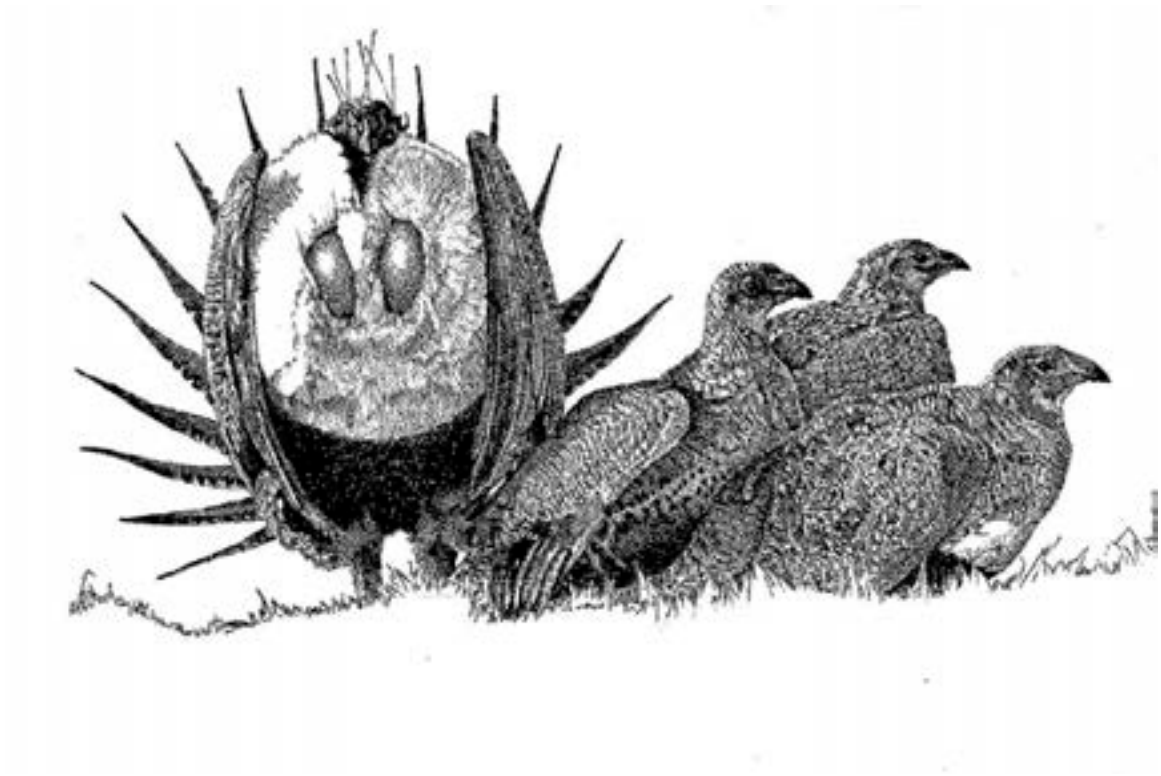
2009
GREATER SAGE-GROUSE JOB COMPLETION REPORT



Edson Fichter

June 1, 2009 – May 31, 2010

Wyoming Game and Fish Department
Cheyenne, WY

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Sage-Grouse Job Completion Report

YEAR: 2009 **PERIOD COVERED: 6/1/2009 - 5/31/2010**
WORKING GROUP: Statewide Summary **PREPARED BY: Tom 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
2001	1584	315	19.9	8067	2735	25.6	8.7
2002	1614	343	21.3	7003	2724	20.4	7.9
2003	1646	421	25.6	8935	3493	21.2	8.3
2004	1713	450	26.3	9537	2319	21.2	5.2
2005	1802	467	25.9	16324	3929	35.0	8.4
2006	1862	478	25.7	21811	5394	45.6	11.3
2007	1932	521	27.0	21282	3687	40.8	7.1
2008	1965	573	29.2	19314	5223	33.7	9.1
2009	1990	603	30.3	15474	5485	25.7	9.1
2010	2027	684	33.7	13828	6310	20.2	9.2

b. Leks Surveyed

Year	Known	Surveyed	Percent Surveyed	Max Total	Avg Males/ Active Lek
2001	1584	730	46.1	9659	22.0
2002	1614	779	48.3	8792	19.7
2003	1646	855	51.9	9541	19.6
2004	1713	896	52.3	10983	21.0
2005	1802	956	53.1	19456	31.4
2006	1862	1056	56.7	23156	34.3
2007	1932	1097	56.8	22330	32.7
2008	1965	989	50.3	16568	27.3
2009	1990	1007	50.6	15086	25.7
2010	2027	910	44.9	10944	20.4

c. Leks Checked

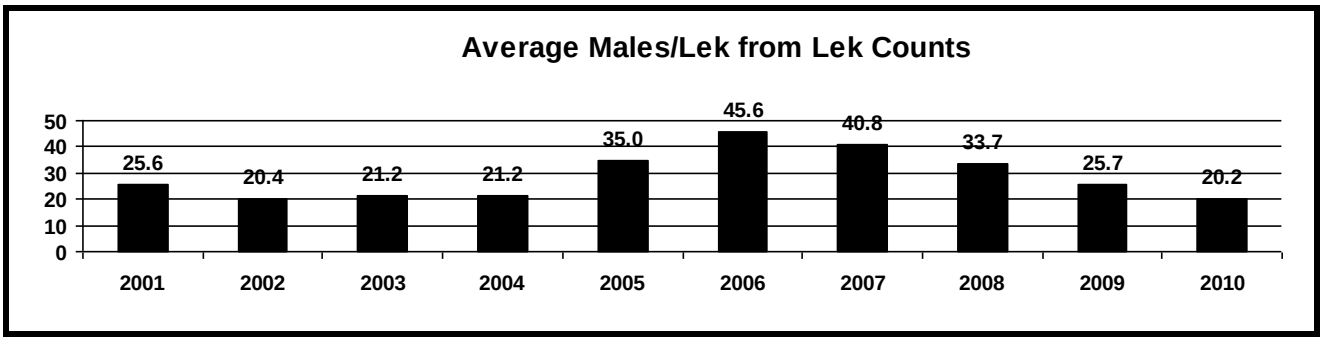
Year	Known	Checked	Percent Checked	Max Total	Avg Males/ Active Lek
2001	1584	1015	64.1	17314	23.5
2002	1614	1098	68.0	15510	20.1
2003	1646	1235	75.0	18155	20.5
2004	1713	1297	75.7	20281	21.5
2005	1802	1405	78.0	35535	33.0
2006	1862	1521	81.7	44764	39.2
2007	1932	1604	83.0	43504	36.5
2008	1965	1545	78.6	35548	30.6
2009	1990	1605	80.7	30504	25.7
2010	2027	1586	78.2	24628	20.3

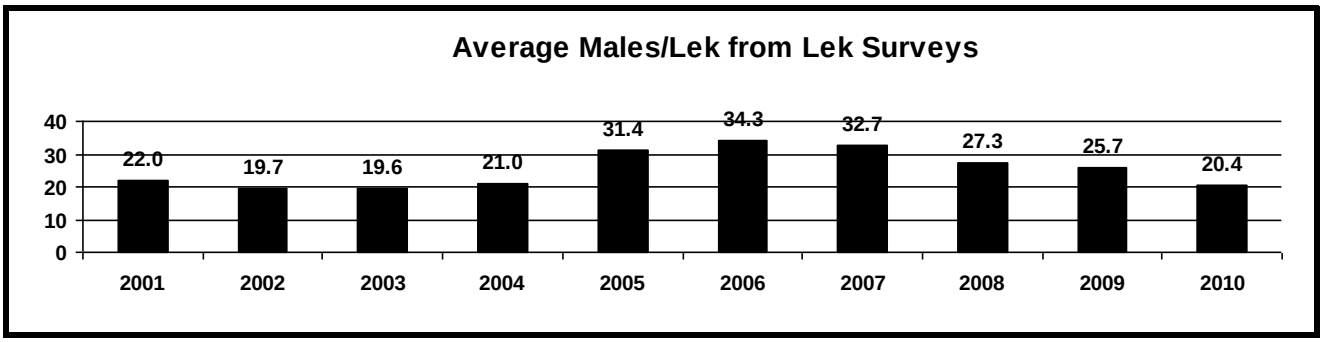
d. Lek Status

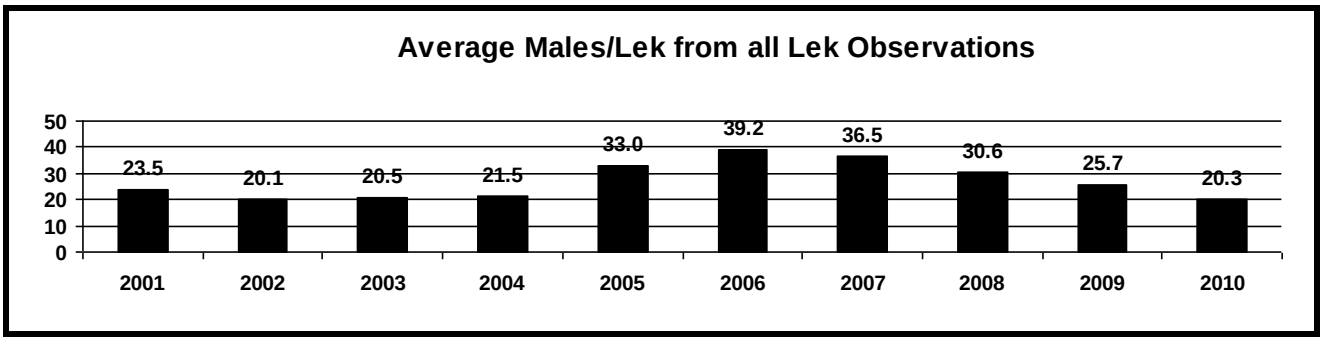
Year	Active	Inactive	Not Located	Unknown	Confirmed Status Total	Confirmed Status Active	Confirmed Status Inactive
2001	723	82	17	762	805	89.8%	10.2%
2002	727	118	17	752	845	86.0%	14.0%
2003	809	161	18	658	970	83.4%	16.6%
2004	843	182	9	679	1025	82.2%	17.8%
2005	1002	130	6	664	1132	88.5%	11.5%
2006	1084	152	8	618	1236	87.7%	12.3%
2007	1136	194	6	596	1330	85.4%	14.6%
2008	1103	221	3	638	1324	83.3%	16.7%
2009	1089	249	0	652	1338	81.4%	18.6%
2010	1063	245	3	716	1308	81.3%	18.7%

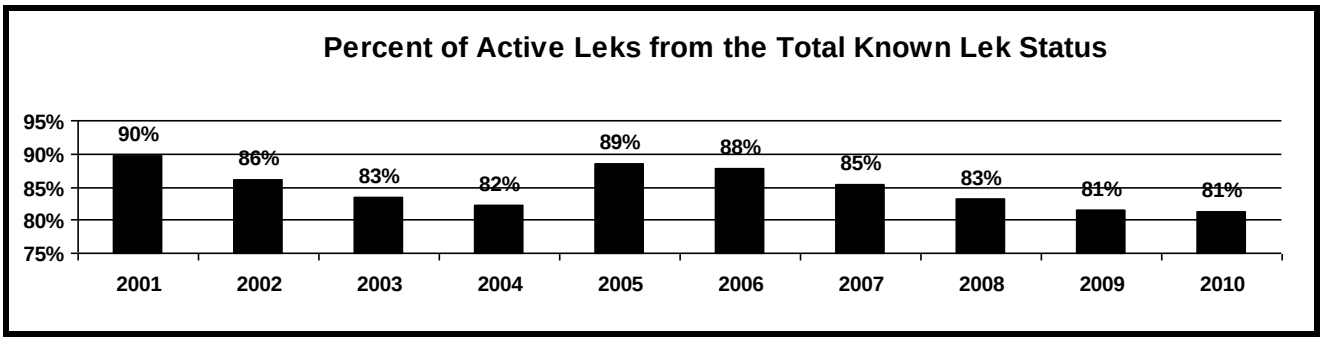
SAGE-GROUSE LEK ATTENDANCE SUMMARY

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









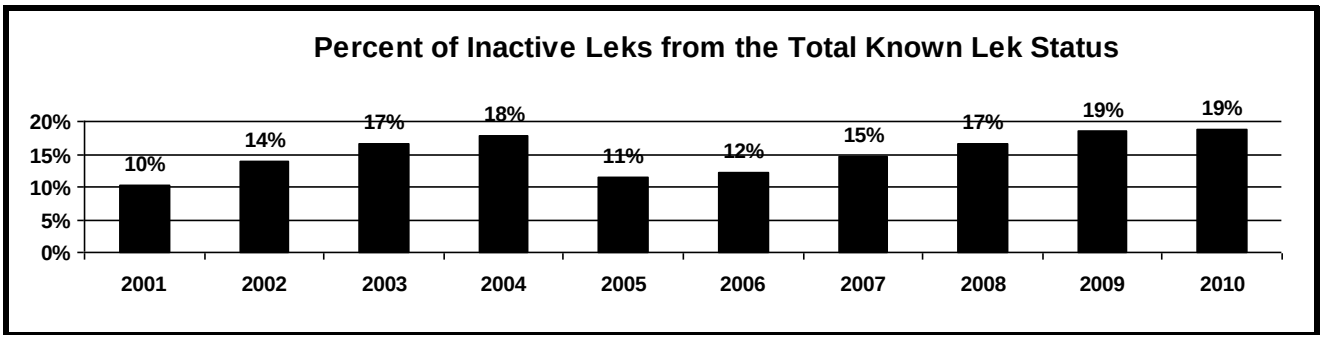


Table3. Summary of unoccupied (historic) leks and lek complexes.

a. Unoccupied Leks

Year	Total Number of Leks: Abandoned	Destroye	Number of abandoned leks checked
2001	184	28	68
2002	185	31	70
2003	196	31	129
2004	191	34	63
2005	197	32	67
2006	208	32	109
2007	217	35	74
2008	208	40	86
2009	218	41	76
2010	216	42	79

Sage Grouse Lek Characteristics (all classifications)

WGFD Region	Number	Percent
Casper	256	11.2%
Cody	283	12.4%
Green River	456	19.9%
Jackson	18	0.8%
Lander	458	20.0%
Laramie	237	10.4%
Pinedale	189	8.3%
Sheridan	390	17.1%

Working Group Area	Number	Percent
Bates Hole	306	13.4%
Big Horn Basin	283	12.4%
Northeast	525	23.0%
South Central	377	16.5%
Southwest	407	17.8%
Upper Green River	141	6.2%
Upper Snake River	18	0.8%
Wind	230	10.1%

Classification	Number	Percent
Occupied	1,899	83.0%
Unknown	97	4.2%
Unoccupied	291	12.7%

BLM Office	Number	Percent
Buffalo	365	16.0%
Casper	180	7.9%
Cody	101	4.4%
Kemmerer	182	8.0%
Lander	235	10.3%
Newcastle	110	4.8%
Pinedale	147	6.4%
Rawlins	523	22.9%
Rock Springs	255	11.1%
Worland	185	8.1%

County	Number	Percent
Albany	77	3.4%
Big Horn	43	1.9%
Campbell	188	8.2%
Carbon	371	16.2%
Converse	58	2.5%
Crook	22	1.0%
Fremont	222	9.7%
Hot Springs	51	2.2%
Johnson	133	5.8%
Laramie	2	0.1%
Lincoln	124	5.4%
Natrona	137	6.0%
Niobrara	19	0.8%
Park	96	4.2%
Platte	6	0.3%
Powder River, MT	1	0.0%
Sheridan	35	1.5%
Sublette	162	7.1%
Sweetwater	286	12.5%
Teton	17	0.7%
Uinta	70	3.1%
Washakie	100	4.4%
Weston	65	2.8%

Land Status	Number	Percent
BLM	1127	49.3%
BLM/Private	12	0.5%
BOR	7	0.3%
National Park	15	0.6%
Not Determined	4	0.2%
Private	857	37.5%
Private/BLM	1	0.0%
Wind River Reservation	60	2.6%
State	138	6.0%
State/Private	1	0.0%
USF&WS	2	0.1%
USFS	48	2.1%
WGFD	2	0.1%

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

a. Season

Year	Season Dates	Length	Bag/Possession Limit
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
2007	Sept 22-Oct 2	11	2/4
2008 Area 1	Sept 20-Sept 30	11	2/4
2008 Area 4	Sept 20-Sept 26	7	2/4
2009 Area 1	Sept 19-Sept 30	12	2/4
2009 Area 4	Sept 19-Sept 25	7	2/4

b. Harvest

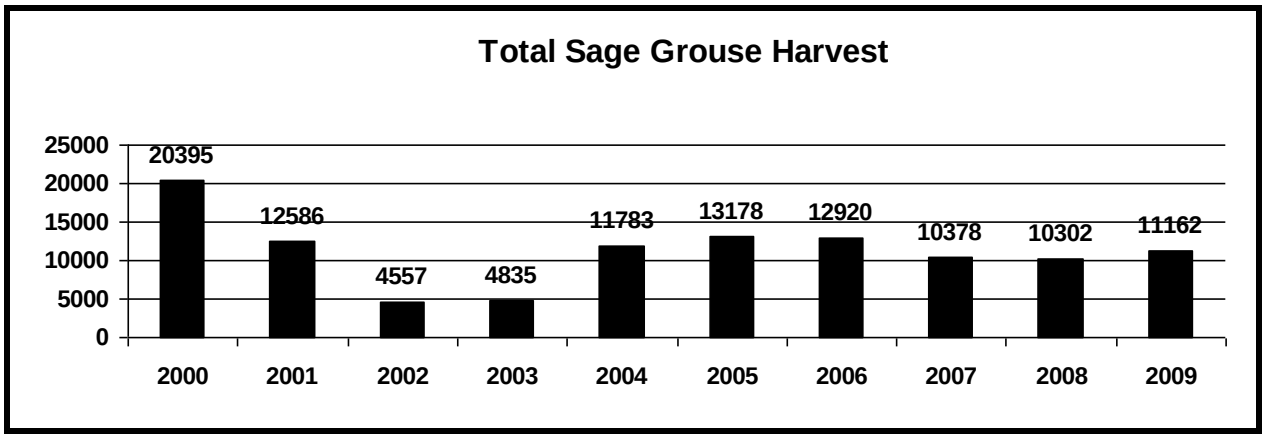
Year	Harvest	Hunters	Days	Birds/ Day	Birds/ Hunter	Days/ Hunter
2000	20,395	8,517	20,800	1.0	2.4	2.4
2001	12,586	5,471	14,267	0.9	2.3	2.6
2002	4,557	2,730	6,642	0.7	1.7	2.4
2003	4,835	2,355	5,705	0.8	2.1	2.4
2004	11,783	5,436	13,229	0.9	2.2	2.4
2005	13,178	5,230	12,175	1.1	2.5	2.3
2006	12,920	5,412	11,981	1.1	2.4	2.2
2007	10,378	5,180	10,699	1.0	2.0	2.1
2008	10,302	4,745	10,065	1.0	2.2	2.1
2009	11,162	4,732	10,812	1.0	2.4	2.3
Avg.	11,210	4,981	11,638	0.9	2.2	2.3

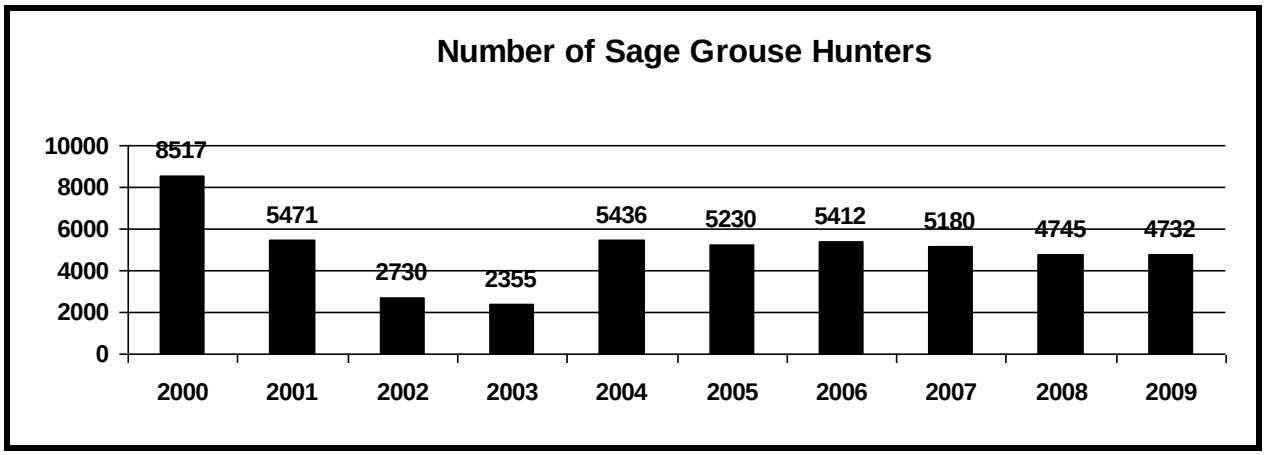
Table 5. Composition of harvest by wing analysis.

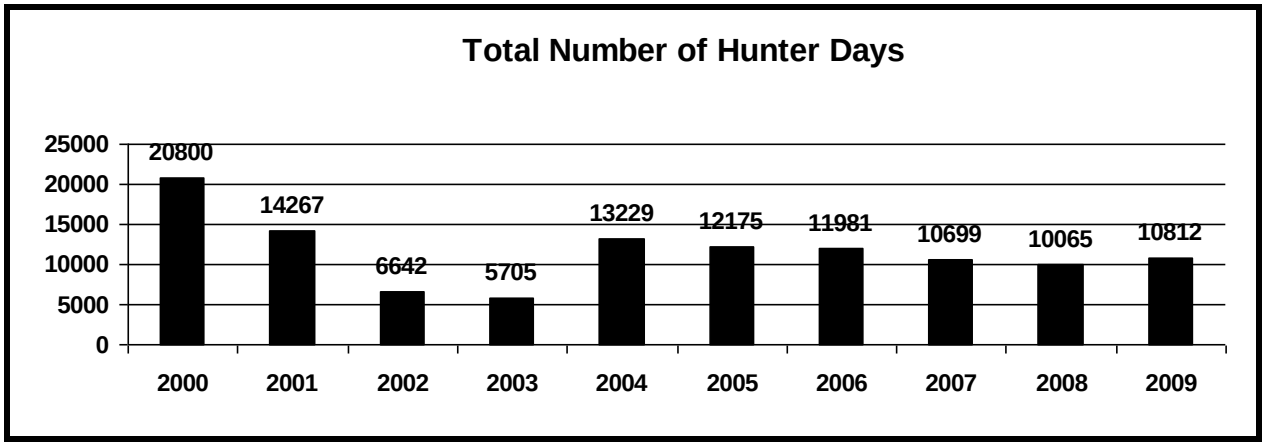
	Sample	Percent Adult		Percent Ylg		Percent Young		Chicks /Hen
Year	Size	Male	Female	Male	Female	Male	Female	
2000	2917	12.5	28.2	5.7	11.5	17.5	24.6	1.1
2001	2824	9.5	28.0	1.7	6.4	21.2	33.1	1.6
2002	1808	9.9	27.2	2.4	7.1	18.6	34.8	1.6
2003	1606	13.0	27.6	1.7	6.5	21.9	29.2	1.5
2004	2268	9.6	22.0	1.3	4.0	30.6	32.5	2.4
2005	2841	13.0	21.8	3.4	6.4	24.3	31.1	2.0
2006	2101	19.5	27.9	4.0	6.7	17.7	24.2	1.2
2007	2232	19.8	37.1	3.4	5.3	15.6	18.8	0.8
2008	2154	14.4	25.8	4.6	6.7	20.3	28.0	1.5
2009	2550	14.1	29.1	5.9	8.3	17.1	25.6	1.1

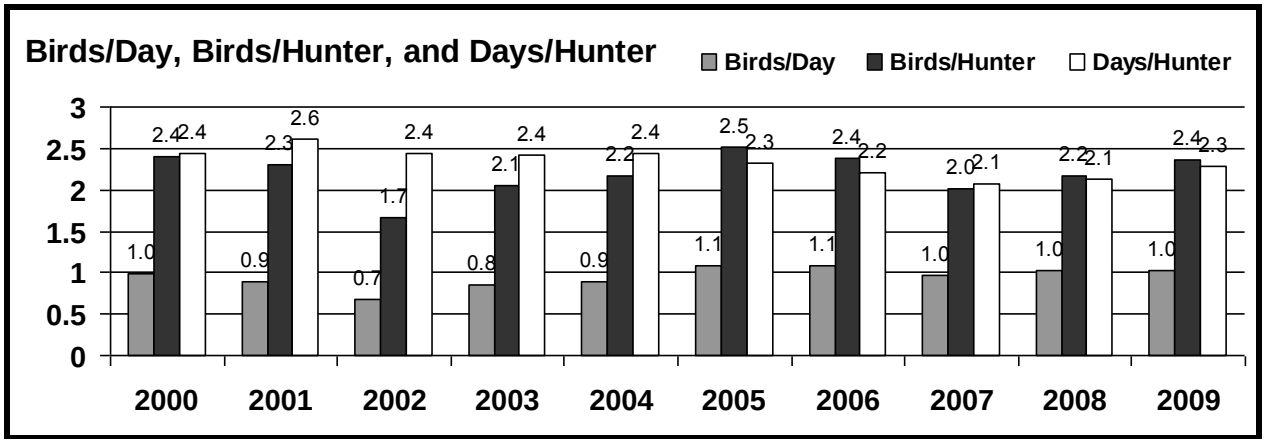
SAGE-GROUSE HARVEST SUMMARY

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







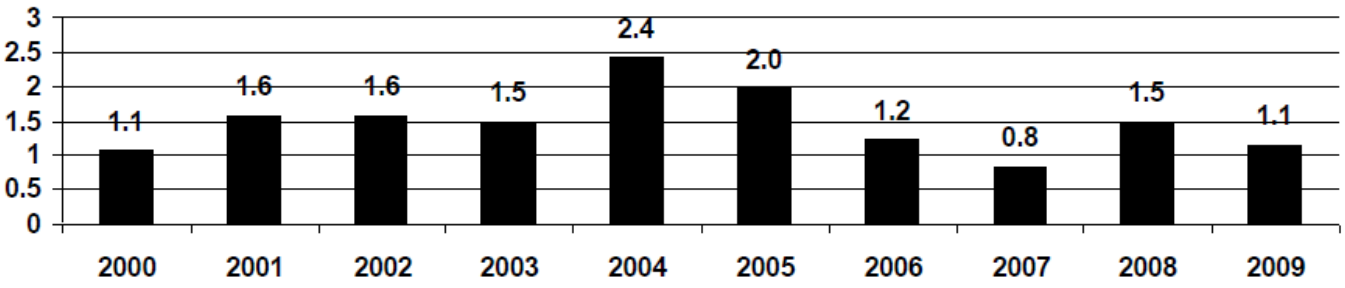


Sage-grouse Wing Analysis Statewide Summary 2009

Adult Males	359	**Percent of All Wings:**	14.1%
Adult Females	742	**Percent of All Wings:**	29.1%
Adult Unknown:	0	**Percent of All Wings:**	0.0%
Total Adults:	1101		
Yearling Males:	150	**Percent of All Wings:**	5.9%
Yearling Females:	211	**Percent of All Wings:**	8.3%
Yearling Unknown	0	**Percent of All Wings:**	0.0%
Total Yearlings:	361		
Chick Males:	436	**Percent of All Wings:**	17.1%
Chick Females:	652	**Percent of All Wings:**	25.6%
Chick Unknown	0	**Percent of All Wings:**	0.0%
Total Chicks:	1088		
Unknown Sex/Age:	0	**Percent of All Wings:**	0.0%
Total for all Sex/Age Groups:	2550		
Chick Males:	436	**Percent of All Chicks:**	40.1%
Yearling Males:	150	**Percent of Adult and Yearling**	29.5%
Adult Males:	359	**Percent of Adult and Yearling**	70.5%
Adult and Yearling	509	**Percent of Adults and Yearlings:**	34.8%
Total Males:	945	**Percent of All Sex/Age Groups:**	37.1%
Chick Females:	652	**Percent of All Chicks:**	59.9%
Yearling Females:	211	**Percent of Adult and Yearling**	22.1%
Adult Females:	742	**Percent of Adult and Yearling**	77.9%
Adult and Yearling	953	**Percent of Adults and Yearlings:**	65.2%
Total Females:	1605	**Percent of All Sex/Age Groups:**	62.9%
Chicks:	1088	**Percent of All Wings:**	42.7%
Yearlings:	361	**Percent of All Wings:**	14.2%
Adults:	1101	**Percent of All Wings:**	43.2%

Chicks/Hen: 1.1

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



Sage-Grouse Job Completion Report

Conservation Plan Area: **Statewide Summary**
Period Covered: **6/1/2009 – 5/31/2010**
Prepared by: **Tom Christiansen – Sage-grouse Program Coordinator**

INTRODUCTION

Sage-grouse data collection and research efforts across Wyoming began to increase in the early 1990s due to the increasing concerns for sage-grouse populations and their habitats (Heath et al. 1996, 1997). Monitoring results suggest sage-grouse populations in the Wyoming were at their lowest levels ever recorded in the mid-1990s. Grouse numbers then increased during the late 1990's with some individual leks seeing three-fold increases in the number of males counted between 1997 and 1999. This increase was synchronous with increased spring precipitation over the period. The return of drought conditions in the early 2000's appeared to have 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 are believed to have 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 dry spring and summer conditions reduced recruitment and the average males per lek declined from 2007 through 2009. Untimely late winter storms in May and early June 2009 may have contributed to reduced nesting success and chick survival.

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.

In December 2007, a federal District Court judge ordered the U.S. Fish and Wildlife Service (Service) to reconsider its 2005 decision of "not warranted" for listing Greater Sage-grouse as threatened or endangered under the Endangered Species Act. On March 5, 2010 the Service issued its new decision of "warranted but precluded" which means Greater Sage-grouse have become a "candidate" for listing but are precluded from immediate listing due to higher priorities. This status is reviewed annually by the Service.

In an unprecedented move to coordinate sage grouse conservation efforts across the State of Wyoming, Governor Dave Freudenthal utilized the recommendations from his Sage-Grouse Implementation Team (SGIT) and released an Executive Order on Aug. 1, 2008 that directed state agencies to work to maintain and enhance greater sage grouse habitat in Wyoming. These actions constituted Wyoming's Core Area Strategy (CAS). Following the release of the new "warranted but precluded" listing decision by the Service, the Governor reconvened the SGIT to revise and update the CAS, a process that is currently underway.

The 2010 Legislature approved the 2011-2012 biennium General Fund budget which again includes funding for the sage-grouse program. Allocation of over $1 million of these funds to local projects will begin after July 1, 2010.

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 (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 planning 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.

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. Radio telemetry studies conducted in Wyoming have demonstrated that most sage-grouse populations in the state are migratory to varying extent. 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 (see following ESA Status section). 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.

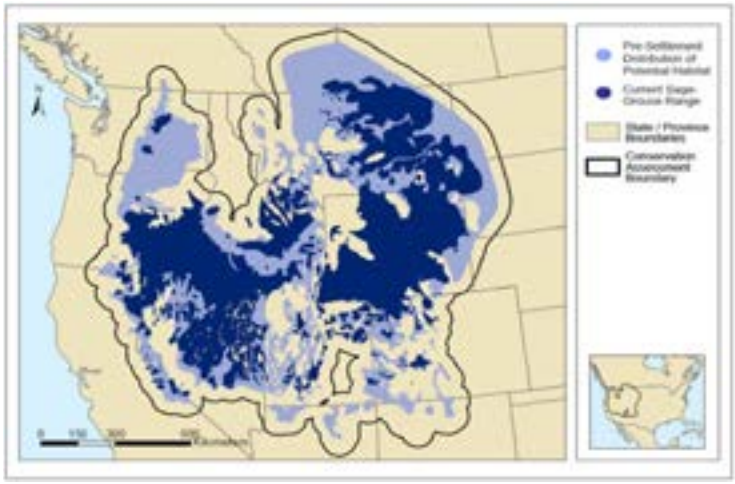


Figure 2. Current distribution of sage-grouse and pre-settlement distribution of potential habitat in North America (Schroeder 2004). For reference, Gunnison sage-grouse in SE Utah and SW Colorado are shown.

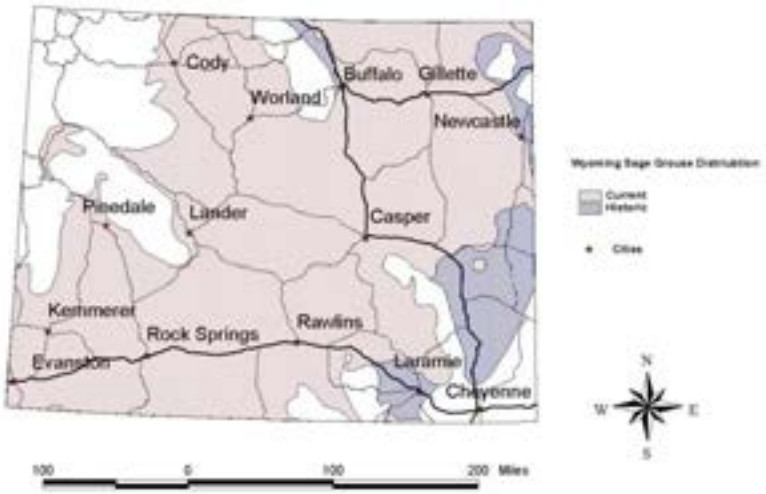


Figure 3. Sage-grouse distribution in Wyoming.

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 Core Area Strategy has expanded and strengthened these protections in core areas.

- The authorization and enforcement of hunting regulations.

- Habitat manipulations, including water development.

- Conducting and/or permitting applied research.

Endangered Species Act Status

In December 2007 a federal District Court judge ordered the U.S. Fish and Wildlife Service (Service) to reconsider its 2005 decision of "not warranted" for listing Greater Sage-grouse as threatened or endangered under the Endangered Species Act. On March 5, 2010 the Service issued its new decision of "warranted but precluded" which means Greater Sage-grouse have become a "candidate" for listing but are precluded from immediate listing due to higher priorities. This status is reviewed annually by the Service.

In its decision document, the Service specifically cited Wyoming's Core Area Strategy (described below) as a mechanism that, if implemented as envisioned, should ensure conservation of sage-grouse in Wyoming and therefore help preclude a future listing.

The Wyoming Game and Fish Department and Commission maintain management authority over candidate species and management emphasis will continue to focus on implementation of the Core Area Strategy.

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, but then 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 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 cannot be said for the most recent three-year period (Figure 7) during which the average number of cocks observed on leks declined, though not to levels documented in the mid-1990s. Thus, there has been a long-term decline, a mid-term increase and short-term decline in the statewide sage-grouse population. The mid- and short-term trends in statewide populations are believed to be 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 illustrate sage-grouse densities based on 2008-2010 peak male lek counts and surveys.

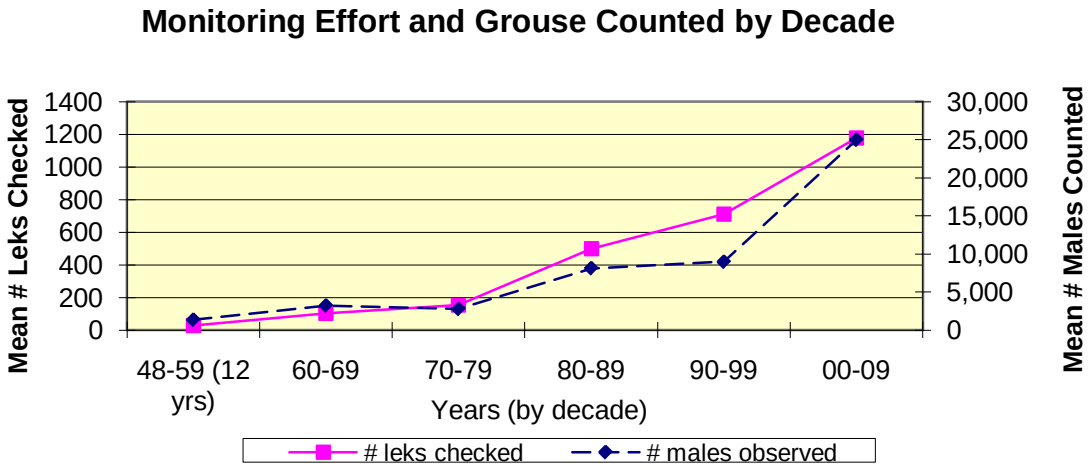


Figure 4. Mean annual numbers of leks checked (monitoring effort) and male grouse counted in Wyoming 1948-2009 by decade.

Lek monitoring data for the 2010 breeding season are summarized in JCR Data Tables 1 a-d. Male attendance at all leks visited (counts and surveys) averaged 20 males per lek during spring 2010, a 21% decrease below the 26 males/lek observed in 2008 and 49% decline from the 39 males/lek observed in 2006. For the 10-year period (2001-2010), average male lek attendance ranged from 20 males/lek in 2002 and 2010, to 39 males/lek in 2006, the highest average males per lek figure recorded since 1978. It is important to note that the number of leks sampled increased substantially 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.

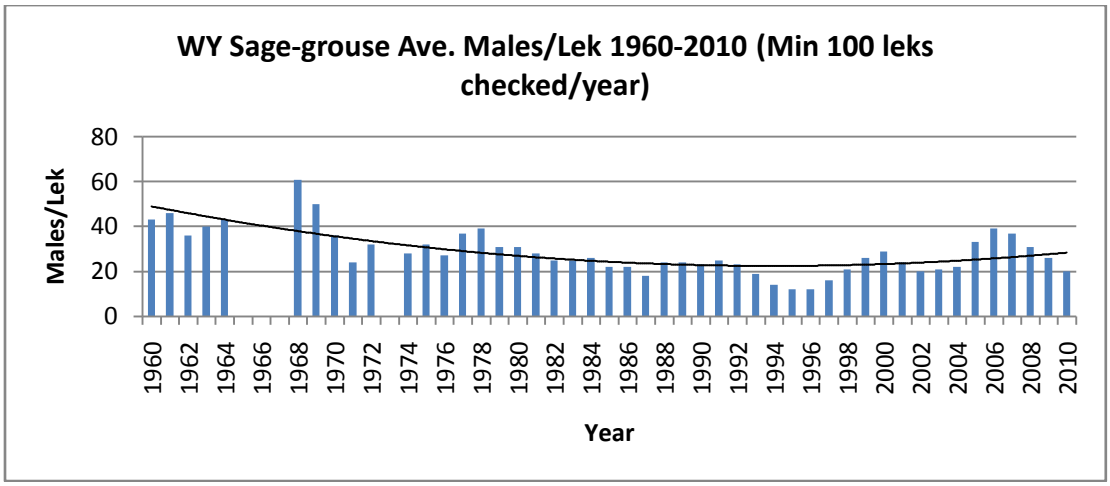


Figure 5. Average number of males per lek counted in Wyoming from 1960-2010 with a minimum of 100 leks checked each year.

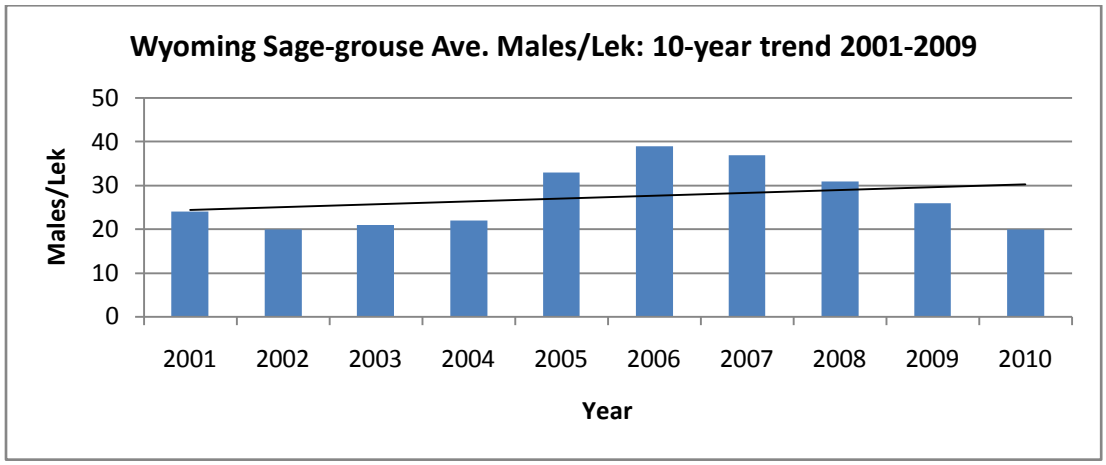


Figure 6. Average number of males per lek observed on leks in Wyoming from 2001-2010 with trend line.

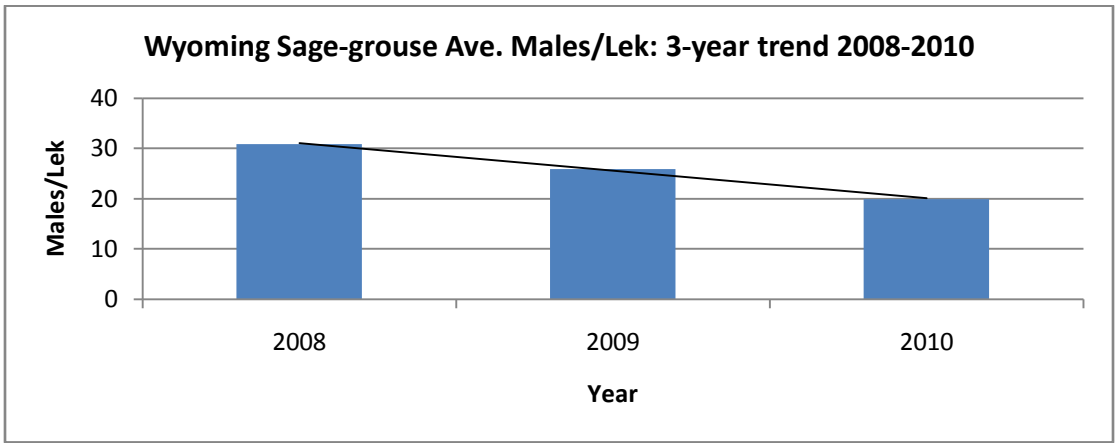
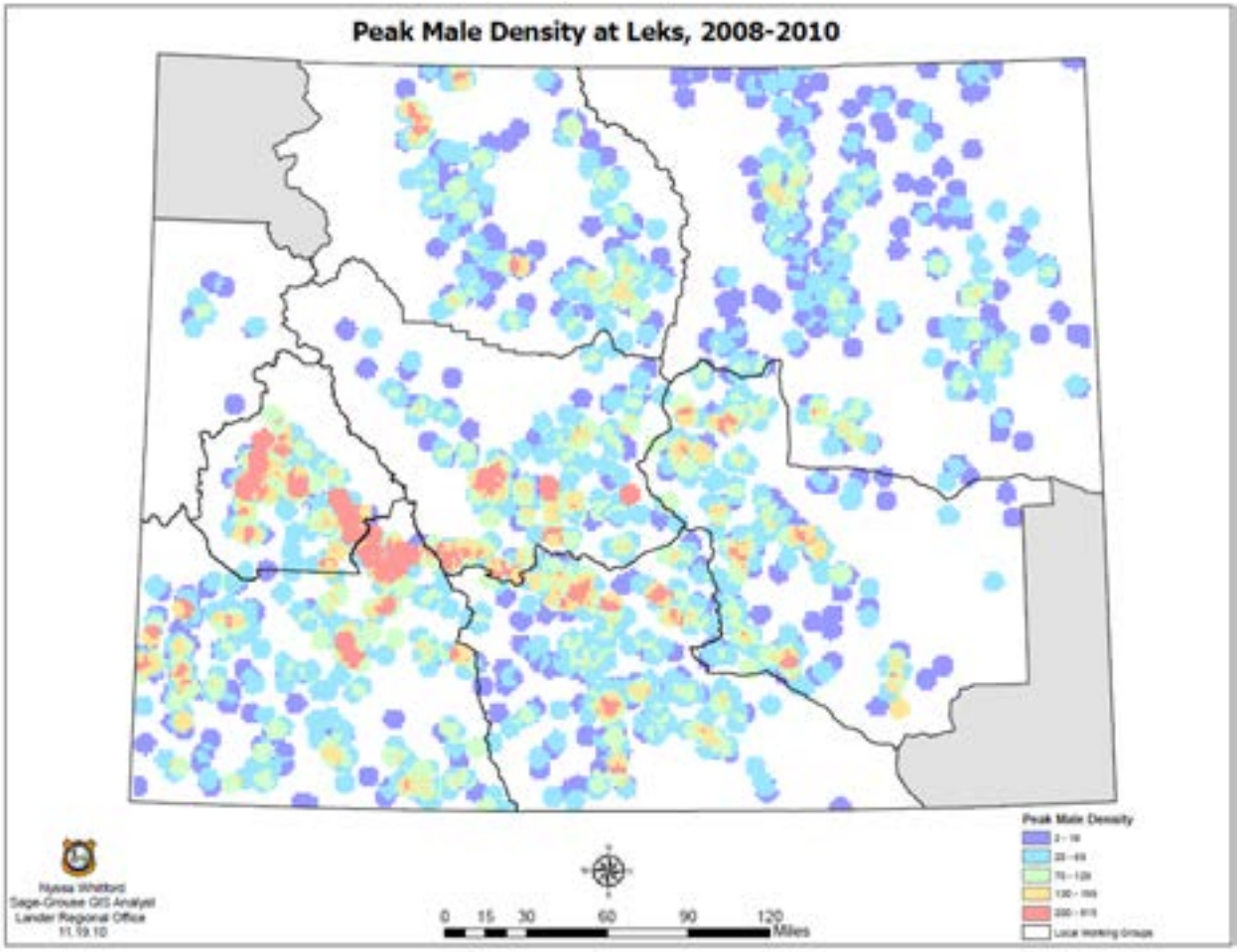


Figure 7. Average number of males per lek observed on leks in Wyoming from 2008-2010 with trend line.



