group, conservation efforts targeting oil, gas and CBNG development, vegetation management, invasive plants, local residential land use, and livestock grazing would be most effective.

SPECIAL PROJECTS

Conservation Planning

The conservation planning process for Wyoming sage-grouse populations was initiated in 2000 with the state plan completed in mid-2003. The state plan is the umbrella document for local conservation planning efforts.

Three local conservation planning groups were formed in March 2004 and included a working group within the Sheridan Region. In September 2004, five additional working groups were formed and the Powder River Basin Local Working Group Area was expanded to include all of northeast Wyoming. The group was subsequently renamed the Northeast Wyoming Working Group. The group includes representation from the BLM, USFS, NRCS, WGFD, local

government, industry, agriculture, conservation organizations, and sportsmen. The purpose of the group is to develop and facilitate implementation of a local conservation plan for the benefit of sage-grouse and, whenever feasible, other species that use sagebrush habitats

The Northeast Wyoming Sage-grouse Conservation Plan was finalized in August 2006 and submitted to the Wyoming Game and Fish Commission in September. The plan and other LWG information is available on the Wyoming Game and Fish Department website at http://gf.state.wy.us/wildlife/wildlife_management/sagegrouse/index.asp

A few of the notable accomplishments of the Northeast Wyoming Local Working Group are:

- Completed and published the Northeast Wyoming Sage-grouse Conservation Plan.
- A seed mix brochure was developed providing information on seeding rangelands and reclamation areas to benefit sage-grouse.
- The group met with a representative of the Wyoming Office of State Lands and Investments and subsequently made a presentation to the Wyoming State Land Board requesting that Best Management Practices outlined in the state conservation plan be implemented to benefit sage-grouse on state lands. Most concerning is the lack of protective measures for sage-grouse leks and nesting habitat on state lands, inadequate reclamation practices and the need for escape ramps in livestock water tanks.
- Coordinated with the Lake DeSmet Conservation District and the NRCS on the Sagebrush/Grassland Habitat Restoration Program. The program has grown to 14 landowners (9 old, 5 enrolled in 2006) who have enrolled more than 340,000 acres. Additionally, 7,000 acres have been treated with the Lawson aerator.
- A State Animal Damage Management Board project proposal was approved to examine existing databases from northeast Wyoming for long-term trends in sage-grouse populations and their possible association with raptor and lagomorph population cycles, and power line placement in sage-grouse habitat. Two Ravens Inc, a professional wildlife-consulting firm conducted the analysis for the Working Group.
- Two project proposals totaling $129,000 were approved for funding from the 2005 Wyoming Governor's Supplemental Budget Appropriation for Sage-Grouse Conservation. The Lake DeSmet Conservation District's Sage-Grouse Habitat Restoration Project received $90,000 to bolster funding of the more than $1.5 million dollar project designed to enhance sagebrush/grassland habitats and implement livestock grazing plans on more than 200,000 acres. A Lawson aerator was purchased with funds donated by Anadarko Petroleum and 300 acres were treated in spring 2005. The University of Montana's sage-grouse research project in the Powder River Basin received $35,000 to continue developing conservation planning tools, evaluate CBNG development impacts and research WNv.
- The LWG reviewed project proposals for Wyoming Sage-grouse Conservation Fund monies appropriated during the 2006 legislative session. The following projects were approved for the amounts shown.

Project	$
Niobrara Conservation District Escape Ramp I&E	1,000
University of California Davis – Noise Study	9,400
Thunder Basin SPOT 5 Landcover Classification	45,000
University of Montana Sage-grouse/Energy Study	30,000
4W Ranch Range & Monitoring	16,200
L DeSmet Conservation District Sagebrush Restoration	27,400
Grazing and Rangeland Monitoring Workshops	5,000
Total Funds Allocated	**$134,000**

- The Petroleum Association of Wyoming and the Montana Petroleum Association sponsored a Sage-Grouse Recommended Management Practices Workshop in Casper in April 2007. The workshop brought together industry, landowners, regulatory agency staff, researchers and wildlife experts for a day and a half workshop to develop a list of management practices that will help conserve sage-grouse habitat in areas of energy development. Recommended management practices were developed for several sectors of the energy industry including: regulatory, construction/reclamation, midstream infrastructure and operations.
- Wyoming Governor Dave Freudenthal hosted the Wyoming Governor's Sage-grouse Summit in July to discuss issues affecting sage-grouse and how best to prevent listing of the bird under the ESA. The two day conference drew a large gathering of wildlife managers, federal agency representatives, landowners, industry representatives and conservation organizations. Following the Summit, an implementation team was formed of representatives attending the conference to develop measures that can be implemented in the state to benefit sage-grouse and sagebrush habitats. A Science Advisory Group was also organized to provide a scientific basis for the Implementation Team's recommendations

Research

The University of Montana continued research in the Powder River Basin of Wyoming and Montana. Additional birds were radio-collared and monitored through the year. The 2007 relocation information was used to validate the winter and nesting models that were developed using the 2004-2006 data. Information from the University of Montana research was also used by the BLM to develop sage-grouse conservation polygons where more structured energy development would occur to maintain the integrity of sagebrush-grassland habitats.

An interim progress report was released presenting preliminary results of a lek-count data analysis for sage-grouse from the Powder River Basin in relation to coal-bed natural gas development (Naugle, et al. 2006a). Leks in areas of intensive development showed more pronounced decreasing population trends than leks with limited or no development. Birds may be displaced by intensive development as evidenced by higher male counts on leks adjacent to this activity. The 2005 lek monitoring surveys showed that active leks, and large and medium sized leks were more often found outside or adjacent to development. Active leks within

intensively developed areas had 20 or fewer males. Other factors may have contributed to the lek attendance trends.

Comparisions of active and inactive leks showed that active leks are twice as far from wells, 1.5 times as far from power lines, and have one-third the wells, one-half the density of power lines and generally less development (wells and power lines) within 3.2 km of the lek complex.

Research will continue into 2007 at both the Wyoming and Montana sites to validate models that predict sage-grouse habitat use.

In another phase of the study, Naugle et al. (2006b) identified sage-grouse winter habitat and evaluated the effect of energy development on habitat suitability. Researchers found that sage-grouse avoided otherwise suitable winter habitats where CBNG development has occurred. However, most suitable winter habitats within the study area have yet to be developed even though most of the areas encompassing these habitats have been leased to energy companies. Spatial habitat models show winter habitat to be limited in the Powder River Basin. Therefore, the researchers suggest there is an urgency to coordinate partnerships for implementing conservation actions. Recommendations include employing spatial limitations on development rather than temporal restrictions to maintain large “unimpacted” areas. Managers should conserve areas supporting leks with large numbers of males in areas with intact winter habitats.

The first evidence that sage-grouse can survive WNv infections was found when two adult and four yearling females captured in the fall 2004 and spring 2005 tested positive for antibodies to WNv. Only three positive mortalities were confirmed in the Powder River Basin in 2006 with results on multiple carcasses still pending. Additionally, three positives were also found in Montana just a few miles north of the Wyoming border. Additional research is needed to identify reservoir hosts as well as factors which contribute to increases in infection rates.

Continuing research conducted by Montana State University on differences in mosquito production in CBNG and non-CBNG ponds in the Powder River Basin found significantly higher *Cx. tarsalis* larval production in mature CBM ponds than other sites in the Powder River Basin. *Cx. tarsalis* is the major mosquito vector for WNv in the region.

RECOMMENDATIONS

1. Participate in the Northeast Wyoming Sage-grouse Working Group. The Group has developed a conservation plan for the species and designed and implemented projects that benefit sage-grouse. The Department representative will continue to assist with implementing projects identified in the plan.
2. Assist the BLM with developing and implementing the sage-grouse monitoring program as prescribed by the Powder River Basin CBNG EIS Record of Decision (April 2003).
3. Assist the University of Montana with the CBNG sage-grouse study to include landowner contacts, radio-collar monitoring, and grouse capture.
4. Participate with WNv monitoring.
5. Assist the BLM with coordinating sage-grouse population monitoring efforts with the private consultants doing work for energy development companies.

6. Use any additional flight money from the BLM in 2008 for lek searches and surveys. All leks should be checked at least once every three years. All leks should be recorded in UTMs (NAD 83) using GPS.
7. Wing barrels should again be used in 2008 for recruitment analysis. Because of low return in many areas, wing barrels should only be used in areas where a substantial number of wings will be collected.
8. Maintain the placement of the Area's lek locations on the Oil and Gas Conservation Commission Web Site. This information is made public so that energy development can use the data to better plan their activities. Expand this effort to include the University of Wyoming's CBNG Clearinghouse website.
9. The sage-grouse database should be maintained and used to store and report sage-grouse data. Any old records that have not been included should be added to the database. Current records should be reviewed to eliminate leks without adequate documentation to support a lek designation.
10. The Regions should continue to solicit habitat projects on private lands that will have benefit for sage-grouse.
11. The Regions should continue to recommend protection of occupied sage-grouse leks during environmental commenting and promote their protection on private land projects.
12. Additional effort is needed to document the status of undetermined leks. Encourage reporting of lek activity from the public and in particular landowners.
13. More media emphasis is needed on sage-grouse to promote sage-grouse conservation.
14. Document wintering sage-grouse locations. Develop a seasonal range map for sage-grouse for the Working Group Area based on guidelines provided in the Wyoming Sage-grouse Conservation Plan.

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APPENDIX I

Wyoming Sage-Grouse Definitions:
(revised 12/08/06)

The following definitions have been adopted for the purposes of collecting and reporting sage-grouse data:

Lek - A traditional courtship display area attended by male sage-grouse in or adjacent to sagebrush dominated habitat. A lek is designated based on observations of two or more male sage-grouse engaged in courtship displays. Before adding the suspected lek to the database, it must be confirmed by an additional observation made during the appropriate time of day, during the strutting season. Sign of strutting activity (tracks, droppings, feathers) can also be used to confirm a suspected lek. Sub-dominant males may display on itinerant (temporary) strutting areas during population peaks. Such areas usually fail to become established leks. Therefore, a site where small numbers of males (<5) are observed strutting should be confirmed active for two years before adding the site to the lek database.

Lek Complex - A group of leks in close proximity between which male sage-grouse may interchange from one day to the next. A specific distance criterion does not yet exist.

Lek Count - A census technique that documents the actual number of male sage-grouse observed attending a particular lek or lek complex. The following criteria are designed to assure counts are done consistently and accurately, enabling valid comparisons to be made among data sets. Additional technical criteria are available from the WGFD.

- Conduct lek counts at 7-10 day intervals over a 3-4 week period after the peak of mating activity. Although mating typically peaks in early April in Wyoming, the number of males counted on a lek is usually greatest in late April or early May when attendance by yearling males increases.
- Conduct lek counts only from the ground. Aerial counts are not accurate and are not comparable to ground counts.
- Conduct counts between ½ hour before sunrise to 1 hour after.
- Count attendance at each lek a minimum of three times annually during the breeding season.
- Conduct counts only when wind speeds are less than 8 kph (5 mph) and no precipitation is falling.

Lek Survey - Ideally, all sage-grouse leks would be counted annually. However, some breeding habitat is inaccessible during spring because of mud and snow, or the location of a lek is so remote it cannot be routinely counted. In other situations, topography or vegetation may prevent an accurate count from any vantage point. In addition, time and budget constraints often limit the number of leks that can be visited. Where lek counts are not feasible for any of these reasons, surveys are the only reliable means to monitor population trends. Lek surveys are designed principally to determine whether leks are active or inactive, requiring as few as one visit to a lek. Obtaining accurate counts of the numbers of males attending is not essential. Lek

surveys involve substantially less effort and time than lek counts. They can also be done from a fixed-wing aircraft or helicopter. Lek surveys can be conducted from the initiation of strutting in early March until early-mid May, depending on the site and spring weather.

Annual status – Lek status is assessed annually based on the following definitions:

- **active** – Any lek that has been attended by male sage-grouse during the strutting season. Acceptable documentation of grouse presence includes observation of birds using the site or signs of strutting activity.

- **inactive** – Any lek where sufficient data suggests that there was no strutting activity throughout a strutting season. Absence of strutting grouse during a single visit is insufficient documentation to establish that a lek is inactive. This designation requires documentation of either: 1) an absence of birds on the lek during at least 2 ground surveys separated by at least 7 days. These surveys must be conducted under ideal conditions (4/1-5/7, no precipitation, light or no wind, ½ hour before to 1 hour after sunrise) or, 2) a ground check of the exact known lek site late in the strutting season (after 4/15) that fails to find any sign (droppings/feathers) of strutting activity. Data collected by aerial surveys may not be used to designate inactive status.

- **unknown** – Leks for which status as active or inactive has not been documented during the course of a strutting season.

Management status - Based on its annual status, a lek is assigned to one of the following categories for management purposes:

- **occupied lek** – A lek that has been active during at least one strutting season within the prior ten years. Occupied leks are protected through prescribed management actions during surface disturbing activities.

- **unoccupied lek** – (Formerly "historical lek".) There are two types of unoccupied leks, "destroyed" and "abandoned." Unoccupied leks are not protected during surface disturbing activities.

- **destroyed lek** – A formerly active lek site and surrounding sagebrush habitat that has been destroyed and is no longer suitable for sage-grouse breeding. A lek site that has been strip-mined, paved, converted to cropland or undergone other long-term habitat type conversion is considered destroyed. Destroyed leks are not monitored unless the site has been reclaimed to suitable sage-grouse habitat.

- **abandoned lek** – A lek in otherwise suitable habitat that has not been active during a period of 10 consecutive years. To be designated abandoned, a lek must be "inactive" (see above criteria) in at least four non-consecutive strutting seasons spanning the ten years. The site of an "abandoned" lek should be surveyed at least once every ten years to determine whether it has been reoccupied by sage-grouse.

- **undetermined lek** – Any lek that has not been documented active in the last ten years, but survey information is insufficient to designate the lek as unoccupied. Undetermined leks will be protected through prescribed management actions during surface disturbing activities until sufficient documentation is obtained to confirm the lek is unoccupied.

Winter Concentration Area - During winter, sage-grouse feed almost exclusively on sagebrush leaves and buds. Suitable winter habitat requires sagebrush above snow. Sage-grouse tend to select wintering sites where sagebrush is 10-14 inches above the snow. Sagebrush canopy cover utilized by sage-grouse above the snow may range from 10 to 30 percent. Foraging areas tend to be on flat to generally southwest facing slopes or on ridges where sagebrush height may be less than 10 inches but the snow is routinely blown clear by wind. When these conditions are met, sage-grouse typically gain weight over winter. In most cases winter is not considered limiting to sage-grouse. Under severe winter conditions grouse will often be restricted to tall stands of sagebrush often located on deeper soils in or near drainage basins. Under these conditions winter habitat may be limiting. On a landscape scale, sage-grouse winter habitats should allow sage-grouse access to sagebrush under all snow conditions.

Large numbers of sage-grouse have been documented to persistently use some specific areas which are characterized by the habitat features outlined above. These areas should be delineated as “winter concentration areas”. Winter concentration areas do not include all winter habitats used by sage-grouse, nor are they limited to narrowly defined “severe winter relief” habitats. Delineation of these concentration areas is based on determination of the presence of winter habitat characteristics confirmed by repeated observations and sign of large numbers of sage-grouse. The definition of “large” is dependent on whether the overall population is large or small. In core population areas frequent observations of groups of 50+ sage-grouse meet the definition while in marginal populations group size may be 25+. Consultation and coordination with the WGFD is required when delineating winter concentration areas.

South Central Conservation Area
Job Completion Report

Species: **Sage-grouse**
Period Covered: **June 1, 2006 – May 31, 2007**
Prepared by: **Tim Woolley**

Region: **South Central Conservation Area**
Mgmt. Areas: **9, 10, 24, 25, 45**

Introduction

Sage-grouse are found in sagebrush habitats throughout the South Central Conservation Area (SCCA). Within the SCCA, about 61% of the leks are on BLM administered land, 33% private, and 6% state, and are monitored by the Wyoming Game and Fish Department (WGFD) collecting lek survey data, lek count data, wings from harvested birds, counts broods, and collects harvest statistics from hunters. Most sage-grouse populations in Wyoming are hunted with closed areas in southeast Wyoming, including the Laramie Plains within the SCCA, and near Jackson.

Sage-grouse hunting seasons have traditionally opened in early September or late August and lasted from 2 to 4 weeks, but in 1995 was changed to late September to reduce the effect of harvest on hens that successfully raised broods. Sage-grouse seasons in Wyoming currently open in late September and close in early October, lasting only about 9 days with a bag limit of 2 and possession limit of 4. Previous limits before 2002 were 3 a day and 6 in possession.

The SCCA Sage-grouse Local Working Group (LWG) was initiated in September of 2004, and completed their Sage-grouse Conservation Plan (Plan) during the spring of 2007. The Plan was presented to and accepted by the Wyoming Game and Fish Commission during July 2007. The SCCA LWG will now meet about 4 times per year, with additional meetings if needed. Project implementation is currently underway with several projects completed, and several more planned for the next 2-3 years.

Conservation Area

The SCCA generally includes The Platte Valley, Laramie Plains, Great Divide Basin, North Ferris, south Sweetwater, Little Snake River Valley, in the counties of Carbon, Sweetwater, Albany, Fremont, and Natrona in southern Wyoming (Figure 1). The SCCA is bordered on the east by the Bates Hole/Shirley Basin Conservation Area, the north by the Wind River/Sweetwater River Basin Area, and the West by the Southwest Conservation Area. The SCCA is mostly public land and is administered by the Bureau of Land Management, the USDA Forest Service, and State of Wyoming. A major portion of the SCCA is of “checkerboard” land ownership (alternating public and private lands within 20 miles of the railroad) along the railroad corridor in the center of the western portion of the area. Major habitat types include shortgrass prairie, sagebrush/grassland, salt desert shrub, mixed mountain shrub, mixed forest types, agricultural, riparian, and urban types. Transportation corridors include, Interstate 80 (I-80), Union Pacific Railroad (mostly parallel along I-80), and State Highways (SH) 70, 789, 287, 230/130. Major cities and towns found in the area are Rawlins, Laramie, Saratoga, Encampment, Baggs, and Wamsutter. The SCCA encompasses all or a portion of the WGFD’s Small/Upland Game Management Areas 9, 10, 24-26, 45, which are formed for primarily data collection and do not correspond to population boundaries, as do big game Herd Units.

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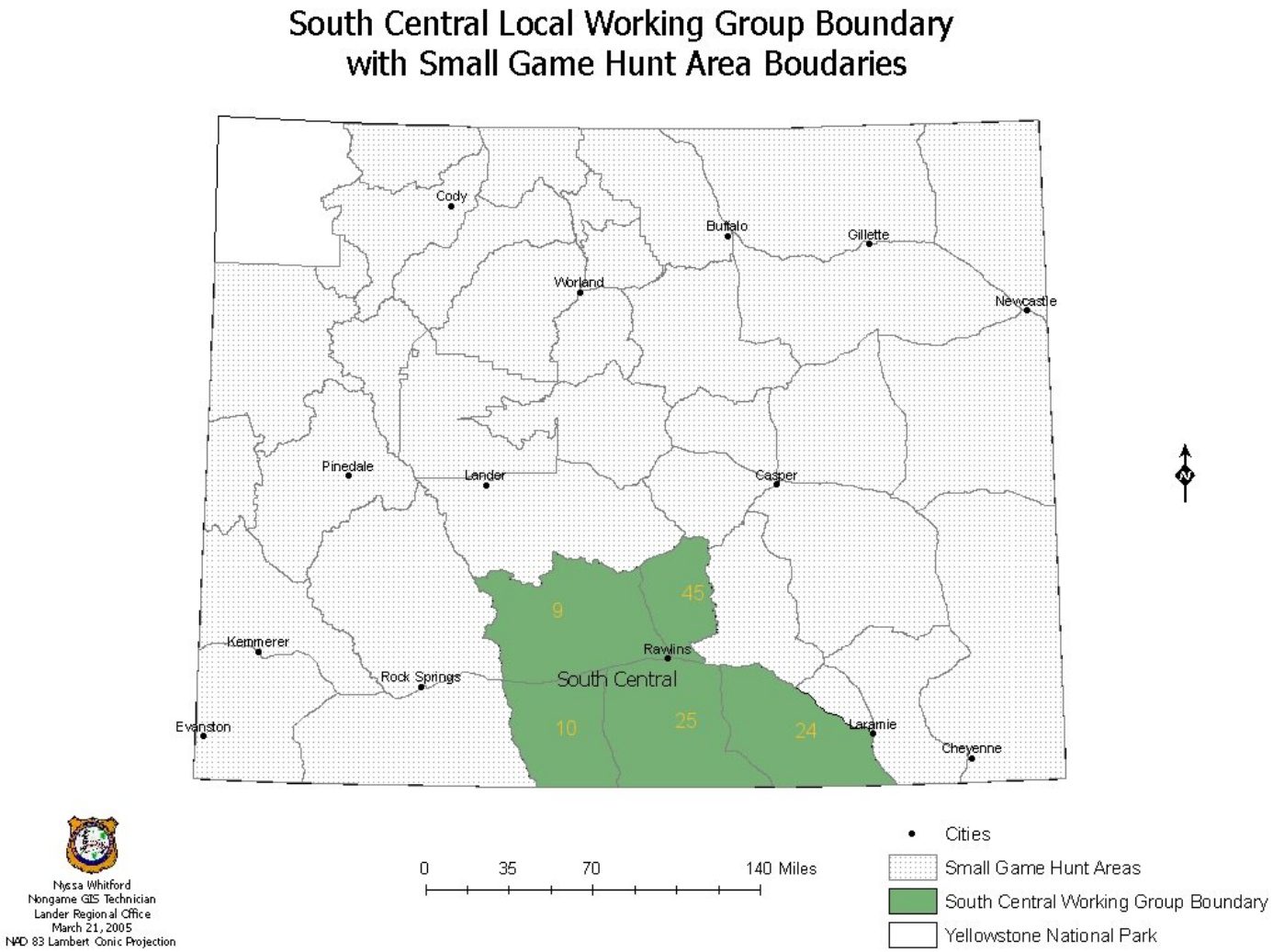
Figure 1



Weather

I compared total precipitation and mean minimum temperature for late spring-summer (April – Aug) to estimate and compare weather conditions among years within the SCCA. National Weather Service climate data from the Baggs, Wamsutter, and Saratoga stations were used in this analysis. I could not use Seminoe weather station because too many years of data were missing.

Baggs spring and summer weather was again warmer and much drier than average (Table 1), as was Saratoga. Wamsutter had average temperatures and extremely dry conditions compared to the average (Table 1). From 1997 through 2006 Baggs has had higher than normal spring/summer minimum temperatures, while Wamsutter has had cooler than normal minimum temperatures, except in 2000- and 2001. The Saratoga station reported a slight increase in minimum temperatures since 1997 that were more pronounced in 2006. Precipitation totals for the 3 stations were varied for 2006. Baggs had an abnormal year for moisture and Saratoga was inconclusive since it was missing precipitation data for May. Wamsutter reported the least rain with a 3.9 in. departure from normal for 2006. Dry conditions were the norm in the SCCA, and will probably impact

populations by decreasing chick production. Variability in data collection at each weather station could also affect this analysis and should be considered.

Table 1. Spring-Summer (Apr-Aug) Climate Data

Year	Baggs		Wamsutter		Saratoga	
	In.	F°	In.	F°	In.	F°
97	8.4	39.8	3.8	39.8	7.9	41.4
98	8.0	40.3	3.1	39.6	7.4	41.2
99	5.9	40.9	7.2	39.9	6.6	41.7
00	4.8	41.6	3.0	41.0	3.6	41.6
01	4.4	40.8	6.6	41.0	3.3	42.5
02	1.9	40.3	1.8	39.2	1.8	41.5
03	2.9	41.6	3.9	38.8	6.3	42.9
04	3.8	40.5	5.5	38.5	6.6	40.8
05	5.4	40.6	1.9	39.7	4.9	41.6
06	3.2	41.5	0.4	40.2	3.8[1]	43.4
1979-2005 Avg.	5.3 in.	38.9°F	4.3 in.	40.0°F	5.5 in.	41.36°F

[1] May data missing

Habitat

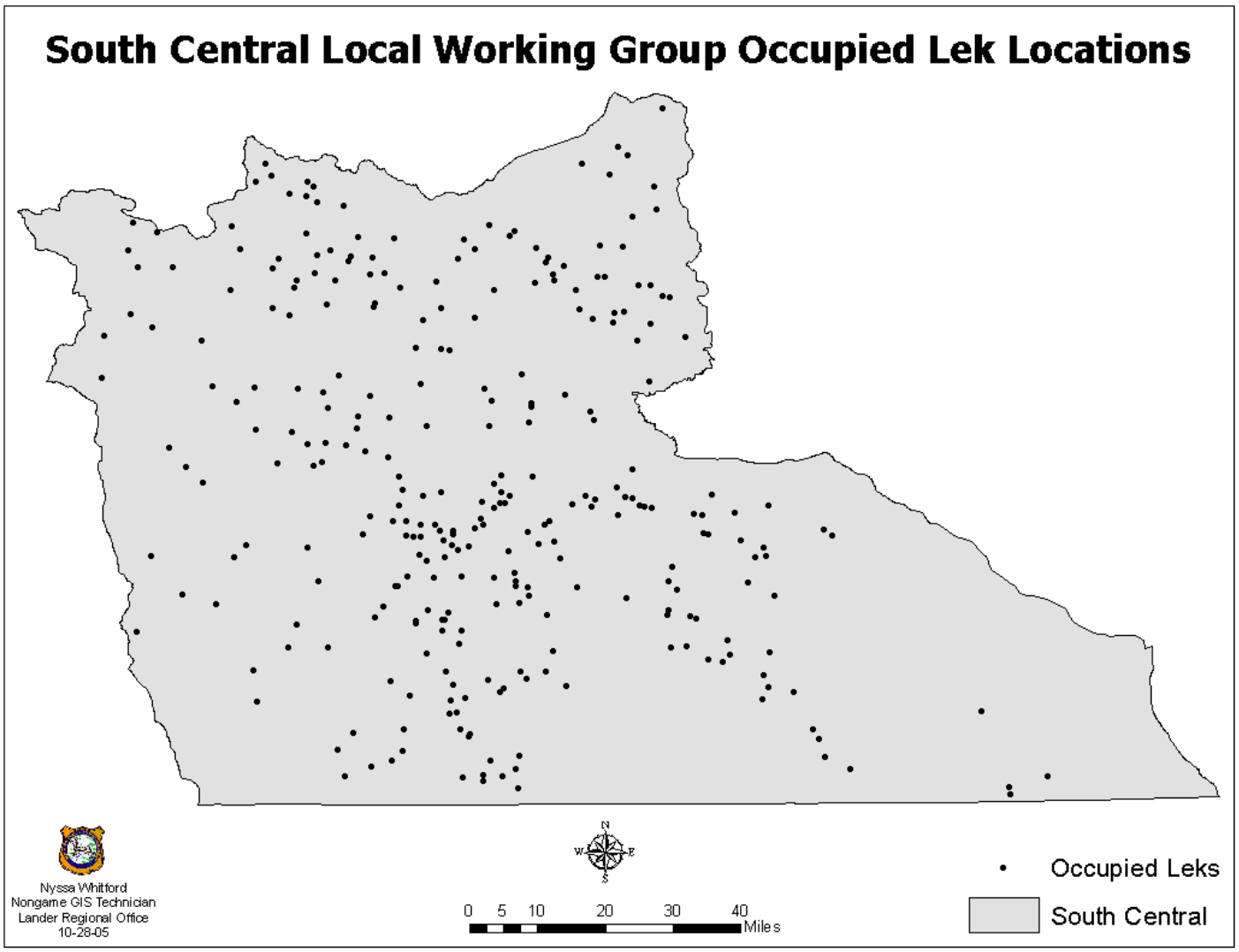
Completed habitat projects presented in the 2007 SCCA Sage-grouse Conservation Plan were mostly upland habitat improvements and are listed in Appendix G. Most of the projects aim to improve upland habitats either directly or by helping increase flexibility of grazing management. Another important project is focused on the collections and propagation of native drought adapted species of forbs to be used in reclamation efforts in the SCCA, although this is a long-term project in the early planning stages.

Currently the mapping of sage-grouse habitat will be a priority in the South Central Conservation Plan to assist in the planning of additional treatments and habitat projects proposed in the area. Habitat management should emphasize improvement or restoration of degraded or lost nesting habitat throughout the SCCA. Additional loss of habitat continues with natural gas development throughout the area with the expansion of the Continental Divide-Creston, and Atlantic Rim energy projects.

Leks and Lek Complexes

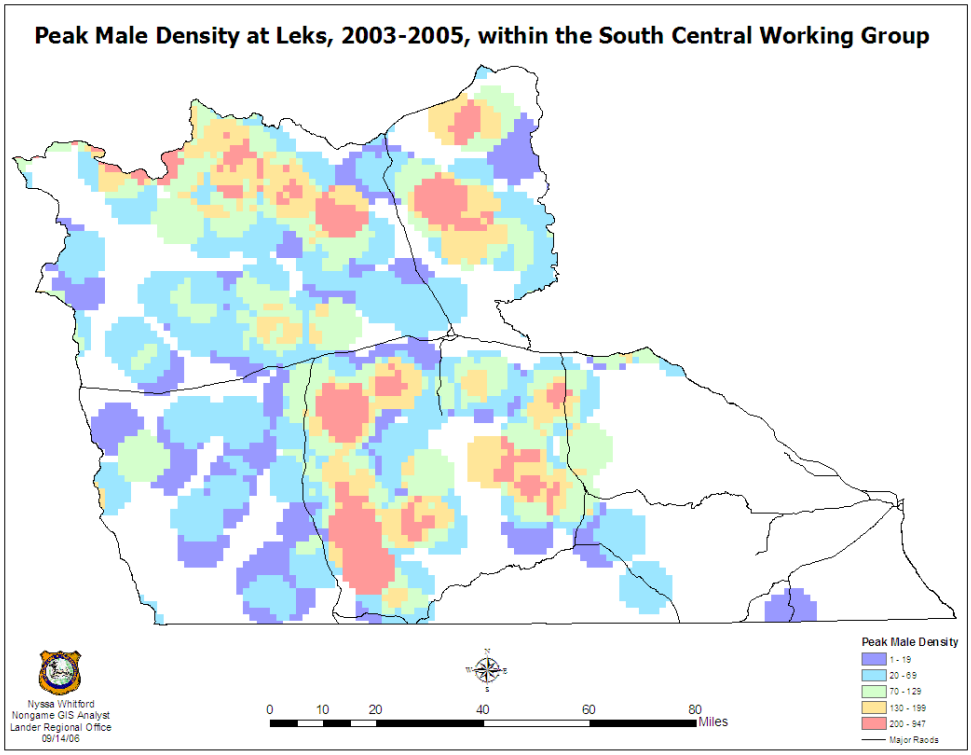
There are 301 occupied leks, 25 of unknown status, and 30 unoccupied leks found known in the SCCA (Figure 2, Appendix A). About 58% of the leks are located on BLM administered land, 33% private land, 5% state trust lands, and 4% other. Breakdown of leks by WGFD region and biologist districts are listed in Appendix A.

Figure 2.



The WGFD, BLM, consultants, and volunteers checked 264 of 324 leks (81.5%) in the SCCA during 2006 (Appendix E and F). Of the 278 leks checked, 47 were counted as "count leks" to determine population abundance, and 231 were surveyed for presence/absence as "survey leks" (Appendix B). The number of count leks increased because there has been a rapid increase in natural gas production in the SCCA and the additional count leks will help monitor the affects of natural gas activity on lek attendance. The highest densities of leks are found south of Rawlins between I-80 and the Colorado State line east of Wyoming Hwy 789, followed by areas northeast and northwest of Rawlins (Figure 3). The Platte River Valley has medium densities and the areas west of Hwy 789 and the Laramie Plains have the lowest densities. These densities are probably correlated to the amount and quality of sagebrush-grassland habitats in the SCCA.

Figure 3. Sage-grouse density by area within the South Central Conservation Area.



Productivity

I used from hunter-harvested wings collected at several locations throughout the hunt areas for estimating productivity. Wings are collected in barrels set at major road junctions where hunters are most likely to pass, and provide a relatively consistent source of productivity data. Wings are gathered and then aged/sexed by molt patterns. Numbers of chicks/hen are calculated and used as a measure of productivity. This technique assumes hunter harvest is unbiased between sex and age classes, especially chicks and hens. Even if this assumption is not met, the trends still provide yearly comparisons of relative chick production.

Composition of sage-grouse wings collected in wing barrels is listed in Appendix D, and shows that number of Chicks/hen increased from 1.6 in 2003 to 2.3 in 2004, but decreased to 1.5 in 2005, and decreased again to 1.4 in 2006 suggesting a potential slight decrease in productivity. Statewide analyses of wing data suggests chick/hen ratios of 1.5-1.7 result in relatively stable populations as determined by lek counts the following year. Data from the SCCA support this since lek counts following 2003 and 2005 were stable and then large increases in average males per lek were observed in 2005 following 2004's 2.3 chicks/hen. During the 2006 season we collected 319 wings within the SCCA, which is slightly lower compared to the 2005 wing samples.

Population trend

Monitoring the total number of males on a lek is often used as an index of trend, but these data should be viewed with caution since survey effort has varied over time, leks have moved, birds move among leks in a complex, and other reasons that are explained on page 12 in the Wyoming Greater Sage-grouse Conservation Plan (2003). Most of the analysis in this report will cover the last 10 years of data collection since there is little reliable data from earlier years.

In the spring of 2007, a combined total of 2057 males and 314 total females were counted on 47 count leks, equaling an average of 43.8 males/lek and 6.7 females/lek. About 14% of the leks in the SCCA were counted in 2007, the highest percentage on record, indicating an increased effort to monitor this area. The average number of males on a count lek decreased by about 14% compared to the 2006 average lek counts (Appendix B, Figure 3). Of the 231 leks surveyed in 2007, 172 were active, 21 inactive and 138 were unknown (Appendix B and E). Lek survey effort was adequate in 2007 with nearly 70% of the leks checked (Appendix B). Generally, there is an upward trend in sage-grouse abundance until 2006 with a decline observed in 2007. While the number of males on survey leks is not as accurate as on count leks, the total number of males counted on survey leks was notably lower between 2006 and 2007 (Appendix B). Based on count and survey lek results in 2006-7, the populations in the SCCA appears to be decreasing slightly.

Complex counts are a more accurate count of abundance compared to individual lek counts, because males may move among nearby leks (2004 SCCA JCR). In the SCCA the total counts of males within complexes were slightly higher, with a slightly lower average number of males/lek in 2007 (Appendix C and F, Figure 4). Of the 185 total complexes, 123 (65%) were active, 7 (4%) were inactive, and 59 (31%) unknown. Again, while the unknown status appears high, disproportionate effort has been allocated to surveying leks of unknown status versus known status in recent years.

Using total complex lek counts for the SCCA and comparing estimates from 1998 to 2006, the population increased until 2000, leveled off in 2000, dropped until 2002 and then began to increase again with a 10-year high of 2014 males observed in 2007. The recent increase correlates to the increased early summer precipitation seen in 2003 and 2004 resulting in better chick production that carried over to higher males on leks in 2005-2007. When chick production decreases as was seen in the last few years, male counts should start to drop after a 1-2 year lag.

Lek counts should be continued with increased effort, especially in areas of development, and where sagebrush has been burned or chemically treated. Information from count surveys will help increase our knowledge of how leks respond to habitat alterations.

Harvest

Harvest is often used as another index of abundance in addition to lek counts. During the 2006 season we collected 319 wings from wing barrels within the SCCA, a decrease of 26 compared to 2005. The Upland harvest survey estimated 717 hunters spent 1505 days to harvest 1342 birds. This equals about 0.9 birds/day, 1.9 birds/hunter, or about 2.1 days/hunter (Appendix D). This is a decrease compared to the last 3 years, which corresponds to slightly decreasing populations. The last year that was lower was in 2002, where 0.8 birds/day were harvested. Season length and bag limit decreased from 16 days and 3 day/6 possession in 2002 to 9 days and 2-day/4 possession in 2003, which also has greatly influenced the numbers of birds harvested from the SCCA. Shorter more restrictive seasons tend to decrease hunter participation. Using harvest data as an index of population trends is compromised if hunting regulations are varied over time.

Special Studies

There are 2 projects occurring in the SCCA. The Stratton sagebrush study is in the second of a four-year study that is evaluating the effects of prescribed burning and grazing on high elevation sagebrush habitats and wildlife species. Researchers are monitoring vegetation, mammals, songbirds, and sage-grouse populations by habitat type and grazing treatment. Sage-grouse over winter and summer use was found to be highest in Black/Wyoming sagebrush areas that are grazed before the peak green up. Post-peak grazing areas in burned Mountain sagebrush areas had the least use by sage-grouse for both summer and winter. The second project underway in the SCCA is the Atlantic Rim sage-grouse research project a cooperative effort among the BLM, WGFD, and Anadarko Petroleum Corp. Currently, only large-scale movements are being monitored until

specific project objectives are refined. Ultimately, cooperators hope to be able to identify important seasonal habitats, mortality estimates, and population status. Large-scale movement monitoring has identified that grouse that breed within the Atlantic Rim Energy Project move to summer ranges east and up in elevation, while some birds in the southern half may be using other areas to winter. Birds north of Muddy Creek appear to be wintering in areas near where they were captured. Contractors collared 100 birds near leks between Rawlins and Baggs during March and April, with about 70?? birds surviving until November.

Diseases

There were no known reported cases of West Nile Virus in the SCCA in 2006.

Recommendations

1. Support LWG efforts to work on reclamation issues, especially seed mixes that benefit sage-grouse.
2. Improve efforts to survey leks of unknown status and search for new leks.
3. Continue to update data from SCCA in the sage-grouse database.
4. Support efforts to continue the sage-grouse research project in the Atlantic Rim project area.
5. Continue to map seasonal habitats, especially winter habitats.
6. Work with BLM (through LWG) to ensure that burns and treatments in and around sage-grouse habitat meet sage-grouse habitat treatment prescriptions.
7. Build partnerships with private landowners to maintain or improve sage-grouse habitats on private lands through mutually beneficial habitat projects.

Literature Cited and/or Studies in Area

Heath B. J., R. Straw, S.H. Anderson, J. Lawson, and M. Holloran. 1998. Sage-grouse productivity, survival, and seasonal habitat use among three ranches with different livestock grazing, predator control, and harvest management practices. Wyoming Cooperative Fish and Wildlife Research Unit. Completion Report 66pp.

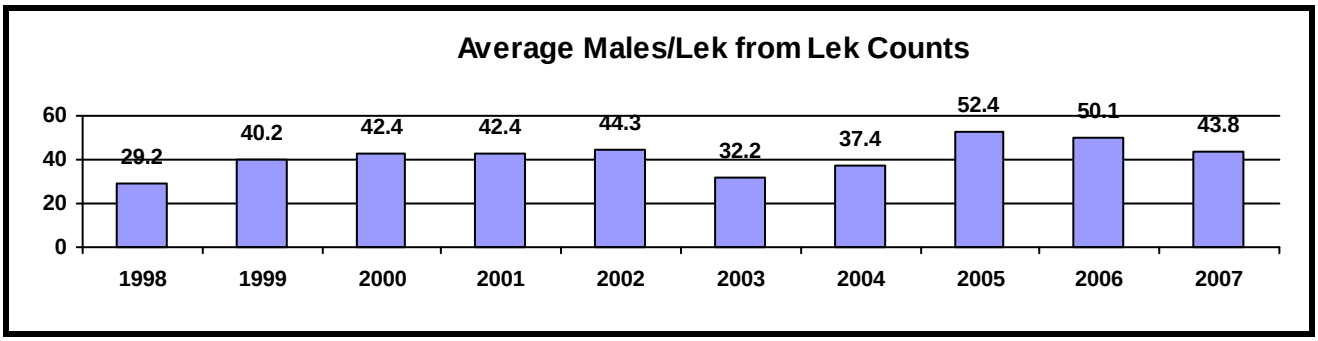
Erickson, H. J. and C. L. Aldredge. 2007. Stratton sagebrush ecological site: An experimental approach to assess various grazing treatments on vegetation and wildlife communities across managed burns and habitat controls. National Resource Ecology Laboratory, Colorado State University. Annual Project Report. 10pp.

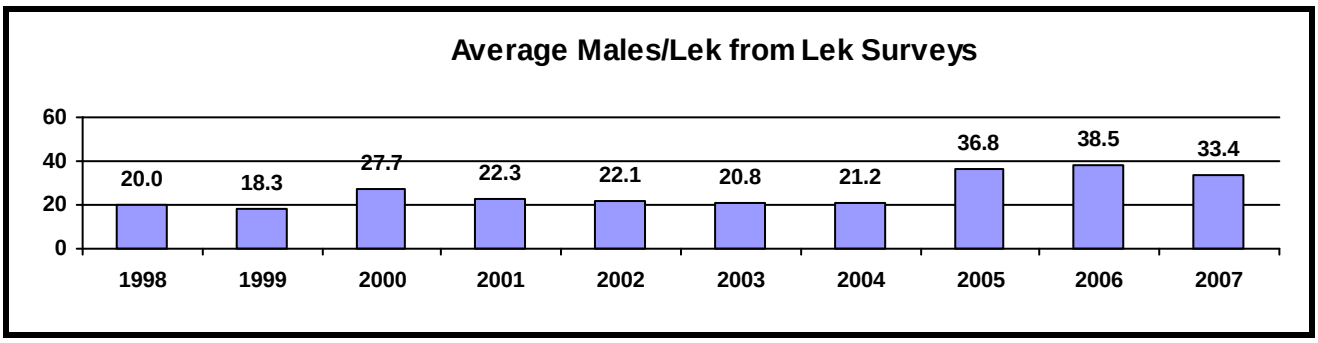
Schoenecker, K. B. Lange, and M. Calton. 2005. 2004 Annual progress report: Stratton Sagebrush Hydrology Study Area: Establishment of a Long Term Research Site in a High Altitude Sagebrush-steppe. U.S. Geological Survey. Open file report 2005 1426. USGS. 12pp.

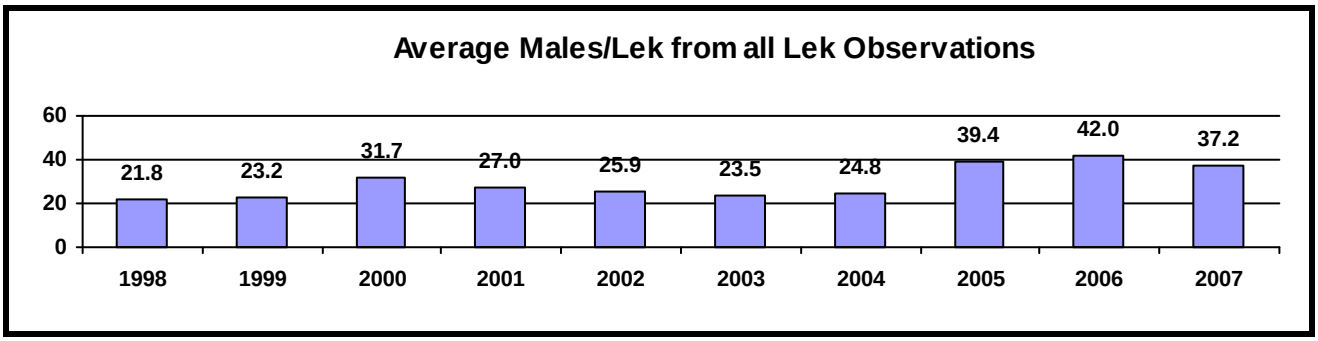
Wyoming Game and Fish Department. 2003. Greater Sage-grouse Conservation Plan. 97pp.

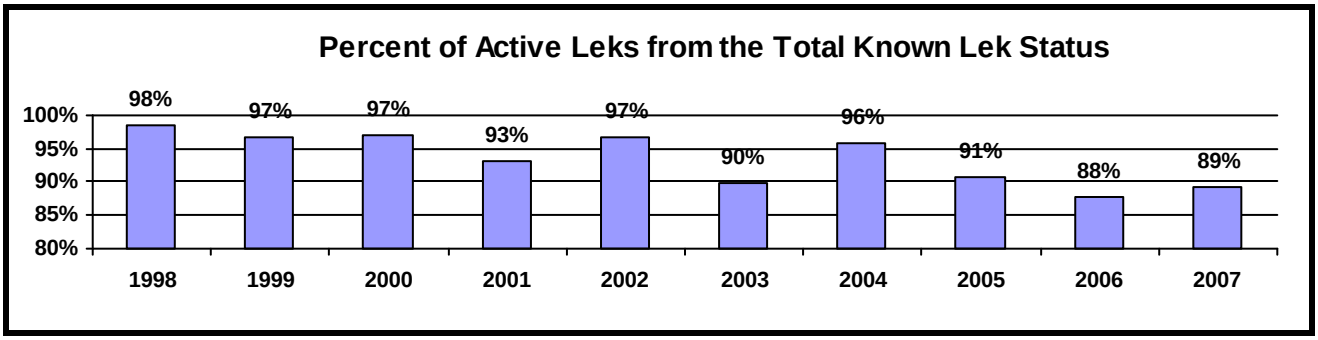
SAGE-GROUSE LEK ATTENDANCE SUMMARY

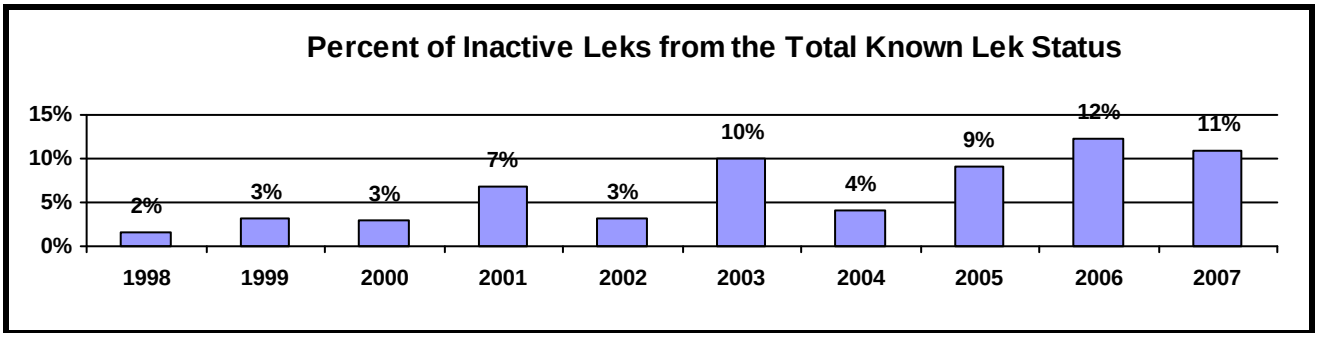
WORKING GROUP: South Central **Area(s):** All





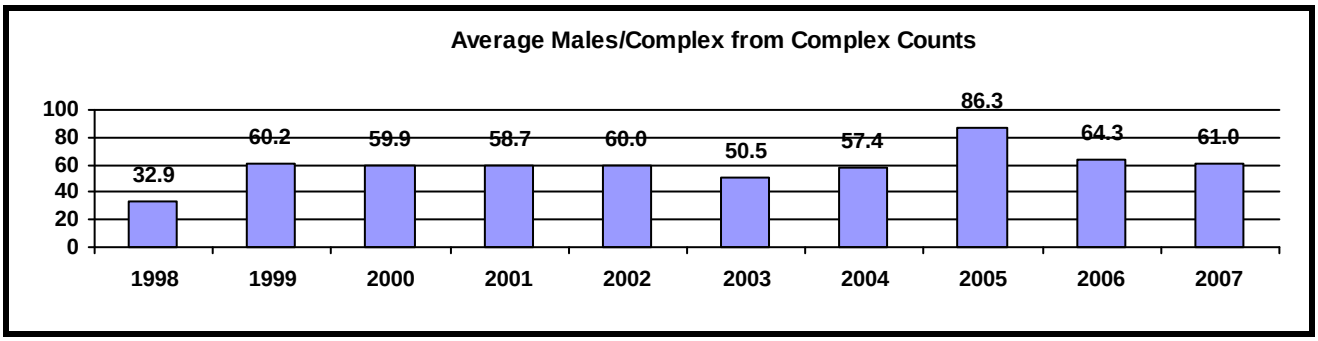


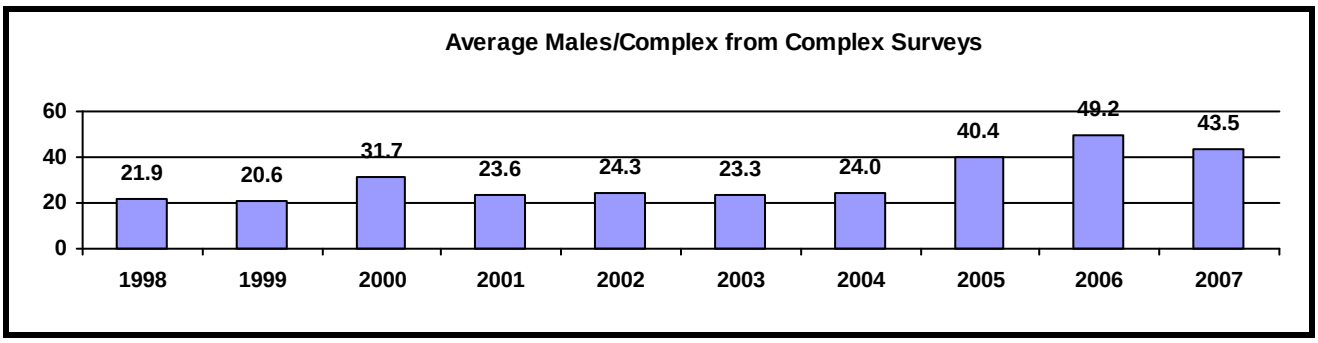


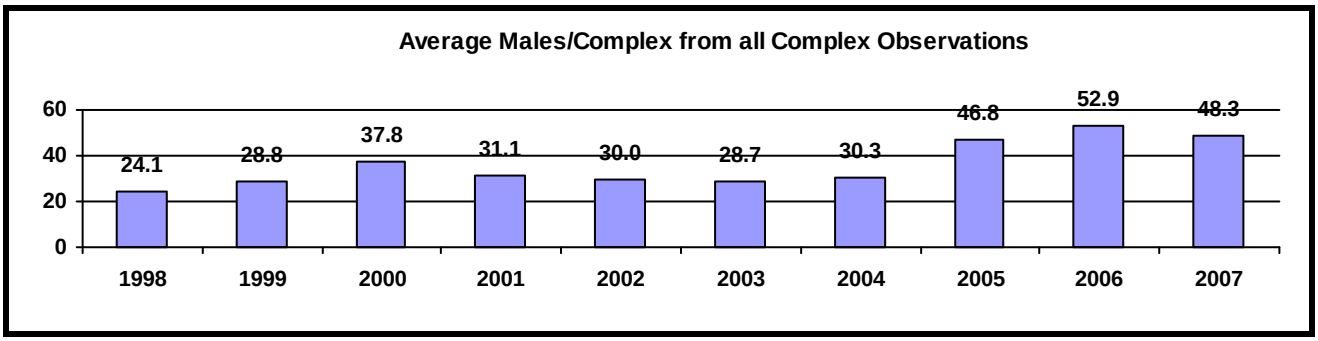


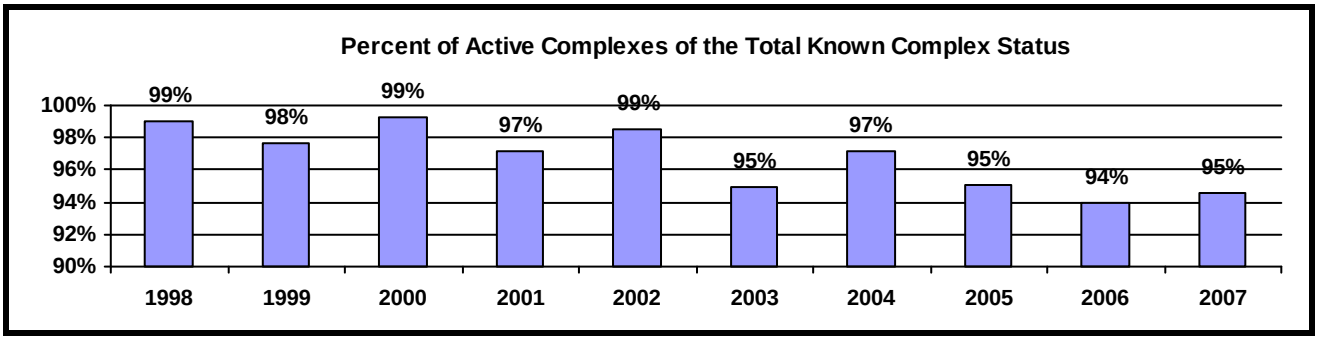
SAGE-GROUSE LEK COMPLEX ATTENDANCE SUMMARY

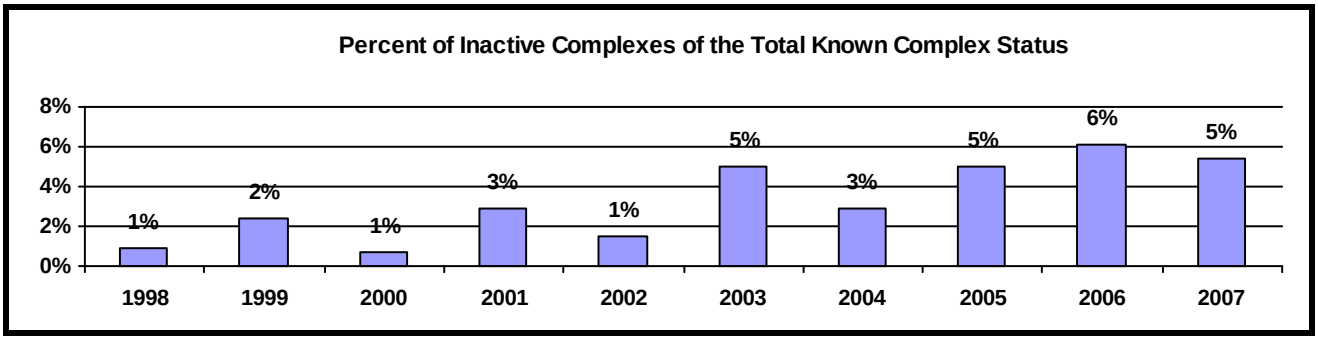
WORKING GROUP: South Central **Area(s): All**





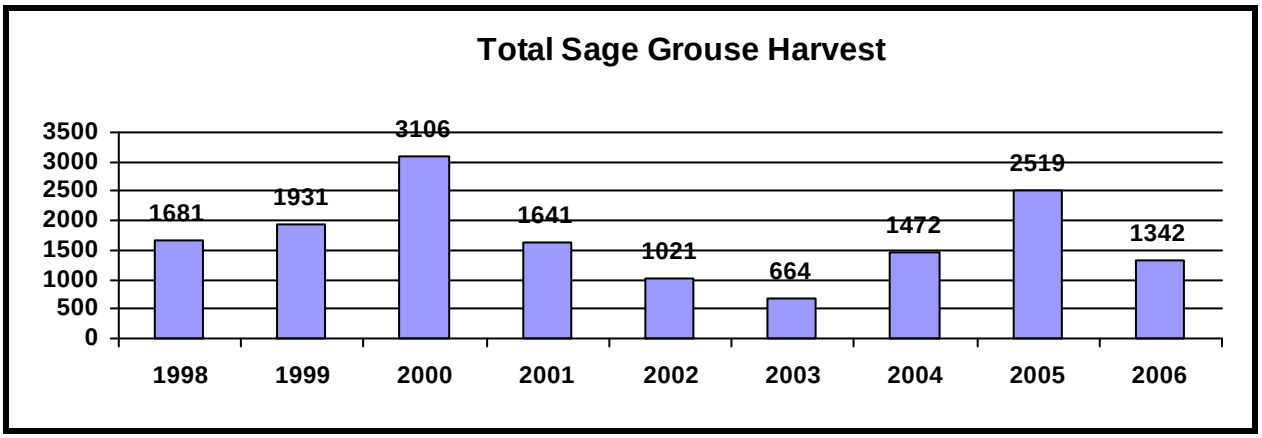


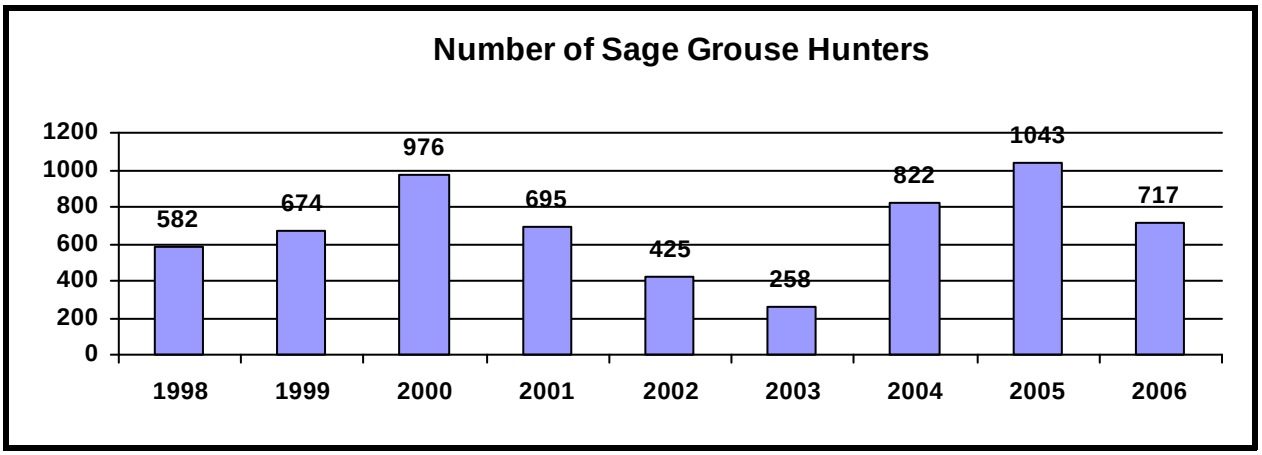


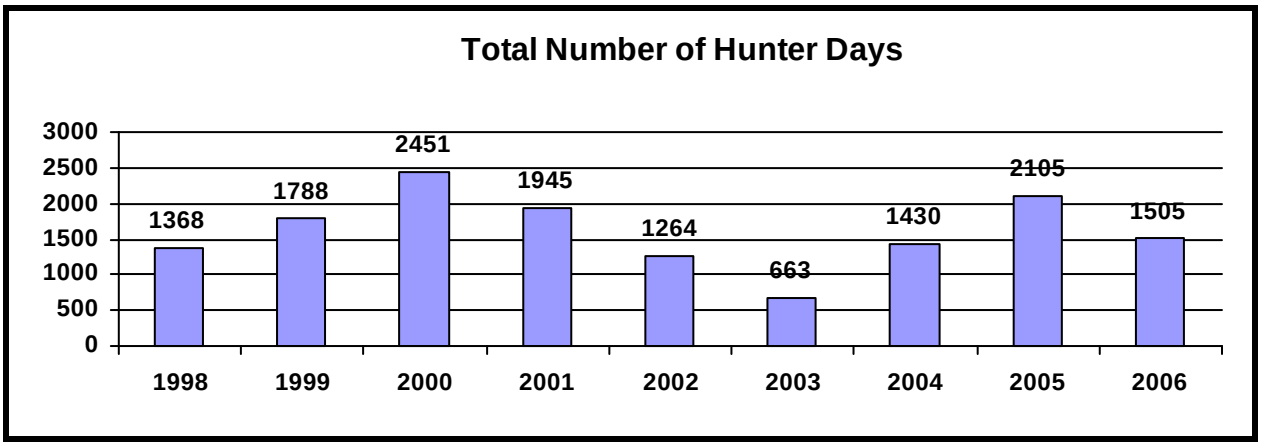


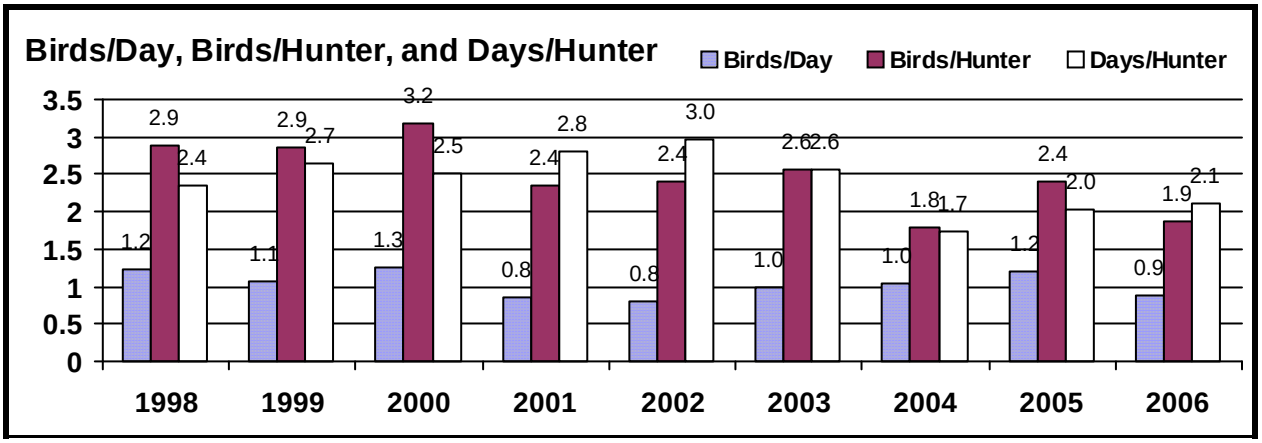
SAGE-GROUSE HARVEST SUMMARY

WORKING GROUP: South Central **Area(s): All**









Sage Grouse Lek Characteristics

Region	Number	Percent
Green River	97	27.2%
Lander	207	58.1%
Laramie	52	14.6%

Working Group Area	Number	Percent
South Central	356	100.0%

Classification	Number	Percent
Occupied	301	84.6%
Unknown	25	7.0%
Unoccupied	30	8.4%

BLM Office	Number	Percent
Casper	1	0.3%
Lander	21	5.9%
Rawlins	324	91.0%
Rock Springs	10	2.8%

Unoccupied Leks	Number
Abandoned	29
Destroyed	1

Biologist District	Number	Percent
Baggs	97	27.2%
Laramie	52	14.6%
Rawlins	192	53.9%
South Lander	15	4.2%

Game Warden District	Number	Percent
Baggs	105	29.5%
East Rawlins	53	14.9%
Elk Mountain	6	1.7%
Rock Springs	10	2.8%
Saratoga	41	11.5%
South Laramie	5	1.4%
West Rawlins	136	38.2%

County	Number	Percent
	0	0.0%
Albany	5	1.4%
Carbon	250	70.2%
Fremont	12	3.4%
Natrona	1	0.3%
Sweetwater	86	24.2%

Land Status	Number	Percent
BLM	205	57.6%
BLM/Private	10	2.8%
Not Determined	2	0.6%
Private	117	32.9%
Private/BLM	1	0.3%
State	19	5.3%
State/Private	1	0.3%
USF&WS	1	0.3%

Management Area	Number	Percent
10	33	9.3%
24	27	7.6%
25	154	43.3%
45	40	11.2%
9	102	28.7%

Sage-Grouse Job Completion Report

YEAR: **PERIOD COVERED:**
WORKING GROUP: **PREPARED BY:**

1. LEK ATTENDANCE SUMMARY (OCCUPIED LEKS)

a. Leks Counted

Year	Known	Counted	Percent Counted	Max Totals Males	Max Totals Females	Avg./Active Lek Males	Avg./Active Lek Females
1998	306	23	7.5	671	384	29.2	16.7
1999	309	32	10.4	1285	584	40.2	18.3
2000	321	34	10.6	1443	831	42.4	24.4
2001	318	37	11.6	1569	403	42.4	10.9
2002	320	26	8.1	1153	418	44.3	16.1
2003	317	41	12.9	1319	660	32.2	16.1
2004	313	36	11.5	1348	314	37.4	8.7
2005	323	27	8.4	1415	459	52.4	17.0
2006	325	42	12.9	2106	782	50.1	18.6
2007	331	47	14.2	2057	314	43.8	6.7

b. Leks Surveyed

Year	Known	Surveyed	Percent Surveyed	Max Total Males	Avg Males/ Active Lek
1998	306	161	52.6	1837	20.0
1999	309	200	64.7	2120	18.3
2000	321	194	60.4	3215	27.7
2001	318	207	65.1	2522	22.3
2002	320	205	64.1	2801	22.1
2003	317	210	66.2	2623	20.8
2004	313	215	68.7	2781	21.2
2005	323	227	70.3	5147	36.8
2006	325	233	71.7	5543	38.5
2007	331	231	69.8	4472	33.4

c. Leks Checked

Year	Known	Checked	Percent Checked	Max Total Males	Avg Males/ Active Lek
1998	306	182	59.5	2464	21.8
1999	309	223	72.2	3245	23.2
2000	321	223	69.5	4630	31.7
2001	318	236	74.2	3913	27.0
2002	320	226	70.6	3828	25.9
2003	317	243	76.7	3806	23.5
2004	313	246	78.6	4025	24.8
2005	323	245	75.9	6336	39.4
2006	325	266	81.8	7554	42.0
2007	331	269	81.3	6476	37.2

d. Lek Status

Year	Active	Inactive	Not Located	Unknown	Confirmed Status Total	Confirmed Status Active	Confirmed Status Inactive
1998	120	2	2	182	122	98.4%	1.6%
1999	149	5	0	155	154	96.8%	3.2%
2000	164	5	0	152	169	97.0%	3.0%
2001	162	12	3	141	174	93.1%	6.9%
2002	151	5	0	164	156	96.8%	3.2%
2003	161	18	0	138	179	89.9%	10.1%
2004	160	7	0	146	167	95.8%	4.2%
2005	158	16	0	149	174	90.8%	9.2%
2006	173	24	0	128	197	87.8%	12.2%
2007	172	21	0	138	193	89.1%	10.9%

Table3. Summary of unoccupied (historic) leks and lek complexes.

a. Unoccupied Leks

Year	Total Number of Leks: Abandoned	Total Number of Leks: Destroyed	Number of abandoned leks checked
1998	21	1	13
1999	21	1	10
2000	21	1	8
2001	22	1	6
2002	21	1	2
2003	25	1	9
2004	27	1	8
2005	27	1	10
2006	27	1	15
2007	27	1	14

b. Unoccupied Lek Complexes

Year	Total Number Complexes: Abandoned	Total Number Complexes: Destroyed	Number of abandoned complexes checked
1998	7	0	3
1999	7	0	2
2000	8	0	2
2001	8	0	2
2002	8	0	1
2003	10	0	3
2004	10	0	1
2005	6	0	2
2006	6	0	2
2007	6	0	1

2. LEK COMPLEX ATTENDANCE SUMMARY (OCCUPIED COMPLEXES)

a. Lek Complexes Counted

Year	Number of Complexes	Maximum Totals		Avg./Active Complex		Number of Leks
		Males	Females	Males	Females	
1998	20	658	372	32.9	18.6	30
1999	25	1505	638	60.2	25.5	44
2000	27	1618	876	59.9	32.4	51
2001	27	1585	403	58.7	14.9	51
2002	21	1261	427	60.0	20.3	38
2003	26	1312	656	50.5	25.2	48
2004	25	1436	315	57.4	12.6	47
2005	16	1381	459	86.3	28.7	30
2006	31	1992	549	64.3	17.7	61
2007	33	2014	307	61.0	9.3	63

b. Lek Complexes Surveyed

Year	Number Complexes	Max. Total Males	Avg. Males/ Active Complex	Number of Leks
1998	125	1777	21.9	189
1999	142	1956	20.6	220
2000	145	3105	31.7	234
2001	142	2308	23.6	228
2002	147	2669	24.3	235
2003	145	2424	23.3	231
2004	150	2568	24.0	238
2005	132	3959	40.4	211
2006	124	4621	49.2	199
2007	123	3828	43.5	199

c. Lek Complexes Checked

Year	Number Complexes	Max. Total Males	Avg. Males/ Active Complex	Number of Leks
1998	145	2435	24.1	219
1999	167	3461	28.8	264
2000	172	4723	37.8	285
2001	169	3893	31.1	279
2002	168	3930	30.0	273
2003	171	3736	28.7	279
2004	175	4004	30.3	285
2005	148	5340	46.8	241
2006	155	6613	52.9	260
2007	156	5842	48.3	262

d. Lek Complex Status

Year	Number of Occupied Complexes				Known Status		
	Active	Inactive	Unknown	Total	Total	Active	Inactive
1998	106	1	99	206	107	99.1%	0.9%
1999	123	3	83	209	126	97.6%	2.4%
2000	138	1	71	210	139	99.3%	0.7%
2001	134	4	73	211	138	97.1%	2.9%
2002	135	2	76	213	137	98.5%	1.5%
2003	132	7	72	211	139	95.0%	5.0%
2004	134	4	73	211	138	97.1%	2.9%
2005	115	6	64	185	121	95.0%	5.0%
2006	123	8	55	186	131	93.9%	6.1%
2007	123	7	59	189	130	94.6%	5.4%

Table 4. Sage-grouse hunting seasons and harvest data.

a. Season

Year	Season Dates	Length	Bag/Possession Limit
1998	Sept 19-Oct 4	16	3/6
1999	Sep 18-Oct 3	16	3/6
2000	Sep 16-Oct 1	16	3/6
2001	Sep 22-Oct 7	16	3/6
2002	Sep 28-Oct 6	9	2/4
2003	Sep 27-Oct 5	9	2/4
2004	Sept 23-Oct 3	11	2/4
2005	Sept 23-Oct 3	11	2/4
2006	Sept 23-Oct 3	11	2/4

b. Harvest

Year	Harvest	Hunters	Days	Birds/ Day	Birds/ Hunter	Days/ Hunter
1998	1,681	582	1,368	1.2	2.9	2.4
1999	1,931	674	1,788	1.1	2.9	2.7
2000	3,106	976	2,451	1.3	3.2	2.5
2001	1,641	695	1,945	0.8	2.4	2.8
2002	1,021	425	1,264	0.8	2.4	3.0
2003	664	258	663	1.0	2.6	2.6
2004	1,472	822	1,430	1.0	1.8	1.7
2005	2,519	1,043	2,105	1.2	2.4	2.0
2006	1,342	717	1,505	0.9	1.9	2.1
Avg.	1,709	688	1,613	1.0	2.5	2.4

Table 5. Composition of harvest by wing analysis.

Year	Sample Size	Percent Adult		Percent Ylg		Percent Young		Chicks/Hen	
		Male	Female	Male	Female	Male	Female	All	Suc.
1998	549	7.8	19.7	6.6	7.5	20.8	37.7	2.2	9.2
1999	631	6.3	21.9	3.8	12.5	24.1	31.1	1.6	17.5
2000	474	10.8	25.3	4.6	12.9	21.7	24.7	1.2	7.3
2001	693	6.3	25.1	1.2	6.1	23.1	38.1	2.0	9.6
2002	203	10.8	29.1	2.0	8.4	13.3	36.5	1.3	4.8
2003	310	13.2	28.4	0.3	4.5	24.8	28.4	1.6	5.7
2004	284	7.4	22.5	0.4	5.3	30.3	34.2	2.3	7.3
2005	345	13.6	27.8	3.8	4.6	20.0	30.1	1.5	0.0
2006	319	16.6	28.2	3.8	5.3	21.9	24.1	1.4	0.0

Table 7. Sage-grouse lek complex status for 2007.

Complex	Type	Status	Peak Males	Peak Females	Leks/ Complex
		Management Area: 10			
Blue Gap	Survey	Inactive	0	0	1
Cherokee Trail	Survey	Active	0	0	1
Coal Gulch	Survey	Active	43	1	1
Courthouse Butte	Survey	Abandone	0	0	1
Creston	Not Check	Abandone			1
Creston	Not Check	Unknown			1
Delaney Rim	Count	Active	136	10	3
Duck Lake	Survey	Active	32	1	1
Echo Springs	Survey	Active	14	0	4
Fort LaClede	Survey	Active	82	14	1
Hangout Ridge	Survey	Active	23	6	2
High Point	Count	Active	12	0	1
High Point	Survey	Active	16		1
Iron Pipe	Survey	Active	31	1	1
Little Robber	Count	Active	48	0	1
Lonnie's	Survey	Active	23	0	1
Mulligan Draw	Count	Active	38	2	1
Mysterious	Count	Inactive	0	0	1
N. Barrel Springs	Count	Active	8	0	1
North Muddy Creek	Survey	Inactive	0	0	1
Red Lakers	Survey	Active	21	0	1
Shallow Creek	Count	Active	31	5	1
Soap Holes	Survey	Active	23	0	2
Strom Reservoir	Survey	Inactive	0	0	2
Willow Cr. Rim	Count	Active	43	1	2
Windmill Draw	Survey	Inactive	0	0	1
		Management Area: 25			
Badwater	Survey	Active	120	5	4
Bridger Pass	Survey	Unknown	0		1
Buck Springs Draw	Not Check	Unknown			1
Cherokee Mine	Count	Active	24	5	1
Cherokee Towers	Survey	Active	5		1
Chokecherry	Not Check	Unknown			1
Continental Divide	Survey	Active	1	1	1
Continental Divide	Survey	Active	110	16	3
Creston	Not Check	Abandone			1
Creston	Not Check	Unknown			1
Deadman Creek	Not Check	Unknown			1
Dirty Man	Survey	Unknown	0	0	1
Doty Mountain	Not Check	Unknown			1
Dry Cow	Count	Active	31	1	3
Eagle Creek	Not Check	Unknown			1
Emigrant Creek	Survey	Unknown	0		1
Fillmore Creek	Count	Active	118	28	3
Fillmore Ranch	Count	Active	69	5	5

Table 7. Sage-grouse lek complex status for 2007.

Complex	Type	Status	Peak Males	Peak Females	Leks/ Complex
Fox Farm	Survey	Active	11	2	1
Garden Gulch	Count	Active	82	4	6
Hillside	Survey	Unknown	10		3
Hogback	Not Check	Unknown			1
Holler Draw	Not Check	Unknown			1
Holler Draw	Not Check	Unknown			1
Holler Draw	Survey	Active	4	0	2
Holler Draw	Survey	Active	4	0	2
Hugus Draw	Survey	Active	0		1
Iron Springs Draw	Survey	Active	25		2
Lake Bed	Survey	Active	11		1
Little Beaver	Survey	Active	15		1
Little Muddy	Survey	Unknown	0		2
Little Sage	Survey	Active	21		2
Little Savery	Survey	Unknown	0	0	6
McKinney Creek	Not Check	Unknown			1
Miller Creek	Not Check	Unknown			1
Miller Hill	Survey	Active	16		3
Miller Hill	Survey	Active	25	0	1
Miller Hill	Survey	Active	25	0	1
Miller Hill	Survey	Active	16		3
Ne Muddy Mtn	Survey	Inactive	0	0	3
North Fork	Survey	Active	12	0	1
North Fork Savery	Survey	Unknown	0	0	1
Olson Divide	Survey	Unknown	0		1
Olson Draw	Not Check	Unknown			1
Overland Trail	Not Check	Unknown			1
Overland Trail	Not Check	Unknown			1
Peach Orchard	Survey	Active	31	9	1
Pipeline	Survey	Active	5	0	6
Ram Canyon	Survey	Active	115	10	4
Red Rim	Survey	Active	37	16	2
Rendle Rim	Survey	Unknown	0	0	1
Rye Gulch	Survey	Inactive	0	0	2
Sage Creek Basin	Survey	Active	69	1	1
Sage Creek Ranch	Survey	Active	22		1
Savery Creek	Survey	Active	16	1	13
Seaverson	Survey	Unknown	0		2
Separation Creek	Not Check	Unknown			2
Separation Creek	Survey	Active	15		3
Separation Hilltop	Survey	Active	33	45	1
Sheep Mountain	Not Check	Unknown			1
Smiley Draw	Count	Active	130	18	5
Smith Draw	Survey	Unknown	0		1
South Cherokee	Survey	Active	17		1
Sulphur Springs	Survey	Unknown	0	0	1

Table 7. Sage-grouse lek complex status for 2007.

Complex	Type	Status	Peak Males	Peak Females	Leks/ Complex
SW Riner	Survey	Active	0		1
Upper Hugus	Not Check	Unknown			2
Upper Iron Springs	Not Check	Unknown			1
Wild Cow	Count	Active	107	6	3
Willows	Count	Active	98	6	5
Management Area: 45					
Annis	Survey	Unknown	0		1
Arkansas	Survey	Active	29	1	2
Arkansas Basin	Survey	Active	64	5	1
Bear Mountain	Not Check	Unknown			1
Boggy Meadows Rim	Survey	Unknown	0		1
Cheyenne	Survey	Active	69	4	4
Corral Creek	Survey	Active	45		1
Deweese	Not Check	Unknown			1
Dry Ditch	Survey	Active	28	2	1
East Ninemile	Count	Active	53	5	1
Ferris	Survey	Active	25	4	1
Flattop	Not Check	Unknown			1
Hatchet	Count	Active	73	4	3
Junk Hill	Not Check	Unknown			1
Little Sand Spring	Count	Active	46	32	2
Little Shoe	Survey	Active	28	2	1
Lone Haystack	Survey	Unknown	0		1
Mahoney	Count	Active	34	23	1
NW Haystack	Survey	Active	116	4	1
Pool Table	Survey	Unknown	0		1
Rawlins	Survey	Active	12	1	2
Riddle	Survey	Active	38	2	2
Rinshaw	Count	Active	141	7	1
Rush Creek	Survey	Active	154	18	1
Sandhole	Survey	Active	18		2
Table Lake	Not Check	Unknown			1
Taper	Survey	Active	56		3
Tin Can	Survey	Active	38		1
Management Area: 9					
Alkali Well	Survey	Active	49	1	1
Arapahoe	Survey	Active	109	1	1
Bairoil	Survey	Active	10		1
Bare Ring Butte	Survey	Active	125	5	1
Basin Well	Survey	Unknown	0		1
Bastard Butte	Survey	Active	2		1
Bear Creek	Not Check	Unknown			1
Black Rock Flat	Survey	Active	26	3	1
Bobs	Survey	Active	74	41	1
Buck Draw	Not Check	Abandone			1
Buck Spring	Survey	Active	24		1

Table 7. Sage-grouse lek complex status for 2007.

Complex	Type	Status	Peak Males	Peak Females	Leks/ Complex
Buffalo Hump	Not Check	Abandone			3
Bull Springs	Count	Active	16	4	1
Chain Lakes Rim	Count	Active	61	10	1
Cherokee	Not Check	Unknown			1
Chicken Spring	Count	Active	181	95	1
Continental Divide	Survey	Active	1	1	1
Continental Divide	Survey	Active	110	16	3
Corral	Survey	Unknown	0		1
Cow Spring	Survey	Active	22	2	2
Crooked Well	Survey	Unknown	0		1
Daley	Not Check	Unknown			1
Discover	Survey	Active	39		2
Eagles Nest	Survey	Active	17	1	1
Eagles Nest Draw	Survey	Active	98	14	2
Eagles Nest Fence	Survey	Active	132		2
Eagles Nest Reservoir	Not Check	Unknown			1
East Antelope	Survey	Active	64		1
East Luman	Survey	Unknown	0		1
Fenced Well	Survey	Active	58	5	2
Fish Pond	Not Check	Abandone			1
Fivemile	Survey	Active	21		3
Girrard	Survey	Active	54	4	2
Green Ridge	Survey	Active	79	50	1
Hadsell	Survey	Active	53	1	2
Harrier	Survey	Active	79	40	1
High Point	Count	Active	12	0	1
High Point	Survey	Active	16		1
Horseshoe Bend	Count	Active	18	2	1
Larsen North Well	Count	Active	34	1	1
Little Osborne	Not Check	Unknown			1
Lost Alkali	Survey	Active	164		6
Luman Rim	Survey	Unknown	0		1
Luman Road	Survey	Active	32		1
Marathon	Survey	Unknown	0		1
May Day	Count	Active	8		1
Minex West	Survey	Active	24		1
Monument Lake	Count	Active	20	1	1
Mud Lake	Count	Active	34	2	2
Mud Springs	Survey	Unknown	0		1
North Lamont	Survey	Active	11		1
North Wamsutter	Survey	Unknown	0		2
Osborne Draw	Survey	Unknown	0		1
Prospects	Survey	Active	68	48	1
Rasmussen	Survey	Active	23	3	1
Red Creek	Survey	Active	79		1
Red Creek Well	Count	Active	79		1

Table 7. Sage-grouse lek complex status for 2007.

Complex	Type	Status	Peak Males	Peak Females	Leks/ Complex
Rocky Draw	Not Check	Unknown			1
Ruby Knolls North	Survey	Unknown	0		1
Ruby Knolls South	Survey	Active	47	31	1
Rusty	Not Check	Abandone			1
Saint Patricks	Survey	Active	17		1
Salt Sage Draw	Survey	Active	34		1
Saxon	Survey	Active	36	2	1
Scotty Lake	Survey	Active	70	2	1
Separation Creek	Survey	Active	15		3
Separation Creek	Not Check	Unknown			2
SK Well	Not Check	Unknown			1
Smiley Springs	Survey	Active	91	3	1
Soda Lake	Not Check	Unknown			1
Sooner	Survey	Active	37	59	2
Sourdough	Survey	Active	0		1
Sourdough Mine	Survey	Active	22		1
Southland Well	Count	Active	69	6	1
Stewart Creek	Count	Active	112	18	1
Stinking Springs	Survey	Active	11	1	1
Stratton	Count	Active	60	6	1
Stratton Lake	Not Check	Unknown			1
Tipton North	Not Check	Unknown			1
Twin Barns	Survey	Active	7		1
Upper Osborne	Survey	Active	72	35	1
West Kinch McKinney	Not Check	Unknown			1
West Towers	Survey	Active	20		1
White Water	Not Check	Unknown			1
Windy Hill	Survey	Active	54		1

Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Management Area: 10									
Complex: Blue Gap									
Blue Gap	3	20	700	Inactive	0	0	0	Woolley	Ground
Blue Gap	4	10	745	Inactive	0	0	0	Woolley	Ground
Complex: Cherokee Trail									
Cherokee Trail	3	21	700	Active	0	0	0	Kenneda	Ground
Cherokee Trail	5	10	615	Active	0	0	0	Kenneda	Ground
Complex: Coal Gulch									
Coal Gulch	4	19	653	Active	29	1	0	DMP	Ground
Coal Gulch	4	26	651	Active	26	0	0	DMP	Ground
Coal Gulch	5	3	540	Active	43	0	0	DMP	Ground
Complex: Courthouse Butte									
Courthouse Butte	3	21	640	Abandoned	0	0	0	Woolley	Ground
Complex: Delaney Rim									
Delaney Rim 1	3	27	746	Active	13	0	0	DP (HWA)	Ground
Delaney Rim 1	4	3	650	Active	37	2	0	DP (HWA)	Ground
Delaney Rim 1	4	10	630	Active	6	0	0	DP (HWA)	Ground
Delaney Rim 1	4	17	640	Active	29	1	0	DP (HWA)	Ground
Delaney Rim 1	4	24	602	Active	32	0	0	DP (HWA)	Ground
Delaney Rim 2	3	27	0645	Active	64	0	15	DMP	Ground
Delaney Rim 2	4	3	725	Active	59	4	0	DMP	Ground
Delaney Rim 2	4	10	659	Active	7	0	0	DMP	Ground
Delaney Rim 2	4	17	605	Active	63	1	0	DMP	Ground
Delaney Rim 2	4	24	700	Active	62	0	0	DMP	Ground
Delaney Rim 3	3	27	733	Active	40	6	0	DP (HWA)	Ground
Delaney Rim 3	4	3	625	Active	40	4	0	DP (HWA)	Ground
Delaney Rim 3	4	10	729	Active	18	1	0	DP (HWA)	Ground
Delaney Rim 3	4	17	700	Active	36	1	0	DP (HWA)	Ground
Delaney Rim 3	4	24	625	Active	32	0	0	DP (HWA)	Ground
Complex: Duck Lake									
East Duck Lake	4	12	645	Active	32	0	0	Kaiser	Ground
East Duck Lake	4	20	645	Active	32	1	0	Kaiser	Ground
East Duck Lake	4	30	615	Active	0	0	0	Kaiser	Ground

Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Echo Springs									
5 Mile Lake	3	27	630	Inactive	0	0	0	JAS	Ground
5 Mile Lake	4	4	752	Inactive	0	0	0	LEB	Ground
5 Mile Lake	4	11	730	Inactive	0	0	0	LEB	Ground
5 Mile Lake	4	26	610	Inactive	0	0	0	DMP	Ground
5 Mile Lake	5	3	715	Inactive	0	0	0	DMP	Ground
North High Point	4	5	655	Active	0	0	0	Read	Ground
North High Point	4	15	704	Active	1	0	0	Read	Ground
North High Point	4	23	659	Active	3	0	0	Read	Ground
Standard Draw	4	6	626	Active	8	0	0	Read	Ground
Standard Draw	4	15	640	Active	8	0	0	Read	Ground
Standard Draw	4	23	636	Active	11	0	0	Read	Ground
Complex: Fort LaClede									
Fort LaClede	3	21	800	Active	82	14	0	Kenneda	Ground
Fort LaClede	4	24	700	Active	48	3	0	Kenneda	Ground
Fort LaClede	5	7	700	Active	15	7	0	Kenneda	Ground
Complex: Hangout Ridge									
Hangout Ridge	3	19	750	Active	18	6	0	Woolley	Ground
Standard Road	3	19	650	Active	5	0	1	Woolley	Ground
Complex: High Point									
High Point	4	12	730	Active	11	0	0	Kaiser	Ground
High Point	4	19	730	Active	9	0	0	Hugh	Ground
High Point	4	20	720	Active	12	0	0	Kaiser	Ground
High Point	4	26	715	Active	9	0	0	DMP	Ground
High Point	4	27	715	Active	0	0	0	JEN	Ground
High Point	4	30	705	Active	10	0	0	Kaiser	Ground
High Point	5	10	700	Active	6	0	0	DMP	Ground
Complex: Iron Pipe									
Iron Pipe	3	21	845	Active	31	1	0	Kenneda	Ground
Iron Pipe	4	24	700	Active	16	0	0	Kenneda	Ground
Iron Pipe	5	7	730	Active	8	0	0	Kenneda	Ground
Complex: Little Robber									
Little Robber	4	6	645	Active	0	0	0	Iversen	Ground
Little Robber	4	13	630	Active	17	0	0	Iversen	Ground
Little Robber	4	21	700	Active	48	0	0	Iversen	Ground
Little Robber	5	1	645	Active	33	0	0	Iversen	Ground
Complex: Lonnie's									
Lonnie's	4	15	750	Active	8	0	0	Woolley	Ground
Lonnie's	4	24	734	Active	23	0	0	Woolley	Ground
Complex: Mulligan Draw									
Mulligan Draw	4	9	700	Active	38	1	0	Noreleus	Ground
Mulligan Draw	4	16	700	Active	34	0	1	Noreleus	Ground
Mulligan Draw	4	23	710	Active	36	2	0	Noreleus	Ground

Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Mysterious									
Mysterious	4	6	710	Inactive	0	0	0	Iversen	Ground
Mysterious	4	13	740	Inactive	0	0	0	Iversen	Ground
Mysterious	4	22	715	Inactive	0	0	0	Iversen	Ground
Mysterious	5	1	710	Inactive	0	0	0	Iversen	Ground
Complex: N. Barrel Springs									
N. Barrel Springs	3	27	700	Active	4	0	0	JAS	Ground
N. Barrel Springs	4	19	605	Active	8	0	0	DMP	Ground
N. Barrel Springs	4	26	547	Active	5	0	0	DMP	Ground
N. Barrel Springs	5	3	630	Active	6	0	0	DMP	Ground
Complex: North Muddy Creek									
North Muddy Creek	3	27	740	Inactive	0	0	0	JAS	Ground
North Muddy Creek	4	17	655	Inactive	0	0	0	LEB	Ground
North Muddy Creek	4	19	725	Inactive	0	0	0	DMP	Ground
North Muddy Creek	5	4	715	Inactive	0	0	0	DMP	Ground
Complex: Red Lakers									
Red Lakers	4	4	704	Active	8	0	0	Read	Ground
Red Lakers	4	12	640	Active	21	0	0	Read	Ground
Red Lakers	4	22	636	Active	10	0	0	Read	Ground
Complex: Shallow Creek									
Shallow Creek	4	7	645	Active	18	0	0	Woolley	Ground
Shallow Creek	4	16	755	Active	16	0	0	Norelius	Ground
Shallow Creek	4	16	605	Active	15	0	0	Woolley	Ground
Shallow Creek	4	24	555	Active	17	1	0	Woolley	Ground
Shallow Creek	5	1	557	Active	17	5	0	Woolley	Ground
Complex: Soap Holes									
Soap Holes	3	19	712	Active	23	0	0	Woolley	Ground
South Hangout	3	19	730	Abandoned	0	0	0	Woolley	Ground
South Hangout	4	13	745	Abandoned	0	0	0	Iversen	Ground
Complex: Strom Reservoir									
Strom Reservoir	4	13	741	Inactive	0	0	0	Iversen	Ground
Strom Reservoir	4	21	730	Inactive	0	0	0	Iversen	Ground
Strom Reservoir	5	1	630	Inactive	0	0	0	Iversen	Ground
Upper Red Creek	4	6	730	Active	0	0	0	Iversen	Ground
Upper Red Creek	4	13	730	Active	31	0	0	Iversen	Ground
Complex: Willow Cr. Rim									
Willow Cr. Rim 1	4	7	659	Active	32	0	0	Woolley	Ground
Willow Cr. Rim 1	4	16	605	Active	33	0	0	Woolley	Ground
Willow Cr. Rim 1	4	24	555	Active	34	1	0	Woolley	Ground
Willow Cr. Rim 1	5	1	616	Active	30	0	0	Woolley	Ground
Willow Cr. Rim 2	4	7	730	Active	11	0	0	Woolley	Ground
Willow Cr. Rim 2	4	16	631	Active	7	0	0	Woolley	Ground
Willow Cr. Rim 2	4	24	617	Active	6	0	0	Woolley	Ground
Willow Cr. Rim 2	5	1	647	Active	12	0	0	Woolley	Ground

Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Windmill Draw									
Windmill Draw	4	9	750	Inactive	0	0	0	Norelus	Ground
Windmill Draw	4	23	820	Inactive	0	0	0	Norelus	Ground
Management Area: 24									
Complex: Badger Creek									
1782181	4	13	0630	Unknown	0	0	0	Withroder	Ground
1782181	4	19	0600	Unknown	0	0	0	Withroder	Ground
Complex: Beaver Hills									
1482221	4	5	0640	Abandoned	0	0	0	Schultz	Ground
1482243	4	11	0625	Active	13	3	2	Schultz	Ground
Complex: Buck Springs									
1783062	4	12	0615	Destroyed	0	0	0	Withroder	Ground
1783062	4	19	0640	Destroyed	0	0	0	Withroder	Ground
Complex: Centennial 11									
1477074	5	1	0700	Abandoned	0	0	0	Haley	Ground
1477074	5	2	0712	Abandoned	0	0	0	Haley	Ground
1477074	5	3	0720	Abandoned	0	0	0	Haley	Ground
Complex: French Creek Road									
1582282	4	16	0630	Active	29	12	1	Schultz	Ground
Complex: Jack Hill 1									
1981293	4	13	0645	Unknown	0	0	0	Schultz	Ground
Complex: Jelm Mountain 21									
1277023	5	1	0555	Abandoned	0	0	0	Haley	Ground
1277023	5	2	0553	Abandoned	0	0	0	Haley	Ground
1277023	5	3	0543	Abandoned	0	0	0	Haley	Ground
1277114	5	1	0550	Unknown	0	0	0	Haley	Ground
1277114	5	2	0559	Unknown	0	0	0	Haley	Ground
1277114	5	3	0555	Unknown	0	0	0	Haley	Ground
Complex: Jelm Mountain 23									
1376324	5	1	0610	Abandoned	0	0	0	Haley	Ground
1376324	5	2	0613	Unknown	0	0	0	Haley	Ground
1376324	5	3	0610	Unknown	0	0	0	Haley	Ground
Complex: Jelm Mountain 24									
1376351	5	1	0620	Inactive	0	0	0	Haley	Ground
1376351	5	2	0625	Inactive	0	0	0	Haley	Ground
1376351	5	3	0620	Inactive	0	0	0	Haley	Ground
Complex: Lake Creek									
1883112	4	12	0715	Active	4	0	0	Burton	Ground
1883133	4	12	0700	Active	19	6	0	Burton	Ground
1883152	4	12	0634	Active	3	0	0	Burton	Ground
Complex: Pass Creek 24									
1983074	4	10	0635	Active	29	3	0	Schultz	Ground
Complex: Pass Creek 25									
2083292	4	10	0700	Abandoned	0	0	0	Schultz	Ground

Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Pass Creek 26									
1983302	4	12	0820	Abandoned	0	0	0	Burton	Ground
Complex: Pass Creek 29									
1984014	4	10	0650	Unknown	0	0	0	Schultz	Ground
Complex: Sixteen Gulch									
1583113	4	6	0645	Unknown	0	0	0	Schultz	Ground
1583243	4	6	0630	Unknown	0	0	0	Schultz	Ground
1583351	4	6	0710	Inactive	0	0	0	Schultz	Ground
Complex: Thode Creek 1									
1981343	4	13	0700	Unknown	0	0	0	Schultz	Ground
Management Area: 25									
Complex: Badwater									
Badwater	4	6	0745	Active	1			Lionberger (B	Ground
Badwater	4	16	0655	Active	15			Lionberger (B	Ground
Badwater	4	23	0648	Active	37	2		Lionberger (B	Ground
P & R	4	6	0640	Active	0			Lionberger (B	Ground
P & R	4	16	0620	Active	1			Lionberger (B	Ground
P & R	4	23	0745	Active	83	3		Lionberger (B	Ground
South Seaverson	4	7	0730	Unknown	0			Lionberger (B	Ground
South Seaverson	4	14	0630	Unknown	0			Kim Olson	Ground
South Seaverson	4	16	0732	Unknown	0			Lionberger (B	Ground
South Seaverson	4	23	0635	Unknown	0			Lionberger (B	Ground
South Seaverson	4	26	0615	Unknown	0			Kim Olson	Ground
West Badwater	4	6	0800	Unknown	0			Lionberger (B	Ground
West Badwater	4	16	0712	Unknown	0			Lionberger (B	Ground
West Badwater	4	23	0718	Inactive	0			Lionberger (B	Ground
Complex: Beaver Creek									
1482163	4	5	0650	Abandoned	0	0	0	Schultz	Ground
Complex: Big Bear									
1381171	4	11	0715	Active	16	1	0	Schultz	Ground
Complex: Big Creek 63									
1281031	4	5	0710	Abandoned	0	0	0	Schultz	Ground
Complex: Blydenburg									
1785042	4	5	0707	Active	25	2	0	Burton	Ground
1785042	4	17	0640	Active	17	0	0	Burton	Ground
1785102	4	5	0730	Inactive	0	0	0	Burton	Ground
1785102	4	17	0648	Inactive	0	0	0	Burton	Ground
Complex: Bridger Pass									
Bridger Pass	4	20	0700	Unknown	0			Kim Olson	
Complex: Cherokee Mine									
Cherokee Mine	4	2	0700	Active	23	5		Blake, Hebert	Ground
Cherokee Mine	4	11	0600	Active	24			Jennifer Hebe	Ground
Cherokee Mine	4	19	0610	Active	17			Hugh Faust (T	Ground
Cherokee Mine	4	27	0608	Active	18	1		Jennifer Hebe	Ground

Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Cherokee Towers									
Cherokee Towers	4	4	0700	Active	0			Erik Norelius (	Ground
Cherokee Towers	4	11	0620	Active	5			Erik Norelius (	Ground
Cherokee Towers	4	19	0620	Active	5			Erik Norelius (	Ground
Complex: Continental Divide									
Continental Divide	4	4	0630	Active	110	16		Ben Toole, Lio	Ground
Continental Divide	4	11	0650	Active	86	3		Ben Toole (BL	Ground
Continental Divide	4	19	0720	Active	10			Erik Norelius (	Ground
Continental Divide	4	26	0720	Active	57	3		Ben Toole (BL	Ground
Continental Divide Satellite	4	4	0730	Active	0			Ben Toole (BL	Ground
Continental Divide Satellite	4	11	0720	Active	8			Ben Toole (BL	Ground
Continental Divide Satellite	4	19	0740	Active	9			Erik Norelius (	Ground
Holler Divide	4	4	0615	Unknown	0			Ben Toole (BL	Ground
Holler Divide	4	11	0635	Unknown	0			Ben Toole (BL	Ground
Holler Divide	4	14	0700	Unknown	1			Kim Olson	Ground
Holler Divide	4	19	0700	Unknown	0			Erik Norelius (	Ground
Holler Divide	4	26	0705	Unknown	0			Ben Toole (BL	Ground
Holler Divide	5	1	0610	Unknown	0			Kim Olson	Ground
Complex: Cow Creek 31									
1684133	4	10	0630	Active	16	4	0	Burton	Ground
1684133	4	16	0730	Active	34	1	0	Burton	Ground
1684133	4	29	0648	Active	33	0	0	Burton	Ground
1684253	4	10	0654	Active	1	0	0	Burton	Ground
1684253	4	16	0710	Active	11	0	0	Burton	Ground
1684253	4	29	0715	Active	11	0	0	Burton	Ground
1684273	4	10	0720	Inactive	0	0	0	Burton	Ground
1684273	4	16	0650	Inactive	0	0	0	Burton	Ground
1684273	4	29	0735	Inactive	0	0	0	Burton	Ground
1684331	4	10	0730	Inactive	0	0	0	Burton	Ground
1684331	4	16	0639	Inactive	0	0	0	Burton	Ground
1684353	4	10	0710	Inactive	0	0	0	Burton	Ground
1684353	4	16	0700	Inactive	0	0	0	Burton	Ground
1684353	4	29	0726	Inactive	0	0	0	Burton	Ground
Complex: Dirty Man									
Dirty Man	5	9	657	Unknown	0	0	0	Woolley	Air
Complex: Dry Cow									
Dry Cow 2	4	16	730	Unknown	0	0	0	Blomquist	Ground
Dry Cow 3	3	23	733	Active	1	1	0	Toole/Norelins	Ground
Dry Cow 4	4	9	644	Active	23	0	0	Blomquist	Ground
Dry Cow 4	4	16	640	Active	31	1	0	Blomquist	Ground
Dry Cow 4	4	24	618	Active	28	1	0	Blomquist	Ground
Complex: Emigrant Creek									
Emigrant Creek	4	20	0640	Unknown	0			Kim Olson	Ground

Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Fillmore Creek									
East Seaverson	4	4	0630	Active	42	19		Kim Olson	Ground
East Seaverson	4	13	0625	Active	43	3		Kim Olson	Ground
East Seaverson	4	18	0620	Active	39	5		Kim Olson	Ground
East Seaverson	4	25	0620	Active	40	0		Kim Olson	Ground
East Seaverson	4	26	0615	Active	39	4		Kim Olson	Ground
East Seaverson	4	27	0605	Active	39	6		Kim Olson	Ground
Fillmore Creek	4	4	0650	Active	50	5		Kim Olson	Ground
Fillmore Creek	4	13	0645	Active	44	0		Kim Olson	Ground
Fillmore Creek	4	18	0635	Active	43	1		Kim Olson	Ground
Fillmore Creek	4	25	0635	Active	16			Kim Olson	Ground
Fillmore Creek	4	26	0630	Active	48	3		Kim Olson	Ground
Fillmore Creek	4	27	0620	Active	47	1		Kim Olson	Ground
West Fillmore Ranch	4	4	0705	Active	26	4		Kim Olson	Ground
West Fillmore Ranch	4	13	0658	Active	25	1		Kim Olson	Ground
West Fillmore Ranch	4	18	0650	Active	24			Kim Olson	Ground
West Fillmore Ranch	4	25	0650	Active	25	5		Kim Olson	Ground
West Fillmore Ranch	4	26	0645	Active	0			Kim Olson	Ground
West Fillmore Ranch	4	27	0637	Active	30	5		Kim Olson	Ground
Complex: Fillmore Ranch									
Fillmore Ranch	4	4	0730	Active	62			Kim Olson	Ground
Fillmore Ranch	4	13	0715	Active	25			Kim Olson	Ground
Fillmore Ranch	4	18	0710	Active	26			Kim Olson	Ground
Fillmore Ranch	4	25	0705	Active	38			Kim Olson	Ground
Fillmore Ranch	4	26	0700	Active	62	2		Kim Olson	Ground
Fillmore Ranch	4	27	0700	Active	69	5		Kim Olson	Ground
Complex: Fox Farm									
Fox Farm	4	27	0830	Active	11	2		Kim Olson	Ground
Complex: Garden Gulch									
Cow Crk. Butte Rd.	4	11	645	Active	36	2	0	Blomquist	Ground
Cow Crk. Butte Rd.	4	18	645	Active	1	0	0	Blomquist	Ground
Cow Crk. Butte Rd.	4	27	615	Active	34	3	0	Kaiser	Ground
Garden Gulch 2	4	11	705	Active	45	1	0	Blomquist	Ground
Garden Gulch 2	4	18	705	Active	40	0	0	Blomquist	Ground
Garden Gulch 2	4	27	630	Active	48	1	0	Kaiser	Ground
Garden Gulch 3	4	11	651	Unknown	0	0	0	Blomquist	Ground
Hay Gulch	5	9	620	Unknown	0	0	0	Woolley	Air
Complex: Goode Reservoir									
1786163	4	6	0700	Active	98	74	0	Burton	Ground
1786163	4	20	0615	Active	120	6	0	Burton	Ground
Complex: Haines Reservoir									
1784314	4	9	0630	Unknown	0	0	0	Burton	Ground
1784314	4	20	0730	Unknown	0	0	0	Burton	Ground
1785362	4	9	0620	Active	33	0	0	Burton	Ground
1785362	4	20	0720	Active	32	2	0	Burton	Ground

Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Hillside									
Hillside	4	23	0625	Unknown	10			Bill Brinegar	Ground
West Junction	4	23	0700	Unknown	0			Bill Brinegar	Ground
Complex: Holler Draw									
Holler Draw 1	4	6	715	Inactive	0	0	0	Toole	Ground
Holler Draw 1	4	26	815	Inactive	0	0	0	Toole	Ground
Soap Hole Wash	4	26	755	Active	4	0	0	Toole	Ground
Complex: Hugus Draw									
Hugus Draw	5	3	0800	Active	0			Bill Brinegar	Ground
Complex: Iron Springs Draw									
Iron Springs Draw	5	3	0710	Active	25			Bill Brinegar	Ground
South Hugus	5	3	0645	Unknown	0			Bill Brinegar	Ground
Complex: Jack Creek Road									
1785282	4	6	0750	Inactive	0	0	0	Burton	Ground
1785282	4	13	0720	Inactive	0	0	0	Burton	Ground
1785282	4	17	0700	Inactive	0	0	0	Burton	Ground
1785282	4	20	0700	Inactive	0	0	0	Burton	Ground
1785331	4	6	0742	Active	45	3	0	Burton	Ground
1785331	4	13	0720	Active	52	0	0	Burton	Ground
1785331	4	17	0700	Active	49	0	0	Burton	Ground
1785331	4	20	0700	Active	53	2	0	Burton	Ground
Complex: Lake Bed									
Lake Bed	4	19	0700	Active	11			Kim Olson	Ground
Lake Bed	5	9		Active	0			Mike Calton (	Ground
Lake Bed	5	15	0620	Active	0			Mike Calton (	Ground
Complex: Little Beaver									
Little Beaver	5	13	0645	Active	15			Greg Hiatt	Ground
Complex: Little Muddy									
East Muddy Divide	5	13	0659	Unknown	0			Greg Hiatt	Ground
Littlefield	5	13	0655	Unknown	0			Greg Hiatt	Ground
Complex: Little Sage									
Little Sage Creek	4	20	0615	Active	21			Kim Olson	Ground
Little Sage Reservoir	4	20	0610	Unknown	0			Kim Olson	Ground
Complex: Little Savery									
5 Buttes	5	9	640	Unknown	0	0	0	Woolley	Air
Bird Gulch 1	5	9	645	Unknown	0	0	0	Woolley	Air
Bird Gulch 2	5	9	645	Unknown	0	0	0	Woolley	Air
Ketchum Buttes	5	9	640	Unknown	0	0	0	Woolley	Air
Little Savery 1	5	9	635	Unknown	0	0	0	Woolley	Air
Complex: Miller Hill									
Miller Hill	5	9	605	Active	25	0	0	Woolley	Air
Miller Hill	5	13	0700	Active	16			Greg Hiatt	Ground

Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Ne Muddy Mtn									
Upper Cottonwood	4	10	830	Inactive	0	0	0	Iversen	Ground
Upper Cottonwood	4	17	700	Inactive	0	0	0	Iversen	Ground
Complex: North Fork									
North Fork	5	9	650	Active	12	0	0	Woolley	Air
Complex: North Fork Savery									
North Fork Savery	5	9	650	Unknown	0	0	0	Woolley	Air
Complex: Olson Divide									
Olson Divide	4	11	0800	Unknown	0			Ben Toole (BL	Ground
Olson Divide	4	18	0740	Unknown	0			Kim Olson	Ground
Olson Divide	4	27	0710	Unknown	0			Ben Toole (BL	Ground
Complex: Overland Trail									
1984294	4	11	0635	Abandoned	0	0	0	Burton	Ground
1984312	4	11	0644	Active	18	1	0	Burton	Ground
1984332	4	11	0620	Active	50	1	0	Burton	Ground
Complex: Overland Trail North									
1984172	4	11	0710	Active	22	0	0	Burton	Ground
Complex: Peach Orchard									
Peach Orchard	3	20	720	Active	31	9	0	Woolley	Ground
Complex: Pick Springs									
1885223	4	5	0640	Active	19	0	0	Burton	Ground
Complex: Pipeline									
Dad Basin 1	4	11	800	Unknown	0	0	0	Blomquist	Ground
Dad Junipers	3	12	612	Active	2	0	0	Blomquist/Nor	Ground
East Dad Road	3	12	800	Inactive	0	0	0	Norelus/Blom	Ground
East Dad Road	4	9	707	Inactive	0	0	0	Blomquist	Ground
East Dad Road	4	11	615	Inactive	0	0	0	Blomquist	Ground
Pipeline	4	9	740	Active	5	0	0	Blomquist	Ground
Complex: Ram Canyon									
Midnight Valley	4	20	0630	Active	17	1		Chris & Riley	Ground
Midnight Valley	4	28	0630	Active	28	3		Chris & Tyler	Ground
Midnight Valley	5	10	0620	Active	20	2		Chris Otto (BL	Ground
Ram Canyon	4	20	0630	Active	21	2		Chris & Riley	Ground
Ram Canyon	4	28	0650	Active	71	7		Chris & Tyler	Ground
Ram Canyon	5	10	0645	Active	71	1		Chris Otto (BL	Ground
Scottys Peak	4	20	0800	Active	14	1		Chris & Riley	Ground
Scottys Peak	4	28	0730	Active	0			Chris & Tyler	Ground
Scottys Peak	5	10	0715	Active	24	2		Chris Otto (BL	Ground

Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Red Rim									
Red Rim	3	5	0815	Active	17			Erik Norelius (	Ground
Red Rim	3	22	0650	Active	27	16		Erik Norelius,	Ground
Red Rim	4	6	0710	Active	37	4	1	Mike Murry (B	Ground
Red Rim	4	17	0640	Active	23			Mike Murry (B	Ground
Red Rim Basin	4	6	0650	Unknown	0			Mike Murry (B	Ground
Red Rim Basin	4	17	0620	Unknown	0			Mike Murry (B	Ground
Red Rim Basin	5	3	0700	Unknown	0			Mike Murry (B	Ground
Complex: Rendle Rim									
Rendle Rim	5	9	630	Unknown	0	0	0	Woolley	Air
Complex: Rye Gulch									
Rye Gulch	4	10	700	Inactive	0	0	0	Iversen	Ground
Rye Gulch	4	20	615	Inactive	0	0	0	Iversen	Ground
Sugarloaf Mtn.	4	10	720	Abandoned	0	0	0	Iversen	Ground
Sugarloaf Mtn.	4	20	630	Abandoned	0	0	0	Iversen	Ground
Complex: Sage Creek Basin									
Sage Creek Basin	5	13	0623	Active	69	1		Greg Hiatt	Ground
Complex: Sage Creek Ranch									
Sage Creek Ranch	5	13	0545	Active	22			Greg Hiatt	Ground
Complex: Sand Basin									
2084341	4	10	0710	Active	17	1	0	Schultz	Ground
Complex: Savery Creek									
Big Gulch 1	5	9	728	Unknown	0	0	0	Woolley	Air
Big Gulch 2	5	9	728	Unknown	0	0	0	Woolley	Air
Boyer International 1	3	26	735	Active	6	0	0	Woolley	Ground
Boyer International 1	5	9	721	Active	4	0	0	Woolley	Air
Coal Bank Wash	4	10	730	Active	16	1	0	Iverson	Ground
Dolan Mesa	5	9	718	Unknown	0	0	0	Woolley	Air
Dutch Joe 1	5	9	716	Unknown	0	0	0	Woolley	Air
Dutch Joe 2	4	20	745	Inactive	0	0	0	Iversen	Ground
Dutch Joe 2	4	28	700	Inactive	0	0	0	Iversen	Ground
Dutch Joe 2	5	7	630	Inactive	0	0	0	Iversen	Ground
Dutch Joe 3	5	9	715	Unknown	0	0	0	Woolley	Air
Negro Creek 1	5	9	722	Unknown	0	0	0	Woolley	Air
Savery	5	9	718	Unknown	0	0	0	Woolley	Air
Complex: Seaverson									
Dike	4	4	0651	Unknown	0			Randy Blake,	Ground
Dike	4	19	0711	Unknown	0			TRC consulta	Ground
Dike	4	27	0729	Unknown	0			Jennifer Hebe	Ground
West Seaverson	4	4	0645	Unknown	0			Jennifer Hebe	Ground
West Seaverson	4	11	0800	Unknown	0			Jennifer Hebe	Ground
West Seaverson	4	19	0645	Unknown	0			Hugh Faust (T	Ground
West Seaverson	4	27	0750	Unknown	0			Jennifer Hebe	Ground

Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Separation Creek									
Separation Creek	4	26	0800	Active	1			Kim Olson	Ground
Separation Creek	4	27	0730	Active	1			Kim Olson	Ground
Twentymile Road	3	5	0640	Active	2			Erik Norelius (	Ground
Twentymile Road	4	25	0815	Active	15			Kim Olson	Ground
Complex: Separation Hilltop									
Separation Hilltop	3	22	0800	Active	33	45		Erik Norelius,	Ground
Complex: Smiley Draw									
Cherokee Creek 1	4	12	800	Inactive	0	0	0	Iversen	Ground
Cherokee Creek 1	4	19	630	Inactive	0	0	0	Iversen	Ground
Wild Horse Basin 2	4	9	620	Active	130	12	0	LSRV Science	Ground
Wild Horse Basin 2	4	16	616	Active	97	5	0	LSRV Science	Ground
Wild Horse Basin 2	4	23	616	Active	91	4	0	LSRV Science	Ground
Wild Horse Basin 2	5	1	615	Active	67	18	0	LSRV Science	Ground
Wild Horse Basin 3	4	12	630	Inactive	0	0	0	Iversen	Ground
Wild Horse Basin 3	4	19	600	Inactive	0	0	0	Iversen	Ground
Complex: Smith Draw									
Smith Draw	3	20	0630	Unknown	0			Bill Brinegar	Ground
Smith Draw	5	3	0600	Unknown	0			Bill Brinegar	Ground
Complex: Snow Creek									
1685214	4	9	0705	Active	23	0	0	Burton	Ground
1685214	4	22	0633	Active	31	1	0	Burton	Ground
1685232	4	9	0654	Active	3	0	0	Burton	Ground
1685232	4	22	0626	Active	6	0	0	Burton	Ground
Complex: South Cherokee									
South Cherokee	4	4	0830	Active	12			Blake, Hebert,	Ground
South Cherokee	4	19	0625	Active	17			Kim Olson	Ground
Complex: South Spring Creek									
1585153	4	4	0722	Active	5	0	0	Burton	Ground
1585153	4	16	0615	Active	6	0	0	Burton	Ground
Complex: Sulphur Springs									
Sulphur Springs	5	9	610	Unknown	0	0	0	Woolley	Air
Complex: SW Riner									
SW Riner	4	19	0745	Unknown	0			Kim Olson	Ground
SW Riner	5	1	0715	Active	0			Kim Olson	Ground
SW Riner	5	9		Active	0			Mike Calton (	Ground
SW Riner	5	15	0530	Unknown	0			Mike Calton (	Ground

Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Wild Cow									
Cherokee Creek 2	4	6	640	Active	17	0	0	Woolley	Ground
Cherokee Creek 2	4	13	629	Active	36	0	0	Woolley	Ground
Cherokee Creek 2	4	20	620	Active	107	6	0	Woolley	Ground
Cherokee Creek 2	4	28	615	Active	75	6	0	Woolley	Ground
Upper Wild Cow Creek	4	6	705	Active	61	0	0	Woolley	Ground
Upper Wild Cow Creek	4	13	655	Active	45	0	0	Woolley	Ground
Upper Wild Cow Creek	6	20	645	Active	60	1	0	Woolley	Ground
Upper Wild Cow Creek	6	28	641	Active	47	0	0	Woolley	Ground
Complex: Willows									
Sand Dunes 1	5	9	615	Unknown	0	0	0	Woolley	Air
Willows 2	4	10	640	Active	65	0	0	Woolley	Ground
Willows 2	4	18	630	Active	84	1	0	Woolley	Ground
Willows 2	4	25	634	Active	60	5	0	Woolley	Ground
Willows 2	5	2	612	Active	27	6	0	Woolley	Ground
Willows 3	4	5	650	Active	30	0	0	Woolley	Ground
Willows 3	4	10	650	Active	12	0	0	Woolley	Ground
Willows 3	4	18	640	Active	14	0	0	Woolley	Ground
Willows 3	4	25	645	Active	17	1	0	Woolley	Ground
Willows 3	5	2	620	Active	5	0	0	Woolley	Ground
Management Area: 45									
Complex: Annis									
Annis	4	29	0645	Unknown	0			Bill Brinegar	Ground
Complex: Arkansas									
Arkansas	5	1	0701	Active	29	1		Greg Hiatt	Ground
Arkansas	5	12	0547	Active	13			Greg Hiatt	Ground
Point East	5	1	0657	Unknown	0			Greg Hiatt	Ground
Complex: Arkansas Basin									
Arkansas Basin	5	1	0723	Active	0			Greg Hiatt	Ground
Arkansas Basin	5	12	0605	Active	64	5		Greg Hiatt	Ground
Complex: Boggy Meadows Rim									
Boggy Meadows Rim	4	21	0658	Unknown	0			Greg Hiatt	Ground
Boggy Meadows Rim	4	28	0639	Unknown	0			Greg Hiatt	Ground
Complex: Cheyenne									
Coal Springs	4	30	0611	Active	29			Greg Hiatt	Ground
Coal Springs	5	10	0625	Active	34			Greg Hiatt	Ground
ID Airstrip	4	30	0556	Active	0			Greg Hiatt	Ground
Rankin	4	30	0624	Active	36	2		Greg Hiatt	Ground
Rankin	5	4	0537	Active	41	1		Greg Hiatt	Ground
Rankin	5	10	0616	Active	31			Greg Hiatt	Ground
Saltiel	4	30	0707	Active	1			Greg Hiatt	Ground
Saltiel	5	4	0557	Active	0			Greg Hiatt	Ground
Saltiel	5	10	0534	Active	4	4		Greg Hiatt	Ground

Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Corral Creek									
Corral Creek	4	29	0650	Active	45			Greg Hiatt	Ground
Complex: Dry Ditch									
Dry Ditch	4	29	0722	Active	28	2		Greg Hiatt	Ground
Complex: East Ninemile									
East Ninemile	4	3	0715	Active	14	3		Bill Brinegar	Ground
East Ninemile	4	13	0700	Active	47			Bill Brinegar	Ground
East Ninemile	4	24	0700	Active	42			Bill Brinegar	Ground
East Ninemile	5	8	0545	Active	53	5		Bill Brinegar	Ground
Complex: Ferris									
Ferris	3	13	1130	Active	25	4		Mike Murry (B	Ground
Ferris	4	12	0807	Active	19	2		Greg Hiatt	Ground
Complex: Hatchet									
Boggy Meadows North	4	4	0710	Active	2			Greg Hiatt	Ground
Boggy Meadows North	4	12	0710	Active	39	2		Greg Hiatt	Ground
Boggy Meadows North	4	21	0639	Active	37			Greg Hiatt	Ground
Boggy Meadows North	4	28	0614	Active	38	1		Greg Hiatt	Ground
South Hatchet	4	4	0717	Active	32			Greg Hiatt	Ground
South Hatchet	4	12	0721	Active	34			Greg Hiatt	Ground
South Hatchet	4	21	0649	Active	33	1		Greg Hiatt	Ground
South Hatchet	4	28	0627	Active	28	3		Greg Hiatt	Ground
Complex: Little Sand Spring									
Little Sand Spring	4	4	0656	Unknown	0			Greg Hiatt	Ground
Little Sand Spring	4	12	0658	Unknown	0			Greg Hiatt	Ground
Little Sand Spring	4	19	0645	Unknown	0			Greg Hiatt	Ground
Little Sand Spring	4	21	0618	Unknown	0			Greg Hiatt	Ground
Little Sand Spring	4	28	0603	Unknown	0			Greg Hiatt	Ground
Ohio	4	4	0653	Active	42	32		Greg Hiatt	Ground
Ohio	4	12	0655	Active	46	3		Greg Hiatt	Ground
Ohio	4	19	0639	Active	2			Greg Hiatt	Ground
Ohio	4	21	0615	Active	41	1		Greg Hiatt	Ground
Ohio	4	28	0600	Active	33	2		Greg Hiatt	Ground
Complex: Little Shoe									
Little Shoe	4	29	0813	Active	0			Greg Hiatt	Ground
Little Shoe	4	29	0630	Active	28	2		Greg Hiatt	Ground
Complex: Lone Haystack									
Lone Haystack	4	29	0601	Unknown	0			Greg Hiatt	Ground
Complex: Mahoney									
Mahoney Dome	4	4	0634	Active	28	23		Greg Hiatt	Ground
Mahoney Dome	4	12	0623	Active	22	2		Greg Hiatt	Ground
Mahoney Dome	4	19	0618	Active	27			Greg Hiatt	Ground
Mahoney Dome	4	21	0556	Active	32	3		Greg Hiatt	Ground
Mahoney Dome	4	28	0533	Active	34			Greg Hiatt	Ground

Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: NW Haystack									
NW Haystack	4	14	0656	Active	116	4		Greg Hiatt	Ground
Complex: Rawlins									
North Rawlins	4	11	0708	Unknown	0			Bill Brinegar	Ground
North Rawlins	5	8	0645	Active	12	1		Bill Brinegar	Ground
Rawlins	4	11	0730	Unknown	0			Bill Brinegar	Ground
Rawlins	5	8	0700	Unknown	0			Bill Brinegar	Ground
Complex: Riddle									
Riddle Creek	4	19	0711	Unknown	0			Greg Hiatt	Ground
Riddle Cut	4	19	0714	Active	38	2		Greg Hiatt	Ground
Complex: Rinshaw									
Rinshaw Cabin	4	4	0735	Active	116	7		Greg Hiatt	Ground
Rinshaw Cabin	4	12	0738	Active	141	1		Greg Hiatt	Ground
Rinshaw Cabin	4	21	0709	Active	121			Greg Hiatt	Ground
Rinshaw Cabin	4	28	0647	Active	121	3		Greg Hiatt	Ground
Complex: Rush Creek									
Rush Creek	5	1	0610	Active	97	4	1	Greg Hiatt	Ground
Rush Creek	5	8	0601	Active	154	18		Greg Hiatt	Ground
Complex: Sandhole									
Red Ridge	4	21	0759	Unknown	0			Greg Hiatt	Ground
Sandhole	4	21	0744	Active	18			Greg Hiatt	Ground
Complex: Taper									
Coal Creek	4	14	0722	Unknown	0			Greg Hiatt	Ground
Crossroads Ridge	4	14	0721	Active	56			Greg Hiatt	Ground
Taper	4	14	0723	Unknown	0			Greg Hiatt	Ground
Complex: Tin Can									
Tin Can	4	14	0627	Active	38			Greg Hiatt	Ground
Management Area: 9									
Complex: Alkali Well									
Alkali Well	4	27	0656	Active	49	1		Greg Hiatt	Ground
Complex: Arapahoe									
Arapahoe	4	23	0625	Active	109	1		Greg Hiatt	Ground
Complex: Bairoil									
Conners	3	26	0711	Active	10			Greg Hiatt	Ground
Complex: Bare Ring Butte									
Bare Ring Butte	4	10		Active	81			Valerie Dobric	Ground
Bare Ring Butte	4	18		Active	125			Valerie Dobric	Ground
Bare Ring Butte	4	26		Active	119			Valerie Dobric	Ground
Bare Ring Butte	5	15	0549	Active	61	5		Greg Hiatt	Ground
Complex: Basin Well									
Basin Well	4	27	0722	Unknown	0			Greg Hiatt	Ground

Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Bastard Butte									
Bastard Butte	4	5	0816	Active	1			Greg Hiatt	Ground
Bastard Butte	5	9	0546	Active	2			Greg Hiatt	Ground
Bastard Butte	5	11	0638	Active	0			Greg Hiatt	Ground
Complex: Black Rock Flat									
Black Rock Flat	4	26	0733	Active	0			Greg Hiatt	Ground
Black Rock Flat	4	27	0609	Active	26	3		Greg Hiatt	Ground
Complex: Bobs									
Bobs	3	24	0703	Active	74	41		Greg Hiatt	Ground
Bobs	4	3	0718	Active	68	6		Rhen Etzelmill	Ground
Complex: Buck Spring									
Buck Spring	3	27	0727	Active	24			Greg Hiatt	Ground
Complex: Bull Springs									
Bull Springs	4	3	0626	Active	15	4		Greg Hiatt	Ground
Bull Springs	4	10	0643	Active	8	1		Greg Hiatt	Ground
Bull Springs	4	11	0634	Active	15	1		Greg Hiatt	Ground
Bull Springs	4	18	0600	Active	15			Greg Hiatt	Ground
Bull Springs	4	25	0602	Active	16	1		Greg Hiatt	Ground
Complex: Chain Lakes Rim									
Chain Lakes Rim	3	28	0658	Active	55	10		DMP (Hayden	Ground
Chain Lakes Rim	4	4	0651	Active	30			DMP (Hayden	Ground
Chain Lakes Rim	4	11	0610	Active	55	4		DMP (Hayden	Ground
Chain Lakes Rim	4	13	0712	Active	60	3		Greg Hiatt	Ground
Chain Lakes Rim	4	18	0710	Active	57	1		DMP (Hayden	Ground
Chain Lakes Rim	4	25	0555	Active	61	5		DMP (Hayden	Ground
Chain Lakes Rim	5	4	0605	Active	49	1		DMP (Hayden	Ground
Complex: Chicken Spring									
Chicken Spring	4	3	0716	Active	134	95		Greg Hiatt	Ground
Chicken Spring	4	10	0727	Active	86	2		Greg Hiatt	Ground
Chicken Spring	4	11	0708	Active	162	8		Greg Hiatt	Ground
Chicken Spring	4	18	0650	Active	181	3		Greg Hiatt	Ground
Chicken Spring	4	25	0640	Active	158	8		Greg Hiatt	Ground
Complex: Continental Divide									
Continental Divide	3	4	0730	Unknown	0			Greg Hiatt	Ground
Continental Divide	3	9	0656	Unknown	0			Greg Hiatt	Ground
Continental Divide	3	24	0726	Active	1	1		Greg Hiatt	Ground
Complex: Corral									
Corral	3	8	0718	Unknown	0			Greg Hiatt	Ground
Corral	4	15	0703	Unknown	0			Greg Hiatt	Ground
Complex: Cow Spring									
Cow Spring	3	27	0656	Active	22	2		Greg Hiatt	Ground
Willow Spring	3	27	0657	Unknown	0			Greg Hiatt	Ground
Complex: Crooked Well									
Crooked Well	3	25	0744	Unknown	0			Greg Hiatt	Ground

Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Discover									
Discover	3	13	0830	Active	37			Greg Hiatt	Ground
Discover Satellite	3	13	0854	Active	2			Greg Hiatt	Ground
Complex: Eagles Nest									
Eagles Nest	4	5	0723	Active	17	1		Greg Hiatt	Ground
Eagles Nest	4	16	0632	Active	12			Greg Hiatt	Ground
Complex: Eagles Nest Draw									
Eagles Nest Draw	3	13	0919	Active	10			Greg Hiatt	Ground
Eagles Nest Draw	3	25	0822	Active	14	8		Greg Hiatt	Ground
Sand Gully	3	25	0825	Active	84	6		Greg Hiatt	Ground
Complex: Eagles Nest Fence									
Eagles Nest Fence	4	22	0642	Active	132			Greg Hiatt	Ground
Texas Oil	4	22	0633	Unknown	0			Greg Hiatt	Ground
Complex: East Antelope									
East Antelope	4	17	0615	Active	64			Greg Hiatt, Bill	Ground
Complex: East Luman									
East Luman	3	15	0920	Unknown	0			Kaiser (BLM)	Ground
East Luman	4	11	0655	Unknown	0			Kaiser (BLM)	Ground
East Luman	4	18	0650	Unknown	0			Kaiser (BLM)	Ground
East Luman	4	25	0642	Unknown	0			Kaiser (BLM)	Ground
Complex: Fenced Well									
Fenced Well	3	9	0706	Active	32			Greg Hiatt	Ground
Fenced Well	3	24	0806	Active	38	5		Greg Hiatt	Ground
Fenced Well	4	13	0636	Active	36			Greg Hiatt	Ground
Ruby Knolls West	3	9	0713	Active	12			Greg Hiatt	Ground
Ruby Knolls West	3	24	0820	Active	0			Greg Hiatt	Ground
Ruby Knolls West	4	3	0618	Active	19			Rhen Etzelmill	Ground
Ruby Knolls West	4	13	0645	Active	22			Greg Hiatt	Ground
Complex: Fivemile									
Fivemile Bend	3	8	0807	Active	14			Greg Hiatt	Ground
Fivemile Bend	4	15	0741	Active	12			Greg Hiatt	Ground
Fivemile Ditch	3	8	0839	Unknown	0			Greg Hiatt	Ground
Fivemile Junction	3	8	0754	Active	7			Greg Hiatt	Ground
Fivemile Junction	4	15	0737	Active	2			Greg Hiatt	Ground
Complex: Girrard									
Girrard	3	17	0830	Active			40	Paul Fontaine	Ground
Girrard	4	17	0734	Active	54	1		Greg Hiatt, Bill	Ground
Girrard	5	4	0725	Active	18	4		Kent Schmidli	Ground
North Girrard	4	17	0750	Unknown	0			Greg Hiatt, Bill	Ground
Complex: Green Ridge									
Green Ridge	3	7	0732	Active	47	2		Greg Hiatt	Ground
Green Ridge	3	25	0716	Active	79	50		Greg Hiatt	Ground

Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Hadsell									
Hadsell Crossing	4	22	0715	Active	38			Greg Hiatt	Ground
Hadsell Crossing	4	23	0659	Active	53	1		Greg Hiatt	Ground
Hadsell Road	4	22	0710	Unknown	0			Greg Hiatt	Ground
Complex: Harrier									
Harrier	3	26	0806	Active	79	40		Greg Hiatt	Ground
Complex: High Point									
High Point	3	17	0836	Active	3			Greg Hiatt	Ground
High Point	5	3	0544	Active	16			Greg Hiatt	Ground
Complex: Horseshoe Bend									
Horseshoe Bend	3	17	0903	Active	7			Greg Hiatt	Ground
Horseshoe Bend	3	28	0657	Active	18	2		DMP (Hayden	Ground
Horseshoe Bend	4	5	0742	Active	13			DMP (Hayden	Ground
Horseshoe Bend	4	11	0729	Active	11			DMP (Hayden	Ground
Horseshoe Bend	4	16	0747	Active	1			Greg Hiatt	Ground
Horseshoe Bend	4	18	0604	Active	18			DMP (Hayden	Ground
Horseshoe Bend	4	25	0710	Active	14			DMP (Hayden	Ground
Horseshoe Bend	5	3	0623	Unknown	0			Greg Hiatt	Ground
Complex: Larsen North Well									
Larsen North Well	4	3	0744	Active	18	1	9	Greg Hiatt	Ground
Larsen North Well	4	10	0748	Active	0			Greg Hiatt	Ground
Larsen North Well	4	11	0737	Active	34			Greg Hiatt	Ground
Larsen North Well	4	18	0718	Active	33			Greg Hiatt	Ground
Larsen North Well	4	25	0706	Active	32			Greg Hiatt	Ground
Complex: Lost Alkali									
East Alkali	4	17	0704	Active	35			Greg Hiatt, Bill	Ground
Lost Alkali	4	17	0703	Unknown	0			Greg Hiatt, Bill	Ground
Lost Arapahoe	4	17	0641	Active	60			Greg Hiatt, Bill	Ground
Lost Creek	4	17	0655	Unknown	0			Greg Hiatt, Bill	Ground
Lost Creek Basin	4	17	0717	Active	69			Greg Hiatt, Bill	Ground
Tierney Spring	4	17	0702	Abandoned	0			Greg Hiatt, Bill	Ground
Complex: Luman Rim									
Luman Rim	4	27	0737	Unknown	0			Greg Hiatt	Ground
Complex: Luman Road									
Luman Road	3	12	0901	Active	32			Greg Hiatt	Ground
Luman Road	5	3	0638	Unknown	0			Greg Hiatt	Ground
Complex: Marathon									
Marathon	3	17	0742	Unknown	0			Greg Hiatt	Ground

Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: May Day									
May Day	3	8	0742	Active	8			Greg Hiatt	Ground
May Day	4	3	0620	Active	7			Hugh Faust (T	Ground
May Day	4	11	0615	Active	7			Randall Blake	Ground
May Day	4	13	0838	Unknown	0			Greg Hiatt	Ground
May Day	4	15	0720	Active	7			Greg Hiatt	Ground
May Day	4	20	0615	Active	7			Hugh Faust (T	Ground
May Day	4	27	0550	Active	0			Jennifer Hebe	Ground
May Day	5	3	0656	Active	7			Greg Hiatt	Ground
Complex: Minex West									
Minex West	3	13	0808	Active	24			Greg Hiatt	Ground
Complex: Monument Lake									
Monument Lake	3	12	0756	Active	20			Greg Hiatt	Ground
Monument Lake	3	28	0627	Active	18	1		JAS (Hayden-	Ground
Monument Lake	4	4	0630	Active	17			DMP (Hayden	Ground
Monument Lake	4	11	0638	Active	16	1		DMP (Hayden	Ground
Monument Lake	4	15	0807	Active	11			Greg Hiatt	Ground
Monument Lake	4	18	0654	Active	16			DMP (Hayde	Ground
Monument Lake	4	25	0619	Active	14			DMP (Hayde	Ground
Monument Lake	5	4	0540	Active	12	1		DMP (Hayde	Ground
Complex: Mud Lake									
Mud Lake	4	2	0700	Unknown	0			Rhen Etzelmill	Ground
Mud Lake North	4	2	0725	Active	34	2		Rhen Etzelmill	Ground
Mud Lake North	4	9	0620	Active	33	1		Rhen Etzelmill	Ground
Mud Lake North	4	17	0730	Active	30			Rhen Etzelmill	Ground
Mud Lake North	4	23	0710	Active	31	2		Rhen Etzelmill	Ground
Complex: Mud Springs									
Mud Springs	4	18	0847	Unknown	0			Greg Hiatt	Ground
Mud Springs	4	20	0743	Unknown	0			Greg Hiatt	Ground
Complex: North Lamont									
North Lamont	3	15	0733	Active	11			Greg Hiatt, Bill	Ground
Complex: North Wamsutter									
Fourmile	4	15	0634	Unknown	0			Greg Hiatt	Ground
North Wamsutter	4	15	0639	Unknown	0			Greg Hiatt	Ground
Complex: Osborne Draw									
Osborne Draw	4	17	0557	Unknown	0			Greg Hiatt, Bill	Ground
Complex: Prospects									
Prospects	3	25	0753	Active	68	48		Greg Hiatt	Ground
Complex: Rasmussen									
Rasmussen	3	17	0804	Active	23	3		Greg Hiatt	Ground
Complex: Red Creek									
Red Creek	5	9	0627	Active	79			Greg Hiatt	Ground

Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Red Creek Well									
Red Creek Well	3	15	1050	Active	0			Kaiser (BLM)	Ground
Red Creek Well	4	5	0752	Unknown	0			Greg Hiatt	Ground
Red Creek Well	4	11	0730	Active	78			Kaiser (BLM)	Ground
Red Creek Well	4	16	0701	Active	73			Greg Hiatt	Ground
Red Creek Well	4	18	0715	Active	77			Kaiser (BLM)	Ground
Red Creek Well	4	25	0720	Active	79			Kaiser (BLM)	Ground
Complex: Ruby Knolls North									
Ruby Knolls North	3	24	0844	Unknown	0			Greg Hiatt	Ground
Complex: Ruby Knolls South									
Ruby Knolls South	3	4	0746	Active	3			Greg Hiatt	Ground
Ruby Knolls South	3	22	0700	Active	47	31		Cheryl Newbe	Ground
Ruby Knolls South	3	22	0710	Active			2	Mary Read (B	Ground
Ruby Knolls South	3	24	0743	Active	43	6		Greg Hiatt	Ground
Complex: Saint Patricks									
Saint Patrick's	3	15	0830	Active	0			Kaiser (BLM)	Ground
Saint Patrick's	3	17	0923	Active	3			Greg Hiatt	Ground
Saint Patrick's	4	11	0640	Active	2			Kaiser (BLM)	Ground
Saint Patrick's	4	16	0722	Unknown	0			Greg Hiatt	Ground
Saint Patrick's	4	18	0635	Active	9			Kaiser (BLM)	Ground
Saint Patrick's	4	25	0650	Active	17			Kaiser (BLM)	Ground
Complex: Salt Sage Draw									
Salt Sage Draw	4	26	0632	Active	34			Greg Hiatt	Ground
Complex: Saxon									
Saxon	4	26	0653	Active	36	2		Greg Hiatt	Ground
Complex: Scotty Lake									
Scotty Lake	5	9	0606	Active	70	2		Greg Hiatt	Ground
Scotty Lake	5	11	0653	Active	24	1		Greg Hiatt	Ground
Complex: Smiley Springs									
Smiley Springs	4	22	0747	Active	31	3		Greg Hiatt	Ground
Smiley Springs	4	23	0722	Active	41	1		Greg Hiatt	Ground
Smiley Springs	5	11	0524	Active	91	1		Greg Hiatt	Ground
Complex: Sooner									
Sooner	3	7	0710	Active	13	1		Greg Hiatt	Ground
Sooner	3	25	0654	Active	33	59		Greg Hiatt	Ground
Sooner	3	30	1829	Active	18			Greg Hiatt	Ground
Sooner	4	25	0746	Active	37	2		Greg Hiatt	Ground
Sooner Oil	3	7	0723	Unknown	0			Greg Hiatt	Ground
Sooner Oil	4	25	0745	Unknown	0			Greg Hiatt	Ground
Complex: Sourdough									
Sourdough	3	12	0838	Unknown	0			Greg Hiatt	Ground
Sourdough	4	13	0800	Active	0			Greg Hiatt	Ground

Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Sourdough Mine									
Sourdough Mine	3	12	0812	Active	22			Greg Hiatt	Ground
Sourdough Mine	4	13	0741	Active	19			Greg Hiatt	Ground
Complex: Southland Well									
Southland Well	4	3	0757	Active	48	6		Greg Hiatt	Ground
Southland Well	4	10	0800	Active	35	1		Greg Hiatt	Ground
Southland Well	4	11	0752	Active	61			Greg Hiatt	Ground
Southland Well	4	18	0734	Active	69	1		Greg Hiatt	Ground
Southland Well	4	25	0723	Active	68	1		Greg Hiatt	Ground
Complex: Stewart Creek									
Stewart Creek	3	30	1917	Unknown	0			Greg Hiatt	Ground
Stewart Creek	4	3	0656	Active	56	18		Greg Hiatt	Ground
Stewart Creek	4	10	0701	Active	44	1		Greg Hiatt	Ground
Stewart Creek	4	11	0653	Active	59	1		Greg Hiatt	Ground
Stewart Creek	4	18	0634	Active	56			Greg Hiatt	Ground
Stewart Creek	4	18	0634	Active	56			Greg Hiatt	Ground
Stewart Creek	4	25	0623	Active	55	5		Greg Hiatt	Ground
Complex: Stinking Springs									
Stinking Springs	5	4	0655	Active	11	1		Kent Schmidli	Ground
Complex: Stratton									
Stratton	4	2	0627	Active	57	6		Rhen Etzelmill	Ground
Stratton	4	9	0708	Active	60	4		Rhen Etzelmill	Ground
Stratton	4	17	0628	Active	59	1		Rhen Etzelmill	Ground
Stratton	4	18	0818	Active	1	1		Greg Hiatt	Ground
Stratton	4	23	0640	Active	55			Rhen Etzelmill	Ground
Complex: Twin Barns									
Twin Barns	3	8	0729	Active	7			Greg Hiatt	Ground
Twin Barns	4	15	0711	Active	6			Greg Hiatt	Ground
Twin Barns	5	3	0704	Active	0			Greg Hiatt	Ground
Complex: Upper Osborne									
Upper Osborne	3	26	0745	Active	72	35		Greg Hiatt	Ground
Upper Osborne	5	15	0520	Active	67	1		Greg Hiatt	Ground
Complex: West Towers									
West Towers	3	4	0807	Active	5			Greg Hiatt	Ground
West Towers	3	4		Active	15			Fred Neuman	Ground
Complex: Windy Hill									
Windy Hill	4	20	0704	Active	54			Greg Hiatt	Ground

Sage-Grouse Job Completion Report

YEAR: 2007 **PERIOD COVERED: 6/1/06 - 5/31/07**
WORKING GROUP: Southwest **PREPARED BY: Grant Frost**

1. LEK ATTENDANCE SUMMARY (OCCUPIED LEKS)

a. Leks Counted

Year	Known	Counted	Percent Counted	Max Totals Males	Max Totals Females	Avg./Active Lek Males	Avg./Active Lek Females
1998	211	30	14.2	874	294	29.1	9.8
1999	220	27	12.3	1353	288	50.1	10.7
2000	224	27	12.1	1238	291	45.9	10.8
2001	234	32	13.7	969	244	30.3	7.6
2002	236	33	14.0	826	299	25.0	9.1
2003	238	58	24.4	1455	431	25.1	7.4
2004	253	49	19.4	1389	242	28.3	4.9
2005	257	58	22.6	2945	446	50.8	7.7
2006	264	65	24.6	4149	526	63.8	8.1
2007	270	65	24.1	3791	603	58.3	9.3

b. Leks Surveyed

Year	Known	Surveyed	Percent Surveyed	Max Total Males	Avg Males/ Active Lek
1998	211	52	24.6	811	20.8
1999	220	90	40.9	2235	30.2
2000	224	96	42.9	2279	27.5
2001	234	109	46.6	1426	18.3
2002	236	133	56.4	1533	20.4
2003	238	133	55.9	1725	21.8
2004	253	121	47.8	1642	21.3
2005	257	127	49.4	3430	36.5
2006	264	173	65.5	3990	36.9
2007	270	185	68.5	5457	42.6

c. Leks Checked

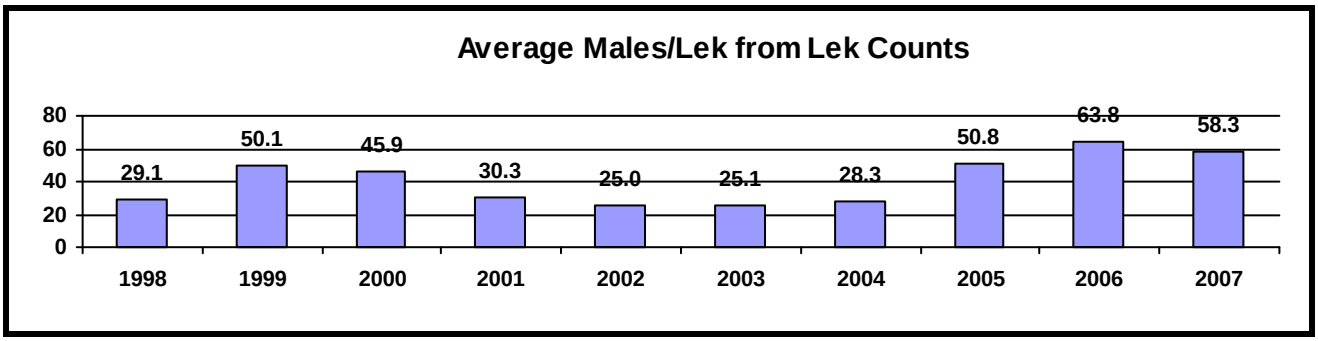
Year	Known	Checked	Percent Checked	Max Total Males	Avg Males/ Active Lek
1998	211	82	38.9	1685	24.4
1999	220	116	52.7	3588	35.5
2000	224	122	54.5	3503	32.1
2001	234	139	59.4	2340	21.7
2002	236	165	69.9	2328	21.8
2003	238	189	79.4	3160	23.2
2004	253	170	67.2	3031	24.1
2005	257	184	71.6	6369	42.2
2006	264	238	90.2	8139	47.0
2007	270	250	92.6	9248	47.9

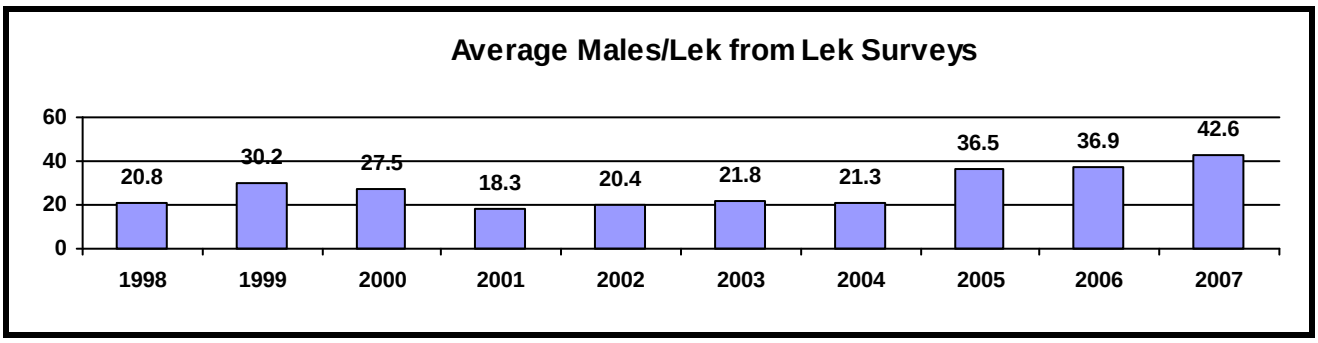
d. Lek Status

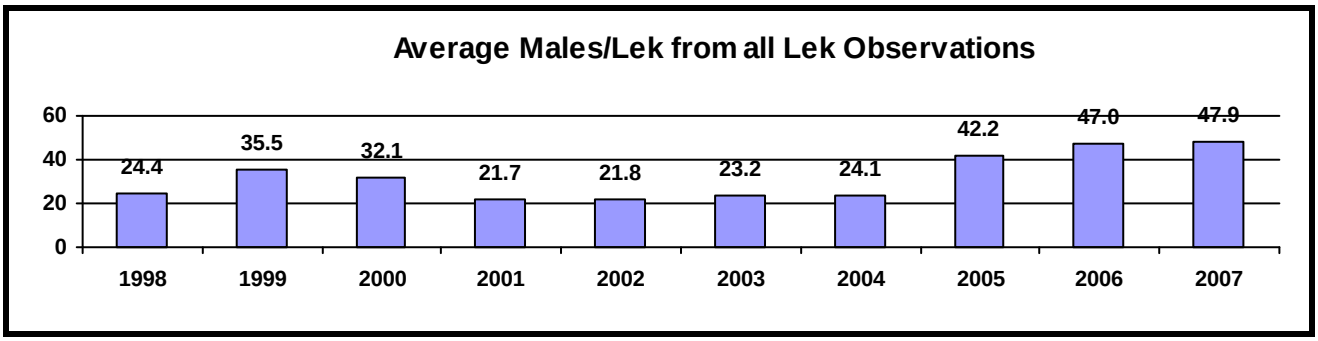
Year	Active	Inactive	Not Located	Unknown	Total	Confirmed Status Active	Confirmed Status Inactive
1998	63	13	0	135	76	82.9%	17.1%
1999	100	5	0	115	105	95.2%	4.8%
2000	109	4	0	111	113	96.5%	3.5%
2001	107	9	2	116	116	92.2%	7.8%
2002	110	25	2	99	135	81.5%	18.5%
2003	133	40	0	65	173	76.9%	23.1%
2004	129	26	0	98	155	83.2%	16.8%
2005	150	20	0	87	170	88.2%	11.8%
2006	180	41	0	43	221	81.4%	18.6%
2007	201	34	0	35	235	85.5%	14.5%

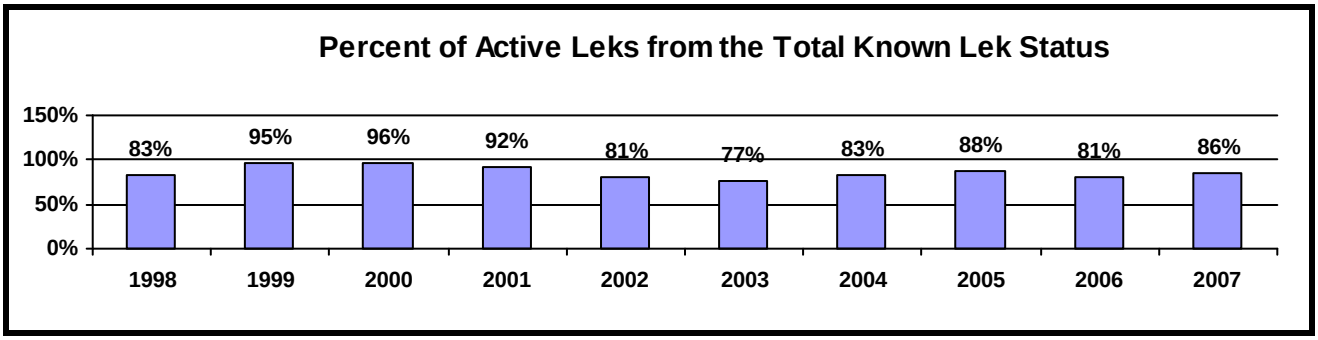
SAGE-GROUSE LEK ATTENDANCE SUMMARY

WORKING GROUP: Southwest **Area(s):** All









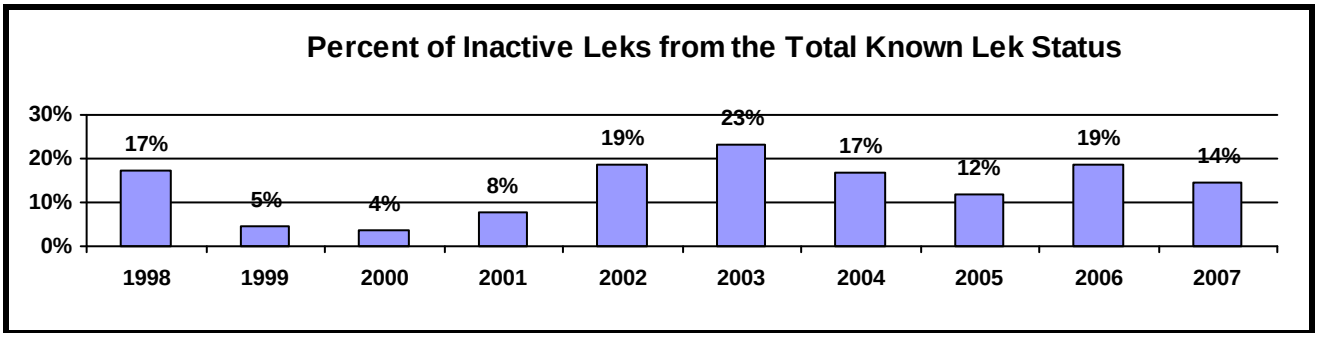


Table3. Summary of unoccupied (historic) leks and lek complexes.

a. Unoccupied Leks

Year	Total Number of Leks: Abandoned	Total Number of Leks: Destroyed	Number of abandoned leks checked
1998	65	13	1
1999	69	13	2
2000	70	14	2
2001	74	13	10
2002	76	14	18
2003	81	14	64
2004	80	14	2
2005	84	14	3
2006	84	14	25
2007	84	14	14

Southwest Wyoming Sage Grouse Lek Characteristics

Region	Number	Percent
Green River	368	100.0%

Working Group Area	Number	Percent
Southwest	368	100.0%

Classification	Number	Percent
Occupied	248	67.4%
Unknown	21	5.7%
Unoccupied	99	26.9%

BLM Office	Number	Percent
Kemmerer	180	48.9%
Pinedale	3	0.8%
Rawlins	1	0.3%
Rock Springs	184	50.0%

Unoccupied Leks	Number
Abandoned	85
Destroyed	14

Biologist District	Number	Percent
Baggs	11	3.0%
Green River	194	52.7%
Kemmerer	163	44.3%

Game Warden District	Number	Percent
Cokeville	57	15.5%
Evanston	28	7.6%
Green River	105	28.5%
Kemmerer	57	15.5%
Mountain View	42	11.4%
Rock Springs	79	21.5%

County	Number	Percent
Fremont	1	0.3%
Lincoln	120	32.6%
Sublette	16	4.3%
Sweetwater	166	45.1%
Uinta	65	17.7%

Land Status	Number	Percent
	0	0.0%
BLM	271	73.6%
NPS	1	0.3%
Private	86	23.4%
State	8	2.2%
USFS	1	0.3%

Management Area	Number	Percent
4	91	24.7%
5	92	25.0%
6	67	18.2%
7	118	32.1%

Table 4. Sage-grouse hunting seasons and harvest data.

a. Season

Year	Season Dates	Length	Bag/Possession Limit
1997	Sept 20-Oct 5	16	3/6
1998	Sept 19-Oct 4	16	3/6
1999	Sept 18-Oct 3	16	3/6
2000	Sept 16-Oct 1	16	3/6
2001	Sept 22-Oct 7	16	3/6
2002	Sept 28-Oct 6	9	2/4
2003	Sept 27-Oct 5	9	2/4
2004	Sept 23-Oct 3	11	2/4
2005	Sept 23-Oct 3	11	2/4
2006	Sept 23-Oct 3	11	2/4

b. Harvest

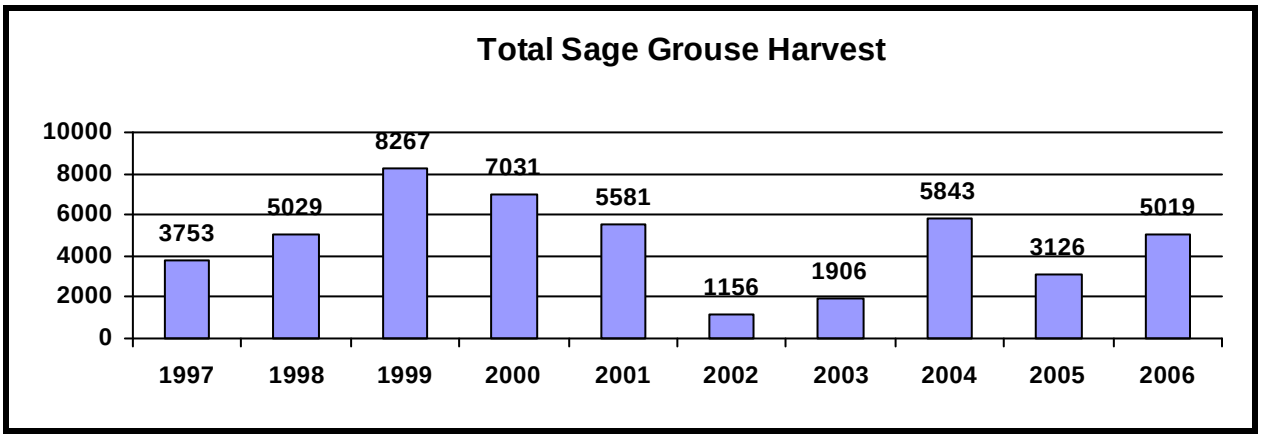
Year	Harvest	Hunters	Days	Birds/ Day	Birds/ Hunter	Days/ Hunter
1997	3,753	1,476	4,579	0.8	2.5	3.1
1998	5,029	1,812	4,366	1.2	2.8	2.4
1999	8,267	2,756	7,460	1.1	3.0	2.7
2000	7,031	3,061	7,278	1.0	2.3	2.4
2001	5,581	2,092	5,624	1.0	2.7	2.7
2002	1,156	694	1,824	0.6	1.7	2.6
2003	1,906	965	2,460	0.8	2.0	2.5
2004	5,843	2,400	6,692	0.9	2.4	2.8
2005	3,126	1,148	2,803	1.1	2.7	2.4
2006	5,019	1,968	4,825	1.0	2.6	2.5
Avg.	4,671	1,837	4,791	0.9	2.5	2.6

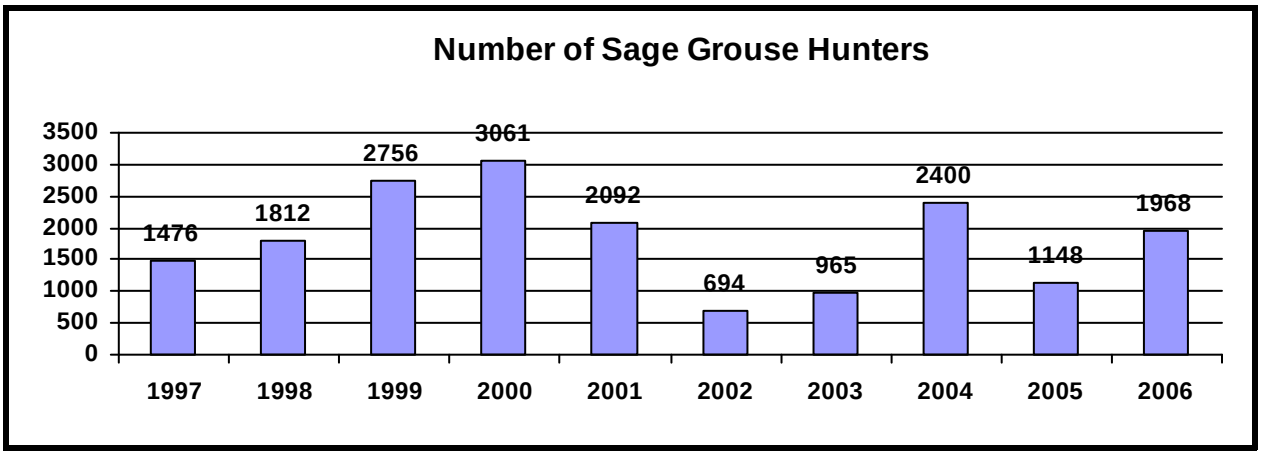
Table 5. Composition of harvest by wing analysis.