Figures 8. Relative sage-grouse density based on peak male lek counts and surveys 2008-2010.

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 cycle, 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.

The following is an excerpt from "*Greater Sage-grouse Population Trends: An Analysis of Lek Count Databases 1965-2007*" prepared by the WAFWA Sage- and Columbian Sharp-tailed Grouse Technical Committee in July 2008 and provided to the U.S. Fish & Wildlife Service for

use in their ESA listing decision: "Wyoming showed similar trends to those at the range-wide and management zone levels. Average maximum males per lek and median maximum males per lek consistently declined from 1965-1969 to 1990-1994 and increased slightly between the period from 1994-1999 and 2000-2004. Both the mean and median males/lek increased sharply in the last period of record (2005-2007), approaching values seen in the 1970s but still fell short of the values reported for the 1965-1969 period. Overall, lek size decreased from 49.1 per lek in 1965-1969 to a low of 19.9 males per lek in 1990-1994 and increased to 37.9 in 2005-2007. Trend analysis showed a measurable decrease for the long-term and 1965-1985 period but no detectable trend could be identified for the 1986-2007 analysis period."

The trends reflected by this analysis are generally consistent with that shown in Figure 3 as well as the analysis conducted for the 2004 WAFWA *Conservation Assessment of Greater Sage-Grouse and Sagebrush Habitats.*

Hunting season and harvest

As a result of concerns about the issue of hunting and its impact to sage-grouse a white paper was prepared in 2008 (Christiansen 2008), presented to the WGF Commission and distributed through the WGF web page. The science and public policy basis for managing sage-grouse harvest in Wyoming are covered in detail within that document.

No major changes were made to the 2009 hunting season (Figure 9,Table 1) compared to 2008.

Area	Season Dates	Daily/Poss. Limits	Falconry
1	Sept. 19-Sept. 30	2/4	Sept. 1-Mar. 1
2, 3	Closed	Closed	Closed
4	Sept. 19-Sept. 25	2/4	Sept. 1-Mar. 1

Figure 9 and Table 1. 2009 sage-grouse hunting season map and regulations.

Hunting seasons in Wyoming are shown in JCR Data Table 4a. 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 and has remained very conservative since that time. Two areas, eastern Wyoming and the Snake River Drainage in northwest Wyoming are closed to sage-grouse hunting (Figure 9).

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 generally increased sage-grouse numbers. Low reproduction in 2006 and 2007, resulted in a 22% decline in reported harvest between 2005 and 2007. Hunter numbers also declined during this period but by only 10%. Hunter numbers were stable between 2008 (4,745) and 2009 (4,732) but harvest actually increased by 8% from 10,302 to 11,162 in spite of what lek counts suggest is a declining population. These changes are not meaningful at the statewide scale and likely reflect field conditions during the hunt. The 2009 harvest data are near the 10-year averages.

The number of sage-grouse wings collected from hunters increased by 18% in 2009, a somewhat larger proportional increase than total harvest. In 2009, 2,550 wings were collected (JCR Table 5), which is about 23% of the estimated harvest. This is very near the 10-year average of 20%.

The 2009 chick:hen ratio (based on harvested wing analysis) was 1.1 chicks per hen (JCR Table 5). This level of productivity is typically associated with a declining population. This is consistent with the 2010 lek data (all lek checks), which indicated a 21% decrease in the average numbers of males on leks (Table 2). 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 and .8:1 in 2007, the average males:lek decreased 20% and 16% respectively. 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.

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%
2007	0.8	-16%
2008	1.5	-16%
2009	1.1	-21%

Table 2. Potential influence of chick production, based on wings from harvested birds, on population trend as measured by male lek attendance.

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 dependent on the current year's precipitation. Weather and climate have been linked to sage-grouse population trends (Heath et al. 1997). Most of the Local Conservation Planning Area JCRs include sections on weather and sage-grouse relationships. In general spring precipitation is positively linked to chick:hen ratios, which are in turn, linked to the following year's lek counts of males. However, periods of prolonged cold, wet weather may have adverse effects on hatching success, plant and insect phenology and production and chick survival. Untimely late winter storms in May and early June 2009 may have contributed to reduced nesting success and chick survival. Efforts to quantify/qualify these effects in a predicable fashion over meaningful scales have largely failed.

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 USGS, BLM, WGF, the Wyoming Geographic Information Science Center (WYGISC) of the University of Wyoming and others.

CONSERVATION STRATEGIES

Governor's Core Area Policy and Executive Order

In an unprecedented move to coordinate sage grouse conservation efforts across the State of Wyoming, Gov. Dave Freudenthal released an executive order (Attachment A) on Aug. 1, 2008 that requires state agencies to work to maintain and enhance greater sage grouse habitat in Wyoming. The executive order was based on the recommendations of the Governor's Sage-Grouse Implementation Team whose efforts were described in last year's JCR and in Attachment A. The SGIT's top priority called for extensive statewide mapping of sage grouse habitats. The mapping efforts resulted in a sage-grouse density and sage-grouse core management area maps (Figure 10) upon which the state's core area strategy is based. Following the release of the new "warranted but precluded" listing decision by the Service, the Governor reconvened the SGIT to revise and update the CAS, a process that is currently underway.

Communications between the Governor's Office, WGFD and the U.S. Fish and Wildlife Service have resulted in wind energy development being discouraged/prohibited from sage-grouse Core Population Areas unless and until it can be demonstrated such activity will not cause sage-grouse population declines.

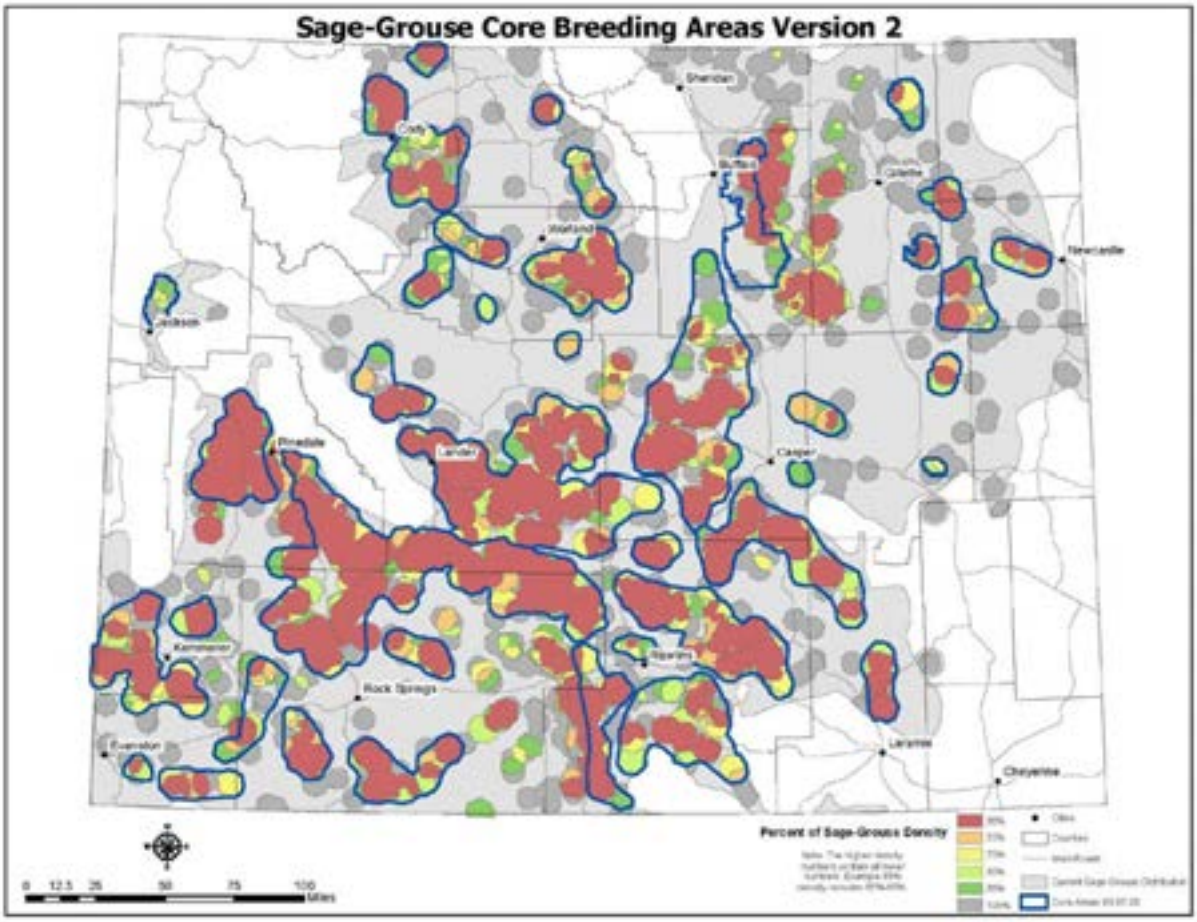


Figure 10. Sage-grouse Implementation Team Core Area map based on 2005-2007 lek counts, and a 4-mile nesting habitat buffer and known management activities such as natural gas developments.

Conservation Planning

In 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's eight LWGs all submitted final conservation plans between 2006 and 2008. All of the plans went through a public review process prior to being finalized.

From 2005-2009, Local Working Groups were allocated approximately $2.5 million to support implementation of local sage-grouse conservation projects. The source of this funding was the State of Wyoming General Fund as requested by Governor Freudenthal and approved by the legislature. Ninety-eight (98) projects were implemented, most of which included multiple cost-sharing partners. Projects include habitat treatments/restoration, improved range management infrastructure and grazing management plans, applied research, inventories, monitoring and public outreach. See Attachment B for a list of these projects.

The 2010 Legislature approved the 2011-2012 biennium General Fund budget which includes another $1.2 million for local projects. Allocation of these funds will begin after July 1, 2010.

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 2008-2009 are shown in Attachment C.

Statewide USFWS Candidate Conservation Agreement with Assurances (CCAA)

A mechanism to achieve the goals of the statewide sage-grouse conservation effort is development of statewide agreements (Candidate Conservation Agreements with Assurances (CCAA), Candidate Conservation Agreements (CCA), Memoranda of Agreement (MOA) and incentives to insure management actions on private and public lands will continue in a manner that is ecologically, economically, and culturally sustainable. These agreements provide a means for conserving species through proactive conservation measures that reduce the potential for additional regulatory requirements that result when species become listed as threatened or endangered. Currently, a CCAA and a CCA are being developed cooperatively by local, state, and federal resource agencies that will provide assurances or reduce the potential for additional regulatory requirements for Wyoming ranch operations in the event that the sage grouse is listed under ESA.

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 and theses that describe the disease and its potential impact

to sage-grouse populations (Doherty 2007, Naugle et al. 2004, Naugle et al. 2005, Walker et al. 2004, Walker et al. 2007a, Zou et al. 2006).

Monitoring efforts in 2009 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.

Results of the monitoring efforts in 2009 suggest WNv activity and mortality were not significant in Wyoming as only one confirmed WNv mortality was documented. This was a telemetered bird in Johnson County associated with sage-grouse response to gas development impacts study being conducted by Big Horn Environmental Consultants, who also studied methods to reduce the incidence of WNv (Big Horn Environmental Consultants 2009).

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 four peer-reviewed manuscripts based on Wyoming research were published (Bui et al. 2010, Copeland et al. 2009, Harju et al. 2010 and Holloran et al. 2010).

On-going research examining energy development impacts to sage-grouse and sage-grouse habitat include University of Wyoming research on the effects of natural gas development in the Atlantic Rim area of Carbon County. The University of California-Davis is also continuing their research specifically designed to assess the effects of noise generated by natural gas development on sage-grouse. Various industry consultants are conducting similar efforts.

The results of these research efforts inform and guide management actions where energy development occurs in sage-grouse habitat. In the last year the WGF updated its recommendations for oil and gas development in crucial wildlife habitats (Wyoming Game and Fish Department 2010) and the Wyoming BLM issued a sage-grouse habitat management instruction memorandum (Bureau of Land Management 2009).

Grazing Management

A group of range and wildlife scientists and managers has prepared a document titled, *"Greater Sage-Grouse Habitat and Livestock Grazing Management with Emphasis on Nesting and Early Brood-Rearing"* (Cagney et al. 2010). This peer-reviewed document is now being distributed as a University of Wyoming Extension Bulletin.

Habitat Treatment

Some natural resource professionals promote using different types of treatments to reduce sagebrush cover in order to increase resiliency of sagebrush-grassland habitats to wildfire, improve forage for livestock grazing, diversify age-structure of sagebrush, reduce "decadent" stands of big sagebrush, and enhance sage-grouse habitat. These treatments include prescribed fire, mechanical alterations, herbicide applications and intensive, short-duration livestock

grazing. Research, monitoring and anecdotal observations suggest that treatments can result in beneficial, benign or harmful impacts to sage-grouse habitat depending on many known and unknown factors. Thus the topic is controversial within the profession and is a research and policy focus (WAFWA 2009 and references therein). As part of the current sage-grouse core area strategy revision process, new policy will be developed in the coming year to address this issue.

PAST RESEARCH/STUDIES

See Attachment D.

MANAGEMENT RECOMMENDATIONS

1) Implement Governor Freudenthal's Sage-Grouse Executive Order and Core Area Strategy.

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

3) Implement local conservation plans in all 8 planning areas.

4) Upgrade the sage-grouse database and Job Completion Report software to an internet application in order to reduce errors and increase efficiency.

5) 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.

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

7) 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.

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Attachment A:

DAVE FREUDENTHAL
GOVERNOR

THE STATE OF WYOMING

STATE CAPITOL
CHEYENNE, WY 82002

Office of the Governor

STATE OF WYOMING
EXECUTIVE DEPARTMENT
EXECUTIVE ORDER

Order 2008-2

GREATER SAGE-GROUSE CORE AREA PROTECTION

WHEREAS the Greater Sage-Grouse (*Centrocercus urophasianus*) is an iconic species that inhabits much of the sagebrush-steppe habitat in Wyoming; and

WHEREAS the sagebrush-steppe habitat type is abundant across the state of Wyoming; and

WHEREAS the state of Wyoming currently enjoys robust populations of Greater Sage-Grouse; and

WHEREAS the state of Wyoming has management authority over Greater Sage-Grouse populations in Wyoming; and

WHEREAS the U.S. Department of the Interior has been petitioned to list the Greater Sage-Grouse as a threatened or endangered species in all or a significant portion of its range, including those populations in Wyoming; and

WHEREAS the listing of the Greater Sage-Grouse would have a significant adverse affect on the custom and culture of the state of Wyoming; and

WHEREAS the listing of the Greater Sage-Grouse would have a significant adverse affect on the economy of the state of Wyoming, including the ability to generate revenues from state lands; and

WHEREAS the Wyoming State Legislature has appropriated significant state resources to conserve Greater Sage-Grouse populations in Wyoming; and

WHEREAS the state of Wyoming has endeavored to conserve Greater Sage-Grouse populations in order to retain management authority over the species through its statewide sage grouse working group, local sage grouse working groups and the efforts and initiatives of private landowners and industry; and

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WHEREAS the Governor's Sage Grouse Implementation Team developed a "Core Population Area" strategy to weave the many on-going efforts to conserve the Greater Sage-Grouse in Wyoming into a statewide strategy; and

WHEREAS on April 17, 2008, the Office of the Governor requested that the U.S. Fish and Wildlife Service review the "Core Population Area" strategy to determine if it was a "sound policy that should be moved forward"; and

WHEREAS on May 7, 2008, the U.S. Fish and Wildlife Service responded that the "core population area strategy, as outlined in the Implementation Team's correspondence to the Governor, is a sound framework for a policy by which to conserve greater sage-grouse in Wyoming".

NOW, THEREFORE, pursuant to the authority vested in me by the Constitution and Laws of the State, and to the extent such actions are consistent with the statutory obligations and authority of each individual agency, I, Dave Freudenthal, Governor of the State of Wyoming, do hereby issue this Executive Order providing as follows:

1. Management by state agencies should, to the greatest extent possible, focus on the maintenance and enhancement of those Greater Sage-Grouse habitats and populations within the Core Population Areas identified by the Sage Grouse Implementation Team and modified through additional habitat and population mapping efforts.
2. Current management and existing land uses within Core Population Areas should be recognized and respected by state agencies.
3. New development or land uses within Core Population Areas should be authorized or conducted only when it can be demonstrated by the state agency that the activity will not cause declines in Greater Sage-Grouse populations.
4. Funding, assurances (including state-conducted efforts to develop Candidate Conservation Agreements and Candidate Conservation Agreements with Assurances), habitat enhancement, reclamation efforts, mapping and other associated proactive efforts to assure viability of Greater Sage-Grouse in Wyoming should be focused and prioritized to take place in Core Population Areas.
5. State agencies should use a non-regulatory approach to influence management alternatives within Core Population Areas, to the greatest extent possible. Management alternatives should reflect unique localized conditions, including soils, vegetation, development type, climate and other local realities.
6. Incentives to enable development of all types outside Core Population Areas should be established (these should include stipulation waivers, enhanced permitting processes, density bonuses, and other incentives). However, such development scenarios should be designed and managed to maintain populations, habitats and essential migration routes outside Core Population Areas.

7. Incentives to accelerate or enhance required reclamation in habitats adjacent to Core Population Areas should be developed, including but not limited to stipulation waivers, funding for enhanced reclamation, and other strategies.
8. Existing rights should be recognized and respected.
9. On-the-ground enhancements, monitoring, and ongoing planning relative to sage grouse and sage grouse habitat should be facilitated by sage grouse local working groups whenever possible.
10. Fire suppression efforts in Core Population Areas should be emphasized, recognizing that other local, regional, and national suppression priorities may take precedent. However, public and firefighter safety remains the number one priority on all wildfires.
11. State agencies work collaboratively with the U.S. Fish and Wildlife Service, Bureau of Land Management, U.S. Forest Service, and other federal agencies to ensure, to the greatest extent possible, a uniform and consistent application of this Executive Order to maintain and enhance Greater Sage-Grouse habitats and populations.
12. State agencies shall work collaboratively with local governments and private landowners to maintain and enhance Greater Sage-Grouse habitats and populations in a manner consistent with this Executive Order.

Given under my hand and the Executive Seal of the State of Wyoming this 1st day of August, 2008.

Dave Freudenthal
Governor

Attachment B:
Wyoming Sage-Grouse Projects Supported with 2005-2010 General Fund Budgets

Project Name	Local Working Group	Total Cost	SG $	Project Description	Status
1 - Martin Ranch Range Improvement (phase I) also see # 21	Bates Hole/ Shirley Basin	$43,290 (multiyear)	$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	Bates Hole/ Shirley Basin	$94,590 (multiyear)	$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	Bighorn Basin	$20,000	$10,000 requested/approved, $8,150 spent	Spring development and protection.	Complete
4 - Heart Mtn SG Habitat Enhancements	Bighorn Basin	$105,000	$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	Bighorn Basin	$26,000	$15,000 requested/approved; $14,493 spent	Mosaic sagebrush mowing and fenced forb seedings.	Complete
6 - Jackson Hole Plant Species Composition & Structure	Jackson Hole	$65,450	$26,250 requested/approved/spent	GIS sage-grouse winter habitat inventory and monitoring.	Complete
7 - DeSmet Conservation District Community-Based Approach to Restore Sagebrush (also see #31 & 72)	Northeast	$1,097,054 (multiyear)	$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	Northeast	$860,000 (multiyear)	$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	South-Central	$40,000	$20,000 requested/approved; $19,996.85 spent	Spring development and protection.	Complete

Wyoming Sage-Grouse Projects Supported with 2005-2010 General Fund Budgets

Project Name	Local Working Group	Total Cost	SG $	Project Description	Status
10 - Seminoe Allotment Water Developments	South-Central	$13,000	$6,500 requested/approved/spent	Spring development and protection.	Complete
11 - Carbon County Seeding	South-Central	$4,000	$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	Southwest	$2,600	$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	Southwest	$15,000	$5,000 requested/approved/spent	Invasive/noxious weed control.	Complete
14 - Rock Creek Prescribed Burn	Southwest	$150,000	$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	Southwest	$4,000	$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	Upper Green River	$235,739	$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.	Upper Green & Wind River/ Sweetwater River	$149,320	$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	Upper Green River	$94,260	$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

Wyoming Sage-Grouse Projects Supported with 2005-2010 General Fund Budgets

Project Name	Local Working Group	Total Cost	SG $	Project Description	Status
19 - Government Draw SG Habitat Improvement	Wind River/ Sweetwater	$32,500	*0	Habitat treatments using mower and Lawson aerator. Proposal requested funding for contracting the equipment and labor. * - With the purchase of the mower, WGF will conduct the mowing and therefore contracting will not be required.	Complete
20 - John Deere CX20 Rotary Cutter	Wind River/ Sweetwater	$22,149	$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
		2005-2006 Total	**~$425,000 approved**		
21 - Martin Ranch Range Improvement (phase II)	Bates Hole/ Shirley Basin	$26,000	$14,000 requested/approved; $10,825.71 spent	Fence construction to implement 3 pasture rotation grazing system and mosaic prescribed fire (continuation of project #1 above).	Complete
22 - 3-Man Ranch Upland Habitat Improvement	Bates Hole/ Shirley Basin	$100,600	$13,944 requested/approved/spent	Water development and fencing to facilitate rest-rotation grazing system	Complete
23 - L3 Cattle Co. fence and spring development	Bates Hole/ Shirley Basin	$21,190	$5,297.50 requested/approved; $5,193.88 spent	Water development and fencing to facilitate deferred-rotation grazing system	Complete
24 - M&D Land Wildlife Inventory	Bates Hole/ Shirley Basin	$54,172	$10,500 requested/approved; $10,302.54 spent	Wildlife surveys, range surveys & management consultation	Complete
25 - Schnoor/Flat Top Big Sagebrush Restoration	Bates Hole/ Shirley Basin	$161,550 (multiyear)	$18,305 requested/approved/spent	LWG $ to apply Plateau herbicide to cheatgrass infested areas. Other mechanical, chemical and RX fire to be used to restore big sage communities.	Complete/ On-going
26 - North Butte Guzzler	Big Horn Basin	$140,000 (multiyear)	$12,000 requested/approved; $11,968.86 spent	One of 12 guzzlers to be installed over a period of 5 years	Complete

Wyoming Sage-Grouse Projects Supported with 2005-2010 General Fund Budgets

Project Name	Local Working Group	Total Cost	SG $	Project Description	Status
27 - Big Horn Basin Land Cover Mapping	Big Horn Basin	$108,000	$30,000 requested/approved/spent	Refined land cover/habitat mapping based on Landsat images.	Complete/ On-going
28 - Bentonite Reclamation Trials	Big Horn Basin	$35,000	$40,000 requested/approved; $39,986.60 spent	Experimentally establish portable irrigation systems to reclaim mined areas w/ sagebrush.	Complete
29 - Emblem Bench/ Table Mtn Habitat Enhancement	Big Horn Basin	$18,000	$2,500 requested/approved; $2,498.37 spent	Sagebrush mowing and grass/forb seeding.	Complete
30 - Jackson Hole Sage-Grouse Demographic Study (also see #75)	Jackson Hole	$504,269 (multiyear)	$62,000 requested/approved/spent	Research to define population demographics and habitat use via VHF and GPS telemetry.	Complete/ On-going
31 - Lake DeSmet CD Habitat Enhancement (also see #7 & 72)	Northeast	$2.4 million (multiyear)	$85,000 requested; $27,400 approved/spent	Habitat restoration, development/implementation of grazing and CBM BMPs, habitat mapping, landowner outreach. Continuation of multi-year project.	Complete/ On-going
32 - Thunder Basin Grassland land cover mapping	Northeast	$250,000 (multiyear)	$45,000 requested/approved; $44,999.24 spent	Land cover/habitat mapping via analysis of remote sensing data.	Complete
33 - 4W Ranch habitat enhancement and monitoring	Northeast	$32,400	$32,400 requested; $16,200 approved; $13,990 spent	Water development and ranch friendly sg monitoring system development.	Complete
34 - Impacts of Energy Development on SG	Northeast	$90,000	$30,000 requested/approved/spent	Research continuing to document impacts of CBNG development to sg.	Complete
35- Stratton research site - assessing grazing and prescribed fire effects.	South-Central	$116,000 (multiyear)	$72,000 requested; $57,000 approved/spent	Research to assess the effects of prescribed fire and grazing management to sg. See also #68.	Complete/ On-going
36- 16-Mile/Atlantic Rim 2007 water projects II	South-Central	$30,000	$10,000 requested/approved; $7,310 spent	Continuation of project #9 above. Spring development and protection.	Complete

Wyoming Sage-Grouse Projects Supported with 2005-2010 General Fund Budgets

Project Name	Local Working Group	Total Cost	SG $	Project Description	Status
37 - Atlantic Rim SG study Phase 1	South-Central	$90,000	$40,000 requested/approved; $36,895.70 spent	Define sg distribution to use as pre-treatment data within natural gas development area. See also #82 & 91.	Complete/ On-going
38 - Red Rim Water Development	South-Central	$48,260	$10,000 requested/approved	Water development to facilitate use of the project area as a grassbank.	Complete
39 - Exclosure & Guzzler maintenance	Southwest	$42,000	$20,000 requested/approved/spent	Monitoring and maintenance of 35 range exclosures and 11 guzzlers on BLM.	Complete
40 - Belle Butte Water Development	Southwest	$132,000	$34,500 requested/approved/spent	Attach 7 wildlife guzzlers to new livestock watering pipeline.	Complete
41 - Hiawatha Aerial Surveys	Southwest	$29,100	$10,000 requested/approved; $2,262 spent	Conduct aerial surveys to document grouse distribution esp. winter and leks.	Complete/ On-going
42 - Red Canyon/ Elk Mtn Rx Burn	Southwest	$300,000	$30,000 requested/approved/spent	Prescribed fire to improve upland plant communities.	Complete
43 - Raven/SG study	Upper Green River	$336,250 (multiyear)	$55,000 requested/approved/spent	Raven ecology study to determine effects to sg.	Complete/ On-going
44 - Lander Front Habitat Improvement	Wind River/ Sweetwater River	$479,700 (multiyear)	$30,000 requested/approved/spent	Various habitat treatments over a large landscape. LWG $ to fund juniper removal.	Complete/ On-going
45 - RB Keith Ranch Wildlife Inventory	Wind River/ Sweetwater River	$37,527	$11,500 requested; $6,250 approved/spent	Wildlife & range surveys to determine conservation needs. Also see #97.	Complete
46 - Examining Noise Effects from Energy Devel. Also see #17 & 77.	Wind/ Sweetwater, Upper Green and Northeast	500,000+ (multiyear)	$78,028 requested; $71,615 approved/spent	Continuing research examining the effects of noise resulting from energy exploration and development	Complete/ On-going
47 - Water trough escape ramps on private land	Statewide	$192,000	$36,000 requested/approved	Provide pre-fab wildlife escape ramps, fence collision deterrents and spring protection fencing to private landowners throughout the state.	On-going

Wyoming Sage-Grouse Projects Supported with 2005-2010 General Fund Budgets

Project Name	Local Working Group	Total Cost	SG $	Project Description	Status
48 - Twin Creek Monitoring Project	Wind River/ Sweetwater River	$8,200	$6,400 requested/approved; $4,960 spent	Monitor vegetation response to grazing management incl. stocking rate, time/timing and longer recovery periods.	Complete
49 - SG Seasonal Habitat and mitigation planning (continuation of project #16)	Upper Green River	$639,790	$25,311.50 requested/approved/spent	Research documenting pre-development/baseline seasonal distribution of sage grouse.	Complete
50 - Rawlins Winter Flights	South-Central	$7,000	$7,000 requested/approved/spent	Document sg winter distribution during harsh winter	Complete
51 - Hiawatha SG Habitat Mapping	Southwest	$417,120	$30,000 requested/approved, $29,634.35 spent	Develop high-resolution seasonal sg habitat maps to help determine energy development influence.	Complete
52 - Peterson Spring Protection (see also #94)	Southwest	$24,480	$17,280 requested, $8,500 approved, $8,194 spent	Develop and protect 3 springs to provide wildlife and livestock water but protect the source from livestock degradation	Complete
53 - SG Education and Community Outreach	Bates Hole - Shirley Basin	$23,000	$13,000 requested/approved/spent	Develop and administer sage-grouse conservation educational programs in the Casper area.	Complete
54 - Western Natrona County Sage-Grouse Study	Bates Hole - Shirley Basin	$133,822	$7,210 requested/approved/spent	Seasonal distribution and habitat use for land use planning along with parasite/disease assay	Complete/ On-going
55 - M & D Land Company Water Development	Bates Hole - Shirley Basin	$18,560	$7,425 requested/approved, $4,000 spent	Water development to facilitate grazing plan implementation (dry hole - unsuccessful)	Complete
56 - Shook Ranch Range Improvement	Bates Hole - Shirley Basin	$70,000	$10,000 requested/approved/spent	Prescribed fire in mountain big sage, developing and protecting water sources, installing a cross fence and implementing rotational grazing system	Complete
57 - Hat-Six Ranch Riparian Buffer	Bates Hole - Shirley Basin	$18,200	$11,600 requested/approved, $9,936.55 spent	Fencing riparian buffer to enhance riparian habitat, reduce erosion and improve brood-rearing use by sg.	Complete
58 - McCullough Peaks HMA Waters and Healthy Rangelands	Big Horn Basin	$360,000	$20,000 requested, $8,434 approved	Develop rangeland water and fenced overflow green strips to improve grazing management and provide sg forage.	Complete

Wyoming Sage-Grouse Projects Supported with 2005-2010 General Fund Budgets

Project Name	Local Working Group	Total Cost	SG $	Project Description	Status
59 - Big Horn Basin Habitat Treatment Research (also see #80)	Big Horn Basin	$34,000	$34,000 requested/approved/spent	Research to quantify and qualify the effects of sagebrush treatments, especially mowing, to sage-grouse habitat	On-going
60 - Westslope Juniper Removal	Big Horn Basin	$27,000	$6,066 requested/approved/spent	Remove junipers encroaching on sagebrush habitat with chainsaws and/or Gyrotrac machines.	Complete/ On-going
61 - Jonah Interagency Office Veg Baseline	Upper Green River Basin	$400,000	$33,875 requested/approved/spent	Baseline inventory of vegetation within JIO focus areas to assist in natural gas development mitigation planning	Complete/ On-going
62 - Raven Brochure	Upper Green River Basin	$2,000	$2,000 requested/approved/spent	Postcard mailed to 5,000 Sublette Co. residents encouraging them to reduce sources of artificial food sources for ravens.	Complete
63 - Winter Range Signs	Upper Green River Basin & Southwest	$6,000	$3,000 requested/approved/spent	Improve effectiveness of existing public land big game and sage grouse winter range closures via new signing.	Complete
64 - Lander SG Flights	Wind River/ Sweetwater River	$6,000	$6,000 requested/approved, $3,795 spent	Flights to document sage-grouse winter distribution and lek locations	Complete
65 - Mower Maintenance	Wind River/ Sweetwater River	$2,750	$2,750 requested/approved, $2,729.39 spent	Maintain mower in order to conduct habitat projects, esp the Government Draw Project (see #20).	Complete
66 - HWA Lysite Study	Wind River/Sweetwater River	$1,305,800	$30,000 requested, $24,900 approved/spent	Sage-grouse distribution and habitat use study to determine appropriate stipulations for natural gas development.	Complete/ On-going
67 - NE Grazing Workshops	Northeast	$7,000	$5,000 requested/approved, $4,975.42 spent	4 grazing/range mgt workshops to be held in Campbell, Crook and Weston Counties by Dr. Roy Roath.	Complete
		2007-2008 Total	**~1,000,000 approved**		
68 - Stratton Research site phase 2 (see #35)	South-Central	$83,300	$58,300 requested/approved	Assess the effects of grazing timing within prescribed burns	On-going
69 - Horse Creek Weed Control	Upper Green River Basin	$22,624	$10,264 requested; $5,000 approved	Chemical control of noxious weeds within a wildfire area	Complete

Wyoming Sage-Grouse Projects Supported with 2005-2010 General Fund Budgets

Project Name	Local Working Group	Total Cost	SG $	Project Description	Status
70 - Northeast Grazing Workshops 2	Northeast	$7,000	$5,500 requested/approved	3 grazing/range mgt workshops to be held in Johnson, Campbell and Weston Counties by Dr. Roy Roath	Complete
71 - Determining characteristics of sage-grouse habitat relative to Ecological Site Descriptions	Upper Green River Basin	$317,589	$99,822 requested/approved	Research project to determine characteristic of nesting and early brood-rearing habitat relative to NRCS Ecological Site Descriptions	On-going
72 - Lake DeSmet Project Phase III-IV (see #7 & 31)	Northeast	$150,500	$47,300 requested/approved	Habitat restoration, development/implementation of grazing and CBM BMPs, habitat mapping, landowner outreach. Continuation of multi-year project (#7 & 31).	Complete On-going
73 - Cross Lazy 2 Conservation Easement	Upper Green River Basin	$3,040,000	$100,000 requested/approved	Conservation easement	Complete
74 - Weston-Niobrara Grouse Study	Northeast	$150,000	$60,000 requested/approved	Telemetry study to determine habitat use and movement on eastern fringe of sage-grouse range	On-going
75 - Jackson Hole Sage-Grouse Population Demographics (see #30)	Upper Snake River Basin	$461,731 (multiyear)	$100,000 requested/approved	Telemetry study to determine habitat use, movement and population demographics in Jackson Hole	On-going
76 - Analyzing NRCS Ecological Site Description (ESD) as a tool for inventorying potential sg nesting habitat	Northeast	$18,500	$14,000 requested/approved	Research comparing known nesting sites to NRCS Ecological Site Descriptions.	Complete
77- Developing a program to predict noise energy development noise impacts to sage-grouse	Wind River/ Sweetwater River; Northeast; Upper Green River Basin	$500,000+ (multiyear)	$51,205 requested/approved	Utilize research results from projects #17 & 46 above to develop a computer program to predict energy development noise impacts to lekking sage-grouse	On-going

Wyoming Sage-Grouse Projects Supported with 2005-2010 General Fund Budgets

Project Name	Local Working Group	Total Cost	SG $	Project Description	Status
78 - Field evaluation of larvivorous fish for mosquito management in the Powder River Basin	Northeast	$31,730	$26,730 requested/approved	Field test of Plains Killifish and/or Fathead Minnows to control West Nile virus vector mosquito larvae	Complete
79 - Big Horn Mountain Sage-Grouse Distribution Study	Northeast	$36,000	$10,000 requested/approved	Telemetry study to determine potential linkage between populations on either side of the Big Horn Mountains	Complete
80 - Big Horn Basin Habitat Treatment research Phase II	Big Horn Basin	$134,959	$59,595 requested/approved	Continuation of project #59	On-going
81 - Spellman Ranch Range Improvement	Northeast	$48,350	$12,500 requested/approved	Fencing, water development and consultation to improve range management	Complete
82 - Identifying habitats for sage-grouse persistence within the Atlantic Rim coalbed methane field	South-Central	$448,090	$56,590 requested/approved	Telemetry study to determine habitat use in the context of energy development. Uses info from projects #37 & 91.	On-going
83 - Shell Valley salt cedar & Russian olive control	Big Horn Basin	$1,672,700 (multiyear)	$44,000 requested/approved	Mechanical and chemical treatment of salt cedar and Russian olive	Complete
84 - Simpson Ridge wind energy impacts study	Bates Hole - Shirley Basin	$655,000	$22,750 requested/approved	Research to determine impacts of wind energy development to sage-grouse	On-going
85 - Grazing Management Assistance	Bates Hole - Shirley Basin	$5,000	$5,000 requested/approved	Small group or 1:1 grazing management assistance from Dr. Roy Roath to landowners	Complete
86 - Black Mountain Sagebrush Restoration	Big Horn Basin	$107,000	$70,000 requested, $60,000 approved	Sagebrush transplants into wildfire area using technology developed by project #28.	On-going
87 - South highway water project	Big Horn Basin	$120,000	$24,000 requested, $20,000 approved	Pipeline, storage and stock tanks to improve grazing management	Complete
88 - Northeast Grazing Management Assistance	Northeast	$25,600	$12,000 requested/approved	Small group or 1:1 grazing management assistance from Dr. Roy Roath to landowners	Complete

Wyoming Sage-Grouse Projects Supported with 2005-2010 General Fund Budgets

Project Name	Local Working Group	Total Cost	SG $	Project Description	Status
89 - Thunder Basin Grasslands core area habitat rehabilitation	Northeast	$86,500	$25,400 requested, $17,500 approved	Aerial application of Plateau herbicide to control cheatgrass and drilling of one water well	Complete
90 - Multi-species habitat enhancement	Northeast	$50,000	$10,000 requested/approved	Improved riparian management via fence removal/replacement and upland water development	Begin Summer 09
91 - Atlantic Rim Flights Phase II (see #37)	South-Central	$484,022	$20,000 requested/approved	Continuation of project #37; also in partnership with project #82	On-going
92 - Buck Draw Solar Well	South-Central	$13,000	$6,500 requested, $3,000 approved	Convert existing generator powered well to solar power and replace tanks and pipelines	Complete
93 - Red Mountain CRM seeding	South-Central	$282,650	$10,500 requested, $5,000 approved	Reseed sagebrush treatment areas with forb rich seed mix to improve diversity and sage-grouse habitat; remove encroaching conifers, wet meadow protection	On-going
94 - Petersen Ranch Project Phase II (see #52)	Southwest	$19,500	$9,000 requested, $3,500 approved	Spring protection and water development	Complete
95 - Kelly Hayfields restoration	Upper Snake River Basin	$120,945	$65,045 requested, $50,000 approved	Restore native vegetation to abandoned smooth brome hayfields	On-going
96 - Beaver Creek invasive vegetation control (another phase of #44)	Wind River/ Sweetwater River	$290,388	$20,000 requested, $10,000 approved	Mechanical and chemical treatment of juniper, salt cedar and Russian olive	Complete On-going
97 - Keith Ranch Water Development and Grazing Mgt	Wind River/ Sweetwater River	$165,266	$27,000 requested, $20,000 approved	Water development and grazing management plan development. Also see #45.	On-going
98 - Seasonal Habitat Mapping	Statewide	$352,000	$155,000 requested, $141,000 approved	Use predictive habitat models to produce sage-grouse seasonal habitat maps	On-going
		2009-2010 Total	**~$1,100,000 approved**		
		2005-2010 Grand Total	**~$2,525,000 approved**		

Attachment C.

Goals from the WY Greater Sage-grouse Conservation Plan (2003) addressed by WGFD in 2009-10.

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: 684 leks were monitored at the intensity required to be "count" leks.
Status: Spring 2010 males/count lek = 20

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

Action: 684 leks were monitored at the intensity required to be "count" leks.
Status: Spring 2010 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: Spring 2010 occupied leks = 1,899

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

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

Action: Participation in the update of Connelly et al. 2004 into a peer-reviewed publication as a Studies in Avian Biology monograph. Participation included providing data and lead in authoring the disease chapter.
Status: Pre-publication draft provided to the Service for use in the listing decision. Final publication is in press.

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: Member of Western Association of Fish & Wildlife Agencies Sage-Grouse Technical Team which coordinates this task across the range.
Status: On-going, continuous.

Action: Implement consistent lek monitoring, data storage and reporting across the state via written protocol, a statewide database and annual job completion reports.
Status: On-going, continuous.

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, or more conservative than, 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 significant outbreaks were documented in 2009.

Action: Authored the disease chapter of the peer-reviewed update of Connelly et al. 2004 which will be published as a Studies in Avian Biology Monograph.

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.

Action: A USGS scientist attempted to address this question with an in-depth analysis of Wyoming climate and grouse data. The scientist was unable to detect cause and affect relationships. This does not mean such relationships don't exist. Rather the relationships may be more complex than existing data can demonstrate.
Status: No additional action planned in the immediate future.

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 (although new duties associated with implementing the state's core area strategy have delayed preparation and distribution of recent statewide reports).

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

Action: See Population Goals #5-6 above.
Status: See Population Goals #5-6 above.

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

Action: Brood surveys are conducted in Northeast Wyoming and 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 is on-going.
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. A white paper on the issue was prepared and distributed in early 2008 (Christiansen 2008).
Status: On-going and continuous.

Action: Harvest surveys and wing barrels are used to collect harvest data.
Status: On-going; annual.

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 significant outbreaks were documented in 2009.

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.

Attachment D.
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.

Brown, K. G. and K. M. Clayton. 2004. Ecology of the greater sage-grouse (*Centrocercus urophasianus*) in the coal mining landscape of Wyoming's Powder River Basin. Final Technical Report. Thunderbird Wildlife Consulting, Inc. Gillette, WY.

Bui, T.D. 2009. The effects of nest and brood predation by common ravens (*Corvus corax*) on greater sage-grouse (*Centrocercus urophasianus*) in relation to land use in western Wyoming. M.S. Thesis. University of Washington, Seattle.

Cagney J., E. Bainter, B. Budd, T. Christiansen, V. Herren, M. Holloran, B. Rashford, M. Smith and J. Williams. 2010. Grazing influence, objective development, and management in Wyoming's greater sage-grouse habitat. University of Wyoming College of Agriculture Extension Bulletin B-1203. Laramie. Available on-line at: http://www.wyomingextension.org/agpubs/pubs/B1203.pdf

Courtemanch, A., G. Chong and S. Kilpatrick. 2007. A remote sensing analysis of sage-grouse winter habitat in Grand Teton National Park and Bridger-Teton National Forest, Wyoming.

Daniel, Jonathan. 2007. Spring precipitation and sage grouse chick survival. M.S. Thesis. Department of Statistics – University of Wyoming, Laramie.

Deibert, P. A. 1995. Effects of parasites on sage-grouse mate selection. PhD Dissertation. University of Wyoming, Laramie.

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

Doherty, M. K. 2007. Mosquito populations in the Powder River Basin, Wyoming: a comparison of natural, agricultural and effluent coal-bed natural gas aquatic habitats. M.S. Thesis. Montana State University, Bozeman.

Girard, G. L. 1937. Life history, habits, and food of the sage-grouse. University of Wyoming Publication 3. University of Wyoming, Laramie.

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

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

Hnilicka, P. and D. Skates. 2010. Movements and survival of sage-grouse on the Wind River Reservation, Wyoming. Completion Report. U. S. Fish and Wildlife Service Lander, Wyoming.

Holloran, M. J. 1999. Sage-grouse seasonal habitat use near Casper, WY. M.S. Thesis. University of Wyoming, Laramie.

Holloran, M. J. and S. H. Anderson. 2004. Greater Sage-grouse seasonal habitat selection and survival in Jackson Hole, Wyoming. Research Completion Report. University of Wyoming Cooperative Fish and Wildlife Research Unit, Laramie.

Holloran, M. J. 2005. Sage-grouse population response to natural gas field development in western Wyoming. PhD Dissertation. University of Wyoming, Laramie.

Holloran, M. J. and S. H. Anderson. 2005a. Spatial distribution of Greater Sage-grouse nests in relatively contiguous sagebrush habitats. Attachment A in Holloran 2005 PhD Dissertation. University of Wyoming, Laramie.

Holloran, M. J. and S. H. Anderson. 2005c. Greater Sage-grouse research in Wyoming: an overview of studies conducted by the Wyoming Cooperative Fish and Wildlife Research Unit between 1994 and 2005. Attachment C in Holloran 2005 PhD Dissertation. University of Wyoming, Laramie.

Holloran, M.J., R.C. Kaiser, and W.A. Hubert. 2010. Yearling greater sage-grouse response to energy development in Wyoming. The Journal of Wildlife Management 74:65-72.

Honess, R. F. and G. Post. 1968. History of an epizootic in sage-grouse. Science Monograph 14. University of Wyoming Agricultural Experiment Station, Laramie.

Jensen, B. M. 2006. Migration, transition range and landscape use by greater sage-grouse (*Centrocercus urophasianus*). M.S. Thesis, University of Wyoming, Laramie.

Johnson, G. D. 1987. Effects of rangeland grasshopper control on sage-grouse in Wyoming. M.S. Thesis, University of Wyoming, Laramie.

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

King, L. and J. Petty. 2008. Investigations of a gravity-fed supplemental irrigation system to enhance sagebrush seedling establishment on reclaimed bentonite mine lands in Wyoming's Big Horn Basin. Shell Valley Consulting Associates, Inc. Shell, WY.

King, L., E. Dunklee and J. Petty. 2009. Use of supplemental watering gels to enhance Wyoming big sagebrush establishment on Big Horn Basin bentonite reclamation. Shell Valley Consulting Associates, Inc. Shell, WY.

Klott, J. H. 1987. Use of habitat by sympatrically occurring sage-grouse and sharptailed grouse with broods. M.S. Thesis. University of Wyoming, Laramie.

Kuipers, J. L. 2004. Grazing system and linear corridor influences on Greater Sage-grouse habitat selection and productivity. M.S. Thesis. University of Wyoming. Laramie.

Lyon, A. G. 2000. The potential effects of natural gas development on sage grouse near Pinedale, Wyoming. M.S. Thesis, University of Wyoming, Laramie.

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

Rothenmaier, D. 1979. Sage-grouse reproductive ecology: breeding season movements, strutting ground attendance and site characteristics, and nesting. M.S. Thesis. University of Wyoming, Laramie.

Slater, S. J. 2003. Sage-grouse use of different aged burns and the effects of coyote control in southwestern Wyoming. M.S. Thesis. University of Wyoming, Laramie.

Thompson, K. M., M. J. Holloran, S. J. Slater, J. L. Kuipers and S. H. Anderson. 2005. Greater Sage-grouse early brood-rearing habitat use and productivity in Wyoming. Attachment B in Holloran 2005 PhD Dissertation. University of Wyoming, Laramie.

Walker, B. L. 2008. Greater sage-grouse response to coal-bed natural gas development and West Nile virus in the Powder River Basin, Montana and Wyoming, U. S. A. PhD Dissertation. University of Montana, Missoula.

Wetzel, W., G. Chong, A. Courtemanch and N. Pope. 2007. Composition and structure of sage grouse winter habitat in the Upper Snake River Basin, Wyoming.

Wyoming sage-grouse research articles published in peer-reviewed press.

Bergquist, E., P. Evangelista, T. J. Stohlgren, and N. Alley. 2007. Invasive species and coal bed methane development in the Powder River Basin, Wyoming. Environmental Monitoring and Assessment 128:381-394.

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

Copeland, H.E., K.E. Doherty, D.E. Naugle, A. Pocewicz, J.M. Kiesecker. 2009 Mapping oil and gas development potential in the US intermountain west and estimating impacts to species. PLoS ONE 4(10): e7400. doi:10.1371/journal.pone.0007400. 7 pp.

Deibert, P. A. and M. S. Boyce. 1997. Heritable resistance to malaria and the evolution of lek behaviour in sage-grouse. Wildlife Biology 3:284.

Doherty, K. E., D. E. Naugle, and B. L. Walker. 2008. Sage-grouse winter habitat selection and energy development. Journal of Wildlife Management 72:187-195.

Harju, S. M., M. R. Dzialak, R. C. Taylor, L. D. Hayden-Wing., J. B. Winstead. 2010. Thresholds and time lags in effects of energy development on greater sage-grouse populations. Journal of Wildlife Management 74:437-448.

Holloran, M. J., and S. H. Anderson. 2003. Direct identification of Northern sage-grouse, *Centrocercus urophasianus*, nest predators using remote sensing cameras. Canadian Field-Naturalist 117:308-310.

Holloran, M. J., and S. H. Anderson. 2005. Spatial distribution of greater sage-grouse nests in relatively contiguous sagebrush habitats. Condor 107:742-752.

Holloran, M. J., B. J. Heath, A. G. Lyon, S. J. Slater, J. L. Kuipers, and S. H. Anderson. 2005. Greater sage-grouse nesting habitat selection and success in Wyoming. Journal Wildlife Management 69:638-649

Johnson, G. D. and M. S. Boyce. 1990. Feeding trials with insects in the diet of sage-grouse chicks. Journal of Wildlife Management 54(1):89-91.

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Krakauer, A. H., M. Tyrrell, K. Lehmann, N. Losin, F. Goller and G. Patricelli. 2010. Vocal and anatomical evidence for two-voiced sound production in greater sage-grouse *Centrocercus urophasianus*. Journal of Experimental Biology 212:3719-3727.

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Naugle, D. E., C. L. Aldridge, B. L. Walker, T. E. Cornish, B. J. Moynahan, M. J. Holloran, K. Brown, G. D. Johnson, E. T. Schmidtmann, R. T. Mayer, C. Y. Kato, M. R. Matchett, T. J. Christiansen, W. E. Cook, T. Creekmore, R. D. Falise, E. T. Rinkes, M. S. Boyce. 2004. West Nile virus: pending crisis for Greater Sage-grouse. Ecology Letters. Volume 7, Issue 8, p. 704-713.

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Walker, B. L., D. E. Naugle, K. E. Doherty, and T. E. Cornish. 2004. Outbreak of West Nile virus in Greater Sage-grouse and guidelines for monitoring, handling, and submitting dead birds. Wildlife Society Bulletin, 32(3):1000-1006.

Walker, B. L., D. E. Naugle and K. E. Doherty. 2007. Greater sage-grouse population response to energy development and habitat loss. Journal of Wildlife Management 71:2644-2654.

Walker, B. L., D. E. Naugle, K. E. Doherty, and T. E. Cornish. 2007. West Nile virus and greater sage-grouse: estimating infection rate in a wild bird population. Avian Diseases 51:691-696.

Zou, L., S. Miller, and E. Schmidtmann. 2006. Mosquito larval habitat mapping using remote sensing and GIS: implications of coal-bed methane development and West Nile virus. Journal of Medical Entomology 43:1034-1041.

Sage-Grouse Job Completion Report

PERIOD COVERED: 6/1/2009 - 5/31/2010
WORKING GROUP: Bates Hole-Shirley Basin PREPARED BY: Justin Binfet

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
2001	222	40	18.0	1127	347	28.2	8.7
2002	224	44	19.6	1245	348	28.3	7.9
2003	230	50	21.7	1522	528	30.4	10.6
2004	232	53	22.8	1723	476	32.5	9.0
2005	239	63	26.4	3358	628	53.3	10.0
2006	240	65	27.1	3844	790	59.1	12.2
2007	257	57	22.2	2407	472	42.2	8.3
2008	256	62	24.2	2215	946	35.7	15.3
2009	258	60	23.3	1611	603	26.9	10.1
2010	254	119	46.9	2482	1215	20.9	10.2

b. Leks Surveyed

Year	Known	Surveyed	Percent Surveyed	Max Total	Avg Males/ Active Lek
2001	222	79	35.6	663	22.9
2002	224	95	42.4	1024	24.4
2003	230	125	54.3	1599	26.7
2004	232	100	43.1	1483	28.5
2005	239	130	54.4	2421	31.0
2006	240	144	60.0	3605	38.8
2007	257	131	51.0	2913	36.9
2008	256	129	50.4	2050	27.3
2009	258	122	47.3	1687	23.8
2010	254	71	28.0	771	17.5

c. Leks Checked

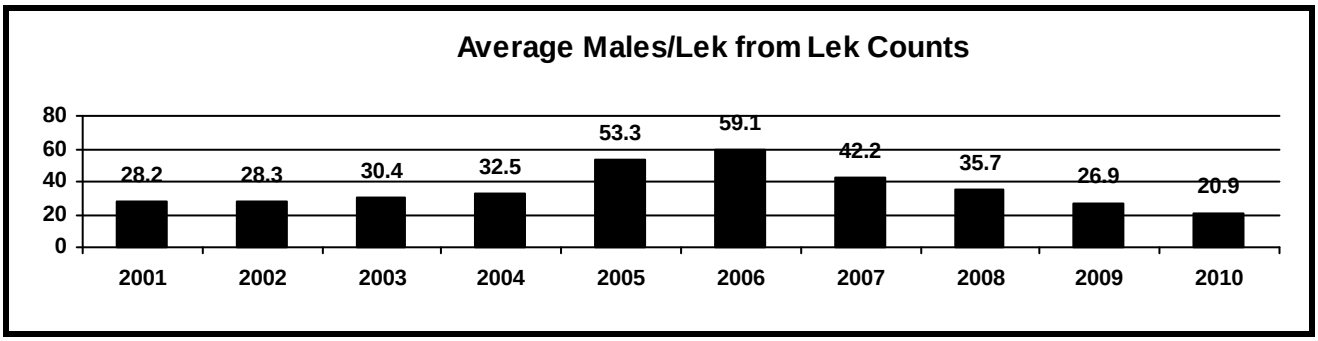
Year	Known	Checked	Percent Checked	Max Total	Avg Males/ Active Lek
2001	222	116	52.3	1768	26.0
2002	224	135	60.3	2252	26.5
2003	230	172	74.8	3076	28.7
2004	232	152	65.5	3206	30.5
2005	239	187	78.2	5779	41.0
2006	240	207	86.3	7360	47.2
2007	257	187	72.8	5320	39.1
2008	256	190	74.2	4246	31.2
2009	258	182	70.5	3298	25.2
2010	254	190	74.8	3253	20.0

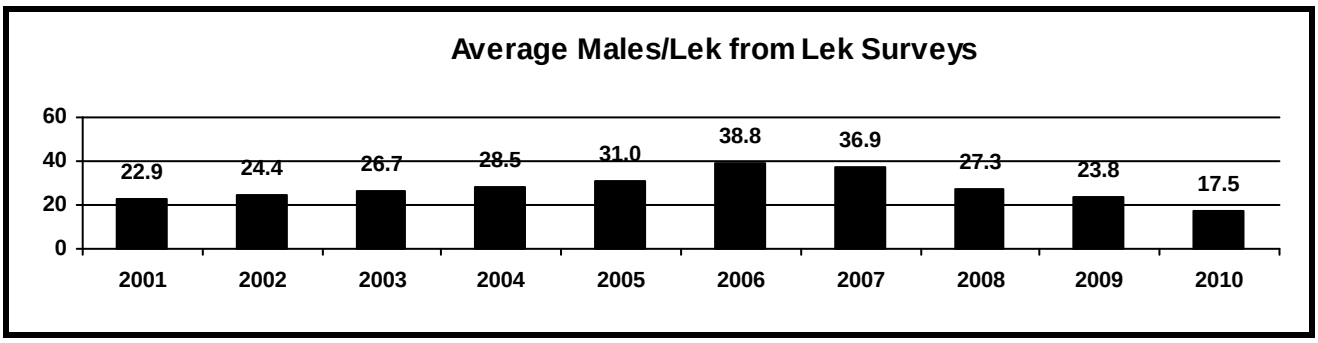
d. Lek Status

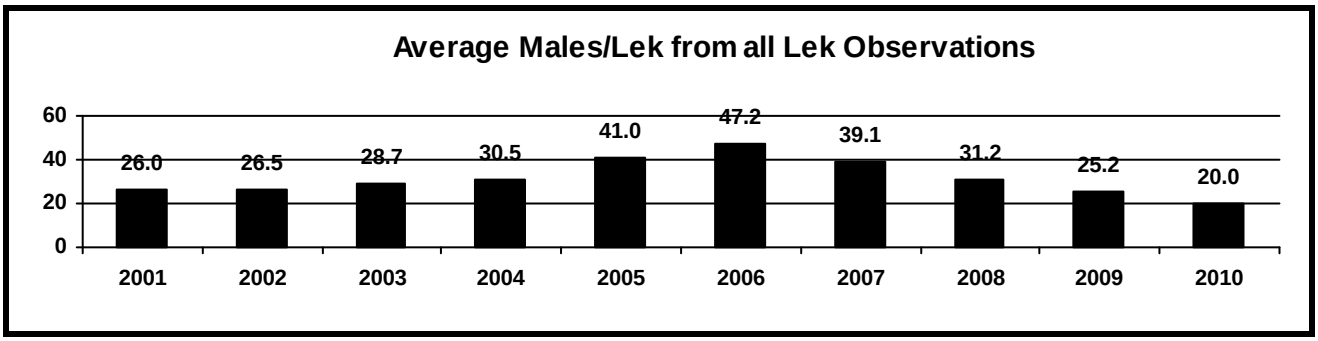
Year	Active	Inactive	Not Located	Unknown	Total	Confirmed Status Active	Confirmed Status Inactive
2001	71	4	0	147	75	94.7%	5.3%
2002	87	12	7	118	99	87.9%	12.1%
2003	100	16	11	103	116	86.2%	13.8%
2004	96	29	0	107	125	76.8%	23.2%
2005	137	9	2	91	146	93.8%	6.2%
2006	153	6	0	81	159	96.2%	3.8%
2007	135	9	0	113	144	93.8%	6.3%
2008	137	40	2	77	177	77.4%	22.6%
2009	129	34	0	95	163	79.1%	20.9%
2010	141	16	1	96	157	89.8%	10.2%

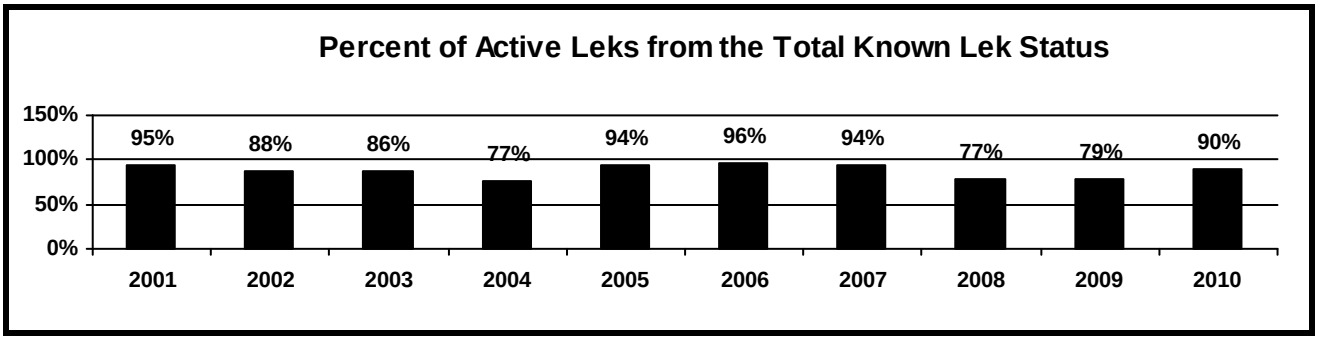
SAGE-GROUSE LEK ATTENDANCE SUMMARY

WORKING GROUP: Bates Hole **Area(s): All**









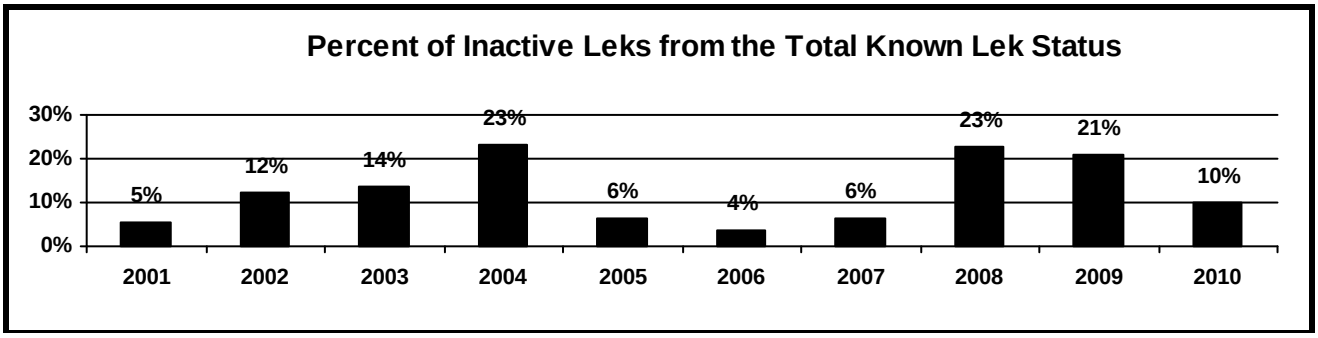


Table 4. Sage-grouse hunting seasons and harvest data.

a. Season

Year	Season Dates	Length	Bag/Possession Limit
2001	Sept 22-Oct 6	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
2007	Sept 22-Oct 2	11	2/4
2008	Sept 22-Oct 2	11	2/4
2009	Sept 19-Sept 30	12	2/4

b. Harvest

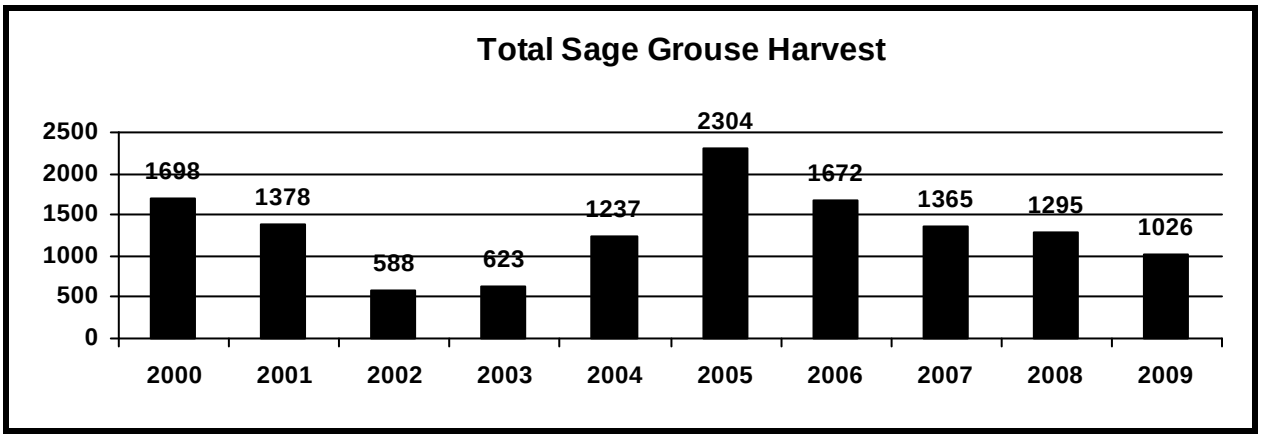
Year	Harvest	Hunters	Days	Birds/ Day	Birds/ Hunter	Days/ Hunter
2000	1,698	753	1,364	1.2	2.3	1.8
2001	1,378	725	1,396	1.0	1.9	1.9
2002	588	377	588	1.0	1.6	1.6
2003	623	318	626	1.0	2.0	2.0
2004	1,237	583	1,071	1.2	2.1	1.8
2005	2,304	925	1,734	1.3	2.5	1.9
2006	1,672	717	1,169	1.4	2.3	1.6
2007	1,365	655	1,155	1.2	2.1	1.8
2008	1,295	654	1,161	1.1	2.0	1.8
2009	1,026	532	956	1.1	1.9	1.8
Avg.	1,319	624	1,122	1.2	2.1	1.8

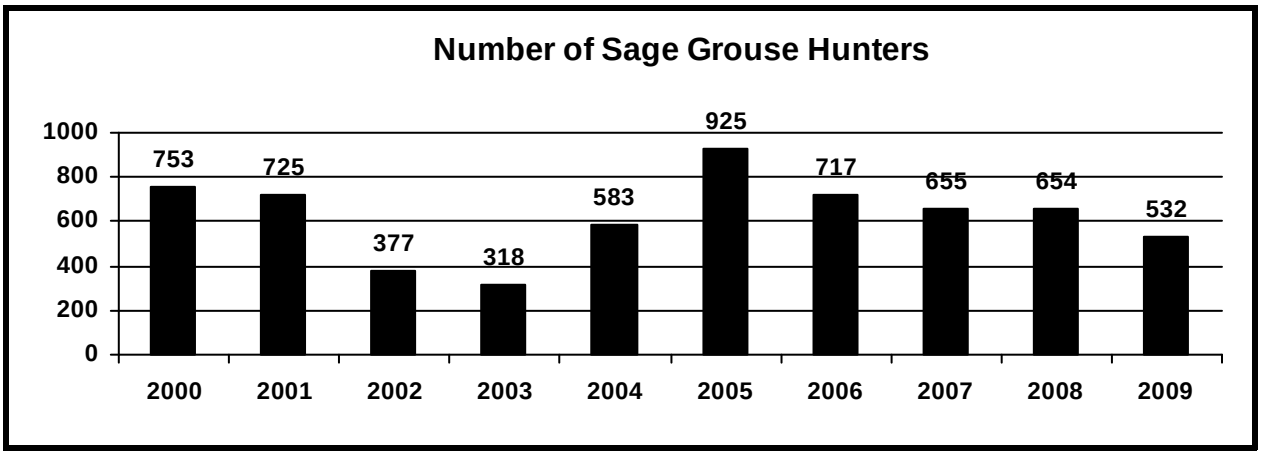
Table 5. Composition of harvest by wing analysis.

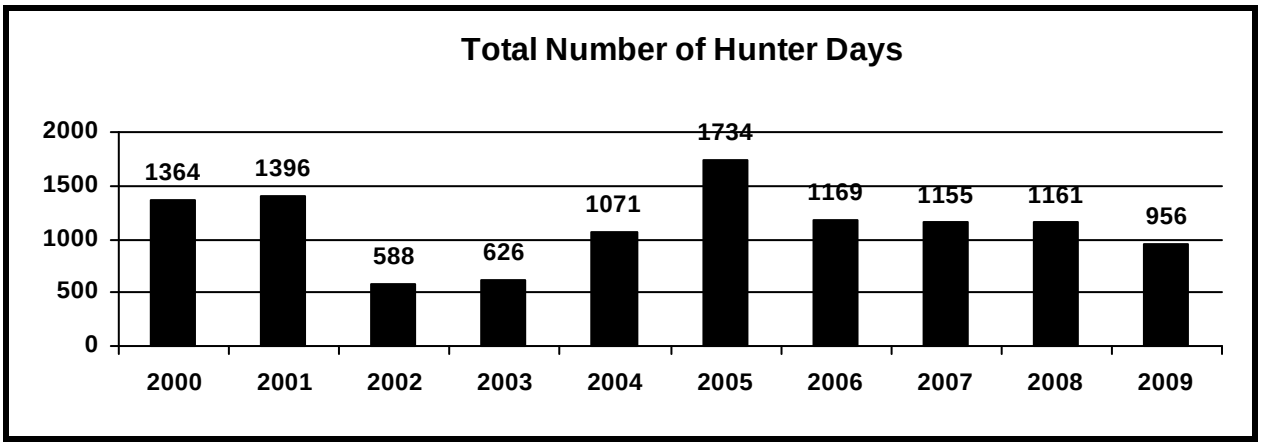
Year	Sample Size	Percent Adult		Percent Ylg		Percent Young		Chicks /Hen
		Male	Female	Male	Female	Male	Female	
2001	560	9.3	19.8	0.4	8.9	21.6	40.0	2.1
2002	663	7.7	18.6	2.4	10.7	15.5	45.1	2.1
2003	214	20.6	24.3	2.8	11.2	19.6	21.5	1.2
2004	308	13.6	24.7	1.3	4.2	24.0	32.1	1.9
2005	372	17.5	25.8	3.0	7.8	21.5	24.5	1.4
2006	305	29.8	22.6	4.3	7.5	13.1	22.6	1.2
2007	546	19.4	53.5	4.2	2.9	8.4	11.5	0.4
2008	160	12.5	26.3	6.9	10.0	15.6	28.8	1.2
2009	314	12.7	26.1	9.2	12.1	17.8	22.0	1.0

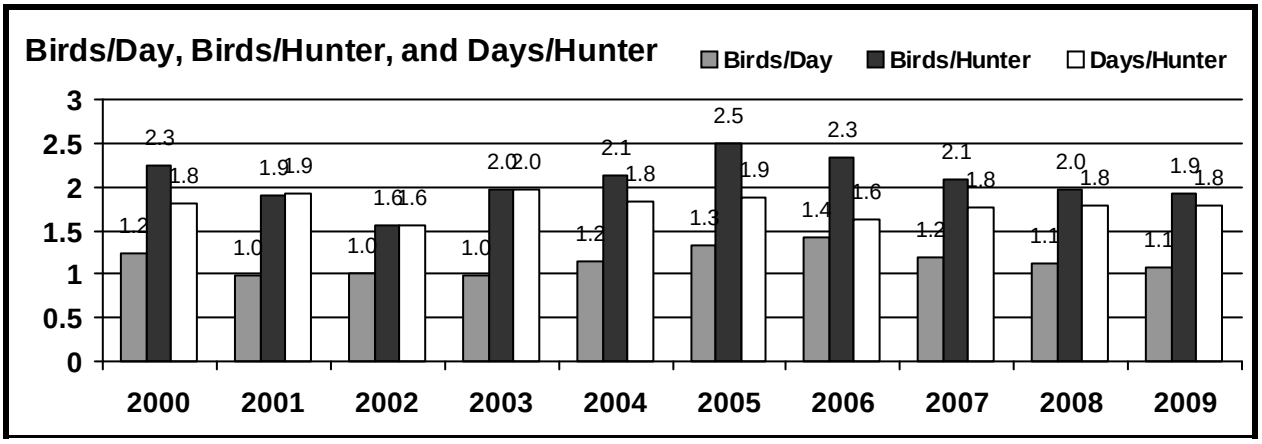
SAGE-GROUSE HARVEST SUMMARY

WORKING GROUP: Bates Hole **Area(s): All**









Sage-grouse Wing Analysis Summary 2009

Region: **Area :**

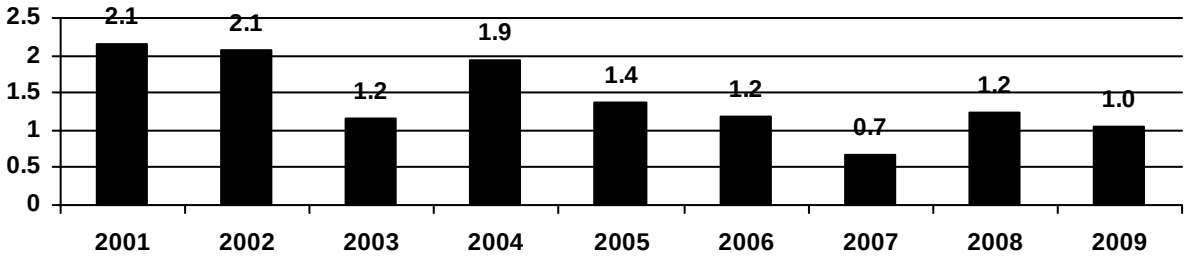
Working Group:

Adult Males	40	**Percent of All Wings:**	12.7%
Adult Females	82	**Percent of All Wings:**	26.1%
Adult Unknown	0	**Percent of All Wings:**	0.0%
Total Adults:	122		
Yearling Males:	29	**Percent of All Wings:**	9.2%
Yearling Females	38	**Percent of All Wings:**	12.1%
Yearling Unknown	0	**Percent of All Wings:**	0.0%
Total Yearlings:	67		
Chick Males:	56	**Percent of All Wings:**	17.8%
Chick Females:	69	**Percent of All Wings:**	22.0%
Chick Unknown	0	**Percent of All Wings:**	0.0%
Total Chicks:	125		
Unknown Sex/Age	0	**Percent of All Wings:**	0.0%
Total for all Sex/Age Groups:	314		

Chick Males:	56	**Percent of All Chicks:**	44.8%
Yearling Males:	29	**Percent of Adult and Yearling Males:**	42.0%
Adult Males:	40	**Percent of Adult and Yearling Males:**	58.0%
Adult and Yearling Males	69	**Percent of Adults and Yearlings:**	36.5%
Total Males:	125	**Percent of All Sex/Age Groups:**	39.8%
Chick Females:	69	**Percent of All Chicks:**	55.2%
Yearling Females	38	**Percent of Adult and Yearling Females:**	31.7%
Adult Females:	82	**Percent of Adult and Yearling Females:**	68.3%
Adult and Yearling Females	120	**Percent of Adults and Yearlings:**	63.5%
Total Females:	189	**Percent of All Sex/Age Groups:**	60.2%

Chicks:	125	**Percent of All Wings**	39.8%
Yearlings:	67	**Percent of All Wings**	21.3%
Adults:	122	**Percent of All Wings**	38.9%
Chicks/Hen:	**1.0**		

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



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

Species: **Sage-grouse**
Period Covered: **June 1, 2009 – May 31, 2010**
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 South Fork of the Powder River Basin, foothills of the Laramie Range and Rattlesnake Hills, and in northern Platte/southern Niobrara Counties. Occupied habitat is fairly contiguous throughout much of Bates Hole and Shirley Basin. Habitats within the South Fork of the Powder River Basin are somewhat 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, and includes portions of the Laramie Plains. Large contiguous blocks of sagebrush/grassland communities east of the Laramie Range have been largely eliminated.

Occupied habitat for sage-grouse within the BHSBCA is nearly 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.

Sage-grouse management data collected by the WGFD focus on lek counts and surveys, harvest statistics, brood surveys, and analysis of 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 population trend based on peak male attendance. Lek surveys are also conducted in the spring, but are typically conducted only one time per lek to determine general lek activity status (e.g., active, inactive, or unknown). Limited sage-grouse brood data is also collected during July and August. Brood counts provide some indication of chick production and survival, although their use is limited in estimating recruitment due to sampling design being neither systematic nor repeatable, with sample sizes typically being small. Where available, wing data provide a more reliable indicator of chick production and recruitment.

Past and current management of sage-grouse within the BHSBCA has focused mainly on the protection and/or enhancement of sagebrush habitats and protection of leks and nesting buffers from surface disturbing activities during the breeding/nesting season. Protection efforts have primarily occurred via controlled surface use or timing stipulations attached to federally permitted projects and through recent revision of the Resource Management Plans in the Casper and Rawlins BLM Field Offices. Sage-grouse habitat protection has been increasingly important given the potential listing under the Endangered Species Act. As a result, the State of Wyoming adopted a core area management strategy through a Governor's Executive Order. This strategy

enhances protections to sage-grouse within delineated core areas, which were further refined in 2010 (version 3). Core areas have been delineated to encapsulate and increase protections for ~83% of the sage-grouse occurring in Wyoming. Protections applied to sage-grouse habitats outside of core areas are less stringent than those within core areas. This discrepancy was designed to focus natural resource development outside of the best remaining sage-grouse habitats.

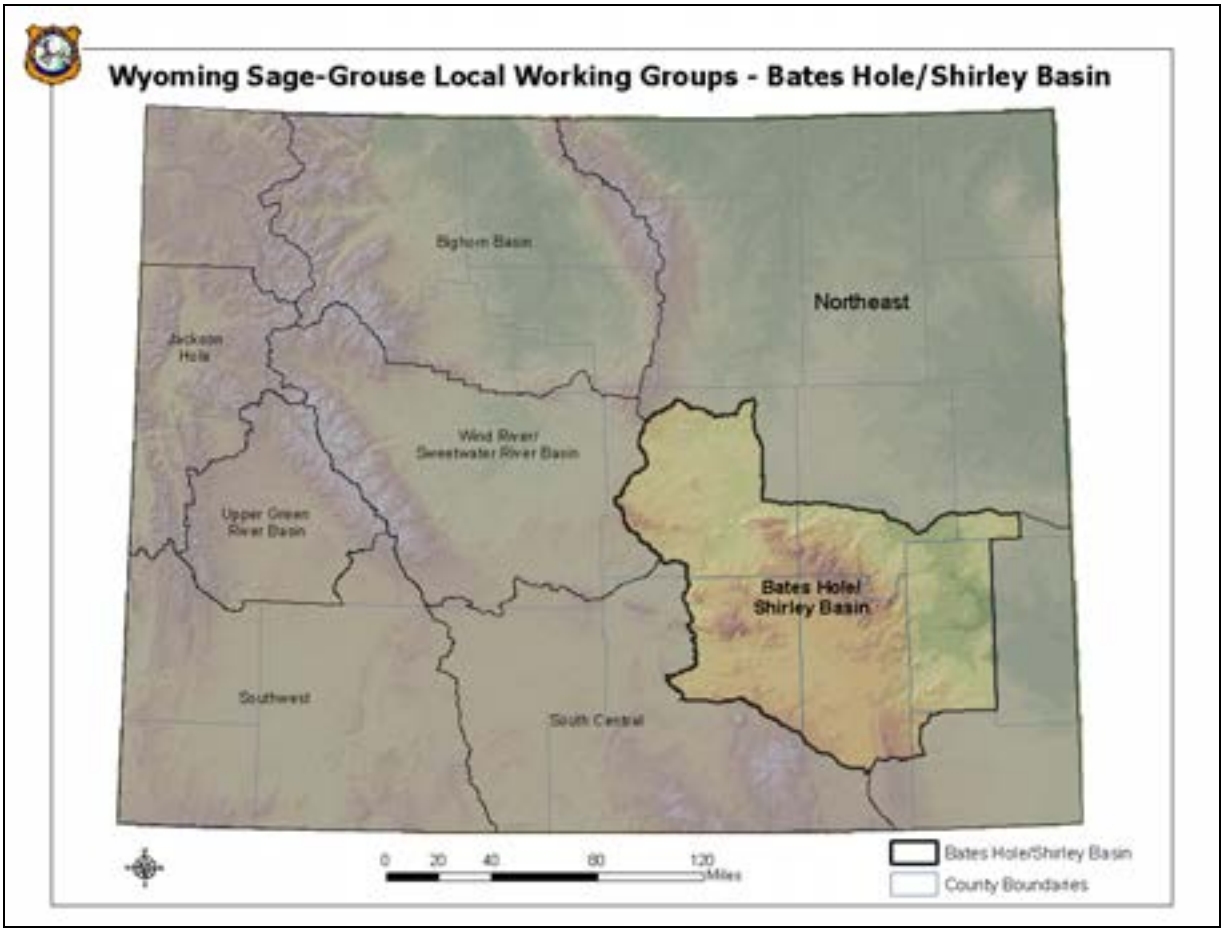
Most sage-grouse populations in Wyoming are hunted, though some portions of the state have been closed to sage-grouse hunting to protect small, isolated populations (i.e., in the southeast, northeast, and northwest portions of the state). Based on the Bates Hole/Shirley Basin Local Working Group's (BHSBLWG) Sage-grouse Conservation Plan, hunting seasons within sage-grouse populations having less than 100 males attending leks should be closed to prevent additive mortality on small, isolated populations (BHSBLWG 2007). Hunting seasons have therefore been closed in the Hat Six area southeast of Casper and in Converse, Niobrara, Platte, and Laramie Counties. Within these areas, sage-grouse populations occur in small, isolated patches of suitable habitat on the fringe of sage-grouse range. Within these small populations, harvest pressure is far more likely to be additive and potentially detrimental.

Historically, sage-grouse hunting seasons opened in early September. Research investigating the impacts of hunting on sage-grouse populations indicated a late September opening date had a decreased 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). This is due to successful hens with broods being typcially more widely distributed across the landscape in later September, which decreases harvest pressure on the most successful segment of the population. In early September, hunters tend to disproportionately focus harvest pressure on successful hens with broods as they are relatively easy to locate, especially near water sources. Sage-grouse seasons within the BHSBCA currently span two weekends, opening in late September and closing in early October, with the exception of the Hat Six area, Converse, and Platte Counties where seasons have been closed entirely. From 1982 – 2001, bag and possession limits were 3 per day and 6 in possession. Since 2002, bag and possession limits have been reduced throughout the BHSBCA to 2 per day and 4 in possession.

Conservation Area

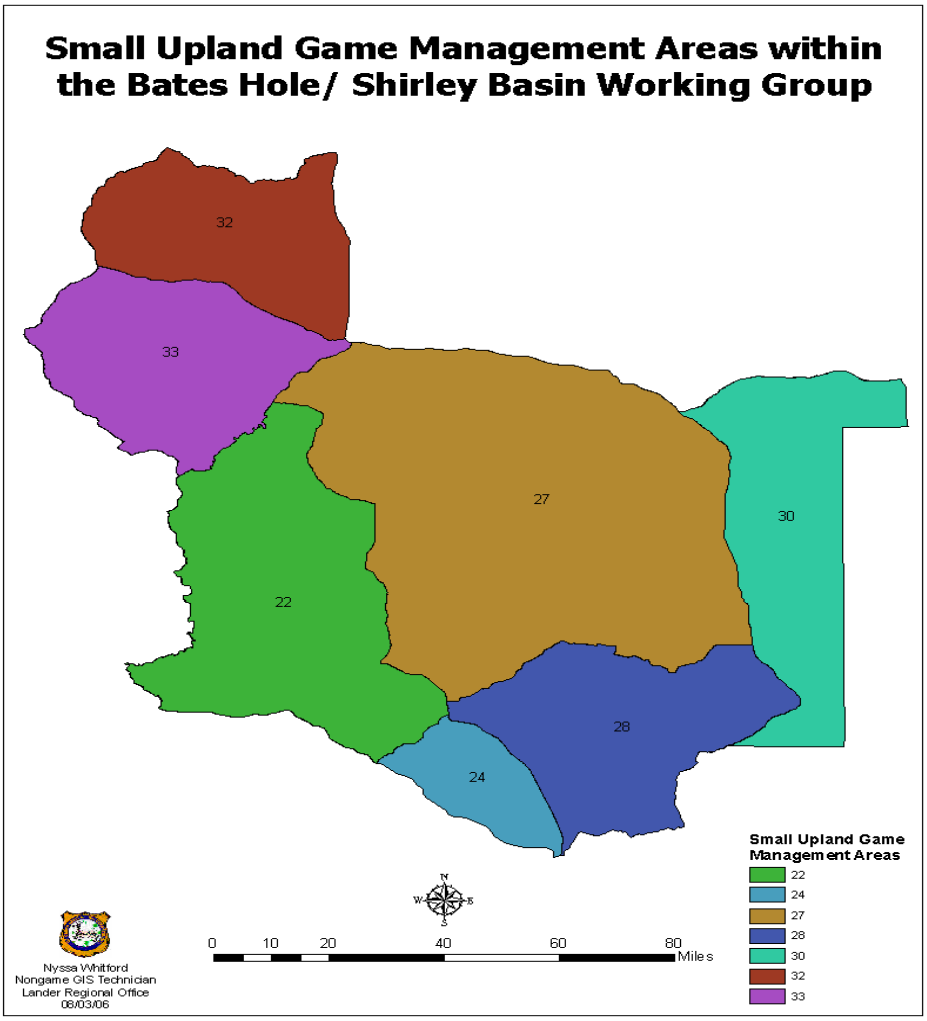
The BHSBCA includes Bates Hole, the Shirley Basin, the Rattlesnake Hills, the southern Bighorn Mountains, the Laramie Range, and isolated occupied habitats in southern Niobrara and Platte County (Figure 1). Political jurisdictions include Albany, Carbon, Converse, Laramie, Natrona, Niobrara, and Platte counties. This area is managed by the BLM (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 within the BHSBCA include livestock grazing, wind energy development, oil and gas development, coal mining, and dry-land and irrigated crop production.

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



For the reporting period, 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. Rather, 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 plan area, analyses/statistics reported include some information outside of the BHSBCA. Sage-grouse are well distributed throughout most of the BHSBCA. Beginning in biological year 2010, sage-grouse management areas will be redrawn based on local working group boundaries.

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



Leks and Lek Complexes

Sage-grouse, and therefore occupied leks, are well distributed throughout the BHSBCA (Figure 3). Much of the historic range in Platte County is no longer occupied due to large scale conversions of sagebrush grasslands to cultivated fields. The Wyoming Game and Fish Department summarizes lek monitoring data each year. As of spring 2010, there are 213 known occupied leks, 55 unoccupied leks, and 38 leks of an undetermined status (Figure 4). Lek definitions are presented in Appendix I. Fifty-three of the 55 unoccupied leks have been abandoned, while 2 have been destroyed. Undoubtedly, there are leks within the BHSBCA that have not yet been identified, while other un-discovered leks have been abandoned or destroyed. The majority of leks defined as "undetermined" lack sufficient data to make a valid status determination. In these cases, historic data indicates these leks were viable at one point, with the leks subsequently being either abandoned or moved. However, location data is either generic or suspect in many of these cases, further confounding the ability to determine the status of these leks.

Figure 3. Recent (2005) and historic range of sage-grouse and occupied leks within the BHSBCA.