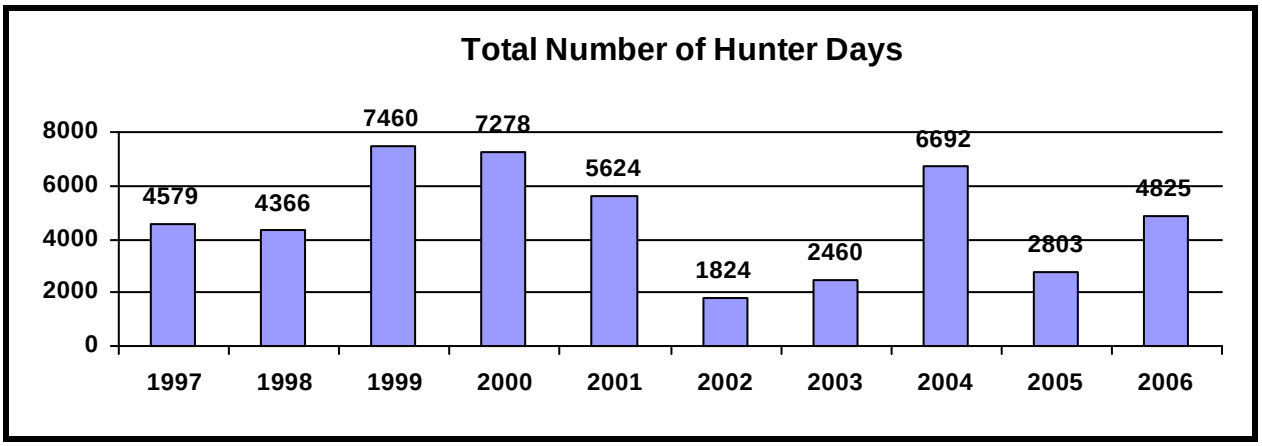
Year	Sample Size	Percent Adult		Percent Ylg		Percent Young		Chicks/Hen
		Male	Female	Male	Female	Male	Female	
1997	424	6.4	11.8	4.7	11.8	28.3	37.0	2.8
1998	832	8.1	21.3	2.5	6.6	28.8	32.7	2.2
1999	1135	7.1	19.6	4.6	8.3	27.6	32.9	2.2
2000	910	13.6	34.6	6.9	10.1	16.0	18.7	0.8
2001	842	11.3	35.0	2.7	4.9	21.5	24.6	1.2
2002	418	9.3	28.9	3.1	3.8	25.4	29.4	1.7
2003	530	10.0	28.1	1.7	5.5	23.4	31.3	1.6
2004	841	6.7	22.7	0.7	3.8	32.1	34.0	2.5
2005	845	8.3	16.9	1.9	4.0	32.7	36.2	3.3
2006	638	16.3	32.3	2.8	6.0	17.2	25.4	1.1

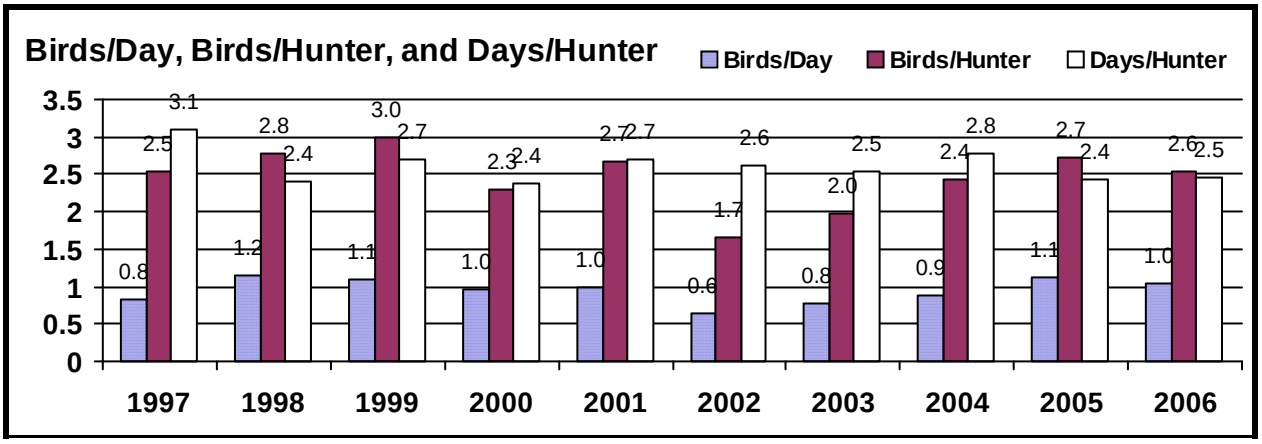
SAGE-GROUSE HARVEST SUMMARY

WORKING GROUP: Southwest **Area(s): All**









Southwest Sage-grouse Wing Analysis Summary 2006

Adult Males:	104	**Percent of All Wings:**	16.3%
Adult Females:	206	**Percent of All Wings:**	32.3%
Adult Unknown:	0	**Percent of All Wings:**	0.0%
Total Adults:	310		
Yearling Males:	18	**Percent of All Wings:**	2.8%
Yearling Females:	38	**Percent of All Wings:**	6.0%
Yearling Unknown:	0	**Percent of All Wings:**	0.0%
Total Yearlings:	56		
Chick Males:	110	**Percent of All Wings:**	17.2%
Chick Females:	162	**Percent of All Wings:**	25.4%
Chick Unknown:	0	**Percent of All Wings:**	0.0%
Total Chicks:	272		
Unknown Sex/Age:	0	**Percent of All Wings:**	0.0%
Total for all Sex/Age Groups:	638		
Chick Males:	110	**Percent of All Chicks:**	40.4%
Yearling Males:	18	**Percent of Adult and Yearling Males:**	14.8%
Adult Males:	104	**Percent of Adult and Yearling Males:**	85.2%
Adult and Yearling Males:	122	**Percent of Adults and Yearlings:**	33.3%
Total Males:	232	**Percent of All Sex/Age Groups:**	36.4%
Chick Females:	162	**Percent of All Chicks:**	59.6%
Yearling Females:	38	**Percent of Adult and Yearling Females:**	15.6%
Adult Females:	206	**Percent of Adult and Yearling Females:**	84.4%
Adult and Yearling Females:	244	**Percent of Adults and Yearlings:**	66.7%
Total Females:	406	**Percent of All Sex/Age Groups:**	63.6%
Chicks:	272	**Percent of All Wings:**	42.6%
Yearlings:	56	**Percent of All Wings:**	8.8%
Adults:	310	**Percent of All Wings:**	48.6%
Chicks/Hen:	**1.1**		

Chicks/hen calculated from wings of harvested sage-grouse.

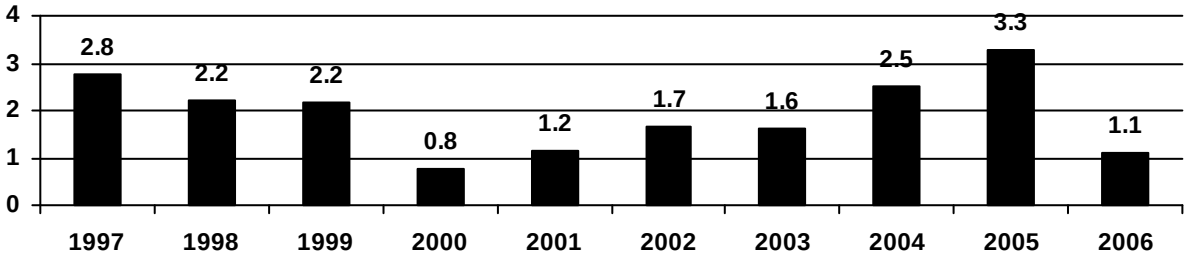


Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Management Area: 4									
Complex: Beachler Creek									
Beachler Creek	4	13	700	Unknown	0	0	0	Crews	Ground
Complex: Beaver Creek									
Beaver Ck	4	14	730	Active	2	3	0	Tratnik	Ground
Complex: BLM Road									
BLM Road	3	31	640	Active	36	10	0	Corbett	Ground
BLM Road	4	6	630	Active	34	1	0	Corbett	Ground
BLM Road	4	13	635	Active	38	2	0	Corbett	Ground
BLM Road	4	22	635	Active	26	0	0	Corbett	Ground
Complex: Boulder Ridge									
Boulder Ridge	4	28	620	Active	82	3	0	Oles	Ground
Complex: Bryan									
Big Island 2	4	24	635	Active	9	0	0	Orpet	Ground
Big Island 2	4	25	635	Active	8	0	0	Orpet	Ground
Complex: Cokeville									
Larson Reservoir Lek	4	14	645	Inactive	0	0	0	Hymas	Ground
Larson Reservoir Lek	4	26	635	Inactive	0	0	0	Hymas	Ground
Trail Creek	4	14	710	Unknown	0	0	0	Hymas	Ground
Wyman Creek	4	13	815	Active	4	0	0	Hymas	Ground
Wyman Creek	4	14	720	Active	25	1	0	Hymas	Ground
Complex: County Rd 4									
County Rd 4	3	27	700	Active	38	0	0	Christiansen	Ground
County Rd 4	4	13	635	Active	5	0	0	Glass	Ground
County Rd 4	4	23	620	Active	46	0	0	Glass	Ground
County Rd 4 West	3	27	735	Active	7	0	0	Christiansen	Ground
County Rd 4 West	4	13	648	Active	0	0	0	Glass	Ground
County Rd 4 West	4	23	634	Active	0	0	0	Glass	Ground
Complex: Craven Creek									
Alkali Creek East	4	14	711	Active	26	1	0	Olson	Ground
Alkali Creek East	4	24	630	Active	29	0	1	Olson	Ground
Alkali Creek West	4		655	Unknown	0	0	0	Olson	Ground
Alkali Creek West	4	14	730	Unknown			2	Olson	Ground
Craven Ck	4	12	730	Abandoned	0	0	0	Olson	Ground
Craven Ck	4	18	720	Abandoned	0	0	0	Olson	Ground
Craven Reservoir 1	4	12	650	Inactive	0	0	0	Olson	Ground
Craven Reservoir 1	4	18	700	Inactive	0	0	0	Olson	Ground
Craven Reservoir 2	4	12	710	Inactive	0	0	0	Olson	Ground
Craven Reservoir 2	4	18	710	Inactive	0	0	0	Olson	Ground
Craven Reservoir W.	4	12	630	Abandoned	0	0	0	Olson	Ground
Craven Reservoir W.	4	18	645	Abandoned	0	0	0	Olson	Ground
Round Mtn	4	13	700	Active	28	1	0	Olson	Ground
Round Mtn	4	24	720	Active	29	2	0	Olson	Ground
Complex: Delaney Creek									
Delaney Creek	3	22	800	Active	35	0	0	K. Olson	Ground
Complex: Dempsey Basin									
Dempsey Basin	4	25	610	Active	4	0	0	Tratnik	Ground
Nellie Case	4	3	645	Active	9	0	4	Tratnik	Ground
Nellie Case	4	14	630	Active	19	17	0	Tratnik	Ground
North Fork Dempsey Creek	4	25	610	Active	177	11	0	Tratnik	Ground

Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Dry Hollow									
Dry Hollow	3	27	730	Active	0	0	0	K. Olson	Ground
Dry Hollow	4	17	700	Active	0	0	0	J. Olson	Ground
Complex: Facinelli Place									
Facinelli Place	3	12	745	Active	4	0	0	Kim Olson	Ground
Facinelli Place	3	22	820	Active	1	0	0	Kim Olson	Ground
Complex: FMC Granger									
FMC Granger	3	22	615	Active	0	0	0	Jacobsen	Ground
FMC Granger	4	21	640	Active	47	1	0	Jacobsen	Ground
FMC Granger	4	28	705	Active	32	0	0	Jacobsen	Ground
FMC Granger	5	10	557	Active	40	0	0	Jacobsen	Ground
Complex: Fossil Butte									
Chicken Creek	4	3	715	Active	40	10	0	Corbett	Ground
Chicken Creek	4	12	650	Active	43	0	0	Corbett	Ground
Chicken Creek	4	30	635	Active	37	0	0	Corbett	Ground
Small Pox Creek	4	3	650	Inactive	0	0	0	Corbett	Ground
Small Pox Creek	4	12	640	Inactive	0	0	0	Corbett	Ground
Small Pox Creek	4	30	625	Inactive	0	0	0	Corbett	Ground
Complex: Horse Creek									
Horse Creek	4	13	720	Active	6	0	0	Hymas	Ground
Horse Creek	4	14	730	Active	15	1	0	Hymas	Ground
Horse Creek 2	4	13	710	Unknown	0	0	0	Hymas	Ground
Petersen Ranch Lek	4	13	650	Active	53	4	0	Hymas	Ground
Complex: Joe Krall									
Joe Krall	4	7	620	Active	17	4	0	Tratnik	Ground
Complex: Lewis Gravel									
Lewis Gravel	4	24	615	Active	41	2	0	Orpet	Ground
Lewis Gravel	4	25	615	Active	30	0	0	Orpet	Ground
Complex: Little America									
Little America 6	3	20	730	Active	4	0	0	Kerr	Ground
Complex: Mud Spring									
Mud Spring	4	6	745	Active	6	0	8	Wondercheck/	Ground
Mud Spring	4	13	757	Active	79	5	0	Wondercheck/	Ground
Complex: N.F. Slate Creek									
N.F. Slate Cr	4	6		Abandoned	0	0	0	Wondercheck	Ground
N.F. Slate Cr	4	13		Abandoned	0	0	0	Wondercheck	Ground
Complex: North Twin									
Hay Hollow	4	12	745	Inactive	0	0	0	Wondercheck	Ground
Hay Hollow	4	17	650	Inactive	0	0	0	Wondercheck	Ground
Hay Hollow	4	24	645	Inactive	0	0	0	Wondercheck	Ground
Linden Canyon	4	8	630	Active	21	4	0	Tratnik	Ground
North Twin Cr	3	25	700	Active	36	7	0	Tratnik	Ground
North Twin Cr	4	8	658	Active	46	14	0	Tratnik	Ground
Complex: Opal Bench									
Opal Bench 1	4	11	710	Active	27	3	0	Crews	Ground
Opal Bench 2	4	9	745	Inactive	0	0	0	Crews	Ground
Opal Bench 2	4	10	755	Inactive	0	0	0	Crews	Ground

Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Oyster Ridge									
East Willow Ck	4	7	741	Inactive	0	0	0	Olson	Ground
East Willow Ck	4	26	700	Inactive	0	0	0	Olson	Ground
East Willow Ck	5	3	725	Inactive	0	0	0	Schuette	Ground
Oyster Ridge North	4	18	730	Abandoned	0	0	0	Wondercheck	Ground
Oyster Ridge North	4	25	700	Abandoned	0	0	0	Wondercheck	Air
Oyster Ridge North	5	3	748	Abandoned	0	0	0	Schuette	Ground
Oyster Ridge South	4	18	0710	Inactive	0	0	0	Wondercheck	Ground
Oyster Ridge South	4	25	0655	Inactive	0	0	0	Wondercheck	Air
Oyster Ridge South	5	3	725	Inactive	0	0	0	Schuette	Ground
School Sect Springs	4	7	640	Inactive	0	0	0	Olson	Ground
School Sect Springs	4	26	715	Inactive	0	0	0	Olson	Ground
Complex: Pomeroy									
Spring Branch	4	13	800	Unknown	0	0	0	Crews	Ground
Complex: Pomeroy Draw									
Pomeroy Draw	3	14	830	Active	12	3	0	K. Olson	Ground
Pomeroy Draw	3	17	715	Active	8	0	0	K. Olson	Ground
Complex: Quaken Asp									
Nancy Hill Grave	4	11	700	Active	2	1	0	Wondercheck	Ground
Nancy Hill Grave	4	12	730	Active			3	Wondercheck	Ground
Nancy Hill Grave	4	24	710	Active	3	0	0	Wondercheck	Ground
Quaken Asp	4	11	730	Inactive	0	0	0	Wondercheck	Ground
Quaken Asp	4	12	700	Inactive	0	0	0	Wondercheck	Ground
Quaken Asp	4	24	730	Inactive	0	0	0	Wondercheck	Ground
Complex: Radio Tower									
Radio Tower	3	14	800	Active	11	0	0	K. Olson	Ground
Radio Tower	4	16	750	Active	15	0	0	J. Olson	Ground
Radio Tower 2	3	14		Active	7	0	0	K. Olson	Ground
Radio Tower 2	3	20		Active	7	0	0	K. Olson	Ground
Radio Tower 2	4	16		Active	15	0	0	J. Olson	Ground
Complex: Seven Mile Gulch									
Seven Mile Gulch 1	3	22	645	Active	28	6	0	Jacobsen	Ground
Seven Mile Gulch 1	4	21	736	Active	5	0	0	Jacobsen	Ground
Seven Mile Gulch 1	4	22	620	Active	11	1	0	Jacobsen	Ground
Seven Mile Gulch 1	4	28	615	Active	27	0	0	Jacobsen	Ground
Seven Mile Gulch 1	5	10	630	Active	0	0	0	Jacobsen	Ground
Seven Mile Gulch 2	3	22	745	Inactive	0	0	0	Jacobsen	Ground
Seven Mile Gulch 2	4	21	750	Inactive	0	0	0	Jacobsen	Ground
Seven Mile Gulch 2	4	22	602	Inactive	0	0	0	Jacobsen	Ground
Seven Mile Gulch 2	5	10	644	Inactive	0	0	0	Jacobsen	Ground
Complex: Seven Mile Wash									
Seven Mile Wash	4	10	830	Inactive	0	0	0	Crews	Ground
Complex: Sheep Creek									
Norris Tratnik	3	17	745	Active			12	K. Olson	Ground
Williams Gas Line	3	17	815	Inactive	0	0	0	K. Olson	Ground

Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Slate Creek									
Emigrant Springs South	4	7	803	Active	0	0	0	Oles	Ground
Emigrant Trail 1	4	7	710	Active	43	4	0	Oles	Ground
Emigrant Trail 1	4	14	719	Active	16	0	15	Oles	Ground
Emigrant Trail 1	4	25	621	Active	19	1	1	Oles	Ground
Emigrant Trail 2	4	7	656	Active	36	7	0	Oles	Ground
Emigrant Trail 2	4	14	659	Active	24	4	0	Oles	Ground
Emigrant Trail 2	4	25	601	Active	43	1	0	Oles	Ground
Jackson Cr. North	4	7	747	Active	35	0	0	Oles	Ground
Jackson Cr. North	4	14	740	Active	4	0	0	Oles	Ground
Jackson Cr. North	4	25	648	Active	57	1	0	Oles	Ground
Complex: Smiths Fork									
Corral Creek	5	1	630	Active	12	1	0	Hymas/volunt	Ground
First Creek	5	1	700	Unknown	0	0	0	Hymas/volunt	Ground
Grade Cr. Bench	5	19	600	Active	1	0	0	Hymas	Ground
Complex: Sullivan Hollow									
Sullivan Hollow	3	20	715	Active	23	6	0	K. Olson	Ground
Complex: Viva Naughton									
Fenn Creek	4	9	700	Active	22	23	0	Lovell	Ground
Viva Naughton	4	9	630	Active	11	12	0	Lovell	Ground
Viva Naughton West	4	9	645	Unknown	0	0	0	Lovell	Ground
Complex: West Beaver									
West Beaver	4	9	740	Active	8	0	0	Lovell	Ground
Complex: Westside									
Christy Canyon 1	4	11	630	Abandoned	0	0	0	Hymas	Ground
Christy Canyon 2	4	11	630	Abandoned	0	0	0	Hymas	Ground
Christy Canyon 3	4	11	630	Abandoned	0	0	0	Hymas	Ground
Snow Creek	4	11	620	Abandoned	0	0	0	Hymas	Ground
Complex: Yellow Point									
Yellow Point North	4	26	645	Active	34	0	0	Kerr	Ground
Yellow Point South	4	26	710	Active	11	0	0	Kerr	Ground
Management Area: 5									
Complex: Aspen Creek									
Aspen Creek	4	17	700	Active	26	2	0	Baker	Ground
Aspen Creek	4	24	700	Active	23	2	6	Baker	Ground
Complex: Austin									
Austin Reservoir	4	29	645	Inactive	0	0	0	King	Ground
Austin Wash	4	21	630	Active	3	0	0	King	Ground
Church Butte 1	4	21	645	Active	12	1	0	King	Ground
Complex: Bear River Divide									
Anna Richey	4	8	749	Active	13	3	0	Tratnik	Ground
Anna Richey	4	17	750	Active	9	2	0	Tratnik	Ground
Anna Richey	5	1	700	Active	18	0	0	Tratnik	Ground
Bear River Divide	4	5	747	Active	4	1	0	Tratnik	Ground
Bert Brush	4	5	645	Active	65	11	0	Tratnik	Ground
Skull Point West	4	8	744	Active	29	4	0	Tratnik	Ground
Skull Point West	4	17	750	Active	31	1	0	Tratnik	Ground
Skull Point West	5	1	700	Active	39	4	0	Tratnik	Ground

Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Bell Creek									
Bell Creek 1	4	25	700	Active	65	15	4	Baker	Ground
Bell Creek 2	4	25	745	Unknown	0	0	0	Baker	Ground
Complex: Blake Hollow									
Blake Hollow Gravel Pit	4	20	720	Active	30	3	2	Baker	Ground
Complex: Bridger Airport									
Bigelow 1	4	11	715	Inactive	0	0	0	King	Ground
Bigelow 1	4	23	700	Inactive	0	0	0	King	Ground
Complex: Bridger Butte									
Bridger Butte	4	11	640	Active	2	0	0	King	Ground
Bridger Butte	4	23	740	Active	2	0	0	King	Ground
Complex: Bullpen									
Bullpen Creek	4	9	830	Inactive	0	0	0	Tratnik	Ground
East Fork Bullpen	4	9	840	Inactive	0	0	0	Tratnik	Ground
Complex: Carter Creek									
Carter Creek	3	19	700	Active	9	4	0	Tratnik	Ground
Complex: Church Butte East									
Church Butte East	4	6	0830	Active	15	0	0	King	Ground
Church Butte East	4	21	0730	Active	31	0	0	King	Ground
Complex: Collett									
Collett Basin	4	9	620	Active	56	8	0	Tratnik	Ground
Collett Basin	4	15	630	Active	55	5	0	Tratnik	Ground
Collett Basin	4	22	602	Active	50	2	0	Tratnik	Ground
Collett Basin	4	30	600	Active	53	3	0	Tratnik	Ground
Question Mark Reservoir	4		700	Active	1	0	0	Tratnik	Ground
Question Mark Reservoir	4	9	735	Active	7	1	0	Tratnik	Ground
Question Mark Reservoir	4	15	720	Active	13	0	0	Tratnik	Ground
Question Mark Reservoir	4	30	700	Active	9	0	0	Tratnik	Ground
Sand Knoll	4	9	800	Inactive	0	0	0	Tratnik	Ground
Sand Knoll	4	23	700	Inactive	0	0	0	Tratnik	Ground
Sand Knoll	4	30	700	Inactive	0	0	0	Tratnik	Ground
South Collett Ck	4	9	646	Active	43	7	0	Tratnik	Ground
South Collett Ck	4	15	650	Active	34	2	0	Tratnik	Ground
South Collett Ck	4	22	642	Active	33	0	0	Tratnik	Ground
South Collett Ck	4	30	640	Active	35	3	0	Tratnik	Ground
Complex: Crockers Point									
Bon Rico Haul Road	4	10	622	Active	18	2	0	Tratnik	Ground
Bon Rico Haul Road	4	16	604	Active	16	1	0	Tratnik	Ground
Bon Rico Haul Road	4	23	650	Active	17	1	0	Tratnik	Ground
Bon Rico Haul Road	5	1	530	Active	16	0	0	Tratnik	Ground
Crockers Point	4	10	700	Active	43	4	0	Tratnik	Ground
Crockers Point	4	17	607	Active	46	5	0	Tratnik	Ground
Crockers Point	4	23	600	Active	50	6	0	Tratnik	Ground
Crockers Point	5	1	600	Active	40	4	0	Tratnik	Ground

Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Dee Ranch									
Cumberland 1	4	17	725	Active	0	0	0	Wondercheck	Ground
Cumberland 1	4	25	730	Active	23	0	0	Wondercheck	Ground
Cumberland 2	4	17	725	Inactive	0	0	0	Wondercheck	Ground
Cumberland 2	4	25	720	Inactive	0	0	0	Wondercheck	Ground
Dee Ranch	4	17	746	Inactive	0	0	0	Wondercheck	Ground
Dee Ranch	4	25	755	Inactive	0	0	0	Wondercheck	Ground
Dee Ranch Road	4	17	728	Inactive	0	0	0	Wondercheck	Ground
Dee Ranch Road	4	25	715	Inactive	0	0	0	Wondercheck	Ground
Little Hogsback	4	17	715	Active	5	0	0	Wondercheck	Ground
Little Hogsback	4	25	710	Active	0	0	0	Wondercheck	Ground
Marsh Hawk	4	17	729	Inactive	0	0	0	Wondercheck	Ground
Marsh Hawk	4	25	740	Inactive	0	0	0	Wondercheck	Ground
South Haystack 1	4	17	740	Inactive	0	0	0	Wondercheck	Ground
South Haystack 1	4	25	745	Inactive	0	0	0	Wondercheck	Ground
South Haystack 2	4	17	742	Inactive	0	0	0	Wondercheck	Ground
South Haystack 2	4	25	748	Inactive	0	0	0	Wondercheck	Ground
Complex: Desertion Point									
Desertion Point East	4	10	800	Active	19	1	0	Lovell	Ground
Desertion Point East	4	11	726	Active	52	1	0	Lovell	Ground
Dry Muddy 3	4	11	745	Unknown	0	0	0	Lovell	Ground
Complex: East Crawford									
Eastside Crawford	4	11	710	Active	0	0	0	Hymas	Ground
Eastside Crawford	4	12	645	Active	105	3	0	Hymas	Ground
Eastside Crawford	4	18	700	Active	105	4	0	Hymas	Ground
Eastside Crawford	4	24	705	Active	106	11	0	Hymas	Ground
Complex: Hampton									
Hampton Main	3	27	735	Active	81	3	0	Wondercheck	Ground
Complex: Hilltop									
Hilltop	4	18	630	Active	0	0	0	King	Ground
Complex: Leavitt Bench									
Honey Creek	4	13	730	Active	82	3	0	King	Ground
Leavitt Bench 1	4	30	700	Abandoned	0	0	0	King	Ground
Leavitt Bench 2	5	8	630	Abandoned	0	0	0	King	Ground
Leavitt Bench 4	4	13	700	Active	16	0	0	King	Ground
Complex: Limekiln									
Limekiln Gulch	4	16	730	Active			4	Baker	Ground
Complex: Little Muddy									
Heard Hollow	4	17	640	Active	28	5	0	Tratnik	Ground
No Name	4	17	735	Inactive	0	0	0	Wondercheck	Ground
No Name	4	25	735	Inactive	0	0	0	Wondercheck	Ground
Shurtleff	4	17	730	Inactive	0	0	0	Wondercheck	Ground
Shurtleff	4	25	752	Inactive	0	0	0	Wondercheck	Ground
Complex: Little Round Mtn									
Little Round Mtn North	4	7	630	Active	63	7	0	Lockwood	Ground
Little Round Mtn North	4	23	635	Active	67	10	0	Lockwood	Ground
Little Round Mtn North	5	7	630	Active	43	8	0	Lockwood	Ground
Little Round Mtn South	4	7	650	Active	59	4	0	Lockwood	Ground
Little Round Mtn South	4	23	645	Active	13	1	0	Lockwood	Ground
Little Round Mtn South	5	7	650	Active	32	5	0	Lockwood	Ground

Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Muddy Creek									
Little Muddy Rim	4	11	630	Active	69	10	0	Lovell	Ground
Mulkay Springs North	4	11	645	Active	61	3	0	Lovell	Ground
Complex: Musselman									
Musselman Draw	4	30	700	Active	0	0	0	Baker	Ground
Complex: Pando									
Pando	4	12	900	Active	12	0	0	Fleming/Bell	Ground
Pando	4	16	800	Active	8	0	0	Wondercheck	Ground
Complex: Piedmont									
Grassy Draw	4	17	715	Active	37	2	2	Baker	Ground
Grassy Draw	4	24	715	Active	38	4	2	Baker	Ground
Grassy Draw	4	30	800	Active	0	0	0	Baker	Ground
Complex: Red Eye									
Red Eye 1	5	8	720	Inactive	0	0	0	Baker	Ground
Red Eye 2	5	8	645	Inactive	0	0	0	Baker	Ground
Complex: Reed Reservoir									
Reed Reservoir SW	4	12	0700	Active	44	1	0	King	Ground
Complex: Roberson									
Roberson East	4	9	700	Inactive	0	0	0	Wondercheck	Ground
Roberson East	4	16	700	Inactive	0	0	0	Wondercheck	Ground
Roberson East	4	23	710	Inactive	0	0	0	Wondercheck	Ground
Roberson North	4	9	712	Active	14	0	0	Wondercheck	Ground
Roberson North	4	12	750	Active			13	Crews	Ground
Roberson North	4	16	715	Active	14	0	0	Wondercheck	Ground
Complex: Sage Creek									
Sage Creek	4	18	700	Active	0	0	0	Baker	Ground
Complex: South Twin Creek									
Clear Creek Ridge	4	13	630	Active	29	9	0	Tratnik	Ground
Middle Clear Creek Ridge	3	25	828	Active	25	34	0	Tratnik	Ground
Middle Clear Creek Ridge	4	13	700	Active	42	7	0	Tratnik	Ground
South Twin Creek	3	25	800	Active	7	8	0	Tratnik	Ground
South Twin Creek	4	8	720	Active	4	0	0	Tratnik	Ground
Complex: Thomas Canyon									
Thomas Canyon	4	26	700	Inactive	0	0	0	Baker	Ground
Complex: Willow Creek									
Cap White	4	22	620	Active	42	0	0	King	Ground
Cap White 2	4	22	630	Active	7	0	0	King	Ground
Perry Bench	4	10	730	Active	13	0	0	King	Ground

Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Windy Point									
Bridger Creek	4	5	730	Active	2	0	0	Hymas	Ground
Bridger Creek	4	6	640	Active	5	0	0	Hymas	Ground
Bridger Creek	4	12	700	Active	32	2	0	Hymas	Ground
Bridger Creek	4	16	715	Active	0	0	0	Hymas	Ground
Bridger Creek	4	18	630	Active	29	0	0	Hymas	Ground
Bridger Creek	4	20	645	Active	28	1	0	Hymas	Ground
Bridger Creek	4	24	610	Active	37	5	0	Hymas	Ground
Bulldog Hollow	4	5	710	Active	6	0	0	Hymas	Ground
Bulldog Hollow	4	6	700	Active	28	4	0	Hymas	Ground
Bulldog Hollow	4	16	650	Active	21	0	0	Hymas	Ground
Bulldog Hollow	4	25	640	Active	22	2	0	Hymas	Ground
Bulldog Hollow South	4	5	720	Active	2	0	0	Hymas	Ground
Bulldog Hollow South	4	6	710	Active	2	0	0	Hymas	Ground
Bulldog Hollow South	4	16	700	Active	13	0	0	Hymas	Ground
Bulldog Hollow South	4	25	645	Active	0	0	0	Hymas	Ground
North Crawford	4	11	645	Active	47	2	0	Hymas	Ground
North Crawford	4	18	720	Active	35	0	0	Hymas	Ground
North Crawford	4	20	710	Active	39	0	0	Hymas	Ground
North Crawford	4	24	630	Active	50	5	0	Hymas	Ground
Sage	4	5	650	Active	0	0	0	Hymas	Ground
Sage	4	6	745	Active	0	0	0	Hymas	Ground
Sage	4	16	645	Active	0	0	0	Hymas	Ground
Sage	4	25	615	Active	0	0	0	Hymas	Ground
Complex: Woodruff									
Salt Creek 1	4	21	715	Active	17	2	5	Baker	Ground
Complex: Ziegler									
Zieglers Wash North	4	12	730	Unknown	0	0	0	Crews	Ground
Zieglers Wonder Wash	4	12	705	Active	45	0	0	Crews	Ground
Management Area: 6									
Complex: Alkali									
Alkali Creek	3	23	840	Active	73	41	0	Hays	Ground
Alkali Creek	4	6	755	Active	48	4	0	Hays	Ground
Alkali Creek	4	12	740	Active	41	3	0	Hays	Ground
Alkali Creek	4	24	750	Active	10	0	0	Hays	Ground
Alkali Creek	4	28	805	Active	0	0	0	Hays	Ground
Complex: Antelope Butte									
Antelope Butte	4	15	725	Active	43	0	0	Christiansen	Ground
Antelope Butte	4	22	720	Active	36	0	0	Lutz	Ground
Antelope Butte	4	30	635	Active	44	1	0	Christiansen	Ground
Complex: Antelope Wash									
Antelope Wash East	3	14	730	Active	24	3	0	Kenneda	Ground
Complex: Arrowhead									
Arrowhead	3	15	810	Active	14	4	0	Frost	Ground
Complex: Blacks Fork									
Blacks Fork 1	4	18	715	Active	35	2	0	Zornes	Ground
Blacks Fork 1	5	1	621	Active	32	0	0	Zornes	Ground
Blacks Fork 1	5	9	610	Active	26	0	0	Zornes	Ground
Blacks Fork 2	5	9	650	Active	23	0	0	Zornes	Ground

Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Brinnegar									
Brinnegar	3	20	630	Active	8	0	0	Frost	Ground
Brinnegar 2	5	9	720	Active	36	0	0	Frost	Ground
Complex: Buckboard									
North Buckboard	4	5		Active	93	3	0	Wold	Ground
North Buckboard	4	12	630	Active	112	3	0	Wold	Ground
North Buckboard	4	20	615	Active	119	2	0	Wold	Ground
North Buckboard	4	27	605	Active	99	2	0	Wold	Ground
North Buckboard	5	9	555	Active	21	0	0	Wold	Ground
North Halfway Hollow	4	5	705	Active	56	0	0	Wold	Ground
North Halfway Hollow	4	12	650	Active	57	0	0	Wold	Ground
North Halfway Hollow	4	20	640	Active	56	3	0	Wold	Ground
North Halfway Hollow	4	27	625	Active	51	0	0	Wold	Ground
North Halfway Hollow	5	9	620	Active	21	0	0	Wold	Ground
Complex: Buffalo Spring									
Upper Salt Wells 2	4	8	740	Active	35	5	0	Hays	Ground
Complex: Buffalo Springs									
Buffalo Springs	4	8	700	Active	97	62	0	Hays	Ground
Buffalo Springs	4	12	655	Active	103	12	0	Christiansen	Ground
Buffalo Springs 2	4	8	645	Active	52	20	0	Hays	Ground
Buffalo Springs 2	4	12	640	Active	8	0	0	Christiansen	Ground
Buffalo Springs 2	4	30	0720	Active	24	2	0	Christiansen	Ground
Laney	4	7	800	Active	0	0	0	Hays	Ground
Laney	4	8	715	Active	68	11	0	Hays	Ground
Complex: Cattail									
Cattail	4	7	640	Active	15	0	0	King	Ground
Complex: Currant Crk.									
Brees Hill	4	12	650	Active	62	0	0	Spence	Ground
Brees Hill	4	27	627	Active	64	1	0	Spence	Ground
Brees Hill	5	4	628	Active	0	0	0	Spence	Ground
Sage Creek	4	12	615	Active	104	3	0	Spence	Ground
Sage Creek	4	26	602	Active	92	4	0	Spence	Ground
Sage Creek	5	4	555	Active	84	3	0	Spence	Ground
Complex: Dripping Rock									
Dripping Rock	4	6	828	Active	31	0	0	Hays	Ground
Complex: Dry Creek									
Dry Crk. 1	4	16	730	Abandoned	0	0	0	King	Ground
Dry Crk. 2	4	16	650	Active	33	0	0	King	Ground
Dry Crk. 3	4	16	635	Abandoned	0	0	0	King	Ground
Dry Crk. 4	4	16	625	Active	37	0	0	King	Ground
Complex: Dry Wash									
Hank Hollow 2	4	20	740	Active	50	0	0	King	Ground
Hank Hollow Bench	4	20	800	Active			15	King	Ground
Main Road	4	20	740	Unknown	0	0	0	King	Ground
Upper Dry Wash 1	4	20	700	Active	0	0	0	King	Ground
Upper Dry Wash 2	4	20	630	Unknown	0	0	0	King	Ground
Complex: Elk Butte									
Elk Butte 2	4	7	700	Active	42	8	0	Hays	Ground
Complex: Greenhough									
Greenhough Flat 1	4	8	850	Active	11	0	0	Hays	Ground

Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Little Dry Creek									
Little Dry Creek	5	10	610	Active	14	2	6	Zornes	Ground
Complex: Lost Dog									
Lost Dog 1	4	4	620	Inactive	0	0	0	Wold	Ground
Lost Dog 1	4	12	605	Inactive	0	0	0	Wold	Ground
Lost Dog 2	4	4	645	Inactive	0	0	0	Wold	Ground
Lost Dog 2	4	12	630	Inactive	0	0	0	Wold	Ground
Lost Dog 4	3	14	700	Active	63	3	0	Frost	Ground
Lost Dog/Hwy 530	4	2	645	Active	30	3	0	Wold	Ground
Lost Dog/Hwy 530	4	20	700	Active	23	0	0	Wold	Ground
Lost Dog/Hwy 530	4	27	600	Active	17	2	5	Wold	Ground
Complex: Massacre Hill									
Massacre Hill	4	18	745	Active	17	0	0	Zornes	Ground
Massacre Hill	5	1	656	Active	16	0	0	Zornes	Ground
Complex: Meadow Spring									
Meadow Sp 1	4	6	730	Active	16	0	0	King	Ground
Meadow Sp 1	4	14	615	Active	19	3	0	King	Ground
Meadow Sp 1	4	26	615	Active	15	0	0	King	Ground
Meadow Sp 2	4	6	640	Active	51	0	0	King	Ground
Meadow Sp 2	4	14	630	Active	58	1	0	King	Ground
Meadow Sp 2	4	24	630	Active	56	2	0	King	Ground
Meadow Sp 3	4	6	700	Active	68	0	0	King	Ground
Meadow Sp 3	4	14	700	Active	73	2	0	King	Ground
Meadow Sp 3	4	26	645	Active	61	0	0	King	Ground
Complex: Pine Butte									
Sand Creek	3	16	800	Active	12	0	0	Kenneda	Ground
Complex: Rifes Rim East									
Chicken Springs Basi	3	23	810	Active	46	7	0	Hays	Ground
Chicken Springs Basi	4	6	720	Active	29	0	0	Hays	Ground
Chicken Springs Basi	4	12	715	Active	34	2	0	Hays	Ground
Chicken Springs Basi	4	24	720	Active	0	0	0	Hays	Ground
Chicken Springs Basi	4	28	740	Active	6	0	0	Hays	Ground
Rifes Rim East	3	23	750	Active	31	17	0	Hays	Ground
Rifes Rim East	4	6	655	Active	19	2	0	Hays	Ground
Rifes Rim East	4	12	655	Active	23	0	0	Hays	Ground
Rifes Rim East	4	24	700	Active	3	0	0	Hays	Ground
Rifes Rim East	4	28	720	Active	24	0	0	Hays	Ground
Complex: Solvay									
Solvay 1	3	20	650	Inactive	0	0	0	Kerr	Ground
Solvay 2	3	20	705	Active	31	12	0	Kerr	Ground
Complex: Spitzi									
Spitzi	5	9	640	Active	26	0	0	Frost	Ground
Complex: Stateline									
Stateline	3	22	705	Active	65	42	0	Woolley	Ground
Complex: Vermillion									
Rifes Rim West	4	7	740	Active	69	4	0	Hays	Ground

Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Worm Creek									
Little Bitter Crk.	4	15	700	Active	13	0	0	Christiansen	Ground
Little Bitter Crk.	4	22	640	Active	28	0	6	Lutz	Ground
Little Bitter Crk.	4	30	555	Active	77	5	0	Christiansen	Ground
Worm Crk. Flats	4	15	635	Active	21	0	0	Christiansen	Ground
Worm Crk. Flats	4	22	615	Active	28	1	0	Lutz	Ground
Worm Crk. Flats	4	30	610	Active	27	2	0	Christiansen	Ground
Management Area: 7									
Complex: Alkali Creek									
Alkali Creek 1	4	4	630	Active	69	10	0	Kerr	Ground
Alkali Creek 1	4	18	620	Active	84	0	0	Kerr	Ground
Alkali Creek 1	4	26	715	Active	67	0	0	Kerr	Ground
Alkali Creek 2	4	4	650	Active	32	4	0	Kerr	Ground
Alkali Creek 2	4	18	640	Active	35	0	0	Kerr	Ground
Alkali Creek 2	4	28	650	Active	19	0	0	Kerr	Ground
Alkali Creek 3	4	4	650	Active	25	0	0	Kerr	Ground
Alkali Creek 3	4	18	640	Active	30	0	0	Kerr	Ground
Alkali Creek 3	4	28	650	Active	23	0	0	Kerr	Ground
Alkali Creek 4	4	4	710	Active	15	0	0	Kerr	Ground
Alkali Creek 4	4	18	700	Active	16	0	0	Kerr	Ground
Alkali Creek 4	4	28	630	Active	5	0	0	Kerr	Ground
Complex: Blue Rim									
Blue Rim	4	7	630	Active	20	0	0	Larry Cherny	Ground
Blue Rim	4	25	630	Active	22	0	0	Larry Cherny	Ground
Blue Rim	5	3	630	Active	2	0	0	Larry Cherny	Ground

Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Bridger Mine									
10 Mile Rim	3	15	730	Active	22	0	0	Bridger Coal	Ground
10 Mile Rim	3	22	727	Active	28	16	0	Bridger Coal	Ground
10 Mile Rim	4	17	721	Active	17	1	0	Bridger Coal	Ground
12 Mile Rim North	3	14	715	Active	3	4	0	Bridger Coal	Ground
12 Mile Rim North	3	21	725	Active	1	0	0	Bridger Coal	Ground
12 Mile Rim North	4	19	655	Active	0	0	0	Bridger Coal	Ground
12 Mile Rim South	3	15	737	Unknown	1	0	0	Bridger Coal	Ground
12 Mile Rim South	3	22	719	Unknown	0	0	0	Bridger Coal	Ground
12 Mile Rim South	4	17	730	Unknown	0	0	0	Bridger Coal	Ground
Black Rock	3	13	710	Active	68	14	0	Bridger Coal	Ground
Black Rock	3	23	710	Active	66	35	0	Bridger Coal	Ground
Black Rock	3	24	815	Active	59	12	16	B. Parks	Ground
Black Rock	4	8	755	Active	36	5	20	B. Parks	Ground
Black Rock	4	18	650	Active	59	2	0	Bridger Coal	Ground
Black Rock	4	28	735	Active	17	0	3	B. Parks	Ground
Continental Divide	3	13	742	Abandoned	0	0	0	Bridger Coal	Ground
Continental Divide	3	23	721	Abandoned	0	0	0	Bridger Coal	Ground
Continental Divide	4	18	650	Abandoned	0	0	0	Bridger Coal	Ground
Drill Hole	3	16	745	Active	134	18	0	Bridger Coal	Ground
Drill Hole	3	21	710	Active	166	62	0	Bridger Coal	Ground
Drill Hole	4	18	730	Active	92	7	0	Bridger Coal	Ground
Rigby Road	3	13	750	Abandoned	0	0	0	Bridger Coal	Ground
Rigby Road	3	23	742	Abandoned	0	0	0	Bridger Coal	Ground
Rigby Road	4	18	709	Abandoned	0	0	0	Bridger Coal	Ground
Upper 10 Mile	3	15	711	Active	39	16	0	Bridger Coal	Ground
Upper 10 Mile	3	22	704	Active	48	53	0	Bridger Coal	Ground
Upper 10 Mile	4	17	645	Active	57	3	0	Bridger Coal	Ground
Complex: Buckhorn									
12 Mile Sink	4	20	640	Active	58	0	0	Kerr	Ground
Buckhorn	4	20	700	Active	55	6	0	Kerr	Ground
W. Fork Buckhorn	4	20	735	Active	36	0	0	Kerr	Ground
Complex: Chindgren									
Chindgren	3	20	705	Active	79	60	0	Lockman	Ground
Chindgren	4	5	700	Active	71	0	0	Lockman	Ground
Chindgren	4	6	0755	Active	0	0	0	Lockman	Ground
Chindgren	4	8	700	Active	0	0	0	Lockman	Ground
Chindgren	4	11	655	Active	52	0	0	Chindgren	Ground
Chindgren	4	20	656	Active	27	2	0	Lockman	Ground
Chindgren	4	21	638	Active	80	1	0	Lockman	Ground
Chindgren	4	26	615	Active	77	8	0	Chindgren	Ground
Complex: County Line									
County Line	4	24	605	Active	41	0	0	Chindgren	Ground

Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Dry Sandy									
Artesian	4	13	705	Active	192	3	0	Christiansen	Ground
Artesian	4	25	640	Active	111	1	0	Christiansen	Ground
Artesian	5	2	635	Active	121	8	0	Christiansen/J	Ground
Dry Sandy 1	4	13	635	Active	69	1	0	Christiansen	Ground
Dry Sandy 1	4	25	605	Active	62	6	0	Christiansen	Ground
Dry Sandy 1	5	2	555	Active	64	2	0	Christiansen/J	Ground
Dry Sandy 3	5	2	720	Inactive	0	0	0	Christiansen	Ground
Sublette	4	13	650	Active	26	0	0	Christiansen	Ground
Sublette	4	25	620	Active	207	14	0	Christiansen	Ground
Sublette	5	2	610	Active	40	0	0	Christiansen	Ground
Complex: East Eden									
15 Mile Spring	4	26	635	Active	121	3	0	Christiansen	Ground
Buffalo Hump	5	14	550	Active	116	0	0	Frost	Ground
East Of Eden	4	25	645	Active	76	0	0	Frost	Ground
East Of Eden	5	8	610	Active	79	0	0	Frost	Ground
East Of Eden	5	14	550	Active	47	0	0	Frost	Ground
Ox Yoke	4	26	655	Active	17	0	0	Christiansen	Ground
Complex: Gasson Bridge									
Gasson Bridge East	4	17	650	Active	40	0	0	Glass	Ground
Gasson Bridge East	4	27	635	Active	6	0	0	Glass	Ground
Gasson Bridge East	5	7	621	Active	5	0	0	Glass	Ground
Gasson Bridge West	4	17	620	Active	147	8	0	Glass	Ground
Gasson Bridge West	4	27	610	Active	139	1	0	Glass	Ground
Gasson Bridge West	5	7	550	Active	55	1	0	Glass	Ground
Complex: Joe Hay									
Bush Rim	4	30	900	Active	0	0	0	Frost	Ground
East Joe Hay	4	26	815	Active	26	1	0	Frost	Ground
Mowing Machine Draw	4	26	650	Active	83	2	0	Frost	Ground
Rock Cabin 1	4	26	730	Active	45	0	0	Frost	Ground
Rock Cabin 2	4	26	615	Active	3	0	0	Frost	Ground
Rock Cabin 3	4	26	630	Unknown	0	0	0	Frost	Ground
Complex: Juel Creek									
Juel Creek 1	4	5	720	Active	161	14	0	Zornes/Christi	Ground
Juel Creek 2	4	13	725	Active	46	1	0	Christiansen	Ground
Juel Creek 2	4	17	650	Active	114	2	0	Christiansen	Ground
Juel Creek 3	4	5	0745	Active	30	3	0	Christiansen/Z	Ground
Juel Creek 3	4	13	0740	Active	60	2	0	Christiansen	Ground
Juel Creek 3	4	17	0700	Active	50	2	0	Christiansen	Ground
Juel Creek 3	4	23	0700	Active	62	1	0	Christiansen	Ground
Juel Creek 3	4	28	0710	Active	62	2	0	Christiansen	Ground
Juel Creek 4	4	5	700	Active	34	5	0	Christiansen/Z	Ground
Juel Creek 4	4	13	750	Active	12	0	0	Christiansen	Ground
Juel Creek 4	4	17	645	Active	37	0	0	Christiansen	Ground
Juel Creek 4	4	28	555	Active	45	2	0	Christiansen	Ground
Juel Creek 5	4	17	710	Active	18	0	0	Christiansen	Ground
Juel Creek 5	4	28	715	Active	15	2	0	Christiansen	Ground
Williams Reservoir No 2	4	13	735	Active	106	7	0	Christiansen	Ground
Williams Reservoir No 2	4	17	655	Active			100	Christiansen	Ground

Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Killpecker									
Killpecker Crk	4	9	634	Active	100	0	0	Christiansen	Ground
Killpecker Crk	4	18	615	Active	119	4	0	Christiansen	Ground
Killpecker Crk	4	26	605	Active	115	7	0	Christiansen	Ground
Complex: Little Colorado Desert									
Steed Canyon	4	15	0630	Active	6	1	0	Hovinga	Ground
Steed Canyon	4	30	0615	Active	3	0	0	Hovinga	Ground
Steed Canyon	5	4	0600	Active	0	0	0	Hovinga	Ground
Complex: McAnn									
Divide	4	28	630	Active	109	4	0	Christiansen	Ground
Hay Creek	4	28	645	Active	50	0	0	Christiansen	Ground
Complex: Midland Ranch									
Little Prospect	4	30	615	Active	9	0	0	Frost	Ground
Midland 2	5	27	700	Active	12	0	0	Chindgren	Ground
Complex: Mitchell Slough									
Mitchell Slough	4	17	730	Active	52	3	0	Christiansen	Ground
Mitchell Slough	4	25	725	Active	93	3	0	Christiansen	Ground
Complex: North Pacific Crk									
North Pacific Crk 7	4	4	720	Active	53	5	0	Frost	Ground
North Pacific Crk 7	4	5	650	Active	56	3	0	Christiansen/Z	Ground
North Pacific Crk 7	4	13	755	Active	33	0	0	Christiansen	Ground
North Pacific Crk 7	4	17	640	Active	58	0	0	Christiansen	Ground
North Pacific Crk 7	4	28	550	Active	53	4	0	Christiansen	Ground
Complex: Oregon Trail									
Oregon Trail Marker	4	16	620	Active	62	4	0	Christiansen	Ground
Complex: Pacific Creek									
Hay Middle Ranch	4	24	720	Active	95	3	0	Frost	Ground
Hay Middle Ranch	5	2	545	Active	80	0	0	Frost	Ground
Hay Middle Ranch	5	10	650	Active	34	2	0	Frost	Ground
Jack Morrow Ck.	4	24	630	Active	67	0	0	Frost	Ground
Jack Morrow Ck.	5	2	700	Active	56	1	0	Frost	Ground
Jack Morrow Ck.	5	10	600	Active	39	0	0	Frost	Ground
Complex: Petroglyph									
Petroglyph	4	9	655	Active	43	0	0	Christiansen	Ground
Petroglyph	4	18	640	Active	46	0	0	Christiansen	Ground
Complex: Poston Reservoir									
Poston Reservoir	4	17	720	Active	206	0	0	Chindgren	Ground
Poston Reservoir	4	24	745	Active	81	3	0	Chindgren	Ground
Complex: Sand Knolls									
Sand Knolls 1	3	20	700	Active	98	13	0	Anselmi	Ground
Sand Knolls 1	4	21	730	Active	33	1	0	Anselmi	Ground
Sand Knolls 1	5	5	600	Active	3	0	0	Anselmi	Ground
Complex: Simpson									
12 Mile Canyon East	3	22	725	Active	65	20	0	Kerr	Ground
Flowing Well	3	22	710	Unknown	0	0	0	Kerr	Ground
Little Colo Well 11	3	22	745	Active	98	25	0	Kerr	Ground
Radio Tower 1	3	22	650	Active	20	8	0	Kerr	Ground
Simpson	3	22	805	Active	80	20	115	Kerr	Ground

Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: South Banana Ranch									
South Banana Ranch	3	21	750	Active	14	0	0	Lockman	Ground
South Banana Ranch	4	5	900	Active	0	0	0	Lockman	Ground
South Banana Ranch	4	8	800	Active	0	0	0	Lockman	Ground
South Banana Ranch	4	10	700	Active	10	0	0	Lockman	Ground
South Banana Ranch	4	18	620	Active	12	0	0	Chindgren	Ground
South Banana Ranch	4	23	717	Active	7	0	0	Lockman	Ground
Complex: Spicer									
Spicer 1	4	17	630	Active	10	0	0	Chindgren	Ground
Spicer 1	4	24	630	Active	60	1	0	Chindgren	Ground
Spicer 2	4	24	645	Active	81	2	0	Chindgren	Ground
Spicer 3	4	17	645	Active	58	0	0	Chindgren	Ground
Spicer 3	4	25	700	Active	168	8	0	Chindgren	Ground
Spicer 4	4	17	745	Active	30	0	0	Chindgren	Ground
Spicer 4	4	24	735	Active	160	6	0	Chindgren	Ground
Complex: Spring Butte									
Spring Butte	3	24	750	Active	17	4	0	B. Parks	Ground
Spring Butte	4	28	715	Active			4	B. Parks	Ground
Complex: Stagecoach									
Stagecoach	3	22	850	Active	30	11	0	Lockman	Ground
Stagecoach	4	5	830	Active	0	0	0	Lockman	Ground
Stagecoach	4	8	723	Active	57	5	0	Lockman	Ground
Stagecoach	4	18	710	Active	60	0	0	Chindgren	Ground
Stagecoach	4	20	817	Active	0	0	0	Lockman	Ground
Stagecoach	4	22	705	Active	54	0	0	Lockman	Ground
Complex: Stagecoach North									
Stagecoach North	3	23	730	Active	41	11	0	Lockman	Ground
Stagecoach North	4	6	700	Active	26	5	0	Lockman	Ground
Stagecoach North	4	10	630	Active	40	8	0	Chindgren	Ground
Stagecoach North	4	22	612	Active	49	2	0	Lockman	Ground
Complex: Starvation Divide									
Starvation Divide				Active	0	0	0	Lockman	Ground
Starvation Divide	4	10	730	Active	16	0	0	Chindgren	Ground
Starvation Divide	4	11	715	Active	43	0	0	Chindgren	Ground
Complex: Starvation Wash									
Starvation Wash	3	20	735	Active	176	31	0	Lockman	Ground
Starvation Wash	4	5	740	Active	79	5	0	Lockman	Ground
Starvation Wash	4	8	705	Active	0	0	0	Lockman	Ground
Starvation Wash	4	10	710	Active	45	0	0	Chindgren	Ground
Starvation Wash	4	11	630	Active	156	0	0	Chindgren	Ground
Starvation Wash	4	20	745	Active	197	9	0	Lockman	Ground
Starvation Wash	4	23	700	Active	181	7	0	Chindgren	Ground
Complex: Table Mtn									
Table Mtn	3	24	645	Active	34	31	0	B. Parks	Ground
Table Mtn	4	8	655	Active	0	1	0	B. Parks	Ground
Table Mtn	4	28	605	Active	33	11	5	B. Parks	Ground
Complex: Table Wash									
Table Wash	3	24	710	Active	57	55	20	B. Parks	Ground
Table Wash	4	8	715	Active	8	0	0	B. Parks	Ground
Table Wash	4	28	630	Active	62	15	20	B. Parks	Ground

Table 8. Sage-grouse lek observations by lek complex for 2007.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Upper Alkali									
Upper Alkali	4	11	640	Active	34	0	0	Chindgren	Ground
Upper Alkali	6	5	100	Active	0	0	0	Chindgren	Ground

Sage-Grouse Job Completion Report

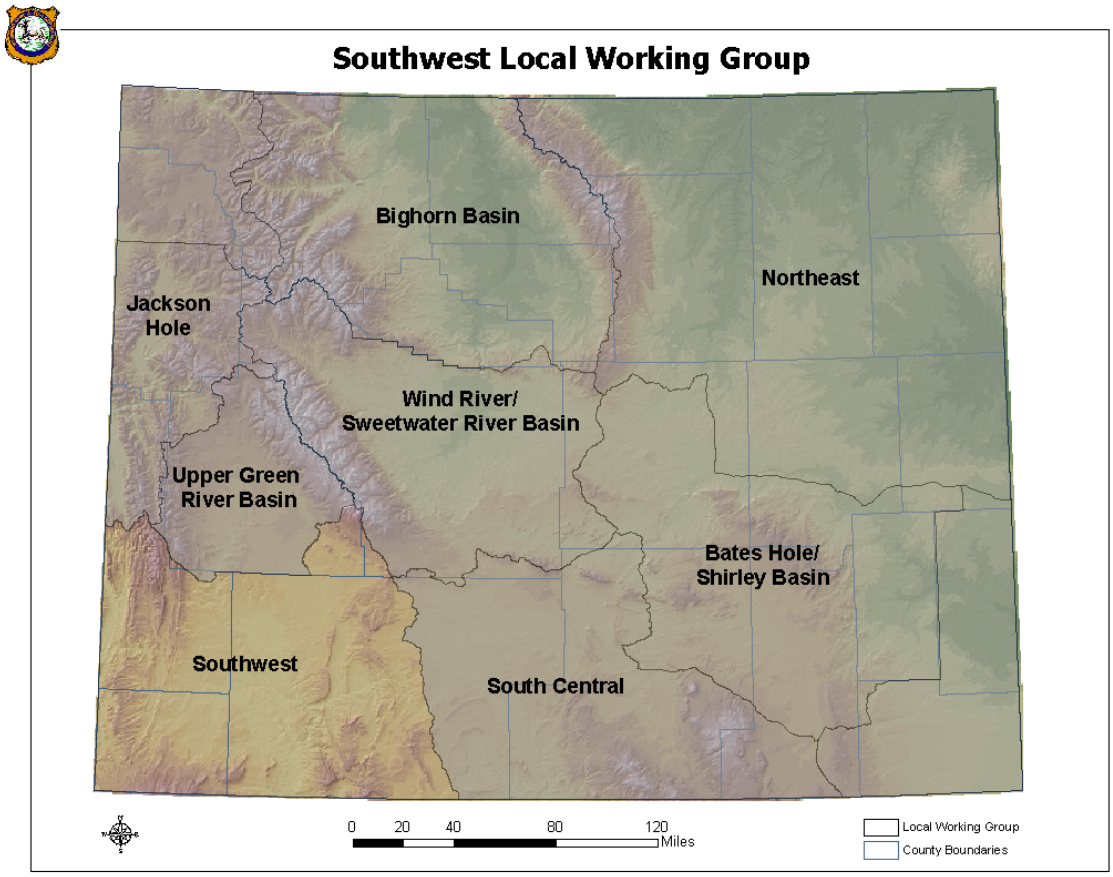
Conservation Plan Area: **Southwest**
Period Covered: **6/1/2006 – 5/31/2007**
Prepared by: **Grant Frost**

INTRODUCTION

This is the third Greater Sage-Grouse completion report prepared for the Southwest Wyoming Sage-Grouse Conservation Planning Area (SWSGCA). The initial report gave a broader, historical perspective on sage-grouse in the area in addition to the analysis of the current year.

The SWSGCA was created in 2004 with the formation of the Southwest Wyoming Local Sage-Grouse Working Group (SWLWG). The SWLWG is one of eight local working groups in Wyoming (Figure 1) that are charged with developing and implementing local sage-grouse conservation plans for the benefit of sage-grouse and, whenever feasible, other species that use sagebrush habitats. These conservation plans are to identify strategies and commitments for the purpose of improving sage-grouse numbers and precluding the need for listing under the Endangered Species Act. The SWLWG is nearly finished drafting their plan, which will be finalized in the summer of 2007.

Figure 1. Wyoming Local sage-grouse working group boundaries.



According to the range-wide Conservation Assessment of Greater Sage-Grouse and Sagebrush Habitats (Connelly et al. 2004), sage-grouse have declined across their range during the past 50 years, as has the quality and distribution of the bird's requisite sagebrush-steppe habitat.

Some of the highest densities of sage-grouse in North America are found in the sagebrush habitats of Southwest Wyoming. Occupied habitat is fairly contiguous throughout much of the area. More fragmented habitats occur in areas of greater human development such as near major highways, large-scale cultivated areas, and high density natural gas development. Naturally fragmented habitats occur near forested areas, badlands, sand dunes and some salt desert shrub habitats.

Most of the occupied sage-grouse habitats in the SWSGCA are public lands, primarily managed by the Bureau of Land Management (BLM). Approximately 74 percent of known leks (strutting grounds) are found on public land; the remaining 26 percent are found on private and state lands.

As of spring 2007 there were 248 known occupied leks in the SWSGCA. Monitoring male attendance on leks provides a reasonable index of relative change in abundance in response to prevailing environmental conditions over time. In general, sage-grouse data collection efforts in the SWSGCA have increased over the past decade due to the increasing concerns for sage-grouse and their habitats. Results of this and prior monitoring suggest sage-grouse populations in the Green River Region were at their lowest levels ever recorded in the mid-1990s. Grouse numbers then responded to increased precipitation during the late 1990's with some individual leks seeing three fold increases in the number of males counted between 1997 and 1999. The return of drought conditions in the early 2000's led to decreases in chick production and survival and therefore population declines; although the population did not decline to mid-1990s levels. Timely precipitation in 2004-05 increased chick survival and later lek attendance, however observations at leks in 2007 suggest that the rate of growth may have leveled off, and drought conditions will have negative impacts if they persist into 2008.

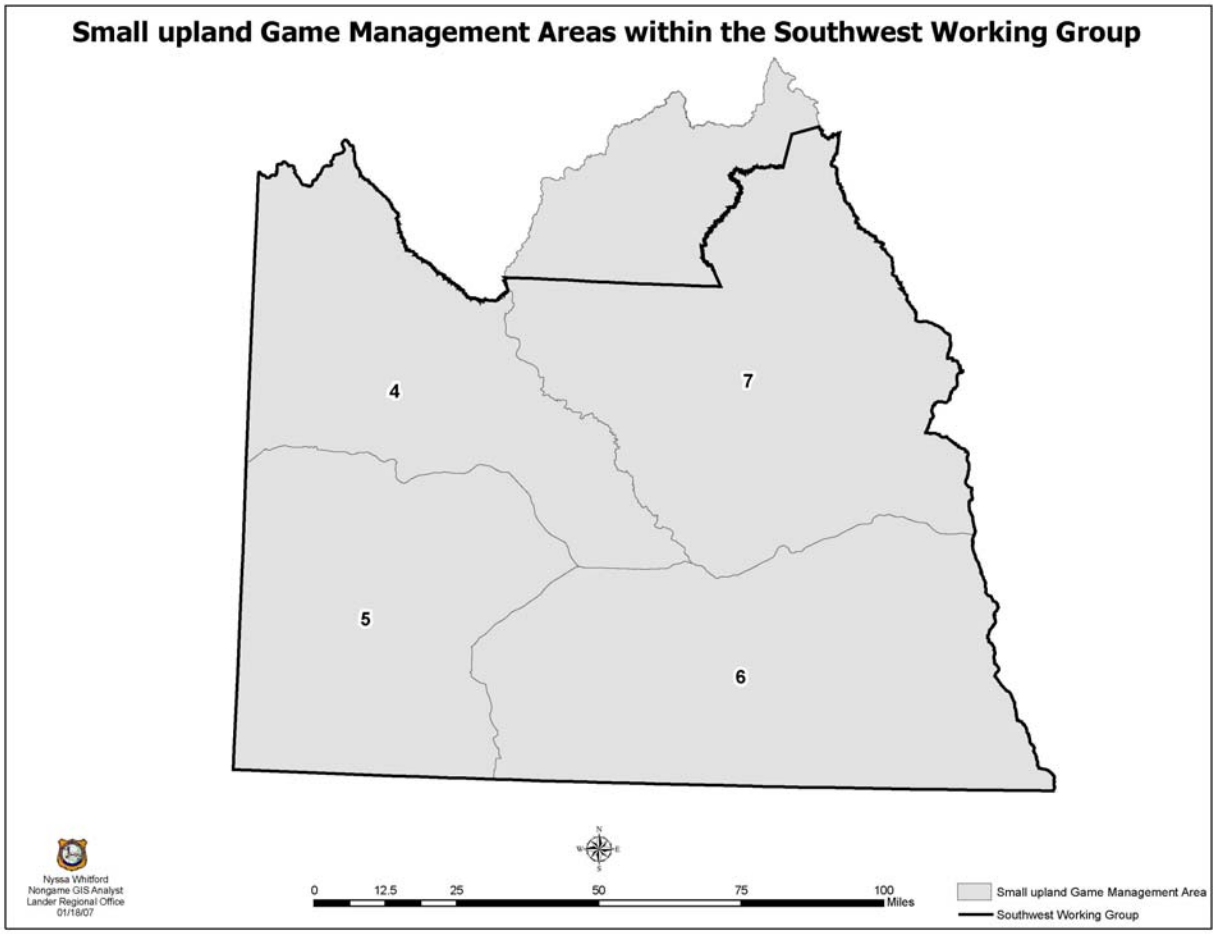
Primary issues of concern for sage-grouse within the Green River Region include: increasing natural gas development, drought, livestock grazing practices and vegetation treatment practices. Public concerns that are often expressed include predation and hunting effects.

METHODS

Data on numbers of sage-grouse attending leks were collected in two ways: lek surveys and lek counts. Lek surveys were defined as at least one visit to a lek during the March-May breeding season to determine if the lek was active. Lek counts consisted of three or more visits (separated by about 7-10 days) to a lek during the peak of strutting activity (April-early May) to obtain the maximum number of males in attendance. Average male attendance was calculated as the maximum number of males observed on each lek divided by the number of leks checked, using only those leks where one or more males were present.

Harvest information is obtained through a mail questionnaire of bird hunters. Starting in 1982 data have been compiled by Upland Game Management Area. Management Areas in the SWSGCA include Areas 4, 5, 6, and 7 (Figure 2).

Figure 2.



Wings were collected from harvested sage-grouse in order to calculate the proportions of adults, juveniles, males, and females in the harvest. Of primary interest is the chick to hen ratio, a statistic that provides an index of annual chick productivity and survival. Some attempts have been made to determine and report a proportion of successfully nesting hens based on the idea that hens that incubated eggs to hatch stage molt wing primaries later than unsuccessful nesters. Early in the fall, successful hens retain old primaries 8 and/or 9, although the breaking point is not clear-cut. Since the hunting season has changed to late September, and the molt is further progressed, it is difficult to determine nesting success since a large proportion of adult birds have molted through all 10 primaries. Given the lack of a reliable method for accurately determining the proportion of successfully nesting hens based on molt pattern, we have chosen not to report nor analyze these data.

RESULTS

Lek monitoring

Lek monitoring data for the 2007 breeding seasons are summarized in JCR Data Tables 1 (a-d). Data from 1998-2006 are given for comparison and trend.

Male attendance at all leks visited (counts and surveys) averaged just under 48 males per lek during spring 2007. This was slight increase over 47 males/lek observed in 2006 and significantly higher than the average of the previous nine years (1998-2006) of 30 males/lek. Average male lek attendance ranged from 22 males/lek in 2002, to 47 males/lek in 2006 over this period. Count lek average male attendance dropped in 2007, while it increased at survey leks.

The average number of males observed at count leks dropped from 64 to 58, while survey leks increased from 37 to 43 comparing 2006 to 2007. Lek counts typically result in higher numbers than lek surveys because counts are designed to be more likely to capture data at the peak of male lek attendance. However, we cannot explain why the trend declined with count data but increased with survey data. Reasonably large sample sizes were achieved with both techniques in both years.

Drought conditions experienced in 2006 likely resulted in lower chick survival and a decline in the population. This is the opposite of 2005 when favorable spring moisture is believed to have led to very high chick production and survival. However male lek attendance data in 2006 and 2007 do not necessarily reflect this hypothesis. A possible explanation is that the high chick production documented in 2005 resulted in a large yearling cohort, many of which may not have attended leks regularly in the spring of 2006. Thus the modest increase in the average number of males observed in 2006 may not have reflected the true increase in the population. However in 2007, the average number of males/lek did not decline as would be suggested by chick production because the relatively large cohort of two-year-old males (from 2005's high production) attended leks more frequently.

It is important to note that the number of leks sampled increased significantly over the 10-year period and the same leks were not checked from year to year. Increased efforts by WGFD personnel, volunteers, other government agency and private industry biologists, and others has helped increase the numbers of leks known, and the percentage of known leks monitored has jumped from under 40% in 1998 to over 90% in 2007.

A statistically valid method for estimating population size for sage-grouse does not yet exist.

Hunting season and harvest

Hunting seasons in the SWSGCA were similar to most of the rest of the state (JCR Data Table 5a). In 1995, the opening of sage-grouse season was moved to the third Saturday in September. Research suggested that hens and broods were more dispersed and less vulnerable to hunting with the later opening date. Due to concerns over low populations the statewide hunting season was shortened to nine days and the daily bag limit decreased to two sage-grouse, in 2002. The opening date was also changed to the fourth Saturday in September. Hunting seasons for all upland and small game were established for 3-year periods beginning in 2004. Overall, the season remains conservative with 11 days of hunting and limits of 2 sage-grouse daily and 4 in possession.

Reporting all of the harvest from Area 7 includes a relatively small number of birds harvested in the Upper Green River Conservation Area, however there is no valid method to allocate the harvest for the areas to the appropriate JCR reporting area. This does not diminish the validity of the trends suggested by the data as long as the data are reported the same from year to year.

Delaying and shortening the season and decreasing the bag limit dramatically decreased the number of sage-grouse hunters and their harvest in the SWSGCA in 2002 and 2003 (JCR Data Table 4a and b). Hunters were also sensitive to the plight of grouse populations and did not take the opportunity to hunt sage-grouse as much as they had in the past. The number of hunters pursuing sage-grouse have rebounded from the lows of 684 in 2002 and 965 in 2003. In 2004, 2005, and 2006 there were an estimated 2,400, 1,148 and 1,968 hunters in the SWSGCA. Likewise, harvest has rebounded but varied. In 2004, 5,843 birds were harvested, 3,126 in 2005, and 5,019 in 2006. The hunters and harvest in 2006 were above the ten year averages. Birds

taken per day and per hunter stayed essentially the same between 2005 and 2006, and are close to the ten year averages.

In 2006, 638 sage-grouse wings were collected from hunters in the SWSGCA (JCR Data Table 5). Fourteen collection barrels were put out in various locations across the SWSGCA. Wings were also collected at the Farson check station on both weekends of the hunting season. The 638 wings are about 12.7% of the 2006 estimated harvest of 5,019 birds. This seems to follow the pattern of higher years of harvest having a lower percentage of wings collected. In 2002 the wing/harvest rate was 36% (418 wings/1,156 harvest). Interestingly, the proportion of wings/estimated harvest averaged 14% between 1998 and 2001. We speculate that the increased proportion of wings collected in 2002 and 2003 may be due to the more restrictive seasons which may favor participation from a higher proportion of dedicated sage-grouse hunters and a lower proportion of casual sage-grouse hunters who may be less likely to participate in wing collection efforts.

The 2006 chick:hen ratio (based on harvested wing analysis) was 1.1 chicks per hen, a drastic reduction in the ratio of 3.3:1 observed the year before. This level of productivity is highly suggestive of a decreasing population. When average males per lek were increasing in the late 1990's, +24% from 1997-98 and +47% from 1998-99, the proceeding years' chick:hen ratio were 2.7 and 2.2 respectively. Conversely, when the chick:hen ratio dropped to 0.9 in 2000, the 2001 average males:lek decreased 32%. Relatively small changes in average males/lek observed in 2002 (-3%), 2003 (+9%) and 2004 (+4%) were proceeded by chick:hen ratios of 1.2, 1.7 and 1.6 respectively. The high reproduction in 2005 did not have a correspondingly large increase of lek attendance in 2006. Another year that contradicts this general pattern was in 2000 when the average numbers of males/lek decreased 10% following a year when there were 2.1 chicks per hen. The discussion in the lek monitoring section about yearling male lek attendance may explain these results, at least for 2006 and 2007. Even in years where lek numbers reflect the previous year's chick production the relationship is not perfectly correlated suggesting factors other than chick production and survival also contribute to population change.

Prior to 1997, wing analysis results may be questioned since personnel were not well trained in techniques. In 1997 the Department began its internal Sage-grouse Working Group, which began hosting an annual wing-bee where training was provided and accuracy of wing reading efforts improved.

Weather and Habitat

Sage-grouse nest success and chick survival has been linked to habitat condition, specifically shrub height and cover, live and residual (remaining from the previous year) grass height and cover, and forb cover. The shrubs (primarily sagebrush) and grasses provide screening cover from predators and weather while the forbs provide food in the form of the plant material itself and in insects that use the forbs for habitat. Spring precipitation is an important determinant of the quantity and quality of these vegetation characteristics. Residual grass height and cover depends on the previous year's growing conditions and grazing pressure while live grass and forb cover are largely dependant on the current year's precipitation.

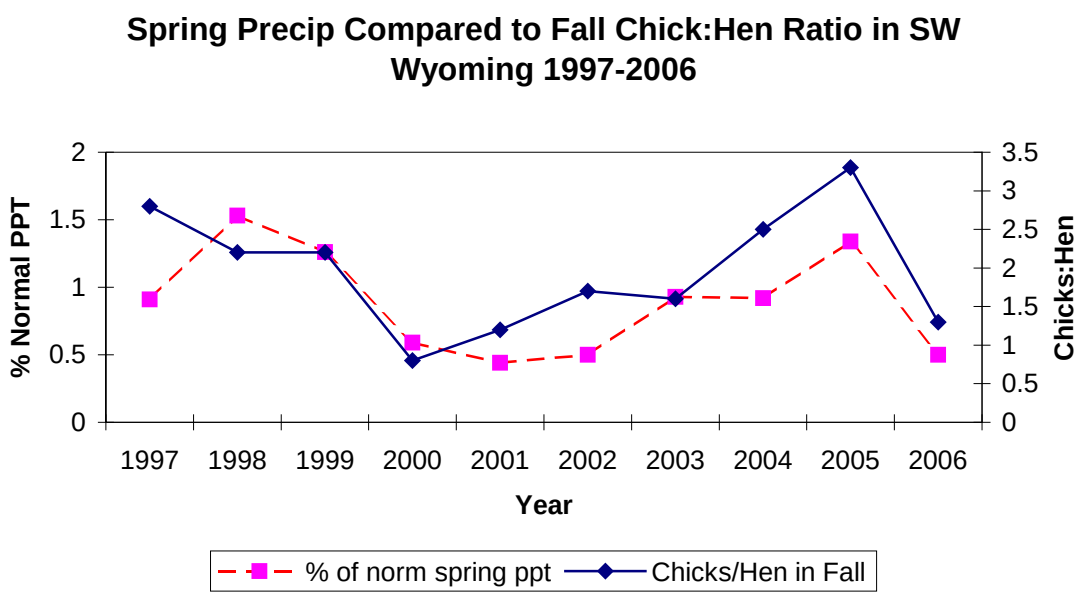
The spring (March-June) precipitation and fall chick:hen ratios (as determined by hunter harvested wings) are shown in narrative Table 2 and Figure 3. A comparison of these variables is suggestive of a positive relationship between them. Generally speaking, spring precipitation that was normal or above normal (90%+) resulted in above average fall chick:hen ratios and years of spring drought resulted in below average chick production. The 1997-2006 average chick:hen ratio was 1.9. The average chick:hen ratio of those years with greater than 90% of normal spring

precipitation was 2.4 while the average chick:hen ratio in the drought years of 2000-2002 and 2006 was 1.2. In turn, years of high chick production generally resulted in increased numbers of birds observed during the subsequent year's lek checks and vice versa as discussed in the "Harvest" section above. A more thorough statistical analysis of these and other weather effects is recommended especially as additional years of data are collected. Wing data collected and analyzed prior to 1997 are not reliable indicators of chick production due to inconsistent observers using outdated techniques.

Table 2. Spring precipitation compared to fall chick:hen ratios in Southwest DAU 1997-2005. Precipitation data source: http://www.wrcc.dri.edu/index.html (Click on Current Observations, Forecasts, and Monitoring - under Monitoring click on USA Divisional Climate Plots - click on Time History Plot #2 – click on the map in the relevant portion of Wyoming, in this case division #3 Green and Bear Drainage Division – set up the plot as desired including List the data for the points plotted? option – add the percentages listed under March through June of the year of interest and divide by four)

Year	% of Average March-June ppt	Chicks:Hen
1997	91%	2.8
1998	153%	2.2
1999	126%	2.2
2000	59%	0.8
2001	44%	1.2
2002	50%	1.7
2003	93%	1.6
2004	92%	2.5
2005	134%	3.3
2006	50%	1.1
2007	57%	N/A

Figure 3.



Winter weather has not been shown to be limiting to sage-grouse except in areas of persistent, deep, snow cover resulting in limited sagebrush availability. This is rarely the case in the SWSGCA.