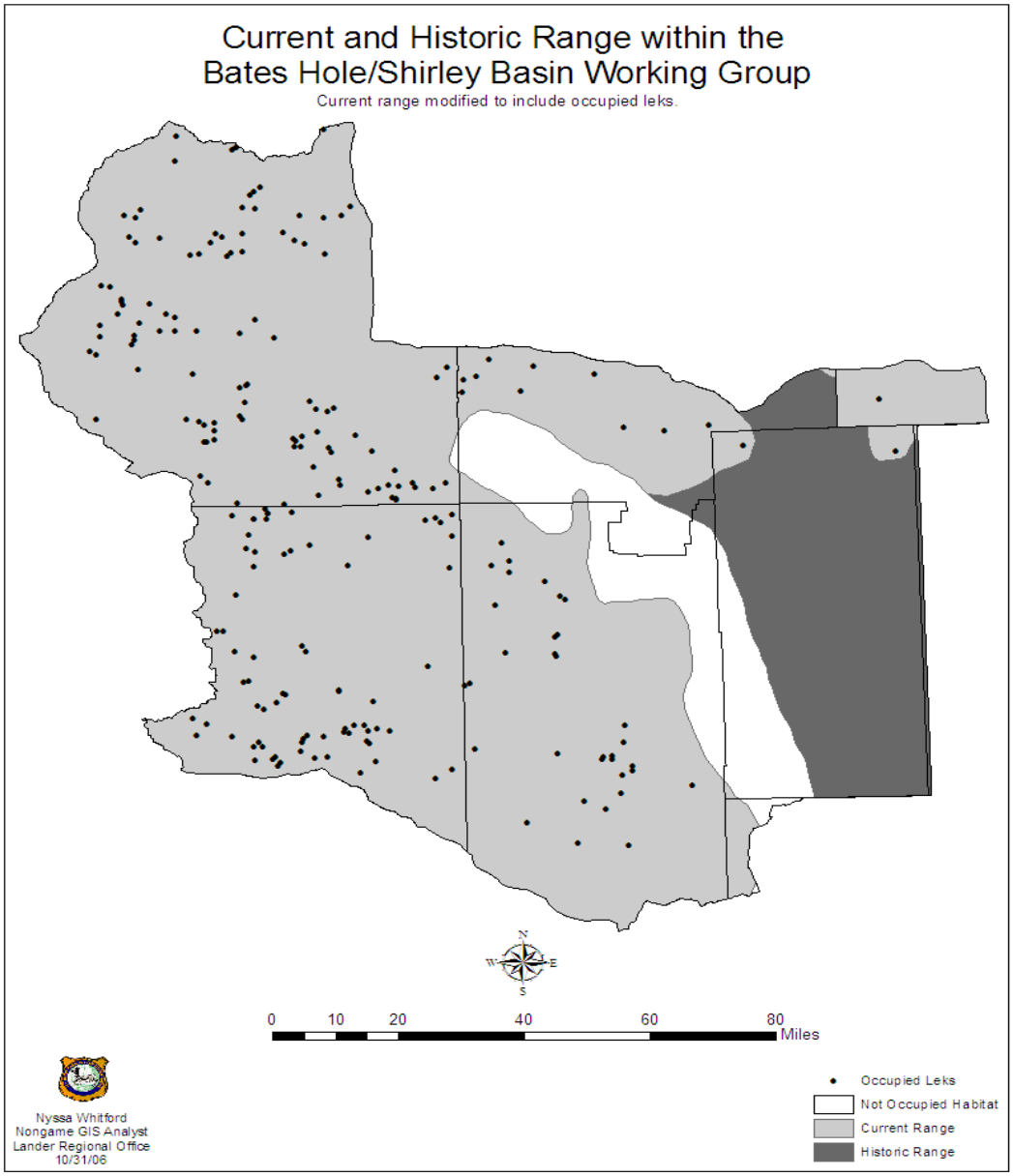


Figure 4. Sage-grouse lek demographics within the BHSBCA, March 2010.

Sage Grouse Lek Characteristics

Region	Number	Percent
Casper	121	39.5%
Lander	2	0.7%
Laramie	183	59.8%

Working Group Area	Number	Percent
Bates Hole	306	#######

Classification	Number	Percent
Occupied	213	69.6%
Undetermined	38	12.4%
Unoccupied	55	18.0%

BLM Office	Number	Percent
Casper	119	38.9%
Lander	2	0.7%
Newcastle	1	0.3%
Rawlins	184	60.1%

Unoccupied Leks	Number
Abandoned	53
Destroyed	2

Biologist District	Number	Percent
Casper	113	36.9%
Douglas	8	2.6%
Laramie	67	21.9%
Rawlins	2	0.7%
Saratoga	69	22.5%
Wheatland	47	15.4%

Game Warden District	Number	Percent
Cheyenne	1	0.3%
Douglas	3	1.0%
East Casper	35	11.4%
East Rawlins	2	0.7%
Elk Mountain	72	23.5%
Glenrock	8	2.6%
Laramie	1	0.3%
Lusk	1	0.3%
Medicine Bow	68	22.2%
North Laramie	37	12.1%
West Casper	72	23.5%
Wheatland	6	2.0%

County	Number	Percent
Albany	72	23.5%
Carbon	110	35.9%
Converse	11	3.6%
Laramie	2	0.7%
Natrona	104	34.0%
Niobrara	1	0.3%
Platte	6	2.0%

Land Status	Number	Percent
	0	0.0%
BLM	109	35.6%
BLM/Private	2	0.7%
BOR	1	0.3%
Not Determined	2	0.7%
Private	161	52.6%
State	27	8.8%
USF&WS	1	0.3%

Management Area	Number	Percent
22	116	37.9%
24	4	1.3%
27	76	24.8%
28	33	10.8%
30	3	1.0%
32	29	9.5%
33	45	14.7%

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 relatively consistent data sets over the last 13 years, enabling meaningful comparisons of current sage-grouse data to a running 10-year average. In 2010, personnel checked 190 of the 306 (62%) known leks in the BHSBCA (includes occupied and unoccupied leks). A total of 119 leks were counted while 71 leks were surveyed. This marks a dramatic increase in the number of leks counted compared to the previous 5-year average of 61. Of the leks checked, 141 were active and 16 were inactive, 1 was not located, and 96 had an unknown status.

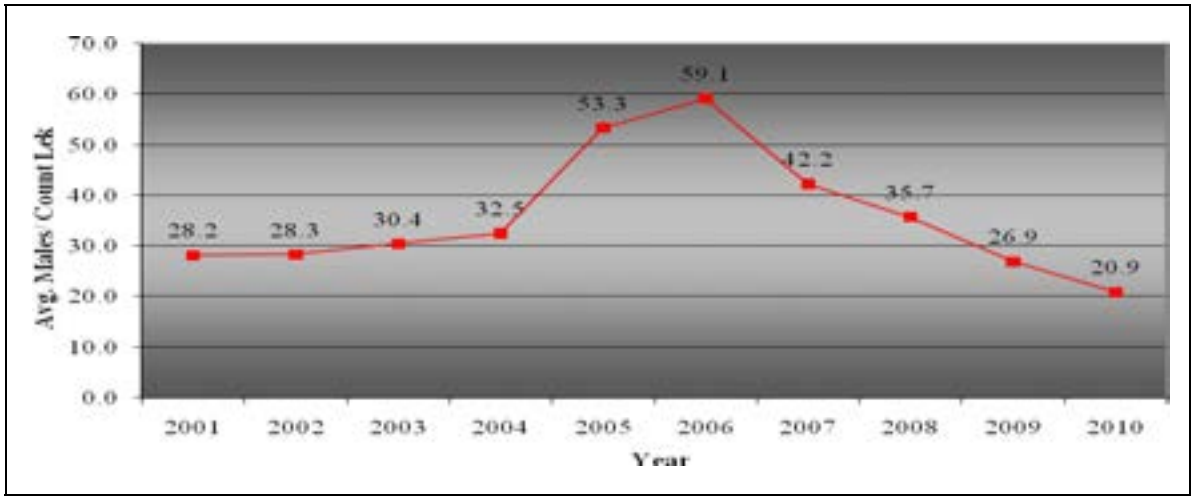
Habitat

There is little doubt sage-grouse habitat quality has declined over the past several decades throughout the BHSBCA. Increased human-caused disturbance (i.e., oil/gas, coal, uranium, and wind energy development), improper grazing by livestock and wildlife, sagebrush eradication programs, and long-term drought have all combined to negatively impacted sage-grouse and their habitats. As the level of concern for sage-grouse and sagebrush ecosystems has risen, various habitat improvement projects have been planned and/or implemented throughout the BHSBCA. However, there is much debate among wildlife managers, habitat biologists, researchers, and rangeland specialists as to the efficacy of various forms of habitat treatments within sagebrush ecosystems. Given the long timeline required to reestablish sagebrush following treatment and the difficulty in measuring sage-grouse population level response to such treatments, habitat treatments designed to improve sagebrush ecosystem function should be conducted with extreme caution, especially in xeric sagebrush stands or in habitats containing isolated sage-grouse populations. Habitat treatments designed to improve sagebrush community health are detailed in Appendix III.

Population Trend

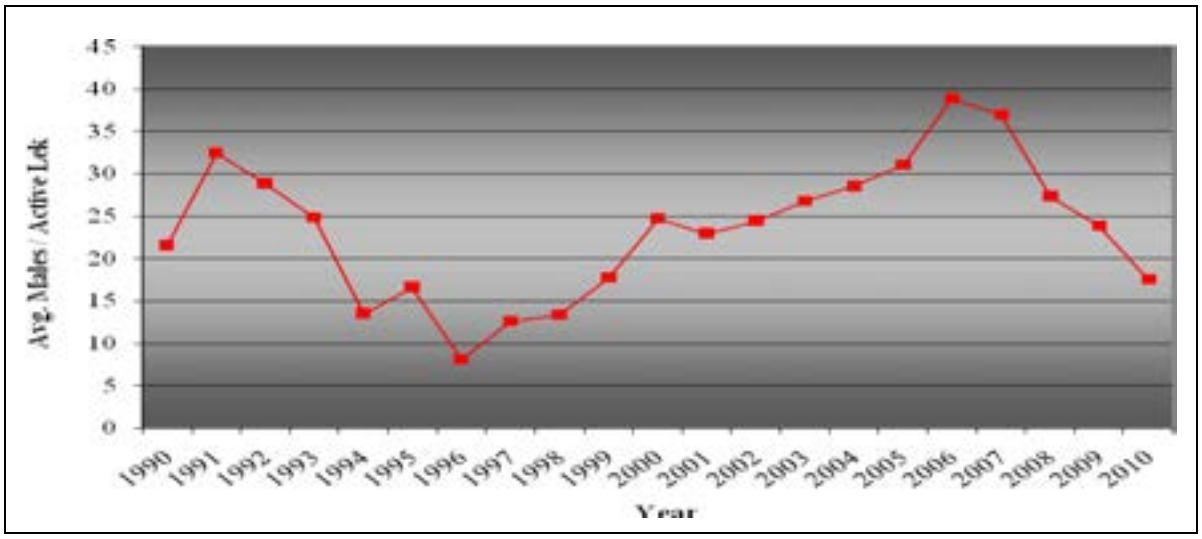
Monitoring male attendance on leks provides a reasonable index of sage-grouse population trend over time. Nevertheless, these data must be interpreted with caution as described in the Wyoming Greater Sage-grouse Conservation Plan (2003). Fluctuations in the number of grouse observed on leks over time are not exclusively a function of changing grouse numbers. These data also reflect changes in lek survey effort due to weather conditions dictating access to monitor leks. Over the last 10 years, the average number of males observed per count lek increased from 28.2 in 2001 to 59.1 in 2006, but has since declined to 20.9 in 2010 (Figure 6). Male lek attendance declined considerably in 2010 for the fourth consecutive year, which was again likely due to poor recruitment and survival in 2009 (see productivity discussion). The average number of males observed per count lek in 2010 is 42% below the 10-year average of 35.8, and was the lowest average recorded since intensive lek monitoring began in 1998. In 2010, a maximum total of 3,253 male sage-grouse were observed during lek surveys and counts within the BHSBCA.

Figure 6. Mean number of peak males per ***counted*** lek within the BHSBCA, 2001 – 2010.



Following a period of substantial growth from 2001 – 2006, sage-grouse populations declined by 65% from 2006 – 2010 based on the mean maximum number of males observed per counted lek. The 2010 average male lek attendance (obtained from lek counts) was the lowest average recorded within the BHSBCA since intensive lek monitoring began in 1998. Average male lek attendance was lower from 1994 – 1997, but no more than 5 leks were counted in any one year. Because relatively few lek counts were conducted prior to 1998, the average number of males per active lek obtained from lek surveys must be used when comparing current population trend to data obtained prior to 1998. Both lek count and lek survey data produce similar lek attendance trends, and are therefore both reliable indicators of population trend. Based on lek survey data, the relatively low average number of males per active lek in 2010 was still higher than averages from 1994 – 1998 (Figure 7).

Figure 7. Mean number of peak males per ***surveyed*** lek within the BHSBCA, 1990 – 2010.



The current 4-year decline in lek attendance has been observed throughout the BHSBCA, and has not been localized in specific areas. However, this decline may have been slightly exaggerated over the last 3 years due to significant spring snowstorms precluding access to check several large leks within the BHSBCA, resulting in many leks being surveyed and not counted or not visited at all (not checking large leks can deflate average male lek attendance averages). For example, the Bates Creek Reservoir Lek had 364 males in 2006, making it one of the largest known leks in Wyoming. But in 2010, only 17 males were observed (during a survey, not a count), which may be partially attributed to much of the lek being submerged under water from unseasonably high water levels in Bates Creek Reservoir. Regardless, sage-grouse populations have declined considerably within the BHSBCA since 2006 despite some data gaps. Focused analyses in other areas within the BHSBCA where access did not inhibit lek counts shows identical trends to those depicted in Figures 6 and 7.

Within the BHSBCA, 53 leks have been abandoned since the 1960's. The timing in which these leks were abandoned is usually difficult to determine due to gaps in data collection. Reasons for abandonment are unknown for many historic leks. It is unclear whether these leks have been abandoned due to natural sage-grouse population fluctuations over time or from anthropogenic disturbances such as natural resource development, poor grazing practices, or hunting/recreation. Since 1998, many abandoned leks have been monitored, with no indication these leks have begun to be reoccupied. However, some of these leks may have never been legitimate leks, with one-time observations being recorded as leks. In addition, many of these leks have generic location-data, which further calls into question the veracity of the original lek designations. In cases where actual leks have been abandoned, such generic location-data makes (re)locating these leks much more difficult. Regardless, these leks should be maintained within the database until sufficient data has been collected to remove them as per WGFD lek monitoring protocol. Monitoring of abandoned/unoccupied leks has increased in recent years.

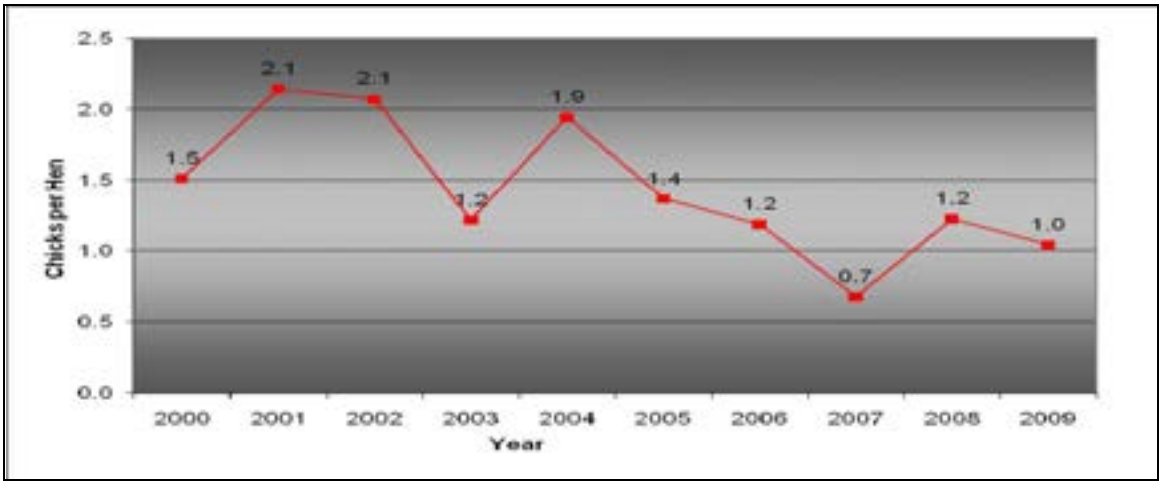
Productivity

Classifying wings based on sex and age from harvested sage-grouse provides a reasonable indicator of annual sage-grouse chick productivity. The sex and age composition of wings obtained from harvested birds is likely proportional to sex and age ratios available in the population. During fall hunting seasons, sage-grouse occur in mixed groups comprised of hens and chicks. Since hunting seasons open in late September, both barren and successful (with brood rearing) hens are typically found together. Therefore, harvest pressure is assumed to be equal across adult hens and chicks (of both sexes) as hunters do not typically differentiate between the two. Sampling bias is therefore assumed to be minimal (excluding mature males, which are typically under-harvested in proportion to the population) when calculating the chick:hen ratio. Summer brood surveys are also conducted, but do not provide as reliable an indicator of chick productivity given they are not conducted in a systematic and repeatable manner. In addition, many observations of sage-grouse occur along riparian areas during summer brood surveys, which may under-represent the number of barren hens occurring on uplands, thus biasing the actual chick:hen ratio. Therefore, brood survey data will not be discussed here.

Based on wing data, chick productivity was estimated to be 1.0 chicks per hen in 2009, which was 33% below the previous 10-year average of 1.5 (Figure 8). Over the last 10 years, wing-

barrel estimated productivity has fluctuated between 0.7 and 2.1 chicks per hen. In general, 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 subsequent increased lek attendance and ratios below 1.2:1 result in decline (WGFD 2007). The 2009 ratio marked the fifth consecutive year of moderate to poor chick production/survival (below 1.5 chicks/hen), resulting in population decrease. Such population decrease has been observed in the aforementioned lek attendance data. It is unknown whether the declining number of chicks observed in the harvest in recent years is due to poor nest success or chick survival, increased predation, deteriorating habitat conditions, or any combination thereof. The poor chick production/survival observed since 2007 may also be attributed to the somewhat colder and wetter springs during these years, which may have led to increased nest abandonment/failure.

Figure 8. Sage-grouse productivity within the BHSBCA based on wing data analysis, 2000 – 2009.



Harvest

Hunter and harvest statistics provide some insight into trends in wildlife populations. Typical of upland game bird populations, there is usually a direct correlation between sage-grouse population levels 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. Since 1982, overall sage-grouse harvest has declined considerably within the BHSBCA (Figure 9). Harvest peaked in 1983 at 14,180 birds and subsequently declined to a low of 588 in 2002. In 2009, an estimated 1,026 sage-grouse were harvested within the BHSBCA. Over the last 10 years within the BHSBCA, trends observed in harvest data generally mirror those observed in male lek attendance from the spring (Figure 10). Over the same time frame, sage-grouse harvest declined considerably from 2000 – 2002, increased through 2005, and has subsequently declined over the last 4 years as sage-grouse populations have declined.

Figure 9. Total sage-grouse harvested per year within the BHSBCA, 1982 – 2009.

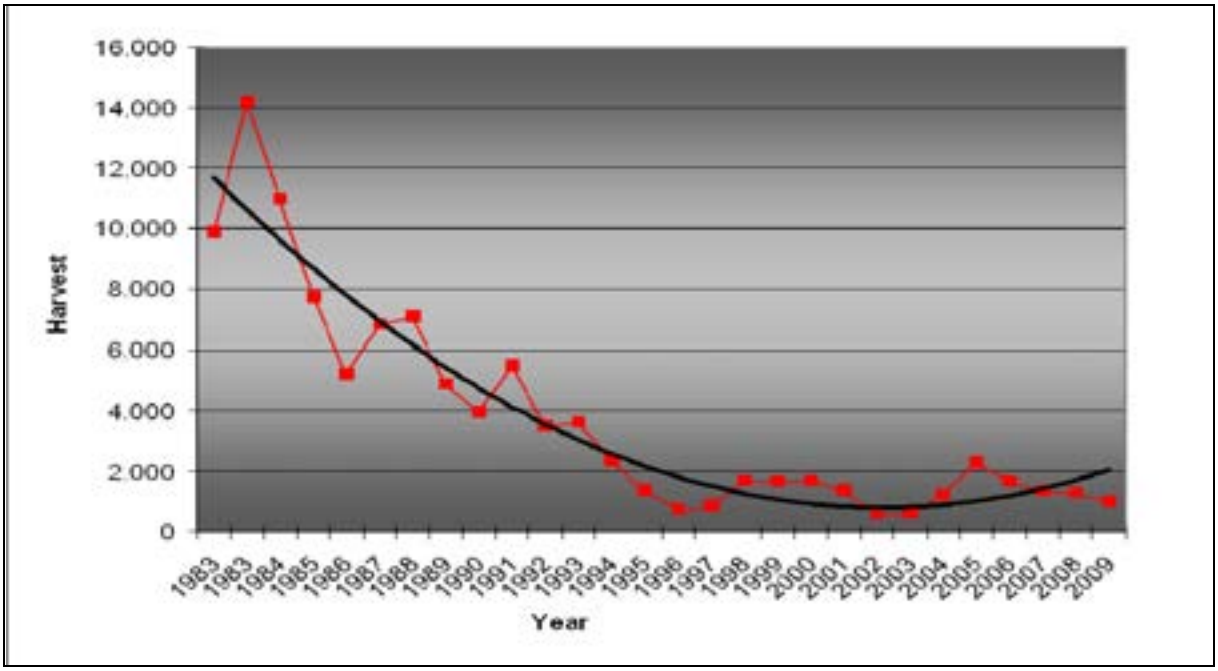
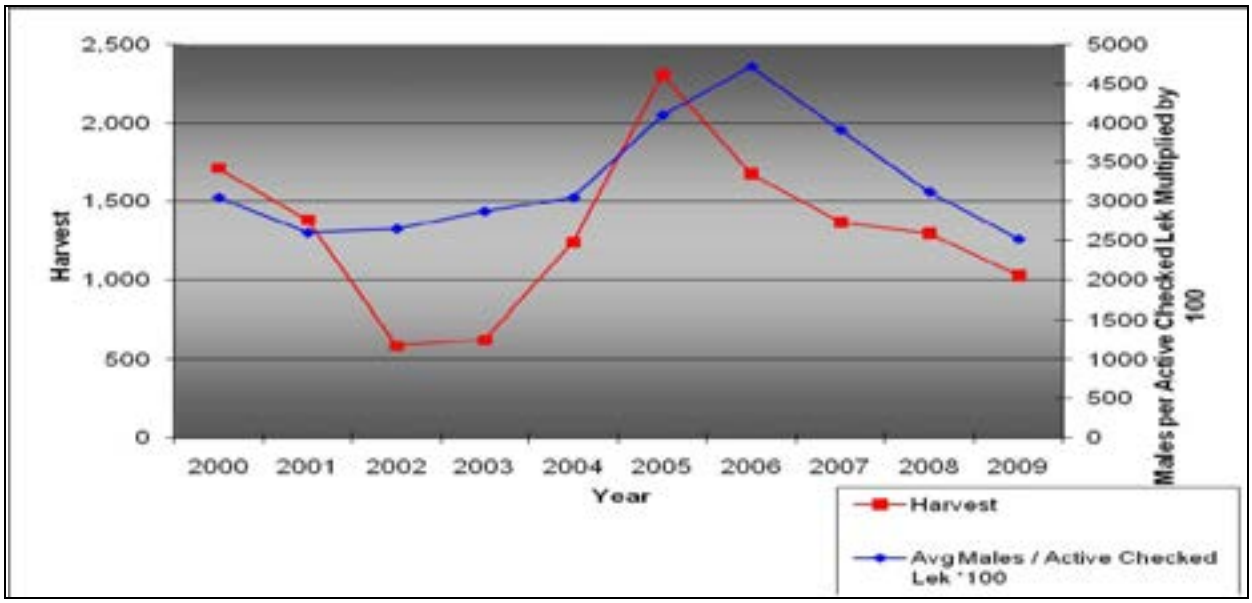


Figure 10. Total sage-grouse harvested per year and the average number of males per active lek checked within the BHSBCA, 1999 – 2009.



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 (WGFD 2008a). 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 increasingly conservative hunting seasons have had on hunter participation over the last 8 years. Managers are unable to quantify population response to changes in harvest levels within the BHSBCA. Research suggests harvest pressure can be an additive source of mortality within small isolated sage-grouse populations, but is generally compensatory at levels under 11% of the preseason population (Braun and Beck 1985, Connelly et al. 2000, Sedinger et al. 2010).

Weather

Based on the Palmer Drought Severity Index, 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 11 years. The following explanation of the Palmer Drought Severity Index was copied from the 2009 WGFD Big Game JCR – Appendix A (WGFD 2010). The Palmer Drought Severity Index was developed in the 1960s, using temperature and precipitation data to determine dryness. The index is most effective in determining long-term 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. Since this index does not reflect snow moisture, it typically works best for areas east of the Continental Divide. Palmer Severity Indices indicate that, from 1995-1999, the Lower Platte climatic division experienced wetter than normal conditions (Figures 11 & 12). The division entered drought conditions in 2000, with conditions becoming extreme in 2002, 2004 and 2006. However, conditions in recent years have returned to wetter than normal. Temperatures were generally normal during bio-year 2009 (Figures 13 & 14). During bio-years 2007 and 2008, precipitation was generally below normal, while precipitation was generally above normal during bio-year 2009 (Figures 15 & 16).

Figure 11. Drought severity trend for Wyoming Climate Division 8 (Lower North Platte Drainage), 1982 – 2010 (http://www.drought.noaa.gov/palmer.html).

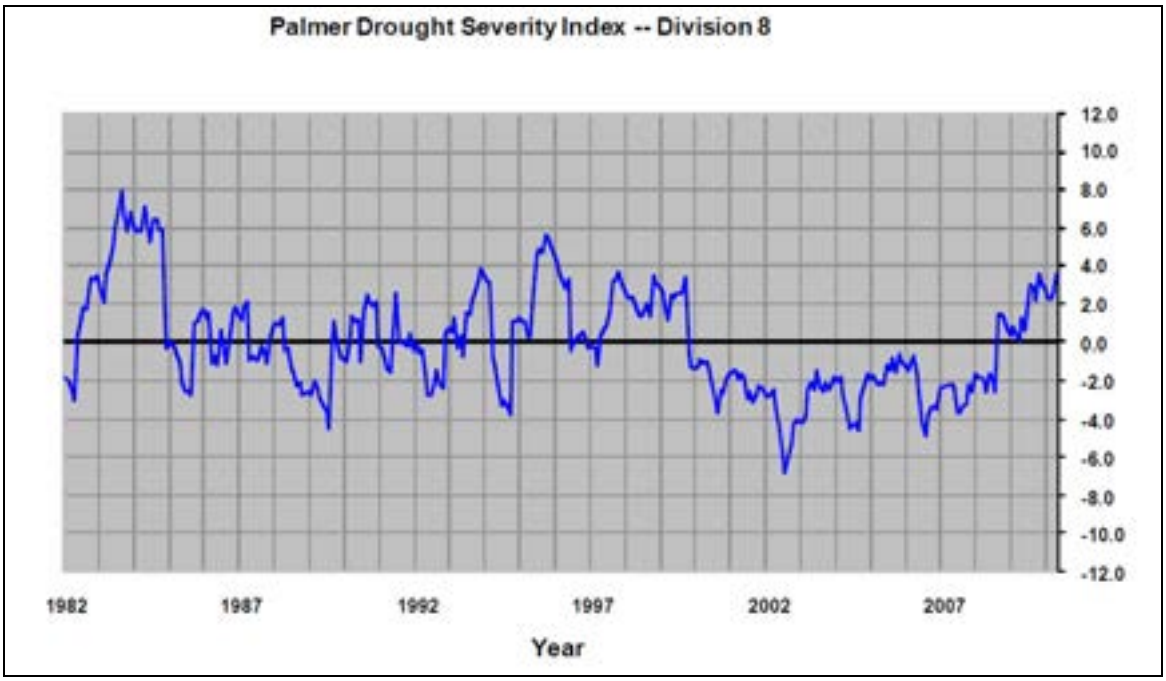


Figure 12. Drought severity trend for Wyoming Climate Division 10 (Upper North Platte Drainage), 1982 – 2009 (http://www.drought.noaa.gov/palmer.html).

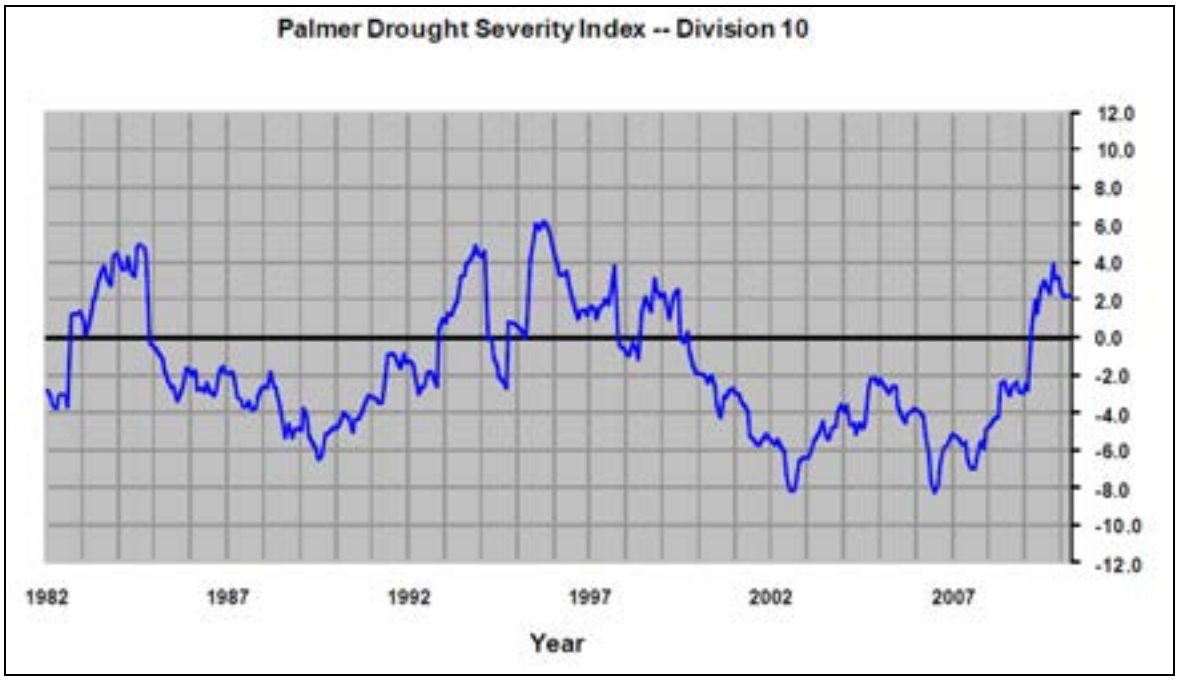


Figure 13. 2009 Bio-Year monthly temperature data (°F), Wyoming Climate Division 8 (Lower North Platte Drainage).

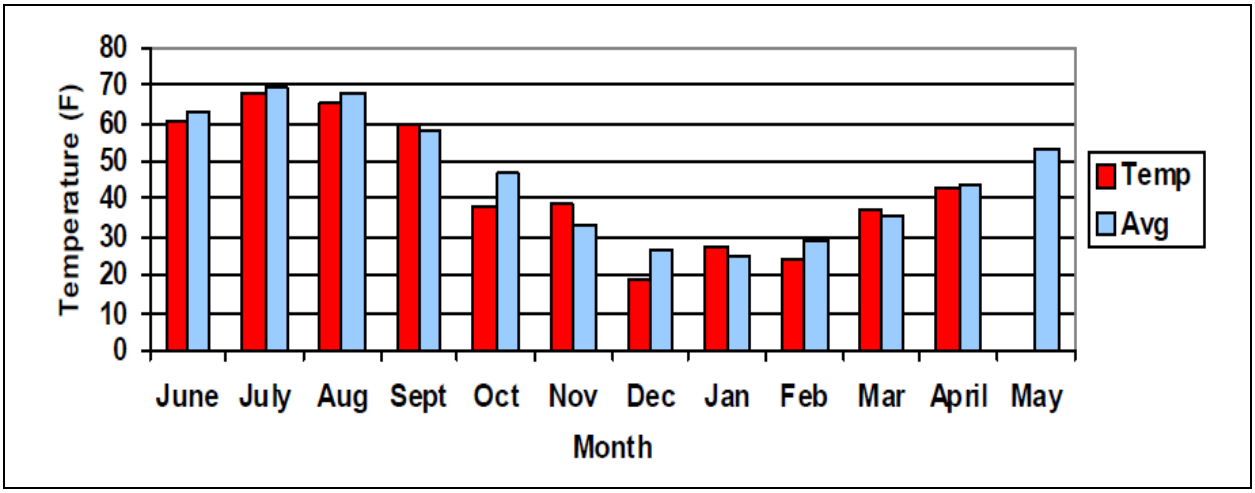


Figure 14. 2009 Bio-Year monthly temperature data (°F), Wyoming Climate Division 10 (Upper North Platte Drainage).

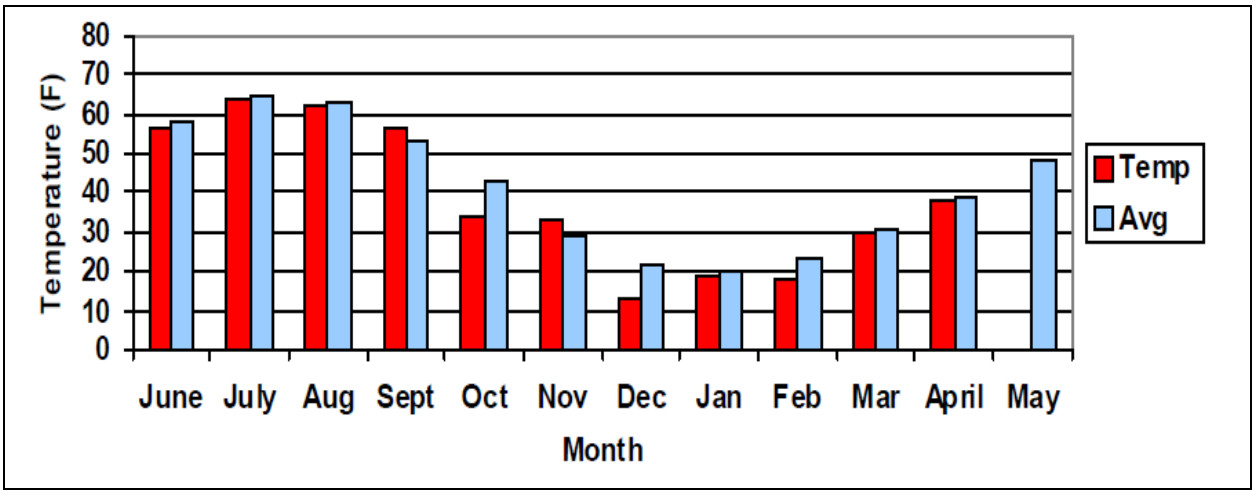


Figure 15. 2009 Bio-Year monthly precipitation data (in), Wyoming Climate Division 8 (Lower North Platte Drainage).

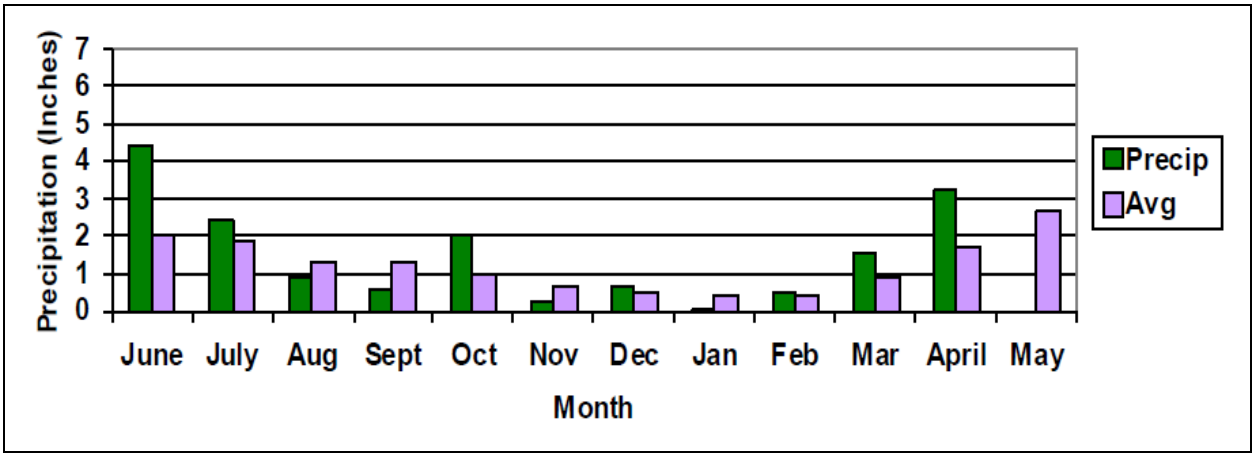
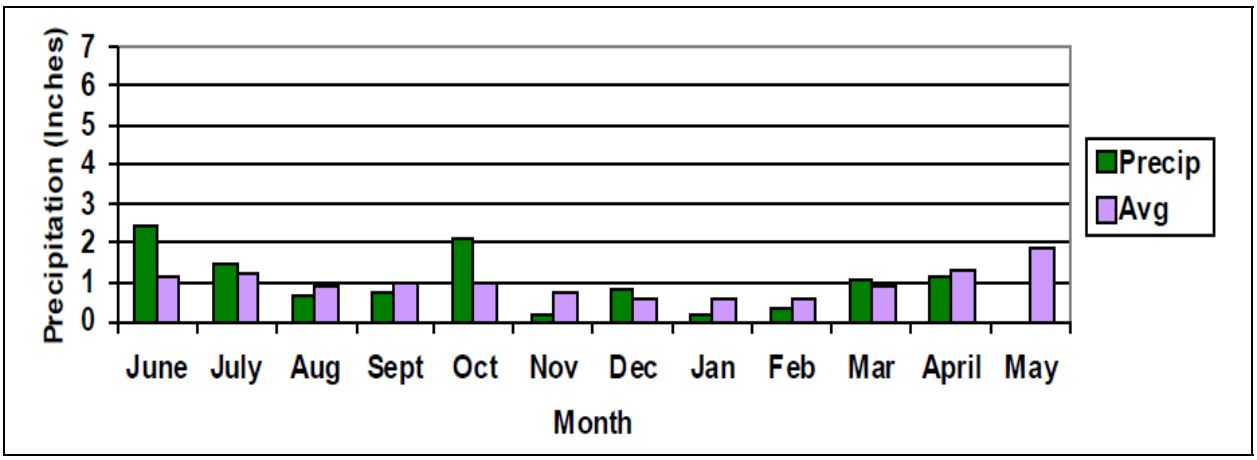


Figure 16. 2009 Bio-Year monthly precipitation data (in), Wyoming Climate Division 10 (Upper North Platte Drainage).



Despite drought conditions prevailing throughout the BHSBCA from 2001 – 2006, sage-grouse populations increased through 2006 within the BHSBCA. During the springs of 2007 – 2010, the region received substantial spring precipitation resulting in vastly improved herbaceous plant and sagebrush leader growth production over the last 4 growing seasons. However, such cool wet springs may have caused elevated nest failure and abandonment and/or poor survival of newly hatched chicks during the early brood rearing phase. This has been evidenced by the poor chick:hen ratios observed in the 2007 – 2009 wing data. Regardless, spring moisture is generally considered to benefit sage-grouse and sagebrush habitats in the long term far more than any deleterious effects of cold wet weather within any one singular year. It is unknown whether the population fluctuations over the last 10 years (increase through 2006 followed by subsequent decline) are a function of prevailing weather conditions or due to a potential cyclical nature of

sage-grouse populations. Meaningful correlations between annual variations in precipitation (and resulting vegetative production) and population trend cannot be made.

Special Studies

The Western Natrona County Sage-grouse Distribution Study was commissioned during the spring of 2008. This study, which is a joint venture with the BLM, WGFD, and the University of Wyoming, was initiated to map seasonal habitat selection and document parasite loading within a high-density sage-grouse population in western Natrona County. This research was primarily funded by the BLM and partially funded from local sage-grouse working group funds. Field data collection concluded in the fall of 2010. An interim report is provided in Appendix II. The principal investigator is currently compiling data, constructing a predictive habitat selection model, and writing the final thesis.

Western EcoSystems Technology, Inc. has provided progress reports to Horizon Wind Energy for The Greater Sage-Grouse Telemetry Study for the Simpson Ridge Wind Energy Project, Carbon County, Wyoming. This report was not provided within this document, but may be available upon request from the project proponent. In summary, the consulting firm was hired to conduct a long-term research project to evaluate the impacts to sage-grouse from wind energy development within a defined core area. A technical committee was assembled to define research methodology and objectives, and included representation from state and federal agencies as well as reputable sage-grouse researchers. This research was partially funded from local sage-grouse working group funds.

Diseases

West Nile Virus (WNV) was first detected in western Natrona County from a dead radio-marked bird during the summer of 2008. During the summer of 2009, a second sage-grouse was confirmed to have died from WNV. These radio-marked grouse were research birds from the aforementioned Western Natrona County Sage-grouse Distribution Study. Within this study, most cases of summer marked bird mortality could not be definitively attributed to WNV as most carcasses were too decomposed at time of discovery to permit diagnosis. The impact on populations exposed to WNV 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 WNV (96%). The extent of WNV infection and its effects on sage-grouse populations throughout the BHSBCA over the last two years is unknown, but potentially significant. However, no data exists to indicate recent declines in the BHSBCA sage-grouse population can be specifically attributed to WNV.

Recommendations

1. Continue to 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 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. The BHSBLWG should continue to solicit conservation projects that will benefit sage-grouse. These might include riparian corridor protection, wind energy related research, water development, and different livestock grazing regimes.

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

6. 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. Continue to monitor inactive or unoccupied leks to adjust classification status as appropriate.

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

8. Continue to inventory abandoned leks to see if any are appropriate for removal from the database based on appropriate criteria. Most abandoned leks within the BHSBCA occur within the Laramie WGFD Region.

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Appendix I. Wyoming Game and Fish Department Sage-grouse Lek Definitions (revised 2/09/2010)

Wyoming Sage-Grouse Definitions:
The following definitions have been adopted for the purposes of collecting and reporting sage-grouse data. See the sage-grouse chapter of the Wyoming Game and Fish Department's Handbook of Biological Techniques for additional technical details and methods.

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.

Satellite Lek – A relatively small lek (usually less than 15 males) that develops within about 500 meters of a large lek during years of relatively high grouse numbers. Locations of satellite leks should be encompassed within lek perimeter boundaries. Birds counted on satellite leks should be added to those counted on the primary lek for reporting purposes.

Lek Perimeter – The outer perimeter of a lek and any associated satellites. Perimeters should be mapped by experienced observers using established protocols for all leks with larger leks receiving higher priority. Perimeters may vary over time as population levels or habitat and weather conditions change. However, changes to mapped perimeters should occur infrequently and only if grouse use consistently (2+ years) demonstrates the existing perimeter to be inaccurate. A point **within** the lek perimeter must be recorded or calculated as the identifying location for the lek. The point may be the geographic center of the perimeter polygon as calculated though a GIS exercise or a GPS point reflecting the center of breeding activity as typically witnessed on the lek.

Lek Complex - A lek or group of leks within 2.5 km (1.5 mi) of each other between which male sage-grouse may interchange from one day to the next.

Lek Count - A census technique that documents the actual number of male sage-grouse observed attending a 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 from 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 15 kph (~10 mph) and no precipitation is falling.
- All leks within a complex should be counted on the same morning.

Lek Count Route – A lek route is a census of a group of leks that are relatively close and represent part or all of a single breeding population/sub-population. Leks should be counted on routes to facilitate repetition by other observers, increase the likelihood of recording satellite leks, and account for shifts in breeding birds if they occur. Lek routes should be established so that all leks along the route can be counted within 1.5 hours following the criteria listed under "Lek Count".

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. Except for those leks not scheduled for checks in a particular year, use of this status should be rare. Leks should be checked with

enough visits to determine whether it is active or not. It is better to have two good checks every other year and confirm it "inactive" than to check it once every year, not see birds, but remain in “unknown” status.

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. Use of this status should be rare (see “unknown” above).

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, 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.

Appendix II. Western Natrona County Sage-Grouse Distribution Project

Second Interim Report -- Revised

September 30, 2009

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INTRODUCTION

After eight petitions to list the greater sage-grouse (*Centrocercus urophasianus*) under the Endangered Species Act of 1973, a 2005 decision was made that they did not warrant protection (USFWS, 2005). In December 2007, this decision was remanded (U.S. District Court, 2007) and has prompted immediate action. Historically found in sagebrush (*Artemisia* spp.) habitats throughout the western United States and southern Canada (Schroeder et al., 2004), greater sage-grouse numbers have decreased in Wyoming and across the West over the past 50 years (Paige and Ritter, 1999; Schroeder et al., 2004). Renewed emphasis on identifying seasonal greater sage-grouse habitat use will aid conservation and management decisions.

Habitat data collected from this study will be incorporated into a predictive model for greater sage-grouse seasonal habitat use. Sagebrush serves as shelter and the primary food source for sage-grouse during the winter months (Patterson, 1952). Lack of suitable sagebrush winter habitat can have detrimental effects on greater sage-grouse populations (Beck, 1977; Swenson et al., 1987). As minimal winter habitat analysis has been conducted in central Wyoming, sampling and comparison of winter habitat will be conducted December through February. Preferred habitat for nesting and brood rearing has been well documented in prior studies (Holloran, 1999; Jensen, 2006; Kuipers, 2004) and will be used for comparisons with data collected from this study.

A parasite survey is being conducted in conjunction with the habitat research as limited research has been conducted on parasites of greater-sage grouse in Wyoming since the mid-1900's (Simon, 1940; Patterson, 1952). Effects of parasites may play a part in species decline by decreasing fecundity and increasing mortality (McCallum and Dobson, 1995). They may also alter predator/prey relationships (Hatcher et al., 2006) resulting in increased mortality. Studies have suggested that the presence of blood parasites results in lower lek attendance (Johnson and Boyce, 1991) and interrupted lek attendance (Atkinson and Van Riper III, 1991; Johnson and Boyce, 1991) which may lead to a decrease in genetic diversity. Data collected from this study will be used to identify potential pathogens that may impact sage-grouse populations.

Another pathogen of concern is West Nile virus, which has been shown to reduce survival rates of greater sage-grouse (Naugle et al., 2004). Deceased birds in the field were recovered using procedures of Walker et al. (2004) for the handling and submitting of birds and sent to the Wyoming State Veterinary Laboratory (WSVL) in Laramie WY.

Seasonal distribution and habitat use by greater sage-grouse in western Natrona County, Wyoming have not been determined and are the foci of the two-year project. Results from this study will provide base-line habitat and pathogen data.

OBJECTIVES

Goals of the Western Natrona County Sage-grouse Distribution Project are to document seasonal movement of the greater sage-grouse, sagebrush characteristics of nesting, early brood rearing and winter habitat, nest success, adult survival rates by gender, and to identify pathogens that may impact the population. The specific study objectives are to:

1. Determine the migratory status and map the seasonal movements of the western Natrona County population. The population is migratory if the movement between summer and winter habitat is greater than 10 kilometers.

2. Develop a predictive model relating seasonal habitat use type (nesting, brood rearing, and winter) to sagebrush site characteristics (height and cover).

3. Estimate the nesting success and adult survival rates for greater sage-grouse in western Natrona County.

4. Conduct a survey of parasite presence and abundance on birds of known age and sex.

This report serves the purpose of updating the partners in this project with the results to date. Analysis is limited at this point as the focus has been on collecting the data. The final report is due by December 31, 2010 and will be in the form of a master's thesis.

STUDY AREA

The primary study area is located in western Natrona County, Wyoming. It encompasses lands south of Highway 20-26, west of Strohecker Road, east of Gas Hills Road, and north of Dry Creek Road. Poison Spider Road runs through the southern part with the Rattlesnake Hills to the southwest. The area is impacted by anthropogenic activities including oil and gas extraction, power lines, grazing, county roads, and some residential development.

Major drainages within this area are Casper Creek, Poison Spider Creek, Wallace Creek, Coyote Creek, and the South Fork Powder River. Topography in the primary study area ranges from flats and ridges to rocky outcrops and cliffs. The principal habitat type is sagebrush-grassland. Dominant vegetation is comprised of Wyoming big sagebrush (A*rtemisia tridentata wyomingensis*) with mountain big sagebrush (*Artemisia tridentata vaseyana*) found in the higher elevations. Silver sagebrush (*Artemisia Cana*) and rabbitbrush (*Chrysothamnus* spp.) are distributed throughout the study area. Diverse grasses are interspersed through the area including needle-and-thread (*Stipa comata*), grama (*Bouteloua* spp.), junegrass (*Koeleria* spp.), western wheatgrass (*Pascopyrum smithii*), and Sandberg bluegrass (*Poa secunda*). Prickly pear cactus (*Opuntia* spp.) as well as invasive cheatgrass (*Bromus* spp.) is also found throughout the study area.

METHODS

Radio Telemetry

Greater sage-grouse were captured using spotlighting and hoop-netting techniques (Giessen et al., 1982; Wakkinen, 1990). The birds were then sexed, aged (juvenile or adult) and fitted with a necklace-mounted radio transmitter. The necklace transmitters, manufactured by ATS (Advanced Telemetry Systems, Isanti, MN) have a battery life of 434 days, weigh 22g, and switch over to a mortality signal after 8 hours of inactivity.

In the spring of 2008, 88 sage-grouse (56 females and 24 males) were captured and fitted with radio-transmitters. As of December 31, 2008, only 45 collared sage-grouse remained. The decision was made to attempt collaring during the winter in order to provide additional location data for winter habitat analysis. In January 2009, 16 sage-grouse (9 females and 7 males) were captured and fitted with radio-transmitters. Capture was limited due to harsh weather conditions. In March and April of 2009, 69 sage-grouse (33 females and 36 males) were captured and fitted with radio-transmitters.

The process was accomplished with the assistance of personnel from the Bureau of Land Management (BLM), the Wyoming Game and Fish Department (WGFD), and a Casper College student volunteer.

A telemetry-equipped, fixed-winged aircraft was used to locate birds monthly throughout the year. Additional flights were conducted during the breeding and nesting/early brood rearing periods (Table 1).

Table 1. Flights providing sage-grouse locations

2008			2009		
May 19-20	Aug 5-6	Dec 15-16	Jan 8-9	May 15-16	Aug 4-5
May 29-30	Sep 17-18		Feb 2-3	May 26-27	Sep 17-18
Jun 12-13	Oct 14-15		Mar 2-3	Jun 15-16	
Jul 9-10	Nov 12-13		Apr 21-22	Jul 15-16	

Aerial points were collected by Laird Flying Service. Flight locations were verified via ground telemetry year-round, as weather and road conditions allowed. Ground monitoring was limited September 2008 through May 2008 due to class schedule. Ground verification was conducted by going to the flight location and utilizing a hand-held, 3-element Yagi antenna and ATS receiver to locate the radio-frequency of the sage-grouse. If the signal could not be heard at the location, the search was expanded out. Higher topographical areas such as ridges, hills, and outcrops were used to increase the probability of obtaining a signal. If the bird was visually observed, the location was recorded for use in future analysis.

Parasite Sample Collection and Identification

Fecal, blood, and ectoparasite samples were collected in 2008 and 2009 during the March and April capture. Only fecal samples were collected in the January capture as weather conditions (wind and freezing temperatures) prevented successful collection of ectoparasite and blood samples. In 2008, 61 blood, 66 fecal, and 14 ectoparasite samples were collected. In 2009, 54 blood, 58 fecal, and 4 ectoparasite samples were collected.

Fecal samples were collected at the location where the bird was roosting or if it defecated while being handled. Feces were placed in small plastic bags, transferred to glass jars in the laboratory, and stored in potassium dichromate ($K_2Cr_2O_7$). Procedures of Duszynski et al. (2008) were followed for the sporulation and identification of the *Eimeria* spp.

Blood samples were collected via nail clipping to obtain blood smears and styptic powder applied to ensure bleeding stopped. Blood slides prepared in the field were fixed in ethanol in the laboratory after trapping for the night was completed. Slides were stained using Giemsa stain (Pritchard and Kruse, 1982) and cover-slipped by staff at Wyoming Medical Center. Samples were examined using an Olympus BX40 light microscope for identification of the *Plasmodium* spp. (avian malaria), *Haemoproteus* spp. (avian malaria), and *Leucocytozoon* spp. (leucocytozoonosis).

Ectoparasite samples were collected using the dust-ruffling method (Walther and Clayton, 1997). Ectoparasite sampling was limited due to the windy conditions prevalent during much of the capture periods. The samples were ocularly examined the day of collection to determine the presence of Mallphaga (lice) or Acarina (mites and ticks).

DNA Sample Collection for Additional WY Studies

In 2009, feather samples and additional blood samples were collected in cooperation with two DNA studies occurring in Wyoming. These studies are using genetic analyses to determine connectivity of sage-grouse populations.

Wyoming Game & Fish Department is utilizing DNA from feather samples. A feather from the captured sage-grouse was placed in a plastic bag. The bag was placed inside-out over the hand in order to avoid touching the feather. Craighead Beringia South is utilizing DNA from blood samples. A blood drop from the clipped toenail was smeared on a DNA blood card. Cards and bags were labeled with the frequency number from the corresponding radio-transmitter to allow for cross-referencing.

Microhabitat Data Collection

Data collected for successful and unsuccessful nest locations, early brood rearing locations, and winter locations included aspect, slope, elevation, nearest anthropogenic feature, visual obscurity, shrub height, sagebrush density, and percent shrub canopy cover.
Shrub canopy cover (%) was measured using 10-m transects for nest locations (Beck, 2008) and 20-m transects for brood rearing and winter sites. Two line-transects were placed perpendicular to each other in the 4 cardinal directions and centered over the location (nest bowl or greater sage-grouse location). Measurements were taken using the line intercept method (Canfield, 1941) with openings in sagebrush of ≥ 3-cm considered as non-sagebrush intercepts (Wambolt et al., 2006). Shrub height was recorded for each shrub intercepting the transect line. Visual obstruction was estimated using a Robel pole (Robel et al. 1970). Density of rooted sagebrush (young, mature, decadent, dead) was measured by the use of a 1-m belt transect along each transect. Rooted sagebrush was designated as decadent if at least 50% of the shrub is dead. Digital photographs were taken of the location, each transect line, and also of the landscape around the location.

Data Collection Specific to Nest and Early Brood Locations

As forbs are a significant dietary component of greater sage-grouse diets (Barnett and Crawford, 1994; Huwer, 2004), species richness of perennial food forbs and cover were recorded for nest and early brood rearing locations. Using a 0.2-m × 0.5-m open-ended quadrat, canopy cover of grasses and forbs were measured using Daubenmire cover classes (Daubenmire, 1959). Coverage of bare ground, litter, rock, and cryptogamic crust were ocularly estimated using Daubenmire cover classes (Daubenmire, 1959). A total of 9 quadrats for nest sites and 13 for brood rearing sites were placed in the plot along the transect lines. One quadrat was located at the center point (nest or early brood rearing location) and 2 along each 5-m transect in the 4 cardinal directions from the center point for nest sites (3 for brood sites).

Grasses are significant as screening cover (Holloran, 1999) and were classified as new or residual and as annual or perennial. The height of grass (droop height) and shrubs (tallest leader) were recorded for the nearest shrub and grass at each quadrat location as well as for each shrub intersecting the transect line.

Data Collection Specific to Winter Locations

Wind direction, snow condition (crusted, melting, or powder), and snow depth (Beck, 1977) as well as temperature, wind speed, and snow density were recorded at the time the collared greater sage-grouse was located. The remainder of the data (slope, aspect, elevation, shrub canopy cover, and shrub height) was collected after the greater sage-grouse had left the area.

RESULTS

Radio Telemetry

Nesting success was determined when the hen abandoned the nest site. The nest was considered successful if the membrane was detached from the shell of ≥ 1 egg (Wallestad and Pyrah, 1974). In 2008, 10 nest sites were located. Four (40%) were successful, 4 (40%) were depredated, and 2 (20%) had no sign of egg remains. In 2009, 25 nests were located. Thirteen (52%) were successful and 12 (48%) were depredated (including one re-nest). Four hens were located with broods, but nests were not located.

At the end of September 2008, 47 collared sage-grouse remained (36 females and 11 males). The mortality rate for the period from April 2008 through September 2009 was 46.6% (41 collars out of service). After the 2009 spring capture, 122 sage-grouse (74 females and 48 males) were being monitored. As of the end of September 30, 2009, 81 collared sage-grouse remained (57 females and 24 males). Mortality rate for the period from April 2009 through September 2009 was 33.6% (41 collars out of service). All necklace radio-transmitters emitting mortality signals have been retrieved.

Parasite Survey and Disease Analysis

Of the 124 fecal samples collected, 50 (40%) have been processed for identification of the *Eimeria* spp. The processed samples were negative. Of the 115 blood samples collected, 61 (53%) have been examined for the presence of the *Plasmodium*, *Haemoproteus*, and *Leucocytozoon* spp. No blood samples were positive for *Leucocytozoon* spp. Fifteen (24.5%) of the examined samples were positive for either *Plasmodium* or *Haemoproteus*. Eighteen (100%) of the ectoparasite samples were negative for the presence of Mallphaga or Acarina.

In the summer of 2008, 2 sage-grouse were submitted to the Wyoming State Veterinary Laboratory. The male tested negative for West Nile Virus and the female tested positive.

DNA Sample Collection

The feather samples were delivered to the Wyoming Game & Fish Department (Casper WY). The blood cards were mailed to Craighead Beringia South (Kelly WY). Feedback will be requested before the completion of the final report for this project. If available, it will be incorporated in the master's thesis.

Microhabitat Sampling

As of September 30, 2009, microhabitat information was collected on 21 nest sites, 5 brood rearing sites, and 26 winter habitat locations. The data has not been analyzed, but will be used in the development of the predictive model.

DISCUSSION

Nest initiation for 2008 was 17.8% (10) and nest success was 40% (4). Monitoring in 2008 did not begin until the last week in May. Nest initiation, nest success, and chick survival rates are inconclusive for 2008 due to the late start in monitoring activity. Nest initiation for 2009 was 37.8% (28 nests which does not include the re-nest) and nest success 61% (17 nests). Clutch sizes ranged from 2 to 8. Brood checks were conducted from July 10 through August 10 in order to provide WGFD with chick survival information. In 2009, 50% of hens with successful nests still had a chick by the middle of August.

In 2008, 90% (9) of nests initiated and in 2009 60% (15) of nests initiated were located within 5 miles of Square Top Butte. Other than grazing by domestic livestock, this area has very little anthropogenic activity. Further analysis is being conducted to determine how far the hens are traveling from capture point to nest site.

The presence of avian malaria within the population will be considered in more detail. There may be a link between the presence of the parasite and the mortalities and unsuccessful nests. Data from unsuccessful nests locations and mortalities have not been analyzed.

Work on the predictive model and analyses of the habitat data will begin in January 2010. Further analysis of the fecal and blood samples will be conducted this winter in the University of Wyoming/Casper Center Parasitology Laboratory at Casper College, Casper WY. Questions and ideas that have been generated from this research will be detailed in the final report.

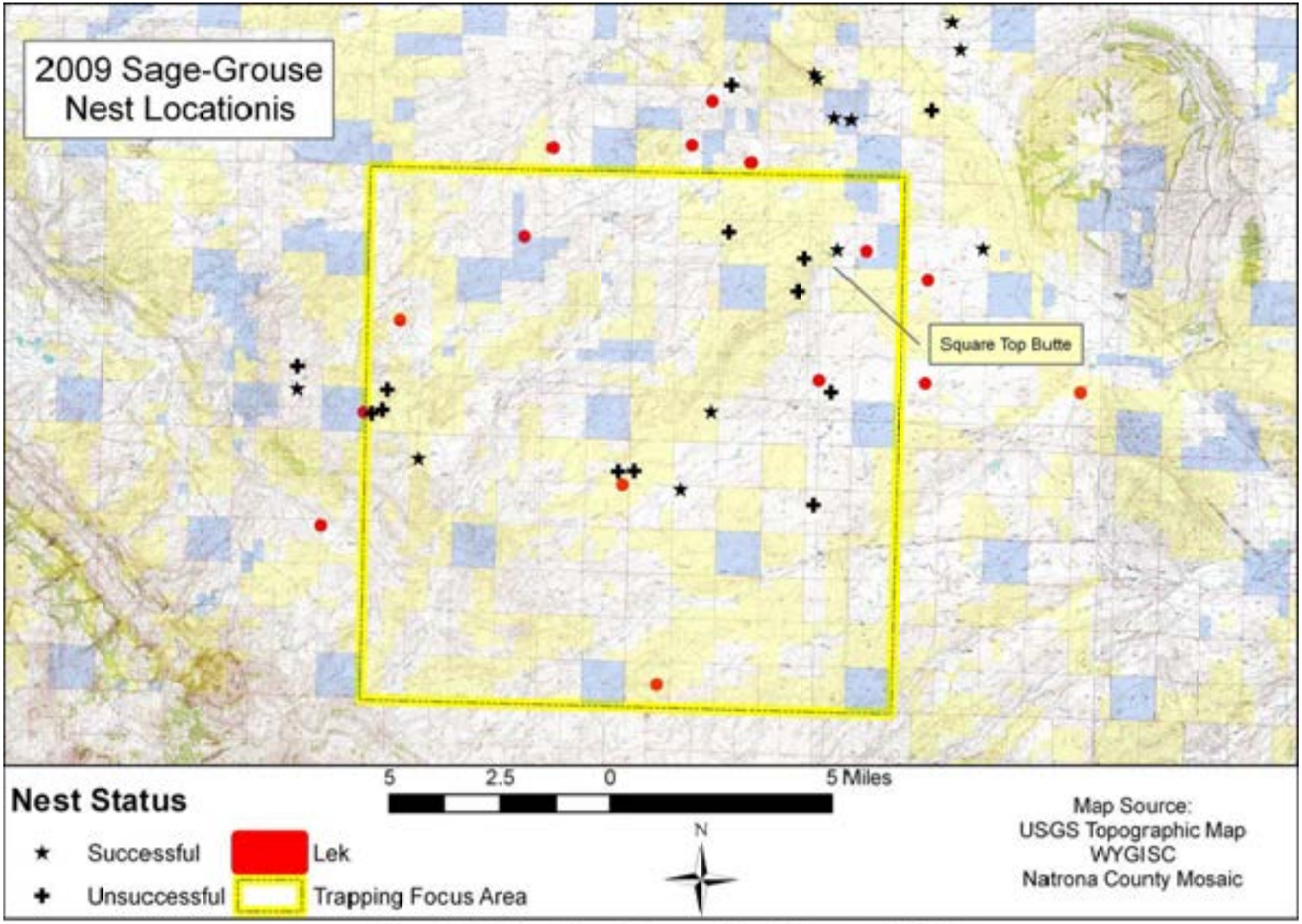

Figure 1. 2009 Locations of Successful and Unsuccessful Nests

PRESENTATIONS

Preliminary data and overview of the project have been presented at various conferences. The financial assistance from various entities made this possible, and it is greatly appreciated.

- *Western Natrona County Sage-Grouse Distribution Project: Parasite survey and determination of seasonal habitat selection of greater sage-grouse (Centrocercus urophasianus)in western Natrona County, WY;* University of Wyoming Graduate Symposium, April 2009

- *Survey of Parasites and West Nile Virus in the Greater Sage-Grouse (Centrocercus urophasianus) in Western Natrona County, Wyoming*; University of Wyoming Student Chapter of the Wildlife Society, April 2009

- *Survey of Parasites and West Nile Virus in the Greater Sage-Grouse (Centrocercus urophasianus) in Western Natrona County, Wyoming*; 79th Meeting of the Cooper Ornithological Society, April 2009.
    - Funded by: Margaret and Sam Kelly Ornithological Research Fund

- *Pathogens of Greater Sage-Grouse (Centrocercus urophasianus)*; 58th Annual International Conference of the Wildlife Disease Association, August 2009
    - Funded by: Margaret and Sam Kelly Ornithological Research Fund, National Institutes of Health - grant # P20 RR016474*, University of Wyoming/Casper Center Dean's Discretionary Fund, Scott-Walter Travel Fund

- *Parasites of Greater Sage-Grouse: Are they resulting in critical fitness consequences for a species in decline?*; 2009 Annual Meeting of the Rocky Mountain Conference of Parasitologists, September 2009
    - Funded by: National Institutes of Health - grant # P20 RR016474*

- Pending: *Western Natrona County Sage-Grouse Distribution Project: A Seasonal Habitat and Parasite Survey* Study; 2009 Joint Meeting of The Wildlife Society – Wyoming Chapter, Society for Range Management – Wyoming Section, and Soil and Water Conservation Society, November 2009
    - United States Department of the Interior – Bureau of Land Management Research Grant

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Many other organizations and individuals have helped in multiple ways to make this project a success. The landowners and lessees have allowed access to their property and answered the myriad of questions that have been put to them. My graduate committee, Scott Seville, Ann Hild, Anna Chalfoun, and Jeff Beck, have been very supportive and provided guidance throughout the project. This project would not be a success without the cooperation of all that have been involved in it, and the assistance is greatly appreciated.

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

No new vegetation projects occurred within the BHSBCA which were specifically designed to enhance sagebrush or sage-grouse populations. However, an updated photograph of vegetation response is available for the Bates Hole Big Sagebrush Restoration Project (below).

Bates Hole Big Sagebrush Restoration – Project Update

In June 2008, approximately 880 acres of prickly-pear cactus were sprayed with Tordon®. The prickly-pear cactus is showing signs of injury to individual pads by turning a maroon color, and the flower stalks were completely killed. It is estimated that it may take 2 to 3 years before the entire plant is dead, although plant mortality should continue to be documented over the next several years. Plateau® herbicide was aerially applied to treat an additional 832 acres of cheatgrass in August of 2008. The 2007 cheatgrass treatment was very successful, with an estimated 95 – 100% control of cheatgrass. Photos of the pasture prior to treatment and post-treatment vegetative response are included below (Photos 1 & 2).

Photo 1. Pre-treatment area within Bates Hole Big Sagebrush Restoration project area.

Photo 2. Post-treatment area within Bates Hole Big Sagebrush Restoration project area

Narrative Report

Species: **Sage-grouse** Period covered: **6/1/2009 – 5/31/2010**
Region: **Cody** Local Working Group area: **Big Horn Basin**
Management areas: **11, 12, 15, 16, 17, 19, 20, 21, 46**
Prepared by: **Tom Easterly, Greybull Wildlife Biologist**

INTRODUCTION

Sagebrush habitat and populations of Greater Sage-grouse (hereafter referred to as sage-grouse) 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 (USFWS) determined that sage-grouse were not warranted for listing; however, in response to a lawsuit, a federal judge remanded the decision back to USFWS for re-evaluation. In early 2010, USFWS determined sage-grouse were warranted for listing but they precluded the species from listing due to other higher priority species. On-going conservation measures, especially in Wyoming, were also cited as an important factor in keeping the birds from being listed.

This annual report summarizes data collected on sage-grouse in the Bighorn Basin in north-central Wyoming during the 2009 biological year (1 June 2009–31 May 2010), including the 2010 breeding season.

STUDY AREA

The Big Horn Basin Conservation Area (Basin) encompasses over 12,300 square miles and is subdivided into various political jurisdictions and ownership patterns (Fig 1). Counties within the Basin include Big Horn, Hot Springs, Park, and Washakie. The Wyoming Game & Fish Department (WGFD) divides the Basin into several Management Areas for data collection and reporting of small and upland game species (Areas 11, 12, 15, 16, 17, 19, 20, 21, 46 and a portion of 40). The Basin is mostly public land managed by the Bureau of Land Management (BLM; 40%), Forest Service (25%), state (5%), or other government agencies (>1%; Bureau of Reclamation, National Park Service, Department of Defense). Over 3100 square miles of the Basin (25%) are private land. 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.

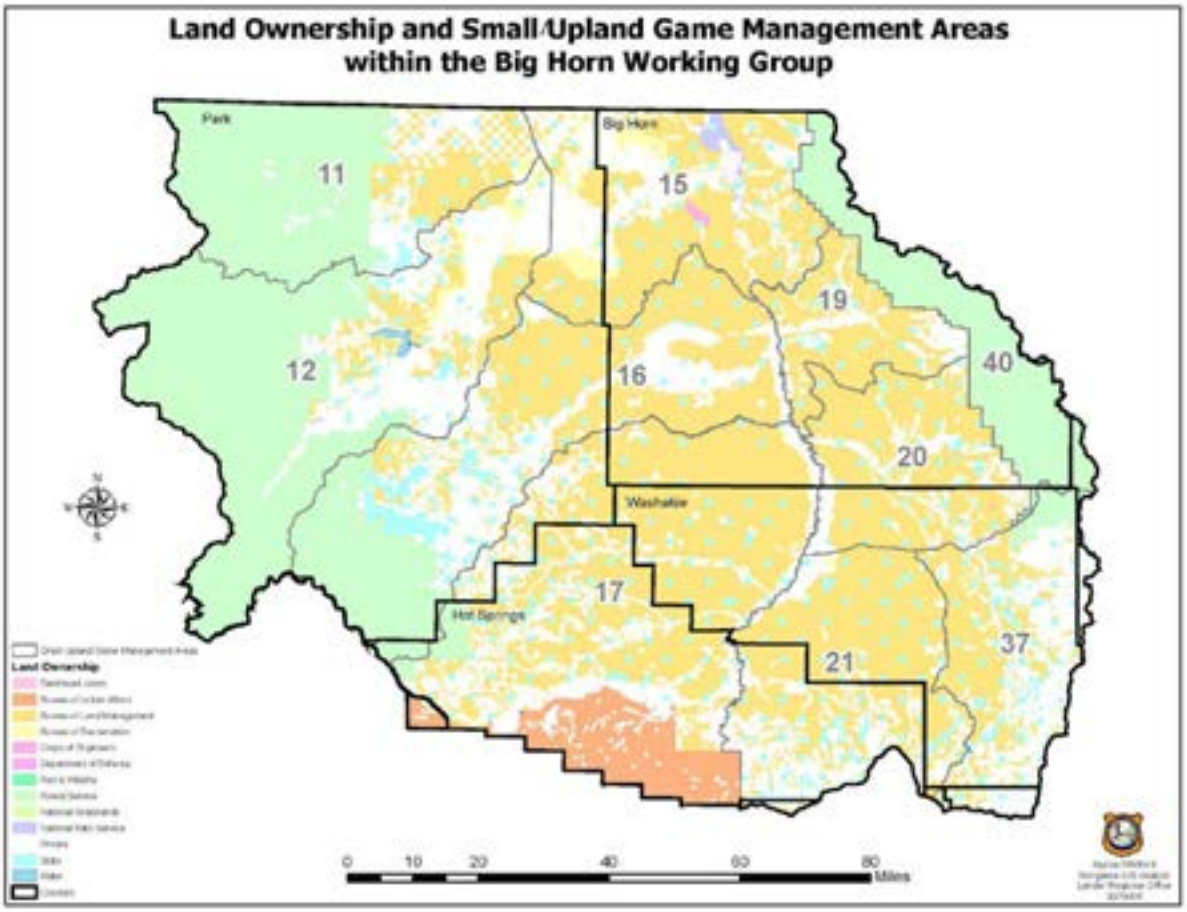

Figure 1. Geopolitical subdivisions and land ownership patterns in the Bighorn Basin, 2008.

Habitats within the 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, cottonwood-riparian corridors, mixed mountain shrub, mixed conifer forests at higher elevations with interspersed aspen stands, and urban areas.

Connelly et al. (2004) recognized sage-grouse in the Bighorn Basin as a distinct sub-population (Fig 2). 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 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 spring 2010, there were 256 known, occupied sage-grouse leks in the conservation area. There are probably leks within the Basin that have not been discovered. A majority of active leks (69%) occur on BLM managed land (Table 1). Twenty-seven 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.

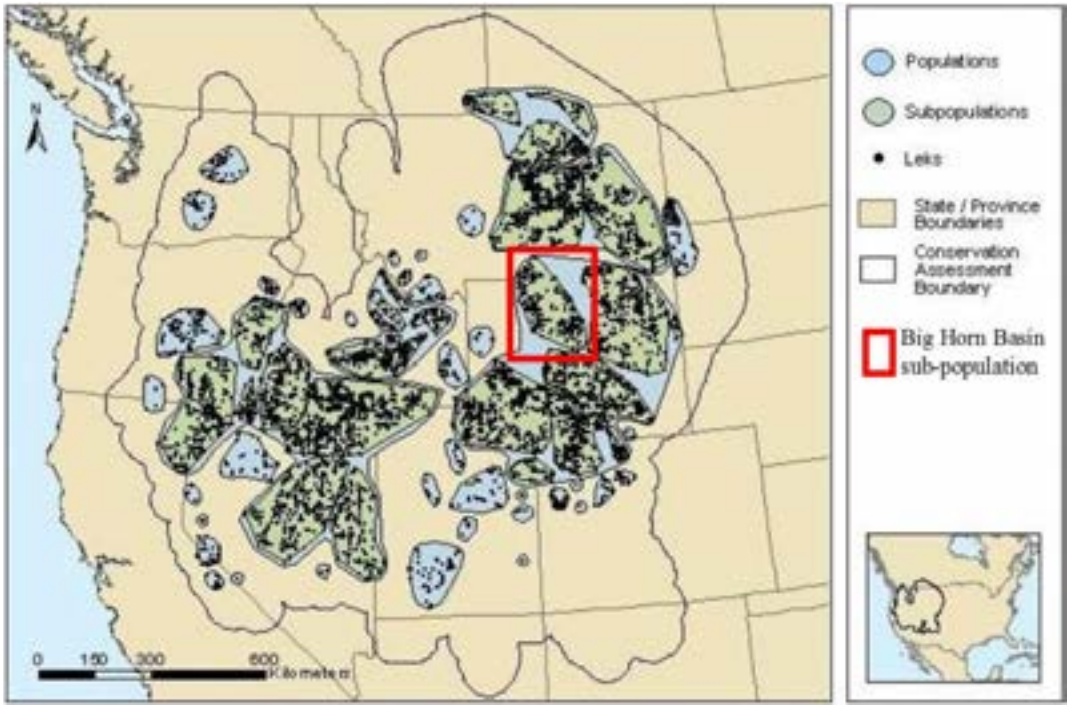

Figure 2. Discrete populations and subpopulations of sage-grouse in western North America, highlighting (red rectangle) the Bighorn Basin sub-population. (Adapted from Connelly et. al. 2004).

Table 1. Distribution of the 283 sage-grouse leks within the Big Horn Basin Conservation Area based on status and various geopolitical subdivisions, 2010.

Classification	Number	Percent
Occupied	256	90.5%
Undetermined	2	0.7%
Unoccupied	25	8.8%

Unoccupied Leks	Number
Abandoned	22
Destroyed	3
Unknown	2

Land Status	Number	Percent
BLM	194	68.6%
BOR	1	0.4%
Private	68	24.0%
State	19	6.7%

BLM Office	Number	Percent
Cody	101	35.7%
Worland	182	64.3%

County	Number	Percent
Big Horn	42	14.8%
Hot Springs	45	15.9%
Park	96	33.9%
Washakie	100	35.3%

WGFD Bio. District	Number	Percent
Cody	76	26.9%
Greybull	44	15.5%
Worland	163	57.6%

Game Warden District	Number	Percent
Greybull	28	9.9%
Lovell	17	6.0%
Meeteetse	36	12.7%
North Cody	22	7.8%
Powell	14	4.9%
South Cody	18	6.4%
Ten Sleep	47	16.6%
Thermopolis	37	13.1%
Worland	64	22.6%

Management Area	Number	Percent
11	12	4.2%
12	25	8.8%
15	19	6.7%
16	40	14.1%
17	53	18.7%
19	16	5.7%
20	16	5.7%
21	54	19.1%
46	48	17.0%

METHODS

Since 1998, 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.

Brood surveys were conducted during July and August. No consistent methodology has been established for brood-rearing surveys, but usually consisted of an observer 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, 21, and 46 (Figure 1). Area 46 was created in 2008 from the western half of old Area 37 to improve analysis of sage-grouse harvest from the Big Horn Basin subpopulation. Few, if any, sage-grouse are harvested from that portion of Area 40 within the Basin.

Surveys were conducted during December through early February to delineate winter distribution and identify important habitats. Winter surveys consisted of driving or flying across areas that contain sufficient sagebrush above snow to provide cover and forage. Observers recorded location, grouse numbers, habitat type, aspect, slope, and snow depth (approximate).

RESULTS

Lek monitoring. Lek monitoring data for the 2010 breeding season are summarized in Table 2 (a.-d.) and Figure 4 for leks counted (3+ visits), surveyed (at least one visit) and all leks checked (counted or surveyed). Data from 2000-09 were given for comparison and trend. Average male attendance was calculated using only those leks where one or more males were present (active leks). During spring 2010, 205 (72%) of the 283 known sage-grouse leks in the Bighorn Basin were visited at least once. Only 75 leks (26%) were observed following count protocols.

Male attendance at all leks visited (counts and surveys) averaged 17.5 males per lek during spring 2010. There was a decrease in average male attendance from 2009 (21 males/lek; Table 2c). This decline was evident in count leks and survey leks (Table 2a and 2b, respectively). Male attendance at all leks averaged 19.4 males/lek between 2000 and 2009.

Declines in average male attendance at leks observed during the past three years were probably natural fluctuations in sage-grouse population cycles and not a declining trend

Table 2(a–d). Lek attendance summary (occupied leks) for the Big Horn Basin Conservation Area, 2000-2010.

a. Leks counted

Year	Known	Counted	Percent Counted	Max Totals Males	Max Totals Females	Avg./Active Lek Males	Avg./Active Lek Females
2000	234	47	20.1	1141	418	24.3	8.9
2001	234	43	18.4	791	300	18.4	7.0
2002	235	58	24.7	773	395	13.3	6.8
2003	238	66	27.7	1051	438	15.9	6.6
2004	246	61	24.8	1140	242	18.7	4.0
2005	248	84	33.9	1758	597	20.9	7.1
2006	253	64	25.3	1714	546	26.8	8.5
2007	255	71	27.8	1881	535	26.5	7.5
2008	254	97	38.2	2054	739	21.2	7.6
2009	256	75	29.3	1728	659	23.0	8.8
2010	261	75	28.7	1512	649	20.2	8.7

b. Leks surveyed

Year	Known	Surveyed	Percent Surveyed	Max Total	Avg Males/ Active Lek
2000	234	62	26.5	1126	23.5
2001	234	84	35.9	1317	19.4
2002	235	73	31.1	572	10.2
2003	238	95	39.9	652	10.2
2004	246	96	39.0	975	14.3
2005	248	99	39.9	1245	18.0
2006	253	109	43.1	1732	23.7
2007	255	97	38.0	1544	22.4
2008	254	88	34.6	1108	17.0
2009	256	115	44.9	1226	18.9
2010	261	130	49.8	1184	15.0

c. Leks checked

Year	Known	Checked	Checked	Percent Max Total	Avg Males/ Active Lek
2000	234	109	46.6	2267	23.9
2001	234	127	54.3	2108	19.0
2002	235	131	55.7	1345	11.8
2003	238	161	67.6	1681	12.9
2004	246	159	64.6	2115	16.4
2005	248	185	74.6	3003	19.6
2006	253	173	68.4	3446	25.2
2007	255	169	66.3	3425	24.3
2008	254	185	72.8	3162	19.5
2009	256	188	73.4	2944	21.2
2010	261	205	78.5	2696	17.5

d. Lek status

Year	Active	Inactive	Not Located	Unknown	Confirmed Status Total	Confirmed Status Active	Confirmed Status Inactive
2000	93	5	2	134	98	94.9%	5.1%
2001	107	10	2	115	117	91.5%	8.5%
2002	102	14	5	114	116	87.9%	12.1%
2003	120	19	4	95	139	86.3%	13.7%
2004	118	21	6	101	139	84.9%	15.1%
2005	138	18	1	91	156	88.5%	11.5%
2006	129	13	1	110	142	90.8%	9.2%
2007	136	9	1	109	145	93.8%	6.2%
2008	146	8	0	100	154	94.8%	5.2%
2009	125	8	0	123	133	94.0%	6.0%
2010	140	10	0	111	150	93.3%	6.7%

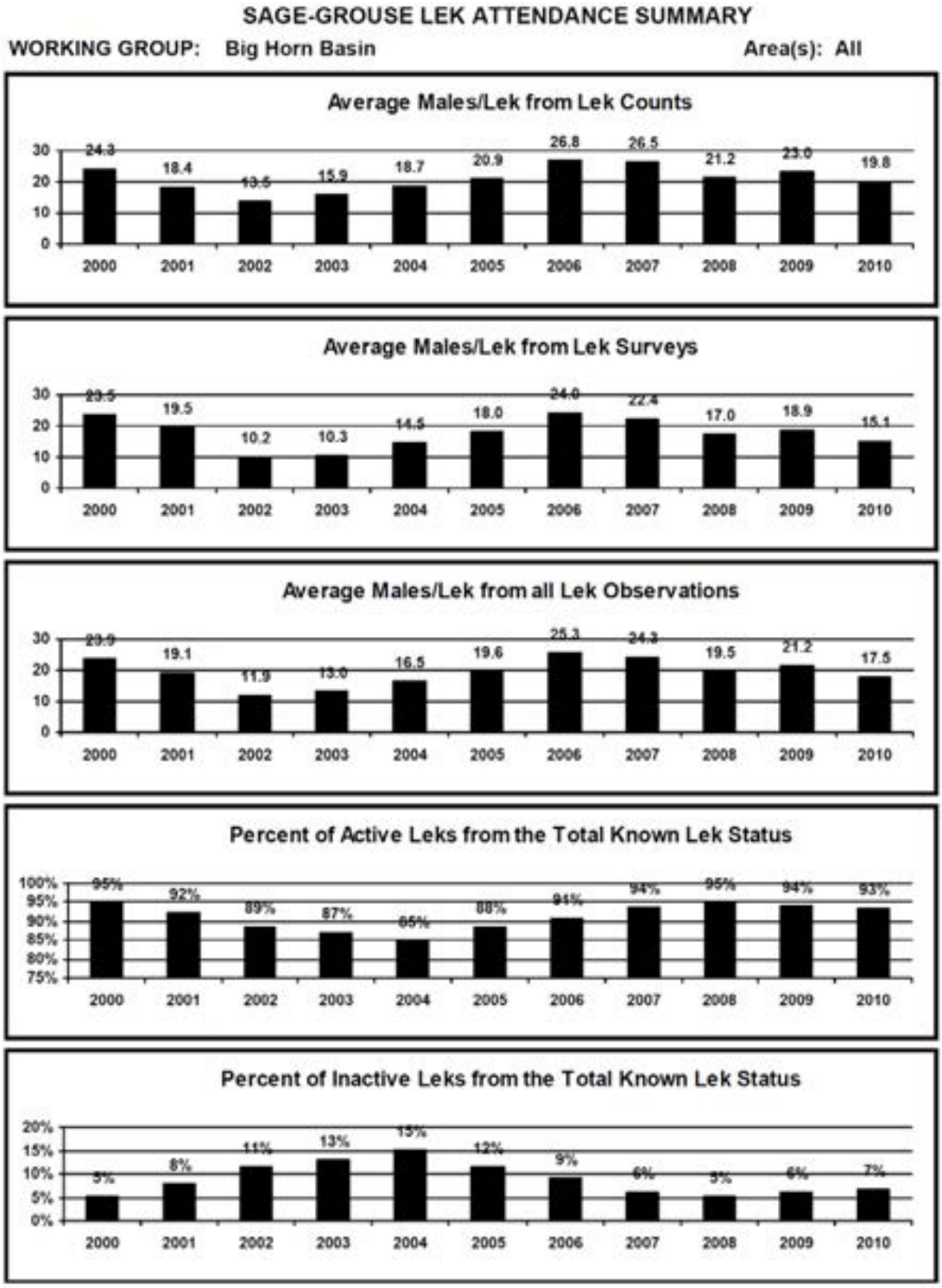

Figure 4 Graphs of lek attendance for the Big Horn Basin Conservation Area, 2000-2010.

in the Bighorn Basin population. Sage-grouse populations cycle on an approximate 7 to 10-year interval (Fig. 5). During the previous low in the population cycle (2002), 12 males per lek on average were observed at leks in the Bighorn Basin. The lowest level observed was 9.4 males/lek in 1995 and peak male attendance was 25 males/lek in 2006. Over that 30-year period, an increasing number of leks have been checked (surveys and counts) each year (Fig. 6). In most years (all but 3), over 50 leks were included in calculations of average males per lek.

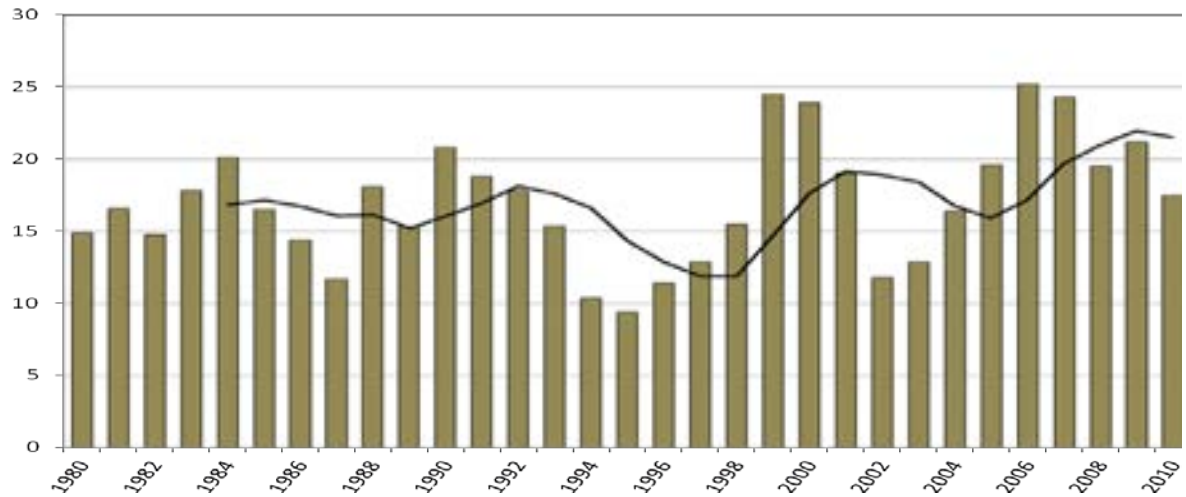

Figure 5. Trends in average male attendance at sage-grouse leks in the Bighorn Basin, 1980-2010. Trend line represents 5-year running average.

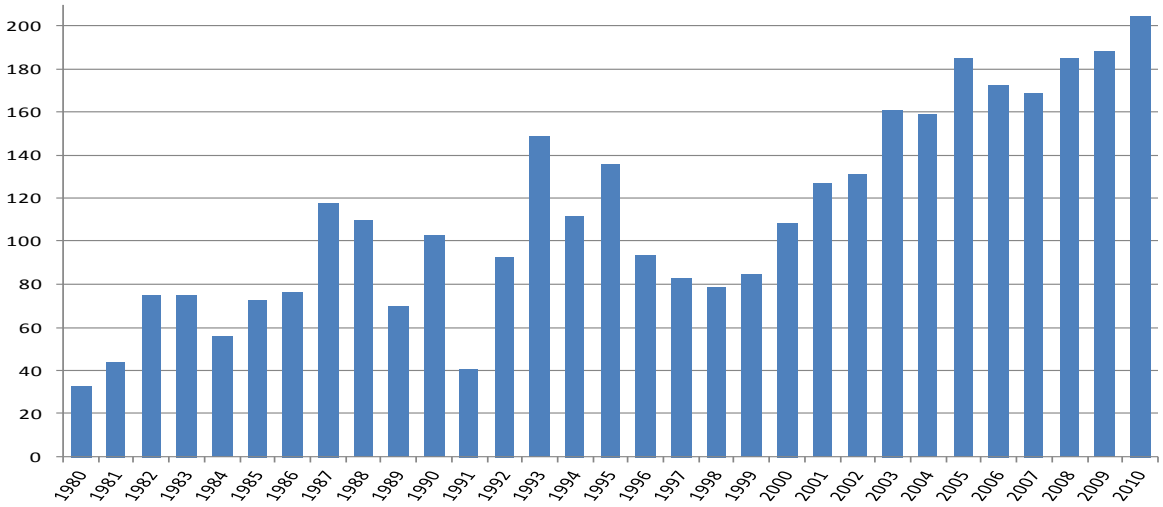

Figure 6. Number of sage-grouse leks checked each year in the Bighorn Basin, 1980-2010.