Shrub Transects

All regions within the WGFD have shrub transects located in big game winter ranges that are measured fall and spring by wildlife biologists and wardens (see previous years report for map showing transect locations). Measurements of leader growth after the growing season, and utilization after the winter are recorded. In the Green River Region, which includes 3 transects from the South-Central Sage-grouse Conservation Area, there are now two years of growth data to begin comparing the quality of habitat. As shown in Table 3, growing conditions in 2006 were not good, as shrub growth was less than the previous year's. All shrub transects averaged 40% less growth in 2006 than 2005, and on transects measuring sagebrush the average was 32% lower. The decrease in shrub growth can be attributed to the much lower than normal precipitation in 2006.

Table 3. Shrub leader growth on shrub transects in the Green River Region.

Transect location	2005	2006	% Change
Red Creek	1.72	0.24	-86%
Faulkner Draw	1.84	1.20	-35%
Box Canyon	2.65	0.81	-69%
Tabernacle Butte	0.62	0.30	-52%
W. Fk Smiths Fk	2.07	2.28	+10%
Leroy	1.48	1.08	-27%
Round Mtn	3.07	2.98	-3%
Average	1.92	1.27	-34%

Habitat and seasonal range mapping. While we believe that most of the currently occupied leks in Southwest Wyoming have been documented (247 leks), other seasonal habitats such as nesting/early brood-rearing and winter concentration areas have not been identified. Efforts to map seasonal ranges for sage-grouse will continue by utilizing winter observation flights and the on-going Southwest Wyoming land cover mapping effort of the BLM, WGF and WYGIS of the University of Wyoming. The Southwest Wyoming Sage-grouse Conservation Assessment and Plan dated July 17, 2007 outlined projects in Appendix III that the local working group had provided funding for wholly or in part. Some have been completed, some are ongoing, and some have been delayed. These will be reported on in the next completion report.

Conservation Planning

The Southwest Wyoming Local Sage-Grouse Working Group (SWLWG) is one of eight local working groups in Wyoming that are charged with developing and implementing local sage-grouse conservation plans for the benefit of sage-grouse and, whenever feasible, other species that use sagebrush habitats. These conservation plans are to identify strategies and commitments for the purpose of improving sage-grouse numbers and precluding the need for listing under the Endangered Species Act. The SWLWG is nearly finished drafting their plan, which will be finalized in the summer of 2007. Over $1.5 million of funding for sage-grouse conservation projects was made available by the Wyoming State Legislature's approval of Governor Freudenthal's 2005 supplemental budget request and 2006's biennium budget request. The following are projects approved and funded by the SWLWG.

Project Title: Sage-grouse and sagebrush Conservation Information and Education Taxidermy Display and Placemats

Project Location: Statewide

Problem Analysis: Sage-grouse require sagebrush habitats to survive. Wyoming has more sage-grouse than any other state. Humans have changed sagebrush habitats and caused sage-grouse populations to decline. Humans are part of the solution to sage-grouse and sagebrush conservation efforts. More information and education is required to spread the messages critical to sage-grouse and sagebrush conservation efforts across Wyoming and the west.

Project Description: Two sage-grouse (1 male and 1 female) were taxidermy mounted for display in a portable plexiglass cases for use around the state, in conjunction with a three-panel display featuring sage-grouse and sagebrush conservation efforts in Wyoming. 20,000 placemats, featuring sage-grouse and sagebrush conservation information, were distributed to Wyoming restaurants. The placemats feature crossword puzzles, fill in the blanks, find the word, and a connect-the-dots to complete a sage-grouse.

Total Project Cost: $2,500 Wyoming Sage-grouse Conservation Funds expended: $2,500

Project Title: South LaBarge Invasive Weed Control

Project Location: The project area was LaBarge Creek to the north, Fontenelle Creek to the south, Highway 189 on the east and Absaroka Ridge to the west.

Problem Analysis: Due to the severe drought conditions for the past five years this area has seen an increase of weed infestation. This area is very important wintering, breeding, nesting and brood rearing habitat for sage-grouse as well a critical big game wintering and parturition area. Intense weed management in this area insures no loss of habitat for sage-grouse or big game.

Project Description: In June 2006 20 Sublette Weed and Pest employees and SW Sage-grouse LWG volunteers and 10 spray units treated 24 miles of roadside. Targeted weeds included black henbane, musk thistle, Russian knapweed, Scotch thistle, and hoary cress.

Total Project Cost: $15,000 Wyoming Sage-grouse Conservation Funds expended: $5,000

Project Title: Rock Creek Prescribed Burn

Project Location: Rock Creek Area, 12 miles northwest of Kemmerer, Wyoming

Problem Analysis: Many aspen, mixed mountain shrub, and sage/grass communities are in a decadent and dying state due to old age, lack of fire, and browsing. By reintroducing fire in this area, these plant communities will regenerate, improving the quality and quantity of the habitat as well as diversifying the age class structure of the vegetation. The area serves as late brood rearing habitat for sage-grouse. Transitional and crucial mule deer, elk, and moose winter range occur in the area, as well as yearlong habitat for elk, deer, moose, and antelope.

Project Description: The Rock Creek Prescribed Burn was completed in the fall of 2005 and treated 11,000 acres with a 30-60% mosaic of blackened area within the burn unit. The project was the result of a consensus recommendation reached by the Rock Creek Resource

Management Working Group. This project was the most environmentally acceptable method of stimulating regeneration of desired plant communities (i.e., aspen, mixed mountain shrubs and grasses) in the Rock Creek Area.

Total Project Cost: $150,000 Wyoming Sage-grouse Conservation Funds expended: $6,000

Project Title: Winter Range Closure Signs

Project Location: Rock Creek, Slate Creek and Cumberland winter ranges near Kemmerer

Problem Analysis: As a result of winter disturbance the BLM is closing areas to motorized vehicles to minimize disturbance and protect wintering big game and sage-grouse. However, the areas are not well marked so the closures are routinely violated.

Project Description: Provide and install signs on roads to educate and inform the public about the importance of winter range and area closures.

Total Project Cost: $4,000 Wyoming Sage-grouse Conservation Funds expended: $2,000

Project Title: Red Canyon/Elk Mountain Prescribed Burn

Project Location: Clear Creek and South Twin Creek Drainages in Lincoln Co. near Kemmerer

Problem Analysis: Many aspen, mixed mountain shrub, and sage/grass communities are in a decadent and dying state due to old age, lack of fire, and browsing. By reintroducing fire in this area, these plant communities will regenerate, improving the quality and quantity of the habitat as well as diversifying the age class structure of the vegetation. The area serves as late brood rearing habitat for sage-grouse. Transitional and yearlong ranges for mule deer, elk, pronghorn and moose occur in the area.

Project Description: The prescribed burn will occur in a 20,000 acre area with approximately 9,000 acres actually burned in a fine-scale mosaic pattern. Aspen and mountain shrub habitats will be targeted for fire and site-specific prescriptions will be prepared to meet objectives of regenerating perennial herbaceous vegetation, aspen and mountain shrubs.

Total Project Cost: $300,000 depending on contributing funds Wyoming Sage-grouse Conservation Funds approved: $30,000

Project Title: Maintenance and monitoring of riparian exclosures and guzzlers.

Project Location: BLM Rock Springs Field Office area

Problem Analysis: Existing riparian exclosures and guzzlers have not been monitored/maintained in recent years. The exclosures serve as brood-rearing habitat and grouse are known to utilize the guzzlers all summer.

Project Description: A seasonal technician will be hired to monitor and repair 35 exclosures and 11 guzzlers. Sage-grouse use of the areas will also be monitored.

Total Project Cost: $42,000 Wyoming Sage-grouse Conservation Funds approved: $20,000

Project Title: Vermillion Creek Prescribed Burn

Project Location: Vermillion Creek Drainage in southern Sweetwater Co. on Pine Mountain.

Problem Analysis: Stream flows are reduced in Vermillion Creek due to phreatophitic losses of water by sagebrush and conifer. By reintroducing fire in this area, perennial herbaceous vegetation, aspen and mountain shrubs should be regenerated and flows to the creek enhanced. The area serves as late brood rearing habitat for sage-grouse. Transitional and yearlong ranges for mule deer, elk, pronghorn and moose occur in the area.

Project Description: The prescribed burn will occur in a 1,200 acre area with approximately 450 acres actually burned in a fine-scale mosaic pattern. Aspen and mountain shrub habitats will be targeted for fire and site-specific prescriptions will be prepared to meet objectives of regenerating perennial herbaceous vegetation, aspen and mountain shrubs.

Total Project Cost: $15,000 Wyoming Sage-grouse Conservation Funds approved: $5,000

Project Title: Aerial sage-grouse surveys – Hiawatha Project Area

Project Location: Southern Sweetwater County along Colorado border near Hiawatha.

Problem Analysis: Only one sage-grouse lek has been documented in a 157,000 acre area that is likely to see up to 4,200 gas wells drilled in the near future. Winter habitat has not be defined or designated either.

Project Description: Conduct twice monthly aerial surveys of the project area from spring 2007 through spring 2008 to provide seasonal sage-grouse data upon which informed management decisions can be made.

Total Project Cost: $29,100 Wyoming Sage-grouse Conservation Funds approved: $10,000

Project Title: Belle Butte Pipeline Water Development

Project Location: Bell, Hill and Sheep Creek drainages in southern Lincoln County.

Problem Analysis: Livestock are over-utilizing some riparian areas in the Cumberland/Uinta allotment. A water pipeline is being developed to distribute livestock water and decrease use in riparian areas.

Project Description: Sage-grouse Conservation Fund dollars would be used to install 7 guzzlers along the pipeline between livestock tanks to provide water for wildlife, primarily sage-grouse. The guzzlers will be filled from the pipeline assuring consistent availability. The guzzlers will be fenced from livestock use. Overall forage utilization levels of 50% will be adhered to in the project area.

Total Project Cost: $132,000.00 Wyoming Sage-grouse Conservation Funds approved: $34,500.00

PAST RESEARCH/STUDIES

Heath, B. J., R. Straw, S.H. Anderson and J. Lawson. 1997. Sage grouse productivity, survival, and seasonal habitat use near Farson, Wyoming. Completion Report. Wyoming Game and Fish Department. Cheyenne.

Slater, S. J. 2003. Sage-grouse (*Centrocercus urophasianus*) use of different-aged burns and the effects of coyote control in southwestern Wyoming. M..S. Thesis. University of Wyoming Department of Zoology and Physiology. Laramie.

Patterson, R.L. 1952. The sage grouse in Wyoming. Wyoming Game and Fish Department. Sage Books.

CONCLUSIONS AND RECOMMENDATIONS

1) There is a need to more consistently and accurately map lek locations using the Global Positioning System (GPS) map datum of NAD83. Some leks in Southwest Wyoming are still being reported in NAD or CONUS 27.

2) Lek perimeters need to be mapped and integrated into the WGF lek database. Priority for this effort should be based on the lek size and impending development actions that may impact leks.

3) Personnel monitoring leks should review and consistently follow established lek monitoring protocol each year.

4) Seasonal habitats (nesting/early brood rearing, winter concentration areas) for sage-grouse should be mapped with the help of the Southwest Wyoming land cover mapping project and sage-grouse observations.

5) Complete and implement the Southwest Sage-Grouse Conservation Plan begun in 2004.

Sage-Grouse Job Completion Report

YEAR: 2006 **PERIOD COVERED: 6/1/06 - 5/31/07**
WORKING GROUP: Upper Green River **PREPARED BY: Dean Clause**

1. LEK ATTENDANCE SUMMARY (OCCUPIED LEKS)

a. Leks Counted

Year	Known	Counted	Percent Counted	Max Totals Males	Max Totals Females	Avg./Active Lek Males	Avg./Active Lek Females
1998	94	45	47.9	1705	456	37.9	10.1
1999	99	48	48.5	1640	570	34.2	11.9
2000	105	20	19.0	539	192	27.0	9.6
2001	106	46	43.4	1731	550	37.6	12.0
2002	108	55	50.9	1565	560	28.5	10.2
2003	107	80	74.8	1599	629	20.0	7.9
2004	113	83	73.5	2001	303	24.1	3.7
2005	110	90	81.8	3146	703	35.0	7.8
2006	119	92	77.3	4196	712	45.6	7.7
2007	124	95	76.6	5023	356	52.9	3.7

b. Leks Surveyed

Year	Known	Surveyed	Percent Surveyed	Max Total Males	Avg Males/ Active Lek
1998	94	28	29.8	625	29.8
1999	99	35	35.4	771	32.1
2000	105	66	62.9	2167	46.1
2001	106	29	27.4	534	28.1
2002	108	11	10.2	196	49.0
2003	107	11	10.3	134	22.3
2004	113	7	6.2	59	14.8
2005	110	18	16.4	491	37.8
2006	119	17	14.3	555	50.5
2007	124	15	12.1	606	67.3

c. Leks Checked

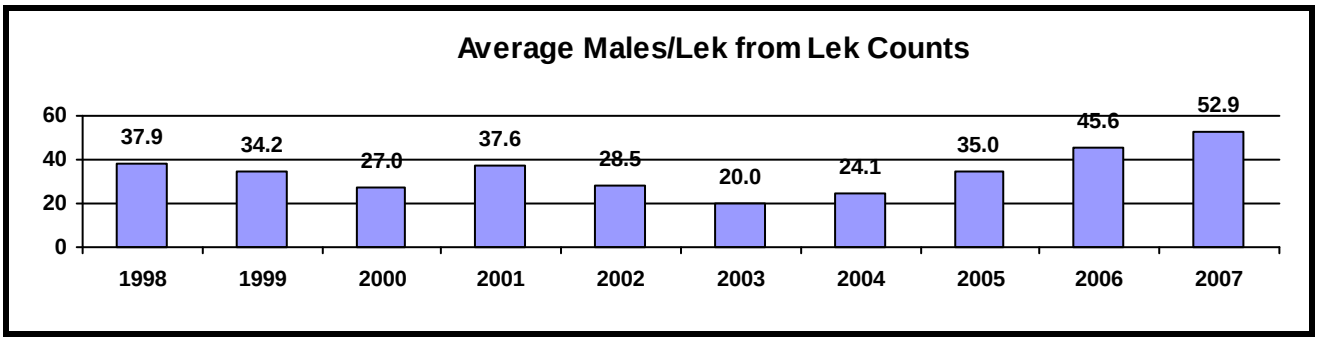
Year	Known	Checked	Percent Checked	Max Total Males	Avg Males/ Active Lek
1998	94	73	77.7	2330	35.3
1999	99	80	80.8	2279	33.0
2000	105	85	81.0	2650	40.2
2001	106	69	65.1	2048	33.6
2002	108	66	61.1	1761	29.8
2003	107	89	83.2	1733	20.4
2004	113	89	78.8	2049	23.8
2005	110	107	97.3	3628	35.6
2006	119	109	91.6	4751	46.1
2007	124	109	87.9	5629	54.7

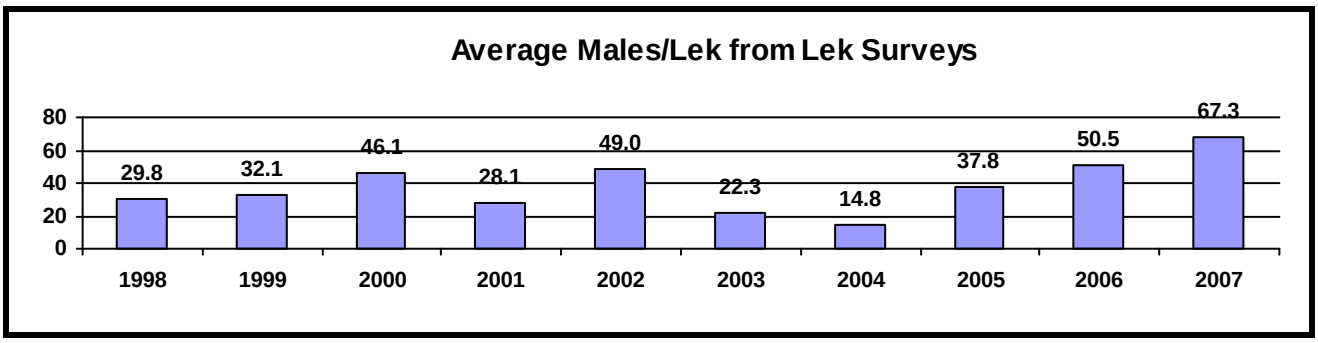
d. Lek Status

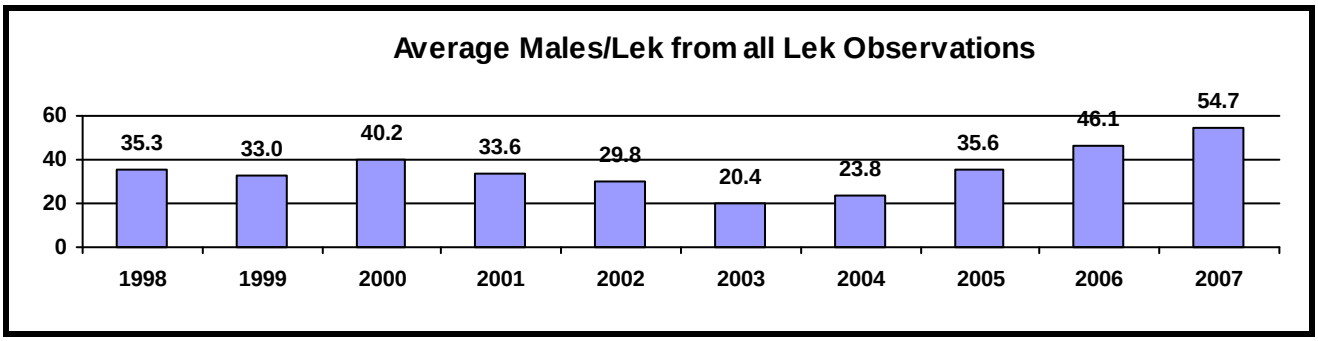
Year	Active	Inactive	Not Located	Unknown	Total	Confirmed Status Active	Confirmed Status Inactive
1998	59	7	0	28	66	89.4%	10.6%
1999	57	10	0	32	67	85.1%	14.9%
2000	65	3	0	37	68	95.6%	4.4%
2001	52	6	3	45	58	89.7%	10.3%
2002	47	15	0	46	62	75.8%	24.2%
2003	64	23	0	20	87	73.6%	26.4%
2004	64	23	0	26	87	73.6%	26.4%
2005	79	28	0	3	107	73.8%	26.2%
2006	78	31	0	10	109	71.6%	28.4%
2007	80	28	0	16	108	74.1%	25.9%

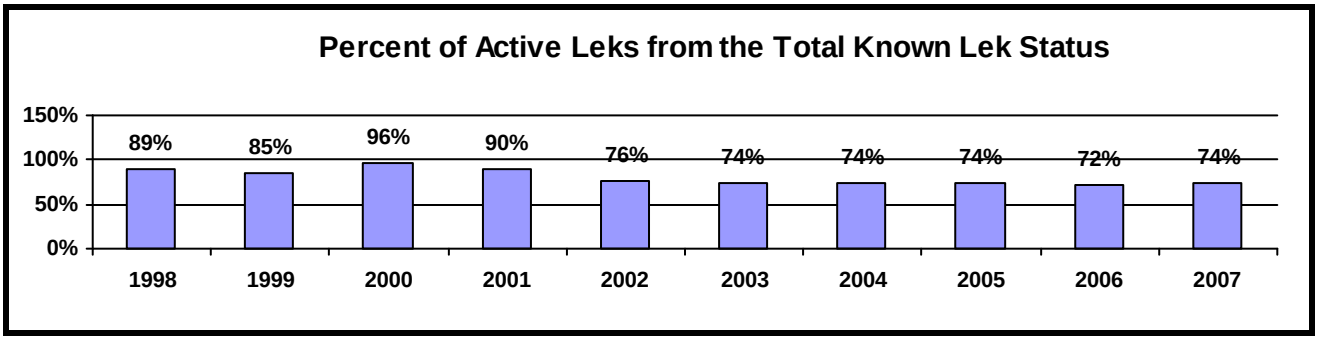
SAGE-GROUSE LEK ATTENDANCE SUMMARY

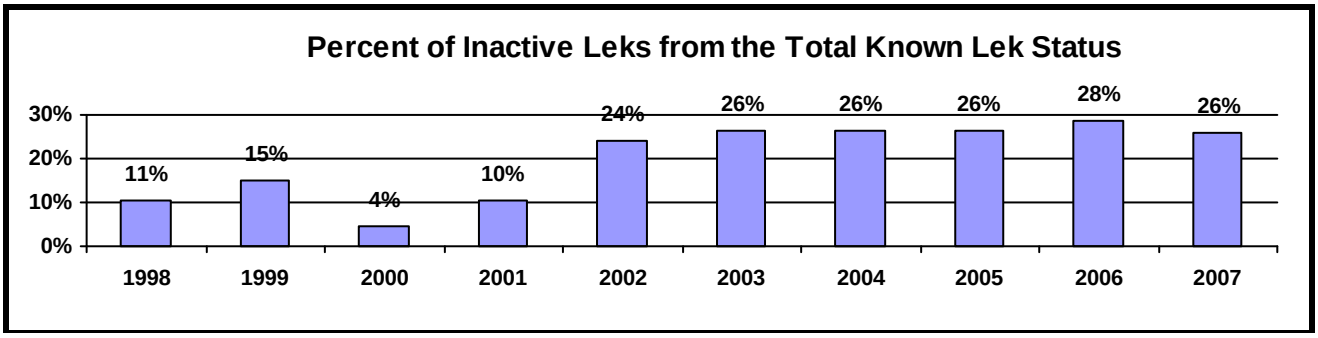
WORKING GROUP: Upper Green River **Area(s):** All











2. LEK COMPLEX ATTENDANCE SUMMARY (OCCUPIED COMPLEXES)

a. Lek Complexes Counted

Year	Number of Complexes`	Maximum Totals Males	Maximum Totals Females	Avg./Active Complex Males	Avg./Active Complex Females	Number of Leks
1998	17	1626	389	95.6	22.9	85
1999	15	1507	500	100.5	33.3	85
2000	9	1017	429	113.0	47.7	60
2001	10	1170	377	117.0	37.7	71
2002	16	1265	498	79.1	31.1	94
2003	20	1139	353	57.0	17.7	119
2004	19	1662	217	87.5	11.4	114
2005	21	2686	552	127.9	26.3	142
2006	23	3231	592	140.5	25.7	157
2007	26	4012	310	154.3	11.9	175

b. Lek Complexes Surveyed

Year	Number Complexes	Max. Total Males	Avg. Males/ Active Complex	Number of Leks
1998	2	74	37.0	17
1999	5	193	38.6	24
2000	13	750	62.5	59
2001	9	241	30.1	39
2002	2	0		16
2003	4	106	35.3	10
2004	1	6	6.0	13
2005	3	153	76.5	7
2006	3	222	111.0	11

c. Lek Complexes Checked

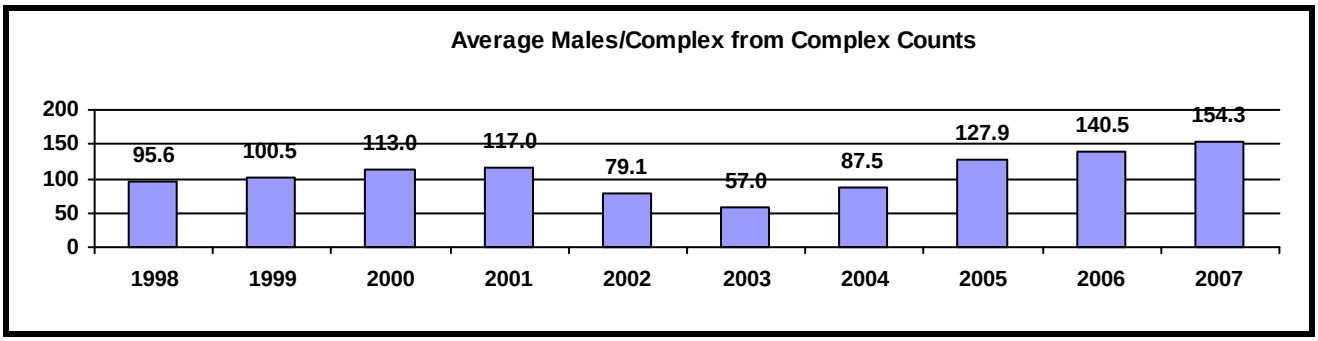
Year	Number Complexes	Max. Total Males	Avg. Males/ Active Complex	Number of Leks
1998	19	1700	89.5	102
1999	20	1700	85.0	109
2000	22	1767	84.1	119
2001	19	1411	78.4	110
2002	18	1265		110
2003	24	1245	54.1	129
2004	20	1668	83.4	127
2005	24	2839	123.4	149
2006	26	3453	138.1	168
2007	26	4012		175

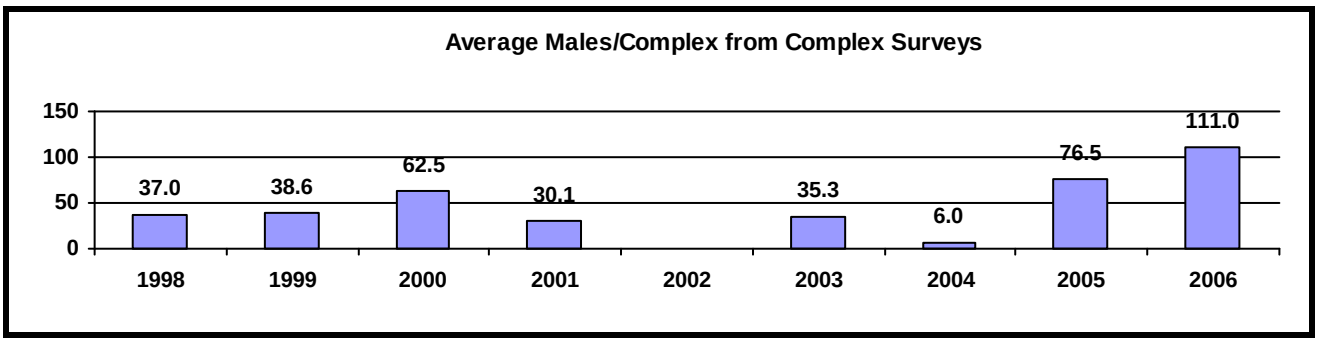
d. Lek Complex Status

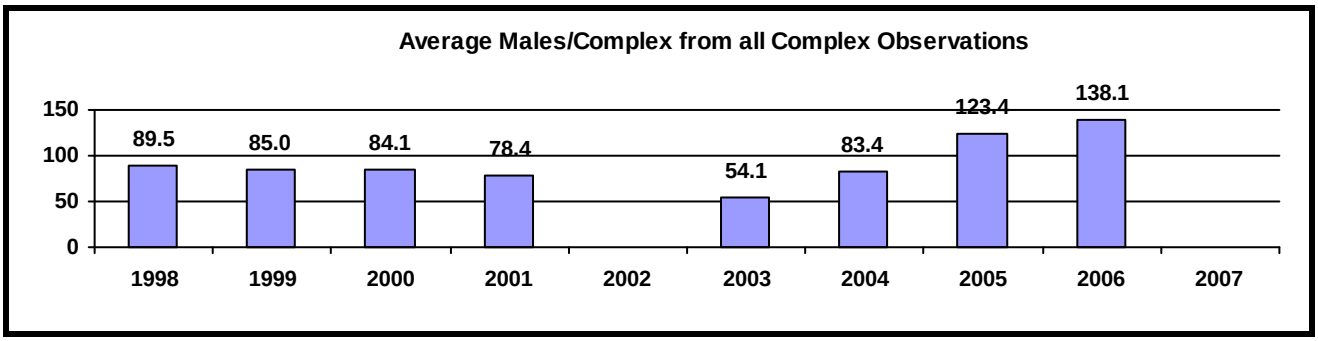
Year	Number of Occupied Complexes: Active	Inactive	Unknown	Total	Known Status: Total	Active	Inactive
1998	19	0	3	22	19	100.0%	0.0%
1999	19	1	3	23	20	95.0%	5.0%
2000	21	1	1	23	22	95.5%	4.5%
2001	18	0	5	23	18	100.0%	0.0%
2002	16	2	6	24	18	88.9%	11.1%
2003	22	1	2	25	23	95.7%	4.3%
2004	19	1	5	25	20	95.0%	5.0%
2005	23	1	1	25	24	95.8%	4.2%
2006	22	4	0	26	26	84.6%	15.4%
2007	24	2	0	26	26	92.3%	7.7%

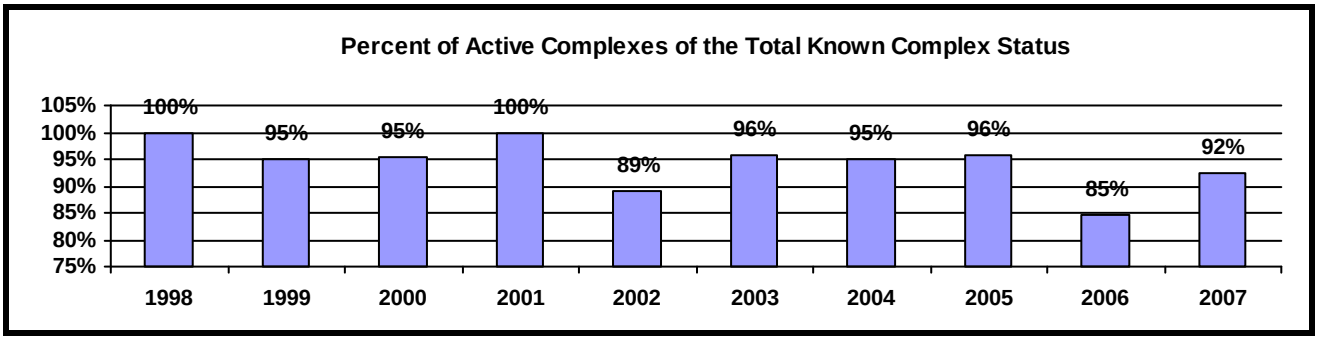
SAGE-GROUSE LEK COMPLEX ATTENDANCE SUMMARY

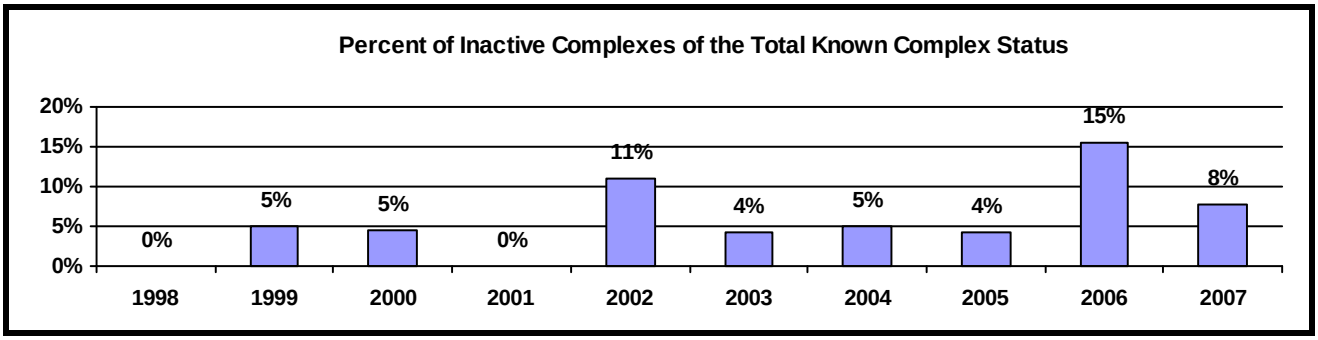
WORKING GROUP: Upper Green River **Area(s): All**











Upper Green River Basin Sage Grouse Lek Characteristics

Region	Number	Percent
Jackson	131	100.0%

Working Group Area	Number	Percent
Upper Green River	131	100.0%

Classification	Number	Percent
Occupied	111	84.7%
Unknown	11	8.4%
Unoccupied	9	6.9%

Unoccupied Leks	Number
Abandoned	8
N/A	1

BLM Office	Number	Percent
	0	0.0%
Pinedale	116	88.5%
Rock Springs	14	10.7%

Biologist District	Number	Percent
Pinedale	90	68.7%
South Jackson	41	31.3%

Game Warden District	Number	Percent
	0	0.0%
Big Piney	55	42.0%
North Pinedale	34	26.0%
South Pinedale	41	31.3%

County	Number	Percent
Sublette	131	100.0%

Land Status	Number	Percent
	0	0.0%
BLM	119	90.8%
Private	6	4.6%
State	4	3.1%

Management Area	Number	Percent
3	88	67.2%
7	43	32.8%

Table 4. Sage-grouse hunting seasons and harvest data.

a. Season

Year	Season Dates	Length	Bag/Possession Limit
1997	Sept 20-Oct 5	16	3/6
1998	Sept 19-Oct 4	16	3/6
1999	Sept 18-Oct 3	16	3/6
2000	Sept 16-Oct 1	16	3/6
2001	Sept 22-Oct 7	16	3/6
2002	Sept 28-Oct 6	9	2/4
2003	Sept 27-Oct 5	9	2/4
2004	Sept 23-Oct 3	11	2/4
2005	Sept 23-Oct 3	11	2/4
2006	Sept 23-Oct 3	11	2/4

b. Harvest

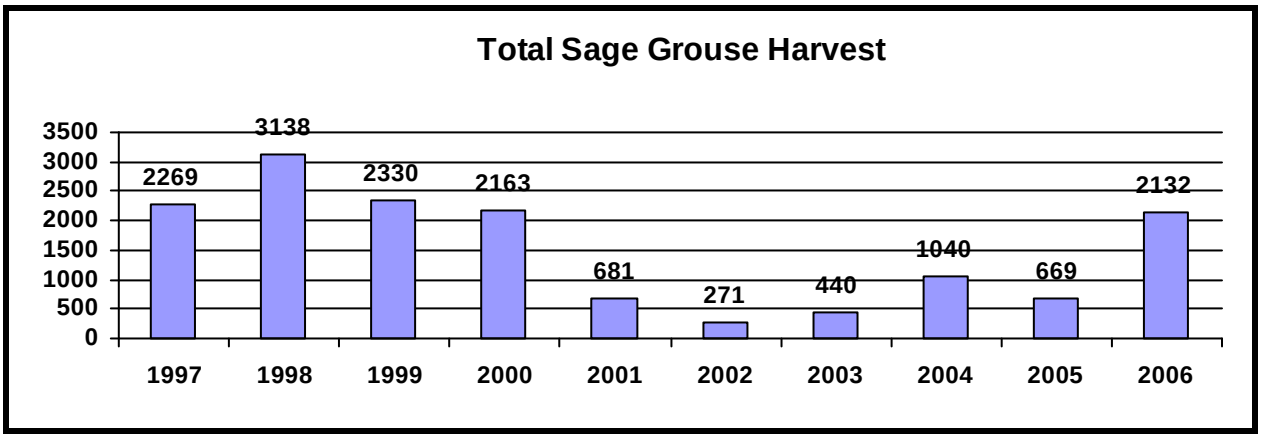
Year	Harvest	Hunters	Days	Birds/ Day	Birds/ Hunter	Days/ Hunter
1997	2,269	735	2,333	1.0	3.1	3.2
1998	3,138	878	2,502	1.3	3.6	2.8
1999	2,330	710	1,888	1.2	3.3	2.7
2000	2,163	731	1,600	1.4	3.0	2.2
2001	681	324	933	0.7	2.1	2.9
2002	271	231	615	0.4	1.2	2.7
2003	440	178	401	1.1	2.5	2.3
2004	1,040	398	1,020	1.0	2.6	2.6
2005	669	233	564	1.2	2.9	2.4
2006	2,132	781	1,885	1.1	2.7	2.4
Avg.	1,513	520	1,374	1.0	2.7	2.6

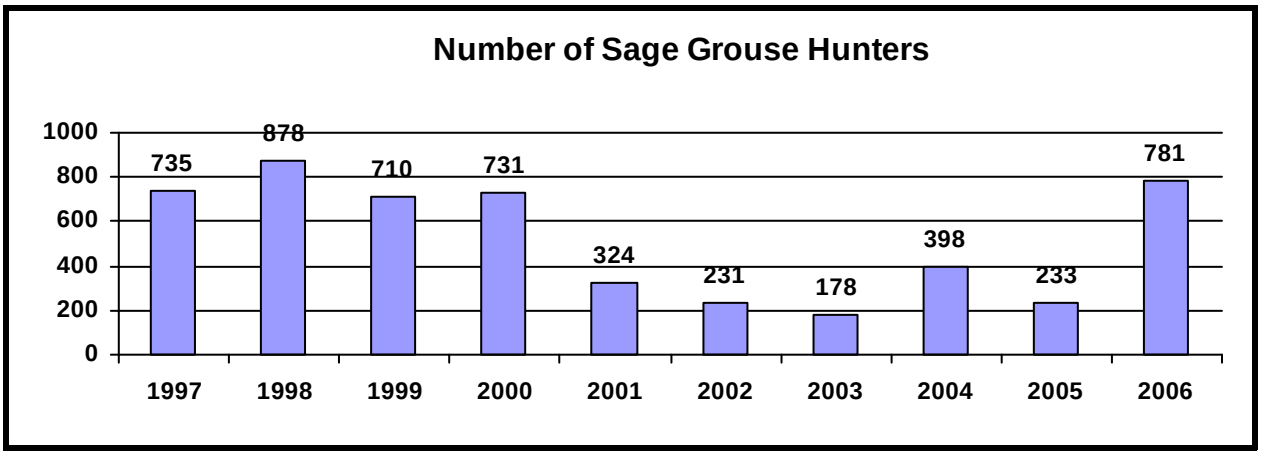
Table 5. Composition of harvest by wing analysis.

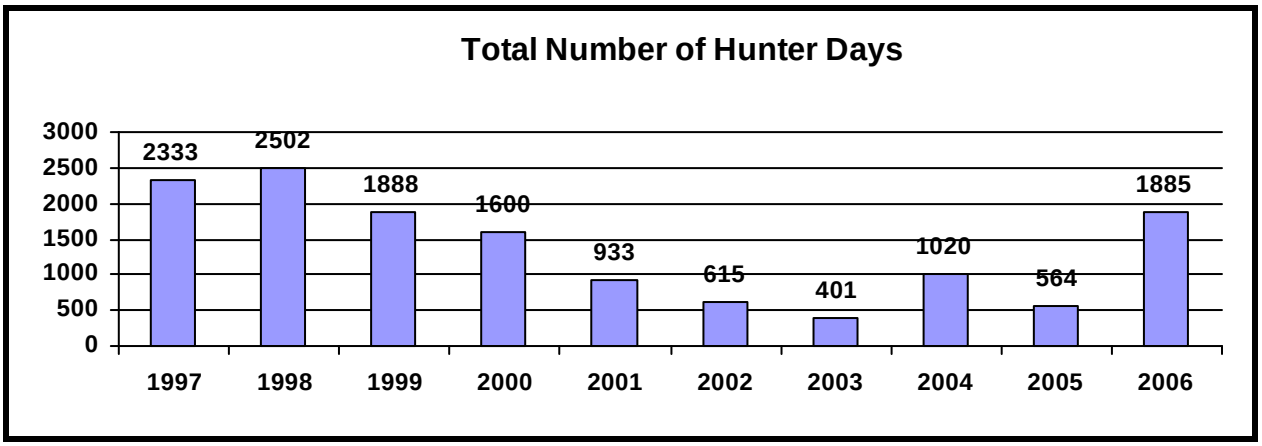
Year	Sample Size	Percent Adult		Percent Ylg		Percent Young		Chicks/Hen
		Male	Female	Male	Female	Male	Female	
1997	596	13.8	25.2	5.4	13.9	17.3	24.5	1.1
1998	7	0.0	0.0	0.0	71.4	0.0	28.6	0.4
1999	660	13.8	27.4	5.3	9.7	14.2	29.5	1.2
2000	571	14.4	30.3	3.9	7.4	13.1	31.0	1.2
2001								
2002	250	15.2	40.0	2.8	0.0	20.0	22.0	1.1
2003	265	12.5	32.1	3.4	8.7	16.6	26.8	1.1
2004	402	11.7	28.6	0.5	3.2	28.6	27.4	1.8
2005	537	17.7	23.3	3.4	7.4	19.0	29.2	1.6
2006	421	15.4	28.7	3.6	7.8	20.9	23.5	1.2

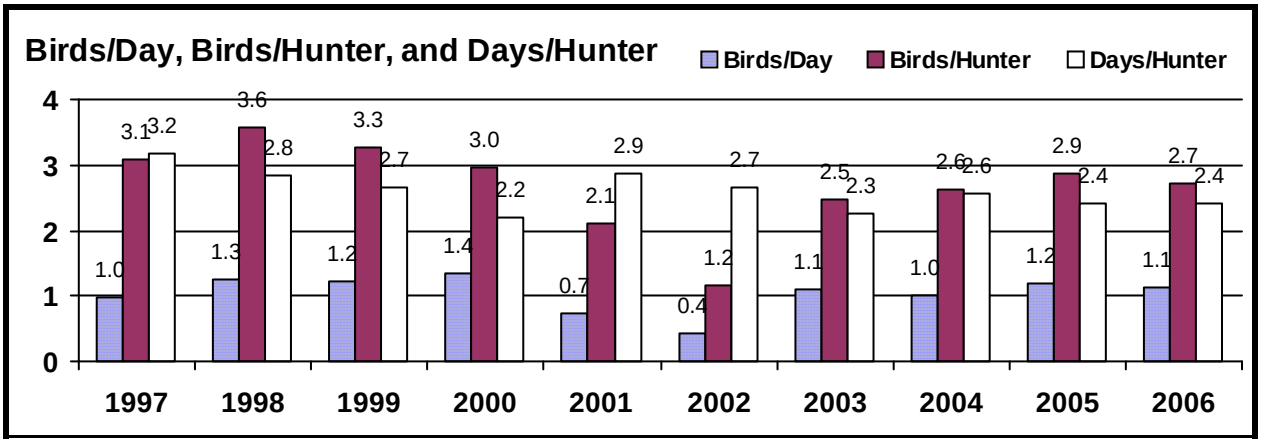
SAGE-GROUSE HARVEST SUMMARY

WORKING GROUP: Upper Green River **Area(s): All**





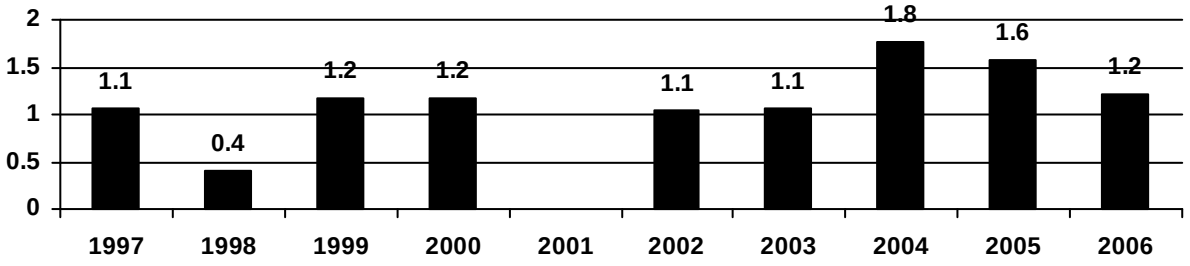




UGRB Sage-grouse Wing Analysis Summary 2006

Adult Males:	65	**Percent of All Wings:**	15.4%
Adult Females:	121	**Percent of All Wings:**	28.7%
Adult Unknown:	0	**Percent of All Wings:**	0.0%
Total Adults:	186		
Yearling Males:	15	**Percent of All Wings:**	3.6%
Yearling Females:	33	**Percent of All Wings:**	7.8%
Yearling Unknown:	0	**Percent of All Wings:**	0.0%
Total Yearlings:	48		
Chick Males:	88	**Percent of All Wings:**	20.9%
Chick Females:	99	**Percent of All Wings:**	23.5%
Chick Unknown:	0	**Percent of All Wings:**	0.0%
Total Chicks:	187		
Unknown Sex/Age:	0	**Percent of All Wings:**	0.0%
Total for all Sex/Age Groups:	421		
Chick Males:	88	**Percent of All Chicks:**	47.1%
Yearling Males:	15	**Percent of Adult and Yearling Males:**	18.8%
Adult Males:	65	**Percent of Adult and Yearling Males:**	81.3%
Adult and Yearling Males:	80	**Percent of Adults and Yearlings:**	34.2%
Total Males:	168	**Percent of All Sex/Age Groups:**	39.9%
Chick Females:	99	**Percent of All Chicks:**	52.9%
Yearling Females:	33	**Percent of Adult and Yearling Females:**	21.4%
Adult Females:	121	**Percent of Adult and Yearling Females:**	78.6%
Adult and Yearling Females:	154	**Percent of Adults and Yearlings:**	65.8%
Total Females:	253	**Percent of All Sex/Age Groups:**	60.1%
Chicks:	187	**Percent of All Wings:**	44.4%
Yearlings:	48	**Percent of All Wings:**	11.4%
Adults:	186	**Percent of All Wings:**	44.2%
Chicks/Hen:	**1.2**		

Chicks/hen calculated from wings of harvested sage-grouse.



Sage-Grouse Job Completion Report

Conservation Plan Area: **Upper Green River Basin**
Period Covered: **6/1/2006 – 5/31/2007**
Prepared by: **Dean Clause**

Introduction

Prior to 2005, Sage-grouse Job Completion Reports (JCR) covered the entire Jackson/Pinedale Region. With the establishment of eight Sage-grouse Working Groups (WG) throughout the state in 2004, JCR's now cover Working Group Areas and not Game & Fish Department Regions as in the past. The Upper Green River Basin WG area covers Upland Game Bird Management Areas (UGBMA) 3 and the north portion of UGBMA 7 that lies within Sublette County.

Sage-grouse are found in suitable sagebrush uplands throughout the Upper Green River Basin. Sage-grouse habitats within Sublette County are expansive and relatively intact outside of developing natural gas fields. Habitats for sage-grouse within Sublette County occur throughout mixed land ownership jurisdictions. Most sage-grouse leks are found on Bureau of Land Management (BLM) lands (91%), with fewer leks found on private (5%), and state (4%) ownership. Nesting and early brood rearing habitats are also found predominantly on BLM lands, while many birds move to moist meadow habitat located on private or public/private interfaces during late brood rearing and/or summer. Fall movements away from these moist areas to sagebrush-dominated uplands on BLM lands occur in late September/early October. As winter progresses, birds concentrate on sagebrush upland habitats, the location of which is determined by snow accumulations and winter severity. These winter concentration areas are also located primarily on BLM lands.

UGBMA 3 falls within the Upper Green River Basin WG area, while a portion of UGBMA 7 is shared with the Southwest WG. All lek data from that portion of Management Area 7 within the UGRBWG area is included in this report. However, this report only addresses harvest information from UGBMA 3. All harvest information for UGBMA 7 will be reported in the Southwest WG JCR.

Traditionally, sage-grouse data collection within the Pinedale/Jackson Region has focused on lek surveys, with a secondary emphasis on collecting information from harvested birds. Prior to 1994, relatively few leks were monitored and prior to 2000, standardized efforts were not used to collect sage-grouse lek information. Since 2000, efforts have been made to standardize lek data collection methods and increase lek monitoring efforts (i.e. collect data on more leks along with increasing the number of site visits per lek). Current lek monitoring has shifted from "lek surveys" to "lek counts" as described below.

Data Collection Efforts and Methods

Information presented in this report includes lek monitoring data, productivity data obtained from brood surveys, research, sex/age composition of harvested birds obtained through the use of wing barrels, winter distribution surveys, and weather data.

Lek monitoring consists of inventory methods called “lek counts” or “lek surveys”. A lek count consist of at least 3 site visits during the strutting season, with each visit conducted at least 7 days apart. Lek counts are used to determine annual status (active or inactive) along with determining population trends. A lek count can also be a census technique that documents the actual number of male sage-grouse observed on a lek complex. A lek complex is defined as a group of leks in close proximity between which male sage-grouse may be expected to interchange from one day to the next. In order to be classified as an accurate lek count (or census), a lek observation must include all leks within a complex on the same morning. These simultaneous observations must be performed at least 3 times during the strutting season, with at least 7 days separating each lek observation. Lek complex counts have not routinely been conducted due to manpower and logistical restraints. Lek complex counts are only practical when a few leks comprise a complex.

A lek survey consists of only 1 or 2 site visits during the strutting season. Lek surveys are primarily important to identify annual status (active or inactive) of a particular lek or lek complex and not for estimating population trends. Overall, lek counts are preferred over surveys and recent emphasis has been placed on collecting lek counts.

Based on the findings at each lek, the lek is assigned an annual status of “Active” (attended by more than one male sage-grouse), “Inactive” (it was known that there was no strutting activity during the breeding season), and “Unknown” (either active or inactive status has not been determined). Based on the past and current status, leks are assigned one of the three categories for management purposes. The category “Occupied” is a lek that has been active during at least one strutting season within the last ten years. Management protection will be afforded to occupied leks. An “Unoccupied” lek has not been active during the past 10 years, although there must be sufficient data to justify placing a lek into this category. A lek survey or count must have been conducted 4 out of 10 years during non-consecutive years (i.e. every other year) without activity to be placed in the “Unoccupied” category. Unoccupied leks are also broken down into two sub-categories (“Destroyed” – habitat no longer exists or “Abandoned” – habitat still exists). Management protection will not be afforded to unoccupied leks. The third category is “Undetermined” which is a lek that has not been documented as being active in the past 10 years, but doesn’t have sufficient data documentation to be considered unoccupied (as mentioned above).

Prior to 2000, no standardized guidelines or criteria were identified to define what constitutes a lek, lek status, and lek category as identified above. Further modifications have periodically been made since then to standardize lek monitoring and definitions.

This lack of consistency in the past (prior to 2003) has led to erroneous lek classification when compared to the "new" lek definitions. The review of past lek monitoring data in the Upper Green River Basin indicated that several documented leks did not meet the criteria to be identified as a lek. In addition, several leks identified in the Sage-grouse JCR database had no monitoring data at all. A common mistake was the establishment of a new lek based on one sighting of displaying males without any follow-up site visits during that same year and following annual visits to the same location revealed no grouse. It is most likely these one-time observations were probably birds that were displaced from a nearby lek and continued to display at a different location that particular morning. These leks not meeting the current lek definitions were deleted from the database. This database clean-up effort was initiated in 2005, resulting in numerous leks and records being deleted. Minor edits and changes will continue to be made as new information arises.

Productivity information obtained from brood surveys (# chicks/hen) has been sporadic and often yields very low sample sizes. However, one permanent brood survey route on Muddy Creek near the Bench Corral elk feedground has been monitored for over ten years. This represents the only such route within the Upper Green River Basin. Ongoing research in the WG area has annually collected nest success and brood information from radio-collared birds. Data collected from radio-collared birds provides good production information.

Information on the sex/age composition of harvested birds is collected through the use of wing barrels distributed throughout Sublette County each fall. Productivity information can also be estimated from this data set, as the number of chicks/hen can be calculated. Wing collection using wing barrels also provide valuable harvest trend data. Total harvest estimates for each Upland Game Bird Management Area is obtained through a hunter harvest questionnaire that is conducted annually.

With declining long-term sage-grouse populations, both locally and range-wide, increased effort has been placed on collecting sage-grouse data. In addition, the increase in natural gas exploration and development within Sublette County has raised concerns regarding the impact of such large-scale landscape developments on sage-grouse populations. In response, several sage-grouse research projects have been initiated in this region. Local research has indicated that current habitat protection measures (stipulations) may not be restrictive enough to protect sage-grouse habitat. In addition, implementation of the existing habitat protection stipulations has been variable, as several exceptions have been granted associated with gas development activities. This has resulted in scrutiny of the effectiveness of the current stipulations intended to preserve sage-grouse and sage-grouse habitats on BLM lands. Current habitat protection stipulations for sage-grouse include: 1) Avoid surface disturbance or occupancy within a ¼ mile of the perimeter of occupied leks. 2) Avoid human activity between 8:00pm and 8:00am from March 1 – April 15 within a ¼ mile of the perimeter of occupied sage-grouse leks. 3) Avoid surface disturbing activities, geophysical surveys, and organized recreational activities (events) which require a special use permit in suitable sage-grouse nesting and early brood-rearing habitat within 2 miles of an occupied lek or in identified

sage-grouse nesting and early brood-rearing habitat outside the 2-mile buffer from March 15 – July 15. 4) Where designated, avoid human activity in sage-grouse winter habitat from November 15 – March 14.

Prior to the winter of 2003, sage-grouse winter distribution information had only been collected opportunistically during other winter surveys (deer, elk, and moose composition counts) and ground observations that were documented in the Wildlife Observation System (WOS). Some data has also been collected by private wildlife consultants conducting ground surveys directed by the BLM for clearance associated with gas development. During 2003 –2006 certain areas within the Upper Green River Basin were surveyed to document sage-grouse important wintering areas. These surveys have been conducted aerially with a helicopter during February using stratified transects at approximately 1 minute (1 mile) intervals to document sign and live observations of grouse. These aerial surveys, along with other existing data, will be very useful baseline information to identify important winter grouse habitats for future management decisions.

Weather data (particularly precipitation data) may be helpful in understanding the effects of environmental conditions on sage-grouse population dynamics. Lower than normal precipitation can affect sage-grouse by reducing the amount of herbaceous vegetation necessary for successful nesting, reduce insect and forb production for early brood success, and reduce the quantity and quality of sagebrush. Not only the amount of annual precipitation, but the timing of precipitation events can be a very significant influence on sage-grouse populations. Individual weather stations within the Upper Green River Basin include Big Piney, Cora, Daniel Fish Hatchery, and Pinedale. Some of these weather stations have incomplete and missing data, which makes monthly and annual comparisons difficult. In addition, these local weather stations do not adequately represent large portions of the Upper Green River Basin. For these reasons, a National Climatic Data Center (NOAA Satellite and Information Service) weather site has been utilized to gather moisture and temperature data. Wyoming is split into 10 different weather reporting Divisions. Division 3 covers the entire southwestern portion of Wyoming and is used in this UGRB Sage-grouse JCR to report precipitation and temperature trends. Climatic data for Division 3 can be found at the NCDC/NOAA web site: http://www.ncdc.noaa.gov/oa/ncdc.html.

Results

Lek Monitoring

A total of 125 leks were documented in the Upper Green River Basin Working Group Area prior lek monitoring efforts in 2007. These leks are classified as follows; 104 occupied, 11 undetermined, 1 unknown, and 9 unoccupied. During 2007, a total of 110 leks (88%) were checked (survey or count). Lek monitoring efforts in 2007 primarily focused on counts (87%) over surveys (13%), similar to the previous five years. Results from the counts and surveys showed that 74% of the leks were active and 26% were inactive. The average number of males/lek for all active leks has continued to increase

the last four years from 21 in 2003 to 24 in 2004 to 35 in 2005 to 46 in 2006 to 54 in 2007.

Generally, the proportion of leks checked that are active has stayed relatively stable at 74% from 2003 to 2007. Compared to the previous five-year period (1998-2002) the proportion of active leks has recently declined. Part of this decline can be attributed to increased abandonment in areas with increased gas development activity in addition to improved monitoring efforts on all leks (including leks with inactivity).

Additional efforts were taken in 2007 to locate new (undiscovered) leks in the south end of the UGRB Working Group Area using fixed-wing aircraft. Four early morning flights were conducted in late April resulted in the discovery of 5 new leks (3 in UGRB and 2 in Southwest Working Group areas). Combining flight surveys with ground efforts resulted in the documentation of seven new leks during 2007 in the UGRB Working Group area. With increased lek monitoring efforts and aerial lek searches during the past few years, a total of 19 new leks have been located from 2004-2007.

Lek Complexes

There are currently 22 occupied lek complexes in the Upper Green River Basin with 125 total leks (includes unknown and unoccupied leks). This equates to an average of 5.7 leks per complex, with a range of 1 to 20 leks per complex. Lek complex designations are somewhat arbitrary and show great variation due to lek numbers and assignments within each complex.

During 2007, 21 of 22 lek complexes (96%) were documented as “active”. If one lek is active within a complex, the entire complex is classified “Occupied”. This represents another reason why current lek complex delineations and analysis are not very useful and should continue to be re-examined. Similar to the trend with lek data, the average number of males per lek complex has continually increased the last four years from 60 males in 2003 to 175 in 2007.

Population Trends and Estimates

No reliable population estimate can be made from data collected during 2007 (or any of the previous years), due to conflicting sex ratio research and the fact that not all active leks have been located. An increasing population trend during 2004 - 2007 is indicated by an increase in the average number of males/lek and males/complex since 2003.

Harvest

The 2006 sage-grouse season was September 23 through October 3, which allowed an 11-day hunting season. This 2006 season was the same as the 2004 and 2005 seasons. A nine-day hunting season was initiated during both 2002 and 2003. Essentially, recent hunting seasons allow for the season to remain open through two consecutive weekends. From 1995 – 2001 hunting seasons were shortened to a 15-16 day season that typically

opened during the third week of September and closed in early October. Prior to 1995, the sage-grouse seasons opened on September 1 with a 30 day season. Seasons have gradually been shortened with later opening dates to increase survival of successful nesting hens (as they are usually more dispersed later in the fall) and reduce overall harvest.

Bag limits from 2003 to 2006 were 2 per day and 4 in possession. 2003 was the first year that bag/possession limits had been this conservative. Bag limits traditionally (prior to 2003) were 3 birds/day with a possession limit 9 (changed to 6 birds from 1994-2002). The estimated harvest rates presented in this report are only from UGBMA 3. A portion of UGBMA 7 also lies within the Upper Green River Basin, but since the majority of this area lies within the Green River Region, the data will be reported in the Southwest Sage-grouse Working Group, Job Completion Report.

The 2006 harvest survey estimated that 781 hunters bagged 2,132 sage grouse and spent 1,885 days hunting. The average number of birds per day was 1.1, the average number of birds per hunter was 2.7, and the number of days spent hunting was 2.4 during 2006. This data indicates there was increased hunter participation and overall harvest during 2006, compared to any of the previous 5 hunting seasons. The 2006 harvest and hunter participation was similar to those documented in 2000. Harvest rates (# birds/day, # birds/hunter, and # days/hunter) have remained similar the past four years (2003-2006). From 1995 to 2002, overall harvest and harvest rates significantly declined following altered (shortened and moved to a later date). Since 2003, hunter participation has increased, along with sage-grouse numbers.

Brood Count Surveys

One permanent brood survey route has been established on Muddy Creek near the Bench Corral elk feedground. Surveys for the past six years documented 8 hens, 1 chick, and 2 males in 2002; 5 hens, 3 chicks, and 2 males during 2003; 13 hens, 11 chicks, 2 males in 2004; and 13 hens, 32 chicks in 2005; 19 hens, 33 chicks in 2006; and 26 hens, 21 chicks, 9 males, 10 unclassified in 2007. This 2007 survey route resulted in 0.8 chicks/hen, a lower ratio than the 2.5 chicks/hen documented in 2005. Most brood counts are random searches or opportunistic sightings. One potentially new brood survey route may include Cottonwood Creek Ranch where 1.1 chicks/hen (sample of 110 grouse) was document in 2007. It may be useful to establish additional permanent brood survey routes in the future.

Sage-grouse research has been ongoing in the Upper Green River Basin for eleven years, which provides very good nest establishment, nest success, and brood production data. During the past two years, research efforts have primarily focused on the areas west of the Green River known as the Soapholes, Ryegrass, and Bench Corral. Of 67 radio-collared hens (yearlings and adults) in 2007, 46 (69%) birds initiated nests. Nest success was 63% (n=27) in 2007, 51% (n=99) in 2006, 62% (n=69) in 2005, 63% (n=57) in 2004, 45% (n=53) in 2003, and 40% (n=52) in 2002. The ratio of chicks per total hens

(successful and unsuccessful hens combined) was 1.02 in 2007, 0.77 in 2006, 0.85 in 2005, 0.81 in 2004, 0.58 in 2003, and 0.55 in 2002.

Wing Collections

A total of 18 sage-grouse wing barrels were distributed throughout Sublette County in 2006 (UGBMA 3 & a portion of 7). Barrels were placed immediately prior to the sage-grouse season opener and were taken down immediately following the closing date. Wing collections were made following each weekend of the hunting season (collected twice). Primary feathers from these wings are used to determine age and sex based on molting patterns.

A total of 431 sage-grouse wings were collected from these barrels during 2006, which is lower than the 537 wings were collect in 2005, similar to the 402 wings collected in 2004 and higher than the 265 collected in 2003. Of the 431 wings collected in 2006, 44% were adult birds, 12% were yearling birds, and 44% were juvenile birds. The proportion of harvest by age class in 2005 was slightly lower for adults at 41%, same for yearlings at 11%, and slightly higher for juveniles at 48%. In 2004, wing collections accounted for 40% adults, 4% yearlings, and 56% juveniles. The overall composition of wings in 2006 indicated a ratio of 1.2 chicks/hen (adult and yearling females), lower than the 1.6 chicks/hen in 2005 and 1.8 chicks/hen in 2004. The 2002 and 2003 wing data showed a similar ratio of chicks/hen at 1.1, compared to 2006. The trends in chick/hen ratios from wing collections have tracked well with trends documented from collared birds from research studies from 2003 – 2005. In 2006, conflicting trends were documented as wing data showed a decline in reproduction rates, while research efforts using collared grouse documented and increase.

Winter Distribution Surveys

No winter surveys were conducted during 2007. Winter surveys were conducted during 2004-2006 in portions of the Upper Green River Basin.

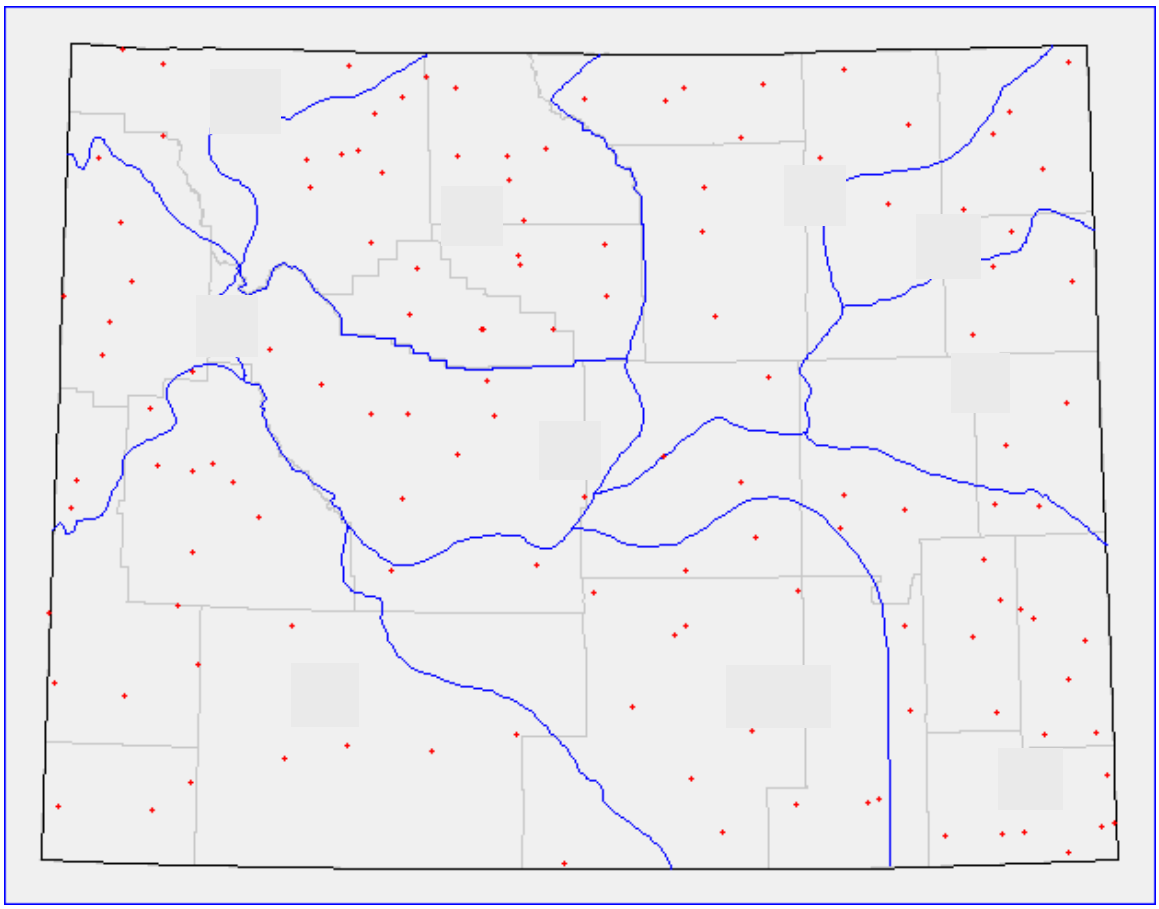
Weather Data

The Palmer Drought Severity Index was developed in the 1960s (http://www.drought.noaa.gov/palmer.html). The index uses temperature and precipitation data to determine dryness. It is most effective in determining long-term (several months) drought. Another index, the Crop Moisture Index (CMI) is more sensitive to short-term conditions. On the Palmer scale, zero is normal, -2 is moderate drought, -3 is severe drought, and -4 is extreme drought. Positive numbers indicate wetter than normal time periods. The Palmer Index is standardized to local conditions. Since this index does not reflect snow moisture, it typically works best for areas east of the Continental Divide.

Additional contact information for NCDC can be found at the following web address: http://lwf.ncdc.noaa.gov/oa/about/ncdccontacts.html.

Wyoming Division 3 monthly temperature, precipitation, and Palmer drought severity data were obtained from: http://lwf.ncdc.noaa.gov/oa/climate/onlineprod/drought/ftppage.html (Figure 1). Graphs portraying Palmer Drought Severity Index data over time were created for Division 3 (Figure 2). Graphs were generated comparing monthly and 30-year normal temperature (Figures 3-5) and precipitation data (Figures 6-8) for bio-years 2004, 2005, and 2006. A bio-year (or biological year) is defined as June – May. A climatic normal is the arithmetic average of a meteorological element over a 30-year period (generally, three consecutive decades). The normal monthly temperature and precipitation are calculated by adding the yearly values for a given month and then dividing by the number of years in the period.

Figure 1. NCDC/NOAA, State of Wyoming Climate Division Map. http://www.wrds.uwyo.edu/wrds/wsc/normals/normalmap.html



Climatic Division 3 – Green and Bear Drainage Basin

Palmer Severity Indices indicate that from 1995-1999 the Green and Bear Drainage Basin climatic division generally experienced wetter than normal conditions

(Figure 2). However, the division entered drought conditions in 2000, with conditions becoming extreme until 2004, then again in 2006 and leading into 2007. During bio-year 2004, temperatures were generally normal (Figure 3). However, temperatures were generally above normal during bio-years 2005 and 2006 (Figures 4 & 5). Bio-year 2004 saw above normal precipitation, while bio-years 2005 and 2006 were well below normal (Figures 6, 7, & 8).

Figure 2. Drought severity trend from 1982 – 2007, Wyoming Climate Division 3.

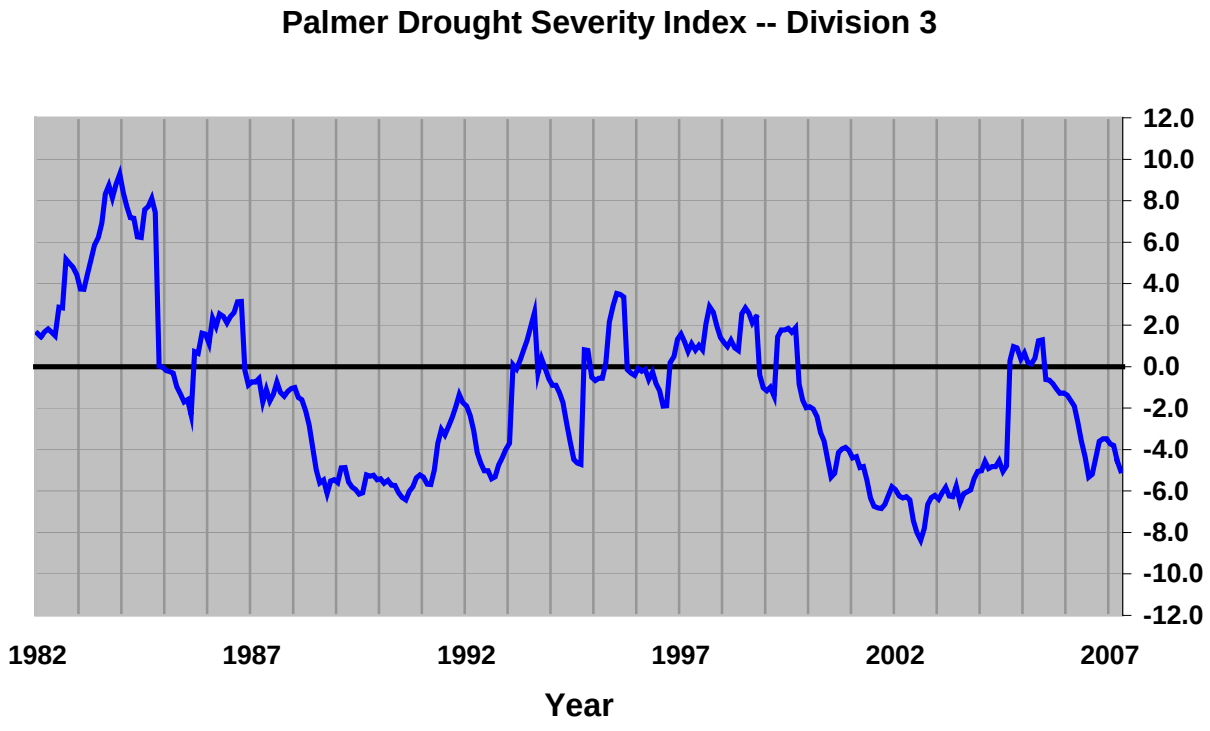


Figure 3. 2004 Bio-Year: Monthly temperature data (^{o}F), Wyoming Climate Division 3.

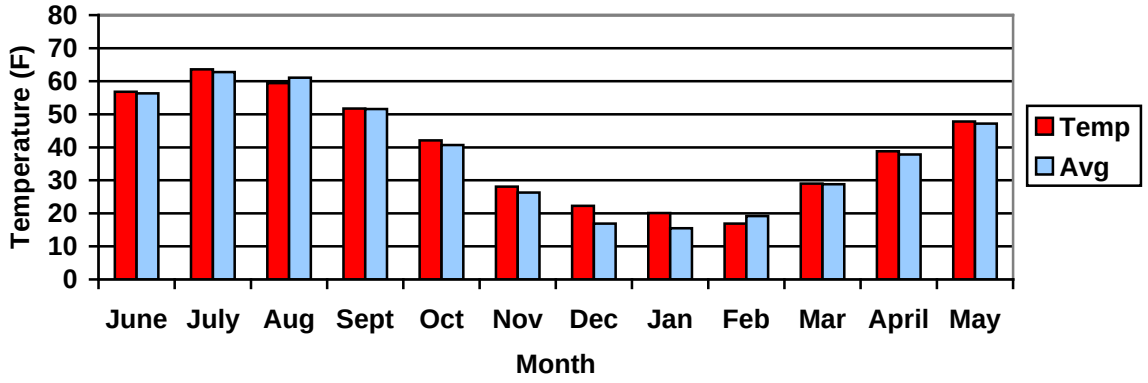


Figure 4. 2005 Bio-Year: Monthly temperature data (^{o}F), Wyoming Climate Division 3.

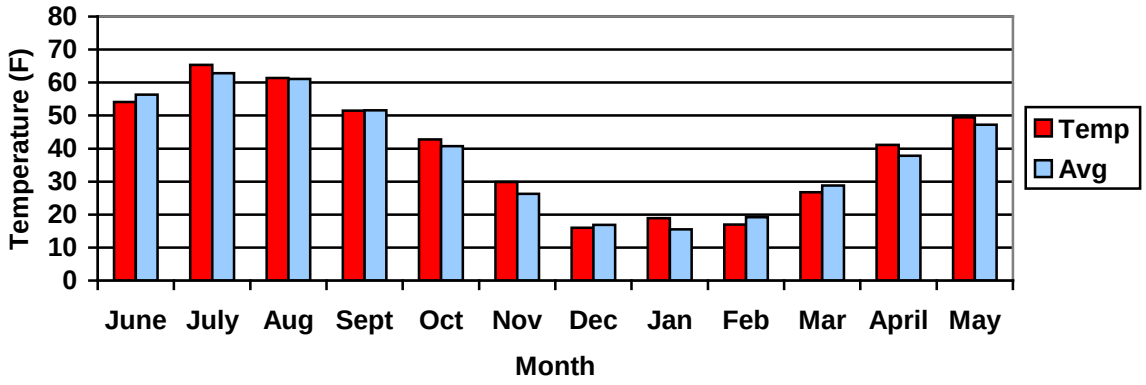


Figure 5. 2006 Bio-Year: Monthly temperature data (^{o}F), Wyoming Climate Division 3.

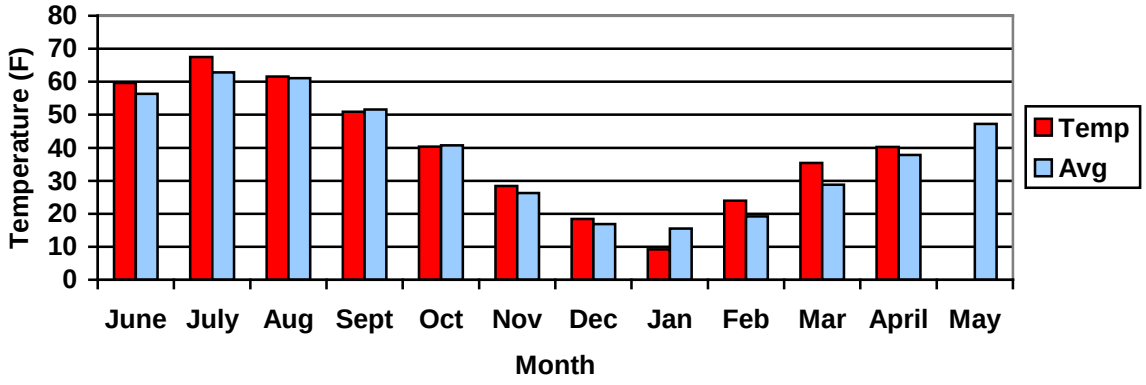


Figure 6. 2004 Bio-Year: Monthly precipitation data (in), Wyoming Climate Division 3.

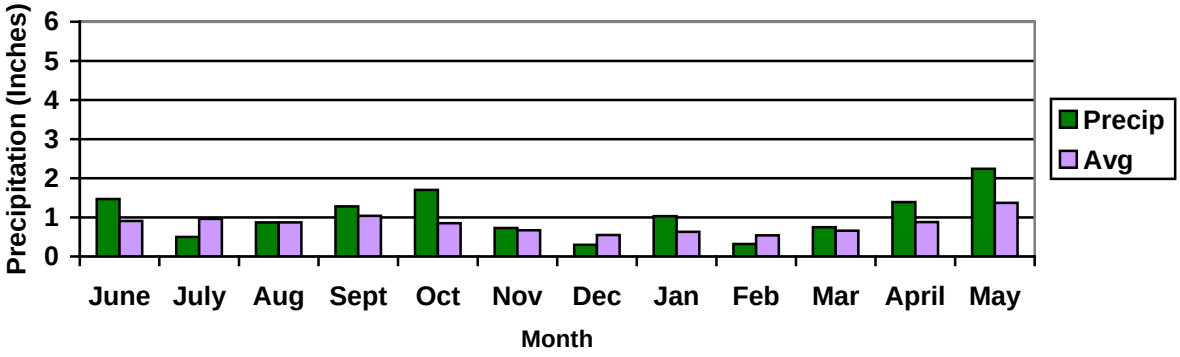


Figure 7. 2005 Bio-Year: Monthly precipitation data (in), Wyoming Climate Division 3.

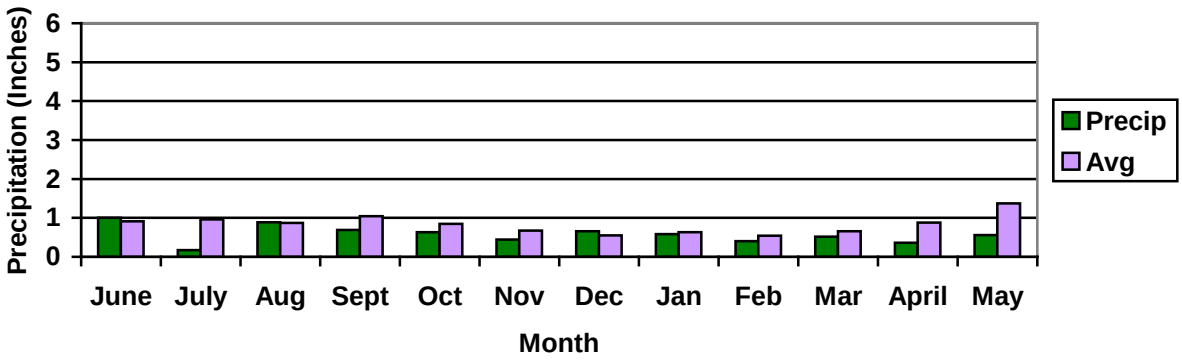
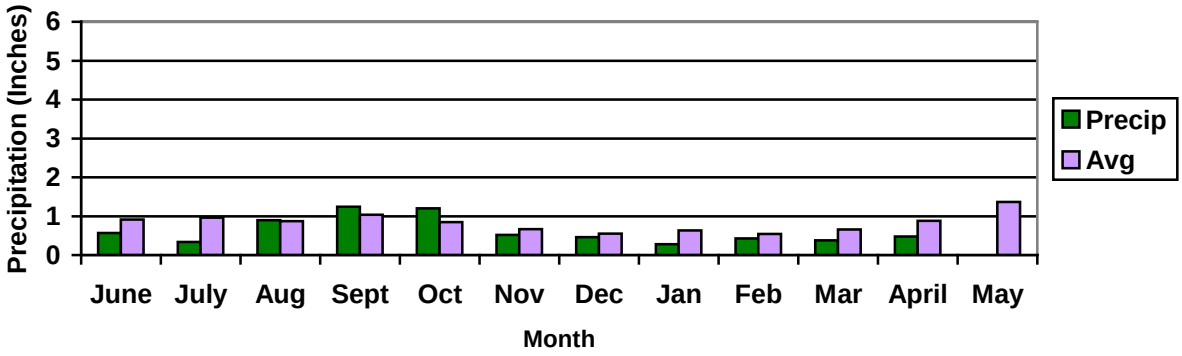


Figure 8. 2006 Bio-Year: Monthly precipitation data (in), Wyoming Climate Division 3.



Special Projects

Sage-grouse Research Projects

Within the last 11 years, there has been several research projects initiated and some completed that will or have provide(d) information on sage-grouse demographics and effects of natural gas development on sage-grouse populations. See Appendix 1 for a summary of past and ongoing sage-grouse research in the Pinedale area.

Sage-grouse Working Group

The Upper Green River Basin Sage-grouse Working Group was formed in March of 2004. The group is comprised of representatives from agriculture, industry, sportsmen, public at large, conservation groups, and government agencies (federal and state). The purpose of the UGRB Working Group is to work towards maintaining or improving sage-grouse populations in the Upper Green River basin. The group was directed to formulate

plans and recommend management actions that will benefit sage-grouse. A local sage-grouse plan (Upper Green River Basin Sage-Grouse Conservation Plan) was finalized in May of 2007 and can be found on the WGFD website (gf.state.wy.us). This Plan identifies past, proposed, and ongoing projects; recommended management activities; funding sources; and other relevant sage-grouse information within the Working Group Area intended to maintain and/or increase sage-grouse populations. Current efforts of the Working Group include efforts and assistance to implement projects and recommendations identified in the Plan.

Management Summary

Data collected and reported in this 2007 Sage-Grouse Job Completion Report gives insight to population trends. Analysis of the past five years of data indicates that the sage-grouse populations have steadily increased since 2003. Grouse populations were at the lowest level in 2003 during the past 10-year period.

Lek monitoring showed a 166% increase in the peak number of males per lek from 2003 to 2007 as males increased from 20.4 males/lek to 54.2 males/lek.

Sage-grouse hunting season length and bag limits have varied during the past 5 years but remained similar during 2002 - 2006. The hunter harvest survey indicated a total harvest of 271 in 2002, 440 in 2003, 1,040 in 2004, 669 in 2005, and 2,132 in 2006, which directly correlates with hunter participation. Hunter participation declined in 2002 and 2003 as a result of shortened seasons starting in 2001 combined with lower grouse numbers. Hunter participation increased in 2004, dropped in 2005, and drastically increased in 2006. With grouse numbers steadily increasing since 2003, the progression of increasing hunter participation was expected, as seen in 2004 and 2006, while the decline in 2005 was unexpected. With the exception of 2002, harvest rates (# of birds/day, #birds/hunter, and # days/hunter) have remained relatively stable in the past five years. Wing collection samples from wing barrels (drop locations) showed similar increasing trends to the harvest survey trends during 2003 and 2004, but showed conflicting trends in 2005 and 2006 (wing collections increased as reported harvest declined in 2005 and wing collections declined as reported harvest increased in 2006). It may be possible that reported harvest estimates were low in 2005, as wing collections accounted for an unusually high proportion of the reported harvest at 80%.

Nest success, brood counts, chick/hen ratios, and wing collections all indicate improved sage-grouse production during 2004 and 2005, with production dropping off in 2006 and 2007. Research data from collared birds (sample size varied from 46 to 113) show nest success at 45% in 2003, increasing to 62-63% in 2004 and 2005, declining to 51% in 2006, and increasing to 63% during 2007. The number of chicks per total hens (successful and unsuccessful hens) improved from 0.55 chicks/hen in 2002 to 0.85 chicks/hen in 2005, dropped to 0.77 chicks/hen in 2006, and improved to 1.02 chicks/hen in 2007. The 2002 and 2003 chicks/hen ratio determined from wing collections was 1.1 for both years and increased to 1.8 and 1.6 chicks/hen in 2004 and 2005 and dropped to

1.2 during 2006. The percent of juveniles in the harvest from wing collections decreased to 44% in 2006 compared to 48% and 56% in 2005 and 2004, respectively.

Above normal precipitation during 2004 and 2005 during key periods (specifically in the spring and early summer) contributed to increased sage-grouse numbers due to enhanced production and juvenile survival in the Upper Green River Basin. Sage-grouse and habitat management activities basically have remained static during the past 5+ years. It is anticipated that grouse numbers will start to decline in 2008 due to decreased chick survival documented in 2006 and 2007 caused by severe drought conditions in the Upper Green River Basin during the spring and summer 2006 and 2007.

Although overall sage-grouse numbers have increased in the past three years, the amount and rate of natural gas development in the Upper Green River Basin has and will continue to impact sage-grouse habitat. Lek monitoring data, along with preliminary results from ongoing sage-grouse research, has shown lower male attendance and in some cases total bird abandonment on leks within and adjacent to developing gas fields. Direct, indirect, and cumulative impacts to sage-grouse from gas and residential development will continue to challenge managers to maintain current grouse numbers.

Recommendations

1. Re-examine current lek complex delineations. Data from the University of Wyoming Cooperative Extension research (Phase III) may provide additional information in regards to movements of birds during the breeding season to refine sage-grouse lek complex boundaries.
2. Once it is felt that lek complexes are accurately described, refine lek complex routes to increase the ease with which lek complex counts can be obtained.
3. Continue to monitor sage-grouse leks and look for new ones.
4. Continue to evaluate records and refine problems in the sage-grouse database.
5. Continue to monitor the natural gas development/sage-grouse research project being conducted by the University of Wyoming.
6. Continue the Muddy Creek sage-grouse brood survey route in the South Jackson Biologist District and establish new routes.
7. Continue to place wing barrels in current locations in order to obtain sex/age and harvest trend information.
8. Continue existing efforts and encourage new efforts to document and identify important sage-grouse areas (breeding, brood rearing, and winter). Record all sage-grouse observations obtained while flying big game classifications surveys or any routine, incidental observations. Work towards developing seasonal range maps. Funding is needed to maintain collared birds and collect location year round data throughout the Upper Green River Basin.
9. Continue to work with GIS personnel and land managers to create seasonal range maps (breeding, summer/fall, and winter) to aid land managers in protecting and maintaining important sage-grouse habitats.

10. Collect updated and precise location data for all existing leks so appropriate protection can be applied to actual lek locations.
11. Continue to identify needed sage-grouse research, data collection efforts, project proposals, development mitigation, and funding.
12. Implement proposals and management recommendations identified in the Upper Green River Basin Sage-Grouse Working Group Conservation Plan. Update this Plan as needed.

Appendix 1
Sage-grouse Research Applicable to the UGRBWGA

COMPLETED STUDIES

Girard, George L. 1937. Life History, Habits and Food of the Sage Grouse. University of Wyoming Publications in Science Vol. III, No. 1. 56pp. University of Wyoming Press, Laramie.

This was the first study of sage-grouse in Wyoming and it was undertaken in Sublette County in 1934. The author noted that much of the information concerning sage-grouse at the time was based on casual observation, and popular articles were written "with little regard for established facts". The purpose of the study was to investigate the life history, habits, and food of the sage grouse, and "to secure information that may be of use to the governments of western states in formulating measures designed to increase or maintain the species in its present habitat". The report details the bird's physical description, distribution, life history, behavioral habits and factors impacting sage-grouse at the time. Suggested management actions included hunting restrictions, establishment of refuges, livestock grazing management, habitat management, and a public education campaign.

Lyon, Alison. G., Potential effects of natural gas development on sage grouse near Pinedale, Wyoming. M.S., Department of Zoology and Physiology, May, 2000.

Sage grouse (Centrocercus urophasianus) populations have been declining over the last half of the century due to such factors as habitat degradation and loss. As natural gas development has increased in Wyoming, so has the concern over how this type of development might effect sage-grouse populations. Therefore a study was initiated on the Pinedale Mesa to examine the effects of natural gas and oil development on use, productivity, general movements and habitat use of sage grouse. A total of 80 grouse (60 adults and 20 chicks) were captured and radio-collared on six leks on the Pinedale Mesa between March-August 1998. Lek classification was determined by the presence of natural development within a 3km buffer and topographic features surrounding the leks. The grouse were monitored and located (using radio telemetry techniques) on a weekly basis to determine lek use, nest site, early brood rearing, late brood rearing, summer and winter habitat selection. Vegetation data collected at use and random sites included: sagebrush density, canopy cover and height, grass and residual grass height and cover and forb cover. Results from the study indicated that hens captured on the disturbed leks demonstrated lower nest initiation rates, traveled twice as far to nest sites, and selected higher total shrub canopy cover and live sagebrush canopy cover than hens captured off of undisturbed leks. Also, most grouse chicks were lost during extreme early brood rearing from hens that mated on all leks. Therefore extreme early brood survival appears to be the limiting factor in sage-grouse population stability on the Pinedale Mesa. Finally, four roosters, and five hens moved up to 60 miles to breed and nest after capture on the Mesa. Consequently we hypothesize that the Mesa is critical winter range for multiple populations of sage-grouse spanning a large demographic area.

Holloran, Matthew J., Greater Sage-Grouse (*Centrocercus urophasianus*) Population Response to Natural Gas Field Development in Western Wyoming. PhD, Department of Zoology and Physiology, December, 2005.

Sage-grouse (*Centrocercus* spp.) populations have declined dramatically throughout the western United States since the 1960s. Increased gas and oil development during this time has potentially contributed to the declines. This study investigated impacts of development of natural gas fields on greater sage-grouse (*C. urophasianus*) breeding behavior, seasonal habitat selection, and population growth in the upper Green River Basin of western Wyoming. Greater sage-grouse in western Wyoming appeared to be excluded from attending leks situated within or near the development boundaries of natural gas fields. Declines in the number of displaying males were positively correlated with decreased distance from leks to gas-field-related sources of disturbance, increased levels of development surrounding leks, increased traffic volumes within 3 km of leks, and increased potential for greater noise intensity at leks. Displacement of adult males and low recruitment of juvenile males contributed to declines in the number of breeding males on impacted

leks. Additionally, responses of predatory species to development of gas fields could be responsible for decreased male survival on leks situated near the edges of developing fields and could extend the range-of-influence of gas fields. Generally, nesting females avoided areas with high densities of producing wells, and brooding females avoided producing wells. However, the relationship between selected nesting sites and proximity to gas field infrastructure shifted between 2000 – 2003 and 2004, with females selecting nesting habitat farther from active drilling rigs and producing wells in 2004. This suggests that the long-term response of nesting populations is avoidance of natural gas development. Most of the variability in population growth between populations that were impacted and non-impacted by natural gas development was explained by lower annual survival buffered to some extent by higher productivity in impacted populations. Seasonal survival differences between impacted and non-impacted individuals indicates that a lag period occurs between when an individual is impacted by an anthropogenic disturbance and when survival probabilities are influenced, suggesting negative fitness consequences for females subjected to natural gas development during the breeding or nesting periods. I suggest that currently imposed development stipulations are inadequate to protect greater sage-grouse, and that stipulations need to be modified to maintain populations within natural gas fields.

Kaiser, Rusty C., Recruitment by greater sage-grouse in association with natural gas development in western Wyoming, M.S., Department of Zoology and Physiology, University of Wyoming, Laramie, Wyoming. August, 2006.

Abstract: The area near Pinedale, Wyoming, in the upper Green River Basin has some of the highest densities of greater sage-grouse in the world. Decreasing counts of males attending leks and evidence of overall population reductions, coupled with increasing natural gas development, have raised concern for conservation of greater sage-grouse in the area. Low yearling recruitment could be causing a decline in the numbers of birds using leks near natural gas development. This study investigated recruitment of males and females to determine if they continued to breed in areas with natural gas development, were displaced to other areas to breed, or did not breed at all. Results indicated that yearling males tended to avoid leks highly immersed into developing gas fields. Females that bred or nested in the gas fields had later nest hatching dates and fewer and smaller broods than birds outside the fields. Both males and females showed low fidelity to natal leks and nest sites. This study suggests that assessing the potential influence of a natural gas field on greater sage-grouse should involve multiple variables to describe the developing field and incorporate the cumulative effects they may have on lek use as the spatial orientation of the leks relative to the developing field changes over time.

ONGOING STUDIES

Examining the effects of noise from energy exploration and development on the breeding biology of the greater sage-grouse (*Centrocercus urophasianus*), is currently being conducted. The Principal Investigator is Gail L. Patricelli, Assistant Professor, at the University of California, Davis. Below is a summary of updated activities from this study.

Summary of Activities: One potential means by which energy development might impact sage-grouse populations is through the production of noise. Acoustic communication is known to be important in the reproductive behaviors of sage-grouse, and energy exploration and development activities generate substantial noise; it is therefore important to determine whether noise produced from energy development affects sage-grouse breeding biology. Sage-grouse mate during the early spring (March-April). During this mating season, males aggregate on display sites called “leks” where females visit to observe male display behaviors and choose their mates. There is evidence that the acoustic displays produced by males on leks facilitate reproduction in at least two ways. First, females use these vocalizations to find leks within the habitat. Second, after arrival at a lek, there is evidence that females use male vocalizations (and other aspects of male display) to choose a mate. Anthropogenic noise in the sage grouse habitat may mask vocalizations produced by males, interfering both with females’ ability to locate leks and to choose mates.

The overall goal of this research is to investigate the potential effects of noise from natural gas development on sage-grouse lekking behaviors. This research has three major lines of inquiry: 1) Descriptive- the characterization of sounds produced by energy development and by sage-grouse, and how these sounds propagate through the environment, 2) Experimental - playback of recorded noise to sage-grouse leks to determine whether noise impacts sage-grouse breeding behaviors, and 3) Predictive - landscape-level modeling of sound propagation in the sagebrush habitat.
Work Accomplished: *Descriptive Acoustics*: Two autonomous recording units (ARUs) were built to record and measure noise sources. During March and April, we measured gas field noise primarily on the Anticline Project Area in Sublette County near Pinedale WY using the ARUs. We measured noise at 5-20 minute intervals throughout the day, we sampled noise at between 2 to 8 locations at each site (2 microphones per ARU, 1-4 ARUs per site). We also took noise measurements with a precision sound level meter (purchased with UCD funds) and GPS (purchased with WSGCF funds) circling each site and along line transects radiating from the source. This year we measured sound at two drilling sites, two large compressor stations, and on three roads. Transects were done to characterize vegetation cover. We will use these for modeling of sound propagation (objective 3 of the overall project). Noise data is currently being analyzed at UC Davis.
Experimental: In spring 2006, we began an experiment to test the hypothesis that noise from energy development affects sage grouse reproductive behavior. To do so, we played back recorded noise to 4 leks and monitored another 4 leks as controls. We placed leks in groups to balance for size and location, and then randomly assigned them to noise or control groups. We plan to continue this experiment for at least 2 more seasons, so results are not available at this time.
We monitored the leks daily by video-taping and photo-identification of birds, and by counting males and females at multiple times during the lekking period. We placed a line of markers at 25-meter intervals along the far edge of the lek relative to the observer to divide the lek into sections. Birds were counted by section each day, allowing us to examine the spatial distribution of birds on the lek relative to the playback speakers. We encountered difficulty building an amplifier/speaker system to play noise during the playback experiment. Our target amplitude was 70 dB SPL—the average level of noise measured at 1/4 mile from drilling stations in Pinedale in 2006. Playback of drilling noise at this amplitude caused 6 speakers to fail; correction of this problem and replacement of speakers delayed the beginning of the experiment. This delay had one positive consequence: we improved our baseline data on lek attendance and behaviors on experimental and control leks. A second difficulty was that our experimental noise did not propagate well across the lek, such that not all birds on a lek experienced the noise at a sufficient level. We will seek funding to add additional speakers to correct this problem for next year.

Greater Sage-grouse Winter Habitat Selection in the Upper Green River Basin, Wyoming: The overall goal of this study is to determine if year-long drilling for natural gas influences grouse seasonal habitat selection within the Pinedale Anticline Project Area (PAPA) through the use of data loggers and radio collared grouse. This study was initiated in 2005 and will be completed in 2009. Funding sources include Shell, Ultra, Questar, and Wyoming Wildlife Consultants (WWC).

Project Title: Greater Sage-grouse Seasonal Habitat and Demographic Documentation to Support Planning of Future Land-Use Strategies: This project was initiated during the spring of 2006. Greater sage-grouse seasonal (nesting, brood-rearing, wintering) habitat selection will be documented through radio-telemetry on birds captured and collared throughout areas west of the Green River from approximately Daniel to Big Piney. This baseline project will span three years. The distributional data gathered over the three years will be used to map critical habitats, information that could subsequently be used to designate areas that need to be protected as well as areas where sagebrush manipulating habitat improvements could be implemented. By collecting demographic information (nest success, chick survival, adult seasonal survival), the data could also be used to identify limiting seasonal habitats, thus focusing any habitat improvements toward the areas where habitat manipulations could be beneficial. This pre-treatment information is critical for quantifying population response to habitat manipulations, information required to evaluate project success and proactively adapt management protocol. The distribution and demographic information will provide pre-treatment data necessary to evaluate potential

gas field development options; that could minimize impacts to sage-grouse populations throughout the west where oil and gas development has and will be proposed.

Project Goals:

a) Determine seasonal distributions of greater sage-grouse throughout the project area.
b) Establish off-site mitigation protocol and the steps necessary to maximize the probability of success.

Project Objectives:

a) Delineate and map seasonally critical areas for greater sage-grouse.
b) Document nest success, chick survival, and seasonal adult survival (demographic information).
c) Determine the potentially limiting seasonal habitat for sage-grouse using the demographic information and propose management options and potential locations to improve these habitats.

Establish baseline information to be used as pre-treatment data for evaluating the success of habitat manipulation projects.

Sage Grouse-Predator Interaction in the Pinedale and Jackson Hole Areas: This study was initiated during 2007. The Principal Investigators is Craighead Beringia South. Research has shown that raven populations are important predators on sage-grouse nests. The changes in habitat in areas affected by energy development and the resulting changes in sage-grouse nesting success and survival, raven populations, and predation rates will be compared to areas without energy development. Completion of this research could significantly advance knowledge about raven demographics and their impacts on sage-grouse populations with varying environmental conditions.

Sage-Grouse Job Completion Report

Conservation Plan Area: **Upper Snake River Basin**
Period Covered: **6/1/2006 – 5/31/2007**
Prepared by: **Joe Bohne**

Introduction

With establishment of eight Sage Grouse Working Groups throughout the state in 2004, Sage Grouse Job Completion Reports (JCR) revised to Working Group Areas and not Game and Fish Department Regions as in the past. The Upper Snake River Basin Working Group includes Game Bird Management Areas (GBMA) 1 and 2 (Hoback Basin, Star Valley, Gros Ventre, and Jackson Hole), which are covered in this report. The 2004 -2005 JCR was the first report produced under the new format.

The role of the Upper Snake River Basin Working Group is to develop and facilitate implementation of a local working group plan for the benefit of sage-grouse and, whenever feasible, other species that use sagebrush habitats. This conservation plan will identify management practices and the financial and personnel resources to accomplish these practices, within an explicit time frame, for the purposes of improving sage-grouse numbers and maintaining a viable population in Jackson Hole that is unique to the valley and an important component of the wildlife diversity associated with Grand Teton National Park and the National Elk Refuge. The plan also addresses the small interstate population associated with Star Valley, the small population in the Gros Ventre Valley, and the population that frequents the Hoback Basin during the summer. The plan will be completed in 2007 and presented to the Wyoming Game and Fish Commission at their January 2008 meeting.

Traditionally, sage-grouse data collection within the Pinedale/Jackson Region has focused on lek surveys and the age and sex composition of harvested birds as determined from wings collected in wing barrels and from hunter field checks collections. Some effort has been made to collect brood survey data and two routes have been established in the Upper Green River (GBMA 3). Prior to 1994, relatively few leks were monitored and prior to 2000, standardized efforts were not used to collect sage grouse lek information. Since 2000, efforts have been made to increase data collection on sage grouse leks and standardize data collection methods. Efforts to collect data on more leks along with increasing the number of site visits per lek have been made. Current lek monitoring has shifted from “lek surveys” to “lek counts” as described below.

Lek monitoring consists of different inventory methods called "lek counts" or "lek surveys". A lek count consists of at least 3 site visits during the strutting season, with each visit conducted at least 7 days apart. Lek counts are used to determine annual status (active or inactive) along with determining population trends. A lek count can also be a census technique that documents the actual number of male sage grouse observed on a lek complex. Counts are only practical where a few leks comprise a complex. Sage-grouse lek complexes include one or more leks that are located relatively close together, usually less than 1 to 2 miles apart, where males and females will frequently move between the leks during the course of the breeding season. From a population perspective, sage-grouse lek complexes represent the basic unit for estimating and monitoring sage-grouse population trends. . In order to be classified as an accurate lek count (or census), a lek observation must include all leks within a complex on the same morning. These simultaneous observations must be performed at least 3 times during the strutting season, with at least 7 days separating each lek observation. In the past, lek complex counts have not routinely been conducted due to manpower and logistical restraints. However, counts on leks in Grand Teton National Park, and to some extent on the National Elk Refuge, were coordinated to occur on the same days in 2005, 2006, and 2007. We presume all the leks in Jackson Hole proper constitute a lek complex and the leks in the Gros Ventre drainage constitute a second lek complex. No marked birds from the Gros Ventre leks have appeared on the Jackson Hole leks (Holloran and Anderson 2004).

A lek survey consists of only 1 or 2 site visits during the strutting season. Lek surveys are primarily important to identify annual status (active or inactive) of a particular lek or lek complex and not for estimating population trends. Overall, lek counts are preferred over surveys and recent emphasis has been placed on collecting lek counts. Based on the findings at each lek, the lek will be assigned an annual status of "Active" (attended by two or more sage grouse or by the evidence of sign), "Inactive" (an absence of birds during at least two ground surveys that were at least 7 days apart or a search of the lek site produced no visible sign at the end of the breeding season), and "Unknown" (either active or inactive status has not been determined). Based on the past and current status, leks are assigned one of the three categories for management purposes. The category "Occupied" is a lek that has been active during at least one strutting season within the last ten years. Management protection will be afforded to occupied leks. An "Unoccupied" lek has not been active during the past 10 years, although there must be sufficient data to justify placing a lek into this category. A lek survey or count must have been conducted 4 out of 10 years during non-consecutive years (i.e. every other year) without activity to be placed in the "Unoccupied" category. Unoccupied leks are also broken down into two subcategories. ("Destroyed" – habitat no longer exists or "Abandoned" – habitat still exists).

Management protection is not being afforded to unoccupied leks. The third category is "Undetermined" which is a lek that has not been documented as being active in the past 10 years, but doesn't have sufficient data documentation to be considered unoccupied.

Prior to 2000, no standardized guidelines or criteria were identified to define what constitutes a lek, lek status, and lek category as identified above. Further modifications were made in 2003 and 2006 to standardize lek monitoring and definitions. This lack of consistency in the past has led to erroneous lek classification when compared to the "new" lek definitions.

With declining long-term sage grouse populations, both locally and range-wide, increased effort has been placed on collecting sage grouse data. In addition, the increase in natural gas exploration and development within Sublette County has raised concerns regarding the impact of such large-scale landscape developments on sage grouse populations. Energy development probably will not be a major impact on sage-grouse populations in most of this DAU. However, some leasing has occurred in the Hoback Basin. The Forest Service is currently conducting an environmental analysis to allow the development of a deep natural gas field in the Noble Basin area north of the Hoback Rim that could result in 136 wells on 17 pads with 15 miles of new road and 14 miles of reconstructed roads and result in about 400 acres of disturbed habitat (Bridger-Teton National Forest 2007). Most of these new roads would occur in an area that is relatively remote and accessed with low standard, two-track roads. The Nobel Basin area provides nesting and brood rearing habitat for some sage-grouse but almost nothing is known about this small population. We assume these birds winter in the Green River Valley south of Daniel, WY. There are no known leks in the Hoback Basin and the breeding habitat for this group of birds is unknown.

Information presented in this report includes only lek monitoring data. No productivity data were collected from brood surveys, or research in 2006-2007 biological year. No data from sex/age composition of harvested birds were collected through the use of wing barrels or field checks because the entire DAU has been closed to hunting since 2000.

Plan Area

The Upper Snake River Basin Working Group Area includes the entire Snake River drainage basin in Wyoming including the major tributaries of the Gros Ventre, Hoback and Salt River drainages. The area boundary encompasses almost all of Teton County and small portions of Sublette and Lincoln Counties

The occupied sage-grouse habitat in the plan area is primarily sagebrush grassland habitat in the valley floor and foothills of Jackson Hole, Hoback Basin, Gros Ventre River Valley and Star Valley. Much of the remainder of the area is forested habitats that are not occupied by sage-grouse. The core population is found primarily in Jackson Hole in Grand Teton National Park and the National Elk Refuge. Sage-grouse also use some of the foothill areas on the Bridger-Teton National Forest in Jackson Hole. There are two leks and possibly a third lek in the Gros Ventre drainage on national forest land. Sage-grouse in Jackson Hole are thought to be non-migratory but some interchange with the birds using the Gros Ventre drainage is likely (Holloran and Anderson 2004).

Sage-grouse also use public and private lands in the Hoback Basin in the summer but no leks have been documented in the area. These birds are thought to move into the area to nest and raise their broods. The hens are probably bred on leks in the Upper Green River drainage. However, it is possible some sage-grouse move into the Basin in late April or early May and display and breed at an unknown lek.

There is a small population of sage-grouse in Star Valley that uses habitat associated with the Gannet Hills in Wyoming and Idaho. There are three known leks located in Idaho in the Crow Creek and Stump Creek drainages near the Wyoming-Idaho state line. All three leks are small (less than 20 birds) but have been checked very infrequently. Star Valley probably provided historic habitat in the valley floor and foothills. Most of the valley no longer considered occupied habitat primarily due to the conversion of sagebrush and mountain shrub communities to farmland. A thin strip of land about a mile wide along the Wyoming–Idaho State line, running from Big Ridge east of Spring Creek to Stump Creek, appears to provide the only suitable habitat in Star Valley and it is used by this small, isolated interstate population..

Results

Lek Monitoring

Sage-grouse leks within the USRBWGA are summarized in Table 1 from 1948 to the present. Lek counts and lek surveys have been conducted within the area since 1948; however, the most consistent data sets occur from 1989 to the present. In some years it is uncertain from the data provided by Grand Teton National Park if leks that were thought to be inactive were actually checked and if they were checked and no birds were observed was the null value reported. Since the status of these leks is uncertain they are noted in the lek database report as not checked (undetermined). It is likely most of these leks are inactive in these years but occasionally some birds do appear to use leks that have been inactive for several years.

Table 1 summarizes the high count on each lek over the survey period. Since there appears to be some movement of males between leks and particularly from the lek on the National Elk Refuge to leks in Grand Teton National Park as the spring progress and snow melt occurs on leks to the north, the total of the high counts in each year may represent an inflated estimate of total males in the population. However data collected in the early years have only been reported as the high count on each lek and the summary in Table 1 is presented in this manner for comparative purposes. We presume the trends in the population based on these counts still mimic actual trends in the population. Similar trends are observed in the report using the conventional analysis provided by the WGFD sage-grouse database report. There are 13 known sage-grouse leks. Ten are considered to be occupied and three appear to be unoccupied historic leks within the plan area (3 BAR H and Antelope Flats in GTNP, Poverty Flats in the NER). There are 2 potential leks that must be confirmed with additional observations of breeding males (Airport Pit and Cottonwood) and one new lek (Spread Creek) located in 2007 but previously reported by other observers in the past but never located. After consulting with Susan

Table 1. Sage-grouse lek counts (maximum males) by lek for the Jackson Hole, Wyoming population , 1948-2006.
(Grand Teton National Park and Wyoming Game and Fish Dept. Unpublished data)

Year	Airport	Beacon	3 Bar H	McBride	Antelope Flats	Moulton	Spread Creek	Bark Corral	Timbered Island	NER North Gap	Poverty Flats	Breakneck Flats	Dry Cottonwood	Total
1948	61		13	15	59	20		36		0				204
1949	51		18	14	62	32		14		0				191
1950	73		9	50	55	16		20		0				223
1951	61		7	52	46	28		20		12				226
1985			NC	27	NC	51*		NC		22				NA
1986	25		NC	27	11	51		NC		14	22			150
1987	25		NC	18	1	30		NC		NC	NC			74
1988	26		NC	23	13	85		7		23	NC			177
1989	30		NC	21	7	91		6		8	NC			163
1990	52		NC	10	10	63		8		22	NC			214
1991	63		NC	13	10	48		16		29	NC			205
1992	51		NC	12	8	37		16		21	NC			168
1993	37	21	NC	16	5	24		8		9	54			198
1994	NC	NC	NC	27	NC	50		NC		7	NC			84
1995	18	15	NC	6	4	63		10		6	NC			122
1996	18	8	NC	4	2	33		8		19	NC			92
1997	15	1	NC	6	0	48		1		10	NC			81
1998	14	0	NC	4	0	33		0		7	NC			58
1999	17	0	NC	0	0	21		0		9	NC			47
2000	18	0	NC	0	0	28		NC		5	0	21		72
2001	15	0	NC	0	0	30		NC		6	0	19		70
2002	19	24	NC	0	0	28		NC		4	0	9		84
2003	25	0	NC	0	0	35		NC	8	3	0	17		88
2004	17	0	NC	0	0	64		2	15	4	NC	14		116
2005	17	0	NC	0	0	49		0	17	18	0	16	6	123
2006	20(6)**	4	0	0	0	44		0	20	30	0	20	9	153
2007	23	0	0	1	0	41	4	1	20	9	0	30	4	133

* includes males and females

** plus 6 males at possible satellite lek Airport Pit

Wolff, biologist for Grand Teton National Park, we have combined the Moulton East and Moulton West leks (reported as separate leks in previous reports) to be reported as the Moulton lek (one lek with two activities centers) in this annual report. In some years it appears the total birds for both activities centers on one day were reported as the high count and in other years a high count for each activity center was reported, but not necessarily on the same date. We have attempted to correct what may have been double counts by taking the highest count for a particular date on both activity centers and reporting that number for the Moulton lek.

In 2007 there were 8 active leks, 4 inactive leks and 1 lek of unknown status. The Antelope Flats, 3 Bar H, Poverty Flats, and Beacon lek were inactive. The McBride lek had one male reported on the lek but its status is uncertain. A new lek was discovered south of the east end of Wolff Ridge in the sagebrush flat along Spread Creek. This lek was reported by several observers but we have never been able to confirm its location. The Airport Pit site had 4 females observed in the vicinity of the area used by 4 to 6 strutting males on several occasions in 2006, but no strutting activity was observed there in 2007. It is possible this is a new lek or perhaps a satellite lek for the Airport Lek but we have not classified it as a lek at this time. . The Cottonwood lek in the Gros Ventre Valley was only checked once in 2007 and it was not active. It is uncertain if this lek is actually a lek since it was found in 2006 with 4 males strutting there on one morning. No birds were seen in a subsequent visit in 2006. We will monitor this location in an attempt to confirm its status in 2008. The Bark Corral lek had female grouse on it on numerous occasions and 1 hen with a GPS collar was observed on the lek on several mornings. Only one male was observed strutting on the lek in 2007 but we have classified the lek as active. It is likely the Antelope Flats, 3 Bar H, Poverty Flats leks are unoccupied.

Based on the WGFD sage-grouse database report, the average number of male sage-grouse per lek from 2000 through 2006 for leks within planning area is fluctuated from an average of 23.0 males per lek in 2000 to 13.0 males per lek in 2004, to 21.9 males in 2006 to 13.8 males per lek in 2007. . The average number of males per all leks checked was similar in most years with 18.0 males per lek observed in 2000 compared to 17.9 males per lek in 2006 but dropped to 10.2 in 2007. The trend in total males counted increased from 72 in 2000 to 157 in 2006, but declined to 133 in 2007. The database report is based on 16 leks, including the Moulton East and West leks, Airport Pit, Dry Cottonwood, Cottonwood and Spread Creek Leks. Only the Moulton leks (now considered one lek with 2 activity centers) is a large lek. The other leks, if active, have had less than 6 males observed on them over the past one to three years since their discovery. As a result the average number of males per lek counted, average number of males per lek surveyed, and average number of males per lek checked all dropped sharply in 2007

The lek data presented in Table 1 differ slightly from the lek data in the database report in that the maximum number of males counted on each lek based on whether the high counts on satellite leks are lumped into the total or if the high count for the lek, including the satellite lek counts, is reported.

It must be noted that that lek data in Table 1 must be interpreted with caution for several reasons: 1) the survey effort and the number of leks surveyed/counted has varied over time; 2) it is assumed that not all leks in the area have been located; 3) sage-grouse populations can exhibit cyclic patterns over approximately a decade; 4) the effects of unknown or unmonitored leks that have become inactive cannot be quantified; 5) lek sites may change over time; 6) lek data collected in Grand Teton National Park from 1952 through 1985 is missing from the agency files and no record has been found from other sources; and 7) in some years it appears that lek data were combined for some leks, which may be considered satellite leks by the observers (i.e. Beacon and Airport leks or Moulton East and Moulton West leks or Bark Corral East and West leks, North Gap and Poverty Flats leks on NER) and it is uncertain in some years if both of these paired leks were surveyed since only a total count is presented for one of the paired leks but it appears totals may have been lumped. Both the number of leks and the number of males attending these leks must be accurately quantified in order to estimate population size and trend.

Population Trends and Estimates

No reliable method for estimating the sage-grouse population for the USRBWGA exists at this time. However, the number of males/lek provides a reasonable index of abundance of sage-grouse populations over time in response to environmental conditions

If the average number of males per lek is reflective of the sage-grouse population, the trend suggests high populations in the early 1990s with a sharp decline through 1999 and a modest recovery starting in 2000. The maximum total counts of males range from 214 in 1990 to 47 in 1999 to 117 in 2005 to 153 in 2006 to 133 in 2007 For the same period and years the database report indicates the average number of males counted per lek ranged from 25.6 in 1990 to a high of 29.6 in 1991 to a low of 7.7 males per lek in 1999 to 23.4 males per lek in 2005 and 21.9 males per lek in 2006 and 13.8 males per lek in 2007. Table 1 provides a long term perspective of the population starting with the research conducted by Patterson (1952) in 1948. The long term trend suggests a declining sage-grouse population with some recovery in recent years. The decline to low levels in 1999 suggests that this population could have been at risk of extirpation if the causes of the decline (which are unknown) were to persist for period of several years.

It appears the most recent peak in sage-grouse numbers occurred in 2006. Drought conditions from 1998-2002 likely resulted in poor brood survival and recruitment into the subsequent year's breeding population. West Nile Virus has not been documented in the plan area and is not likely a contributor to declines observed in this area of the state. Chick production and survival apparently was high in 2003-2005 with good recruitment into the 2004, 2005, and 2006 breeding populations. Spring moisture in 2003 may have enhanced grass and forb production, thereby providing improved residual cover for the 2004 and 2005 nesting seasons. Combined with mild winters, apparently grouse production improved each year. The severe winter of 2005-2006 appears not to have had

a significant adverse impact on over-winter survival of grouse going into the 2006 breeding season. However, it appears chick production may have declined in 2006, based on male attendance at leks in 2007. However, no brood data were collected in 2006.

Population Viability

At the request of the USRBWG, the WGFD contracted with Dr, David McDonald, Department of Zoology, University of Wyoming to prepare a demographic population assessment for the sage-grouse population in Jackson Hole. The analysis can be used as a risk assessment for the long term viability of this population and is included in the 2005 JCR. Based on this assessment it appears that the long term viability of this population can be assured only if mortality factors affecting adult females and secondarily, young birds, do not increase. The major conclusions of the analysis are:

- Survival accounts for 60.5% of the total "possible" sensitivity. Any absolute changes in survival will have greater impact on population dynamics than will changes in fertility rates (39.5% of the total sensitivity).
- Survival accounts for 68.7% of the total elasticity, considerably more than that for fertility (31.3%). Proportional changes in survival, particularly of adults and during the first year, will have major impacts on population dynamics.
- The stochastic models produced simulated population trends that were a reasonable fit to the observed trends. They do not, however, hint at cyclical fluctuations in the same way as the observed data. Data from a longer series of years might help resolve the issue of whether some of the observed trends reflect long term cycling.

Harvest

Most of the plan area has been closed to hunting since the establishment of Grand Teton National Park. No hunting for sage-grouse has ever been allowed on lands under the jurisdiction of Grand Teton National Park or the National Elk Refuge. Prior to 1995, the traditional sage-grouse seasons opened on September 1 with a 30 day season. Seasons have gradually been shortened with later opening dates date to increase survival of successful nesting hens, as they are usually more dispersed later in the fall, and reduced overall. Harvest. From 1995 through 1999 hunting seasons were shortened to a 15-16 day season that typically opened during the third week of September and closed in early October. The bag limit was 3 birds/day, while the possession limit changed from 9 to 6 birds in 1994. In 2000 the hunting season was closed in Management Areas 1 and 2 in the Snake River Drainage. The closure was in effect for the 2006 hunting season. Prior to 2000 a few hunters were known to have hunted in the Gros Ventre drainage and the Hoback Basin with some success. The annual harvest survey conducted by the Wyoming Game and Fish Department likely did not adequately sample the few hunters that hunted sage-grouse in the USRBWGA comprised of Management Areas 1 and 2. Based on the Annual Harvest Survey by the WGFD, the average harvest from 1996 through 1999 was 305 birds taken by an average of 138 hunters who spent an average of 403 days in the field. The estimated harvest ranged from 283 birds in 1996 to 407 birds in 1999 and hunters ranged from a low of 60 in 1996 to 229 reported in 1999. The average birds

harvest per day ranged from 0.6 in 1999 to 1.1 in 1998 and birds per hunter ranged from 1.5 in 1997 to 4.7 in 1996. These data seem high since a wing barrel on the Gros Ventre Road in 1998 and 1999 collected no wings. It appears the hunters who hunted in the Gros Ventre drainage or in the Hoback Basin were likely local hunters who traditionally hunted these areas. However, trends in the harvest data from 1996 through 1999 for the USRBWGA are similar to trends reported for the adjacent Upper Green River Basin WGA for the same time period although the values are much lower.

Based on the population viability analysis by Dr. McDonald it appears that any increase in mortality of females and juveniles should be avoided and the hunting season closure on these small isolated populations in Jackson Hole, the Gros Ventre drainage, and in Star Valley is warranted. It is unlikely that these populations will recover enough to support hunting in the near future. So little is known about sage-grouse that use the Hoback Basin that it would be imprudent to hunt these birds until more is know about their numbers, seasonal habitat use, seasonal movements and ties to the sage-grouse population in the Upper Green River Basin.

Habitat Protection

In response to the intense gas field development in the Upper Green River Basin, several sage grouse research projects have been initiated in this region. The results of those studies are reported or referenced in the Upper Green River Basin Working Group Conservation Plan and annual JCR. Implementation of existing stipulations intended to preserve sage grouse and sage grouse habitats on BLM and Forest Service lands have been scrutinized and exceptions granted. These stipulations are often applied to other resource development activities in an attempt to protect important sage-grouse habitats. Current habitat protection stipulations for sage grouse include: 1) Avoid surface disturbance or occupancy within a ¼ mile of the perimeter of occupied leks. 2) Avoid human activity between 8:00pm and 8:00am from March 1 – April 15 within a ¼ mile of the perimeter of occupied sage grouse leks. 3) Avoid surface disturbing activities, geophysical surveys, and organized recreational activities (events) which require a special use permit in suitable sage grouse nesting and early brood-rearing habitat within 2 miles of an occupied lek or in identified sage-grouse nesting and early brood-rearing habitat outside the 2-milebuffer from March 15 – July 15. 4). Where it has been designated, avoid human activity in sage-grouse winter habitat from November 15 – March 14. These habitat protection measures are currently under review. Based on research in the Powder River Basin and the Pinedale area, it appears that current protective measures and timing stipulations on oil and gas leases and conditions of approval for individual wells are not effective to prevent significant declines in grouse numbers within natural gas and coal bed methane gas fields Current research suggests these stipulations do not effectively mitigate the impacts of energy development and grouse numbers decline over time within these large natural gas fields and leks eventually disappear within the perimeter of these fields.

Special Projects

Plant species composition and structure: development of an inventory and monitoring system for Jackson area sage-grouse habitat quality to quantify current conditions, potential winter habitat, and effects of future management actions.

Holloran and Anderson (2004) suggested that winter habitat was a limiting factor on the Jackson sage grouse population. In 2005 the USRBWG received $26,250 to evaluate the condition of sage grouse wintering habitat in Jackson Hole. Funding was obtained through the Wyoming Sage-Grouse Conservation Fund which will allow a team headed by Dr. Geneva Chong from USGS to complete the project in cooperation with Grand Teton National Park, the National Elk Refuge, and the Bridger–Teton National Park. An inventory and monitoring system for habitat quality, combined with a classification of potential winter habitat from remotely sensed data could provide an initial step to address sage grouse habitat information needs. For example, questions regarding interactions between habitat and snow (depth and density) would be served by baseline information on plant species composition (native and non-native) and structure (e.g., aerial cover, height, bare ground). These initial data in turn can be correlated with spatial data (e.g., maps and remotely sensed information) to develop probability maps for items of interest (e.g., estimates of the amount of exposed *Artemisia* spp with varying depths of snow). We will gain baseline data and general habitat information (species composition and structure) by establishing inventory and monitoring plots. These data will be directly linked to remotely sensed habitat information (Landsat Thematic Mapper satellite imagery) and to a separately funded winter habitat use study to be conducted during the 2005-2006 winter using data collected from a. helicopter survey of potential winter habitat in Jackson Hole and the Gros Ventre Valley. These winter grouse location data were augmented by locations of radio marked grouse collected during the winter for the Holloran and Anderson (2004) study and incidental observations from past Wyoming Game and Fish Department winter big game surveys stored on the agency's Wildlife Observation System (WOS) database.

Project Goals:

a) Estimate potential winter habitat from remotely sensed information.
b) Quantify current habitat quality (defined by species composition and structure).
c) Quantify relationships between remotely sensed habitat information and ground-based habitat information.
d) Quantify the effects of already applied treatments (e.g., wildfire in place of prescribed fire on Blacktail Butte) and other management actions on habitat quality.
e) Develop preliminary spatial models relating vegetation composition and structure to potential winter habitat.

The results of the two studies are attached in Appendix 1 and 2.

Appendix 1:
Remote Sensing Analysis of Sage-Grouse Winter Habitat in Grand Teton National Park and Bridger-Teton National Forest, Wyoming

ALYSON COURTEMANCH, Grand Teton National Park
GENEVA CHONG, U.S. Geological Survey
STEVE KILPATRICK, Wyoming Game and Fish Department

Appendix 2:
Composition and structure of sage-grouse winter habitat in the Upper Snake River Basin

WILLIAM WETZEL, Teton Science Schools
GENEVA CHON, US Geological Survey
ALYSON COURTEMANCH, Grand Teton National Park
NATHANIEL POPE, College of the Atlantic

Airport Safety Study

The impact of the Jackson Hole Airport on the sage-grouse population is an issue which needs to be addressed. One active lek (Airport) and 1 active satellite lek (Beacon) exist within the fenced airport property. Several airplane strikes by sage-grouse have been reported but the confirmed strikes have occurred in August, not during the breeding season. Concerns about sage-grouse strikes on aircraft and the resulting safety issues has caused the Federal Aeronautics Administration to contract with Wildlife Services, USDA to study risks associated with wildlife affecting safe aircraft operations at the Jackson Hole Airport. Efforts to reduce the risks that sage-grouse pose to airport operations could have negative impacts on this population. The study was initiated in 2006 and should be completed in 2008. In addition, the National Park Service has expressed interest in marking sage-grouse that frequent the airport lek with radio or satellite telemetry to more intensively study their movements and habitat selection to determine if the birds can be effectively discouraged from using the airport area for breeding and brood rearing.

Estimating Sage Grouse Population Demographics for Population Monitoring, Modeling, and Recovery; Dr. Howard Quigley and Dr. Derek Craighead Principle Investigators; Craighead Beringia South.

The USRBWG supported the sage-grouse study by Craighead Beringia South with partial funding from the Wyoming Sage-grouse Conservation Fund in 2006 and 2007. The project was initiated in the spring of 2007 with efforts to capture and attach radios to sage-grouse. The research project is supported by the National Park Service, U. S. Fish and Wildlife Service, Bridger-Teton National Forest, Wyoming Game and Fish Department, Jackson Hole Airport Board and a number of other agencies, organizations and individuals. A progress report will be included in the 2007 JCR.

Introduction:

The sage grouse population within the Upper Snake River Ecosystem (USRE) has been declining over the past 60 years. However, the probable demographic parameter(s) responsible for this decline has yet to be determined for the grouse population in this area. As a necessary first step in the long-term effective recovery and management of sage grouse in the USRE, these limiting factors must be determined.

While direct habitat alteration to benefit sage grouse is an action that will likely be required range-wide for the recovery of the species, documenting the habitat requirements for the species, and for particular populations or sub-populations, is a vital first step. Adequate research describing the microhabitat for all seasons in each region will better guide direct habitat manipulations and preservation in local areas. Likewise, detailed information on general productivity and survival estimates can illuminate life-history stages requiring more attention from managers. For example, if a particular population is found to have high post-fledging survival through brood-rearing, but low winter survival of hatch-year birds, a management focus on winter habitat would be prudent, rather than a brood-rearing focus.

Considering that the overall population within the USRE is a relatively small, isolated population that primarily occurs on federally managed areas of restricted human use (Grand Teton National Park and the National Elk Refuge), it is crucial to thoroughly understand the underlying dynamics and to protect the integrity and the unique genetic structure of this mountain valley population. In addition, this isolated situation, plus the strict control of human activity in this area, may present ideal conditions for this population to serve as a natural “control” for many other populations of sage grouse and sage grouse research.

We propose the implementation of an intensive, field-based, targeted research effort to track a portion of the population over the course of three years to specifically identify macro habitat and microhabitat requirements, habitat-correlated productivity limitations, dispersal, and inter-species interactions. In addition, this effort will create long-term monitoring protocols and improved population viability modeling capabilities. These results will provide the Jackson Interagency Habitat Initiative (GTNP, NER, and BTNF) with critical information for management actions to improve habitat for sagebrush-obligate species, for example, altering sage-brush fire regime management. The USRE has an active sagebrush fire management program that is likely to become even more active as pressure to manipulate elk winter range increases in the area. Without a detailed map of sage grouse movement patterns, habitat use, productivity, and mortality information, critical habitat may be inadvertently destroyed through sagebrush fire management.

Project Description:

The two main tools utilized in conducting this work will be VHF and GPS telemetry. VHF telemetry will allow us to track a large number of individuals and to document individual variation within the population. With GPS transmitters, we will obtain extremely detailed daily movement patterns not available with conventional tracking. We will be able to document movement dynamics more accurately and develop time and energy budget models for birds, both annually and seasonally. Such information has not

been documented for the majority of grouse populations; this may be one of the most important factors for population viability. Without detailed knowledge of each population's needs, it is virtually impossible to accurately and effectively manage critical habitat, increase grouse production and recruitment, and secure a future for this species.

We will model habitat selection of grouse as it relates to potential predators (e.g., ravens, red-tailed hawks, and ground squirrels) annually using ArcView Geographic Information System (GIS). Predator information (e.g., Common Ravens) will be concurrently gathered by Beringia South though other ongoing projects. We will also attempt to correlate grouse nesting success with variables such as nearest potential predator, distance to the nearest road, and distance to anthropogenic resources.

Project Goals:

This research project will pursue scientifically-gathered information to characterize and define the following goals:

1. Annual adult female survival
2. Annual productivity rates
3. Nest success rates
4. Brood sex ratios
5. General winter habitat use
6. Habitat differentiation by grouse and predators
7. Annual yearling survival
8. Predators post-hatch
9. Natal Dispersal
10. Re-nesting Rates

Project Objectives:

This research project will pursue scientifically-gathered information to characterize and define the following objectives:

1. Critical Habitat Identification
2. Manage Sagebrush Fire Regimes
3. Accurate Population Modeling
4. Designing Long-Term Monitoring Protocols
5. Baseline Data for Future Research
6. Identifying Limiting Factor(s) for the Population
7. Identify Influence of Potential Predators

Habitat Assessment, Monitoring and Evaluation

The purpose of the plan being developed by the USRBWG is to promote management that results in functional sage brush plant communities for sage grouse and other species that use sage brush environments. Connelly et al. (2000) developed guidelines to manage sage grouse habitats based on a synthesis of existing sage grouse research. These guidelines were adapted for use in Wyoming by Bohne et al. (2007). The WGFD recommends these guidelines should be considered in the design criteria for all sage grouse habitat management projects and sagebrush treatments in occupied sage-grouse habitat in Wyoming. Meeting these guidelines is contingent upon knowledge of existing habitat conditions for the Jackson Hole sage grouse population and the 3 other populations in the USRBWGA.

The goal of habitat assessment and monitoring is to maintain information on the spatial distribution of sage brush communities and the vegetative structure and species composition within those communities. Land managers can use this information to

develop habitat management objectives for sage grouse and assess the effects of management actions on sage grouse habitat. Land use and jurisdiction patterns are complicated within the USRBWG's area of responsibility, but most sage grouse habitat is under federal management (Grand Teton National Park, Bridger Teton National Forest and the National Elk Refuge). Compilation of habitat information across jurisdictional boundaries is necessary to assess sage grouse habitat quality for the Jackson population. Habitat information that is currently available is summarized in Table 2.

Project Objectives:

a) Analyze existing Landsat imagery to identify potential winter habitat.
b) Establish vegetation sampling plots in coordination with management activities and information from a).
c) Initiate development of a database on habitat quality based on field sampling
d) Initiate development of a digital photo database for the plots sampled in b above
e) Determine connections between vegetation structure and composition with habitat quality, particularly winter habitat.

Table 2. Sage grouse habitat-related data that is currently available within the Jackson working group's area of responsibility.

AGENCY	TYPE	FORMAT	DESCRIPTION
NER	Plant Community Map	Digital, shapefile	Plant community map of National Elk Refuge, Original air photo interpretation 1986, updated 2000. 35 plant community types, including 3 sage brush types
NER	Aerial photos	Photo hardcopies	Color infrared aerial photos of National Elk Refuge, flight lines designed for stereo interpretation , July 2001,
NER	Image	Digital, MrSid	GTNP, NER and vicinity. 2001 true color orthophoto basemap, 1-m pixel
NER	Habitat Data	Digital and Hardcopy	Forage production data 1986-2005. Includes data for 3-4 sage brush sites located on NER over this time period.
NER	Invasive Plant Species Map	Digital, Shapefile, ArcMap	2005, Location, patch size data for invasive plant species on NER
BTNF	Photo Points	Photo hardcopies, digital photos	EcoData plot data collected 1994-1999. 1,053 plots. Color ground-based photo set at randomized plots established to track vegetation changes
BTNF	Forest Vegetative Layer	Digital, shapefile, ArcGIS	Estimated completion winter 2006-7. Provides information on plant communities, dominance.
BTNF	Satellite Image	Digital, shapefile	Utah State University satellite classification. Based on 88 plots over 4,409,500 acres. Delineates broad vegetation types. 63.6%

			accurate.
BTNF	Noxious Weed Database	ArcGIS, shapefiles, digital photos	Annual location, patch size data for invasive plant species on the Jackson RD.
GTNP	Veg Map	Digital, coverage	From 2001 aerial photos and ground surveys, 52 classifications with 4 sage brush types, GTNP, NER, and vicinity
GTNP	Detailed Veg Plots	Locations digital, plot data currently hardcopy	Land Birds project habitat survey plots
GTNP	Habitat Use	Digital?	Matt Hollaran's radio telemetry data (habitat use)
TCWP	Noxious Weed Database	Digital, Map Info Coverage	Noxious weed location and patch size info for Teton County.

Past Research Projects

Patterson, R.L. 1952. The sage grouse in Wyoming. Sage Books, Denver, Colorado, USA.

Holloran, M. J. and S.H. Anderson. 2004. Greater sage-grouse seasonal habitat selection and survival in Jackson Hole, Wyoming. Wyoming Cooperative Fish and Wildlife Research Unit, University of Wyoming, Laramie, USA.

Management Summary

If the average number of males per lek is reflective of the sage-grouse population, the trend suggests relatively high populations in the early 1990s with a sharp decline through 1999 and a modest recovery starting in 2000. The maximum total counts of males range from 214 in 1990 to 47 in 1999 to 153 in 2006 and 133 in 2007. Lek data must be collected consistently between jurisdictions.

The long-term viability of this population probably can be assured only if mortality factors currently affecting this population do not increase, resulting in greater losses of adult and juvenile hens. Based on this assumption, reinstituting the hunting season in Management Areas 1 and 2 is not warranted at this time.

Habitat monitoring and mapping of sagebrush habitats used by sage-grouse are a priority. Additional surveys of winter sage-grouse distribution are needed to confirm habitat selection and winter distribution. Key areas on public lands used by sage-grouse should be protected from management actions which could have adverse impacts. Wildfire suppression should be a priority in this areas as well. Restoration of native sagebrush

habitats on lands formerly farmed in Grand Teton National Park appear to have the greatest potential to expand and improve habitat used by this species.
The impact of the Jackson Hole Airport on the sage-grouse population is an issue which should be evaluated. Management options that do not adversely affect the sage-grouse population should be considered carefully in any risk assessment associated with safe aircraft operations at the Jackson Hole Airport. Efforts to reduce the risks that sage-grouse pose to airport operations could have negative impacts on this population. Any airport management proposals should consider potential impacts on this population which may be at some risk of extirpation.

The sage-grouse study by Craighead Beringia South should provide essential information to manage the sage-grouse population and its habitat in Jackson Hole.

Recommendations

1. Coordinate lek surveys across jurisdictional boundaries using the lek survey protocols adopted by the WGFD.
2. Attempt to locate the missing historical data collected by the National Park Service.
3. Search for new leks annually.
4. Continue winter sage-grouse distribution surveys to expand winter habitat mapping capabilities and seek to map other seasonal habitats using habitat models validated with observed data.
5. Cooperate with Wildlife Services, the National Park Service, and the Jackson Hole Airport Board to complete the wildlife risk assessment and design projects to minimize risks of sage-grouse strikes on aircraft.
6. Continue to support the sage-grouse study by Craighead Beringia South to determine demographic data and vital rates for the Jackson Hole population, determine seasonal distribution and habitat use.; identify critical habitat, identify limiting factors for the population, determine the influence of potential predators, develop an accurate population model, design long term monitoring protocols, propose management strategies for sagebrush habitats and fire regimes, and provide baseline data for future research.
7. Collect seasonal distribution and habitat use data for the sage-grouse populations associated with the Gros Ventre Valley, Star Valley, and the Hoback Basin.
8. Cooperate with the Pocatello Region of the Idaho Fish and Game Department to gather more information on the interstate population in Star Valley.
9. Encourage Grand Teton National Park to consider sagebrush habitat restoration projects in the Mormon Row and Hayfields areas which could be used as winter and nesting habitats for sage-grouse in Jackson Hole
10. Protect important breeding, nesting, and winter habitats used by these sage-grouse populations until areas burned in the past 20 years have recovered to provide functional habitat. Habitat losses associated with historic human footprint and more recent wildfires and prescribed burns appear to be significant and make habitat retention the highest habitat management priority for this DAU. A GIS based map of vegetation treatments and wildfires in the USRBCA has been developed for the Jackson Hole and Gros Ventre Valley as part of an effort to determine the extent of habitat losses in recent years and to develop priority areas for wildfire suppression.

10. Complete the USRBWG Sage-grouse Conservation Plan and work to implement the strategies and projects identified in the plan.

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Connelly, J.W., M.A. Schroeder, A.R. Sands, and C.E. Braun. 2000. Guidelines for management of sage grouse populations and habitat. Wildlife Society Bulletin28:967-985.

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Patterson, R.L. 1952. The sage grouse in Wyoming. Sage Books, Denver, Colorado, USA.

Appendix 1

Remote Sensing Analysis of Sage-Grouse Winter Habitat in Grand Teton National Park and Bridger-Teton National Forest, Wyoming

ALYSON COURTEMANCH, Grand Teton National Park
GENEVA CHONG, U.S. Geological Survey
STEVE KILPATRICK, Wyoming Game and Fish Department

Abstract. *Over the past 50 years, greater sage-grouse (*Centrocercus urophasianus*) populations have declined throughout their range in Wyoming due to a variety of factors, including increased livestock grazing, farming, residential development, invasive plants, and oil and gas development. The Jackson Hole, Wyoming sage-grouse population has followed this same trend of decline. Holloran & Anderson (2004) suggested that winter habitat availability and condition could be a limiting factor for the Jackson Hole population. We utilized satellite imagery to identify and map exposed winter sagebrush habitat for average and high snowfall winters in the Jackson Hole area. We also performed a Kernel density analysis to determine sage-grouse home range and winter habitat use areas. We identified six key winter habitat areas that sage-grouse use, based on our Kernel density analysis coupled with the satellite image classification. We were unable to detect any exposed sagebrush on the high snowfall winter image. Our results support the suggestion by Holloran & Anderson (2004) that winter habitat may be a limiting factor for the Jackson Hole sage-grouse population during high snowfall winters. During average snowfall years the six sage-grouse use areas we identified may represent the most critical areas to the population. This may also suggest that other factors, in addition to winter sagebrush availability are limiting population sizes.*

Introduction

Historically, the greater sage-grouse (*Centrocercus urophasianus*) has ranged across nearly all of Wyoming, because of Wyoming's extensive sagebrush (*Artemisia spp*.) habitat. However, sage-grouse populations have declined throughout their range during the past 50 years, most likely due to a combination of factors, including increased livestock grazing, farming, residential development, invasive plants, and oil and gas development, which have reduced the quantity and quality of available sagebrush habitat (Wyoming Sage-Grouse Working Group, 2003). The Jackson Hole sage-grouse population has experienced this same decline, despite ranging in an area with a high density of public lands and protected habitat.

During the winter, sage-grouse require exposed, dense, tall sagebrush for forage and shelter. Holloran & Anderson (2004) suggested that the quantity and condition of sage-grouse winter habitat could be a limiting factor for the Jackson Hole population.

The objective of this study was to use remote sensing analysis to identify and map potential sage-grouse winter habitat for both average and severe winters in the Jackson Hole, Wyoming area. Much of the needed information had already been compiled; including vegetation maps produced by Grand Teton National Park and Bridger-Teton National Forest and sage-grouse observation locations by the Wyoming Game and Fish Department and Holloran & Anderson (2004). This study was designed to combine this existing data with remote sensing satellite imagery to yield a better understanding of the Jackson Hole sage-grouse population's winter habitat availability, distribution, and use.

Study Area

The study area encompasses the Jackson Hole sage-grouse population's known range, which includes parts of Grand Teton National Park, Bridger-Teton National Forest, the National Elk Refuge, and private land. The study area also includes the towns of Jackson, Kelly, and Wilson. The major topographical features are the Teton Range, the Snake and Gros Ventre River drainages, Jackson Lake, and the extensive flats, including Antelope Flats and Baseline Flat (Figure 1).

The study area has a wide range of vegetation types, ranging from mixed conifer and deciduous forests in the foothills of the Teton Range, to cottonwood riparian forests and willow shrublands along the Snake and Gros Ventre Rivers, to mixed shrublands and grasslands extending along Baseline and Antelope Flats. In addition, various sagebrush habitats exist throughout Grand Teton National Park and Bridger-Teton National Forest. Baseline Flat and Antelope Flats, as well as the northern National Elk Refuge are dominated by sagebrush dry shrubland and mixed sagebrush antelope bitterbrush shrubland; the Gros Ventre drainage has primarily mountain big sagebrush; and mixed sagebrush shrubby cinquefoil shrubland is found scattered along the Snake River and Elk Ranch (Figure 2).

Fire has highly influenced the landscape within and surrounding Jackson Hole. Likely the most influential fires on the sage-grouse population have been those near Blacktail Butte. Since 1998, approximately 2110 hectares of sagebrush habitat to the south and east of the butte have burned with the most extensive burn happening in 2003. Prior to these fires, Blacktail Butte served as a popular wintering area for sage-grouse, but since the fires, the vegetation has been replaced by mostly grassland with only scattered sagebrush. Additionally, increasing habitat fragmentation on private lands has reduced the quantity of sagebrush habitat available for the sage-grouse population.

Methods

Satellite Image Analysis

We purchased a U.S. Geological Survey (USGS) Landsat 5 TM (Thematic Mapper) satellite image from March 6, 1996, which was an average snowfall winter in our study area. We also purchased a USGS Landsat 7 ETM+ (Enhanced Thematic Mapper Plus) satellite image with Systematic Correction from March 10, 2006, a high

snowfall winter. We selected images based on their absence of cloud cover and similarity in time of year. Both of these satellite images had pixel areas of 28.5 x 28.5 meters (812.25 m^2), or about 0.2 acres.

We also acquired summer vegetation classification maps from Grand Teton National Park and Bridger-Teton National Forest. Using ESRI ArcMap 9.1 Spatial Analyst, we extracted all classes containing sagebrush (low sagebrush, sagebrush/bitterbrush, sagebrush/shrubby cinquefoil, sagebrush dry shrubland, mountain big sagebrush, and spiked big sagebrush) from the vegetation layers.

We performed an unsupervised land cover classification for each satellite image and used it to identify exposed winter sagebrush from the known summer sagebrush habitat areas. After the ground-truthing was completed, we refined the classification even more to reflect a more accurate winter sagebrush representation.

Ground-Truthing

In order to verify the sagebrush identified on the satellite images through the unsupervised classification, we conducted ground-truthing of sagebrush sites during summer 2006. We extracted the center location coordinates of 113 pixels classified as sagebrush on the March 1996 satellite image. These pixels were grouped around the areas of Kelly, the northern National Elk Refuge, Slide Lake, the Gros Ventre Drainage, Blacktail Butte, and Ditch Creek (Figure 3). We chose these sites because they showed high concentrations of winter sagebrush in the unsupervised classification, they were known to be within sage grouse winter range (Holloran & Anderson, 2004), and they were easily accessible to the study team.

Of the 113 identified sites, we visited thirty-four. At each site, we set up a 30x30 meter plot. From the center of the plot, we set 1 m^2 subplots extending in each cardinal direction at 1, 4.5, and 14 meter distances (Figure 4). Within each 1 m^2 subplot, we recorded the height and percent cover for all shrub species present as well as the percent cover for all tree species with canopy overhanging the plot. We also recorded additional shrub or tree species and their heights within the main plot that did not occur in the 1 m^2 subplots.

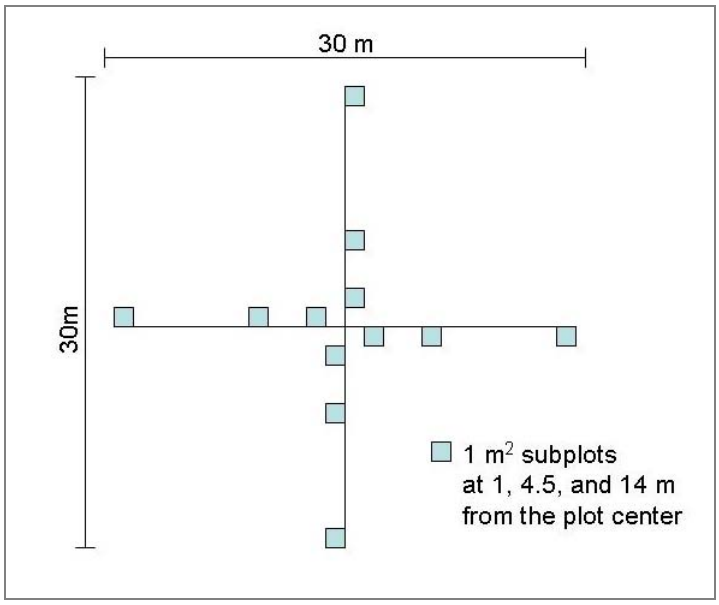

Figure 4. Layout for the sagebrush ground-truthing plots

Kernel Density Home Range Analysis

We conducted a Kernel density home range analysis for sage-grouse winter locations in Grand Teton National Park and Bridger-Teton National Forest using ESRI ArcMap 9.1 Spatial Analyst. We acquired sage-grouse winter location data from 1978 to 2006 from the Wyoming Game and Fish Department's wildlife observation database, which included winter flight observations, ground observations, and radio-collared sage-grouse locations (Holloran & Anderson, 2004).

Results

Kernel Density Home Range Analysis

The Kernel density home range analysis yielded the highest density probability south of Blacktail Butte, followed by areas around Kelly, the Teton Science School, and the upper Gros Ventre drainage. The analysis also identified medium and low densities further east in the Gros Ventre drainage, on Elk Ranch, Upper Antelope Flats, Upper Baseline Flat, and the Potholes (Figures 5 and 6).

Satellite Image Analysis

On the March 1996 satellite image, which represented an average snowfall winter, we identified exposed sagebrush within three summer sagebrush classes, mountain big sagebrush, sagebrush dry shrubland, and a small amount in the sagebrush/bitterbrush

class (Figure 7). We were unable to identify any exposed sagebrush on the March 2006 satellite image, most likely due to high snowfall levels.

When we overlayed the Kernel home range density results with our identified winter sagebrush areas, the high-density sagebrush areas generally matched the Kernel density polygons. Using both the Kernel density and the winter sagebrush results, we identified six main sage-grouse winter habitat areas: Airport/Gros Ventre Junction, Kelly/Northern National Elk Refuge, Teton Science School, Gros Ventre Drainage, Elk Ranch/Spread Creek, and Potholes/Burned Ridge/Upper Antelope Flats (Figure 8).

Ground-Truthing

Of the 34 summer ground-truthing sites that we visited, 23 had sagebrush occur within the 1 m^2 subplots (68%). The average height for sagebrush in these plots was 68 cm and the average cover was 12 percent. Seven of the 34 sites (20%) had sagebrush, but it did not occur within the 1 m^2 subplots, and four sites had no sagebrush present, even in the main plot (12%) (Table 1). Overall, 88% of the ground-truthing sites contained sagebrush.

Table 1. Sagebrush characteristics, number of sites, and percent of total sites results for ground-truthing sagebrush analysis

Sagebrush Characteristics	**Number of Sites (Total = 34)**	**Percent of Total Sites (%)**
Present in 1 m^2 subplots	23	68
Present in main plot, but not 1 m^2 subplots	7	20
None present	4	12

Discussion

Sixty-eight percent of the ground-truthing sites contained sagebrush in the 1 m^2 subplots, suggesting that the majority of our March 1996 winter sagebrush results were correct. At sites where sagebrush was either not present or had a low percent cover, other species such as aspen (*Populus tremuloides*), Canada buffaloberry (*Shepherdia canadensis*), snowberry (*Symphoricarpos oreophilus*), rabbitbrush (*Chrysothamnus spp.*), and narrow-leaved cottonwood (*Populus angustifolia*) were present, suggesting that there is a close spectral similarity between these species and therefore some overlap in the classification. Through a more extensive ground-truthing effort, it is possible that the classification could be improved, however we believe this would result in changes in

some individual pixels but would probably not significantly change the overall landscape distribution of winter sagebrush seen in our results.

Our winter sagebrush classification results suggest that mountain big sagebrush and sagebrush dry shrubland are the most critical vegetation classes for the sage-grouse population, as the majority of exposed winter sagebrush falls into one of these two classes (Figure 7). Most likely, the other four sagebrush vegetation classes are covered with snow and inaccessible to sage-grouse, even during average snowfall winters.

Generally, the winter sagebrush distribution in our study area corresponds with the observed sage-grouse winter locations from 1978-2006, as shown in Figure 8. Even though winter sagebrush habitat exists throughout Grand Teton National Park and Bridger-Teton National Forest, our results suggest that the sage-grouse population is using only select areas of exposed sagebrush, as shown by the Kernel density home range polygons (Figure 8). This selection could be due to factors such as decreased predation risk, warmer temperatures, or better forage quality.

It is important to note that our results do not reflect the habitat changes since the Blacktail Butte fires of 1998-2003. Our satellite image is from March 1996 and our Kernel density data is from 1978-2006, with the majority of it (238 of 266 sage-grouse locations) collected prior to the largest fire in 2003. Unfortunately, we were unable to accurately compare differences in sage-grouse habitat use before and after the fires because of the data imbalance. Therefore, our Kernel density results that show Blacktail Butte as the highest density area for sage-grouse are likely out-dated. This suggests the importance of continuing to collect winter sage-grouse location data and more recent satellite images in order to get a more accurate picture of current winter habitat distribution and use.

Our failure to identify any pixels containing sagebrush on the March 2006 satellite image suggests that during high snowfall winters, exposed sagebrush is found in low density, scattered patches, making it undetectable within our 28.5 x 28.5 meter pixels. We believe that even during high snowfall winters, exposed sagebrush exists, but it is undetectable using satellite imagery. Other studies have also found that it is difficult to use satellite imagery to detect small, scattered areas of vegetation in landscapes dominated by highly reflective surfaces, such as sand or snow (Edwards et al. 1999; Milich & Weiss 2000) because high reflectivity washes out other weaker spectral signatures.

Our results support the suggestion by Holloran & Anderson (2004) that winter habitat may be a limiting factor for the Jackson Hole sage-grouse population during high snowfall winters. However, during average snowfall years, it appears that the sage-grouse are still favoring the six winter habitat areas that we identified (Figure 8). These areas may represent the most critical areas to the population, but this may also suggest that other factors, in addition to winter sagebrush availability are limiting population sizes. The fact that populations have not declined following the 2003 Blacktail Burn adds to our curiosity regarding what factors limit the local population size. We believe that continuing to monitor sage-grouse winter movements along with sagebrush distribution changes in the future will yield information useful for management decisions affecting the Jackson Hole population.

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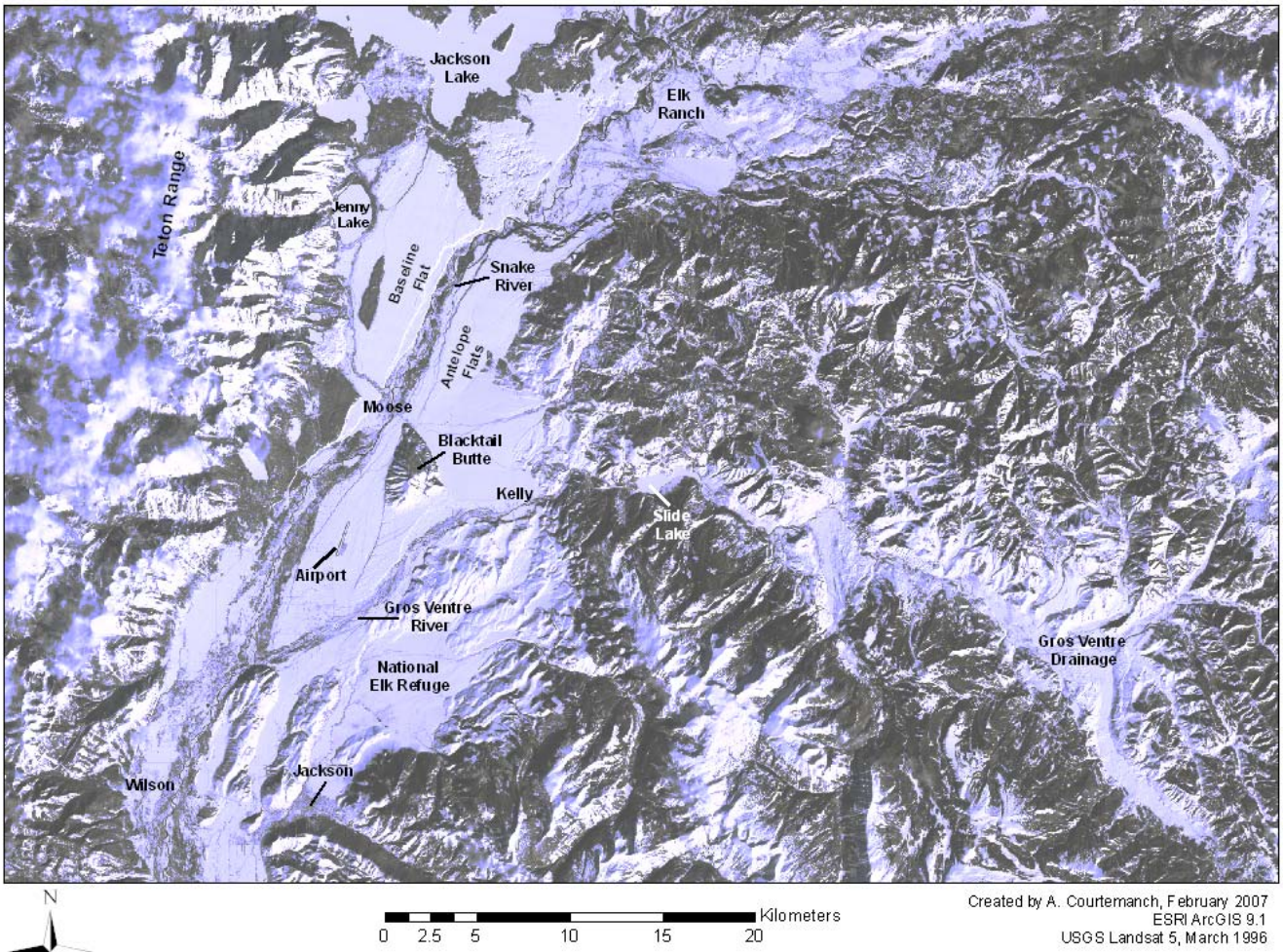

Figure 1. Study area, showing Grand Teton National Park, Bridger-Teton National Forest, National Elk Refuge, towns, and major landmarks.