Brood surveys. Surveys for sage-grouse are conducted during July and August each year to document nest success and brood-rearing habitats. Most survey work is done in conjunction with other activities and no transect routes were established. All sage-grouse observed by WGFD personnel were entered into the Department's Wildlife Observation System. WGFD personnel coded 95 hours to sage-grouse (species code CT) brood surveys (activity code 512) in 2009; including travel time to and from possible

brood-rearing areas. Twenty-four groups of female sage-grouse (with or without chicks) were observed (Table 3). Groups of grouse recorded as only males, only unknown adults, or unknown sex/age were not included. Broods were observed mostly in agricultural fields and sagebrush-grassland habitats. Locating broods and counting chicks in dense vegetation (e.g., alfalfa) is difficult, so total chick production may be underestimated. Data is still insufficient to delineate critical brood-rearing areas.

Little data were collected for any one management area, so all observations for the entire Bighorn Basin were combined in calculations of brood size (Table 4). For those groups of grouse where all birds were classified to sex and age, there were 3.2 chicks per hen. When more than one hen was observed with a group of chicks, the number of broods was estimated based on the average brood size with only one hen observed. There were 4.0 chicks observed per brood. Between 1999 and 2008, grouse production averaged 4.2 chicks/brood and 2.4 chicks/hen (Table 4). Most annual production data was based on small sample sizes, so results may not accurately reflect true conditions. Wing barrels to collect wings of harvested grouse have also been used to estimate chick production; however, efforts to collect enough wings in the Bighorn Basin have resulted in insufficient number of wings to estimate annual production.

Table 3. Number of sage-grouse hens with or without broods observed by WGFD personnel in the Bighorn Basin during summer 2009.

Date	Adult Female	Adult Unknown	Juvenile	Unknown	# Broods	Mgmt area	Habitat type[1]	General location
7 July	1		4		1	17	4.1	Grass Ck
8 July	1		5		1	46	4.1	Nowood Ck
8 July	1		2		1	46	7.6	Nowood Ck
9 July	1		4		1	17	11.0	Cottonwood Ck
9 July	1		3		1	17	11.0	Cottonwood Ck
9 July	1		1		1	17	11.0	Cottonwood Ck
9 July	1		3		1	17	11.0	Cottonwood Ck
9 July	1		2		1	17	11.0	Cottonwood Ck
15 July	4					20	4.1	Red Gulch Rd
17 July	1		3		1	16	Unk	Dry Ck YU Bench
28 July	1		4		1	17	11.0	Cottonwood Ck
28 July	1		3	4	1	17	7.3	Cottonwood Ck
28 July	1		3		1	17	7.3	Owl Ck
3 Aug	1		6		1	17	4.1	Cottonwood Ck
10 Aug	2		15		2	16	Unk	Meeteetse Rim
10 Aug			3		1	16	Unk	Meeteetse Rim
10 Aug	1		5		1	16	Unk	Meeteetse Rim
13 Aug			1			12	4.1	McCullough Peaks
14 Aug	7		18		4	17	11.3	Blue Mesa
14 Aug		4	4		1	17	11.0	Gooseberry Ck
20 Aug	1		3		1	21	4.1	Blue Bank
20 Aug		4	5		1	21	4.1	Blue Bank
26 Aug	4		2		1	21	Unk	Copper Mountain
30 Aug	1		5		1	12	4.1	McCullough Peaks
Total	33		104		26			

[1] Habitat types follow Wyoming Game & Fish Department Wildlife Observation System codes: 4.1=Sagebrush-grassland, 7.3=Mountain-foothills grassland, 7.6=Moist meadow grassland, 11.0=Agricultural lands, 11.3=Irrigated meadow, Unk=Unknown.

Table 4. Brood survey data collected by Wyoming Game & Fish Department personnel in the Bighorn Basin, 1999-2009.

Year	Groups observed	Broods	Chicks	Hens	Chicks/ brood	Chicks/ hen
1999		19	83	48	4.4	1.7
2000	24	25	85	32	4.3	2.7
2001	22	14	51	24	3.6	2.1
2002	12	10	35	16	3.5	2.2
2003	22	24	103	30	4.3	3.4
2004	14	17	71	73	4.2	1.0
2005	27	23	123	41	5.3	3.0
2006	23	24	99	38	4.1	2.6
2007	57	56	191	99	3.4	1.9
2008	24	18	88	29	4.6	3.0
2009	24	26	104	33	4.0	3.2
1999-2008 Average	25	23	93	43	4.2	2.4

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 1982-94, hunting seasons averaged 25 days long (range 16-31 days). Between 2004-08, the hunting season for sage-grouse was 11 days long with daily and possession limits of 2 and 4, respectively. Grouse hunting season in 2009 was open 19 September to 30 September (12 days).

Moving and shortening the season and decreasing the bag limit decreased the number of sage-grouse harvested and the number of hunters in the Big Horn Basin (Fig. 7 and Table 5). Annual average harvest (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 (2002-2009), hunters averaged 1.5 birds/hunter and 2.3 days/hunter. The number of hunters and number of birds harvested decreased with later and shorter seasons, but number of days that each hunter spends hunting has remained relatively the same (2.4 days/hunter during 1982-94 vs. 2.3 during 2002-09).

The WGFD has changed management area designations and boundaries to simplify hunter reporting of sage-grouse harvest data. New management areas follow conservation area boundaries for sage-grouse local working groups (Fig. 8). The Bighorn Basin is management area B. Areas will be in effect for the 2011 hunting season.

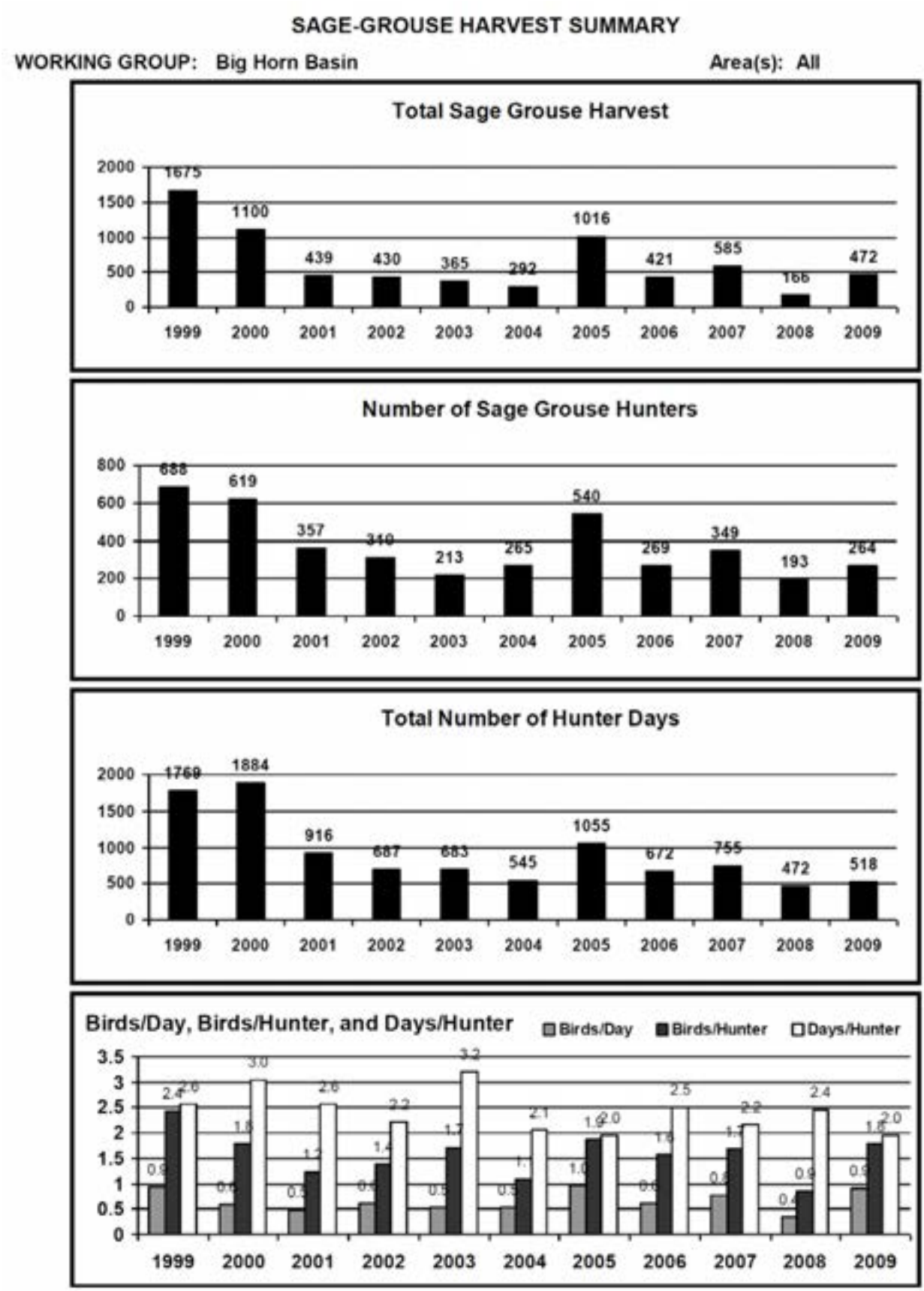

Figure 7 Graphs of harvest data for the Big Horn Basin Conservation Area, 2000-2010..

Table 5. Sage-grouse harvest data from management areas in the Big Horn Basin Conservation Area (11, 12, 15, 16, 17, 19, 20, 21, and 46), 1999-2009.

Year	Harvest	Hunters	Days	Birds/ Day	Birds/ Hunter	Days/ Hunter
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
2007[1]	585	349	755	0.8	1.7	2.2
2008[1]	166	193	472	0.4	0.9	2.4
2009[1]	472	264	518	0.9	1.8	2.0
1999-2008[1] Avg.	649	380	944	0.6	1.6	2.5

[1] Beginning in 2007, Area 46 harvest data was included in the Big Horn Basin Conservation Area

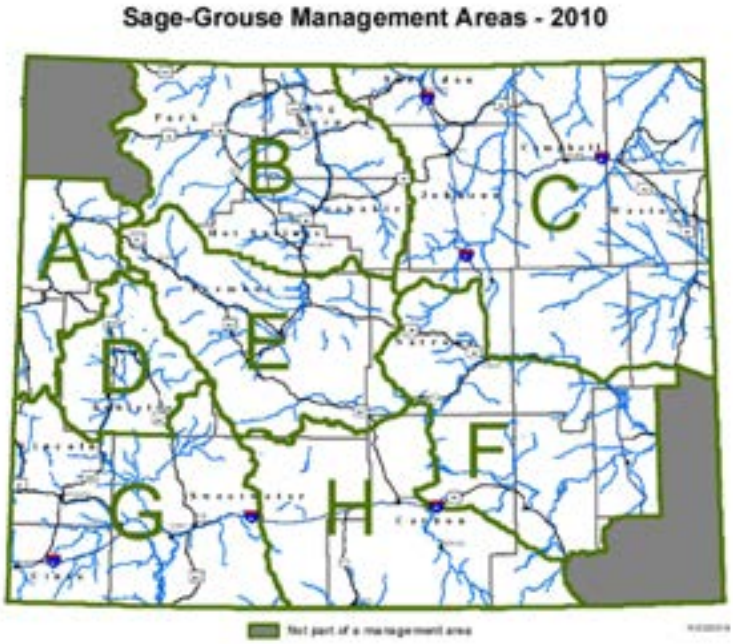

Figure 8. Management area boundaries for reporting and summarizing sage-grouse harvest, 2010.

Winter concentration areas. Survey flights were flown across several areas in the Bighorn Basin during winter 2009-10. Winter concentration areas in the southern Basin (Worland field office, BLM) were mapped in 2008. Maps were not changed based on new data that was collected this winter. Sage-grouse that were documented further justified delineation of those areas mapped in 2008. Surveys were also conducted in the northern part of the Basin (Cody field office, BLM) in January 2010. Winter concentration areas will be delineated as more data is collected.

Conservation planning. The Big Horn 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 BHBLWG 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 group's mission statement was, "*Through the efforts of local concerned citizens, recommend management actions that are based on the best science to enhance sagebrush habitats and ultimately sage-grouse populations within the Big Horn Basin*."

The Sage-grouse Conservation Plan for the Big Horn Basin identified several factors that may influence sage-grouse populations in the Big Horn Basin. A brief description of each factor and potential 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 and Governor created the Sage-grouse Conservation Fund (SgCF) to be spent by LWGs on goals established in local conservation plans. The Legislature again approved funds for SgCF in the 2006–2008, 2008-2010, and 2010-12 budget cycles. Marathon Oil Company donated a total of $70,000 between 2004 and 2010 to the Wildlife Heritage Foundation of Wyoming for sagebrush habitat work in the Basin. Those monies have funded projects designed to accomplish goals and objectives of our local conservation plan.

No new conservation projects were funded or initiated by the LWG in 2009-10. Several projects funded in previous years were completed. Most notably, the graduate research project to determine if mowing or prescribed burning could be used to improve habitat for sage-grouse was completed (Hess 2010 and related literature). Mowing and burning did not result in micro-habitat characteristics that met habitat guidelines for sage-grouse as outlined by Connelly et al. (2004). Sagebrush canopy cover and density were lower than adjacent control sites. Herbaceous vegetation measured 5-20 years following treatment increased, but not significantly over untreated sites. Insect abundance was also slightly higher on treated sites. Habitat treatments, monitored in that research, were not conducted specifically to enhance sage-grouse habitat. Use of treated sites by sage-grouse was not monitored. Mowing and burning treatments represented less than 20% of sagebrush habitat available in those areas as recommended by Connelly et al. (2004).

Various other entities have undertaken special conservation measures designed specifically to benefit sage-grouse. The BLM-Worland field office conducted sage-grouse habitat assessments on about 40 allotments, primarily for grazing permit renewal and compliance with grazing standards and guidelines. Assessments included

line intercept transects (canopy cover and shrub height), belt transect to describe sagebrush stand age (young, mature, decadent and dead sagebrush, by %), and Daubenmire cover class plots. BLM also coordinated an inventory of 56 miles of potentially hazardous fence within 0.5 mile of sage-grouse leks. Fourteen sage-grouse strikes were documented involving 12.3 miles of fence that will be marked in the 2011 field season.

American Colloid Company (bentonite mining company) began a pilot project to monitor sage-grouse movement and use of areas that will be mined by that company. Seven grouse (1 female, 6 males) were radio-collared in April 2010 on leks west of Hyattville. Those birds migrated east toward the Bighorn National Forest to higher elevation for summer. The hen may have had a brood, but lost it soon after hatch to unknown causes. Mortality of adults (2) was also unknown. This research will be expanded in 2011 to include collaring grouse near existing bentonite mines and in un-mined areas to determine if bentonite mining affects habitat use, movement, nest success, and survival. Research will be conducted by University of Wyoming, Department of Renewable Resources (Dr. Jeff Beck and a PhD student).

CONCLUSIONS

Sage-grouse populations in the Bighorn Basin remain healthy despite being at a low portion of a population cycle. Sagebrush habitats in the Basin also remain healthy despite climate related (e.g. drought) and anthropogenic changes to those habitats. Sage-grouse in the Basin face threats to long-term existence, but are not threatened with foreseeable extinction. On-going conservation efforts by many people may be adequate to mitigate those anthropogenic impacts. Monitoring efforts should continue across the Bighorn Basin to ensure sage-grouse populations and habitats are increasing or maintaining.

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Hess, Jennifer, E., *Greater sage-grouse (Centrocercus urophasianus) habitat response to mowing and prescribed burning Wyoming big sagebrush and the influence of disturbance factors on lek persistence in the Bighorn Basin, Wyoming*; M.S. thesis, Department of Renewable Resources, University of Wyoming, Laramie WY, December 2010.

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Northeast Wyoming Working Group

2009 ANNUAL SAGE-GROUSE COMPLETION REPORT

Prepared By:

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

Sage-Grouse Job Completion Report

YEAR: **PERIOD COVERED: 6/1/2009 - 5/31/2010**

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
2001	293	91	31.1	1176	345	12.9	3.8
2002	306	100	32.7	776	456	7.8	4.6
2003	329	101	30.7	772	359	7.6	3.6
2004	365	142	38.9	990	242	7.0	1.7
2005	417	106	25.4	1489	487	14.0	4.6
2006	445	88	19.8	1793	584	20.4	6.6
2007	461	115	24.9	2036	358	17.7	3.1
2008	471	127	27.0	1861	800	14.7	6.3
2009	471	158	33.5	1135	531	7.2	3.4
2010	470	199	42.3	1557	816	7.8	4.1

b. Leks Surveyed

Year	Known	Surveyed	Percent Surveyed	Max Total Males	Avg Males/ Active Lek
2001	293	96	32.8	779	13.4
2002	306	109	35.6	515	9.7
2003	329	126	38.3	673	9.9
2004	365	199	54.5	908	9.2
2005	417	208	49.9	2112	16.1
2006	445	263	59.1	3294	19.4
2007	461	292	63.3	3424	20.3
2008	471	287	60.9	2364	15.9
2009	471	247	52.4	1346	11.8
2010	470	185	39.4	579	7.9

c. Leks Checked

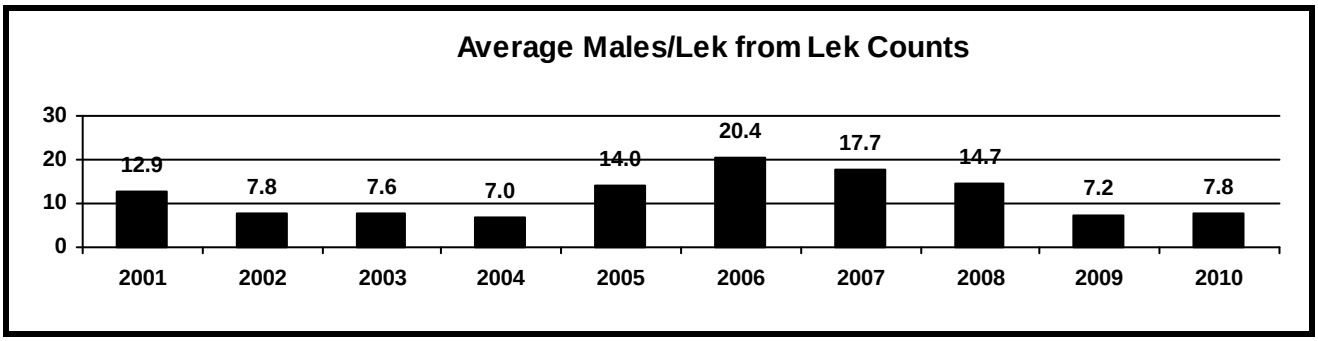
Year	Known	Checked	Percent Checked	Max Total Males	Avg Males/ Active Lek
2001	293	172	58.7	1874	13.4
2002	306	196	64.1	1237	8.7
2003	329	199	60.5	1347	8.7
2004	365	296	81.1	1763	8.2
2005	417	311	74.6	3588	15.3
2006	445	350	78.7	5079	19.8
2007	461	406	88.1	5460	19.3
2008	471	408	86.6	4116	15.2
2009	471	405	86.0	2481	9.1
2010	470	384	81.7	2136	7.9

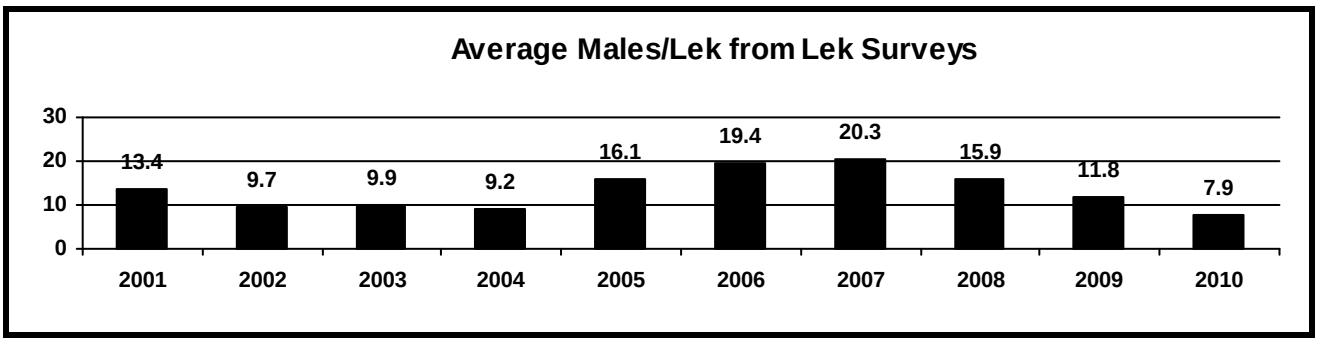
d. Lek Status

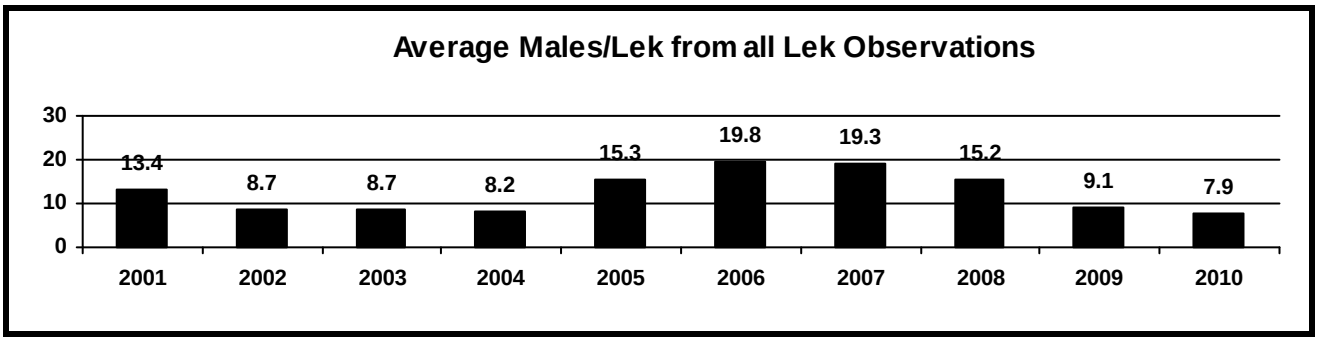
Year	Active	Inactive	Not Located	Unknown	Confirmed Status Total	Confirmed Status Active	Confirmed Status Inactive
2001	123	25	7	138	148	83.1%	16.9%
2002	116	35	2	153	151	76.8%	23.2%
2003	121	35	1	172	156	77.6%	22.4%
2004	158	64	2	141	222	71.2%	28.8%
2005	210	34	2	171	244	86.1%	13.9%
2006	235	32	6	172	267	88.0%	12.0%
2007	249	81	3	128	330	75.5%	24.5%
2008	235	94	0	142	329	71.4%	28.6%
2009	221	95	0	155	316	69.9%	30.1%
2010	193	132	2	143	325	59.4%	40.6%

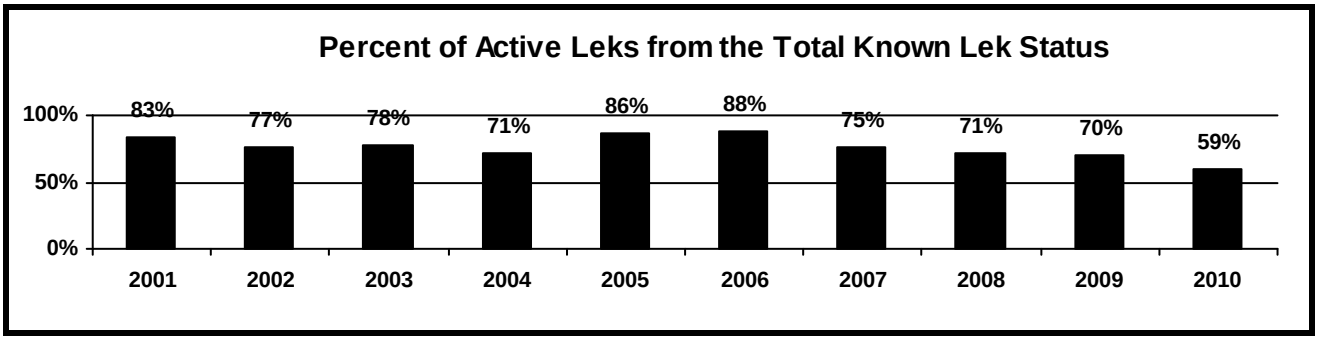
SAGE-GROUSE LEK ATTENDANCE SUMMARY

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









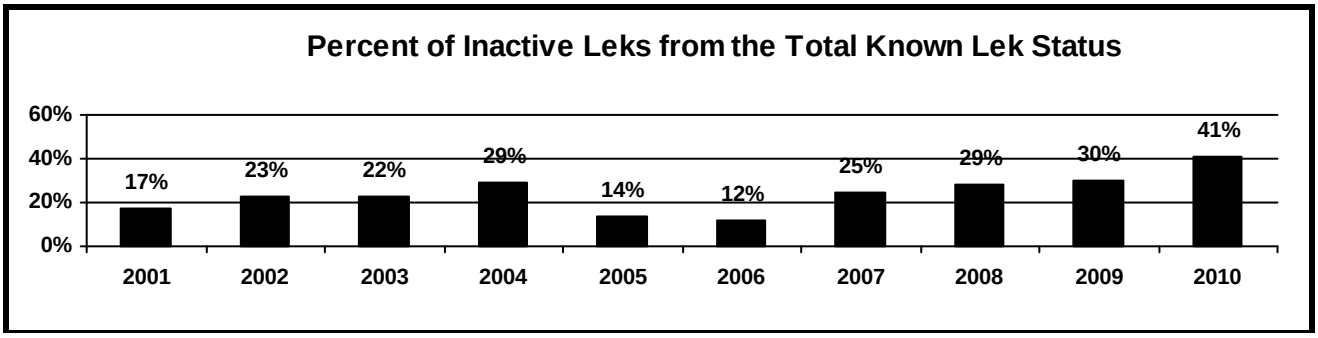


Table 4. Sage-grouse hunting seasons and harvest data.

a. Season

Year	Season Dates	Length	Bag/Possession Limit
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
2007	Sept 22-Oct 2	11	2/4
2008	Sept 22-Oct 2	11	2/4
2009	Sept 19-Sept 25	7	2/4

b. Harvest

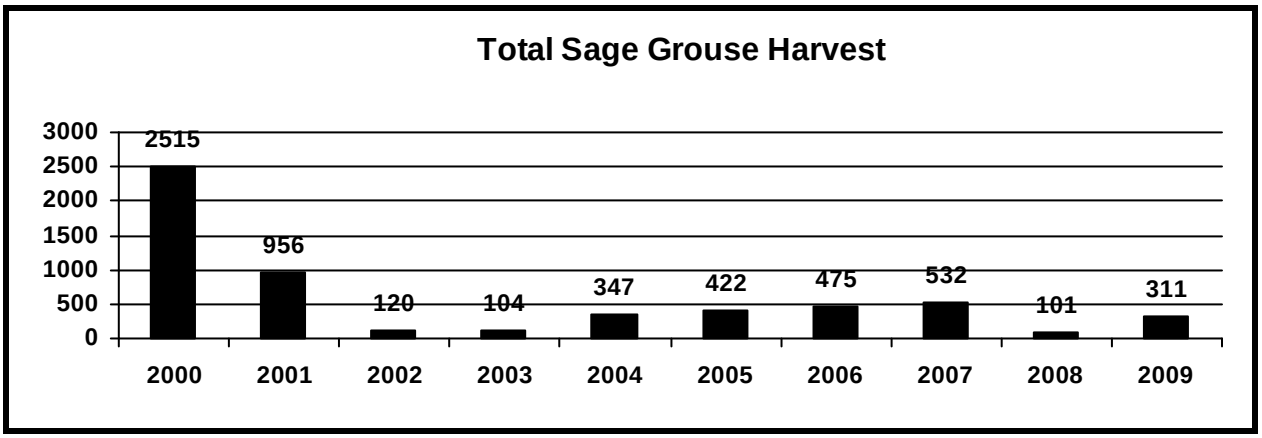
Year	Harvest	Hunters	Days	Birds/ Day	Birds/ Hunter	Days/ Hunter
1999	2,513	981	4,233	0.6	2.6	4.3
2000	2,515	1,170	3,743	0.7	2.1	3.2
2001	956	518	1,414	0.7	1.8	2.7
2002	120	210	712	0.2	0.6	3.4
2003	104	80	168	0.6	1.3	2.1
2004	347	271	471	0.7	1.3	1.7
2005	422	342	1,649	0.3	1.2	4.8
2006	475	283	509	0.9	1.7	1.8
2007	532	297	632	0.8	1.8	2.1
2008	101	186	295	0.3	0.5	1.6
2009	311	230	559	0.6	1.4	2.4
Avg.	763	415	1,308	0.6	1.5	2.7

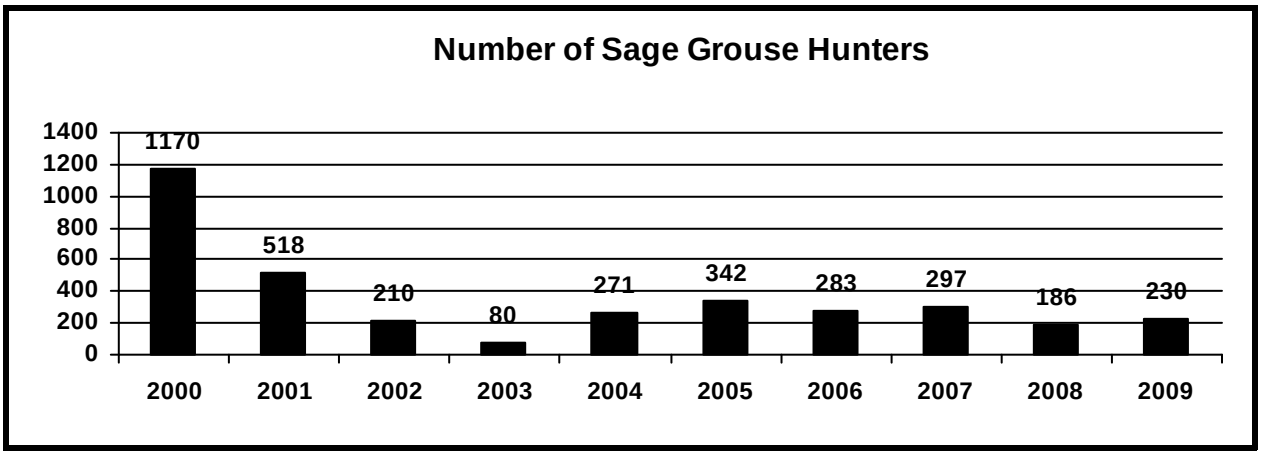
Table 5. Composition of harvest by wing analysis.

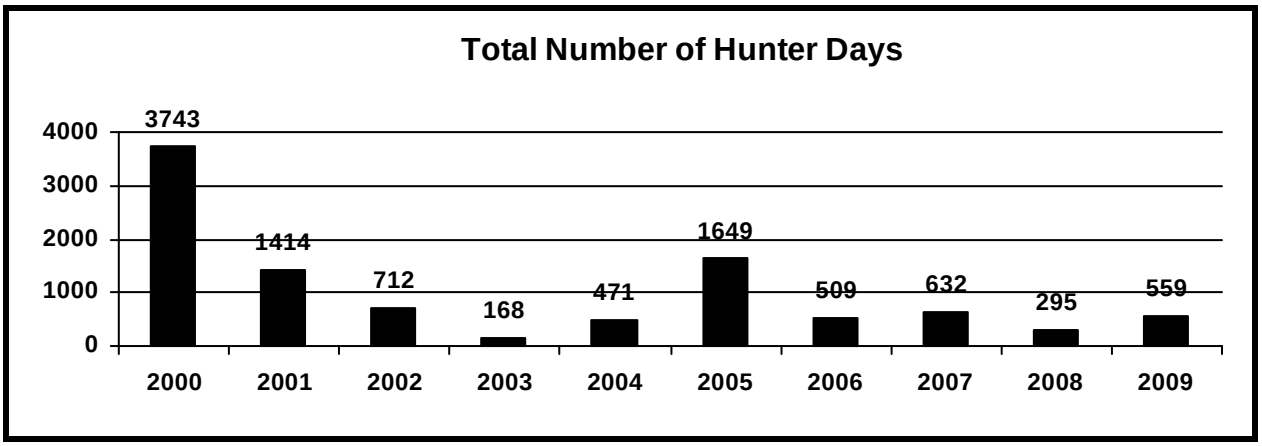
Year	Sample Size	Percent Adult		Percent Ylg		Percent Young		Chicks /Hen
		Male	Female	Male	Female	Male	Female	
2000	130	10.0	19.2	0.8	19.2	31.5	19.2	1.3
2001	103	10.7	26.2	0.0	10.7	20.4	32.0	1.4
2002	35	5.7	51.4	0.0	11.4	0.0	31.4	0.5
2003	22	9.1	9.1	9.1	9.1	27.3	36.4	3.5
2004	64	12.5	12.5	25.0	15.6	26.6	7.8	1.2
2005	109	6.4	14.7	5.5	16.5	26.6	30.3	1.8
2006	56	3.6	14.3	17.9	21.4	28.6	14.3	1.2
2007	96	10.4	25.0	8.3	6.3	33.3	16.7	1.6
2008	6	0.0	0.0	50.0	50.0	0.0	0.0	0.0
2009	24	25.0	33.3	8.3	29.2	4.2	0.0	0.1

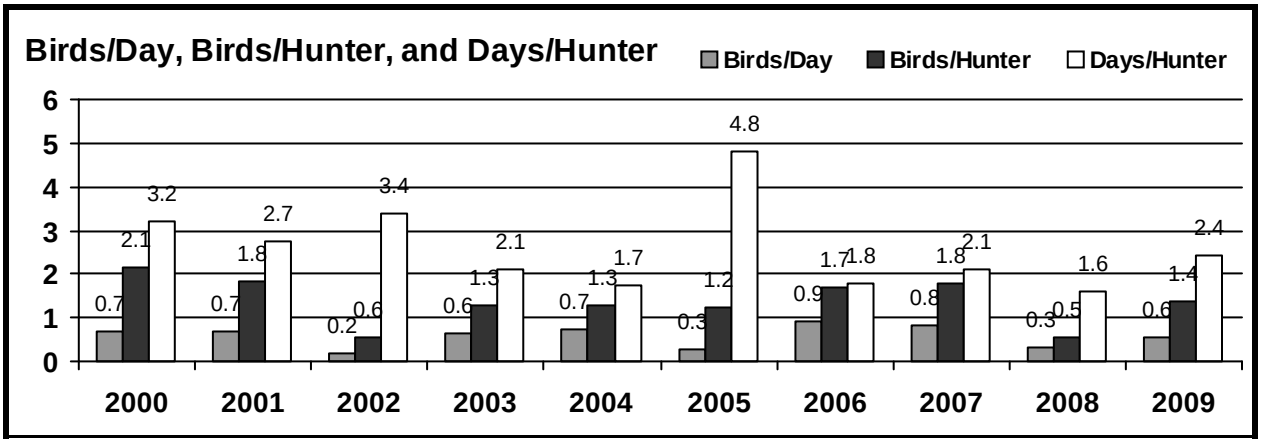
SAGE-GROUSE HARVEST SUMMARY

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









HUNTING SEASONS AND HARVEST BY MANAGEMENT AREA FOR 2009

Area	Season Dates	Length	Limit	Harvest	Hunters	Days	Birds/ Day	Birds/ Hunter	Days/ Hunter	Comments
35	Closed									
36	Closed			0	9	18	0.0	0.0	2.0	
44	Closed									
Totals				**0**	**9**	**18**		**0.0**	**2.0**	

Area	Season Dates	Length	Limit	Harvest	Hunters	Days	Birds/ Day	Birds/ Hunter	Days/ Hunter	Comments
37	Sept 19-Sept 25	7	2/4	59	24	52	1.1	2.5	2.2	Any Sage-grouse
38	Sept 19-Sept 25	7	2/4	99	92	209	0.5	1.1	2.3	Any Sage-grouse
40	Sept 19-Sept 25	7	2/4	106	44	173	0.6	2.4	3.9	Any Sage-grouse
41	Sept 19-Sept 25	7	2/4	47	61	107	0.4	0.8	1.8	Any Sage-grouse
Totals				**311**	**221**	**541**	**0.6**	**1.4**	**2.4**	

2009 JOB COMPLETION REPORT

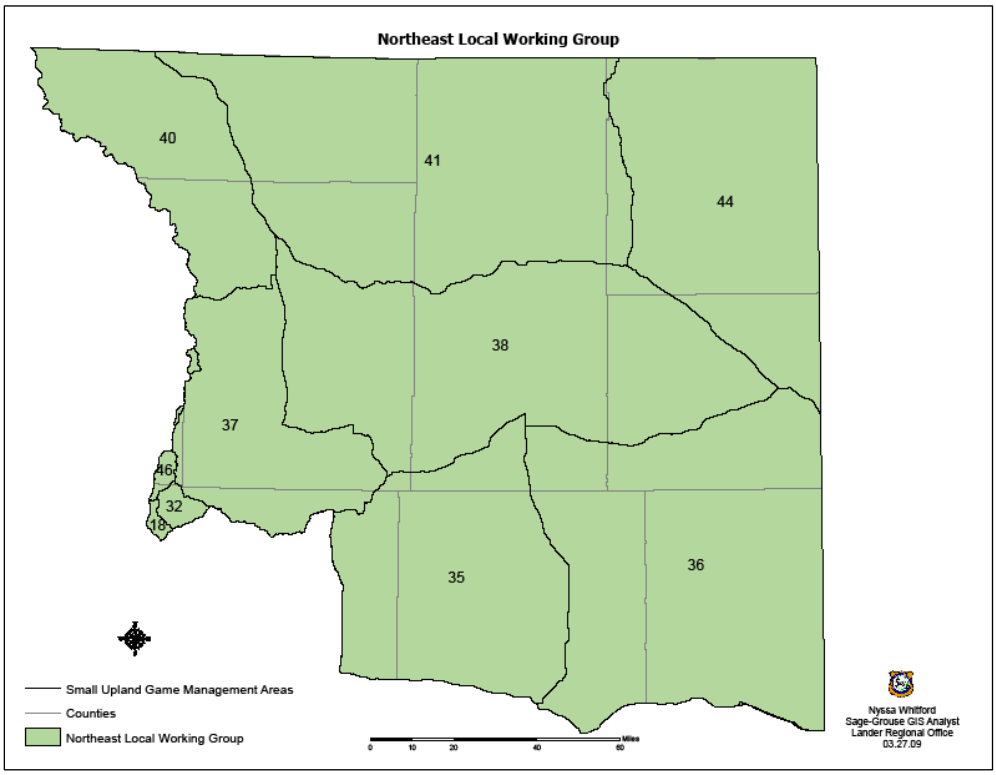
Narrative
SPECIES: **Sage-grouse**
DAU NAME: **Northeast Wyoming Working Group**
MGMT AREAS: **35, 36, 37, 38, 41, 44 and Portions of Areas 18, 32, 40 and 46**
Period Covered: **6/1/2009 – 5/31/2010**
Prepared by: **Dan Thiele, Wildlife Biologist**

INTRODUCTION

Sage-grouse data are reported for the area encompassed by the Northeast Wyoming Working Group Area (NEWWGA) 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 wildlife species that use sagebrush habitats. Prior to 2005, sage-grouse management was reported by Wyoming Game and Fish Department (WGFD) Region. The NEWWGA covers Wyoming from the Bighorn Mountain divide to South Dakota and from Montana to Interstate Highway 25 and U.S. Highway 20/26 (Figure 1). The Area boundary encompasses the WGFD Sheridan Region and a portion of the Casper Region and includes Upland Game Management Areas 35, 36, 37, 38, 41, 44 and parts of Areas 18, 32, 40 and 46. The Area 37 boundary was realigned in 2008 to conform to the local working group boundary. Prior to the change, harvest data for Areas 37 and 40 were included in this reporting area since the bulk of these management areas lie east of the Bighorn Mountain divide. Management area boundaries corresponding to the working group area are shown in Figure 2.

Figure 1. Northeast Wyoming Working Group Area.

Figure 2. Northeast Wyoming Working Group Area and Upland Game Management Areas.



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, grassland 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 8 males per active lek in 2010 compared to the statewide average of 20 males per active lek. Male lek attendance for the other working group areas ranged from 18 to 32 males per active lek. Most leks in northeast Wyoming are small with less than 20 males. In years when grouse are at the peak of their cycle, less than 10% of the leks have greater than 50 males at peak count.

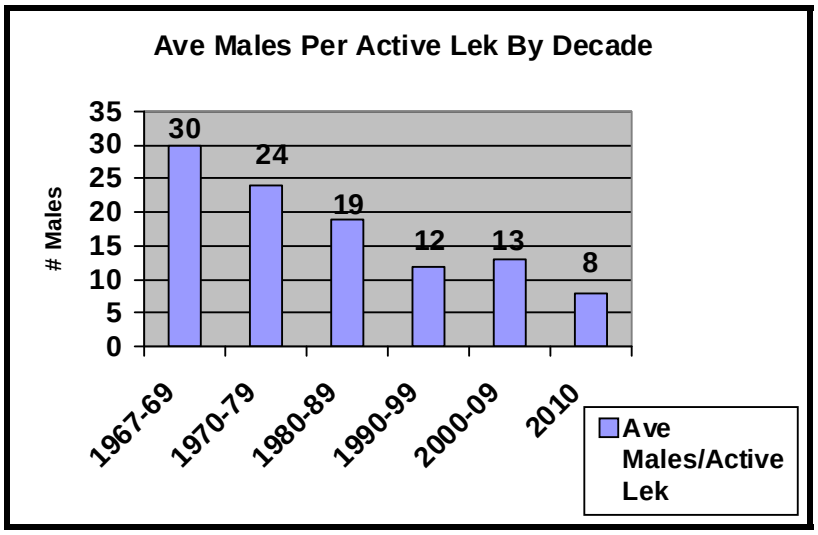
Average male lek attendance has decreased significantly over the years. Figure 3 shows the average number of males per active lek by decade since monitoring efforts began. Average male attendance has decreased by more than one-half over the last thirty years. A slight upswing occurred from 2000-2009, however, the long-term trend remains a concern.

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 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, mainly 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. The BLM predicted 51,000 wells could be drilled in the Powder River Basin Oil and Gas Project Record of Decision (BLM 2003). In May 2010, the Wyoming Oil and Gas Conservation Commission reported that 14,394 producing wells yielded 45,035,150 Mcf of methane gas. In addition to producing wells there are over 12,600 shut in wells. Federal mineral leases provided for 66% of the production while fee leases accounted for 26% and State leases 8%. Wells, roads, power lines, produced water, activity and dust are components of development which affect sage-grouse habitat at a broad scale.

Figure 3. Average Number of Males per Active Lek by Decade for Northeast Wyoming Leks.



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 although most of this 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.

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). Meanwhile, an increasing number of research projects have provided new information on sage-grouse and sage-grouse habitat. A peer reviewed scientific monograph incorporated the latest scientific information and analysis on the sage-grouse in 2009, providing a principle source of the latest information of sage-grouse and their habitats from which the U.S. Fish and Wildlife Service would base their listing determination. The monograph was published in 2011 in *Studies of Avian Biology*, managed by

the Cooper Ornithological Society (Knick and Connelly, 2011). The U.S. Fish and Wildlife Service released their 12-month finding on petitions to list the greater sage-grouse on 23 March 2010, finding that the listing of the greater sage-grouse (range-wide) was warranted but precluded by higher priority species. Therefore, the sage-grouse is designated as a candidate for Endangered Species Act protection. Candidate species do not receive regulatory protection under the Endangered Species Act but the U.S. Fish and Wildlife Service encourages voluntary conservation of the species.