Figure 1

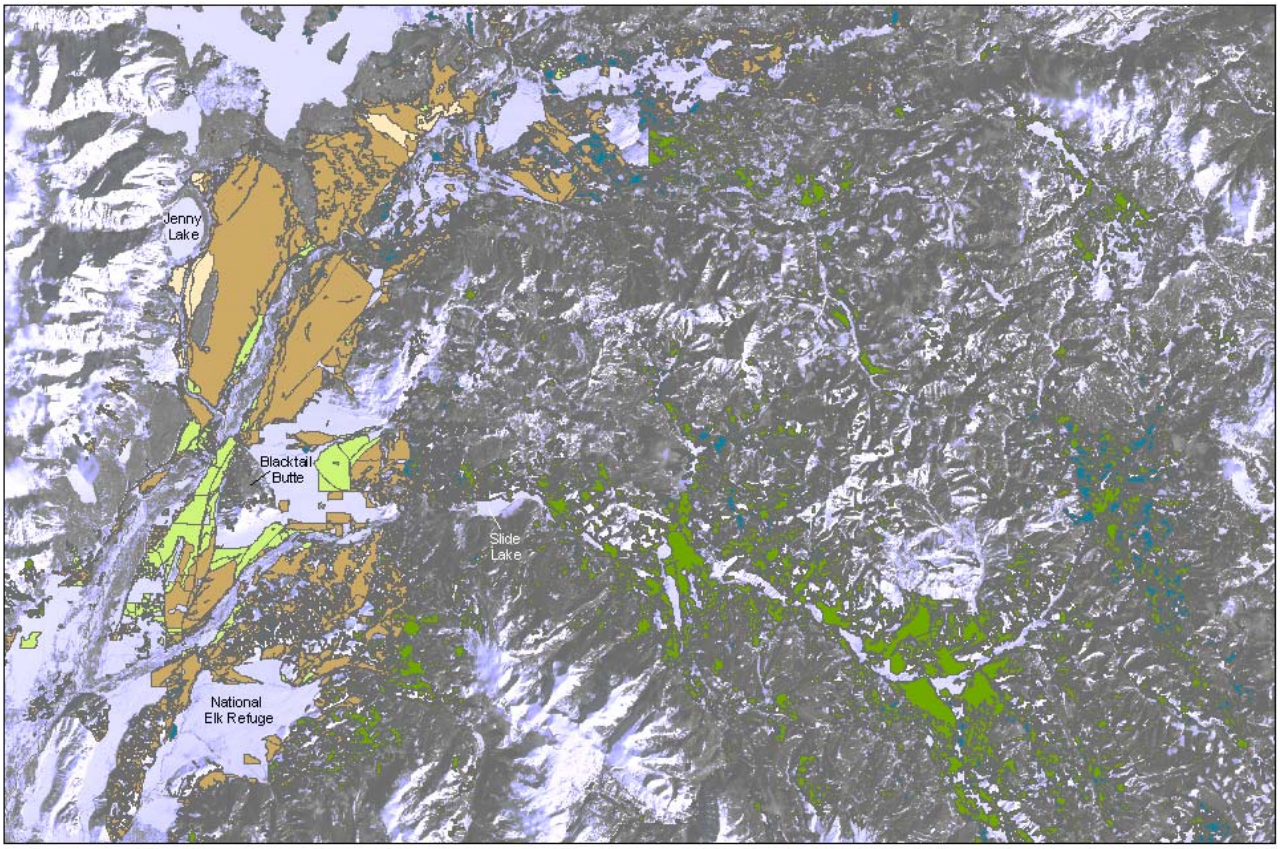

Figure 2. Summer sage habitat distribution
in Grand Teton National Park and Bridger-Teton National Forest

Figure 2

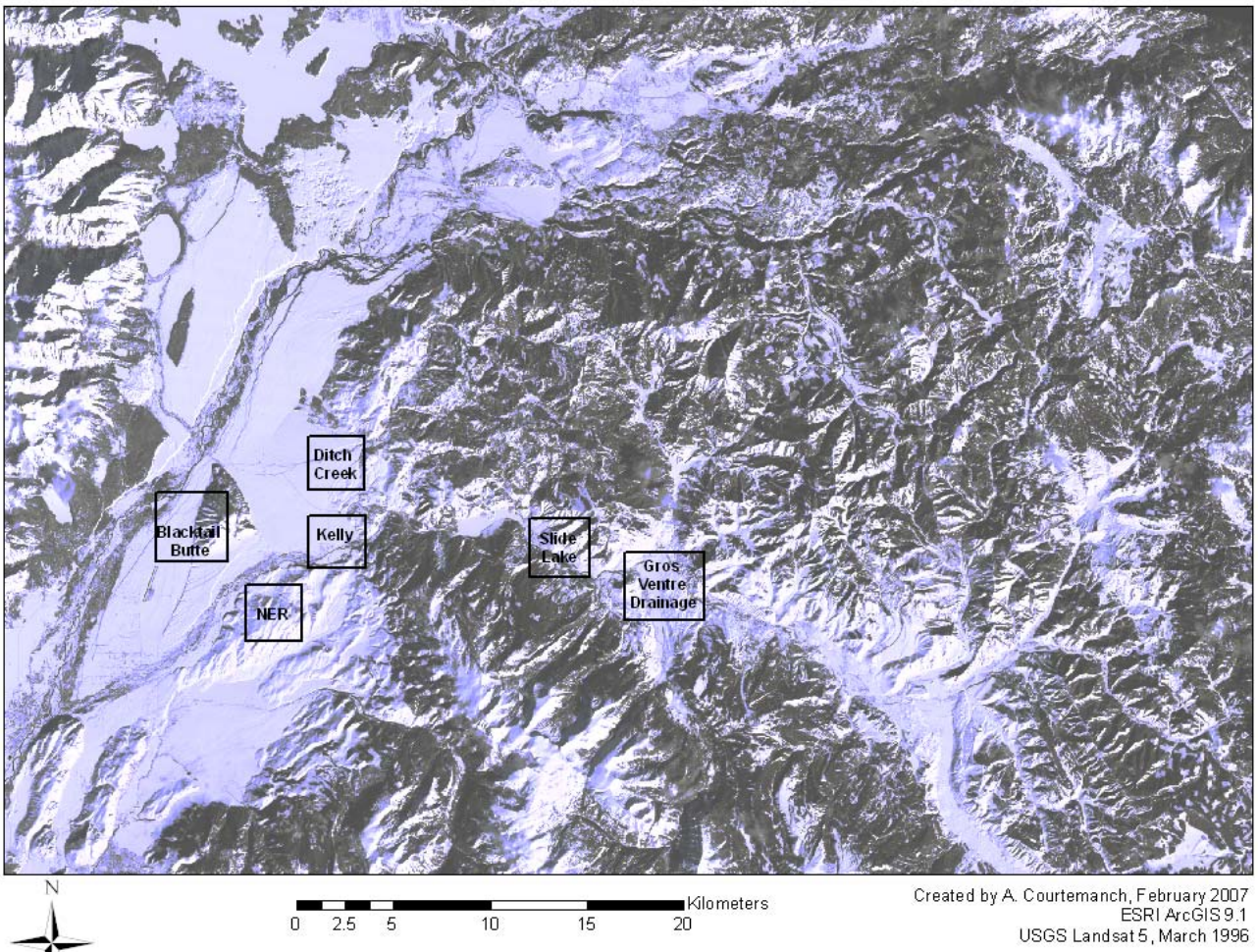

Figure 3. Unsupervised classification selected ground-truthing areas:
Blacktail Butte, National Elk Refuge (NER), Kelly, Ditch Creek, Slide Lake, and the Gros Ventre Drainage.

Figure 3

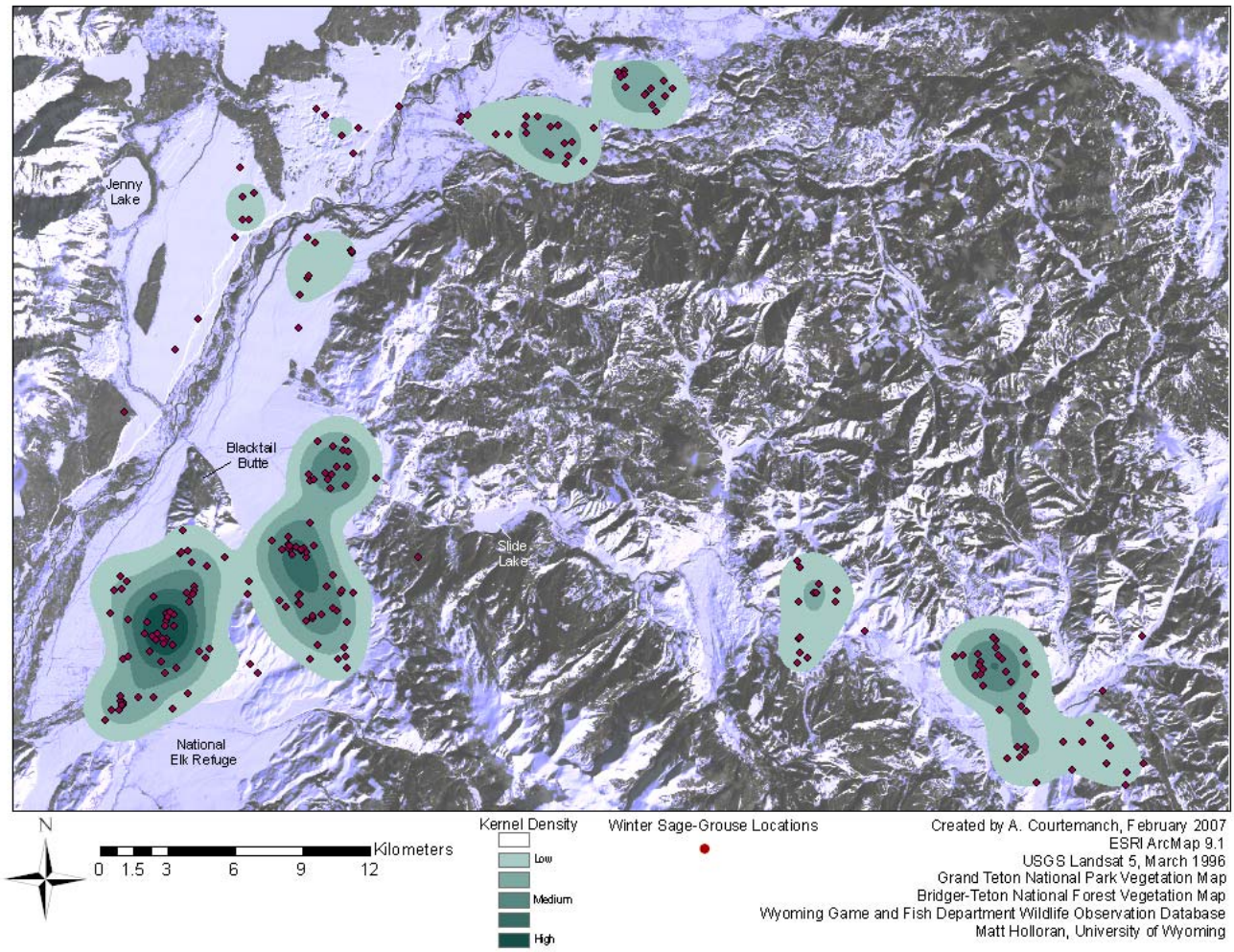

Figure 5. Sage-grouse winter observation locations (1978-2006) and corresponding sage-grouse Kernel density analysis for Grand Teton National Park and Bridger-Teton National Forest

Figure 4

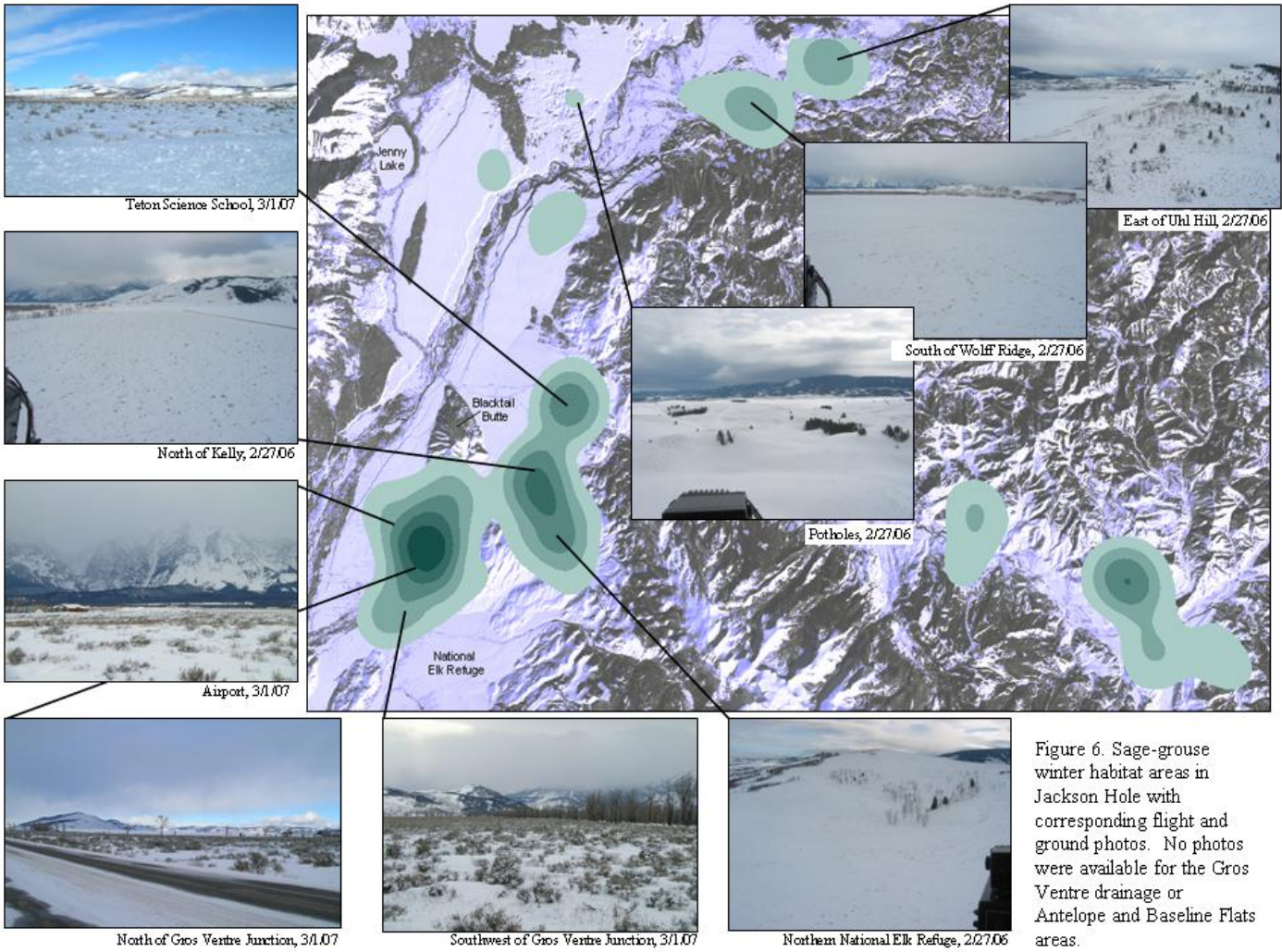

Figure 6. Sage-grouse winter habitat areas in Jackson Hole with corresponding flight and ground photos. No photos were available for the Gros Ventre drainage or Antelope and Baseline Flats areas.

Figure 5

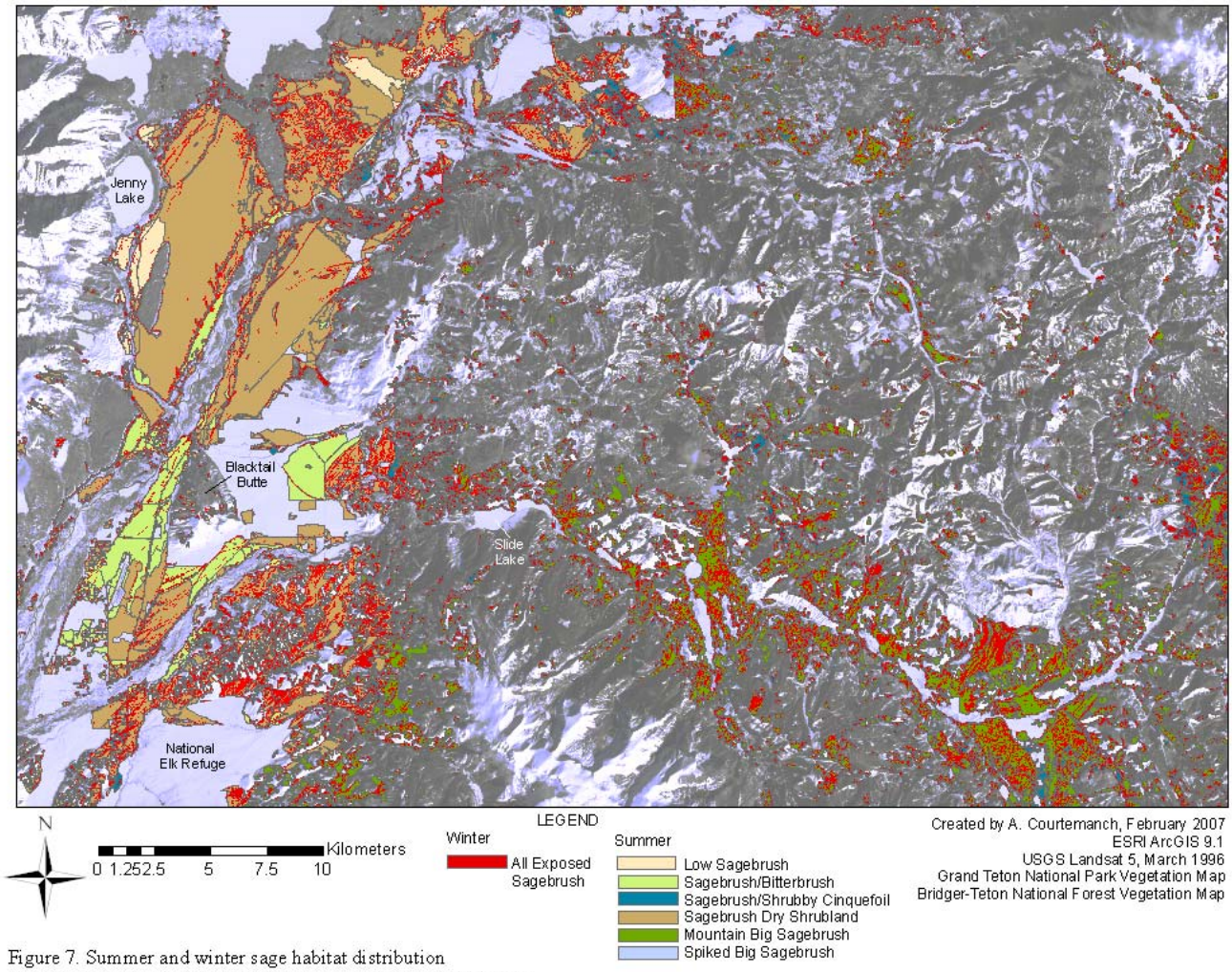

Figure 7. Summer and winter sage habitat distribution in Grand Teton National Park and Bridger-Teton National Forest

Figure 6

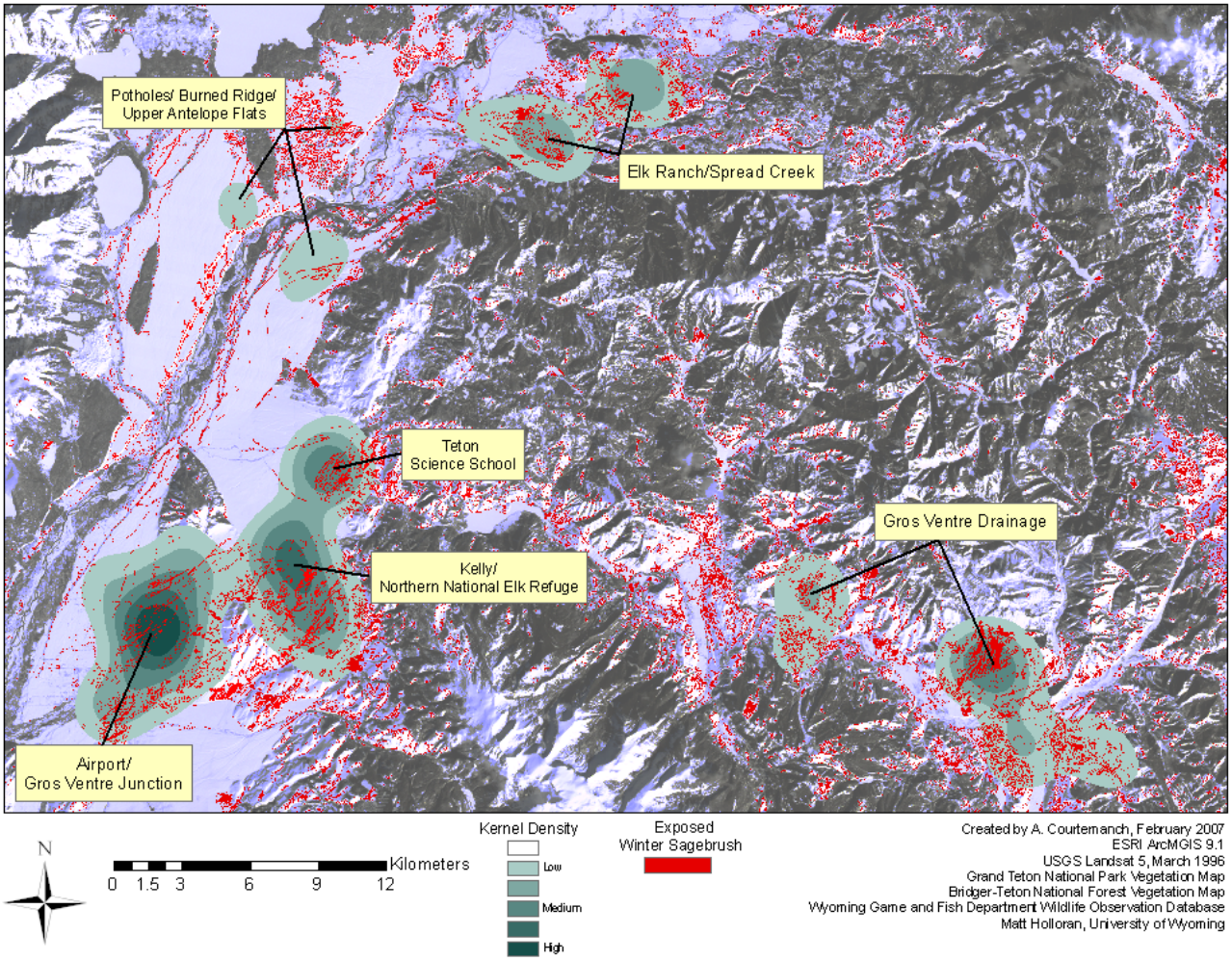

Figure 8. Sage grouse winter Kernel density homeranges and exposed sagebrush areas (March 1996) in Grand Teton National Park and Bridger-Teton National Forest

Figure 7

Appendix 3

Composition and structure of sage-grouse winter habitat in the Upper Snake River Basin

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Nathaniel Pope, College of the Atlantic

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Introduction

Prior to European settlement of western North America, greater sage-grouse (*Centrocercus urophasianus*) distribution covered approximately 1.2 million km^2 of sagebrush-steppe habitat (*Artemisia* spp.). By 2004, potential habitat had dropped to an estimated 670,000 km^2, meaning that 44% of habitat area was lost primarily to cultivation, livestock grazing and mineral resource extraction (Schroeder et al. 2004). On top of habitat loss, the North American sage-grouse population declined 2% annually between 1965 and 2003 (Connelly et al. 2004). The decline in sage-grouse population is alarming at an ecosystem level given that sage-grouse are a landscape-scale species with habitat requirements that vary considerably by season (Connelly et al. 2004). In addition to simple habitat loss, the continued decline in sage-grouse populations may be a product of degraded conditions in remaining habitat (Schroeder et al. 2004).

It is believed that sage-grouse habitat requirements are narrower in winter than in other seasons, yet whether or not strict winter habitat requirements make winter limiting for sage-grouse populations is disputed (Beck 1977, Connelly et al. 2004). In spring and summer, sage-grouse consume forbs, sagebrush and insects, often leaving pure sagebrush habitats for sagebrush grasslands, upland meadows and riparian areas. Over winter, however, sage-grouse are wholly dependent on sagebrush for food and cover (Beck 1977, Connelly et al. 2004). Beck (1977) found that in northern Colorado, sagebrush height above snow, slope and aspect determined suitable winter habitat and that 80% of the population used 7% of the available sagebrush-dominated land. These findings led Beck (1977) to suggest that suitable winter habitat is limited more than summer habitat. Connelly et al. (2004), to the contrary, claim "Unless snow completely covers sagebrush, severe weather conditions apparently do not seriously impact sage-grouse populations." Furthermore, Beck and Braun (1978) found that sage-grouse gain weight through winter, a fact that Connelly et al. (2004) use to argue that winter is not limiting. To add to the complexity, Holloran and Anderson (2004) found sage-grouse populations in Jackson Hole, Wyoming, declined more in years with high snow than in years with low snow. Perhaps these divergent clues to winter population dynamics connect when one considers reproduction. The elaborate displays and rituals involved in sage-grouse breeding in the spring must require significant energy investments, explaining why sage-grouse gain

weight in winter. Accordingly, during high snow years sage-grouse may still gain weight but perhaps not enough to match the energy required for reproduction, resulting in the population declines measured by Holloran and Anderson (2004). The evidence suggests that high snow limits sage-grouse populations, but the limitations imposed by average snow winters are not well understood.

A detailed understanding of habitat composition and structure is crucial to help land managers develop effective conservation plans. Past studies that measured the parameters of sage-grouse winter habitat gave only estimates of sage height and cover and did not identify plants to species (e.g. Beck 1977, Holleran and Anderson 2004). The goal of this study is to quantify in detail the abiotic and biotic composition and structure of winter habitat observed to be used by sage-grouse in the Jackson Hole, Wyoming, area. The results of this study and a GIS analysis of the same area (Courtemanch et al. 2007; Appendix 2) establish a baseline for future management and allow further evaluation of the importance and availability of winter habitat in the study area.

Study area

The study was conducted in and around Jackson Hole, Wyoming (approximately 43.5ºN, 110.5ºW), on lands managed by Grand Teton National Park, the National Elk Refuge, or Bridger-Teton National Forest (Fig. 1). Jackson Hole is a montane valley with a semi-arid climate, bounded to the west by the Teton Range, to the east by the Gros Ventre Hills, to the north by Jackson Lake and to the south by the town of Jackson. The range of elevations surveyed was from 1940 to 2420m. Plots were predominantly in sagebrush dominated vegetation, but were occasionally located in aspen (*Populus tremuloides*) stands, willow (*Salix* spp.) shrublands or sagebrush-grassland habitats. The three common sage varieties in order of abundance are mountain big sagebrush (*Artemisia tridentata vaseyana*), threetip sagebrush (*A. tripartita tripartita*) and basin big sagebrush (*A. tridentata tridentata*).

Methods

Study sites were selected from UTM locations of sage-grouse winter observations, which span the period 1978-2006 with a majority from a 1999-2003 radio telemetry study by Holloran and Anderson (2004) and the rest from the Wyoming Game and Fish Department. The bird observations exhibited clustering, indicating that winter habitats were relatively static over the almost 30 year time period (Courtemanch et al. 2007). We sampled a total of 68 plots with at least two plots per observation cluster, though larger clusters had up to six plots. We used a 168m^2 multi-scale, circular vegetation plot with three 1m^2 quadrat subplots (Fig. 2). For each plot we recorded elevation, aspect, slope, GPS coordinates (UTM), disturbance type and level, and fire history. We measured species percent cover and height and percent cover of abiotic variables (e.g., soil, rock, animal scat, litter) in each subplot. The entire 168m^2 plot was searched for species not found in the 3 subplots, providing a species list and richness measure for the area (Barnett et al. 2007). The fieldwork was completed July-August 2006.

Though we have data on every plant species, only shrubs and trees are used in these analyses because non-woody plants are not considered important in winter habitat.

The cover measurements we report are means of the three subplots in a plot. A height measurement is the mean height when a species is present in a subplot (i.e., if a species were absent from a subplot, it was not included as zero height). Cover measurements reported for sage are a sum of all the sage species cover. Sage height is the height of the tallest sage species in a plot.

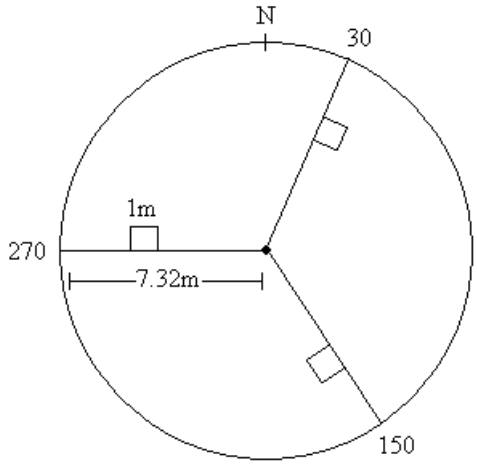

Fig. 2. Plot structure. Plots are circular with a radius of 7.32m and spokes at 30º, 150º and 270º. Each spoke has one $1m^2$ quadrat, 4.57m from the center point.

The sampling design was stratified to measure the variety of habitats used by sage-grouse in the winter. The design was not a random sampling of habitat, nor was it weighted by sage-grouse abundance. This design satisfied the goal of understanding the upper and lower limits of winter habitat parameters, but does not allow mean comparisons with high certainty. As a result, the statistical analyses avoid techniques that measure centrality and instead focus on the variation in the data. For example, box plots are used heavily for assessing variation and comparing ranges. Analyses were conducted using R version 2.4.1 (2006).

The first set of analyses deals with variation in the entire sample. The range in height and cover of shrub species is compared using box plots and principal component analyses (PCA). The goal with these analyses is to understand the overall composition and structure of winter habitats. The second set of analyses assesses variation spatially. Plots were grouped into 11 regions (Fig. 3) and 24 clusters (Fig. 4), which were determined using spatial proximity and observational data. For example, clusters g and f were close enough to be one cluster, but g is on Blacktail Butte, while f is in the flats below. Spatial groups were used to assess the variation at different levels and to determine if different areas had different habitat characteristics. One-sample student's *t*-tests were used to compare the mean region and cluster sage height and cover variance with the overall sage height and cover variance. We used ArcMap 9.1 (ESRI 2006) to plot regions, clusters and habitat parameters on a satellite image (Courtemanch et al. 2007). One area, the Blacktail Butte Burn, had been important winter habitat before it burned in 2003. We excluded this area from the analyses that describe sage-grouse winter habitat because it is unknown to what degree sage-grouse continue to use the area post-burn. We use the understanding of winter habitat developed by the previous

analyses to assess whether or not the Blacktail Butte Burn area would still meet the requirements of adequate winter habitat.

Results

Overall variation

Of the 61 plots that did not burn in the 2003 Blacktail Butte Burn (unburned plots), only 3 lacked a sagebrush species, but these had 61, 7 and 3% cover of another shrub species. Mountain big sage (*A. tridentata vaseyana*) was by far the most common shrub, present in subplots in 48 of the 60 unburned plots and in the main plot of an additional 6 plots. Three-tip sage (*A. tripartita*) and basin big sage (*A. tridentata tridentata*) were present in subplots of 13 and 7 plots respectively. The other shrubs found in the $1m^2$ subplots were mountain snowberry (*Symphoricarpos oreophilus*), antelope bitterbrush (*Purshia tridentata*), yellow rabbitbrush (*Chrysothamnus viscidiflorus*) and rubber rabbitbrush (*Ericameria nauseosa*). Except for the rabbitbrush species, which had mostly low cover when present, the range in species cover was not remarkably different (Fig. 5). The main difference was the number of plots in which species were present. Less abundant shrub and tree species, found in the main plot or fewer than 4 subplots, included russet buffaloberry (*Shepherdia canadensis*), Booth's willow (*Salix boothii*), Canadian gooseberry (*Ribes oxyacanthoides*), wax currant (*Ribes cereum*), Douglas-fir (*Pseudotsuga menziesii*), chokecherry (*Prunus virginiana*), quaking aspen (*Populus tremuloides*), limber pine (*Pinus flexilis*), common juniper (*Juniperus communis*) and Saskatoon serviceberry (*Amelanchier alnifolia*).

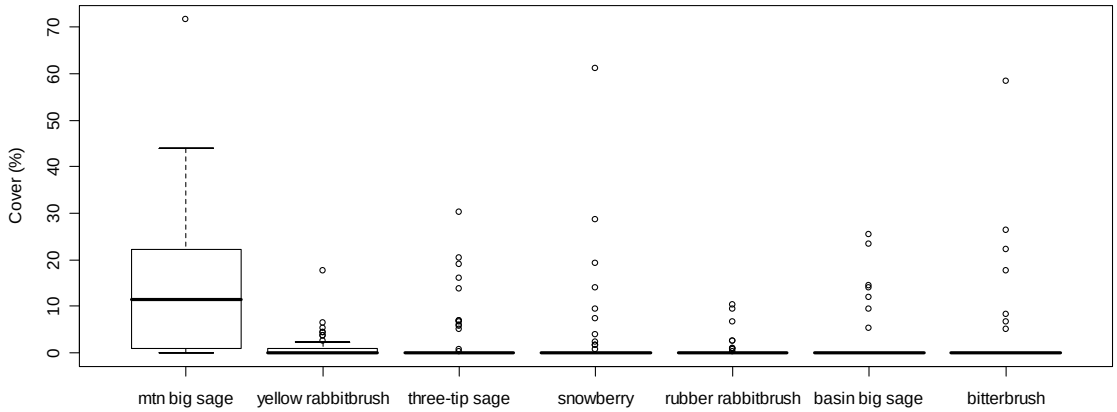

Fig. 5. Percent cover of the 7 common shrub species in descending order of commonness. Vertical lengths of boxes show the interquartile range (middle 50% range of data). Dotted lines show the upper and lower quartiles. Dark bands indicate medians or the middle data value. Circles show outliers. Except for mountain big sage and yellow rabbitbrush, shrub species were present in fewer than 25% of plots, thus the entire interquartile range is at the zero value.

Basin big sage was the tallest of the 7 common shrubs. Its height range almost exceeded that of the other shrubs, ranging from a low of 86 up to 156cm, with a median around 115cm. Mountain big sage, in comparison, had a low height of 12cm and a high

of only 96cm. Three-tip sage and the rabbitbrush species fell within the height range of mountain big sage, but were generally shorter. Snowberry and bitterbrush have a smaller height range but fell near the middle of the mountain big sage range (Fig. 6).

Fig. 6. Heights of the 7 common shrub species in descending order of commonness. Box width is proportional to the number of plots in which that species was present. These are heights when the species were present; absences were not included as zero height.

The PCA analyses of shrub cover (Fig. 7) revealed that the shrub community varied primarily with mountain big sage cover except for plots that had either antelope bitterbrush or mountain snowberry. Community groups were not readily distinguished from the variation. Instead, most plots lay along the mountain big sage axis. About 13 plots lay outside the mountain big sage axis. Of these plots, 7 had increased antelope bitterbrush cover while 6 had increased mountain snowberry cover. Antelope bitterbrush and mountain snowberry never occurred in the same plot and thus the PCA biplot (Fig. 7) shows them on opposite ends of the same axis.

Variation in shrub height grouped primarily into plots with or without basin big sage (Fig. 8). For plots without basin big sage, the variation was along the mountain big sage axis. The seven plots containing basin big sage were found across the entire range of mountain big sage heights. Therefore in the PCA biplot (Fig. 8) the axes representing variation in mountain and basin big sage are orthogonal and independent. On the other hand, plots with big mountain sage taller than 60cm lacked three-tip sage, resulting in a slight negative correlation. The variation in the other shrub species was less influential.

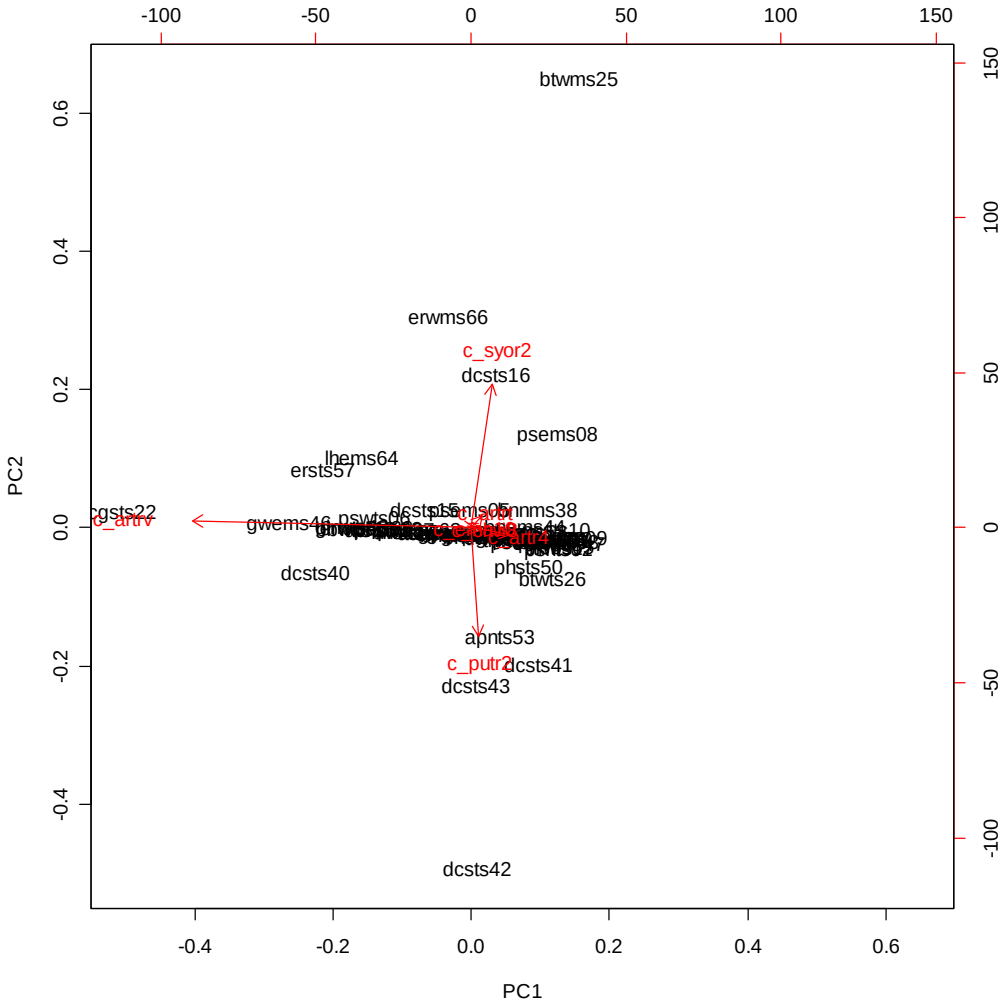

Fig. 7. Biplot for a principal component analysis (PCA) of shrub cover (excluding burned sites). PC1 and PC2 are the primary two principal components and they represent 68% of the total shrub cover variation. Black labels are the vegetation plots. Red arrows indicate increasing cover of the species (code labeled in red) to which they point. Orthogonal arrows are independent variables, while parallel arrows are correlated: positively if they point in the same direction and vice versa. The length of an arrow gives a general idea of the magnitude of the association. In this case, the horizontal axis represents variation in mountain big sage cover (c_artrv). Plots with more big mountain sage are farther left in this plot. Plots that lie above the mountain big sage axis have increased mountain snowberry cover (c_syor2). Plots below the horizontal had increased antelope bitterbrush cover (c_putr2). For example, plot dcsts40 had high big mountain sage cover, low antelope bitterbrush cover and lacked mountain snowberry.

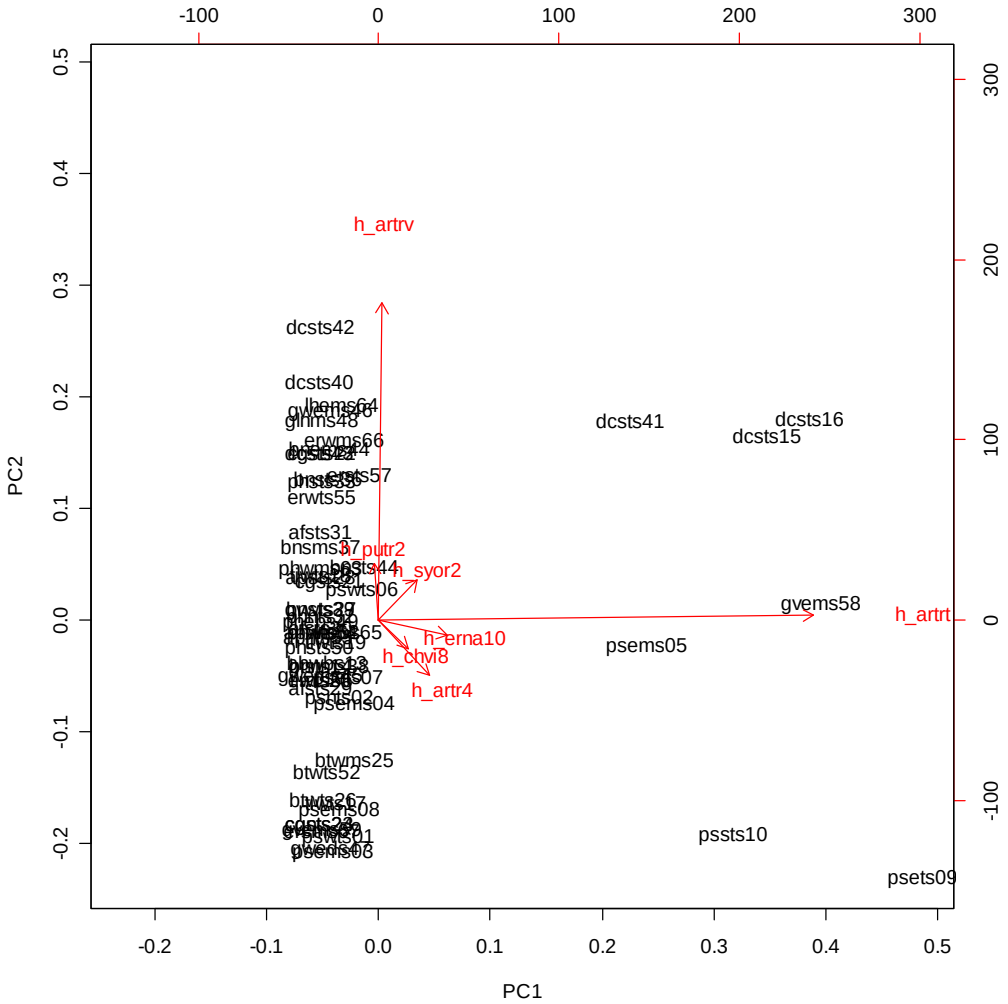

Fig. 8. Biplot for a PCA of shrub height (excluding burned sites). See Fig. 7 for a description of the plot. The first two principal components (PC1 and PC2) in this PCA account for 64% of the total shrub height variation. Plots are primarily aligned along the vertical axis which represents mountain big sage height (h_artrv). The main exception is the 7 plots with basin big sage (h_artrt). The less influential species are three-tip sage (h_artr4), yellow rabbitbrush (h_chvi8), rubber rabbitbrush (h_erna10), mountain snowberry (h_syor2) and antelope bitterbrush (h_putr2).

Spatial analyses

Variation in the composition and structure of sage-grouse winter habitat was large at both region (Fig. 3) and cluster (Fig. 4) spatial scales. Variance did not significantly decrease when plots were grouped into regions or clusters (*t*-test, $p>0.1$). The range in sage height and cover in different regions overlapped extensively (Fig. 9), and those ranges remained overlapping even at the cluster spatial scale with the exception of g and s clusters that lacked sage (Figs. 10 and 11). The GIS maps (Figs. 12 and 13) show that there can be significant variation in sage cover and height even at a scale of tens of meters. For example, cluster l had sage above 85cm and below 14cm in height. Of note, region 4

(Ditch Creek) had consistently tall sage and happens to be one of three regions (4, 6 and 8) to have basin big sage (Fig. 14). Cluster e (Blacktail Butte Burn), on the other hand, had plots with low sage cover and short sage. Clusters g and s lacked sage.

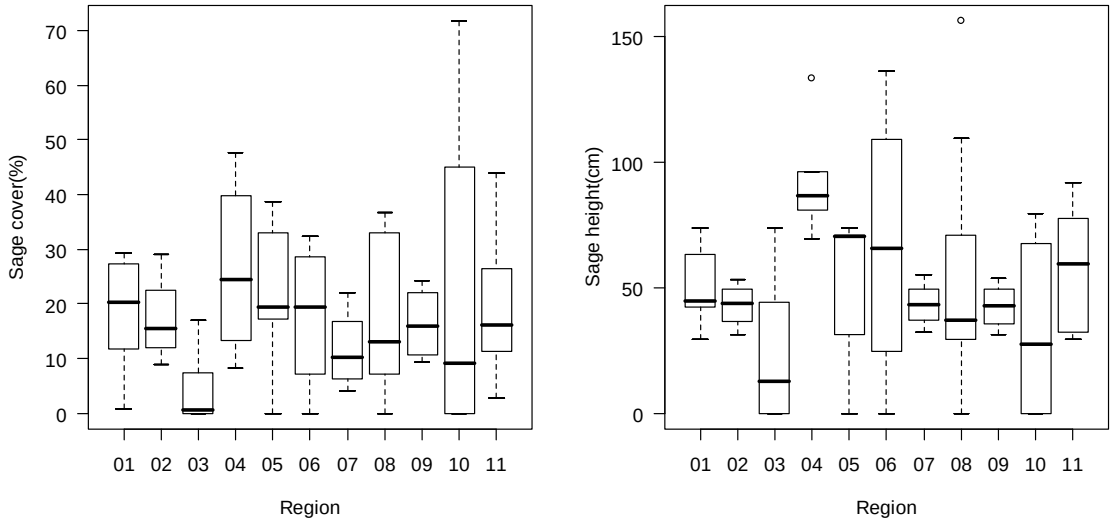

Fig. 9. Sage percent cover and height by region. Ranges overlap extensively. Region 3 includes the Blacktail Butte burn area. See Fig. 3. for explanation of region codes.

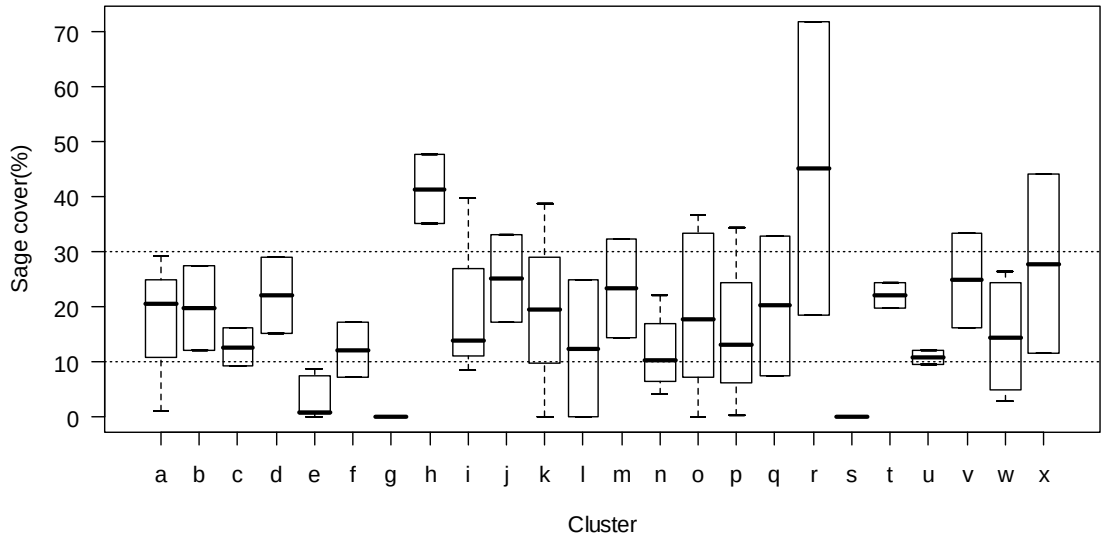

Fig. 10. Sage cover by habitat cluster. See Fig. 4 for an explanation of the cluster codes. The dotted lines show the range of sage cover recommended by Connelly et al. (2000) for sage-grouse winter habitat. Cluster e is the Blacktail Butte burn area.

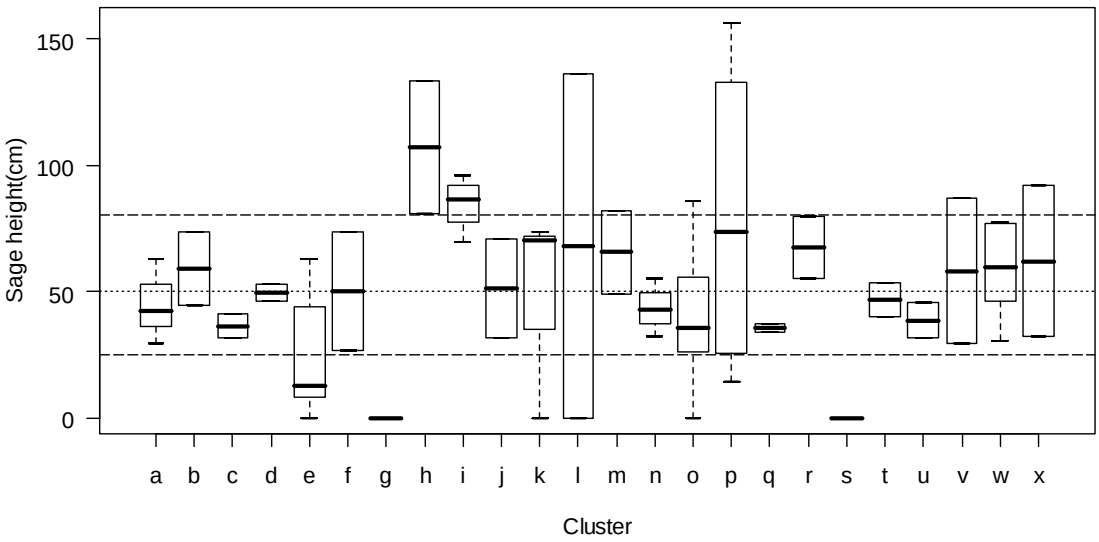

Fig. 11. Sage height by habitat cluster. See Fig. 4 for an explanation of the cluster codes. The dashed lines show the typical range of sage height (25-80cm) in sage-grouse winter habitat, reported by Crawford et al. (2004). The dotted line shows the minimum sage height required according to Connelly et al. (2000) if there were 25cm of snow.

Discussion

Overall, sage-grouse winter habitat in Jackson Hole has a surprising amount of variation. The huge range in sage cover (0-72%) and height (0-156cm) falls outside the range reported in the literature. Crawford et al. (2004) report sage height in typical winter habitats as 25-80cm. Connelly et al. (2000) recommend managing for 10-30% sage cover with at least 25-35cm of sage exposed above snow. The literature values are plotted as threshold lines with the clusters in Figs. 10 and 11. Generally the clusters fall within the ranges for height and cover, but most clusters have plots that fall below or above the range. If there were 25cm of snow, 50cm tall sage would be required for the 25cm of exposed sage recommended by Connelly et al. (2000). Only three clusters fall entirely above this threshold (dotted line, Fig. 11). Furthermore, certain plots had tall sage with cover below 10% or high cover but short sage (Fig. 15). When a height requirement of 50cm (25cm of sage above 25cm of snow) and a cover requirement of 10% are viewed together, only 26 (43%) of the 61 unburned plots seem to be suitable habitat. When the height requirement is lowered to 25cm, there are still only 42 (69%) plots with suitable habitat, but this according to Connelly et al. (2000) would necessitate a lack of snow. The results of this study show a much greater degree of variation in winter habitats than is reported in the literature. The main question posed by these results is are the sage-grouse present in seemingly sub-adequate habitats because of a dearth of better habitat or do they use and need habitats that fall outside of the ranges reported in the literature?

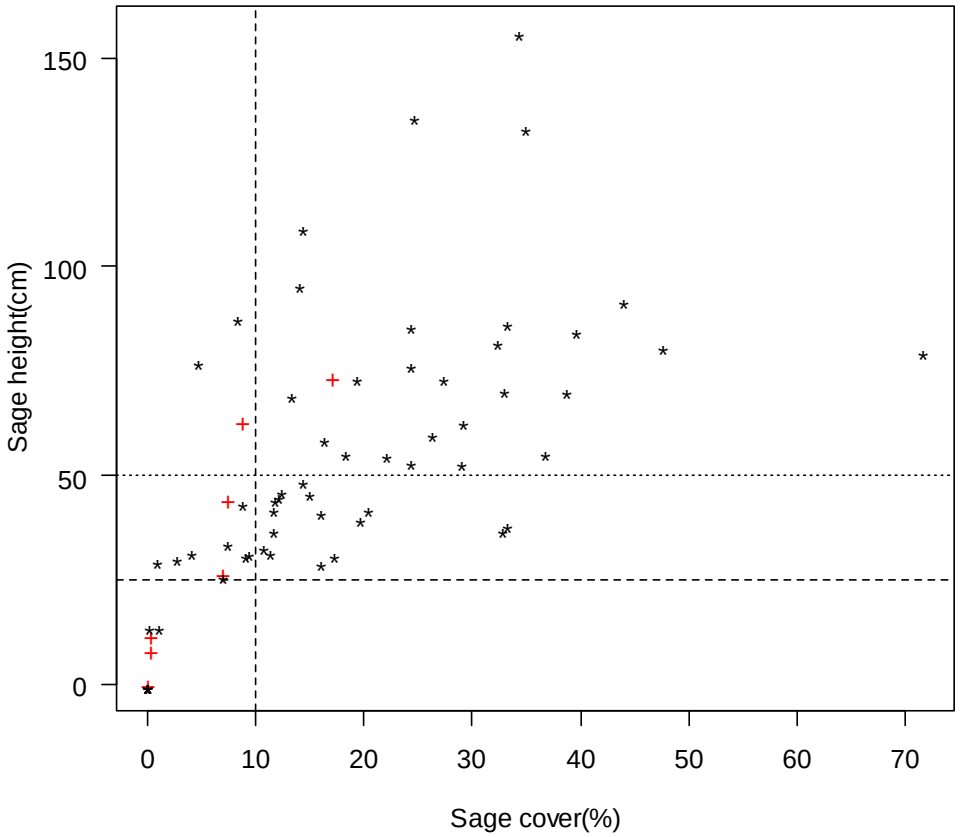

Fig. 15. Sage height and cover are plotted to show the two main structural components of winter habitat. Red + symbols are plots from the Blacktail Butte burn area. The asterisks represent the unburned plots. The vertical dashed line is the minimum sage cover recommended by Connelly et al. (2000). The horizontal dashed line is the lower boundary of the typical winter-habitat sage height reported by Crawford et al. (2004). The horizontal dotted line at 50cm is the minimum sage height required to satisfy the recommendations of Connelly et al. (2000, 25cm of exposed sage) if there were 25cm of snow. Note that 8 values overlap at the origin, l burn plot and 7 other plots.

The large variation in habitats used by sage-grouse has several possible explanations. First, the observations were one snapshot in time. When observed, the individual may have been passing through an area devoid of sage to reach better habitat. But even if the extreme values are left out of the habitat analyses, the variation is still large. Excluding 10 plots (16% of the 61 unburned plots) with the lowest sage height and cover results in a sage cover and height range of 3-72% and 29-156cm. Furthermore, plots were usually located in areas where multiple observations were recorded, thus excluding one plot can be equivalent to ignoring several observations not just one itinerant bird. Second, sage-grouse, opposite to what was previously thought (Beck 1977, Connelly et al. 2004) may simply be capable of using a wide range of winter habitat. Sage-grouse are capable of scratching down to 30cm into crusted snow and use snow burrows for roosting (Beck 1977, Back et al. 1987). These abilities may allow sage-grouse to use habitats that seem to have inadequate sage height. This explanation for the variation in habitat suggests that sage-grouse are not limited by their winter habitat and that focusing management on

winter habitat alone will not be enough to increase sage-grouse populations in the Jackson Hole area.

The third explanation for the large habitat range uses a dynamic view of sage-grouse habitat use and takes into account different functional requirements. Sage-grouse may have separate habitat requirements for roosting and feeding. Perhaps sage-grouse roost in burrows in snowdrifts trapped in tall sage-areas but leave these areas to feed in windblown habitats with low but exposed sage. An advantage of feeding in open areas with lower sage is that the flock could more easily detect approaching predators. Interestingly, separate habitat categories are not apparent in this study area. Therefore, if sage-grouse use habitats differently, then their transition is continuous from tall sage to low sage, suggesting that the different habitat requirements are not rigid in practice. Daily use is probably determined by a combination of ideal habitat preferences, weather and snow distribution (e.g., on a particularly windy day they may use protected, taller sage for feeding instead of preferred short exposed sage). This hypothesis, unlike the previous one, suggests that landscape diversity should be a primary goal in land management. This study does not have the proper data to determine between this and the previous hypothesis, but the Beringia South study (Bryan Bedrosian, personal communication) telemetry and GPS collar study will show how sage-grouse use habitats on an hourly to weekly basis.

The dominance of mountain big sage in winter habitat (Fig. 5) is probably a function of its wide distribution instead of habitat preference. The least common sage, basin big sage, lacked short individuals, indicating that it is not regenerating in this area. Basin big sage with an abundance of short heights may be recolonizing areas lost to disturbance (e.g., fire). Further research should look for historical changes in sage species distribution and abundance. It could be beneficial to know if mountain and basin big sage provide different levels of nutriment to sage-grouse. Remington and Braun (1985) find that sage-grouse in Colorado select for Wyoming big sagebrush (*A. tridentata wyomingensis*) over mountain big sagebrush. They claim that sage-grouse prefer the higher protein and lower monoterpene (volatile oil) levels in Wyoming big sagebrush. If basin big sage, as Wyoming big sage, is more nutritious than mountain big sage, then increasing basin big sage distribution could be an important management goal, especially if taller sagebrush is desired.

The PCA analyses (Figs 7 and 8) revealed only one separate habitat group: plots with basin big sage. This group is apparent only in the height PCA because basin big sage was present at relatively low cover (5-25%), in only seven plots and always at tall heights. This habitat distinction may be functionally important for sage-grouse because of the tall heights, despite low presence and cover. Yet, if basin big sage were regenerating in the area and short individuals were present, then this habitat distinction might also be simply continuous variation, as with the other shrubs.

Spatial analyses

The data show that winter habitat is spatially heterogeneous to a fine scale. There was as much variation within plot clusters as among them. This is not surprising given the natural and human history of Jackson Hole. The valley is a mosaic of fire disturbance, ungulate grazing, slope and topography in addition to mixed human uses including

cultivation, livestock grazing, development and recreation. The high habitat variation at small spatial scales supports the notion that sage-grouse are adapted to a mosaic landscape. The sage height and cover maps (Figs. 12-14) show that sage-grouse can travel short distances between high sage and low sage areas. Thus land management should encourage landscape diversity and not simply promote mature, tall sage stands. These data show that fine scale species level vegetation mapping is required for a full understanding of the landscape variation. Land managers should not look at the Jackson Hole in terms of crude scale GIS vegetation layers; rather the land units must be closer to the size of habitat patches. The GIS maps produced by this study (Figs. 12-14) and Courtemanch et al. (2007) provide not a complete picture of the landscape but a good starting point for understanding the general habitat scale, distribution and variation.

Ditch Creek (region 4) has particularly tall sage and is one of the few areas with basin big sage (Fig. 14). Interestingly, the plots at Ditch Creek without basin big sage also have tall mountain big sage. This area should be figured into management plans if preservation of tall sage and moreover of basin big sage is desired.

It is difficult to predict if sage-grouse still use the Blacktail Butte burn area as winter habitat. It has low sage height and especially low cover but still falls within the range of the other plots (Figs. 10, 11 and 15). It is possible that sage-grouse are still using the area but have shifted the type of use. It may provide forage, but it is unlikely that height and cover are sufficient to shelter birds in winter weather. The data on post-fire species cover and composition from this study will help land managers understand what type of fire is beneficial or harmful to sage-grouse habitat, especially once Bryan Bedrosian's study shows if and how sage-grouse are using the Blacktail burn.

Future research

- Bedrosian et al.'s telemetry and GPS study will allow us to understand why, when and how sage-grouse are using seemingly inadequate habitats. There are three possible results. First there may be a dearth of adequate habitat. This would necessitate managing for better habitat, probably taller sage with greater cover. Second sage-grouse may be able to use a wide range of winter habitat for roosting or feeding, in which case little management would be required. Finally, sage-grouse may need a complex mosaic of sage heights and covers to satisfy their winter feeding and roosting requirements. At first glance this mosaic may simply seem like a wide habitat range as in the previous scenario, when in fact a specific mosaic is desired. Management in this case should strive to maintain landscape diversity.

- This study used only winter observations of sage-grouse and shrub data, but year round sage-grouse observations and herbaceous species data exist. When plotted together, sage-grouse winter and summer observations are coincident in most places (Fig. 16). The main exception is that sage-grouse use the large, open Antelope Flats in summer but not in winter. If vegetation plots were sampled on Antelope Flats, the data from this study (including the herbaceous plant data)

could be extended past just winter for a year round understanding of sage-grouse habitat.

- This study measured sage height in summer. Information on snow depth, especially in relation to sage height, would improve understanding of winter habitat as it is experienced in winter. Short sage would provide little cover regardless of snow depth, but if the snow is shallow it may provide excellent foraging. Tall sage may encourage the formation of snow drifts, making feeding difficult but providing sheltered burrows for sage-grouse.

- To truly understand sage-grouse habitat, we need a better understanding of sagebrush. Past studies have shown significant differences in protein levels in sage leaves (Remington and Braun 1985), but basin big sage has not been tested. In addition, a historical understanding of sage-distribution would greatly aid land managers. It appears as if basin big sage is not regenerating in this area. If it was historically abundant in this area, it may be important for sage-grouse.

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Wind River/Sweetwater River Conservation Area
Job Completion Report

Species: **Greater Sage-grouse** Working Group:**Wind River/Sweetwater River**
Period Covered: **June 1, 2006 – May 31, 2007** Mgmt. Areas: **8, 14, 18, & WRR**
Prepared by: **Stan Harter, South Lander Wildlife Biologist**

Introduction

The Wind River/Sweetwater River Conservation Area (WRSRCA) encompasses about 10,163 mi^2, including a diverse array of vegetation communities (Figure 1). Greater sage-grouse (*Centrocercus urophasianus*) are found throughout the sagebrush/grassland habitats of Wind River and Sweetwater River drainages. Occupied habitat is fairly contiguous throughout much of the conservation area, with principal differences in sagebrush species and associated plant communities related to elevation, precipitation, and soil type diversity. Habitats within the Gas Hills and Badwater Creek areas appear to be the most fragmented by changes in habitat type and energy development. Migrant populations of sage-grouse occur within portions of the conservation area, with some overlap among more stationary resident populations. Large, contiguous blocks of sagebrush/grassland communities have been eliminated in most of the Bureau of Reclamation's (BOR) Withdrawal Area near Riverton and converted into agricultural croplands, as well as near most developed urban areas.

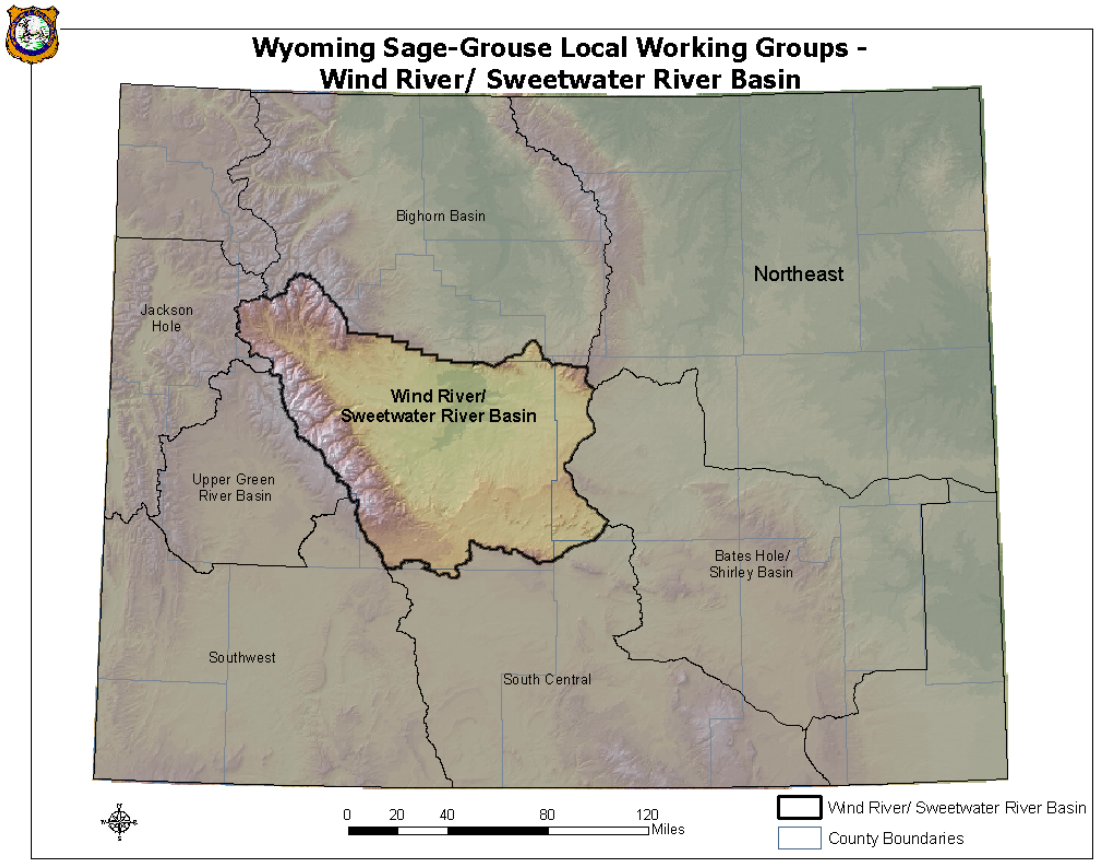

Figure 1. The Wind River/Sweetwater River Conservation Area.

Known occupied sage-grouse leks within the WRSRCA are predominantly located on public lands (55% Bureau of Land Management (BLM) and Bureau of Reclamation (BOR), or tribal lands on the Wind River Reservation (WRR – 28%). Approximately 12% of known leks are found on private land with the remaining 5% found on Wyoming State Trust lands (Appendix A).

Management data collected by the Department for sage-grouse have focused on lek counts and surveys, harvest statistics, and data derived from wings collected from harvested birds. Lek surveys and/or counts have been conducted within the WRSRCA since the 1960s. Lek counts are conducted annually in April and early May at 7-10 day intervals over a 3-4 week period after the peak of mating activity. Lek counts are conducted to estimate trends in the population based on the average peak male attendance. Lek surveys are also conducted each spring, but normally consist of only one visit per lek to determine general lek status. Sage-grouse brood data have also been collected, primarily in July and August. These brood counts provide some indication of population trends. However, their use is limited in estimating recruitment because surveys are not conducted in either a systematic or consistent manner and sample sizes are often quite small. Emphasis on brood counts has decreased over the past few years because of their limited use as an indicator of recruitment and population trends. Wing data collected from hunter harvested birds provide a much more reliable indicator of recruitment.

Past management of sage-grouse within the WRSRCA focused mainly on protection and/or enhancement of their habitats and protection of leks from surface disturbing activities during the breeding season. Protection efforts occurred through the project review process conducted by State and Federal agency personnel and the BLM's Resource Management Plans. Sage-grouse have been given increasing consideration through the project review process with emphasis on minimizing disturbance during the breeding season within and around lek sites and protections for nesting and early brood rearing habitats.

Most sage-grouse populations in Wyoming are hunted, although some areas of the state have been closed to protect small, isolated populations in the southeast and northwest portions of the state. Hunting in the WRSRCA is allowed through Wyoming Game and Fish Department (WGFD) hunting seasons, with unique seasons set on WRR by the Shoshone and Arapaho Tribal Fish and Game Department (SATFG). Most hunting seasons occur in fall, but a limited spring hunt is allowed on WRR, principally for cultural reasons. Historically, sage-grouse hunting seasons opened in early September. Research into the potential impact of hunting on sage-grouse indicated a late September opener had less negative impact on hen survival and may increase recruitment compared to an early September season (Braun and Beck 1996; Heath et al. 1997; Connelly et al. 2000). Sage-grouse seasons in Wyoming currently open in late September and close in early October, with daily bag and possession limits set at 2 and 4, respectively.

Conservation Area

The Wind River/Sweetwater River Conservation Area features the Wind and Sweetwater River drainages. The area extends from Dubois in the west to Muddy Gap and Waltman in the east, and from South Pass and Cyclone Rim in the south to the Owl Creek Mountains and South Bighorns in the north. The WRR is also included in the local planning area. Political jurisdictions include Fremont, Hot Springs, Natrona, and very small portions of Carbon, Sublette, and Sweetwater counties (Figure 1). Figure 2 indicates land ownership within the WRSRCA, including areas managed by the U.S. BLM (Lander, Rock Springs, Casper and Rawlins Resource Areas), the U.S. BOR, the U.S. Forest Service (Shoshone and Bridger National Forests), the State of Wyoming, and private landowners. The Eastern Shoshone and Northern Arapaho Tribal Business Councils manage lands within WRR, in association with the U.S. Bureau of Indian Affairs and U.S. Fish and Wildlife Service (USFWS). Major habitat types within the plan area include: sagebrush/grassland, salt desert shrub, mixed mountain shrub, grasslands, mixed forests (conifers and aspen), agricultural crops, riparian corridors, and urban areas. Primary land uses within the

WRSRCA include: livestock grazing, oil/gas development, mining, dryland and irrigated crop production, recreation, and urban expansion.

The Wind River/Sweetwater River Local Working Group was organized in fall 2004 to develop and implement a local conservation plan to benefit sage-grouse and other species that use sagebrush habitats. This conservation plan will identify management practices to improve sage-grouse habitat and populations. The mission statement of the Wind River/Sweetwater River Local Sage-grouse Working Group is "to identify issues and implement strategies to enhance sage-grouse and their habitats". The Wind River/Sweetwater River Local Sage-Grouse Conservation Plan will be completed in August 2007. This plan and other Wyoming sage-grouse information will be placed on the WGFD website at http://gf.state.wy.us/wildlife/wildlife_management/sagegrouse/index.asp

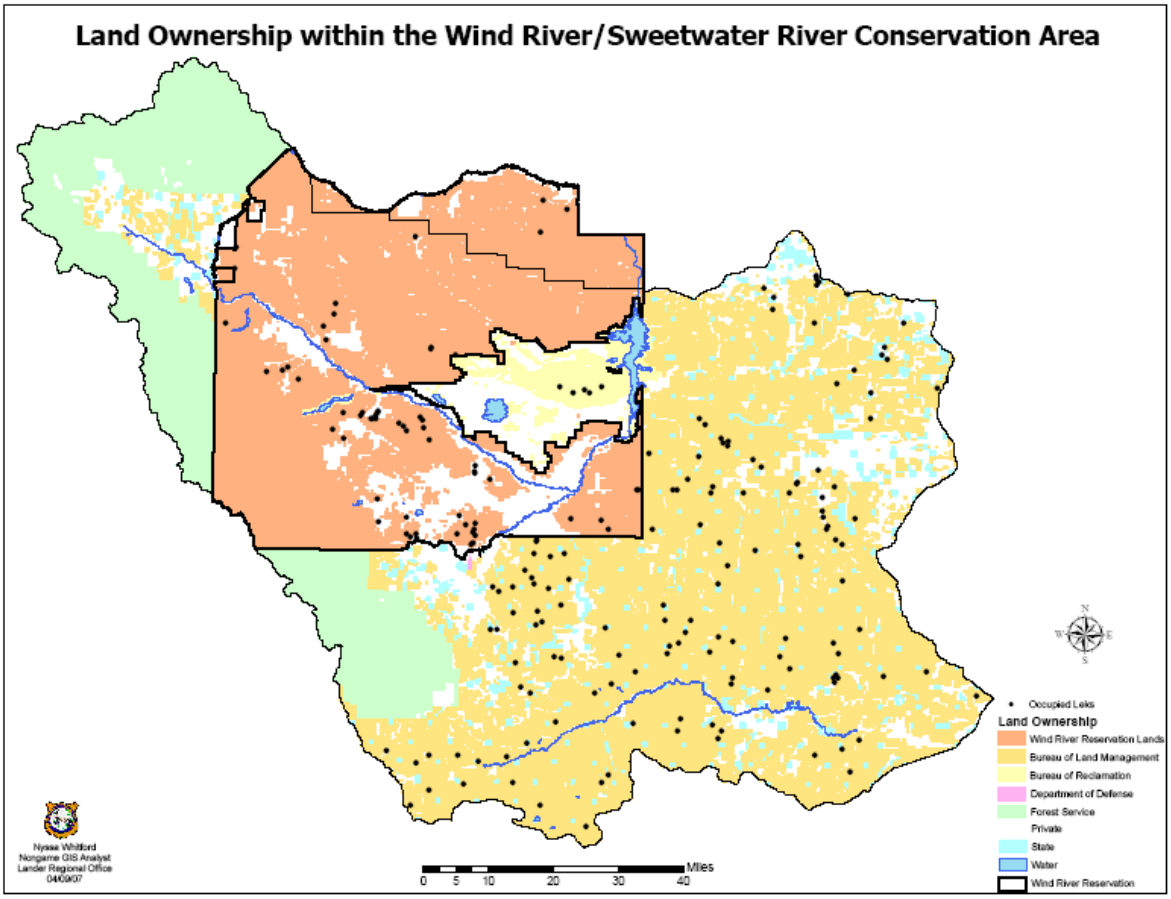

Figure 2. Land ownership within the WRSRCA (dots = leks). Source: WGFD GIS coordinator, Cheyenne, WY.

The WRSRCA encompasses all of the WGFD's Small/Upland Game Management Areas 8, 14, 18, and the WRR (Figure 3). Management recommendations and conservation efforts apply to all tribal lands within the WRR in both Fremont and Hot Springs Counties. The management areas do not correspond to sage-grouse population boundaries, but are used for general data collection and reporting for all small and upland game species.

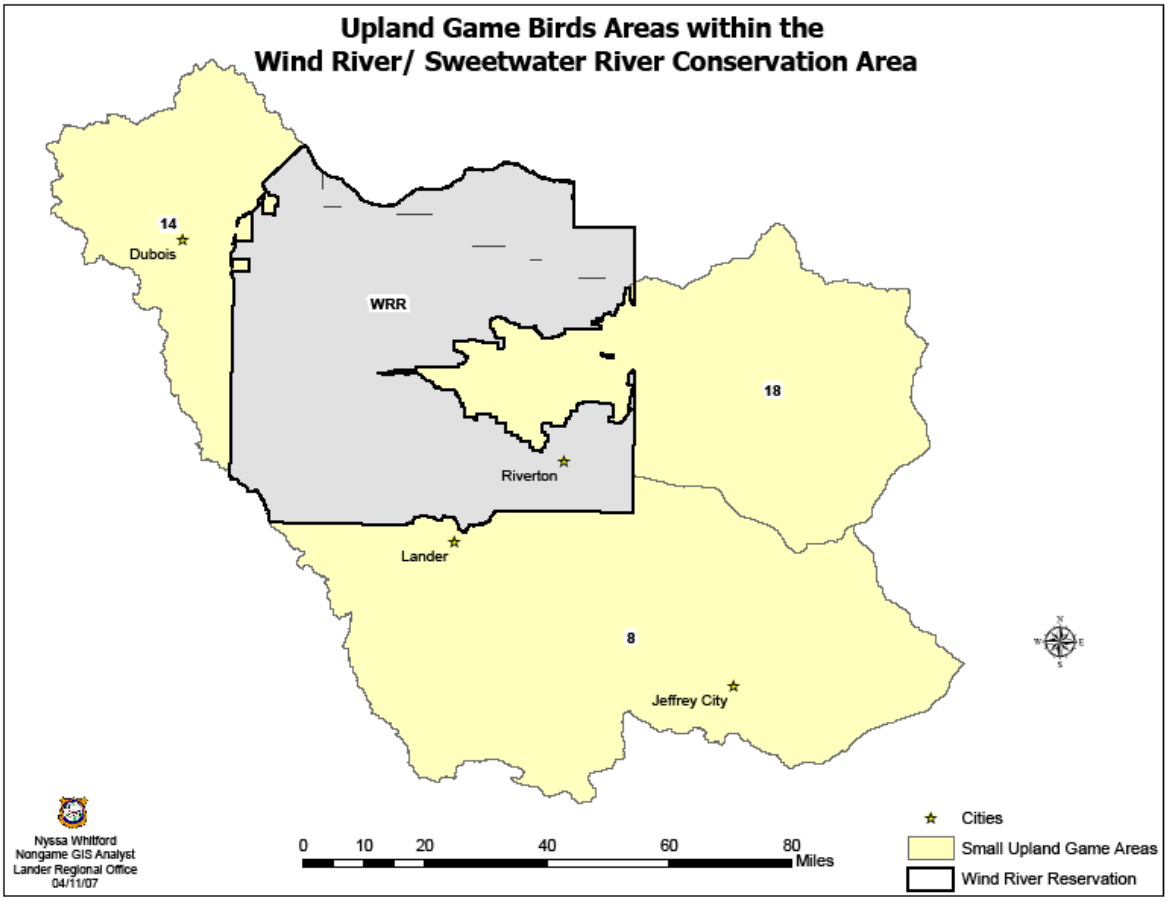

Figure 3. WGFD small game-upland game bird management areas and the WRSRCA. Source WGFD.

Lek Monitoring

WGFD, federal agencies, and volunteers have conducted lek counts and surveys each spring within the WRSRCA for over 40 years, providing some of the best long-term management data currently available for sage-grouse. Lek counts include those lek observations conducted 3–4 times each spring, about 7–10 days apart. Lek counts are a census technique that document the actual number of male sage-grouse observed attending a particular lek or lek complex. Lek surveys typically consist of only one spring visit and are intended to determine general lek status. Occupied leks and sage-grouse distribution within the WRSRCA are represented in Figure 4.

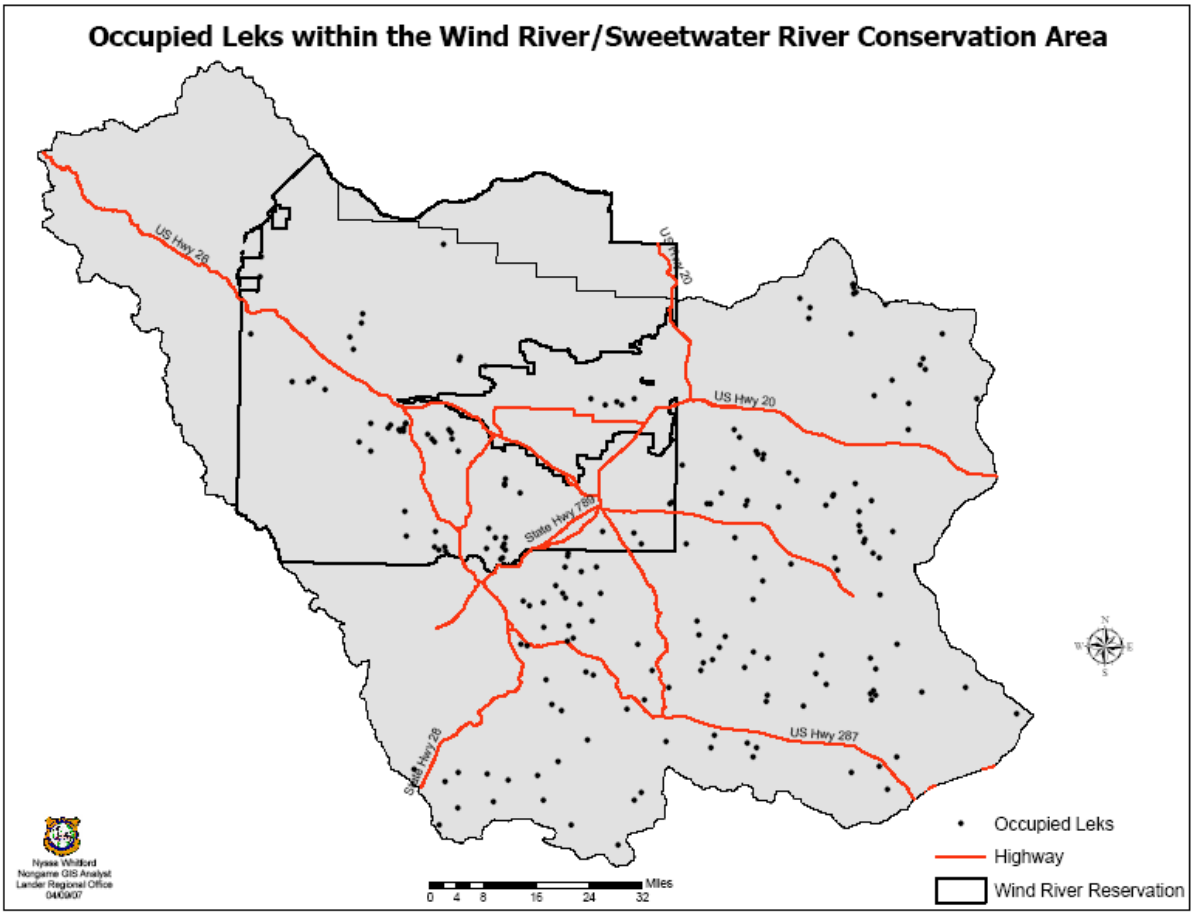

Figure 4. Locations of occupied sage-grouse leks within the WRSRCA, May 2006. Source WGFD Lander.

Leks and Lek Complexes

Sage-grouse are generally found throughout the WRSRCA except in heavily forested, agriculturally developed, or urbanized areas. Sage-grouse lek sites in the WRSRCA are located within the Lander WGFD Region, 2 Wildlife Biologist and 5 Game Warden Districts, 4 BLM Resource Areas, 5 Wyoming counties, and WRR (Appendix A). Currently there are 215 known occupied leks (Figure 4, Appendix A) within the conservation area. Anecdotal information indicates the possible existence of another 6 leks on WRR, however no data are available for lek attendance. In addition, there are almost certainly leks within the WRSRCA that have not yet been documented. Similarly, there are leks that have been abandoned or destroyed that are undocumented. Lek attendance has increased since 1995, when sage-grouse numbers had declined dramatically. Since 1995, 70 leks have been discovered in the WRSRCA, likely the result of increased observation efforts, with establishment of new leks also being possible.

Of the 215 known occupied leks in the WRSRCA, 186 were checked in 2007 by WGFD, BLM, USFWS, and SATFG, assisted by several volunteers (Appendices A, B, and F). Of those checked, 75 were counted and 111 were surveyed. Of the 141 leks where status was confirmed, 133 (94%) were active and 8 (6%) were inactive. Eight leks were discovered in 2007, primarily in areas where prior searches had not been conducted. Average peak male attendance at count leks was 62.4, which is 3% lower than in 2006 (64.3) and 88% above the average since 1995 (33.2).

The number of count leks increased dramatically in 2006 and 2007, largely due to efforts put forth by researchers from the University of California-Davis, who monitored most of the leks in the Government Draw area south of Hudson. These researchers monitored 16 leks on a nearly daily basis from early March through the end of April, allowing personnel, to whom these leks were previously assigned, to monitor and search for leks elsewhere. Male attendance at leks varies daily, as is illustrated at the Monument Draw lek (Figure 5), where counts were conducted on all but 4 mornings from March 3 through April 30, 2007.

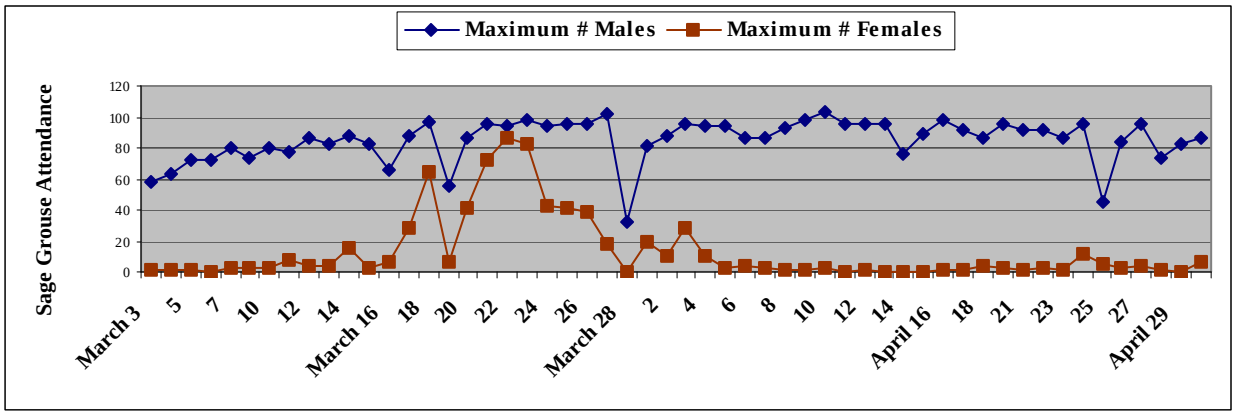

Figure 5. Daily variation in male sage-grouse attendance on Monument Draw lek, 2007.

A set of 18 leks in the Lander area have been continuously counted since 1995, and data trends show little difference between these intensive lek counts and those counted intermittently or all leks checked throughout the WRSRCA during the same time period (Figure 6).

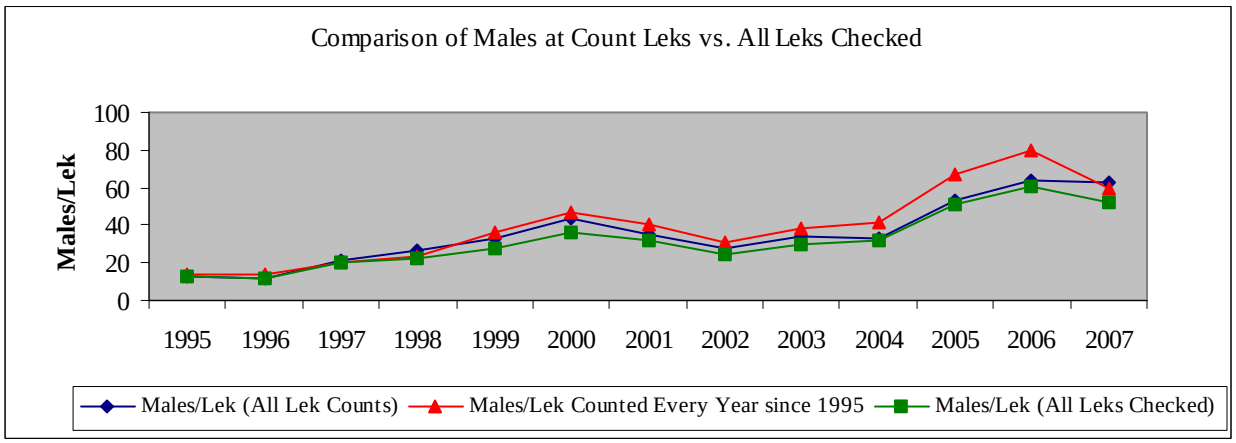

Figure 6. Male attendance trends for lek counts since 1995.

In 2007, 64 of 84 known lek complexes were checked in the WRSRCA (Appendix C and G). Of those checked, 25 were counted and 39 surveyed. Of the complexes checked where status was confirmed, 56 (100%) were active. The high percentage of active leks and complexes is somewhat biased since personnel concentrate monitoring efforts on leks known or thought to be active. Peak male attendance at complexes counted in 2007 averaged 153.8 males, 19% below that observed in 2006 (190.6 males) and 66.3% above the previous 12-year average (92.5 males). Because the number of complexes counted has varied and composition of some complexes changed over the past decade, direct comparisons from year to year should be made with caution. In addition, a meticulous review of complex composition needs to be completed to ensure all leks within a complex meet the current definition. Several complexes appear to contain leks separated by distances exceeding what could be expected to experience daily interchange.

For instance, the Lander complex contains 16 leks, some of which are separated by more than 5 miles. It is possible that at least 6 complexes may be derived from the Lander complex by comparing distances with known radio telemetry locations in this area.

Population Trend

Monitoring male attendance on leks provides a reasonable index of relative change in abundance in response to prevailing environmental conditions over time. Nevertheless, these data must be viewed and interpreted with caution for several reasons described in the Wyoming Greater Sage-Grouse Conservation Plan, 2003.

Lek count surveys have been conducted within the WRSRCA since the early 1960s, with the most consistent data collection beginning in 1995. From 1966 to 1977, all 13 known leks in the WRSRCA were surveyed annually, with peak male attendance (92.3 males/lek) occurring in 1968. Leks counts were initiated in the WRSRCA in 1986 with 4 of 113 known leks being counted. The number of leks counted has increased markedly to 75 count leks being monitored in 2007. Concurrent with increased monitoring effort, the number of sage-grouse (total males observed) has also increased (Figure 7), but the increase has been more dramatic since 2004, with 8,128 total males observed in 2006. Although the number of known leks continued to increase steadily, the number of male sage-grouse observed declined dramatically in the mid-1990s, but has rebounded rapidly in the late 1990s and early 21st century. The average number of males observed/all leks checked increased from 51.3 in 2005 to 61.6 in 2006, but dropped again in 2007 to 51.7. The 16% decline in male attendance in 2007 was expected following reduced chick survival during summer 2006. The ratio of 51.7 males/lek checked was slightly above that observed in 2005 and is the second highest ratio since the 1960s.

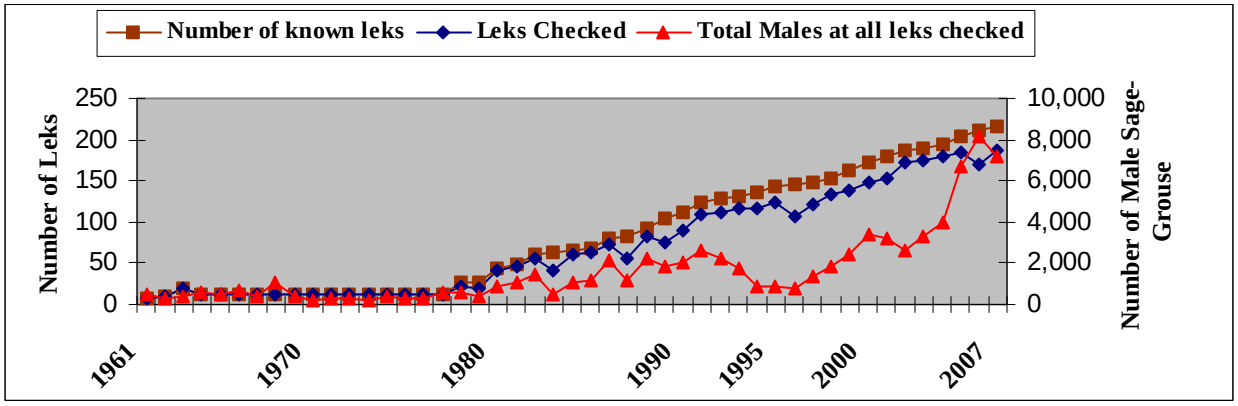

Figure 7. Lek numbers and total male attendance in WRSRCA, 1961 – 2007.

Productivity

Some sage-grouse brood data have been collected and documented during July and early August. Brood data provide some indication of population trend based on production. In most years, brood data are limited because of low sample sizes, due to low populations or conflicting work schedule demands. Historically, there has been no set brood count protocol throughout the WRSRCA. Annual pronghorn classifications are conducted via ground observations and allow personnel to observe numerous broods in August.

Where available, harvest wing data provide a much more reliable indicator of recruitment than do brood data. Several wing barrels placed in along major hunting area exit roads in Upland Game Bird

Management Area 8 have typically provided significant wing data, due to relatively high numbers of sage-grouse hunters in the Lander area. Table 1 indicates wing data from hunter harvested birds during the 2006 hunting season yielded an average brood size of 1.3 chicks per hen, signifying decreased chick survival, probably as a result of hot, dry summer conditions (sample size shown includes chicks and hens only). Rainfall was well below average during March - June 2006 (Table 2), and average high temperatures in May, June and July were between 6 - 8^0F above the 30-year average from 1971 – 2005 at 3 weather stations in the WRSRCA. July's average high of 92.2°F was highest since 1948 in Lander.

Although brood survey data and spring precipitation do not appear correlated, there is reason to believe chick production is linked to precipitation (Figure 8). This link may be related to the timing of the precipitation and resultant vegetation growth, rather than precipitation amounts alone. For example, total precipitation in March and April 2006 was lower than during the same period in 2005. However, precipitation came in a late-April snowstorm followed by warming temperatures. This resulted in vigorous herbaceous growth and enhanced nesting habitat by providing additional hiding cover. From May through August almost no precipitation fell in most of the WRSRCA and chick mortality increased. Differences in the precipitation/brood size pattern are also related to other factors including temperature, conflicting land uses, or other disturbances.

Table 1. Brood data from harvest wing barrels for Upland Bird Management Area 8 for 1995 - 2006.

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Chicks/Hen	2.0	2.6	2.8	2.4	2.1	1.1	2.3	1.3	1.8	5.0	1.7	1.3
Sample Size	124	283	110	218	491	479	419	201	208	325	515	254

Table 2. Spring (March – June) 2006 precipitation at three weather stations in the WRSRCA.

Weather Station	March	April	May	June	3-month Total
Lander	1.7	0.19	1.93	0.63	4.45
Average	1.12	2.05	2.41	1.36	6.94
Riverton	0.51	0.25	1.4	0.83	2.99
Average	0.46	1.15	1.73	1.28	4.62
Jeffrey City	0.85	0.02	1.3	0.47	2.64
Average	0.79	1.25	1.97	1.04	5.05

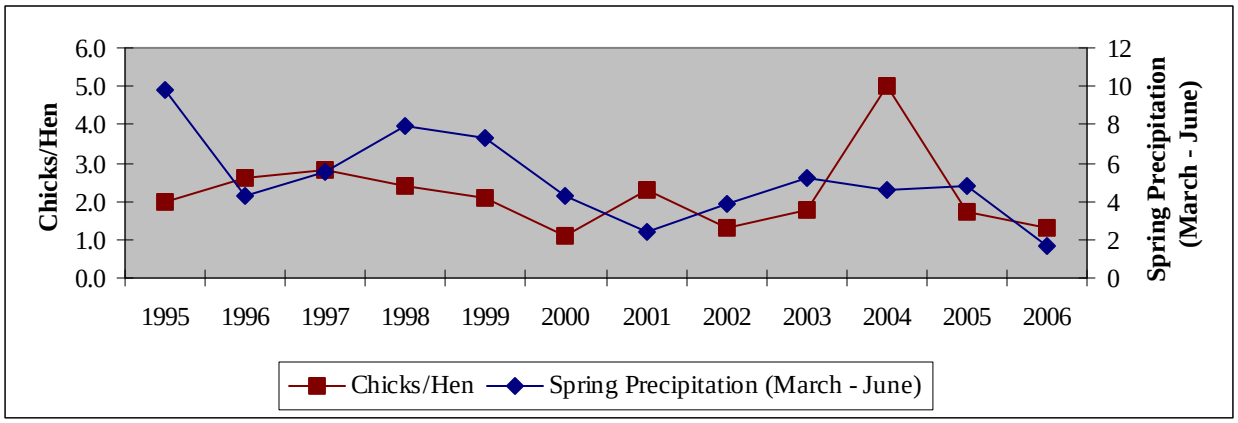

Figure 8. Average brood size from hunter harvested wing data and spring (March-June) precipitation in the WRSRCA.

Harvest

Hunter and harvest statistics provide insight into the status or trends in wildlife populations. Harvest data within the WRSRCA are available since 1982, and indicate total harvest is closely associated with the number of hunters (Figure 9). Harvest peaked in 1984 at 12,568 birds and steadily and dramatically declined to a low of 307 in 2003. Fluctuations in the number of hunters and total harvest appear to be directly related to bird populations. In 1995, hunting seasons were changed across Wyoming with a later opening date, at which time the number of hunters dropped by about half of the previous 5 years. Harvest levels remained at approximately 600 birds until 2000, when harvest increased to nearly 1,100 birds following a brief peak in grouse populations. Hunting seasons were changed again in 2002, with reduced bag and possession limits. Hunter numbers and harvest again dropped following this change. With increased numbers of grouse in 2005, harvest increased above 2004 levels with a slightly smaller increase in hunter numbers. Hunter effort (days/bird) and birds/hunter have not changed significantly since 1995 (Figure 10 and Appendix E).

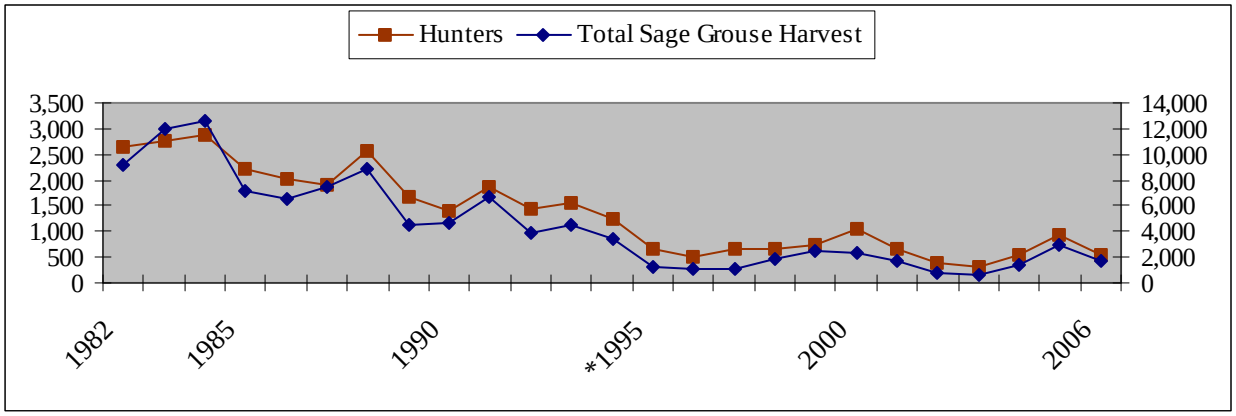

Figure 9. Total hunters and total sage-grouse harvested within the WRSRCA, 1982 – 2005.

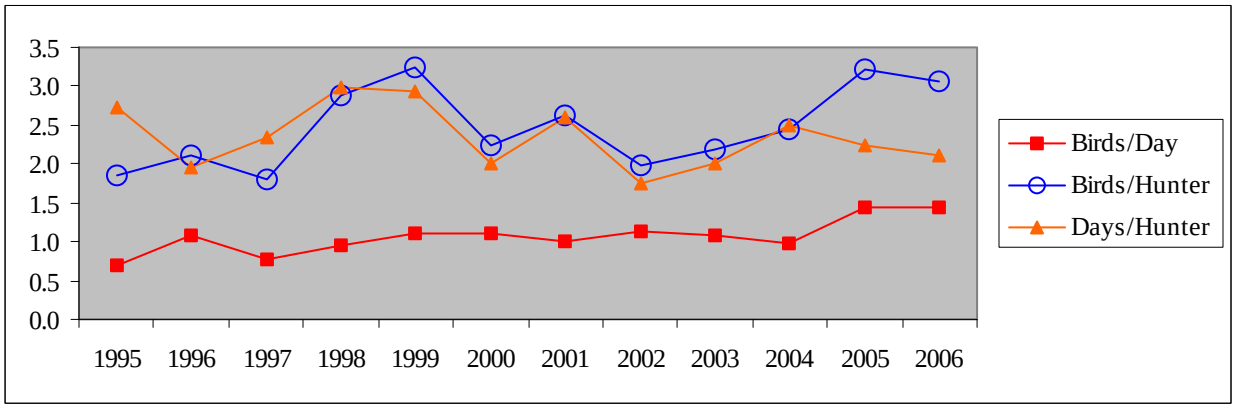

Figure 10. Hunter effort statistics for the WRSRCA from 1995 – 2006.

Weather

Sage-grouse evolved with variable weather and long-term climatic change, and survived multiple ice-ages and droughts. Annual weather fluctuations, multi-year weather events, and long term climatic change all influence sage-grouse populations through physical stress and by modification of habitats. Annual variations in precipitation and temperature can affect annual sage-grouse production and may be site-specific. Cold, wet weather during early brood-rearing can physically stress and kill young chicks and

have adverse affects on insect populations. However, cool, wet springs can be advantageous to sage-grouse by promoting herbaceous growth, especially forbs. Extremely hot-dry conditions during early summer forces sage-grouse to congregate on the few riparian areas that remain well hydrated, thereby increasing the potential for predation and the risk of disease. Typically, wet years are good for sage-grouse production and dry years inhibit production.

Short-term climatic cycles affect the length of the growing season and influence plant succession and the abundance and duration of herbaceous cover and forb availability. Typically, wet cycles benefit sage-grouse, while dry cycles or drought may reduce the amount of grass and forb production to levels that are inadequate for sage-grouse survival. Periodic weather events, such as extreme winters can increase snow depths to levels that cover most of the sagebrush and limit areas available for foraging and cover. Long term and/or extreme drought can cause changes in vegetative communities that decrease the effectiveness of sage-grouse habitats for long periods, and result in reductions in productivity that culminate in population declines. A multi-year weather cycle of above normal precipitation can enhance sage-grouse populations, due to the positive influence moisture has on vegetative communities. Multi-year weather events usually occur on a larger geographical scale than annual fluctuations, and influence sage-grouse populations at the regional level.

Drought monitoring data collected by the National Climatic Data Center (NCDC) branch of the National Oceanic and Atmospheric Administration (NOAA) is compiled into the Palmer Drought Index, which was developed in the 1960s and uses temperature and rainfall information in a formula to determine dryness. It has become the semi-official drought index. The Palmer Drought Severity Index for the Wind River Basin (Figure 11) indicates much of the WRSRCA has been drier than average beginning in the late 1940s (indicated by the red circle), with infrequent, short wet periods in the last 60 years.

Exceptional drought conditions prevailed throughout the WRSRCA from 2000 to 2002, leading to very poor habitat conditions. Based on total precipitation and minimum daily temperatures, the summer of 2002 was only slightly less severe than in 2001, the harshest since weather records were collected beginning in 1892. Summer conditions in 2003 were much improved compared to 2001 and 2002, but were likely not adequate to restore subsoil moisture levels to provide adequate root system recovery to most sagebrush communities within the WRSRCA. Above average precipitation was recorded in 2004, leading to an increase in chick production over that observed in 2003. Weather conditions in 2004 and 2005 were greatly improved over the previous 5 years, particularly when comparing spring precipitation.

In contrast to 2004 and 2005, spring precipitation in 2006 was well below normal, with only 3.02” of precipitation in Lander from January 1 to April 30 (71% of average). Precipitation in Jeffrey City during the same period was 1.78” (63% of average). Conditions worsened as summer 2006 progressed, with only trace amounts of precipitation falling throughout much of the WRSRCA from May 1 through August. Abnormally high temperatures exacerbated the dry conditions, with July being the 2nd hottest on record for Lander and Riverton weather stations. These summer conditions diminished any benefits provided by the spring precipitation and livestock use remained high on rangeland allotments in many locations. Field personnel remarked that resulting habitat conditions were among the worst ever observed. Sagebrush showed nearly no new growth; resulting from previous combinations of extremely dry weather, low vegetative vigor, and heavy cattle use.

Lander and Riverton weather stations set or matched record high temperatures on 4 days in mid-March 2007. Despite a late-March snowstorm that brought nearly 30 inches of snow to Lander and 8 inches to Riverton, precipitation for calendar year 2007 was about 21% and 45% below average in Lander and Riverton respectively (as of April 15, 2007). As of April 10, 2007, the WRSRCA was categorized as under “severe” drought, as depicted on the U.S. Drought Monitor website, showing improvement since the March 27 categorization of “extreme”. http://www.drought.unl.edu/dm/monitor.html

Winters have been generally mild throughout most of the WRSRCA during the past decade. Since winter weather is not normally considered a limiting factor to sage-grouse, mild weather should have a positive influence on survival. One possible detrimental factor resulting from mild winters is lack of snowmelt precipitation, which would cause reduced spring grass and forb growth.

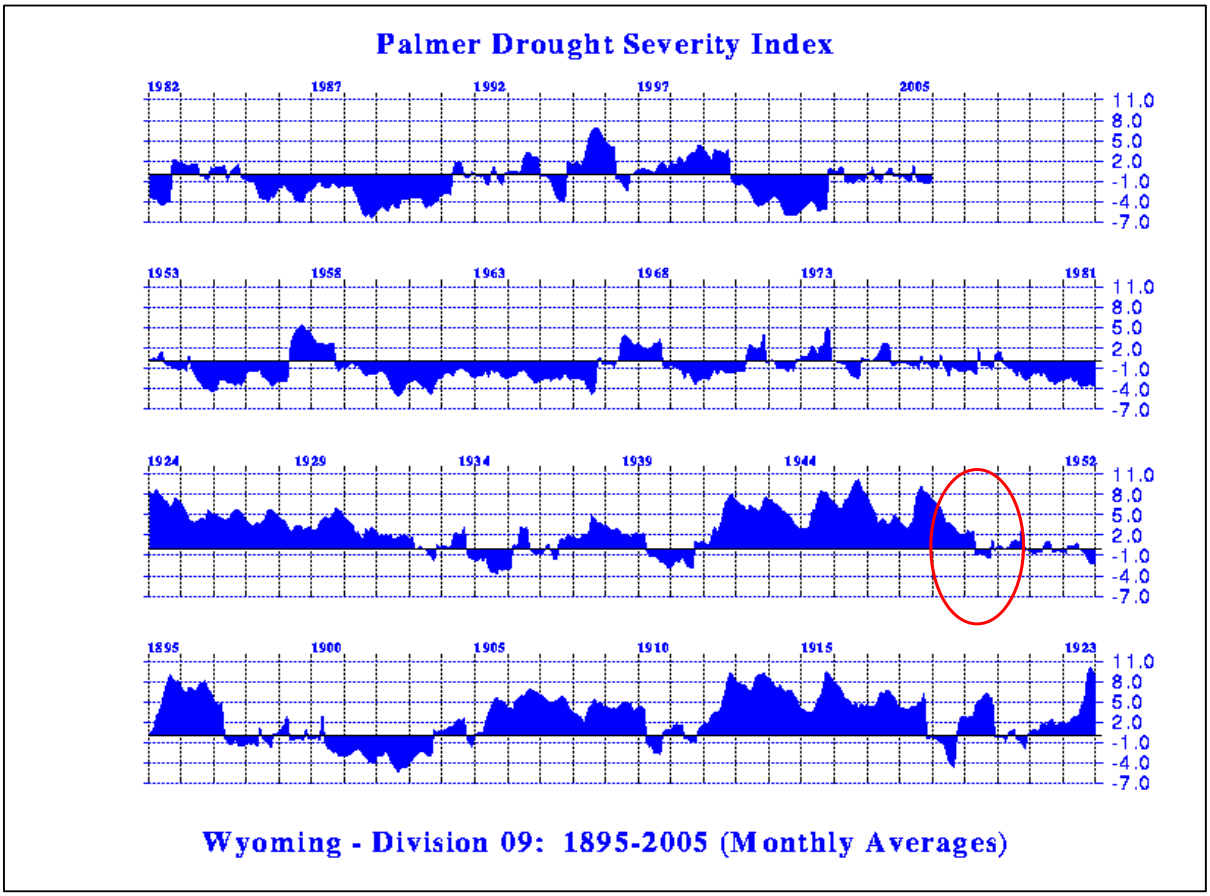

Figure 11. Palmer Drought Severity Index for Wyoming Division 09 (Wind River Basin) from 1895 – 2005.

A relationship between spring precipitation and chick production/survival is indicated through peak male attendance the following year (Figure 12). This connection is probably linked to the amount of residual grass cover remaining from the previous year (t-1), along with current year's grass and forb production. In most years, precipitation from the previous year appears to influence the amount of residual vegetation available for security understory cover at nests. The current year's new grass growth contributes additional security cover at nests and coupled with new forb growth, provides good hiding cover for newly hatched chicks. In addition, lush new vegetation seems to be linked with greater diversity and abundance of insects, which serve as the principal food source for chicks during the first 2 weeks after hatching. Divergence in the trend between precipitation and the following year's peak male lek attendance may be the result of cooler temperatures, conflicting land uses, and other disturbances.

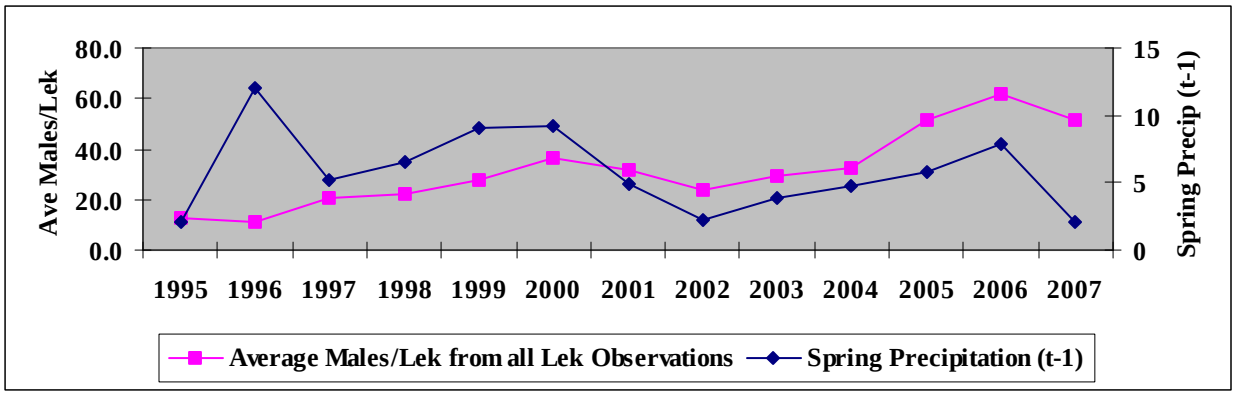

Figure 12. Spring (March/April) precipitation in year (t-1) compared to peak male attendance at all leks observed from 1995 – 2007 in the WRSRCA.

Habitat

Sage-grouse habitat quality has been affected by recent drought throughout the WRSRCA. Disturbance (i.e., oil/gas, season-long grazing by livestock and wildlife, etc.) combined with lengthy drought periods and sagebrush eradication programs in many areas have negatively impacted sage-grouse and their habitats. With recently elevated concerns for sage-grouse, habitat improvement projects are being planned and/or implemented throughout the WRSRCA to address declining sage-grouse habitat condition. In addition, research projects in the Lander area are continuing to provide more insight to sage-grouse movements and habitat use. Habitat conditions vary greatly within the WRSRCA, due to climatic differences, soil types, land use, and elevation.

Habitat Monitoring

Sagebrush transects have been established by WGFD in the WRSRCA and are monitored for production and to estimate over-winter utilization by big game. One transect is located along Yellowstone Ridge on the west side of Beaver Creek, with a similar transect located near Moneta. Although these transects were established to monitor big game winter range conditions, they are located in areas containing habitats suitable for sage-grouse and future transects may be established to monitor conditions in other key sage-grouse habitats.

Fifty Wyoming big sagebrush (*Artemisia tridentata wyomingensis*) plants were tagged along each transect. In fall, 10 measurements of current annual leader growth were recorded randomly on each tagged plant. An assessment of age and hedge class was also recorded for each plant. In 2006, current annual leader growth averaged 10.2 mm (0.40”) at the Moneta transect and 6.2 mm (0.22”) at the Yellowstone Ridge transect. Sagebrush leader production was 61% and 53% lower in 2006 than in 2004 at Moneta and Yellowstone Ridge, respectively (Figure 7).

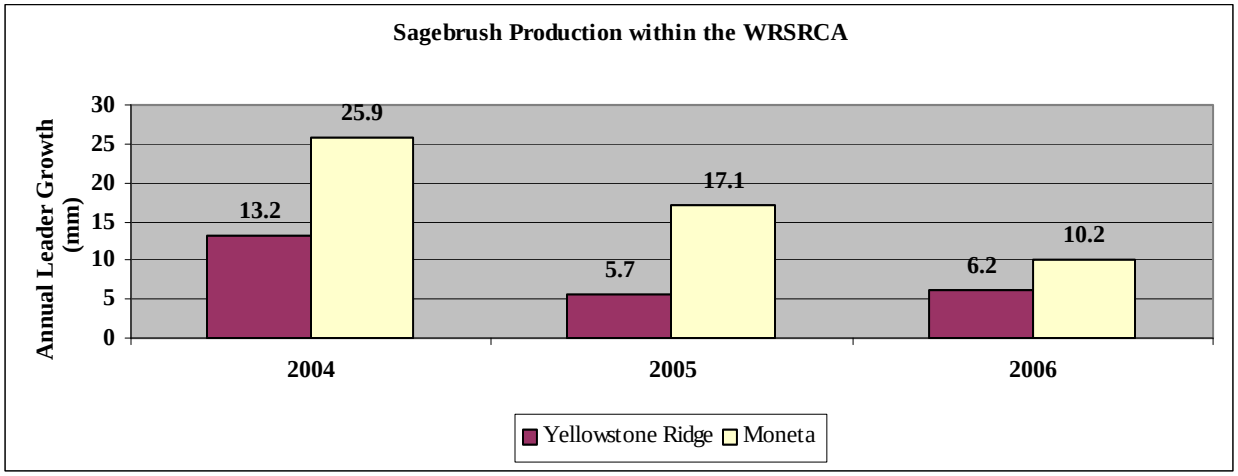

Figure 7. Sagebrush production at Yellowstone Ridge and Moneta transects 2004 – 2006. Source WGFD.

Range monitoring for big game winter ranges on WRR in 2005 indicated range production and condition was similar to 2004 and vastly improved from previous drought years. In fact, average grass, sedge, forb and fringed sage production in 2005 was 448% higher than in 2002 at the same monitoring sites. According to the Modified Palmer Drought Severity Index, a measure of the degree of long-term wetness or drought, the Wind River Basin experienced 3 consecutive years of “severe” or "extreme" drought between 2000 and 2002, followed by “mild” drought in 2003, and mild to no drought in 2004 or 2005. Consequently, forage production was adversely affected in the past, especially in the Owl Creek Mountains. A near lack of precipitation in summer 2006 resulted in a poor forage growth and production. While these sites were monitored with respect to big game winter forage, the results indicated diminished herbaceous cover likely provided poor sage-grouse nesting habitat.

The BLM has established various types of long-term upland and riparian habitat monitoring studies on public lands within the WRSRCA. Information collected is used to monitor vegetative changes in important wildlife habitats. There are over 200 Condition and Trend transects, which are typically read every 5 years, and are used to ascertain changes in plant species composition, plant diversity, ground cover and vegetative production on rangelands. Sagebrush canopy cover is monitored on 75+ permanent browse transects located in key wildlife habitats. In addition, cross-section transects, greenline, and permanent photo-points are used to monitor important riparian systems. Although the data obtained from these site-specific monitoring sites are not conducive to trend generalizations, it does indicate that drought has affected herbaceous and browse production.

Habitat Inventory

An extensive habitat mapping project was recently completed in southwestern portions of the WRSRCA to delineate and evaluate crucial winter and yearlong ranges associated with the South Wind River Mule Deer Herd Unit. Maps delineating specific browse communities including, sagebrush/bitterbrush (*Purshia tridentata*), silver sagebrush (*Artemisia cana*), three tip sagebrush (*Artemisia tripartita*), and mixed stands that include skunkbush sumac (*Rhus aromatica*), chokecherry (*Prunus virginiana*), snowberry (*Symphoricarpos albus*), etc. have been completed by hand, with a contractor hired to digitize these maps into GIS layers. In total, nearly 170,000 acres of habitats were mapped, with more than 200 sites identified for potential habitat improvement projects. Much of the habitat contained in this project also supports sage-grouse, and projects improving sagebrush health should provide better habitat conditions for sage-grouse.

WGFD partnered with The Nature Conservancy in acquiring a conservation easement on the 16,000 acre (4,970 acres deeded) Twin Creek Ranch in 2005. Owners of the Twin Creek Ranch place a high value on sage-grouse and their livestock management utilizes a rest-rotation system that favors sage-grouse habitat.

WGFD is nearing completion of transactions with several property owners northwest of Lander to acquire conservation easements that would prevent fragmentation of wildlife habitat on approximately 3,300 acres of deeded land. In addition to these conservation easements, the landowners have a strong desire to implement habitat improvement projects for the enhancement of wildlife on these properties.

Knowledge of sage-grouse habitat use is limited throughout much of the WRSRCA outside the Lander - South Hudson focus area. As such, inventory and mapping of sagebrush and associated sage-grouse habitat should be a priority for the Wind River/Sweetwater River Local Working Group in ongoing planning efforts. Winter habitat use should also be documented when conditions and budgets allow.

In late-2005, a questionnaire was mailed to over 260 landowners within the WRSRCA in an effort to obtain additional information from private lands and associated public land permit areas. This information may provide insight and focus toward which future habitat mapping, inventory, monitoring and treatments may be targeted. A summary of the responses to this questionnaire will be reported in the 2007-08 completion report.

Government Draw Habitat Improvement Project

Phase I of the Government Draw Habitat Improvement Project was completed in February 2006. The project area provides sage-grouse wintering, breeding, nesting, and early brood-rearing habitat south of Hudson, Wyoming. The area has experienced season-long cattle grazing since the early 1900s in conjunction with a long-term lack of disturbance. This has resulted in older age-class sagebrush stands with little regeneration and limited herbaceous understory. Recent sage-grouse studies indicate that hens with their chicks leave shortly after hatching to migrate to higher elevation habitats having greater vegetation diversity. Chick mortality can be high as these young birds must navigate across a highway and travel 20+ miles to reach preferred habitats. Increasing herbaceous plant abundance, species diversity, and the overall nutrient quality of the vegetation community may encourage birds to remain longer on their nesting and early brood-rearing habitats. Larger chicks would be better able to make the arduous trip and the end result should be increased chick survival.

Goals:

1. Improve sage-grouse nesting and early brood-rearing habitat.
2. Lengthen time spent by sage-grouse in nesting and early brood-rearing habitats.
3. Increase chick survival.
4. Utilize knowledge gained for additional treatments throughout the Lander – South Hudson focus area.

Objectives:

1. Increase forb density and diversity within treated areas.
2. Increase sage-brush recruitment and age-class diversity within treated areas.
3. Increase perennial grass plant density and diversity within treated areas.
4. Create a mosaic of vegetation communities.

The project entailed conducting different vegetation treatment methods on sagebrush/grass rangeland to determine each method's effectiveness in improving sage-grouse habitat. Prescribed fire was planned for a part of the project area having deep soils covered predominantly by Basin big sagebrush (*Artemisia tridentata tridentata*). Due to poor herbaceous cover (fine fuels) and limited time of opportunity, burning

was not successful in 2006, and will be delayed until prescribed burning conditions are met and grazing deferment may be achieved. Timing of the treatment would take into consideration grass, forb, and sagebrush recruitment goals and prevention of cheatgrass (*Bromus tectorum*) establishment and/or expansion. Mechanical treatments were employed and included using a mower on nearly 400 acres and Lawson pasture aerator on about 70 acres on sites with shallow soils and covered by Wyoming big sagebrush. Treated zones consisted of irregular mosaic patterns, alternating with a mosaic of untreated zones. Approximately 25% of the initial mechanical unit area was treated. Treatment areas were deferred from livestock grazing for the first growing season. Initial monitoring indicated a 3 to 4-fold increase in hawksbeard *(Crepis spp.)*, a forb utilized by sage-grouse, in the aerated treatment zone. Sagebrush cover was reduced by 60-80% in most of the treated sites. However, stems remaining after treatment indicate a rapid response to the removal of surrounding sagebrush. Some stems produced as much as 4 inches of new leader growth in the first year following treatment, even during one of the driest summers on record for the Lander area. Several sagebrush plants in the treatment zones produced seed stalks, which were not observed in virtually any of the untreated sites.

Phase II was completed in February 2007, with 860 acres mowed inside a 7,000 acre project boundary. Potential exists for expansion for several additional years, pending results of Phases I and II. There are several thousand acres of important sage-grouse habitat within the South Hudson area that could benefit from vegetation manipulation treatments. Results of this project can be used to determine additional treatment areas and treatment methods in the South Hudson area, in other sage-grouse habitat within the BLM's Lander Field Office, and elsewhere in Wyoming. The project should also improve forage conditions for pronghorn and mule deer, which utilize the area yearlong. Livestock are expected to benefit from an increase in herbaceous vegetation.

Special Studies

South Hudson Coal Bed Methane Study

The South Hudson Coal Bed Methane Study ended early-summer 2003. In response to a proposal to drill for coalbed natural gas (CBNG) within core sage-grouse habitat south of Hudson, WGFD and BLM embarked on a telemetry study. To gather pre-disturbance data, 6 males and 16 females were trapped from 4 leks near the proposed wells in spring 2001, and an additional 17 birds were trapped in spring 2002. These birds were equipped with radio transmitters and monitored until 2003. Although the CBNG test wells proved to be infeasible for commercial field development, the results of the telemetry study provided some valuable insight regarding sage-grouse habitat use in this area. Prior to this study, it was known that sage-grouse left the study area in June each year, but direction and distance of the emigration was unknown. The results of this study found that birds that nested in the Government Draw area south of Hudson moved south and southwest up to 65 air miles from the leks where captured. The findings of this study provided baseline data and information that was incorporated into the study design of future research conducted by Jarren Kuipers and Brian Jensen in cooperation with the University of Wyoming Cooperative Fishery and Wildlife Research Unit from 2003 through 2006. Complete results for this project were published in the Wyoming Game and Fish Department's 2002 Lander Region upland game completion report. (Ryder, WGFD 2003).

McGraw Flats/South Pass Cattle Grazing Study by Jarren Kuipers

University of Wyoming Graduate Student Jarren Kuipers finished his Master of Science Thesis in Spring 2004 detailing results of field research conducted in the McGraw Flats/South Pass study area. The purpose of this research was to A.) Provide scientifically credible data that would assist wildlife and land management agencies and private land owners in ascertaining the impacts grazing has on sage-grouse population sustainability, and B.) Determine livestock grazing practices that will lead to overall sagebrush steppe ecosystem health and thus provide sage-grouse habitat conducive to sustainable populations. A copy of this thesis is available for review at the University of Wyoming's Science Library and in the Wyoming Game and Fish Department's Lander Regional Office. (Kuipers 2004)

Migration, Transition Range And Landscape Use By Greater Sage-Grouse by Brian Jensen

University of Wyoming Graduate Student Brian Jensen began field operations for a new Master of Science study during Spring 2004 and published his thesis in May 2006. His study attempted to identify important facets of late brood-rearing habitat in western portions of Management Area 8. Data collected during Jarren Kuipers' research and the South Hudson Coal Bed Methane Study provided a starting point for habitat measurements and was supplemented by radio telemetry data collected during this new project. A copy of this thesis is available for review at the University of Wyoming's Science Library and in the Wyoming Game and Fish Department's Lander Regional Office. (Jensen 2006)

Examining the effects of noise from energy exploration and development on the breeding biology of the greater sage-grouse by University of California – Davis

A multi-year, multi-location study began in February 2006 to study the effects of noise produced by energy development on sage-grouse. The study area included the Government Draw area south of Hudson as a principal location for the research on introduced noise, combined with an area south of Pinedale where researchers are collecting measurements of noise actually produced by natural gas field energy development. Project goals and objectives follow and a progress report is provided in Appendix H.

Goals:

1. To determine whether noise from energy development impacts reproduction in sage-grouse
2. Ultimately, to develop a model that managers can use to evaluate means of mitigating any impact.

Objectives:

1. Measurement of noise production and propagation in the sagebrush habitat:
2. Measurement of sounds produced by energy development
3. Long-term measurement of noise at leks
4. Measurement of sounds produced by grouse and grouse leks
5. Measurement of the propagation of sound through the environment
6. Experiment to test the effects of noise on grouse behaviors

Sage-grouse movements and survival study on the Wind River Reservation

The Wind River Reservation initiated a radio telemetry study in 2006 to provide baseline information on movements, seasonal ranges, and survival that will assist in managing the sage-grouse population at sustainable levels. In April 2006, 31 sage-grouse were captured from 3 different leks and equipped with radio transmitter necklaces to facilitate telemetry tracking. Telemetry data so far has provided insightful movement data, documented nesting attempt and nest success rates, and mortality rates.

Diseases

In 2006, Fremont County experienced dozens of cases of West Nile Virus in humans and horses, and 3 radio collared sage-grouse possibly died from WNV on the Wind River Reservation, but confirmation was not possible.

Management Recommendations

1. Implement the Wind River/Sweetwater River Local Sage-Grouse Conservation Plan and work with land management agencies to incorporate recommended management practices.

2. Continue to collect summer brood data in conjunction with other duties.

3. Continue to collect age and sex composition of the harvest via wing collection and analyses.

4. Continue intensive lek counts in the Government Draw area south of Hudson.

5. Continue ground checks of all non-intensively monitored leks.

6. Document winter habitat use when conditions and budgets allow.

7. Continue to cooperate with private landowners and Federal/state land managers to reduce negative impacts to crucial sage-grouse habitats.

8. Inventory and map sagebrush and other associated sage-grouse habitats across the Wind River/Sweetwater River Local Conservation Area as time and funding allow.

9. Conduct a thorough review of all lek complexes to determine appropriate designations following current definitions.

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Appendix A. Sage-grouse lek characteristics within the WRSRCA, 2007.

Category	Number of Leks	Percent of Category	Category	Number of Leks	Percent of Category
WGFD Region			**Working Group**		
Lander	215	100	Wind River/Sweetwater River	215	100
Classification			**BLM Office**		
Occupied	209	97.2	Casper	9	4.2
Unoccupied	6	2.8	Lander	196	91.2
			Rock Springs	7	3.3
			Worland	3	1.4
Unoccupied Leks					
Abandoned	6				
			Game Warden District		
Biologist District			East Rawlins	3	1.4
Wind River Reservation	61	28.4	Lander	53	24.7
North Lander	62	28.8	North Riverton	23	10.7
South Lander	92	42.8	South Riverton	68	31.6
			West Rawlins	9	4.2
County			**Land Status**		
Carbon	1	0.5	Bureau of Land Management	113	52.6
Fremont	192	89.3	Bureau of Reclamation	5	2.3
Hot Springs	6	2.8	Private	25	11.6
Natrona	15	7.0	Wind River Reservation	61	28.4
Sweetwater	1	0.5	State	11	5.1
Upland Bird Management Area					
18	55	25.6			
8	99	46.0			
WR	61	28.4			

Appendix B. Lek attendance summary of occupied leks in the WRSRCA, 1995 – 2007.

a. Leks Counted

Year	Known	Counted	Percent Counted	Max Totals Males	Max Totals Females	Avg./Active Lek Males	Avg./Active Lek Females
1995	141	26	18.4	326	75	12.5	2.9
1996	144	21	14.6	253	82	12.0	3.9
1997	148	25	16.9	527	291	21.1	11.6
1998	152	25	16.4	652	101	26.1	4.0
1999	162	28	17.3	934	323	33.4	11.5
2000	170	27	15.9	1179	511	43.7	18.9
2001	178	33	18.5	1173	570	35.5	17.3
2002	184	33	17.9	922	310	27.9	9.4
2003	186	37	19.9	1271	438	34.4	11.8
2004	191	40	20.9	1300	545	32.5	13.6
2005	200	41	20.5	2229	613	54.4	15.0
2006	206	65	31.6	4179	1392	64.3	21.4
2007	209	75	35.9	4683	982	62.4	13.1

b. Leks Surveyed

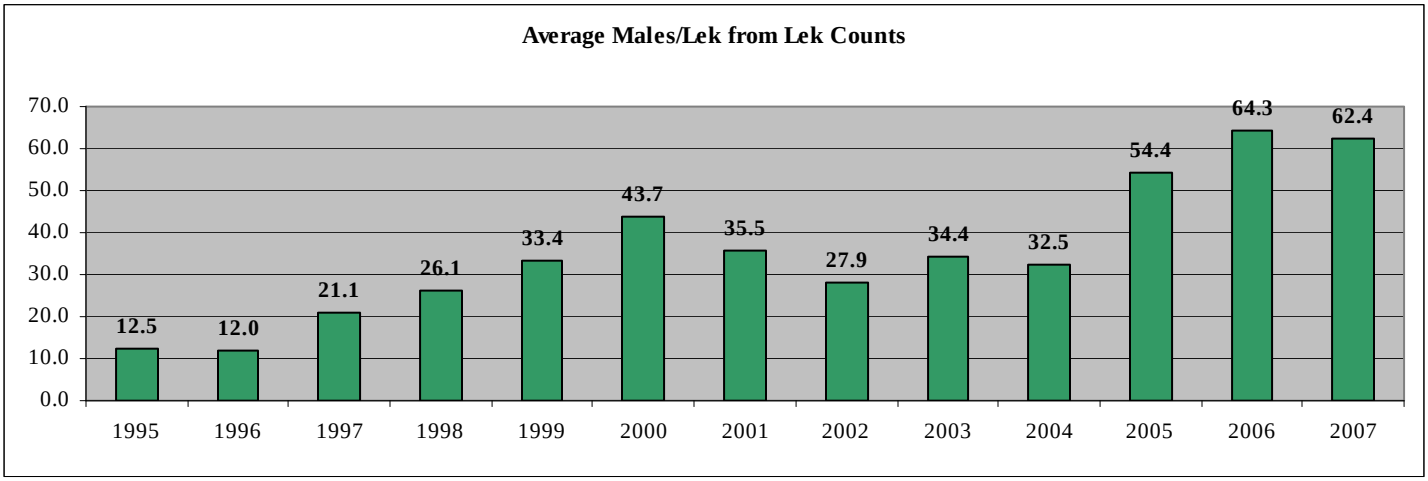
Year	Known	Surveyed	Percent Surveyed	Max Total Males	Avg Males/ Active Lek
1995	141	97	68.8	587	12.2
1996	144	87	60.4	504	11.0
1997	148	96	64.9	816	19.9
1998	152	108	71.1	1166	20.5
1999	162	111	68.5	1466	25.3
2000	170	121	71.2	2238	33.4
2001	178	118	66.3	2009	29.5
2002	184	138	75.0	1738	22.3
2003	186	137	73.7	1997	27.0
2004	191	138	72.3	2691	32.4
2005	200	142	71.0	4438	49.3
2006	206	105	51.0	3949	58.9
2007	209	111	53.1	2548	39.2

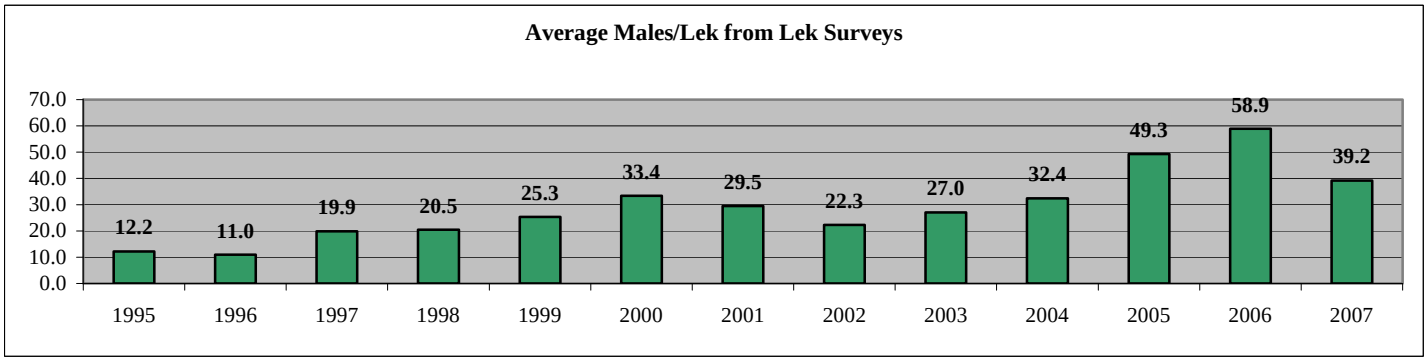
c. Leks Checked

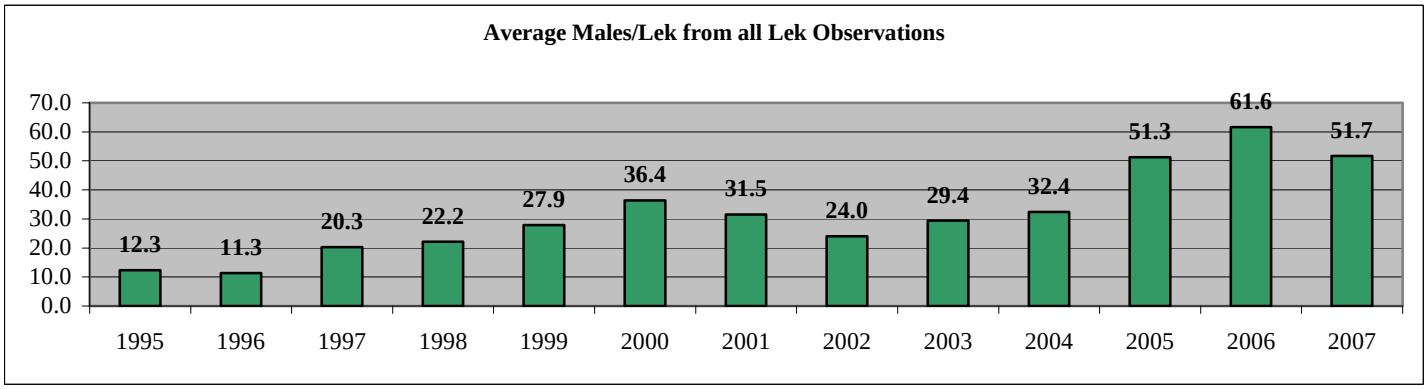
Year	Known	Checked	Percent Checked	Max Total Males	Avg Males/ Active Lek
1995	141	123	87.2	913	12.3
1996	144	108	75.0	757	11.3
1997	148	121	81.8	1343	20.3
1998	152	133	87.5	1818	22.2
1999	162	139	85.8	2400	27.9
2000	170	148	87.1	3417	36.4
2001	178	151	84.8	3182	31.5
2002	184	171	92.9	2660	24.0
2003	186	174	93.5	3268	29.4
2004	191	178	93.2	3991	32.4
2005	200	182	91.0	6667	51.3
2006	206	170	82.5	8128	61.6
2007	209	186	89.0	7231	51.7

d. Lek Status

Year	Active	Inactive	Not Located	Unknown	Total	Confirmed Status Active	Confirmed Status Inactive
1995	69	6	0	66	75	92.0%	8.0%
1996	66	4	0	74	70	94.3%	5.7%
1997	63	4	0	81	67	94.0%	6.0%
1998	77	6	0	69	83	92.8%	7.2%
1999	80	6	0	76	86	93.0%	7.0%
2000	100	3	0	67	103	97.1%	2.9%
2001	98	6	0	74	104	94.2%	5.8%
2002	107	6	0	71	113	94.7%	5.3%
2003	108	5	0	73	113	95.6%	4.4%
2004	113	11	0	67	124	91.1%	8.9%
2005	125	7	0	68	132	94.7%	5.3%
2006	124	11	0	71	135	91.9%	8.1%
2007	133	8	1	67	141	94.3%	5.7%







Appendix C. Lek complex attendance summary of occupied leks in the WRSRCA, 1995 – 2007.

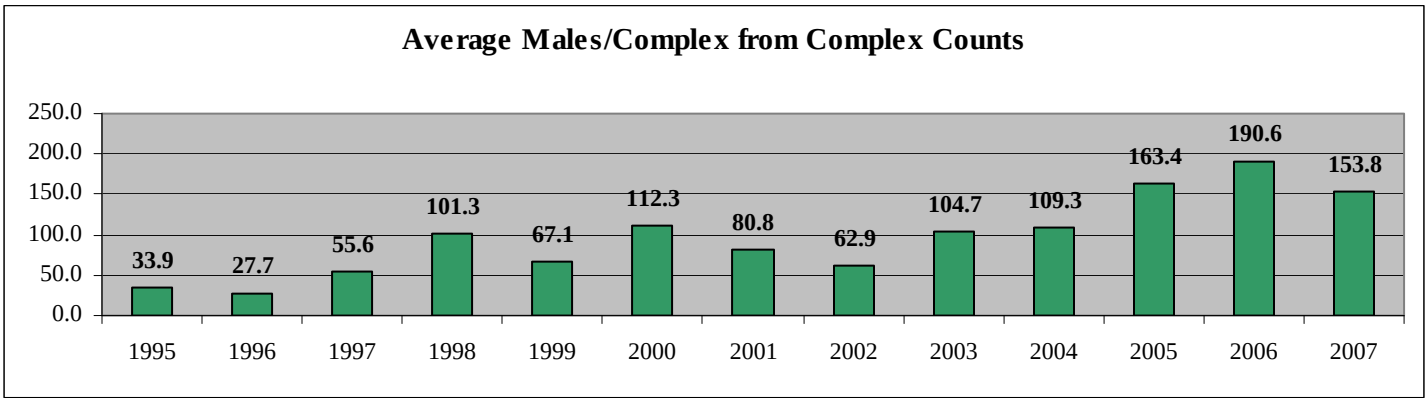
a. Lek Complexes Counted	Year	Number of Complexes	Maximum Totals Males	Maximum Totals Females	Avg./Active Complex Males	Avg./Active Complex Females	Number of Leks
	1995	7	237	56	33.9	8.0	34
	1996	6	166	66	27.7	11.0	25
	1997	9	500	240	55.6	26.7	46
	1998	8	810	78	101.3	9.8	40
	1999	9	604	233	67.1	25.9	44
	2000	8	898	343	112.3	42.9	36
	2001	11	889	452	80.8	41.1	41
	2002	11	692	250	62.9	22.7	55
	2003	12	1256	403	104.7	33.6	57
	2004	12	1311	477	109.3	39.8	57
	2005	13	2124	538	163.4	41.4	70
	2006	22	4194	1143	190.6	52.0	83
	2007	25	3846	611	153.8	24.4	84

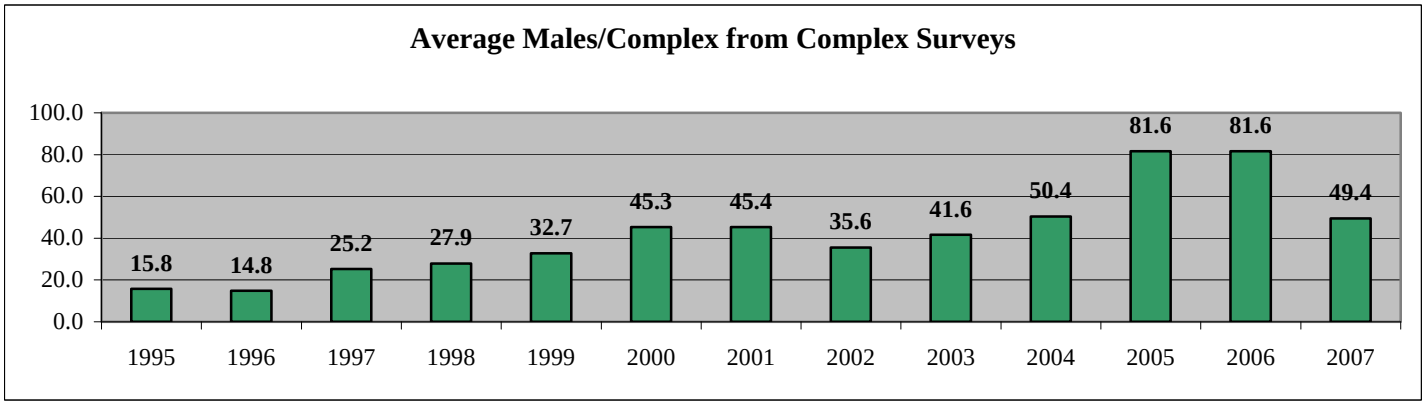
b. Lek Complexes Surveyed	Year	Number Complexes	Max. Total Males	Avg. Males/ Active Complex	Number of Leks
	1995	53	458	15.8	100
	1996	53	489	14.8	107
	1997	50	656	25.2	91
	1998	56	1032	27.9	106
	1999	54	1306	32.7	107
	2000	59	1765	45.3	129
	2001	55	1724	45.4	130
	2002	57	1568	35.6	125
	2003	57	1621	41.6	124
	2004	61	2268	50.4	133
	2005	57	3346	81.6	124
	2006	44	2449	81.6	99
	2007	39	1434	49.4	63

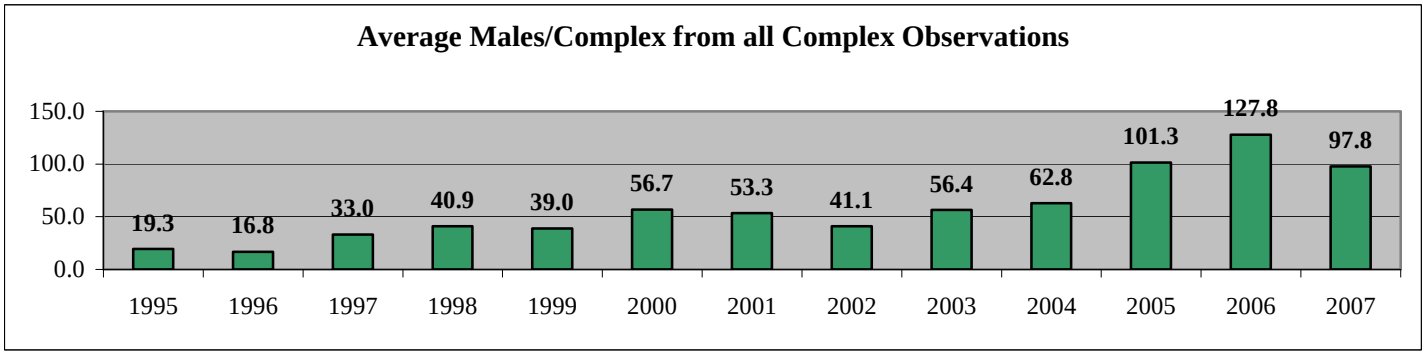
c. Lek Complexes Checked	Year	Number Complexes	Max. Total Males	Avg. Males/ Active Complex	Number of Leks
	1995	60	695	19.3	134
	1996	59	655	16.8	132
	1997	59	1156	33.0	137
	1998	64	1842	40.9	146
	1999	63	1910	39.0	151
	2000	67	2663	56.7	165
	2001	66	2613	53.3	171
	2002	68	2260	41.1	180
	2003	69	2877	56.4	181
	2004	73	3579	62.8	190
	2005	70	5470	101.3	194
	2006	66	6643	127.8	182
	2007	64	5280	97.8	147

d. Lek Complex Status

	Number of Occupied Complexes				Known Status		
Year	Active	Inactive	Unknown	Total	Total	%Active	%Inactive
1995	36	0	32	68	36	100.0	0.0
1996	39	1	29	69	40	97.5	2.5
1997	34	1	35	70	35	97.1	2.9
1998	44	1	25	70	45	97.8	2.2
1999	48	1	22	71	49	98.0	2.0
2000	53	0	20	73	53	100.0	0.0
2001	50	0	24	74	50	100.0	0.0
2002	55	0	20	75	55	100.0	0.0
2003	54	0	21	75	54	100.0	0.0
2004	57	1	19	77	58	98.3	1.7
2005	54	0	23	77	54	100.0	0.0
2006	52	0	28	80	52	100.0	0.0
2007	56	0	28	84	56	100.0	0.0







Appendix D. Sage-grouse Wing Analysis for the WRSRCA, Harvest Year 2006.

Adult Males:	95	**Percent of All Wings:**	26.0%
Adult Females:	93	**Percent of All Wings:**	25.4%
Adult Unknown:	0	**Percent of All Wings:**	0.0%
Total Adults:	188		
Yearling Males:	17	**Percent of All Wings:**	4.6%
Yearling Females:	17	**Percent of All Wings:**	4.6%
Yearling Unknown:	0	**Percent of All Wings:**	0.0%
Total Yearlings:	34		
Chick Males:	49	**Percent of All Wings:**	13.4%
Chick Females:	95	**Percent of All Wings:**	26.0%
Chick Unknown:	0	**Percent of All Wings:**	0.0%
Total Chicks:	144		
Unknown Sex/Age	0	**Percent of All Wings:**	0.0%
Total for all Sex/Age Groups:	366		

Chick Males:	49	**Percent of All Chicks:**	34.0%
Yearling Males:	17	**Percent of Adult and Yearling Males:**	15.2%
Adult Males:	95	**Percent of Adult and Yearling Males:**	84.8%
Adult and Yearling Males:	112	**Percent of Adults and Yearlings:**	50.5%
Total Males:	161	**Percent of All Sex/Age Groups:**	44.0%
Chick	95	**Percent of All Chicks:**	66.0%
Yearling	17	**Percent of Adult and Yearling Females:**	15.5%
Adult Females:	93	**Percent of Adult and Yearling Females:**	84.5%
Adult and Yearling	110	**Percent of Adults and Yearlings:**	49.5%
Total Females:	205	**Percent of All Sex/Age Groups:**	56.0%

Chicks:	144	**Percent of All Wings:**	39.3%
Yearlings:	34	**Percent of All Wings:**	9.3%
Adults:	188	**Percent of All Wings:**	51.4%
Chicks/Hen:	**1.3**		

Appendix E. Sage-grouse hunting seasons, harvest, and wing analyses, 1995-2006.

a. Season

Year	Season Dates	Length	Bag/Possession Limit
1995	Sep 16-Sep 30	15	3/6
1996	Sep 21-Oct 4	14	3/6
1997	Sep 20-Oct 5	16	3/6
1998	Sep 19-Oct 4	16	3/6
1999	Sep 18-Oct 3	16	3/6
2000	Sep 16-Oct 1	16	3/6
2001	Sep 22-Oct 7	16	3/6
2002	Sep 28-Oct 6	9	2/4
2003	Sep 27-Oct 5	9	2/4
2004	Sept 23-Oct 3	11	2/4
2005	Sept 23-Oct 3	11	2/4
2006	Sept 23-Oct 3	11	2/4

b. Harvest data

Year	Harvest	Hunters	Days	Birds/ Day	Birds/ Hunter	Days/ Hunter
1995	1,205	647	1,757	0.7	1.9	2.7
1996	1,079	514	1,005	1.1	2.1	2.0
1997	1,166	643	1,505	0.8	1.8	2.3
1998	1,883	655	1,962	1.0	2.9	3.0
1999	2,416	748	2,186	1.1	3.2	2.9
2000	2,380	1,067	2,154	1.1	2.2	2.0
2001	1,765	670	1,746	1.0	2.6	2.6
2002	733	370	648	1.1	2.0	1.8
2003	669	307	617	1.1	2.2	2.0
2004	1,398	572	1,444	1.0	2.4	2.5
2005	2,994	930	2,080	1.4	3.2	2.2
2006	1,710	558	1,183	1.4	3.1	2.1
Avg.	1,617	640	1,524	1.1	2.5	2.3

c. Composition of harvest by wings collected.

	Sample	Percent Adult		Percent Ylg		Percent Young		Chicks/Hen
Year	Size	Male	Female	Male	Female	Male	Female	
1995	151	13.9	17.2	4.0	9.9	25.8	29.1	2.0
1996	324	6.5	15.4	6.2	8.6	21.9	41.4	2.6
1997	114	2.6	21.9	0.9	3.5	31.6	39.5	2.8
1998	248	6.0	19.8	6.0	6.0	24.2	37.9	2.4
1999	547	5.5	18.3	4.8	10.4	26.0	35.1	2.1
2000	595	12.1	22.2	7.4	15.6	16.8	25.9	1.1
2001	467	7.9	20.8	2.4	6.2	22.7	40.0	2.3
2002	227	10.6	30.0	0.9	8.8	21.1	28.6	1.3
2003	236	11.9	26.3	0.0	4.7	23.7	33.5	1.8
2004	369	11.9	12.5	0.0	2.2	35.8	37.7	5.0
2005	633	13.6	22.7	5.1	7.1	21.0	30.5	1.7
2006	366	26.0	25.4	4.6	4.6	13.4	26.0	1.3

Appendix F. Sage-grouse lek observations by lek complex in the WRSRCA, 2007.