In 2007, Wyoming's Governor convened a sage-grouse summit and created an implementation team to develop a conservation strategy to manage the species to prevent listing under the Endangered Species Act and retain State authority in management decisions. The Governor issued an Executive Order in August 2008 outlining the core area strategy with 23 recommendations that conserve Wyoming's most important sage-grouse habitats while allowing for natural resources development outside core areas. Statewide, core areas account for approximately 34% of the current sage-grouse range while encompassing leks with 81% of the 2008 peak males. However, within a three county area of the Powder River Basin (Campbell, Johnson and Sheridan Counties), core areas were designated based on CBNG development patterns along with lek density data thereby encompassing leks supporting only 28% of the 2008 peak males.

Following the March 2010 listing decision by the U.S. Fish and Wildlife Service, Governor Freudenthal asked the sage-grouse implementation team to revisit Wyoming's sage-grouse management strategy. The group's three tasks were to review core area boundaries, review development guidelines inside and outside core habitats, and identify connectivity areas to ensure movement cooridors between populations to preserve genetic integrity. The NEWLWG provided recommendations to the implementation team on core area boundary revisions, connectivity area designation and connectivity corridor development recommendations.

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 accompanying 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 NEWWGA, 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.

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 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 resulted in 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 NEWWGA 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. From 2004 to 2007, hunting seasons were 11 days with a bag and possession limits of 2 and 4 respectively. Seasons were again revised in 2008 with a new hunt area created for a portion of northeast Wyoming. Additional discussion is provided in the Harvest Results section.

WEATHER

Beginning in 2005, a wetter weather pattern developed for northeast Wyoming ending the period of drought which began in 2000. Precipitation in two of the last three years has been above normal due to above normal spring rainfall. In bio-year 2007, precipitation was 130% of normal while in 2008 precipitation was 98% of normal. For the 12-month reporting period (June 2009 – May 2010), precipitation was 114%% of normal while the average monthly temperature was about 1˚ below normal (Figures 4 and 5). Summer precipitation for the months of June, July and August was 139% of normal providing for an extended forage green up period. Winter and early spring were drier than normal with annual precipitation through April just below normal. May precipitation was nearly double (+2.4 inches) the normal resulting in above normal precipitation for the year. Average monthly temperatures were near normal with the exception of warmer months of September (+5˚) and November (+7˚). June, October, December and May were noticeably colder with temperatures 5˚, 9˚, 7˚ and 5˚ below normal, respectively.

Figure 4. 2009 Bio-Year: Monthly Precipitation Data (in), Wyoming Climate Division 5.

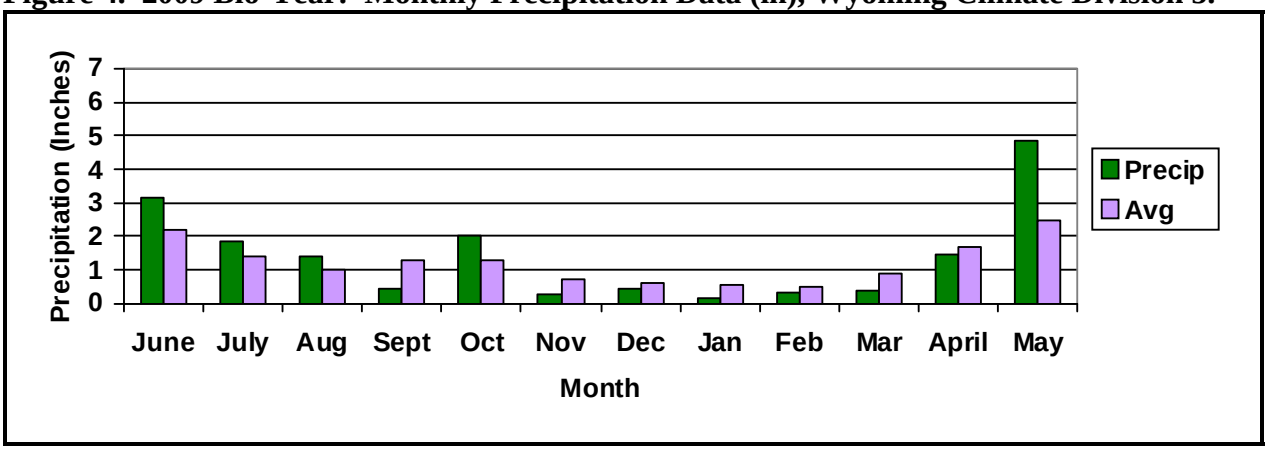
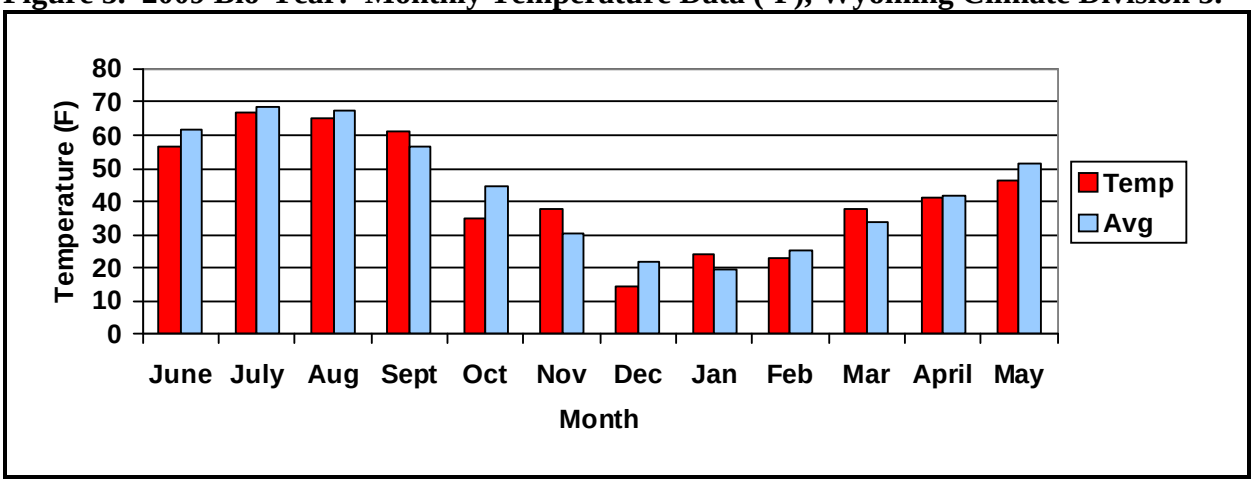


Figure 5. 2009 Bio-Year: Monthly Temperature Data (°F), Wyoming Climate Division 5.



National Climate Data Center/National Oceanic and Atmospheric Administration (NCDC/NOAA) weather data for Wyoming Climatic Division 5 was summarized by the Biological Services Division of the Wyoming Game & Fish Department. Climatic Division 5 includes the Powder River, Little Missouri River and Tongue River drainages. Weather data from this area are provided as a general indication of weather patterns over the entire working group area.

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

No West Nile virus mortalities were reported for northeast Wyoming in 2009-10.

Brood Surveys

Limited sage-grouse brood data have been collected in recent years. In 2009, a sample of 27 birds was reported from the Newcastle Biologist District resulting in a chick to hen ratio of 0.4 chicks per hen. This sample size is inadequate to draw any firm conclusions. Brood surveys the past three years yielded chick to hen ratios of 1.2, 3.2 and 3.4 in 2008, 2007 and 2006, respectively. The 2006 and 2007 ratios suggest relatively good hatch success and early brood survival.

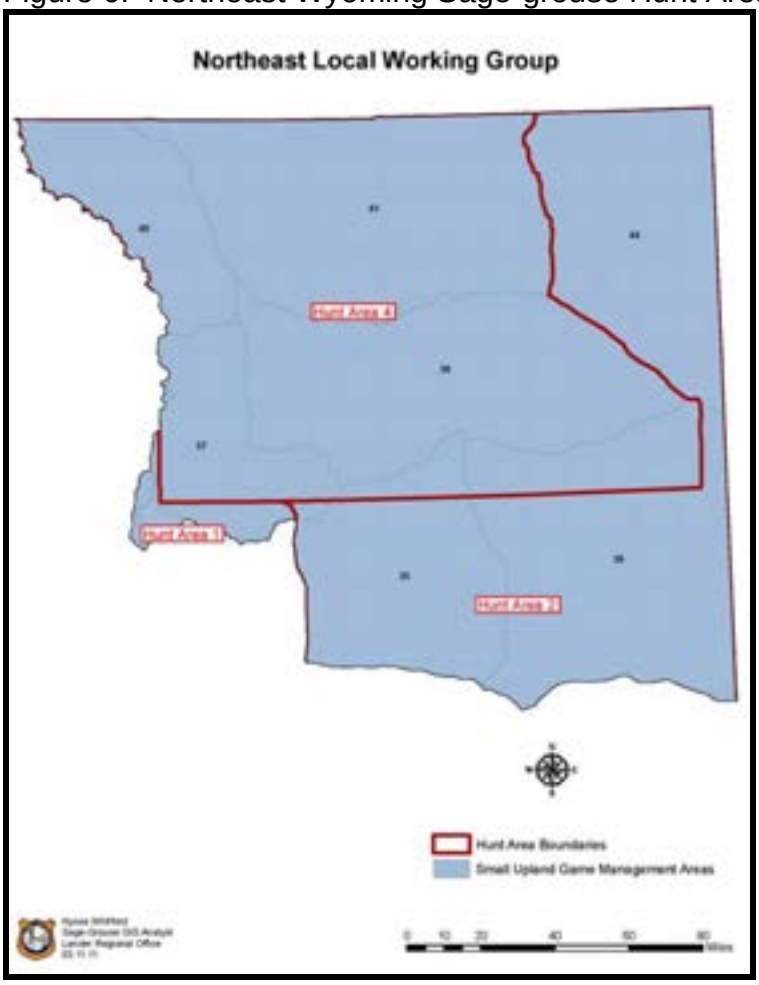
Harvest Results

Sage-grouse hunt areas and hunting seasons were restructured in Wyoming for the 2008 hunting season with identical seasons implemented in 2009. Due to concerns of low grouse densities in dispersed habitats on the periphery of the bird's range in eastern Wyoming, a portion of northeast Wyoming was closed to hunting. Furthermore, declining lek attendance and impacts from coal bed natural gas development in the Powder River Basin warranted a more conservative hunting season structure for the area remaining open to hunting. A new hunt area (Hunt Area 4) was established for Sheridan, Johnson and Campbell Counties and a portion of Crook and Weston Counties (Figure 6). The season length was reduced from 11 days to 7 days with an unchanged bag and possession limit of 2 and 4 birds, respectively. The remaining portions of Crook, Weston, Niobrara, Converse and northeast Natrona Counties within the NEWWGA were closed to hunting. This was the first change in hunting season structure since 2004. A small part of the NEWWGA is in Hunt Area 1 where the hunting season remained unchanged with an 11 day season and a bag and possession limit of 2 and 4 birds, respectively.

Although sage-grouse numbers have decreased over time and are under review for federal listing under the Endangered Species Act, populations in open hunt areas are adequate to support Wyoming's conservative hunting season structure. Even so, some segments of the public continue to voice concern that the WGFD continues to offer hunting seasons while working to reverse declining population trends. In response to this concern the Department produced a white paper on the implications of harvest strategies on sage-grouse in Wyoming, *Hunting and Sage-grouse: A Technical Review of Harvest Management on a Species of Concern in Wyoming*.

The 2009 harvest survey indicated that 311 sage-grouse were harvested by 230 hunters who spent a total of 559 days hunting sage-grouse within Management Areas 37, 38, 40, and 41. The average number of birds harvested per hunter day was 0.6. The average number of sage-grouse harvested per hunter was 1.5 and the average number of days hunted was 2.7.

Figure 6. Northeast Wyoming Sage-grouse Hunt Areas.



The total number of sage-grouse harvested tripled from 2008 when only 101 birds were harvested with the restructured hunting season and hunt area boundary adjustments. The ten-year average (2000-2009) is 588 birds, with harvest ranging from a low of 101 birds in 2008 to a high of 2,515 birds in 2000. The median harvest for the ten year period is 385 birds indicating the average is influenced by the high harvest in 2000. Hunter numbers increased 24% from 2008. Hunter numbers over the last ten years have ranged from 80 hunters in 2003 to 1,170 hunters in 2000. Hunter days increased 89% from 2008 but remained well below the 3,743 days logged in 2000.

Harvest had developed an increasing trend from 2003 through 2007. Harvest decreased the past two years likely due to the more conservative hunting season structure and lower bird numbers. Even though male lek attendance was higher from 2005 thru 2008, hunter interest remains well below past levels. The more conservative season length and bag limit combined with increased publicity about the sage-grouse's plight likely contributes to these trends.

Distribution of the harvest was suspect with Area 40 contributing 34% of the harvest while Area 38 was credited with 32% of the harvest. A portion of management area 40 lies outside the NEWWGA boundary. This portion of the working group area includes the Bighorn National Forest and some historical habitat. It is unlikely that this area would contribute the greatest share of the Area 40 harvest. It's possible the harvest actually was taken in the Bighorn Basin portion of the area. Area 40 harvest 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. Very small portions of Areas 18, 32 and 46 lie in the southwest corner of the working group area. Therefore, harvest from these areas is not included in the harvest estimate.

Composition of the harvest as determined by analysis of wings deposited by hunters in wing barrels provides insight into current year's chick production although in most years the sample is too small. The 2009 sample was only 24 wings resulting in a chick to hen ratio of 0.1. The sample is too small to warrant confidence; however, the ratio was similar to the brood count ratio of 0.4 chicks/hen.

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 WGFD, 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 tenth 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.

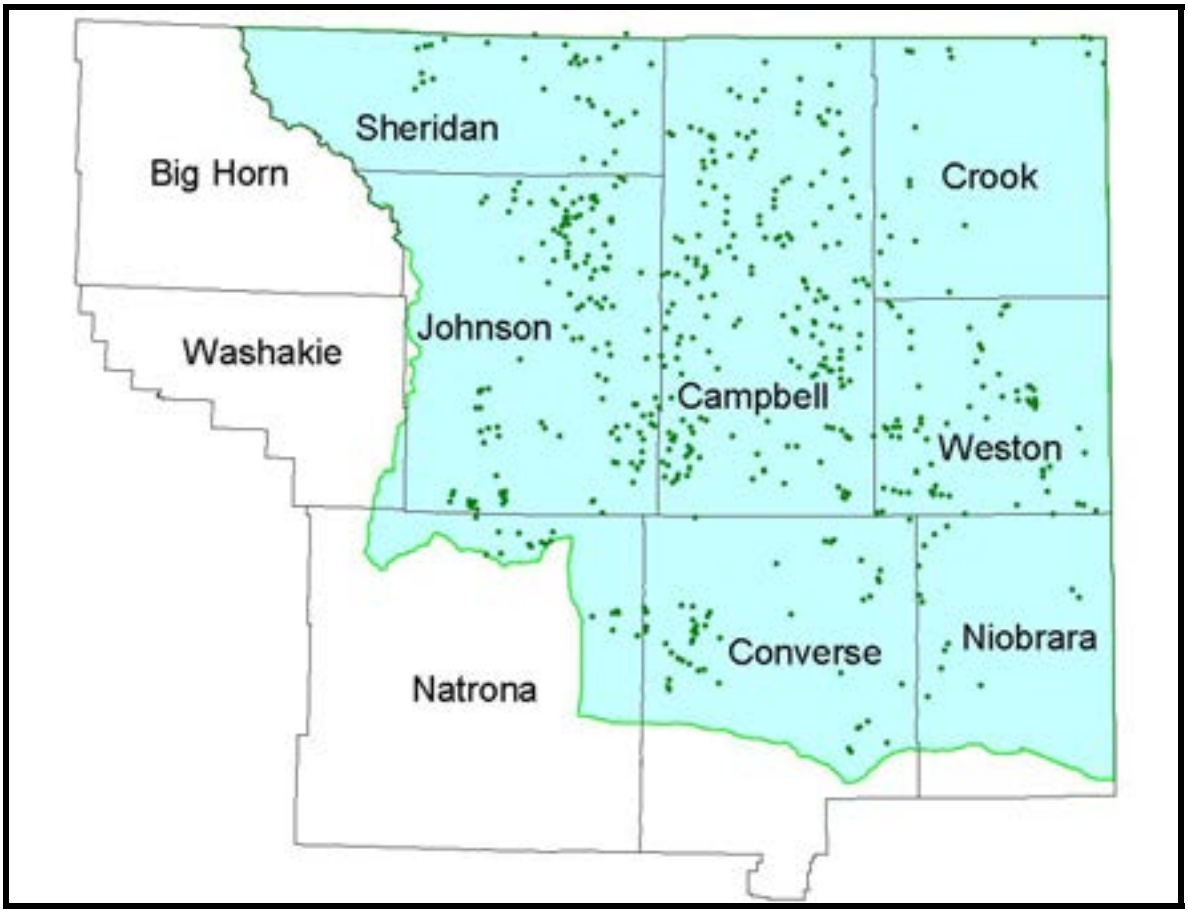
Following the 2010 lek monitoring period there are 525 documented leks in the NEWWGA (Figure 7). Of this total, 470 are classified as occupied leks and 55 leks are classified as unoccupied leks. Unoccupied leks have either been destroyed or abandoned and are not used by sage-grouse, however, abandoned leks should be monitored on occasion. Sixty-six 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 (see Appendix 1 for lek definitions). The figures provided above may differ from previous years because of continued evaluation of lek data or data that arrived after the reporting period.

During the 2010 breeding season 199 leks were counted, representing about 42% of known occupied leks (JCR Table 1a). The 470 known leks is less than the 525 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 7.8. This is slightly higher than the 7.2 males/active lek in 2009 but well below the 14.7 males/active lek observed in 2008 and the most recent cycle high of 20.4 males/active lek found in 2006.

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 visits to a lek following a stringent protocol to ensure accurate counts of male sage-grouse at lek sites. Designated lek 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 149 leks have been established in the Working Group Area.

Figure 7. Sage-grouse Leks in the Northeast Wyoming Working Group Area.



The number of known occupied leks checked by lek counts and lek surveys combined was 384 leks or 82% of the known occupied leks (JCR Table 1c). The average number of males/active lek was 7.9 compared to 9.1 males/active lek in 2009. This was the lowest number of males/active lek since 1997. For the 10-year period, 2001-2010, the number of males/active lek has ranged from 7.9 in 2010 to 19.8 in 2006. These numbers and trends are comparable to the lek count data. One-hundred-ninety-three leks were documented as active with peak male attendance ranging from 1 to 49 males. The three leks with the highest number of males were the 41-Flying E Lek with 49 males and the 41-Stranahan I and 35-North 95 Leks with 45 males. No lek has exceeded 100 males since 2007. The median peak male attendance was 8 males/active lek, unchanged from 2009.

In total, there were 1,452 recorded observations of sage-grouse leks. This was over 800 fewer lek visits than recorded in 2008 due to a coordinated effort of agencies and consultants to reduce excessive visits to leks, including aerial surveys of leks monitored from the ground. This problem was most prevalent in the CBNG fields where monitoring buffers of Plan of Development (POD) boundaries overlap resulting in multiple visits to leks. Although some leks still experience more lek visits than necessary, the frequency has been greatly reduced.

Seven previously unknown leks were documented and added to the sage-grouse database this year, two in Area 36, one in Area 38, two in Area 41 and two in Area 44. Peak male attendance

for new leks ranged from 6 to 19 males with an average of 12 males. Several suspected leks were noted but need further documentation of activity or location before being considered confirmed leks.

A number of leks were deleted from the database as there was insufficient documentation to continue including them in the database. These seven leks included 35-20 Mile Hill, 35-55 Ranch 6, 35-Lone Tree Gulch 3, 35-Teapot Cr 1, 35-Teapot Cr 2, 36-Bruce 1 and 44-Inyan Cara.

The number of leks listed in JCR Tables 1a, 1b and 1c shows one less known lek in 2010 compared to 2009. This is because the number of known leks is the same as occupied leks. Therefore, it includes leks added to the database less those deleted from the database. In addition, any leks that have a status change to unoccupied would not be included in the total of known leks. In 2010, an equal number of leks were added and deleted with one lek's status changed to unoccupied. Therefore, there is one less known lek in 2010.

Lek status as determined from lek counts and lek surveys shows 325 leks with confirmed lek status. Fifty-nine percent of the leks (n=193) 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. One-hundred-thirty-two leks (41%) were determined to be inactive based on multiple ground visits and/or checks for sign (feathers/ droppings) late in the strutting season. For the 10-year period, the percentage of leks with confirmed status as active was the lowest while the percentage of leks confirmed inactive was the highest. A large number of leks (n=149) 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.

Comparing leks in the Sheridan and Casper WGFD Regions shows differences in lek attendance and activity patterns. The Sheridan Region supports 74% of the LWG area leks. Average males per active lek for this portion of the LWG averaged 6.7 for combined surveys and counts compared to 10.3 in the Casper Region and 7.9 for the entire LWG. Furthermore, the percentage of confirmed active leks in the Sheridan Region is at its lowest percentage (54.1%) in the 10-year period while the percentage of confirmed inactive leks is at 45.9%, the highest in the 10-year period. These figures reflect decreasing and increasing trends, respectively, since 2006, comparable to average male lek attendance trends. Conversely, confirmed active and inactive leks in the Casper Region were 72.8% and 27.2%, respectively. These differences could result from any number of factors, or combination of factors. Impacts from CBNG development in the Powder River Basin are likely influencing the Sheridan Region data. The Sheridan Region typically has a lower percentage of confirmed active leks and a higher percentage of confirmed inactive leks than the Casper Region. However, figures were comparable in 2005 and 2006 and therefore suggest developing trends need close scrutiny in future years.

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.

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

Region	Number	Percent
Casper	135	25.7%
Sheridan	390	74.3%

Working Group	Number	Percent
Northeast	525	100.0%

Classification	Number	Percent
Occupied	403	76.8%
Undetermined	66	12.6%
Unoccupied	56	10.7%

BLM Office	Number	Percent
Buffalo	365	69.5%
Casper	49	9.3%
Newcastle	109	20.8%

Unoccupied Leks	Number
Abandoned	34
Destroyed	21

Biologist District	Number	Percent
Buffalo	66	12.6%
Casper	29	5.5%
Douglas	39	7.4%
Gillette	234	44.6%
Newcastle	67	12.8%
Sheridan	90	17.1%

Game Warden	Number	Percent
Buffalo	72	13.7%
Dayton	18	3.4%
Douglas	18	3.4%
East Casper	5	1.0%
Glenrock	27	5.1%
Kaycee	51	9.7%
Lusk	19	3.6%
Moorcroft	50	9.3%
Newcastle	61	11.6%
North Gillette	66	12.6%
Sheridan	18	3.4%
South Gillette	115	21.9%
Sundance	5	1.0%

County	Number	Percent
Big Horn, MT	1	0.2%
Campbell	188	35.8%
Converse	47	8.3%
Crook	22	4.1%
Johnson	133	25.7%
Natrona	15	3.3%
Niobrara	18	3.3%
Powder River, MT	1	0.2%
Sheridan	35	6.4%
Weston	65	12.8%

Land Status	Number	Percent
BLM	55	10.5%
Private	379	72.2%
State	45	8.6%
USFS	42	8.0%

Management Area	Number	Percent
18	0	0.0%
32	0	0.0%
35	35	6.7%
36	73	13.9%
37	41	7.8%
38	178	33.9%
40	5	1.0%
41	175	33.3%
44	18	3.4%
46	0	0.0%

Lek Characteristics

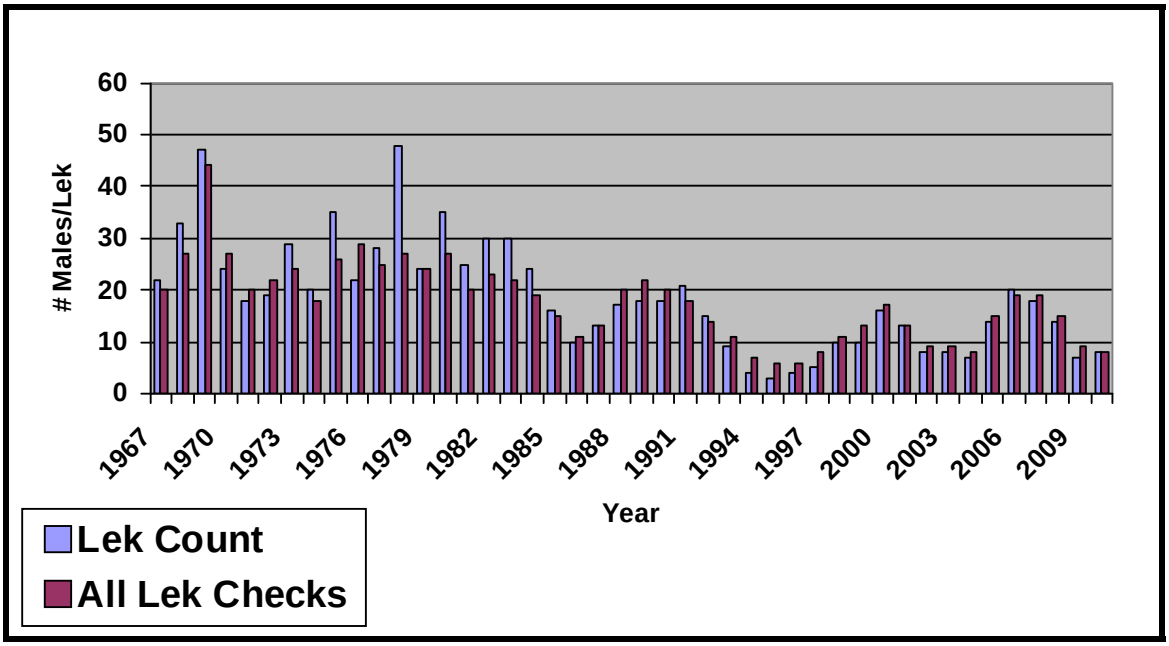
There are 525 sage-grouse leks within the NEWWGA. Table 1 shows the demographics of leks with regard to WGFD region, management area, county, biologist district, game warden district, land status, and historical status.

Population Trends

No reliable or cost effective method for estimating the sage-grouse population for the NEWWGA 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 and other influences. 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 8 shows the average number of males/active lek for lek counts and all lek monitoring (counts and surveys) combined from 1967 to 2010 for the NEWWGA. 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 with the exception of the most recent cycle, subsequent peaks in the average male attendance are usually lower than the previous peak. Additionally, periodic lows in the average male attendance are generally lower than the previous low. The long term trend suggests a steadily declining sage-grouse population.

Figure 8. Northeast Wyoming Working Group Male Sage-grouse Lek Attendance 1967- 2010.



It appears that sage-grouse numbers reached a new peak in 2006 and 2007, exceeding the previous peak of 2000. In fact, the trends suggest sage-grouse may have been at their highest

numbers since 1991. The 2008 - 2010 data indicate that peak has passed and lek attendance is entering the declining phase of the cycle.

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.

HABITAT

Habitat Conditions

The general condition of native vegetation during the growing season was very good although spring precipitation came later than normal. April and May 2009 precipitation was below normal followed by above normal rainfall in June, July and August. The cooler, wetter June may have had negative impacts on nesting and early brood rearing but also benefited sage-grouse by extending the green up period for brood rearing habitat. The improved spring precipitation for the third year running enabled native grasses to compete with the increased occurrence of cheatgrass resulting from the drought of 2006 combined with ample September moisture that same year. Shrub surveys showed improved sagebrush production and stand condition.

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 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 in benefiting sage-grouse.

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.

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 WGFD website at http://gf.state.wy.us/wildlife/wildlifemanagement/sagegrouse/index.asp. With the completion of the conservation plan working group meetings were scaled back.

The LWG reviewed and allocated funds from the 2009-10 Wyoming Sage-grouse Conservation Fund which totaling $1.2 million. All projects were approved prior to the current reporting

period. A summary of the projects and funding is provided in the 2008 report. The LWG prioritized the local projects for funding and supported funding the statewide projects. Ten local projects and two statewide projects were approved for funding by the State Team.

Research

The following publications have been authored relative to research conducted in the Powder River Basin of Wyoming and Montana.

Doherty, K. E. 2008. Sage-grouse and Energy Development: Integrating Science With Conservation Planning to Reduce Impacts. Dissertation. University of Montana. Missoula, MT.

Doherty, K. E., D. E. Naugle, B. L. Walker, and J. M. Graham. 2008. Greater sage-grouse winter habitat selection and energy development. Journal of Wildlife Management 72:187–195.

Foster, M. A.. W. N. Davis, and A. C. Beyer. 2011. Monitoring Greater Sage-Grouse Populations and Habitat Use in the Southeast Montana Sage-grouse Core Area. Project Update January 2011. Montana Fish Wildlife and Parks *in cooperation* with the Bureau of Land Management. Miles City, MT. 41 pp.

Harju, S.M., M.R. Dzialak, R.C. Taylor, L.D. Hayden-Wing, and J.B. Winstead. 2010. Thresholds and Time Lags in Effects of Energy Development on Greater Sage-Grouse Populations. Journal of Wildlife Management 74:437-448.

Kucker Doherty, M. 2007. Comparison of Natural, Agricultural and Effluent Coal Bed Natural Gas Aquatic Habitats. Master of Science. Montana State University. Boseman, MT.

Naugle, D. E., C. L. Aldridge, B. L. Walker, T. E. Cornish, B. J. Moynahan, M. J. Holloran, K. Brown, G. D. Johnson, E. T. Schmidtmann, R. T. Mayer, C. Y. Kato, M. R. Matchett, T. J. Christiansen, W. E. Cook, T. Creekmore, R. D. Falise, E. T. Rinkes, M. S. Boyce. 2004. West Nile virus: pending crisis for Greater Sage-grouse. Ecology Letters. Volume 7, Issue 8, p. 704-713.

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Taylor, R. L., D. E. Naugle, and L. S. Mills. 2010. Viability analyses for conservation of sage-grouse populations. Completion report, Miles City Field Office, Montana, USA.

Walker, B. L., D. E. Naugle, K. E. Doherty, and T. E. Cornish. 2004. Outbreak of West Nile Virus in Greater Sage-grouse and Guidelines for Monitoring, Handling, and Submitting Dead Birds. Wildlife Society Bulletin 32(3): 1000–1006.

Walker, B. L. 2008. Greater Sage-grouse Response to Coalbed-Natural Gas Development and West Nile Virus in the Powder River Basin, Montana and Wyoming, USA. Dissertation. University of Montana. Missoula, MT.

Continuing research is occurring in the Powder River Basin including studies sponsored by Fidelity Exploration and Development Company and Anadarko Petroleum Corporation and the BLM.

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. Coordinate with the BLM and industry to minimize the number of visits to leks during lek monitoring efforts.
4. Participate in 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 2011 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 2009 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. 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.
9. The Working Group should continue to solicit habitat projects on private lands that will have benefit for sage-grouse.
10. The Regions should continue to recommend protection of occupied sage-grouse leks during environmental commenting and promote their protection on private land projects.
11. Additional effort is needed to document the status of undetermined leks. Encourage reporting of lek activity from the public and in particular landowners.
12. 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.
13. Document lek perimeters to ensure adequate buffer distance in protecting leks.

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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

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.

Sage-Grouse Job Completion Report

PERIOD COVERED: 6/1/2009 - 5/31/2010
WORKING GROUP: South Central **PREPARED BY: Will Schultz**

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
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	322	27	8.4	1415	459	52.4	17.0
2006	325	42	12.9	2106	782	50.1	18.6
2007	333	48	14.4	2087	319	43.5	6.6
2008	337	49	14.5	1648	479	33.6	9.8
2009	342	77	22.5	2021	1139	26.2	14.8
2010	346	49	14.2	1293	769	26.4	15.7

b. Leks Surveyed

Year	Known	Surveyed	Percent Surveyed	Max Total	Avg Males/ Active Lek
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	322	227	70.5	5147	36.8
2006	325	233	71.7	5659	39.3
2007	333	233	70.0	4583	33.5
2008	337	182	54.0	3181	27.9
2009	342	188	55.0	2648	24.7
2010	346	176	50.9	2467	22.4

c. Leks Checked

Year	Known	Checked	Percent Checked	Max Total	Avg Males/ Active Lek
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	322	245	76.1	6336	39.4
2006	325	266	81.8	7670	42.6
2007	333	272	81.7	6617	37.2
2008	337	227	67.4	4768	30.0
2009	342	263	76.9	4669	25.4
2010	346	224	64.7	3759	23.8

d. Lek Status

Year	Active	Inactive	Not Located	Unknown	Total	Confirmed Status Active	Confirmed Status Inactive
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	161	7	0	145	168	95.8%	4.2%
2005	158	16	0	148	174	90.8%	9.2%
2006	173	24	0	128	197	87.8%	12.2%
2007	175	22	0	136	197	88.8%	11.2%
2008	163	18	0	156	181	90.1%	9.9%
2009	176	35	0	131	211	83.4%	16.6%
2010	153	13	0	180	166	92.2%	7.8%

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.

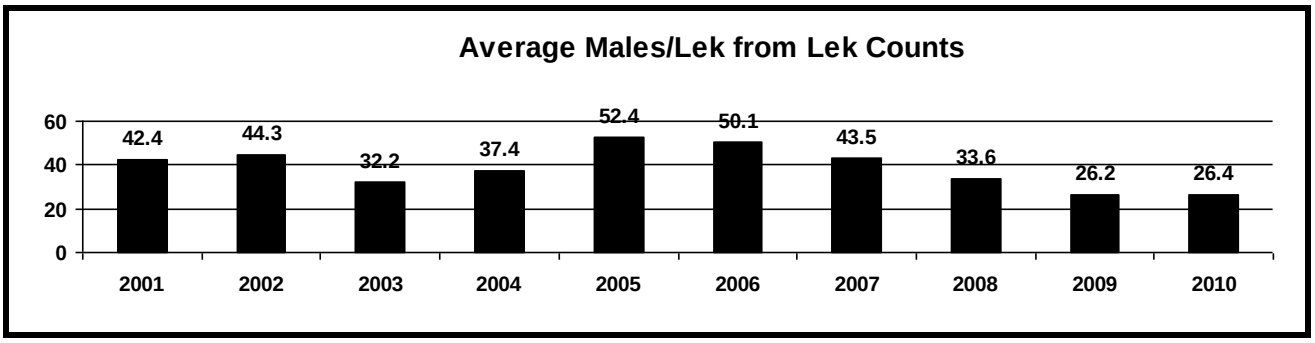
- **destroyed lek** – A formerly active lek site and surrounding sagebrush habitat that has been destroyed and is no longer suitable for sage-grouse breeding. A lek site that has been strip-mined, paved, converted to cropland or undergone other long-term habitat type conversion is considered destroyed.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

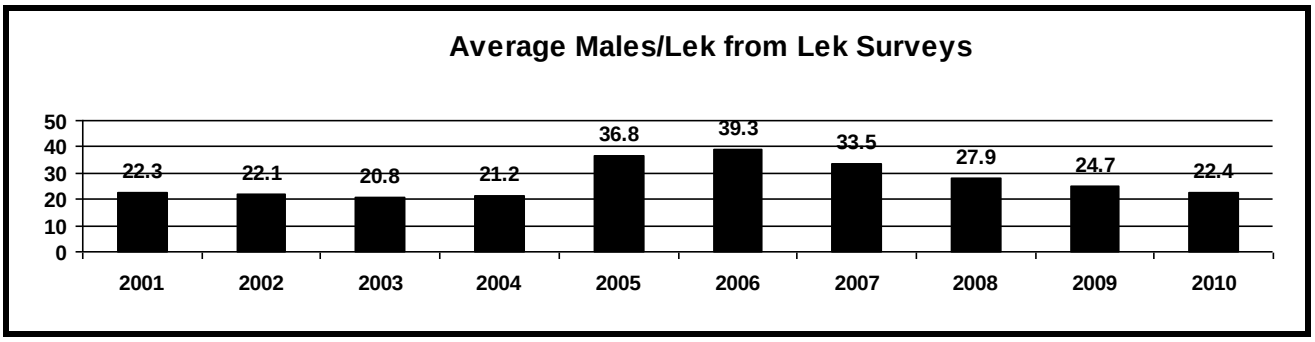
- **abandoned lek** – A lek in otherwise suitable habitat that has not been active during a period of 10 consecutive years. To be designated abandoned, a lek must be "inactive" (see above criteria) in at least four non-consecutive strutting seasons spanning the ten years. The site of an "abandoned" lek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

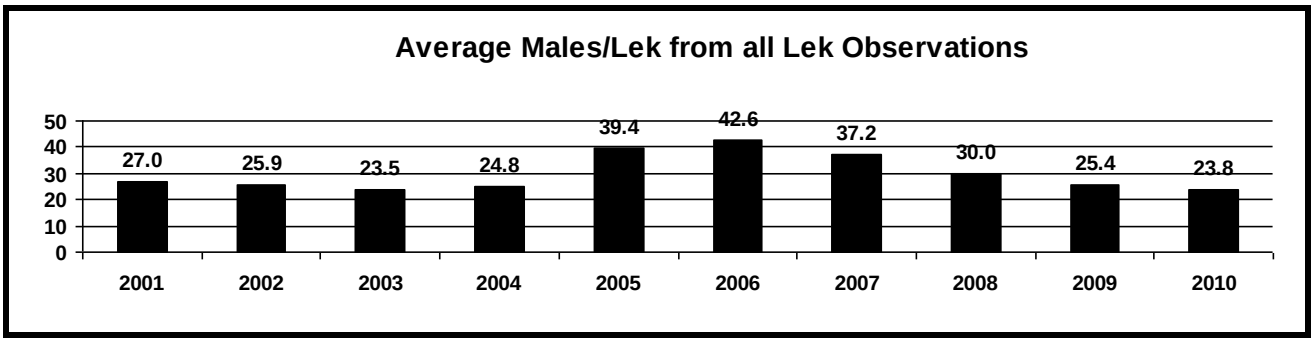
- **undetermined lek** – Any lek that has not been documented active in the last ten years, but survey information is insufficient to designate the lek as unoccupied. Undetermined

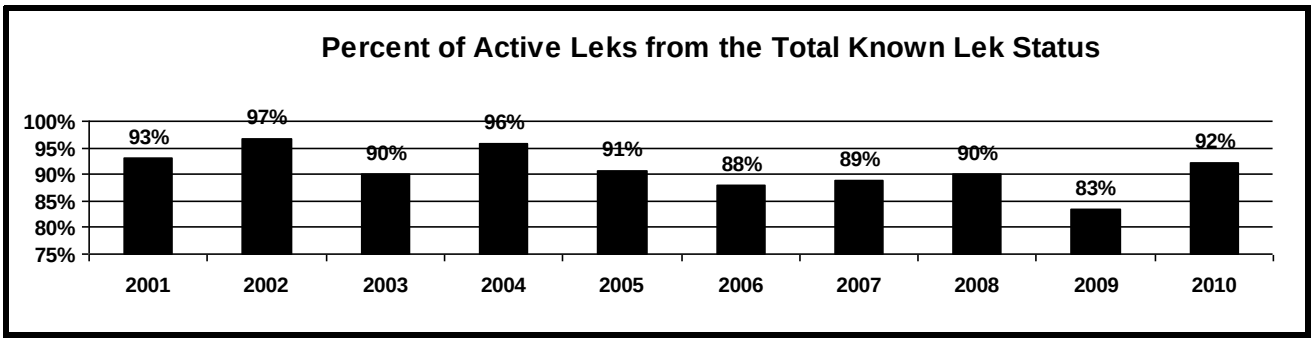
SAGE-GROUSE LEK ATTENDANCE SUMMARY

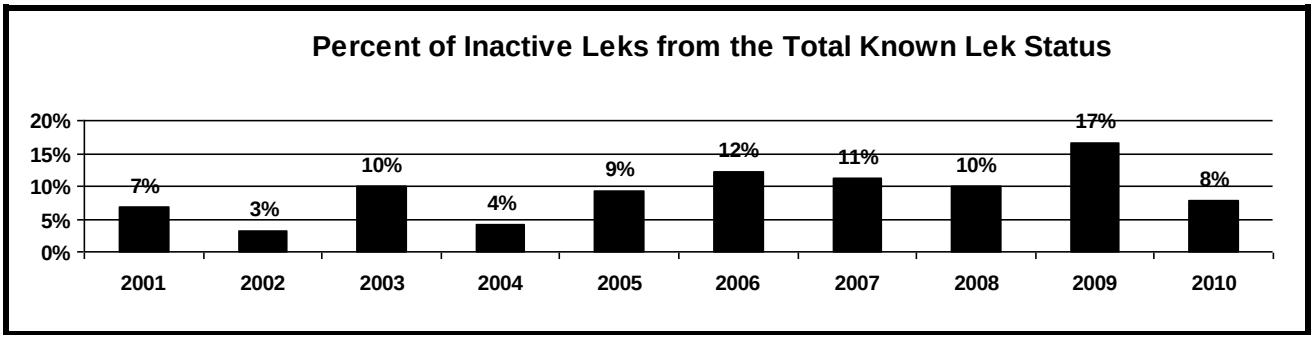
WORKING GROUP: South Central **Area(s): All**











Sage Grouse Lek Characteristics

Region	Number	Percent
Green River	97	25.7%
Lander	226	59.9%
Laramie	54	14.3%

Working Group Area	Number	Percent
South Central	377	######

Classification	Number	Percent
Occupied	322	85.4%
Undetermined	4	1.1%
Unknown	19	5.0%
Unoccupied	32	8.5%

BLM Office	Number	Percent
Casper	2	0.5%
Lander	23	6.1%
Rawlins	338	89.7%
Rock Springs	14	3.7%

Unoccupied Leks	Number
Abandoned	30
Destroyed	1

Biologist District	Number	Percent
Baggs	97	25.7%
Laramie	5	1.3%
Rawlins	210	55.7%
Saratoga	49	13.0%
South Lander	16	4.2%

Game Warden District	Number	Percent
Baggs	108	28.6%
East Rawlins	56	14.9%
Elk Mountain	6	1.6%
North Rock Springs	12	3.2%
Rock Springs	2	0.5%
Saratoga	43	11.4%
South Laramie	5	1.3%
West Rawlins	145	38.5%

County	Number	Percent
	0	0.0%
Albany	5	1.3%
Carbon	260	69.0%
Fremont	13	3.4%
Natrona	2	0.5%
Sweetwater	95	25.2%

Land Status	Number	Percent
BLM	216	57.3%
BLM/Private	10	2.7%
Not Determined	2	0.5%
Private	123	32.6%
Private/BLM	1	0.3%
State	21	5.6%
State/Private	1	0.3%
USF&WS	1	0.3%
WGFC	1	0.3%
WGFD	1	0.3%

Management Area	Number	Percent
10	33	8.8%
24	27	7.2%
25	163	43.2%
45	42	11.1%
9	112	29.7%

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

a. Season

Year	Season Dates	Length	Bag/Possession Limit
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
2007	Sept 22-Oct 2	11	2/4
2008	Sept 22-Oct 2	11	2/4
2009	Sept 19-Sept 30	12	2/4

b. Harvest

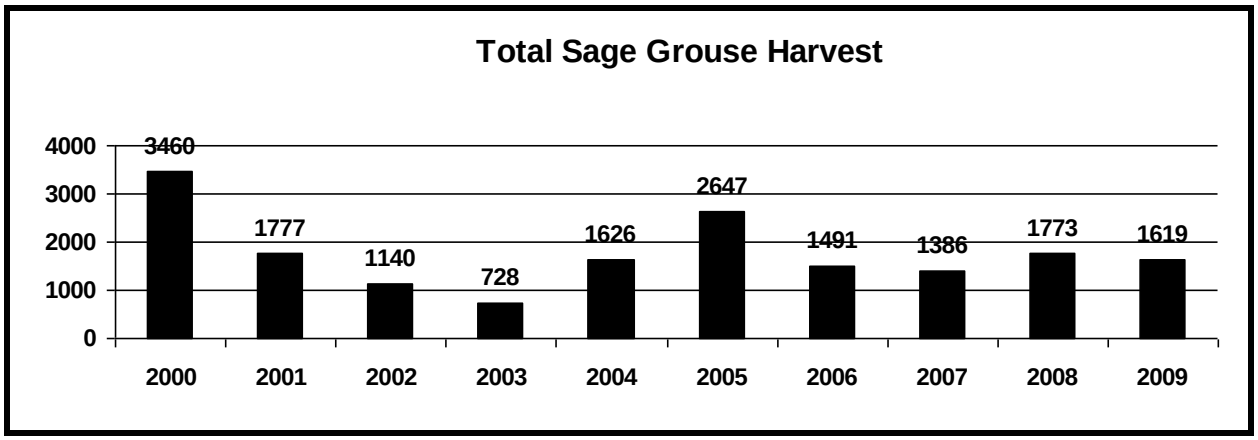
Year	Harvest	Hunters	Days	Birds/ Day	Birds/ Hunter	Days/ Hunter
2000	3,460	1,097	2,738	1.3	3.2	2.5
2001	1,777	761	2,062	0.9	2.3	2.7
2002	1,140	491	1,442	0.8	2.3	2.9
2003	728	294	750	1.0	2.5	2.6
2004	1,626	947	1,986	0.8	1.7	2.1
2005	2,647	1,112	2,290	1.2	2.4	2.1
2006	1,491	836	1,738	0.9	1.8	2.1
2007	1,386	739	1,531	0.9	1.9	2.1
2008	1,773	743	1,511	1.2	2.4	2.0
2009	1,619	726	1,474	1.1	2.2	2.0
Avg.	1,765	775	1,752	1.0	2.3	2.3

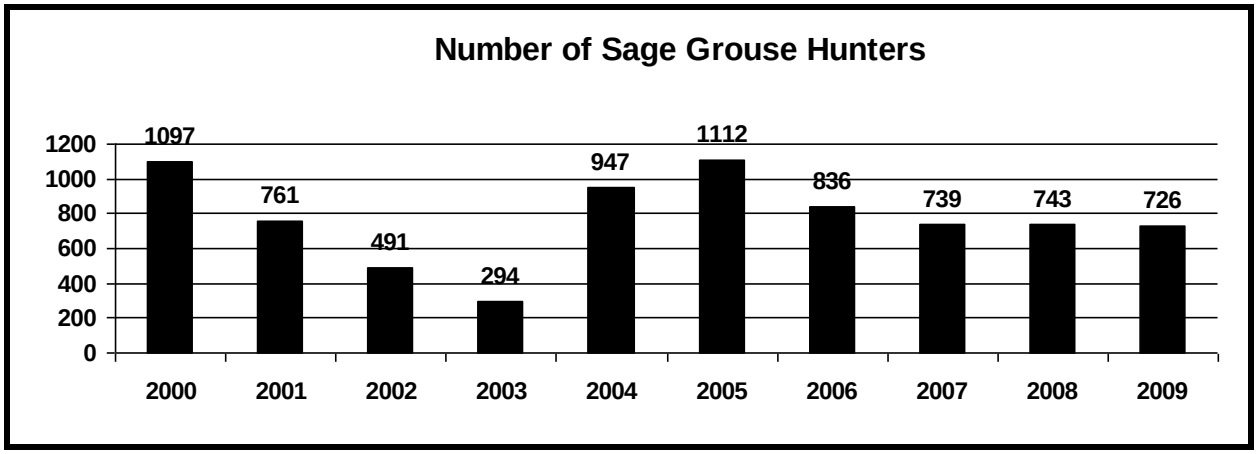
Table 5. Composition of harvest by wing analysis.