Upland Game Bird Management Area 18

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex 9 Mile									
9 Mile North	3	22	0800	Active	2	0		Greg Anderson	Ground
9 Mile South	3	22	0810	Active	26	9		Greg Anderson	Ground
Complex Alkali Creek									
Alkali Creek North	3	19	0745	Active	44	5		Greg Anderson	Ground
Alkali Creek North	5	4	0630	Active	0	0	50	Casper BLM	Air
Alkali Creek South	3	19	0805	Active	37	0		Greg Anderson	Ground
Complex Arrowhead									
Arrowhead - West	2	14	0829	Active	28	0		UC-Davis	Ground
Arrowhead - West	2	23	0715	Active	33	0		UC-Davis	Ground
Arrowhead - West	3	7	0741	Active	3	0		UC-Davis	Ground
Arrowhead - West	3	10	0630	Active	48	1		UC-Davis	Ground
Arrowhead - West	3	13	0823	Active	10	0		UC-Davis	Ground
Arrowhead - West	3	15	0725	Active	45	0		UC-Davis	Ground
Arrowhead - West	3	18	0817	Active	43	1		UC-Davis	Ground
Arrowhead - West	3	21	0725	Active	35	3		UC-Davis	Ground
Arrowhead - West	3	23	0714	Active	47	8		UC-Davis	Ground
Arrowhead - West	3	26	0802	Active	42	4		UC-Davis	Ground
Arrowhead - West	3	28	0720	Active	26	0		UC-Davis	Ground
Arrowhead - West	4	1	0715	Active	37	6		UC-Davis	Ground
Arrowhead - West	4	4	0802	Active	26	0		UC-Davis	Ground
Arrowhead - West	4	6	0705	Active	38	1		UC-Davis	Ground
Arrowhead - West	4	9	0750	Active	0	0		UC-Davis	Ground
Arrowhead - West	4	12	0642	Active	47	0		UC-Davis	Ground
Arrowhead - West	4	15	0740	Active	46	2		UC-Davis	Ground
Arrowhead - West	4	17	0800	Active	38	0		UC-Davis	Ground
Arrowhead - West	4	18	0618	Active	42	1		UC-Davis	Ground
Arrowhead - West	4	22	0720	Active	41	0		UC-Davis	Ground
Arrowhead - West	4	25	0636	Active	47	0		UC-Davis	Ground
Arrowhead - West	4	29	0720	Active	25	0		UC-Davis	Ground
Arrowhead - West	4	30	0613	Active	24	0		UC-Davis	Ground
Complex Badwater									
Badwater Ranch - North	4	19	0655	Active	67	6		Greg Anderson	Ground
Badwater Ranch - South	4	19	0635	Unknown	0	0		Greg Anderson	Ground
Cedar Gap	4	19	0630	Active	7	0		Greg Anderson	Ground
Complex Badwater Canyon									
Badwater Canyon	4	19	0730	Active	28	7		Greg Anderson	Ground
Complex Bass Lake Road									
Bass Lake Road	4	12		Unknown	0	0		Brad Gibb	Ground
Bass Lake Road	4	20		Unknown	0	0		Brad Gibb	Ground
Complex Big Flat									
Big Flat	4	12		Unknown	0	0		Brad Gibb	Ground
Big Flat	4	20		Unknown	0	0		Brad Gibb	Ground
Complex Black Rocks									
Black Rocks	3	20	0700	Active	36	5		Greg Anderson	Ground
Complex Bridger Trail									
Bridger Trail	4	10	0740	Active	43	19		Greg Anderson	Ground
Complex Bushwacker - East									
Bushwacker - East	4	12		Unknown	0	0		Brad Gibb	Ground
Bushwacker - East	4	20		Unknown	0	0		Brad Gibb	Ground
Complex Bushwacker - West									
Bushwacker - West	4	12		Unknown	0	0		Brad Gibb	Ground
Bushwacker - West	4	20		Unknown	0	0		Brad Gibb	Ground
Complex Canyon Creek									
Canyon Creek - Ranch South	3	20	0743	Active	13	0		Greg Anderson	Ground
Canyon Creek - Red Hill	3	20	0803	Active	43	8		Greg Anderson	Ground
Canyon Creek - Stock	3	20	0755	Unknown	0	0		Greg Anderson	Ground
Canyon Creek - Well	3	20	0750	Active	3	0		Greg Anderson	Ground
Complex Canyon Creek - Ranch									
Canyon Creek - Ranch	3	20	0725	Unknown	0	0		Greg Anderson	Ground

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex Chalk Hills									
Chalk Hills	3	22	0750	Unknown	0	0		Greg Anderson	Ground
Complex Coal Bank Hills									
Coal Bank Hills	5	10	0730	Active	0	0	15	Casper BLM	Air
Complex Conant Creek									
Conant Creek - North	2	26	0750	Active	0	0		UC-Davis	Ground
Conant Creek - North	3	3	0800	Active	0	0		UC-Davis	Ground
Conant Creek - North	3	5	0640	Active	31	0		UC-Davis	Ground
Conant Creek - North	3	10	0700	Active	30	0		UC-Davis	Ground
Conant Creek - North	3	12	0725	Active	30	0		UC-Davis	Ground
Conant Creek - North	3	15	0835	Active	32	4		UC-Davis	Ground
Conant Creek - North	3	18	0720	Active	13	0		UC-Davis	Ground
Conant Creek - North	3	22	0745	Active	34	0		UC-Davis	Ground
Conant Creek - North	3	24	0725	Active	28	8		UC-Davis	Ground
Conant Creek - North	3	27	0805	Active	5	0		UC-Davis	Ground
Conant Creek - North	4	2	0820	Active	3	0		UC-Davis	Ground
Conant Creek - North	4	3	0650	Active	6	0		UC-Davis	Ground
Conant Creek - North	4	6	0711	Active	29	2		UC-Davis	Ground
Conant Creek - North	4	9	0736	Active	10	0		UC-Davis	Ground
Conant Creek - North	4	12	0645	Active	29	0		UC-Davis	Ground
Conant Creek - North	4	15	0735	Active	28	0		UC-Davis	Ground
Conant Creek - North	4	18	0641	Active	29	1		UC-Davis	Ground
Conant Creek - North	4	22	0659	Active	29	1		UC-Davis	Ground
Conant Creek - North	4	24	0654	Active	26	0		UC-Davis	Ground
Conant Creek - North	4	29	0736	Active	9	0		UC-Davis	Ground
Complex Davison Road									
Davison Road - 7 Mile	3	23	0700	Active	4	1		Greg Anderson	Ground
Complex Davison Road - 12 Mile									
Davison Road - East 12 Mile	3	23	0750	Active	4	0		Greg Anderson	Ground
Davison Road - South 12 Mile	3	23	0733	Unknown	0	0		Greg Anderson	Ground
Falcon Nest	3	23	0815	Active	44	9		Greg Anderson	Ground
Complex Davison Road - 8 Mile									
Davison Road - 8 Mile	3	23	0720	Active	21	7		Greg Anderson	Ground
Complex Fuller Airstrip									
Fuller Airstrip	4	10	0650	Active	26	5		Greg Anderson	Ground
Complex Jackpot									
Jackpot	4	10		Active	23	3		Carrie Dobey	Ground
Complex Lysite Creek									
Davis Pass - North	4	26		Unknown	0	0		Greg Anderson	Ground
Davis Pass - West	4	26		Unknown	0	0		Greg Anderson	Ground
Lysite Creek - Bottom	4	26		Active	0	0	35	Greg Anderson	Ground
Lysite Creek - Hill	4	26		Unknown	0	0		Greg Anderson	Ground
Complex Maverick Butte									
Maverick Butte	4	25	0700	Active	42			Greg Anderson	Ground
Complex Nebo									
Nebo	2	21	0645	Active	17	0		UC-Davis	Ground
Nebo	2	23	0640	Active	15	0		UC-Davis	Ground
Nebo	3	3	0635	Active	10	0		UC-Davis	Ground
Nebo	3	7	0630	Active	15	0		UC-Davis	Ground
Nebo	3	10	0727	Active	24	0		UC-Davis	Ground
Nebo	3	13	0744	Active	22	0		UC-Davis	Ground
Nebo	3	15	0820	Active	14	0		UC-Davis	Ground
Nebo	3	18	0733	Active	25	0		UC-Davis	Ground
Nebo	3	20		Active	24	6		BJ Lukins	Ground
Nebo	3	21	0838	Active	26	1		UC-Davis	Ground
Nebo	3	23	0802	Active	23	2		UC-Davis	Ground
Nebo	3	26	0724	Active	28	4		UC-Davis	Ground
Nebo	3	28	0813	Active	5	0		UC-Davis	Ground
Nebo	4	1	0820	Active	26	1		UC-Davis	Ground
Nebo	4	4	0707	Active	24	0		UC-Davis	Ground
Nebo	4	6	0753	Active	16	0		UC-Davis	Ground
Nebo	4	6		Active	12	3		BJ Lukins	Ground
Nebo	4	9	0717	Active	27	0		UC-Davis	Ground
Nebo	4	12	0730	Active	33	0		UC-Davis	Ground

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Nebo	4	15	0635	Active	23	0		UC-Davis	Ground
Nebo	4	18	0714	Active	25	0		UC-Davis	Ground
Nebo	4	22	0640	Active	35	2		UC-Davis	Ground
Nebo	4	25	0733	Active	29	0		UC-Davis	Ground
Nebo	4	26		Active	31	3		BJ Lukins	Ground
Nebo	4	29	0640	Active	19	0		UC-Davis	Ground
Nebo	4	30	0656	Active	24	0		UC-Davis	Ground
Nebo	5	8		Active	0	0		BJ Lukins	Ground
Complex Pipeline									
Pipeline	2	26	0630	Active	9	0		UC-Davis	Ground
Pipeline	3	22	0700	Active	33	22		Greg Anderson	Ground
Pipeline	4	26	0650	Active	15	0		Chris Daubin	Ground
Willow Springs Draw	3	22	0730	Unknown	0	0		Greg Anderson	Ground
Complex Pit									
Pit	4	25		Active	25	0		Greg Anderson	Ground
Complex Powerline									
Powerline	2	26	0831	Active	15	0		UC-Davis	Ground
Powerline	3	5	0728	Active	29	0		UC-Davis	Ground
Powerline	3	10	0620	Active	46	2		UC-Davis	Ground
Powerline	3	12	0820	Active	43	2		UC-Davis	Ground
Powerline	3	15	0742	Active	44	4		UC-Davis	Ground
Powerline	3	18	0810	Active	42	17		UC-Davis	Ground
Powerline	3	22	0715	Active	46	31		UC-Davis	Ground
Powerline	3	24	0818	Active	60	7		UC-Davis	Ground
Powerline	3	27	0730	Active	47	1		UC-Davis	Ground
Powerline	3	31	0911	Active	24	0		UC-Davis	Ground
Powerline	4	3	0730	Active	48	1		UC-Davis	Ground
Powerline	4	6	0749	Active	38	0		UC-Davis	Ground
Powerline	4	9	0701	Active	41	0		UC-Davis	Ground
Powerline	4	12	0722	Active	49	0		UC-Davis	Ground
Powerline	4	15	0706	Active	47	2		UC-Davis	Ground
Powerline	4	18	0722	Active	34	3		UC-Davis	Ground
Powerline	4	22	0623	Active	47	3		UC-Davis	Ground
Powerline	4	24	0728	Active	38	0		UC-Davis	Ground
Powerline	4	29	0633	Active	7	0		UC-Davis	Ground
Complex Sand Creek Bench									
Sand Creek Bench	3	19	0700	Active	3	0		Greg Anderson	Ground
Complex Sand Creek Ranch									
Sand Creek Ranch	3	19	0717	Unknown	0	0		Greg Anderson	Ground
Complex South Bridger Creek									
South Bridger Creek	4	10	0700	Active	20	2		Greg Anderson	Ground
Complex Squaw Butte									
Squaw Butte East	4	6	0700	Active	89	7		Greg Anderson	Ground
Complex Stock Pond									
Stock Pond	4	12		Unknown	0	0		Brad Gibb	Ground
Stock Pond	4	20		Unknown	0	0		Brad Gibb	Ground

Upland Game Bird Management Area 8

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex Antelope Flats									
Antelope Flats	4	19	0655	Unknown	0	0		Stan Harter	Ground
Antelope Flats	4	25	0805	Active	46	0		Stan Harter	Ground
Complex Beaver Rim									
Antelope Springs	4	11	0605	Active	17	3		Tom Ryder	Ground
Antelope Springs	4	19	0630	Active	7	0		Tom Ryder	Ground
Antelope Springs	4	26	0715	Active	0	0		Tom Ryder	Ground
Antelope Springs	5	1	0540	Active	11	3		Tom Ryder	Ground
Carmody Lake	4	11	0630	Active	77	2		Tom Ryder	Ground
Carmody Lake	4	19	0647	Active	42	1		Tom Ryder	Ground
Carmody Lake	4	26	0545	Active	74	0		Tom Ryder	Ground
Carmody Lake	5	1	0630	Active	71	2		Tom Ryder	Ground
Cedar Rim Windmill	4	11	0715	Abandoned	0	0		Tom Ryder	Ground
Cedar Rim Windmill	4	19	0615	Abandoned	0	0		Tom Ryder	Ground
Cedar Rim Windmill	4	26	0615	Abandoned	0	0		Tom Ryder	Ground
Cedar Rim Windmill	5	1	0700	Abandoned	0	0		Tom Ryder	Ground
Dishpan Butte	3	23	0923	Active	8	0		Stan Harter	Ground
Dishpan Butte	4	11	0655	Active	43	2		Tom Ryder	Ground
Dishpan Butte	4	19	0705	Active	32	0		Tom Ryder	Ground
Dishpan Butte	4	26	0605	Active	46	0		Tom Ryder	Ground
Dishpan Butte	5	1	0650	Active	18	0		Tom Ryder	Ground
Government Meadows	4	11	0725	Abandoned	0	0		Tom Ryder	Ground
Government Meadows	4	19	0730	Abandoned	0	0		Tom Ryder	Ground
Government Meadows	4	26	0625	Abandoned	0	0		Tom Ryder	Ground
Government Meadows	5	1	0710	Abandoned	0	0		Tom Ryder	Ground
Government Slide Draw	3	6	0627	Active	2	0		UC-Davis	Ground
Government Slide Draw	3	8	0759	Active	22	0		UC-Davis	Ground
Government Slide Draw	3	11	0748	Active	51	5		UC-Davis	Ground
Government Slide Draw	3	16	0710	Active	56	44		UC-Davis	Ground
Government Slide Draw	3	18	0732	Active	60	7		UC-Davis	Ground
Government Slide Draw	3	19	0723	Active	66	0		UC-Davis	Ground
Government Slide Draw	3	21	0710	Active	52	0		UC-Davis	Ground
Government Slide Draw	3	24	0752	Active	54	2		UC-Davis	Ground
Government Slide Draw	3	27	0807	Active	37	6		UC-Davis	Ground
Government Slide Draw	3	28	0805	Active	2	0		UC-Davis	Ground
Government Slide Draw	4	2	0828	Active	48	1		UC-Davis	Ground
Government Slide Draw	4	5	0655	Active	46	0		UC-Davis	Ground
Government Slide Draw	4	10	0640	Active	52	0		UC-Davis	Ground
Government Slide Draw	4	14	0625	Active	56	1		UC-Davis	Ground
Government Slide Draw	4	17	0713	Active	63	1		UC-Davis	Ground
Government Slide Draw	4	21	0630	Active	53	0		UC-Davis	Ground
Government Slide Draw	4	24	0721	Active	51	0		UC-Davis	Ground
Government Slide Draw	4	27	0635	Active	44	3		UC-Davis	Ground
Complex Beulah Belle									
Beulah Belle Lake	4	7	0725	Active	14	0		Bill Brinegar	Ground
Beulah Belle Lake	4	16	0710	Active	13	0		Bill Brinegar	Ground
Beulah Belle Lake	4	26	0620	Active	42	3		Bill Brinegar	Ground
Complex Cedar Rim Pipeline									
Scarlett Ranch	3	26	0830	Active	40	5		Brian Heath	Ground
Scarlett Ranch	4	14	0650	Active	12	0		Brian Heath	Air
Scarlett Ranch	4	30	0605	Active	53	0		Brian Heath	Ground
Complex Cottonwood									
Cottonwood Divide No. 1	3	23	0730	Abandoned	0	0		Bob Trebelcock	Ground
Cottonwood Divide No. 1	3	27	0730	Abandoned	0	0		Bob Trebelcock	Ground
Cottonwood Divide No. 1	4	12	0705	Abandoned	0	0		Bob Trebelcock	Ground
Cottonwood Divide No. 1	4	25	0642	Abandoned	0	0		Bob Trebelcock	Ground
Cottonwood Divide No. 2	3	23	0720	Active	3	3		Bob Trebelcock	Ground
Cottonwood Divide No. 2	3	27	0715	Active	2	0		Bob Trebelcock	Ground
Cottonwood Divide No. 2	4	12	0715	Active	0	0		Bob Trebelcock	Ground
Cottonwood Divide No. 2	4	25	0645	Active	0	0		Bob Trebelcock	Ground

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex Cottonwood Divide									
Chubby Springs	3	23	0815	Active	44	0		Bob Trebelcock	Ground
Chubby Springs	3	27	0650	Active	51	1		Bob Trebelcock	Ground
Chubby Springs	4	12	0630	Active	56	3		Bob Trebelcock	Ground
Chubby Springs	4	25	0611	Active	48	3		Bob Trebelcock	Ground
Complex Coyote									
Coyote Lake	5	2		Active	22	0		Bob Trebelcock	Ground
Coyote Lake	5	12	0630	Active	32	1		Stan Harter	Ground
Crofts	5	2		Active	17	0		Bob Trebelcock	Ground
Crofts	5	12	0700	Active	17	0		Stan Harter	Ground
Complex Diamond Springs									
Black Rock	4	4	0745	Unknown	0	0		Travis Crane	Ground
Black Rock Draw	4	4	0730	Active	87	0		Travis Crane	Ground
Black Rock Draw	4	10	0745	Active	94	4		Travis Crane	Ground
Dry Lakes	4	4	0645	Active	87	16		Travis Crane	Ground
Dry Lakes	4	10	0700	Active	69	6		Travis Crane	Ground
Complex Dobie									
North Dobie No. 1	5	15	0620	Active	12	0		Stan Harter	Ground
Complex Dry Cheyenne									
Dry Cheyenne	4	20	0637	Active	63	0		Chris Daubin	Ground
Complex Dry Creek									
Dry Creek	4	7	0815	Unknown	0	0		Bill Brinegar	Ground
Dry Creek	4	26	0645	Unknown	0	0		Bill Brinegar	Ground
Riddle	4	26	0630	Active	9	1		Bill Brinegar	Ground
Complex East Long Creek									
East Long Creek No. 1	4	11	0655	Active	65	0		Dan Bjornlie	Ground
East Long Creek No. 1	4	22	0644	Active	57	0		Dan Bjornlie	Ground
East Long Creek No. 2	4	11	0719	Active	91	3		Dan Bjornlie	Ground
East Long Creek No. 2	4	22	0715	Active	120	4		Dan Bjornlie	Ground
East Long Creek No. 3	4	11	0750	Active	35	0		Dan Bjornlie	Ground
East Long Creek No. 3	4	22	0735	Active	43	0		Dan Bjornlie	Ground
Complex Grassy Lake									
Grassy Lake	5	2		Active	5	0		Bob Trebelcock	Ground
Complex Hall Creek									
Hall Creek 1	3	7	0741	Active	32	0		Stan Harter	Ground
Hall Creek 1	4	9	0722	Active	46	2		Stan Harter	Ground
Hall Creek 1	4	17	0719	Active	40	0		Stan Harter	Ground
Hall Creek 1	4	23	0629	Active	46	0		Stan Harter	Ground
Hall Creek 2	3	7	0751	Active	8	0		Stan Harter	Ground
Hall Creek 2	4	9	0735	Active	15	1		Stan Harter	Ground
Hall Creek 2	4	17	0731	Active	14	0		Stan Harter	Ground
Hall Creek 2	4	23	0652	Active	9	0		Stan Harter	Ground
Complex Horseshoe									
Conant Fence	2	23	0820	Active	6	0		UC-Davis	Ground
Conant Fence	3	8	0650	Active	26	0		UC-Davis	Ground
Conant Fence	3	11	0850	Active	8	0		UC-Davis	Ground
Conant Fence	3	14	0759	Active	37	6		UC-Davis	Ground
Conant Fence	3	17	0822	Active	37	11		UC-Davis	Ground
Conant Fence	3	20	0725	Active	37	20		UC-Davis	Ground
Conant Fence	3	23	0825	Active	36	0	2	UC-Davis	Ground
Conant Fence	3	25	0811	Active	37	1		UC-Davis	Ground
Conant Fence	3	27	0738	Active	19	0		UC-Davis	Ground
Conant Fence	4	3	0822	Active	20	0		UC-Davis	Ground
Conant Fence	4	5	0650	Active	35	0		UC-Davis	Ground
Conant Fence	4	8	0815	Active	7	0		UC-Davis	Ground
Conant Fence	4	10	0741	Active	34	0		UC-Davis	Ground
Conant Fence	4	11	0641	Active	39	0		UC-Davis	Ground
Conant Fence	4	14	0736	Active	35	0		UC-Davis	Ground
Conant Fence	4	17	0632	Active	29	0		UC-Davis	Ground
Conant Fence	4	20	0719	Active	35	2		Chris Daubin	Ground
Conant Fence	4	21	0757	Active	1	0		UC-Davis	Ground
Conant Fence	4	23	0747	Active	21	1		UC-Davis	Ground
Conant Fence	4	27	0629	Active	31	0		UC-Davis	Ground
Homestead Flats	2	23	0650	Active	8	0		UC-Davis	Ground

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Homestead Flats	3	4	0715	Active	20	0		UC-Davis	Ground
Homestead Flats	3	8	0810	Active	7	0		UC-Davis	Ground
Homestead Flats	3	11	0744	Active	37	0		UC-Davis	Ground
Homestead Flats	3	14	0905	Active	3	0		UC-Davis	Ground
Homestead Flats	3	17	0738	Active	39	0		UC-Davis	Ground
Homestead Flats	3	20	0843	Active	31	0		UC-Davis	Ground
Homestead Flats	3	23	0729	Active	48	10		UC-Davis	Ground
Homestead Flats	3	25	0711	Active	43	3		UC-Davis	Ground
Homestead Flats	3	27	0815	Active	4	0		UC-Davis	Ground
Homestead Flats	4	3	0728	Active	39	0		UC-Davis	Ground
Homestead Flats	4	5	0805	Active	28	0		UC-Davis	Ground
Homestead Flats	4	8	0738	Active	9	0		UC-Davis	Ground
Homestead Flats	4	10	0640	Active	32	0		UC-Davis	Ground
Homestead Flats	4	11	0739	Active	25	0		UC-Davis	Ground
Homestead Flats	4	14	0657	Active	30	0		UC-Davis	Ground
Homestead Flats	4	17	0720	Active	35	0		UC-Davis	Ground
Homestead Flats	4	21	0708	Active	4	0		UC-Davis	Ground
Homestead Flats	4	23	0656	Active	40	0		UC-Davis	Ground
Homestead Flats	4	27	0721	Active	45	0		UC-Davis	Ground
Horseshoe Playa	4	27	0627	Active	26	1		Chris Daubin	Ground
Signor Ridge	4	13	0720	Active	3	0		Greg Anderson	Ground
Signor Ridge	4	17	0630	Active	36	2		Chris Daubin	Ground
Complex Lander									
Ballenger Draw	3	13	0805	Active	40	0		UC-Davis	Ground
Ballenger Draw	3	16	0832	Active	31	1		UC-Davis	Ground
Ballenger Draw	3	19	0716	Active	47	18		UC-Davis	Ground
Ballenger Draw	3	22	0811	Active	47	4		UC-Davis	Ground
Ballenger Draw	3	25	0718	Active	52	38		UC-Davis	Ground
Ballenger Draw	4	4	0738	Active	54	3		UC-Davis	Ground
Ballenger Draw	4	7	0802	Active	51	0		UC-Davis	Ground
Ballenger Draw	4	10	0652	Active	77	0		UC-Davis	Ground
Ballenger Draw	4	13	0720	Active	76	1		UC-Davis	Ground
Ballenger Draw	4	20	0728	Active	54	0		UC-Davis	Ground
Ballenger Draw	4	23	0625	Active	55	0		UC-Davis	Ground
Ballenger Draw	4	26	0742	Active	38	0		UC-Davis	Ground
Ballenger Draw	4	29	0709	Active	43	1		UC-Davis	Ground
Ballenger Reservoir	7	3	1330	Unknown	0	0		Stan Harter	Ground
Carr Springs Draw	2	22	0809	Active	44	0		UC-Davis	Ground
Carr Springs Draw	3	1	0714	Active	4	0		UC-Davis	Ground
Carr Springs Draw	3	4	0800	Active	5	0		UC-Davis	Ground
Carr Springs Draw	3	6	0646	Active	1	0		UC-Davis	Ground
Carr Springs Draw	3	8	0745	Active	113	0		UC-Davis	Ground
Carr Springs Draw	3	9	0656	Active	98	0		UC-Davis	Ground
Carr Springs Draw	3	14	0805	Active	127	0		UC-Davis	Ground
Carr Springs Draw	3	17	0740	Active	131	11		UC-Davis	Ground
Carr Springs Draw	3	20	0750	Active	133	31		UC-Davis	Ground
Carr Springs Draw	3	23	0738	Active	127	57		UC-Davis	Ground
Carr Springs Draw	3	24	0700	Active	131	33		UC-Davis	Ground
Carr Springs Draw	3	26	0720	Active	130	73		UC-Davis	Ground
Carr Springs Draw	4	3	0807	Active	70	3		UC-Davis	Ground
Carr Springs Draw	4	6	0815	Active	96	7		UC-Davis	Ground
Carr Springs Draw	4	9	0635	Active	136	6		UC-Davis	Ground
Carr Springs Draw	4	12	0655	Active	142	3		UC-Davis	Ground
Carr Springs Draw	4	15	0648	Active	139	1		UC-Davis	Ground
Carr Springs Draw	4	17	0835	Active	65	0		UC-Davis	Ground
Carr Springs Draw	4	18	0700	Active	123	3		UC-Davis	Ground
Carr Springs Draw	4	22	0615	Active	135	2		UC-Davis	Ground
Carr Springs Draw	4	24	0640	Active	144	2		UC-Davis	Ground
Carr Springs Draw	4	28	0610	Active	125	4		UC-Davis	Ground
Carr Springs Draw	4	30	0640	Active	108	1		UC-Davis	Ground
Chugwater Reservoir	3	8	0633	Active	23	0		UC-Davis	Ground
Chugwater Reservoir	3	19	0853	Active	19	0		UC-Davis	Ground
Chugwater Reservoir	3	21	0835	Active	31	11		UC-Davis	Ground
Chugwater Reservoir	3	24	0647	Active	12	15		UC-Davis	Ground
Chugwater Reservoir	4	5	0817	Active	0	0		UC-Davis	Ground

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Chugwater Reservoir	4	10	0740	Active	35	0		UC-Davis	Ground
Chugwater Reservoir	4	14	0720	Active	0	0		UC-Davis	Ground
Chugwater Reservoir	4	17	0618	Active	42	0		UC-Davis	Ground
Chugwater Reservoir	4	21	0720	Active	17	0		UC-Davis	Ground
Chugwater Reservoir	4	24	0607	Active	34	0		UC-Davis	Ground
Chugwater Reservoir	4	27	0550	Active	27	1		UC-Davis	Ground
Coal Mine Gulch	2	22	0706	Active	19	0		UC-Davis	Ground
Coal Mine Gulch	3	4	0705	Active	45	0		UC-Davis	Ground
Coal Mine Gulch	3	7	0720	Active	0	0	61	UC-Davis	Ground
Coal Mine Gulch	3	11	0735	Active	62	0		UC-Davis	Ground
Coal Mine Gulch	3	13	0837	Active	59	0		UC-Davis	Ground
Coal Mine Gulch	3	16	0720	Active	74	0		UC-Davis	Ground
Coal Mine Gulch	3	19	0818	Active	73	11		UC-Davis	Ground
Coal Mine Gulch	3	22	0720	Active	78	11		UC-Davis	Ground
Coal Mine Gulch	3	25	0815	Active	86	5		UC-Davis	Ground
Coal Mine Gulch	3	28	0726	Active	34	0		UC-Davis	Ground
Coal Mine Gulch	4	4	0818	Active	12	1		UC-Davis	Ground
Coal Mine Gulch	4	7	0652	Active	12	0		UC-Davis	Ground
Coal Mine Gulch	4	10	0731	Active	82	0		UC-Davis	Ground
Coal Mine Gulch	4	13	0644	Active	73	0		UC-Davis	Ground
Coal Mine Gulch	4	20	0634	Active	95	2		UC-Davis	Ground
Coal Mine Gulch	4	23	0706	Active	81	0		UC-Davis	Ground
Coal Mine Gulch	4	26	0628	Active	93	0		UC-Davis	Ground
Coal Mine Gulch	4	29	0640	Active	60	0		UC-Davis	Ground
Cottontail Reservoir	3	21	0657	Active	143	4		UC-Davis	Ground
Cottontail Reservoir	3	24	0711	Active	153	0		UC-Davis	Ground
Cottontail Reservoir	3	26	0653	Active	149	20		UC-Davis	Ground
Cottontail Reservoir	4	9	0637	Active	159	0		UC-Davis	Ground
Cottontail Reservoir	4	12	0640	Active	149	0		UC-Davis	Ground
Cottontail Reservoir	4	15	0634	Active	10	0		UC-Davis	Ground
Cottontail Reservoir	4	22	0617	Active	129	3		UC-Davis	Ground
Cottontail Reservoir	4	25	0622	Active	147	5		UC-Davis	Ground
Cottontail Reservoir	4	28	0621	Active	150	2		UC-Davis	Ground
Gustin Reservoir	2	18	0815	Active	15	0		UC-Davis	Ground
Gustin Reservoir	2	22	0715	Active	10	0		UC-Davis	Ground
Gustin Reservoir	2	28	0735	Active	31	0		UC-Davis	Ground
Gustin Reservoir	3	9	0635	Active	16	0		UC-Davis	Ground
Gustin Reservoir	3	12	0745	Active	21	0		UC-Davis	Ground
Gustin Reservoir	3	13	0805	Active	17	0		UC-Davis	Ground
Gustin Reservoir	3	14	0802	Active	25	0		UC-Davis	Ground
Gustin Reservoir	3	17	0805	Active	22	6		UC-Davis	Ground
Gustin Reservoir	3	20	0721	Active	21	0		UC-Davis	Ground
Gustin Reservoir	3	23	0800	Active	21	7		UC-Davis	Ground
Gustin Reservoir	3	25	0716	Active	22	0		UC-Davis	Ground
Gustin Reservoir	3	27	0715	Active	18	4		UC-Davis	Ground
Gustin Reservoir	3	28	0650	Active	19	0		UC-Davis	Ground
Gustin Reservoir	4	1	0719	Active	22	0		UC-Davis	Ground
Gustin Reservoir	4	7	0082	Active	16	0		UC-Davis	Ground
Gustin Reservoir	4	11	0640	Active	19	0		UC-Davis	Ground
Gustin Reservoir	4	14	0750	Active	22	1		UC-Davis	Ground
Gustin Reservoir	4	15	0615	Active	18	0		UC-Davis	Ground
Gustin Reservoir	4	20	0707	Active	20	1		UC-Davis	Ground
Gustin Reservoir	4	23	0639	Active	21	0		UC-Davis	Ground
Gustin Reservoir	4	27	0807	Active	20	0		UC-Davis	Ground
Gustin Reservoir	4	30	0620	Active	22	0		UC-Davis	Ground
Lander Valley Reservoir	3	1	0820	Active	6	0		UC-Davis	Ground
Lander Valley Reservoir	3	6	0730	Active	0	0	37	UC-Davis	Ground
Lander Valley Reservoir	3	9	0640	Active	39	0		UC-Davis	Ground
Lander Valley Reservoir	3	12	0822	Active	44	1		UC-Davis	Ground
Lander Valley Reservoir	3	15	0750	Active	48	3		UC-Davis	Ground
Lander Valley Reservoir	3	18	0800	Active	48	20		UC-Davis	Ground
Lander Valley Reservoir	3	21	0815	Active	53	18		UC-Davis	Ground
Lander Valley Reservoir	3	22	0725	Active	55	38		UC-Davis	Ground
Lander Valley Reservoir	3	24	0841	Active	49	8		UC-Davis	Ground
Lander Valley Reservoir	3	26	0736	Active	45	5		UC-Davis	Ground

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Lander Valley Reservoir	4	3	0817	Active	30	0		UC-Davis	Ground
Lander Valley Reservoir	4	6	0703	Active	32	0		UC-Davis	Ground
Lander Valley Reservoir	4	9	0755	Active	28	0		UC-Davis	Ground
Lander Valley Reservoir	4	12	0720	Active	42	0		UC-Davis	Ground
Lander Valley Reservoir	4	15	0742	Active	35	0		UC-Davis	Ground
Lander Valley Reservoir	4	18	0715	Active	36	0		UC-Davis	Ground
Lander Valley Reservoir	4	22	0730	Active	0	1		UC-Davis	Ground
Lander Valley Reservoir	4	25	0652	Active	45	2		UC-Davis	Ground
Lander Valley Reservoir	4	28	0725	Active	35	0		UC-Davis	Ground
Lander Valley Reservoir	4	30	0634	Active	35	0		UC-Davis	Ground
Monument Draw	3	3	0710	Active	58	1		UC-Davis	Ground
Monument Draw	3	4	0720	Active	63	1		UC-Davis	Ground
Monument Draw	3	5	0715	Active	72	1		UC-Davis	Ground
Monument Draw	3	6	0700	Active	72	0		UC-Davis	Ground
Monument Draw	3	7	0700	Active	80	2		UC-Davis	Ground
Monument Draw	3	9	0800	Active	73	2		UC-Davis	Ground
Monument Draw	3	10	0600	Active	80	2		UC-Davis	Ground
Monument Draw	3	11	0730	Active	77	8		UC-Davis	Ground
Monument Draw	3	12	0730	Active	87	4		UC-Davis	Ground
Monument Draw	3	13	0830	Active	83	4		UC-Davis	Ground
Monument Draw	3	14	0730	Active	88	15		UC-Davis	Ground
Monument Draw	3	15	0730	Active	82	3		UC-Davis	Ground
Monument Draw	3	16	0835	Active	66	6		UC-Davis	Ground
Monument Draw	3	17	0705	Active	88	28		UC-Davis	Ground
Monument Draw	3	18	0730	Active	97	64		UC-Davis	Ground
Monument Draw	3	19	0830	Active	56	6		UC-Davis	Ground
Monument Draw	3	20	0730	Active	86	41		UC-Davis	Ground
Monument Draw	3	21	0730	Active	96	72		UC-Davis	Ground
Monument Draw	3	22	0800	Active	94	86		UC-Davis	Ground
Monument Draw	3	23	0730	Active	98	83		UC-Davis	Ground
Monument Draw	3	24	0705	Active	94	43		UC-Davis	Ground
Monument Draw	3	25	0700	Active	96	41		UC-Davis	Ground
Monument Draw	3	26	0758	Active	96	39		UC-Davis	Ground
Monument Draw	3	27	0730	Active	102	18		UC-Davis	Ground
Monument Draw	3	28	0735	Active	32	0		UC-Davis	Ground
Monument Draw	4	1	0730	Active	81	19		UC-Davis	Ground
Monument Draw	4	2	0733	Active	88	10		UC-Davis	Ground
Monument Draw	4	3	0700	Active	96	28		UC-Davis	Ground
Monument Draw	4	4	0730	Active	94	10		UC-Davis	Ground
Monument Draw	4	5	0700	Active	94	2		UC-Davis	Ground
Monument Draw	4	6	0703	Active	86	4		UC-Davis	Ground
Monument Draw	4	7	0700	Active	87	3		UC-Davis	Ground
Monument Draw	4	8	0700	Active	93	1		UC-Davis	Ground
Monument Draw	4	9	0700	Active	98	1		UC-Davis	Ground
Monument Draw	4	10	0700	Active	103	2		UC-Davis	Ground
Monument Draw	4	11	0700	Active	95	0		UC-Davis	Ground
Monument Draw	4	12	0800	Active	96	1		UC-Davis	Ground
Monument Draw	4	13	0700	Active	95	0		UC-Davis	Ground
Monument Draw	4	14	0708	Active	76	0		UC-Davis	Ground
Monument Draw	4	15	0815	Active	89	0		UC-Davis	Ground
Monument Draw	4	16	0711	Active	98	1		UC-Davis	Ground
Monument Draw	4	17	0700	Active	92	1		UC-Davis	Ground
Monument Draw	4	18	0700	Active	87	4		UC-Davis	Ground
Monument Draw	4	20	0704	Active	96	2		UC-Davis	Ground
Monument Draw	4	21	0700	Active	92	1		UC-Davis	Ground
Monument Draw	4	22	0700	Active	91	3		UC-Davis	Ground
Monument Draw	4	23	0700	Active	86	1		UC-Davis	Ground
Monument Draw	4	24	0700	Active	95	12		UC-Davis	Ground
Monument Draw	4	25	0610	Active	45	5		UC-Davis	Ground
Monument Draw	4	26	0700	Active	84	3		UC-Davis	Ground
Monument Draw	4	27	0603	Active	96	4		UC-Davis	Ground
Monument Draw	4	28	0720	Active	73	1		UC-Davis	Ground
Monument Draw	4	29	0700	Active	82	0		UC-Davis	Ground
Monument Draw	4	30	0600	Active	86	6		UC-Davis	Ground
Ninemile Draw	2	28	0747	Active	0	0		UC-Davis	Ground
Ninemile Draw	3	19	0816	Active	5	0		UC-Davis	Ground

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Ninemile Draw	3	21	0745	Active	8	0		UC-Davis	Ground
Ninemile Draw	3	24	0826	Active	5	0		UC-Davis	Ground
Ninemile Draw	3	27	0826	Active	0	0	0	UC-Davis	Ground
Ninemile Draw	4	5	0728	Active	0	0		UC-Davis	Ground
Ninemile Draw	4	10	0713	Active	0	0		UC-Davis	Ground
Ninemile Draw	4	14	0645	Active	0	0		UC-Davis	Ground
Ninemile Draw	4	17	0753	Active	3	0		UC-Davis	Ground
Ninemile Draw	4	21	0655	Active	4	0		UC-Davis	Ground
Ninemile Draw	4	27	0708	Active	3	0		UC-Davis	Ground
North Sand Gulch	2	25	0740	Active	47	0		UC-Davis	Ground
North Sand Gulch	3	1	0740	Active	48	0		UC-Davis	Ground
North Sand Gulch	3	2	0718	Active	44	0		UC-Davis	Ground
North Sand Gulch	3	6	0625	Active	50	0		UC-Davis	Ground
North Sand Gulch	3	9	0730	Active	8	0		UC-Davis	Ground
North Sand Gulch	3	12	0750	Active	58	2		UC-Davis	Ground
North Sand Gulch	3	15	0815	Active	0	0		UC-Davis	Ground
North Sand Gulch	3	18	0728	Active	57	23		UC-Davis	Ground
North Sand Gulch	3	21	0737	Active	54	0	14	UC-Davis	Ground
North Sand Gulch	3	22	0815	Active	60	10		UC-Davis	Ground
North Sand Gulch	3	24	0755	Active	53	5		UC-Davis	Ground
North Sand Gulch	3	26	0813	Active	45	1		UC-Davis	Ground
North Sand Gulch	4	3	0745	Active	29	2		UC-Davis	Ground
North Sand Gulch	4	6	0752	Active	33	0		UC-Davis	Ground
North Sand Gulch	4	9	0720	Active	57	0		UC-Davis	Ground
North Sand Gulch	4	12	0755	Active	51	0		UC-Davis	Ground
North Sand Gulch	4	15	0707	Active	55	0		UC-Davis	Ground
North Sand Gulch	4	17	0732	Active	30	0		UC-Davis	Ground
North Sand Gulch	4	18	0750	Active	4	1		UC-Davis	Ground
North Sand Gulch	4	22	0656	Active	51	1		UC-Davis	Ground
North Sand Gulch	4	25	0734	Active	45	0		UC-Davis	Ground
North Sand Gulch	4	28	0658	Active	52	0		UC-Davis	Ground
North Sand Gulch	4	30	0719	Active	50	0		UC-Davis	Ground
Preacher Playa	3	13	0755	Unknown	0	0		UC-Davis	Ground
Preacher Playa	4	5	0700	Unknown	0	0		UC-Davis	Ground
Preacher Reservoir	2	18	0745	Active	2	0		UC-Davis	Ground
Preacher Reservoir	2	22	0640	Active	20	0		UC-Davis	Ground
Preacher Reservoir	3	5	0705	Active	18	0		UC-Davis	Ground
Preacher Reservoir	3	9	0700	Active	31	0		UC-Davis	Ground
Preacher Reservoir	3	12	0825	Active	34	0		UC-Davis	Ground
Preacher Reservoir	3	13	0744	Active	30	2		UC-Davis	Ground
Preacher Reservoir	3	17	0715	Active	30	10		UC-Davis	Ground
Preacher Reservoir	3	20	0837	Active	32	0	6	UC-Davis	Ground
Preacher Reservoir	3	23	0745	Active	28	9		UC-Davis	Ground
Preacher Reservoir	3	25	0800	Active	31	7		UC-Davis	Ground
Preacher Reservoir	3	26	0749	Active	29	8		UC-Davis	Ground
Preacher Reservoir	3	28	0720	Active	7	0		UC-Davis	Ground
Preacher Reservoir	4	5	0649	Active	35	1		UC-Davis	Ground
Preacher Reservoir	4	8	0800	Active	30	0		UC-Davis	Ground
Preacher Reservoir	4	11	0715	Active	28	0		UC-Davis	Ground
Preacher Reservoir	4	14	0645	Active	34	0		UC-Davis	Ground
Preacher Reservoir	4	15	0700	Active	28	0		UC-Davis	Ground
Preacher Reservoir	4	17	0710	Active	30	0		UC-Davis	Ground
Preacher Reservoir	4	20	0636	Active	33	3		UC-Davis	Ground
Preacher Reservoir	4	21	0601	Active	27	3		UC-Davis	Ground
Preacher Reservoir	4	23	0733	Active	30	1		UC-Davis	Ground
Preacher Reservoir	4	27	0627	Active	23	0		UC-Davis	Ground
Preacher Reservoir	4	30	0654	Active	31	0		UC-Davis	Ground
Thomsen Well	5	4		Inactive	0	0		Stan Harter	Ground
West Carr Springs Draw	2	22	0752	Active	12	0		UC-Davis	Ground
West Carr Springs Draw	3	1	0702	Active	14	0		UC-Davis	Ground
West Carr Springs Draw	3	6	0724	Active	48	0		UC-Davis	Ground
West Carr Springs Draw	3	8	0811	Active	6	0		UC-Davis	Ground
West Carr Springs Draw	3	9	0728	Active	63	0		UC-Davis	Ground
West Carr Springs Draw	3	14	0725	Active	17	0		UC-Davis	Ground
West Carr Springs Draw	3	17	0815	Active	65	2		UC-Davis	Ground
West Carr Springs Draw	3	20	0700	Active	27	0		UC-Davis	Ground

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
West Carr Springs Draw	3	23	0825	Active	76	27		UC-Davis	Ground
West Carr Springs Draw	3	24	0725	Active	68	26		UC-Davis	Ground
West Carr Springs Draw	3	26	0655	Active	86	50		UC-Davis	Ground
West Carr Springs Draw	4	3	0911	Active	8	0		UC-Davis	Ground
West Carr Springs Draw	4	6	0650	Active	78	8		UC-Davis	Ground
West Carr Springs Draw	4	9	0645	Active	96	13		UC-Davis	Ground
West Carr Springs Draw	4	12	0620	Active	89	5		UC-Davis	Ground
West Carr Springs Draw	4	15	0707	Active	88	1		UC-Davis	Ground
West Carr Springs Draw	4	18	0615	Active	94	1		UC-Davis	Ground
West Carr Springs Draw	4	22	0650	Active	92	1		UC-Davis	Ground
West Carr Springs Draw	4	24	0620	Active	85	6		UC-Davis	Ground
West Carr Springs Draw	4	28	0635	Active	89	3		UC-Davis	Ground
West Carr Springs Draw	4	30	0605	Active	63	3		UC-Davis	Ground
Complex Lander Cutoff									
Sharps Meadows Creek	3	27	0900	Active	34	3		Stan Harter	Ground
Sharps Meadows Creek	4	20	0800	Active	2	0		Rene Schell	Ground
Sharps Meadows Creek	4	26	0722	Active	44	0		Rene Schell	Ground
Sharps Meadows Creek	5	8	0550	Active	101	2		Stan Harter	Ground
Complex Long Creek									
Cedar Rim Pipeline No. 1	3	27		Abandoned	0	0		Brian Heath	Ground
Cedar Rim Pipeline No. 1	4	6	0650	Abandoned	0	0		Sue Oberlie	Ground
Cedar Rim Pipeline No. 1	4	12		Abandoned	0	0		Brian Heath	Air
Cedar Rim Pipeline No. 1	4	13	0645	Abandoned	0	0		Sue Oberlie	Ground
Cedar Rim Pipeline No. 1	4	14	0635	Abandoned	0	0		Brian Heath	Air
Cedar Rim Pipeline No. 1	4	23	0635	Abandoned	0	0		Sue Oberlie	Ground
Cedar Rim Pipeline No. 1	4	30	0528	Abandoned	0	0		Brian Heath	Ground
Cedar Rim Pipeline No. 1	5	1	0635	Abandoned	0	0		Sue Oberlie	Ground
Cedar Rim Pipeline No. 2	3	26		Active	32	3	4	Brian Heath	Ground
Cedar Rim Pipeline No. 2	4	6	0700	Active	106	4		Sue Oberlie	Ground
Cedar Rim Pipeline No. 2	4	13	0650	Active	119	9		Sue Oberlie	Ground
Cedar Rim Pipeline No. 2	4	14	0631	Active	35	0		Brian Heath	Air
Cedar Rim Pipeline No. 2	4	23	0640	Active	111	3		Sue Oberlie	Ground
Cedar Rim Pipeline No. 2	4	30	0541	Active	95	2		Brian Heath	Ground
Cedar Rim Pipeline No. 2	5	1	0645	Active	89	1		Sue Oberlie	Ground
Long Creek No. 1	4	13	0815	Active	0	0		Stan Harter	Ground
Long Creek No. 1	4	20	0738	Active	45	0		Stan Harter	Ground
Long Creek No. 2	4	13	0750	Unknown	0	0		Stan Harter	Ground
Long Creek No. 2	4	20	0755	Unknown	0	0		Stan Harter	Ground
Long Creek No. 3	4	6	0730	Inactive	0	0		Sue Oberlie	Ground
Long Creek No. 3	4	13	0720	Inactive	0	0		Sue Oberlie	Ground
Long Creek No. 3	4	20	0805	Inactive	0	0		Stan Harter	Ground
Long Creek No. 3	4	23	0640	Inactive	0	0		Sue Oberlie	Ground
Long Creek No. 3	5	1	0720	Inactive	0	0		Sue Oberlie	Ground
Long Creek No. 4	3	27	0740	Inactive	0	0		Brian Heath	Ground
Long Creek No. 4	4	6	0745	Inactive	0	0		Sue Oberlie	Ground
Long Creek No. 4	4	13	0815	Inactive	0	0		Sue Oberlie	Ground
Long Creek No. 4	4	14	0640	Inactive	0	0		Brian Heath	Air
Long Creek No. 4	4	23	0730	Inactive	0	0		Sue Oberlie	Ground
Long Creek No. 4	4	30	0638	Inactive	0	0		Brian Heath	Ground
Long Creek No. 4	5	1	0740	Inactive	0	0		Sue Oberlie	Ground
West Long Creek No. 1	4	13	0710	Active	176	10		Stan Harter	Ground
West Long Creek No. 1	4	20	0658	Active	133	3		Stan Harter	Ground
West Long Creek No. 2	4	13	0642	Active	34	2		Stan Harter	Ground
West Long Creek No. 2	4	20	0631	Active	177	17		Stan Harter	Ground
Complex McGraw Flats									
McGraw Flats No. 1	3	22	0700	Inactive	0	0		Bob Trebelcock	Ground
McGraw Flats No. 1	3	27	0810	Inactive	0	0		Bob Trebelcock	Ground
McGraw Flats No. 1	4	19	0710	Inactive	0	0		Bob Trebelcock	Ground
McGraw Flats No. 1	4	25	0800	Inactive	0	0		Bob Trebelcock	Ground
McGraw Flats No. 2	3	22	0730	Active	131	11		Bob Trebelcock	Ground
McGraw Flats No. 2	3	27	0830	Active	115	6		Bob Trebelcock	Ground
McGraw Flats No. 2	4	19	0645	Active	65	0		Bob Trebelcock	Ground
McGraw Flats No. 2	4	25	0745	Active	116	4		Bob Trebelcock	Ground

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex McTurk Ridge									
McTurk Ridge	4	14	0710	Active	27	0		Brian Heath	Air
McTurk Ridge	4	23	0637	Active	64	3		Brian Heath	Ground
Complex Ninemile									
Ninemile Reservoir	2	28	0805	Active	18	0		UC-Davis	Ground
Ninemile Reservoir	3	19	0833	Active	43	0		UC-Davis	Ground
Ninemile Reservoir	3	21	0845	Active	35	0		UC-Davis	Ground
Ninemile Reservoir	3	24	0841	Active	40	0		UC-Davis	Ground
Ninemile Reservoir	3	27	0857	Active	0	0	4	UC-Davis	Ground
Ninemile Reservoir	4	5	0740	Active	0	0		UC-Davis	Ground
Ninemile Reservoir	4	10	0725	Active	27	0		UC-Davis	Ground
Ninemile Reservoir	4	14	0710	Active	44	0		UC-Davis	Ground
Ninemile Reservoir	4	17	0805	Active	1	0		UC-Davis	Ground
Ninemile Reservoir	4	21	0710	Active	34	0		UC-Davis	Ground
Ninemile Reservoir	4	24	0619	Active	21	0		UC-Davis	Ground
Ninemile Reservoir	4	27	0720	Active	24	0		UC-Davis	Ground
Complex Onion Flats									
Onion Flats No. 1	2	28	0639	Active	0	0		UC-Davis	Ground
Onion Flats No. 1	3	4	0810	Active	0	0	22	UC-Davis	Ground
Onion Flats No. 1	3	13	0720	Active	40	0		UC-Davis	Ground
Onion Flats No. 1	3	16	0755	Active	50	8		UC-Davis	Ground
Onion Flats No. 1	3	19	0710	Active	57	0		UC-Davis	Ground
Onion Flats No. 1	3	22	0825	Active	44	11		UC-Davis	Ground
Onion Flats No. 1	3	25	0700	Active	55	6		UC-Davis	Ground
Onion Flats No. 1	4	4	0635	Active	51	0		UC-Davis	Ground
Onion Flats No. 1	4	7	0807	Active	45	0		UC-Davis	Ground
Onion Flats No. 1	4	10	0647	Active	55	0		UC-Davis	Ground
Onion Flats No. 1	4	13	0759	Active	38	0		UC-Davis	Ground
Onion Flats No. 1	4	16	0847	Active	46	0		UC-Davis	Ground
Onion Flats No. 1	4	20	0745	Active	41	0		UC-Davis	Ground
Onion Flats No. 1	4	23	0630	Active	55	0		UC-Davis	Ground
Onion Flats No. 1	4	23	0735	Active	50	0		Stan Harter	Ground
Onion Flats No. 1	4	26	0720	Active	57	0		UC-Davis	Ground
Onion Flats No. 1	4	29	0725	Active	43	0		UC-Davis	Ground
Onion Flats No. 2	3	4	0750	Active	0	0	15	UC-Davis	Ground
Onion Flats No. 2	3	7	0704	Active	29	0		Stan Harter	Ground
Onion Flats No. 2	3	19	0720	Active	23	0		UC-Davis	Ground
Onion Flats No. 2	3	22	0809	Active	19	0		UC-Davis	Ground
Onion Flats No. 2	3	25	0722	Active	23	0		UC-Davis	Ground
Onion Flats No. 2	4	4	0705	Active	0	0		UC-Davis	Ground
Onion Flats No. 2	4	9	0647	Active	41	5		Stan Harter	Ground
Onion Flats No. 2	4	10	0702	Active	32	0		UC-Davis	Ground
Onion Flats No. 2	4	13	0723	Active	21	0		UC-Davis	Ground
Onion Flats No. 2	4	16	0652	Active	22	0		UC-Davis	Ground
Onion Flats No. 2	4	17	0641	Active	35	0		Stan Harter	Ground
Onion Flats No. 2	4	20	0715	Active	34	0		UC-Davis	Ground
Onion Flats No. 2	4	23	0640	Active	13	0		UC-Davis	Ground
Onion Flats No. 2	4	23	0722	Active	20	0		Stan Harter	Ground
Onion Flats No. 2	4	26	0700	Active	5	0		UC-Davis	Ground
Onion Flats No. 2	4	29	0703	Active	2	0		UC-Davis	Ground
Complex Picket Lake									
Picket Lake	4	19	0705	Active	14	0		Stan Harter	Ground
Picket Lake	5	9	0715	Active	70	3		Greg Hiatt	Ground
Complex Sage Hen									
Agate Flats	4	12	0715	Active	23	1		Laurie Van Fleet	Ground
Agate Flats	4	20	0630	Active	28	3		Laurie Van Fleet	Ground
Agate Flats	4	27	0622	Active	24	0		Laurie Van Fleet	Ground
Agate Flats	5	15	0755	Active	23	0		Stan Harter	Ground
Blackjack	4	12	0745	Active	191	11		Laurie Van Fleet	Ground
Blackjack	4	20	0600	Active	247	7		Laurie Van Fleet	Ground
Blackjack	4	27	0646	Active	225	6		Laurie Van Fleet	Ground
Blackjack	5	15	0705	Active	229	0		Stan Harter	Ground
McIntosh Meadows	4	12	0705	Active	1	0		Laurie Van Fleet	Ground
McIntosh Meadows	4	20	0641	Active	0	0		Laurie Van Fleet	Ground
McIntosh Meadows	4	27	0633	Active	0	0		Laurie Van Fleet	Ground
Sage Hen No. 1	4	12	0647	Inactive	0	0		Laurie Van Fleet	Ground

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Sage Hen No. 1	4	20	0715	Inactive	0	0		Laurie Van Fleet	Ground
Sage Hen No. 1	4	27	0730	Inactive	0	0		Laurie Van Fleet	Ground
Sage Hen No. 2	4	12	0642	Active	0	0		Laurie Van Fleet	Ground
Sage Hen No. 2	4	20	0708	Active	2	0		Laurie Van Fleet	Ground
Sage Hen No. 2	4	27	0722	Active	1	0		Laurie Van Fleet	Ground
Sage Hen No. 3	4	12	0630	Active	51	3		Laurie Van Fleet	Ground
Sage Hen No. 3	4	20	0654	Active	37	1		Laurie Van Fleet	Ground
Sage Hen No. 3	4	27	0713	Active	43	3		Laurie Van Fleet	Ground
Sage Hen No. 4	4	12	0620	Inactive	0	0		Laurie Van Fleet	Ground
Sage Hen No. 4	4	20	0648	Inactive	0	0		Laurie Van Fleet	Ground
Sage Hen No. 4	4	27	0709	Inactive	0	0		Laurie Van Fleet	Ground
Complex Signor Pipeline									
Signor Pipeline	4	13	0700	Active	2	0		Greg Anderson	Ground
Signor Pipeline	4	17	0659	Active	65	2		Chris Daubin	Ground
Complex Soap Holes									
Cottonwood Creek	3	26	0658	Active	3	1		Brian Heath	Ground
Cottonwood Creek	4	12	0650	Active	0	0		Brian Heath	Air
Cottonwood Creek	4	19	0700	Active	0	0		Amy Adams	Ground
Cottonwood Creek	4	21	0750	Active	0	0		Amy Adams	Ground
Cottonwood Creek	4	24	0715	Active	0	0		Brian Heath	Ground
Cottonwood Creek	5	3	0615	Active	0	0		Amy Adams	Ground
Ice Slough	4	13	0630	Inactive	0	0		Amy Adams	Ground
Ice Slough	4	21	0630	Inactive	0	0		Amy Adams	Ground
Ice Slough	5	3	0600	Inactive	0	0		Amy Adams	Ground
Nancy Creek	3	26	0736	Active	47	13		Brian Heath	Ground
Nancy Creek	4	12	0634	Active	16	0		Brian Heath	Air
Nancy Creek	4	19	0635	Active	35	0		Amy Adams	Ground
Nancy Creek	4	21	0730	Active	55	4		Amy Adams	Ground
Nancy Creek	4	24	0650	Active	48	0		Brian Heath	Ground
Nancy Creek	5	3	0705	Active	12	0	2	Amy Adams	Ground
Nancy Creek Reservoir	3	26	0721	Active	50	10		Brian Heath	Ground
Nancy Creek Reservoir	4	12	0802	Active	12	0		Brian Heath	Air
Nancy Creek Reservoir	4	19	0620	Active	73	2		Amy Adams	Ground
Nancy Creek Reservoir	4	21	0715	Active	63	3		Amy Adams	Ground
Nancy Creek Reservoir	4	24	0658	Active	45	0		Brian Heath	Ground
Nancy Creek Reservoir	5	3	0650	Active	0	0		Amy Adams	Ground
Soap Holes	4	13	0615	Active	152	8		Amy Adams	Ground
Soap Holes	4	21	0615	Active	164	6		Amy Adams	Ground
Soap Holes	5	3	0540	Active	170	0		Amy Adams	Ground
Complex South Pass									
Dickie Springs	4	20	0710	Active	87	0		Rene Schell	Ground
Dickie Springs	4	29	0715	Active	88	0		Rene Schell	Ground
Dickie Springs	5	8	0710	Active	64	0		Rene Schell	Ground
Dickie Springs Creek	4	20	0630	Active	208	11		Rene Schell	Ground
Dickie Springs Creek	4	29	0630	Active	236	0		Rene Schell	Ground
Dickie Springs Creek	5	8	0645	Active	224	4		Rene Schell	Ground
Fish Creek	3	27	0745	Active	121	24		Stan Harter	Ground
Fish Creek	4	14	0630	Active	136	10		Rene Schell	Ground
Fish Creek	4	26	0610	Active	118	0		Rene Schell	Ground
Fish Creek	5	8	0640	Active	164	6		Stan Harter	Ground
Long Gulch	4	25	0625	Active	128	0		Stan Harter	Ground
Long Gulch	5	8	0755	Active	1	0		Stan Harter	Ground
Oregon Trail	4	25	0726	Active	151	5		Stan Harter	Ground
Pacific Creek Playa	3	27	0815	Active	3	0		Stan Harter	Ground
Pacific Creek Playa	4	20	0730	Active	69	0		Rene Schell	Ground
Pacific Creek Playa	4	29	0740	Active	72	0		Rene Schell	Ground
Pacific Creek Playa	5	8	0610	Active	74	2		Rene Schell	Ground
Pine Creek	4	14	0800	Active	53	3		Rene Schell	Ground
Pine Creek	4	26	0637	Active	50	0		Rene Schell	Ground
Pine Creek	5	8	0710	Active	71	3		Stan Harter	Ground
Willow Creek State	4	19	0635	Unknown	0	0		Stan Harter	Ground
Willow Creek State	4	25	0641	Active	84	0		Stan Harter	Ground

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex Split Rock									
Bill's	3	15	0804	Active	39	4		Greg Hiatt	Ground
Bill's	3	25	0715	Active	43	22		Dave Lieb	Ground
Bill's	4	11	0710	Active	49	3		Stan Harter	Ground
Dry Draw	4	11	0751	Active	16	0		Stan Harter	Ground
Rawlins Draw	4	11	0730	Active	22	0		Stan Harter	Ground
Spring Creek	4	11	0639	Active	73	4		Stan Harter	Ground
Complex Stampede									
Buffalo Creek	4	4	0710	Active	34	4		Travis Crane	Ground
Buffalo Creek	4	10	0715	Active	34	3		Travis Crane	Ground
Radio Tower Draw No. 1	4	17	0745	Inactive	0	0		Carrie Dobey	Ground
Radio Tower Draw No. 1	4	26	0710	Inactive	0	0		Carrie Dobey	Ground
Radio Tower Draw No. 1	5	4	0700	Inactive	0	0		Carrie Dobey	Ground
Radio Tower Draw No. 2	4	17	0715	Active	85	0		Carrie Dobey	Ground
Radio Tower Draw No. 2	4	26	0650	Active	82	3		Carrie Dobey	Ground
Radio Tower Draw No. 2	5	4	0650	Active	72	0		Carrie Dobey	Ground
Complex Sweetwater									
Radium Springs	5	1		Active	18	0		Bob Trebelcock	Ground
Silver Creek	5	1		Active	86	0		Bob Trebelcock	Ground
Wilson Gulch	5	2		Active	29	1		Bob Trebelcock	Ground
Complex Twin Creek									
East Twin Creek	2	26	0700	Active	35	0		UC-Davis	Ground
East Twin Creek	2	28	0833	Active	0	0	25	UC-Davis	Ground
East Twin Creek	3	7	0640	Active	0	0	13	UC-Davis	Ground
East Twin Creek	3	11	0845	Active	63	0		UC-Davis	Ground
East Twin Creek	3	13	0800	Active	52	1		UC-Davis	Ground
East Twin Creek	3	19	0745	Active	71	18		UC-Davis	Ground
East Twin Creek	3	21	0800	Active	62	8		Stan Harter	Ground
East Twin Creek	3	22	0748	Active	80	39		UC-Davis	Ground
East Twin Creek	3	25	0750	Active	79	18		UC-Davis	Ground
East Twin Creek	3	28	0725	Active	3	0		UC-Davis	Ground
East Twin Creek	4	4	0745	Active	17	0		UC-Davis	Ground
East Twin Creek	4	7	0715	Active	74	0		UC-Davis	Ground
East Twin Creek	4	10	0757	Active	79	0		UC-Davis	Ground
East Twin Creek	4	13	0653	Active	74	0		UC-Davis	Ground
East Twin Creek	4	16	0722	Active	72	0		UC-Davis	Ground
East Twin Creek	4	20	0640	Active	78	1		UC-Davis	Ground
East Twin Creek	4	23	0720	Active	57	0		UC-Davis	Ground
East Twin Creek	4	26	0635	Active	73	1		UC-Davis	Ground
East Twin Creek	4	29	0633	Active	66	2		UC-Davis	Ground
Twin Creek	3	7	0718	Active	82	5		Stan Harter	Ground
Twin Creek	3	12	0814	Active	87	22		Stan Harter	Ground
Twin Creek	3	21	0717	Active	84	30		Stan Harter	Ground
Twin Creek	3	22	0801	Active	98	12		UC-Davis	Ground
Twin Creek	3	25	0734	Active	66	10		UC-Davis	Ground
Twin Creek	4	4	0715	Active	60	11		UC-Davis	Ground
Twin Creek	4	9	0658	Active	88	5		Stan Harter	Ground
Twin Creek	4	10	0717	Active	53	0		UC-Davis	Ground
Twin Creek	4	13	0713	Active	83	0	2	UC-Davis	Ground
Twin Creek	4	16	0703	Active	76	1	2	UC-Davis	Ground
Twin Creek	4	17	0654	Active	85	0		Stan Harter	Ground
Twin Creek	4	20	0700	Active	83	0		UC-Davis	Ground
Twin Creek	4	23	0711	Active	89	3		Stan Harter	Ground
Twin Creek	4	23	0650	Active	75	7		UC-Davis	Ground
Twin Creek	4	26	0645	Active	80	7		UC-Davis	Ground
Twin Creek	4	29	0652	Active	66	0		UC-Davis	Ground
Complex Warm Springs									
Warm Springs No. 1	4	11	0750	Active	40	0		Tom Ryder	Ground
Warm Springs No. 1	4	19	0555	Active	76	4		Tom Ryder	Ground
Warm Springs No. 1	4	26	0645	Active	73	0		Tom Ryder	Ground
Warm Springs No. 1	5	1	0605	Active	71	0		Tom Ryder	Ground
Warm Springs No. 1	5	12	0555	Active	13	0		Stan Harter	Ground
Warm Springs No. 2	4	11	0800	Abandone	0	0		Tom Ryder	Ground
Warm Springs No. 2	4	19	0610	Abandone	0	0		Tom Ryder	Ground
Warm Springs No. 2	4	26	0700	Abandone	0	0		Tom Ryder	Ground
Warm Springs No. 2	5	1	0610	Abandone	0	0		Tom Ryder	Ground

Upland Game Bird Management Area – WRR

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex Alkali Butte									
Alkali Butte (#26)	4	11	945	Unknown	0	0		D. Skates	Ground
Alkali Butte North (#39)	4	11	711	Active	25			D. Skates	Ground
Complex Bighorn Draw									
Bighorn Butte (#4A)	4	18	650	Unknown	0	0		P. Hnilicka	Ground
Bighorn Butte (#4B)	4	18	645	Unknown	24	1		P. Hnilicka	Ground
Bighorn Butte (#4C)	4	18	635	Unknown	0	0		P. Hnilicka	Ground
Bighorn Butte (#4D)	4	18	622	Active	54	1		P. Hnilicka	Ground
Bighorn Draw (#3A)	4	25	610	Unknown	0	0		P. Hnilicka	Ground
Bighorn Draw (#3A)	4	26	620	Unknown	0	0		P. Hnilicka	Ground
Bighorn Draw (#3B)	4	25	615	Active	12		30	P. Hnilicka	Ground
Bighorn Draw (#3B)	4	26	625	Active	48	1		P. Hnilicka	Ground
Bighorn Draw (#3C)	4	25	615	Unknown	0	0		P. Hnilicka	Ground
Bighorn Draw (#3C)	4	26	625	Unknown	0	0		P. Hnilicka	Ground
Complex Boulder Flat									
Blue Trail (#31A)	4	5	630	Unknown	0	0		S. Roth	Ground
Boulder Flat (#8)	3	27	630	Active	21	8		S. Roth	Ground
Boulder Flat (#8)	4	4	630	Active	21	14		S. Roth	Ground
Boulder Flat (#8)	4	12	630	Active	27			S. Roth	Ground
Boulder Flat (#8)	4	16	600	Active	22			S. Roth	Ground
Mill Creek Southwest	4	12	0700	Unknown	0	0		S. Roth	Ground
Northwest Draw (#7)	4	12	0645	Unknown	0	0		S. Roth	Ground
Ray Lake (#17)	4	13	0630	Active	38			S. Roth	Ground
Sacajawea (#29)	4	5	630	Active	16	7		S. Roth	Ground
Complex Crowheart Butte									
Crowheart Butte (#9)	3	21	655	Not	0	0		P. Hnilicka	Ground
Dry Creek	3	21	730	Active	54			P. Hnilicka	Ground
Ega Butte (#11)	3	21	800	Unknown	0	0		P. Hnilicka	Ground
Ega Draw (#10)	3	21	710	Active	9			P. Hnilicka	Ground
Complex Lookout Butte									
Lookout Butte Bottom	4	16	605	Active	28	2		P. Hnilicka	Ground
Lookout Butte Tank (#35A)	4	16	625	Unknown	0	0		P. Hnilicka	Ground
Complex Mule Butte									
Mule Butte North (#12)	4	9	625	Active	39	2		P. Hnilicka	Ground
Mule Butte Pump House (#34)	4	9	645	Unknown	0	0		P. Hnilicka	Ground
Mule Butte South (#14)	4	9	625	Unknown	0	0		P. Hnilicka	Ground
Mule Butte Windmill (#13)	4	9	0630	Unknown	0	0		P. Hnilicka	Ground
Complex Riverton East									
Riverton East (#33A)	3	20		Active	8	4		Hayden-Wing	Ground
Riverton East (#33A)	4	6		Active	4		1	Hayden-Wing	Ground
Riverton East (#33A)	4	26		Active	4			Hayden-Wing	Ground
Riverton East (#33A)	5	8		Unknown	1			Hayden-Wing	Ground
Riverton East (#33B)	3	20		Active	0	0		Hayden-Wing	Ground
Riverton East (#33B)	4	6		Active	2			Hayden-Wing	Ground
Riverton East (#33B)	4	26		Active	0	0		Hayden-Wing	Ground
Riverton East (#33B)	5	8		Active	0	0		Hayden-Wing	Ground
Riverton East (#33C)	3	20		Active	12	15		Hayden-Wing	Ground
Riverton East (#33C)	4	6		Active	11			Hayden-Wing	Ground
Riverton East (#33C)	4	26		Active	11	2		Hayden-Wing	Ground
Riverton East (#33C)	5	8		Active	0	0		Hayden-Wing	Ground
Complex Sage Creek									
Fred Harris (#37)	4	5	630	Active	115	29		P. Hnilicka	Ground
Middle Fork Sage Creek (#27)	4	5	735	Unknown	0	0		P. Hnilicka	Ground
Sage Creek Dry Pond	4	2	720	Unknown	0	0		P. Hnilicka	Ground
Sage Creek Dry Pond	4	13	640	Unknown	0	0		P. Hnilicka	Ground
Sage Creek Sundance East (#19)	4	2	640	Unknown	0	0		P. Hnilicka	Ground
Sage Creek Sundance East (#19)	4	13	615	Unknown	0	0		P. Hnilicka	Ground
Sage Creek Sundance East (#19)	4	17	630	Unknown	0	0		P. Hnilicka	Ground
Sage Creek Sundance North (#19)	4	2	700	Active	51	3		P. Hnilicka	Ground
Sage Creek Sundance North (#19)	4	13	625	Active	38	2		P. Hnilicka	Ground
Sage Creek Sundance North (#19)	4	17	630	Active	77	0		P. Hnilicka	Ground
Sage Creek Sundance Northwest (#19)	4	2	720	Active	17			P. Hnilicka	Ground

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Sage Creek Sundance Northwest (#19)	4	13	645	Active	10	1		P. Hnilicka	Ground
Sage Creek Sundance Northwest (#19)	4	17	700	Active	28			P. Hnilicka	Ground
Sage Creek Sundance South (#19)	4	2	640	Unknown	0	0		P. Hnilicka	Ground
Sage Creek Sundance South (#19)	4	13	625	Unknown	0	0		P. Hnilicka	Ground
Sage Creek Sundance South (#19)	4	17	630	Unknown	0	0		P. Hnilicka	Ground
Winchester Draw (#21)	4	13	705	Active	14	1		P. Hnilicka	Ground
Winchester Draw (#21)	4	17	735	Active	17	0		P. Hnilicka	Ground
Complex Sharpnose									
Sand Hills (#38)	4	3	720	Unknown	0	0		P. Hnilicka	Ground
Sharpnose (#22)	3	22	700	Active	82	54		P. Hnilicka	Ground
Sharpnose (#22)	4	3	715	Active	85	30		P. Hnilicka	Ground
Sharpnose (#22)	4	5	630	Active	95	13	20	D. Skates	Ground
Sharpnose (#22)	4	10	755	Active	97	1		D. Skates &	Ground
Sharpnose (#22)	4	18	623	Active	106			D. Skates	Ground
Sharpnose Draw	4	3	735	Active	12			P. Hnilicka	Ground
Sharpnose Draw	4	10	805	Active	3			D. Skates &	Ground
Sharpnose East	3	22	725	Active	31	25		P. Hnilicka	Ground
Sharpnose East	3	27	640	Active	33	15		P. Hnilicka	Ground
Sharpnose East	4	3	630	Active	29	10		P. Hnilicka	Ground
Sharpnose East	4	5	650	Active	42	7		D. Skates	Ground
Sharpnose East	4	10	600	Active	27	2		D. Skates &	Ground
Sharpnose East	4	18	638	Active	23	2		D. Skates	Ground
Sharpnose Southeast (#23A)	3	22	745	Unknown	0	0		P. Hnilicka	Ground
Sharpnose Southeast (#23A)	4	5	703	Unknown	0	0		D. Skates	Ground
Sharpnose Southeast (#23B)	4	5	715	Unknown	0	0		D. Skates	Ground
WyPo (#16)	3	13	0830	Active	24	11		B. St. Clair	Ground
WyPo (#16)	3	22	750	Active	36	21		P. Hnilicka	Ground
WyPo (#16)	4	5	735	Active	35	2		D. Skates	Ground
WyPo Pipeline A	3	22	745	Unknown	0	0		P. Hnilicka	Ground
Complex Willow Creek									
Little Sand Draw	4	20	711	Active	48	2		S. Roth & D.	Ground
Meadow Creek (#28A)	2	8	0900	Active	4			P. Hnilicka	Ground
Meadow Creek (#28A)	4	3	0800	Active	36	4		S. Roth	Ground
Meadow Creek (#28B)	4	3	0730	Unknown	0	0		S. Roth	Ground
Meadow Creek (#28C)	4	3	0730	Unknown	0	0		S. Roth	Ground
Willow Creek Bench (#30)	4	3	630	Active	20	13		S. Roth	Ground
Willow Creek Bench (#30)	4	22	600	Active	18	1		S. Roth	Ground

Appendix G. Sage-grouse lek complex status for the WRSRCA, 2007.

Upland Bird Management Area 18

Complex	Type	Status	Peak Males	Peak Female	Leks/ Complex
9 Mile	Survey	Active	28	9	2
Alkali Creek	Survey	Active	81	5	2
Arrowhead	Count	Active	48	8	2
Badwater	Survey	Active	74	6	3
Badwater Canyon	Survey	Active	28	7	1
Bass Lake Road	Survey	Unknown	0	0	1
Big Flat	Survey	Unknown	0	0	1
Black Rocks	Survey	Active	36	5	1
Bridger Trail	Survey	Active	43	19	1
Bushwacker - East	Survey	Unknown	0	0	1
Bushwacker - West	Survey	Unknown	0	0	1
Canyon Creek	Survey	Active	59	8	5
Canyon Creek - Ranch	Survey	Unknown	0	0	1
Chalk Hills	Survey	Unknown	0	0	1
Coal Bank Hills	Survey	Active	0	0	1
Conant Creek	Count	Active	34	8	2
Davison Road	Survey	Active	4	1	1
Davison Road - 12 Mile	Survey	Active	48	9	4
Davison Road - 8 Mile	Survey	Active	21	7	1
Devil’s Slide	Not Checked	Unknown			1
East Canyon Creek	Not Checked	Unknown			1
Fuller Airstrip	Survey	Active	26	5	1
Jackpot	Survey	Active	23	3	1
Lysite Creek	Survey	Active	0	0	4
Maverick Butte	Survey	Active	42		1
Nebo	Count	Active	35	6	1
Noble Ridge	Not Checked	Unknown			1
Oil Playa	Not Checked	Unknown			1
Pipeline	Survey	Active	33	22	2
Pit	Survey	Active	25	0	1
Powerline	Count	Active	60	31	1
Sand Creek Bench	Survey	Active	3	0	1
Sand Creek Ranch	Survey	Unknown	0	0	1
South Bridger Creek	Survey	Active	20	2	1
South Fuller Reservoir	Not Checked	Unknown			1
Squaw Butte	Survey	Active	89	7	1
Stock Pond	Survey	Unknown	0	0	1
Windmill	Not Checked	Unknown			1

Upland Bird Management Area 8

Complex	Type	Status	Peak Males	Peak Female	Leks/ Complex
Antelope Flats	Survey	Active	46	0	1
Beaver Rim	Count	Active	137	44	6
Beulah Belle	Count	Active	42	3	1
Cedar Rim Pipeline	Count	Active	53	5	1
Cottonwood	Count	Active	3	3	2
Cottonwood Divide	Count	Active	56	3	1
Coyote	Survey	Active	49	1	2
Diamond Springs	Survey	Active	174	16	3
Dobie	Survey	Active	12	0	1
Dry Cheyenne	Survey	Active	63	0	1
Dry Creek	Survey	Active	9	1	2
East Long Creek	Count	Active	220	4	3
Gas Hills	Not Checked	Unknown			1
Grassy Lake	Survey	Active	5	0	1
Hall Creek	Count	Active	61	3	2
Horseshoe	Count	Active	102	20	4
Lander	Count	Active	580	196	16
Lander Cutoff	Count	Active	101	3	1
Long Creek	Count	Active	355	21	8
McGraw Flats	Count	Active	131	117	2
McTurk Ridge	Survey	Active	64	3	1
Ninemile	Count	Active	44	0	1
Onion Flats	Count	Active	138	11	2
Picket Lake	Count	Active	70	3	1
Sage Hen	Count	Active	314	15	7
Signor Pipeline	Survey	Active	65	2	1
Soap Holes	Count	Active	282	24	5
South Pass	Count	Active	598	24	8
Split Rock	Survey	Active	160	22	4
Stampede	Count	Active	85	4	3
Sweetwater	Survey	Active	104	1	3
Twin Creek	Count	Active	221	51	2
Warm Springs	Count	Active	76	4	2

Upland Bird Management Area -WR

Alkali Butte	Survey	Active	25	0	3
Bargee	Not Checked	Unknown			1
Bighorn Draw	Survey	Active	78	2	7
Boulder Flat	Count	Active	38	14	7
Crowheart Butte	Survey	Active	63	0	4
East Fork	Not Checked	Unknown			2
Lookout Butte	Survey	Active	28	2	2
Mule Butte	Survey	Active	39	2	4
Odie Ranch	Not Checked	Unknown			3
Riverton East	Count	Active	20	19	3
Sage Creek	Count	Active	122	29	11
Sharpnose	Count	Active	172	100	9
Willow Creek	Survey	Active	56	17	5

BLM PROJECT QUARTERLY REPORT: June 30, 2007

Project Start Date: 2005 June 19; Field work started on 2005 April 1
Project Name/Title: Examining the Effect of Noise from Energy Exploration and Development on the Breeding Biology of the Greater Sage-Grouse
BLM Agreement Number: BAA0033002
BLM Project Manager:
Name: Tom Rinkes
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VERY BRIEFLY summarize project activities for this report period:

Introduction: Populations of the greater sage-grouse (*Centrocercus urophasianus*) are declining throughout their range, leading to their designation as a Species of Concern and their recent consideration for listing under the Endangered Species Act. Many factors have been implicated in this decline (e.g. grazing, habitat loss) and there appears to be no universal cause across the range of the species. It is likely that a suite of interacting factors is contributing to the decline, which complicates conservation efforts. Over the last decade, natural gas development has expanded rapidly across much of the sage-grouse habitat. It is crucial to determine whether this activity is contributing to observed declines in sage-grouse populations. Since we are still in the relatively early stages of this energy exploration, steps can be taken to mitigate the impact of these activities if the problem is diagnosed early. Determining whether natural gas development impacts sage-grouse is critical to the goal of providing sound environmental protections in areas of energy development, therefore ensuring that it will not again be necessary to consider listing sage-grouse under the Endangered Species Act.

One potential means by which energy development might impact sage-grouse populations is through the production of noise. Acoustic communication is known to be important in the reproductive behaviors of sage-grouse, and energy exploration and development activities generate substantial noise; it is therefore important to determine whether noise produced from energy development affects sage-grouse breeding biology. Sage-grouse mate during the early spring (March-April). During this mating season, males aggregate on display sites called “leks” where females visit to observe male display behaviors and choose their mates. There is evidence that the acoustic displays produced by males on leks facilitate reproduction in at least two ways. First, females use these vocalizations to find leks within the habitat. Second, after arrival at a lek, there is evidence that females use male vocalizations (and other aspects of male display) to choose a mate. Anthropogenic noise in the sage grouse habitat may mask vocalizations produced by males, interfering both with females’ ability to locate leks and to choose mates.

Goals: The overall goal of this research is to investigate the potential effects of noise from natural gas development on sage-grouse lekking behaviors. This research has three major lines of inquiry: 1) Descriptive- the characterization of sounds produced by energy development

and by sage-grouse, and how these sounds propagate through the environment, 2) Experimental - playback of recorded noise to sage-grouse leks to determine whether noise impacts sage-grouse breeding behaviors, and 3) Predictive - landscape-level modeling of sound propagation in the sagebrush habitat.

Our specific goals for the second quarter of 2007 were:

1. Field work (completion of the 2007 season)
    a. Noise experiments on leks
    b. Noise monitoring in the Powder River Basin and Pinedale
2. Data Analysis
    a. Noise experiments on leks
    b. Noise data from Pinedale and the Powder River Basin

Work Accomplished:

Noise Experiment:

In spring 2006, we began an experiment to test the hypothesis that noise from energy development affects sage grouse reproductive behavior. To do so, we played back recorded noise to 4 leks and monitored another 4 leks as controls. We started fieldwork for the second year of the noise experiment in February 2007, with playback of noise starting in February/March and continuing through early May. In early 2007, we increased the number of leks in the experiment for a total of 8 experimental leks (4 road noise and 4 drilling noise) and 8 control leks. All leks are paired to balance for size and location, and then randomly assigned to noise or control groups.

During the 2007 season, we monitored the leks by conducting multiple counts of birds at each lek visited during the lekking period. Each lek was divided into 25 meter sections using a line of stakes that is perpendicular to the line from the observation point to the center of the lek; this allowed us to look at spatial distribution of birds on the lek. Each lek was visited every three days and videotaped every other visit using high resolution HD 1080i format. The videotapes will be analyzed at UC Davis for behaviors and position of birds. For the 2007 season, we ended monitoring on May 1 and playback of noise on May 4. We will continue playback and monitoring at these leks for the 2008 breeding season.

In April, we began recording the vocalizations of individual birds on two experimental leks and one control lek. We took photos of individuals from a blind on the lek for later identification using unique tail plumage patterns and recorded the vocalizations of these same individuals using a shotgun microphone and Marantz audio recorder. Graduate student Jessica Blickley will analyze various parameters of the recorded vocalizations and compare individuals from experimental and control leks to determine if individuals are adjusting their vocalizations to compensate for increased background noise.

In April, we collected fecal matter from experimental and control leks for analysis of corticosterone levels in collaboration with Dr. John Wingfield. Corticosterone is a stress hormone that can be used to gauge chronic stress and development of techniques and benchmarks for analysis of sage-grouse feces may provide a useful way to determine if populations are experiencing long-term stress. We collected approximately 15 samples from each of 12 leks (6 experimental and 6 control) in both early and late April, using a collection protocol

that minimized the likelihood of collecting multiple samples from the same individual. Analysis of these samples will likely be completed in late 2007/2008, pending the acquisition of funds.

Descriptive Acoustics:

We continued noise monitoring of energy development sites in the Powder River Basin (Johnson and Sheridan counties) through the end of April. Noise monitoring included 1) placement of autonomous recording units (ARUs) near compressor stations, generators, access roads, and drilling rigs and 2) measuring the sound pressure level along line transects radiating from the noise source using a handheld meter (Larson-Davis 824 Sound Level Meter) and a GPS (Magellan Meridian). ARUs were programmed to record at set intervals throughout the day and are left for 3-6 days at each location. We also continued noise monitoring at impacted and non-impacted leks in both the Pinedale and Powder River Basin areas.

Table 1: Summary of noise sources/sites monitored in the Powder River Basin and Pinedale area during 2007 field season

Site type	Total monitored (SPL meter)		Total monitored (ARU)	
	PRB	Pinedale	PRB	Pinedale
Generator	3	0	2	0
Compressor station	6	0	6	0
Drilling rig	0	0	2	0
Access road/Highway	0	0	2	0
Lek	4	6	4	6

<u>Detailed list of Noise Sources monitored:</u>

Powder River Basin

- Access roads/highways:
  - Highway I-90- ARU (2 locations)
  - Dead Horse Creek Road- ARU (2 locations)
- Drilling Rigs:
  - Williams Production drilling unit off Lower Sussex Road- ARU (4 locations)
  - Williams Production drilling unit off Kingsbury Road- ARU (4 locations)
- Generators:
  - Anadarko generator- ARU (2 locations), SPL
  - Wardner Ranch generator- ARU (4 locations), SPL
  - Dry Creek Road generator- ARU (2 locations)
  - Lower Powder River Road generator- ARU (2 locations)
- Compressors:
  - Powder River compressor- ARU (4 locations), SPL
  - WGR Cinderella compressor- ARU (2 locations), SPL
  - Jeff POD- ARU (2 locations), SPL
  - Neil POD- ARU (2 locations), SPL
  - WGR Pumpkin compressor- ARU (2 locations), SPL
  - Optigas Cat Creek compressor- SPL
  - WGR Venice compressor- ARU (4 locations)

Leks:

Flying E lek- ARU (2 locations), SPL
Upper Dry Creek II lek: ARU (4 locations), SPL
41 Ash Creek lek- ARU (2 locations), SPL
Christian I lek- ARU (4 locations), SPL

Pinedale

Leks:

Oil Road Fork lek- ARU (2 locations), SPL
Speedway lek- ARU (locations), SPL
Stud Horse Butte East lek- ARU (2 locations), SPL
The Rocks lek- ARU (2 locations), SPL
Sand Draw Reservoir lek- ARU (2 locations), SPL
Shelter Cabin lek- ARU (2 locations), SPL

Data Analysis:

During the second quarter, we continued data analysis for both the descriptive acoustics and noise introduction projects. For the experimental data, we continued collection of video data using focal animal event recording. We have completed the focal animal event recording for 2006 and began recruitment and training of undergraduate interns to begin data collection from 2007 videos. For focal animal event recording, the time spent strutting, chasing and fighting are all recorded for individual males using an event recording package called ERIS. Graduate student Jessica Blickley is developing a Matlab program to analyze focal animal data from 2006 and 2007.

In June, we hired a new technician who will continue analysis of the noise recordings and SPL meter data from both the Powder River Basin and the Pinedale area. Former postdoc Diane Blackwood is continuing work on a program that will be used in analysis of the noise recordings. This program is scheduled for completion in early July.

List any Project Milestones/work accomplished during the report period:

Milestone	Completion Date	Deliverable
1.Completed noise monitoring in Powder River Basin	April 2007	collection of data for noise analysis
2. Year 2 of noise introduction and monitoring of noise experiment leks	May 2007	collection of data for behavioral/lek attendance analysis
3. Collected fecal matter from noise experiment leks	April 2007	will be used for stress hormone analysis in noise exp.

Difficulties encountered, if any.

None

Contractor and status of funding committed to contractor, if any.
No work was contracted out.

Need for additional funding, if any.
None.

Is the proposed schedule being maintained?
Yes.

Delays anticipated, if any, along with steps taken to mitigate delay.
None.

If the schedule has changed, discuss why the schedule changed and provide the new schedule.
NA

Cumulative funds spent (provide each source and amount by FY if a multiyear project).
FY 2005 approximately $ 99,820.61 expended
FY 2006 approximately $ 114,847.12 expended
FY 2007 approximately $ 79,790.56 expended
Cumulative spending: approximately $ 294,458.29