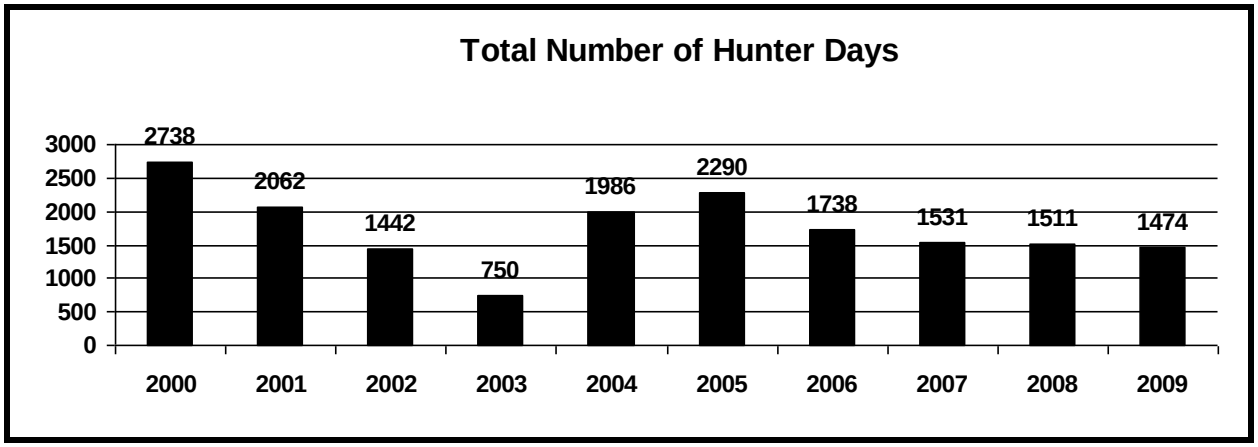
Year	Sample Size	Percent Adult		Percent Ylg		Percent Young		Chicks /Hen
		Male	Female	Male	Female	Male	Female	
2001	693	6.3	25.1	1.2	6.1	23.1	38.1	2.0
2002	203	10.8	29.1	2.0	8.4	13.3	36.5	1.3
2003	310	13.2	28.4	0.3	4.5	24.8	28.4	1.6
2004	284	7.4	22.5	0.4	5.3	30.3	34.2	2.3
2005	345	13.6	27.8	3.8	4.6	20.0	30.1	1.5
2006	315	16.8	28.3	3.8	5.4	21.6	24.1	1.4
2007	199	20.1	35.2	7.0	12.6	10.6	14.6	0.5
2008	290	8.6	25.2	2.1	5.5	25.2	33.1	1.9
2009	282	15.2	23.8	8.5	9.9	15.6	27.0	1.3

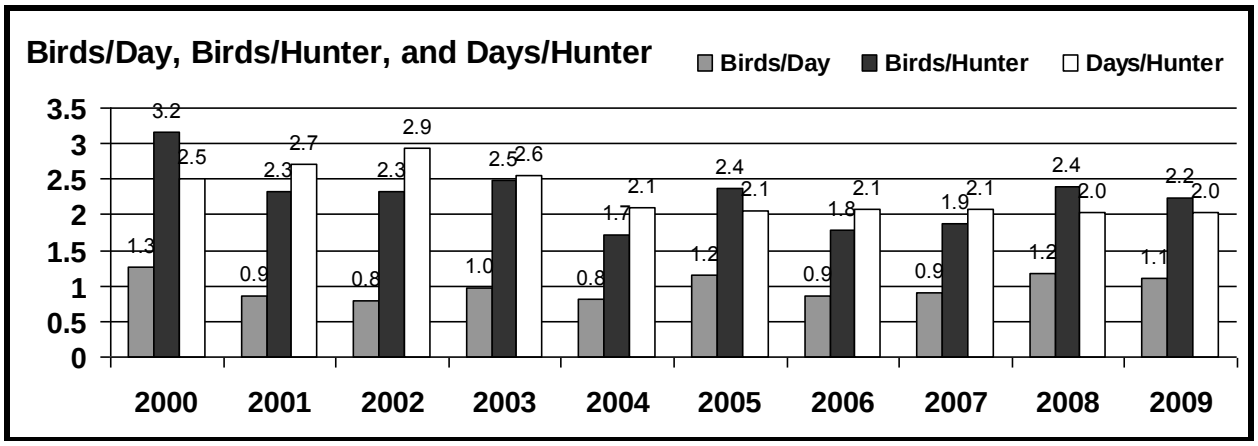
SAGE-GROUSE HARVEST SUMMARY

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









Sage-grouse Wing Analysis Summary 2009

Region: **Area :**

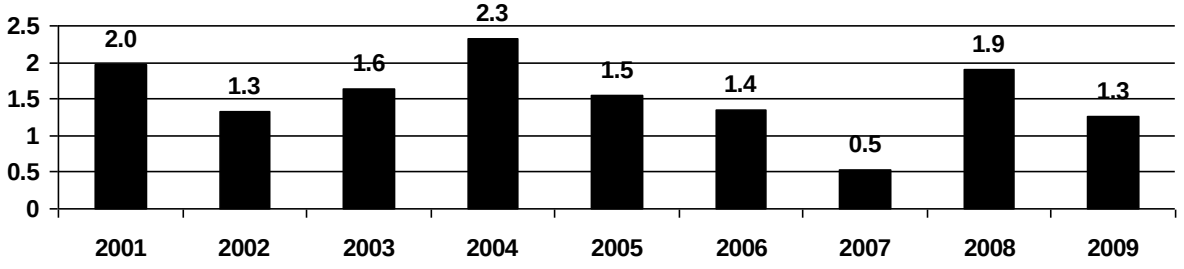
Working Group: South Central

Adult Males:	43	**Percent of All Wings:**	15.2%
Adult Females:	67	**Percent of All Wings:**	23.8%
Adult Unknown:	0	**Percent of All Wings:**	0.0%
Total Adults:	110		
Yearling Males:	24	**Percent of All Wings:**	8.5%
Yearling Females:	28	**Percent of All Wings:**	9.9%
Yearling Unknown:	0	**Percent of All Wings:**	0.0%
Total Yearlings:	52		
Chick Males:	44	**Percent of All Wings:**	15.6%
Chick Females:	76	**Percent of All Wings:**	27.0%
Chick Unknown:	0	**Percent of All Wings:**	0.0%
Total Chicks:	120		
Unknown Sex/Age:	0	**Percent of All Wings:**	0.0%
Total for all Sex/Age Groups:	282		

Chick Males:	44	**Percent of All Chicks:**	36.7%
Yearling Males:	24	**Percent of Adult and Yearling Males:**	35.8%
Adult Males:	43	**Percent of Adult and Yearling Males:**	64.2%
Adult and Yearling Males:	67	**Percent of Adults and Yearlings:**	41.4%
Total Males:	111	**Percent of All Sex/Age Groups:**	39.4%
Chick Females:	76	**Percent of All Chicks:**	63.3%
Yearling Females:	28	**Percent of Adult and Yearling Females:**	29.5%
Adult Females:	67	**Percent of Adult and Yearling Females:**	70.5%
Adult and Yearling Females:	95	**Percent of Adults and Yearlings:**	58.6%
Total Females:	171	**Percent of All Sex/Age Groups:**	60.6%

Chicks:	120	**Percent of All Wings:**	42.6%
Yearlings:	52	**Percent of All Wings:**	18.4%
Adults:	110	**Percent of All Wings:**	39.0%
Chicks/Hen:	**1.3**		

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



South Central Conservation Area
Job Completion Report

Species: **Sage-grouse**
Period Covered: **June 1, 2009 – May 31, 2010**

Conservation Plan Area: **South Central**
Mgmt Areas: **9, 10, 24, 25, and 45**

Introduction

The South Central Conservation Area (SCCA) generally includes The Platte Valley, Laramie Plains, Great Divide Basin, North Ferris, south Sweetwater and Little Snake River Valley in the counties of Carbon, Sweetwater, Albany, Fremont and Natrona in southern Wyoming (Figure 1). The SCCA is mostly public land and is administered by the Bureau of Land Management (BLM), the USDA Forest Service and State of Wyoming (Figure 2). A major portion of the SCCA is "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 sagebrush/grassland, salt desert shrub, short-grass prairie, 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 70, 789, 287, 230/130. Major cities and towns found in the area are Rawlins, Laramie, Saratoga, Encampment, Baggs, and Wamsutter. There are 322 occupied, 23 unknown, and 32 unoccupied leks in the SCCA. About 60% of the sage-grouse leks are on BLM administered land, 33% are on private and 5% on state owned lands.

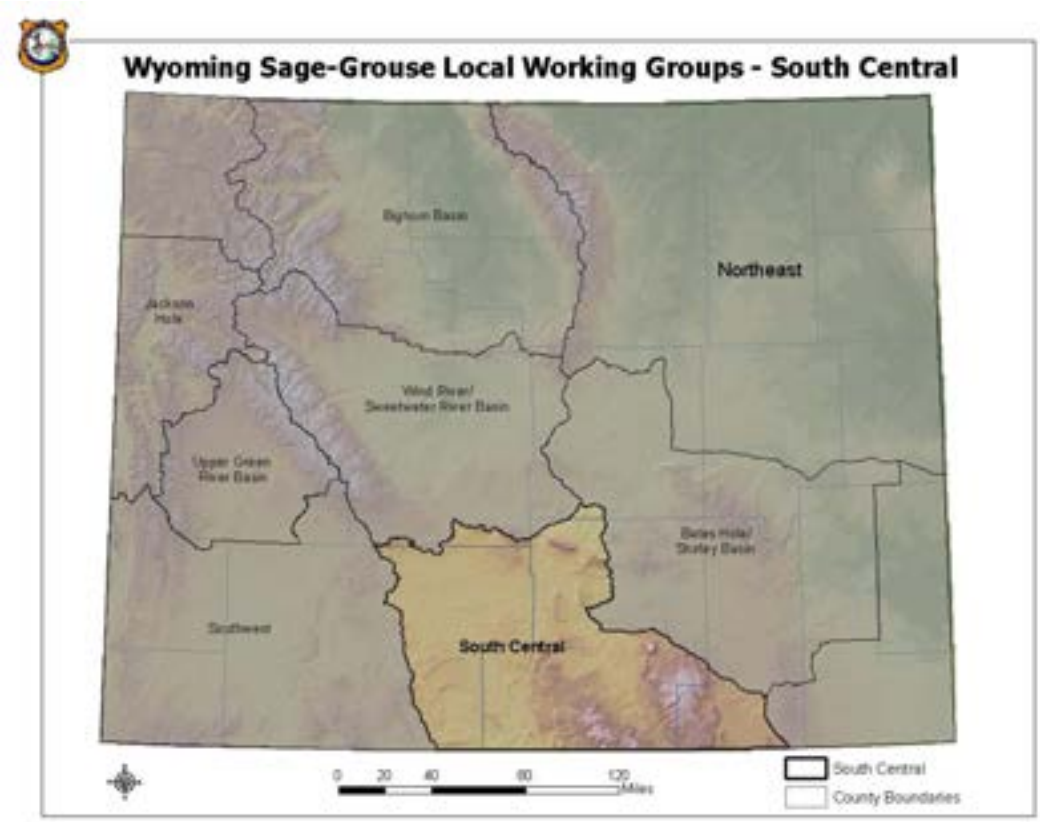


Figure 1.

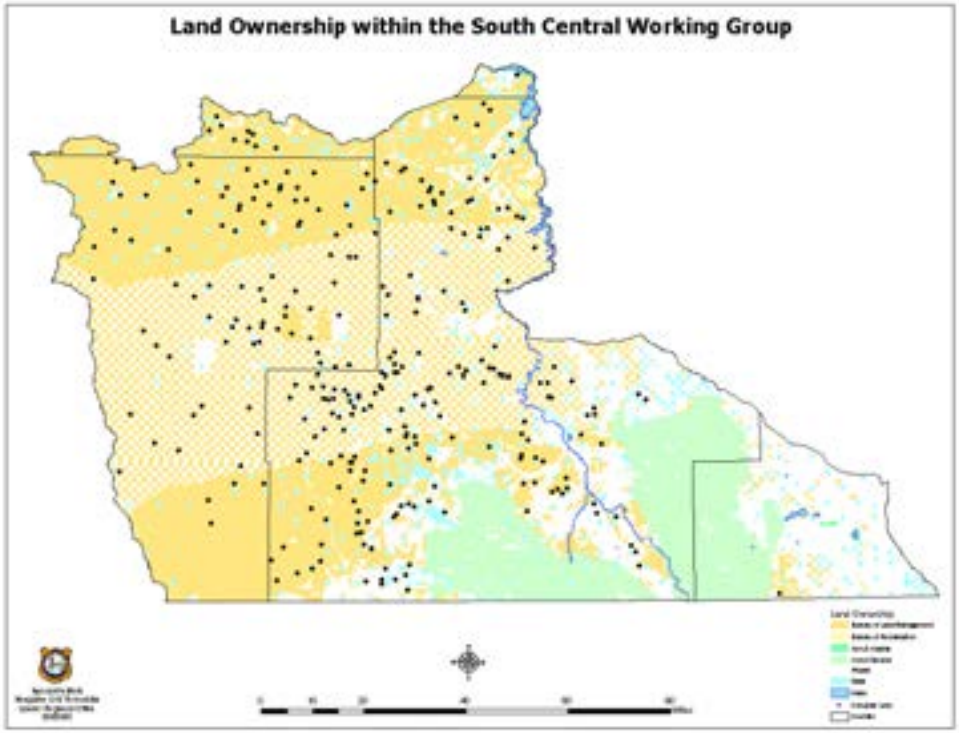


Figure 2.

The SCCA Sage-grouse Local Working Group (LWG) was initiated in September of 2004 and completed their Sage-grouse Conservation Plan (Plan) in 2007. The SCCA LWG now meets 1-2 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. And, in an unprecedented move to coordinate sage grouse conservation efforts across the State of Wyoming, Gov. Dave Freudenthal released an Executive Order on Aug. 1, 2008 that established "Core Population Areas" (Figure 3) and directs state agencies to work to maintain and enhance greater sage grouse habitat in Wyoming.

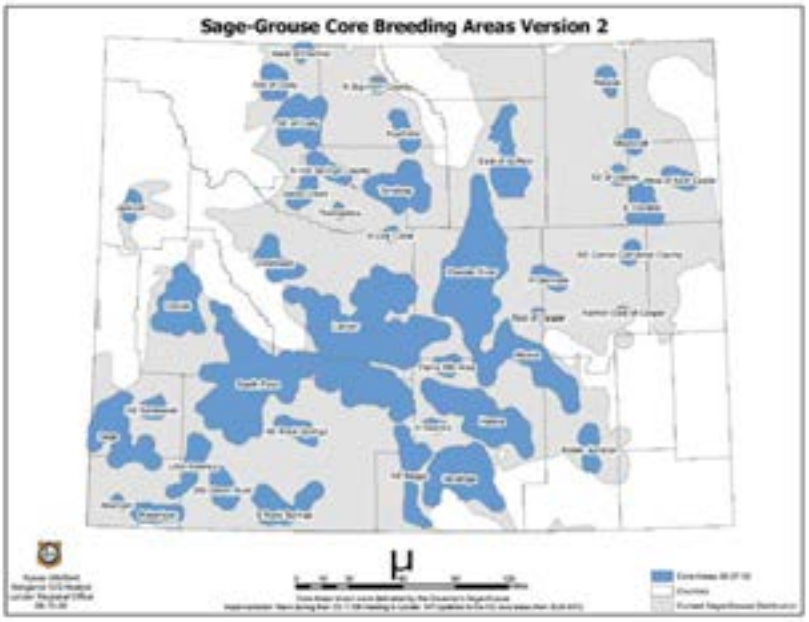


Figure 3.

Weather

The National Climate Data Center/National Oceanic and Atmospheric Administration (NCDC/NOAA) has divided Wyoming into 10 climatic divisions for the purpose of weather data recording (Figure 4). These divisions correspond to major watersheds within the state. Wyoming's climatic division 10, the Upper Platte, covers much of the SCCA. Climatic data for all divisions can be found at the NCDC/NOAA web site: http://www.ncdc.noaa.gov/oa/ncdc.html . The 2009 bio-year weather data reported here was compiled from the 2009 Big Game Job Completion Report. (WGFD 2010).

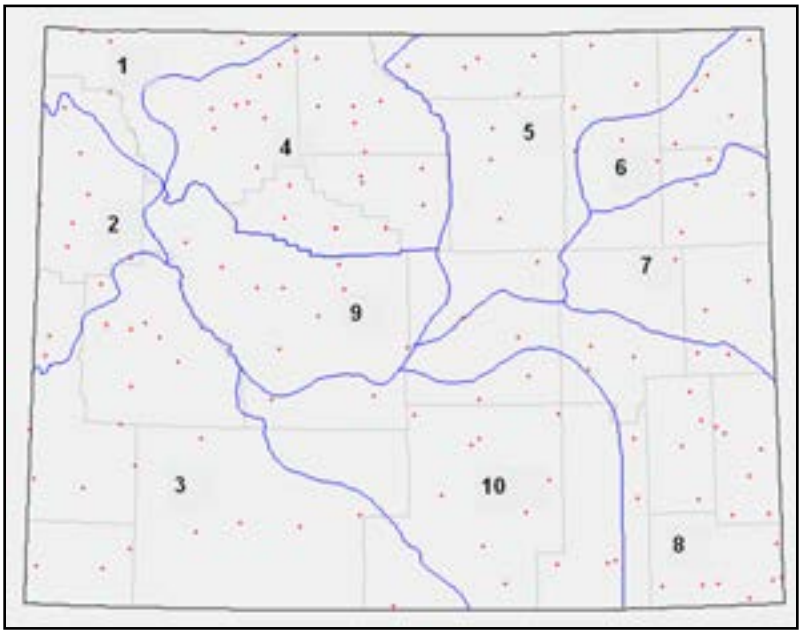


Figure 4. NCDC/NOAA, State of Wyoming Climate Division Map.

The Palmer Drought Severity Index (http://www.drought.noaa.gov/palmer.html) uses temperature and precipitation data to determine dryness. Palmer Severity Indices indicate that, from 1995-1999, the Upper Platte climatic division generally experienced wetter than normal conditions (Figure 5). The division entered extreme drought conditions in 2000 and remains there through 2008. Conditions returned to wetter than normal in 2009.

Bio-year temperatures were generally average or below average in the Upper Platte Climatic Division (Figure 6). The winter of 2009-10 winter was similar to the 2008-09 winter, with warmer temperatures and generally less precipitation. During bio-year 2009, precipitation was slightly wetter than average overall in the Upper Platte Climatic Division (Figure 7). Precipitation in May and June of 2009 was higher than average. Untimely late winter storms in May and early June may have contributed to reduced nesting success and chick survival.

Spring habitat conditions are one of the most important factors in determining nesting success and chick survival. Specifically, shrub height, live and residual grass height and cover, and forb cover have a large impact on sage-grouse nesting success. The shrub and grasses provide screening cover from predators and weather while the forbs provide forage and also provide insects that reside in the forbs. Spring precipitation is an important determinant of the quality and quantity 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 dependent on the current year's precipitation.

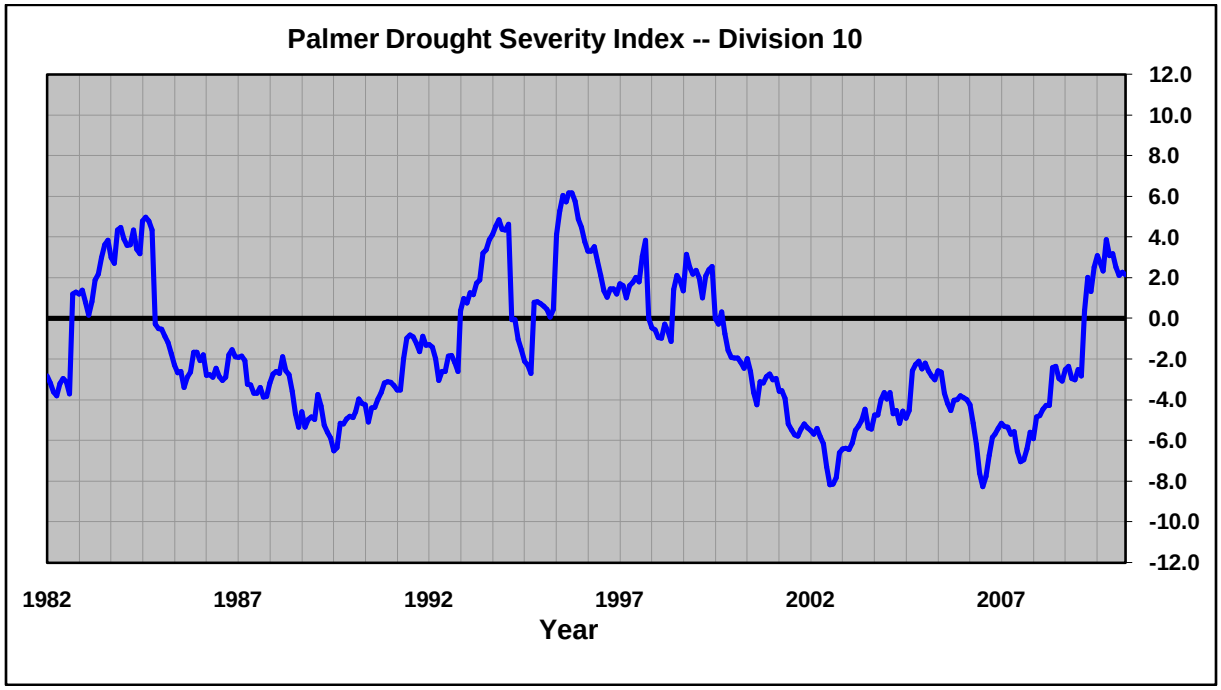


Figure 5. Drought severity trend from 1982 – 2010, Wyoming Climate Division 10.

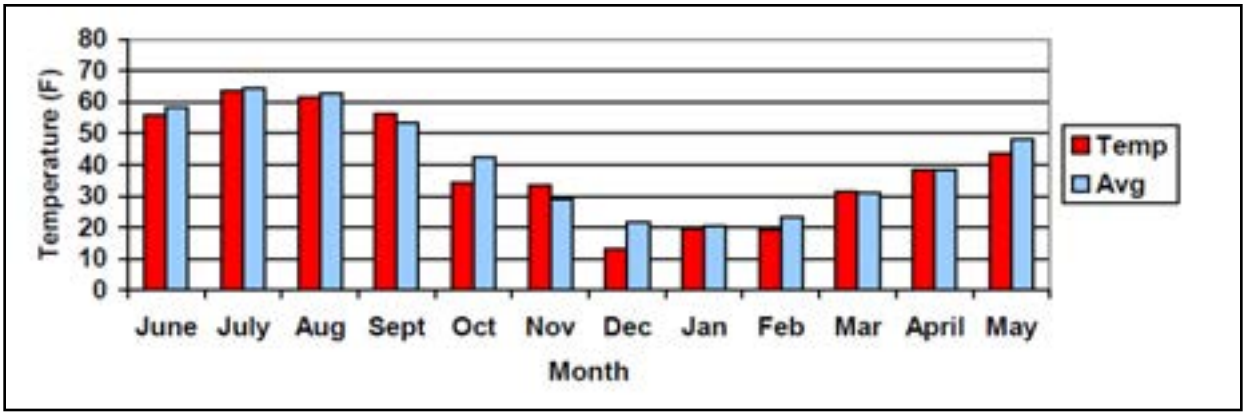


Figure 6. 2009 Bio-Year: Monthly temperature data (°F), Wyoming Climate Division 10.

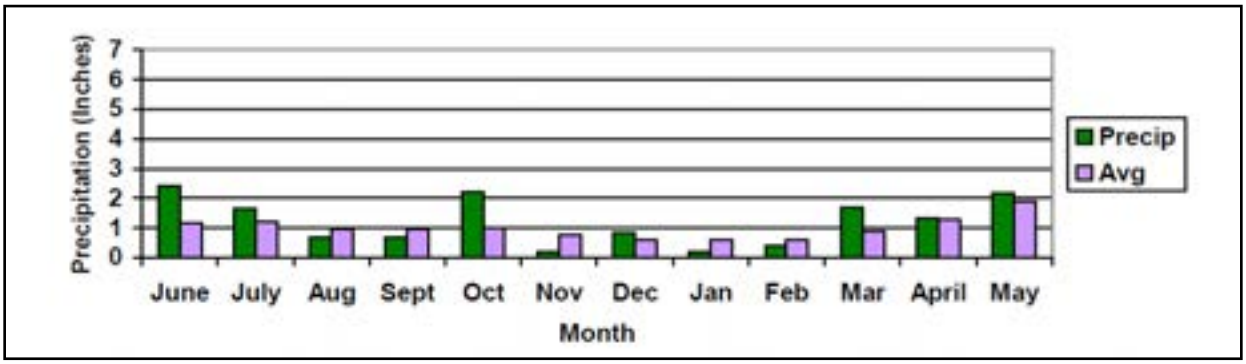


Figure 7. 2009 Bio-Year: Monthly precipitation data (in), Wyoming Climate Division 10.

Habitat

There are several energy projects within the SCCA, most are natural gas, both deep gas and coalbed methane. In addition to natural gas, wind energy permit proposals are being submitted to the Rawlins BLM office, with a major project being planned, the Chokecherry/Sierra Madre project south of Rawlins. While wind energy is a clean and renewable, it is still an industrial development that has potential impacts to sage-grouse (and other wildlife) habitats and populations. There has been no research specific to the potential impacts of wind energy developments on sage-grouse, so we will not know for certain, and to what extent, if these projects will have an impact. However, documented impacts from similar anthropogenic disturbances like natural gas development suggest wind power development will negatively affect sage-grouse. Moreover, documented impacts of wind turbines and associated transmission lines to other species, suggest impacts to sage-grouse are likely. Ideally, the WGFD, BLM, and wind energy companies should start planning research that increases our knowledge of how sage-grouse will respond to wind energy development.

In an unprecedented move to coordinate sage grouse conservation efforts across the State of Wyoming, Gov. Dave Freudenthal released an Executive Order on Aug. 1, 2008 that established "Core Population Areas" (Figure 3) and directs state agencies to work to maintain and enhance greater sage grouse habitat in Wyoming. Large portions of the SCCA are now defined as "Core" sage-grouse habitat. The specific provisions of the Executive Order can be viewed on the WGF sage-grouse web page http://gf.state.wy.us/wildlife/wildlife_management/sagegrouse/index.asp .

The Wyoming Landscape Conservation Imitative (WLCI) overlaps most of the SCCA and was established in 2007 in response to landscape scale industrial growth in southwest Wyoming. WLCI is a multi-agency, long-term, science-based program designed to assess and enhance aquatic and terrestrial habitats at the landscape scale, while facilitating responsible development through local collaboration and partnerships. The priority objectives addressed are fragmented habitats, invasive species, and water quality and quantity. The WLCI works to maintain, improve or restore the ecological function and health. Visit the WLCI website for further information: http://www.wlci.gov/

Finally, recent communications between the Governor's Office, WGFD and the Service have resulted in wind energy development being discouraged/prohibited from sage-grouse Core Population Areas unless and until it can be demonstrated such activity will not cause sage-grouse population declines. This has major implications for potential wind development in the SCCA.

Lek Monitoring and Population Trend

The WGFD, BLM, consultants, and volunteers checked 224 leks in the spring of 2010, about 65% of the occupied plus unknown status leks in the SCCA. This was down from the 77% of leks checked in 2009. The 2001-2010 average proportion of leks checked was 68%. The lower proportion of leks checked in the spring of 2010 was due to late winter storms affecting access to leks and limiting the number of days when conditions were favorable for lek monitoring.

Monitoring the total number of males on a lek is 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).

In 2010 (2009 biological year), observers counted 1,293 males on count leks, averaging 26 males per active lek (Appendix B). This was the same average as in 2009, and was 13% less than the average for 2008. Survey leks, though not as accurate for trends, also showed a decline in average numbers males per active lek, dropping from about 27/lek combined for 2008-2009, to 22 in 2010. The apparent decline is within the norms for cyclic variation and likely at least in part attributable to weather conditions, especially during the spring as discussed in the weather section of this report, however increasing levels of human development in the form of natural gas wells and infrastructure are also likely responsible based on the results of recently completed research in other parts of Wyoming (Lyon and Anderson 2003, Holloran 2005, Kaiser 2006, Walker et al. 2007, Walker 2008 and Doherty 2008).

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

Harvest

The 2009 upland harvest survey indicated 726 hunters spent 1,474 days to harvest 1,619 birds. This equals about 1.1 birds/day, 2.2 birds/hunter, and 2.0 days/hunter. Compared to 2008 when hunting regulations were similar but total harvest, birds/day, and birds/hunter were higher, the 2009 harvest suggested either a lower population or poor hunting conditions. The lower population size suggested by analysis of harvest data is in agreement with the lek monitoring results discussed above which also suggested a declining population.

Hunter-harvested wings are collected at several locations throughout most hunt areas and are used for estimating productivity. Wings were collected in barrels set at major road junctions where hunters are most likely to pass, and can provide a relatively consistent source of productivity data. Wings are gathered and then aged/sexed by molt patterns, and 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, trends still provide yearly comparisons of relative chick production.

During the 2009 hunting season we collected 282 wings from wing barrels within the SCCA. This was a decrease of 8 wings compared to the 290 collected in 2008. Age and sex composition of the wings indicates that the proportion of chicks/hen decreased from 1.9 in 2008 to 1.3 in 2009. Statewide analyses of wing data have suggested chick/hen ratios of 1.4-1.7 typically results in relatively stable populations as determined by lek counts the following year. The chicks/hen ratio observed in the 2009 wing data appears to largely explain the population decline we have documented in lek counts. The increased 2008 chick production of 1.9 chicks/hen was not reflected in either the 2009 or 2010 lek monitoring results. Typically yearling males have exhibited lower lek attendance rates, which may explain the 2009 lek monitoring results. However, we cannot definitively support this hypothesis and no increase was observed in 2010 either.

Special Studies

There are 2 research projects targeting sage-grouse occurring in the SCCA. The Stratton sagebrush study (Erickson et al. 2008) entered the fourth and final year, of 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.

The second project underway in the SCCA is the Atlantic Rim sage-grouse research project. This cooperative effort among the BLM, WGFD, and Anadarko Petroleum Corp is being conducted by Beck and Kirol of the University of Wyoming. The project objectives are; 1) to generate seasonal probability-of-occurrence maps across the Atlantic Rim project area where greater sage-grouse will occur seasonally based of habitat selection of radio-marked birds; 20 identify source habitats through seasonal risk-assessment modeling; 3) generate areas-of-critical-conservation-concern maps across the Atlantic Rim based on limiting seasonal habitats, risk assessment, multi-seasonal occurrence, and seasonal juxtaposition. An interim progress report was released in January of 2010 (Kirol and Beck 2010).

Disease

No disease mortalities for sage-grouse were reported within the SCCA during this period.

Conservation Plan Implementation

The projects being implemented by the SCCA Local Sage-Grouse Working Group in accordance with the SCCA Conservation Plan are shown in Table 1. Additional information can be viewed at: http://gf.state.wy.us/wildlife/wildlife_management/sagegrouse/index.asp .

Project Name	Biennium	Amount granted	Grantee/Project Sponsor	Project Description
Sixteen Mile-Atlantic Rim Water Developments	2005-2006 2007-2008	20,000 10,000	BLM - Rawlins FO, Blake Sheep Co., Espy Livestock	Spring development and protection
Seminoe Water Development/Spring Protection	2005-2006	6,500	BLM - Rawlins FO	Spring development and protection
Carbon County Seeding	2005-2006	2,000	Carbon County	Forb seeding in mesic areas near low volume county roads
Atlantic Rim SG Distribution Study	2007-2008 2009-2010	10,000 20,000	BLM - Rawlins FO, WGFD	Sage-grouse habitat use telemetry study relative to Atlantic Rim Gas Field Development
Red Rim Water Development	2007-2008	10,000	WGFD	Water development
Winter Range Survey	2007-2008	7,000	WGFD	Sage-grouse winter distribution flights
Stratton Sagebrush Ecology Site: Assessing the effects of grazing treatments on sagebrush vegetation and wildlife communities across prescribed burns and habitat controls	2007-2008 2009-2010	10,000 58,300	Colorado State University	Master's research evaluating prescribed fire and grazing impacts to sage-grouse and other wildlife
Identifying habitats for Greater Sage-Grouse population persistence within the Atlantic Rim, Wyoming coalbed methane field	2009-2010	56,590	University of Wyoming	Expansion of Atlantic Rim SG distribution study listed above
Buck Draw Solar Well	2009-2010	3,000	BLM - Rawlins FO	Water development
SC Red Mountain Seeding	2009-2010	5,000	Laramie Rivers Cons. District	Forb seed purchase for use in CRM level habitat plan
Statewide Water Trough Escape Ramp, Fence Markers and Spring Fencing	2007-2008	33,000	Niobrara Conservation District	Making escape ramps, fence markers and spring protection fence available to landowners and agencies - statewide
Statewide Seasonal Habitat Map	2009-2010	141,000	USGS, WY Wildlife & Nat. Res. Trust	Statewide project that uses remotely sensed vegetation data and telemetry relocations to develop seasonal habitat models and maps

Table 1. Projects being implemented in the SCCA with legislative funding made available to the Local Sage-Grouse Working Group.

Recommendations

1.) Improve efforts to survey leks of unknown status.
2.) Support LWG efforts to work on reclamation issues, especially seed mixes that benefit sage-grouse.
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.

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Literature Cited and/or Studies in Area (continued)

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_____. 2010. Appendix A. Wyoming Statewide Weather Data: Biological Years 2007 – 2009 *in* Laramie Region Big Game Job Completion Report. Laramie, WY. 34pp.

Sage-Grouse Job Completion Report

YEAR: 2009 **PERIOD COVERED: 6/1/2009 - 5/31/2010**
WORKING GROUP: Southwest **PREPARED BY: Patrick Burke**

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
2001	235	33	14.0	969	244	29.4	7.4
2002	238	35	14.7	841	304	24.0	8.7
2003	238	59	24.8	1460	434	24.7	7.4
2004	253	49	19.4	1389	242	28.3	4.9
2005	258	59	22.9	2955	449	50.1	7.6
2006	267	67	25.1	4153	526	62.0	7.9
2007	283	68	24.0	3840	605	56.5	8.9
2008	292	69	23.6	4284	646	62.1	9.4
2009	309	68	22.0	2499	792	36.8	11.6
2010	315	77	24.4	2128	1105	27.6	14.4

b. Leks Surveyed

Year	Known	Surveyed	Percent Surveyed	Max Total	Avg Males/ Active Lek
2001	235	109	46.4	1438	18.4
2002	238	133	55.9	1533	20.4
2003	238	133	55.9	1725	21.8
2004	253	121	47.8	1642	21.3
2005	258	127	49.2	3430	36.5
2006	267	173	64.8	3990	36.9
2007	283	196	69.3	5830	42.6
2008	292	163	55.8	4020	33.2
2009	309	205	66.3	5531	35.7
2010	315	196	62.2	3714	27.1

c. Leks Checked

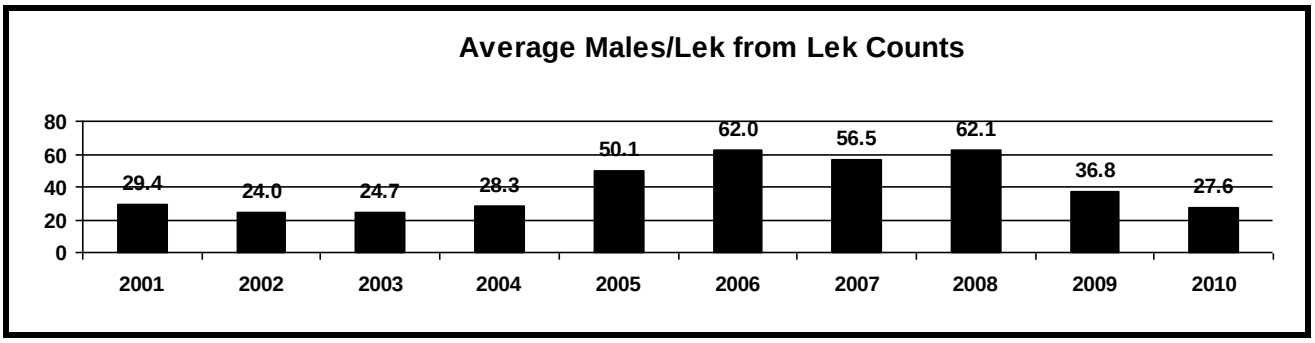
Year	Known	Checked	Percent Checked	Max Total	Avg Males/ Active Lek
2001	235	140	59.6	2352	21.6
2002	238	167	70.2	2343	21.5
2003	238	190	79.8	3165	23.1
2004	253	170	67.2	3031	24.1
2005	258	185	71.7	6379	42.0
2006	267	240	89.9	8143	46.5
2007	283	263	92.9	9632	47.2
2008	292	231	79.1	8237	43.6
2009	309	272	88.0	7984	36.0
2010	315	270	85.7	5701	27.0

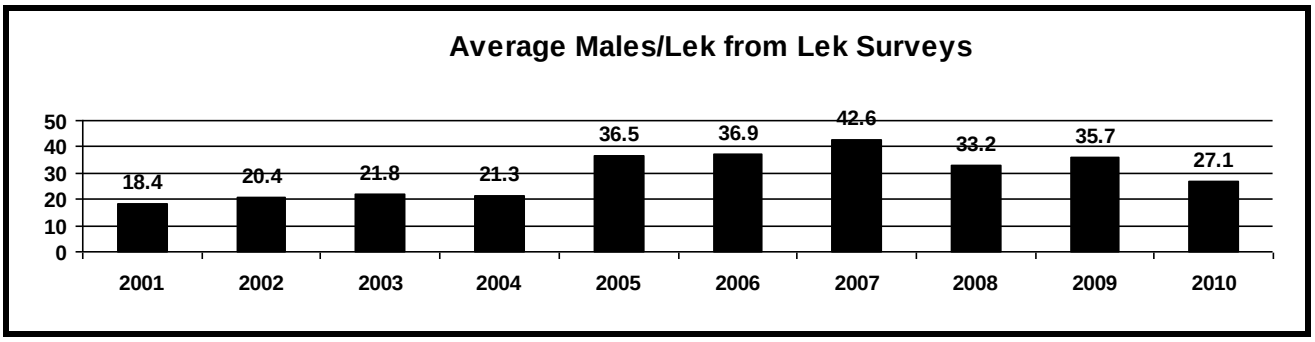
d. Lek Status

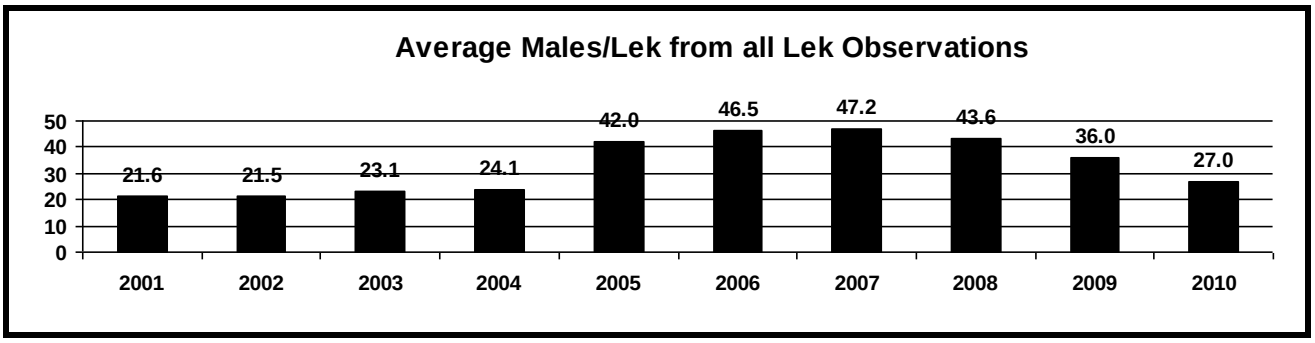
Year	Active	Inactive	Not Located	Unknown	Confirmed Status Total	Confirmed Status Active	Confirmed Status Inactive
2001	108	9	2	116	117	92.3%	7.7%
2002	112	26	2	98	138	81.2%	18.8%
2003	134	40	0	64	174	77.0%	23.0%
2004	130	25	0	98	155	83.9%	16.1%
2005	152	19	0	87	171	88.9%	11.1%
2006	183	41	0	43	224	81.7%	18.3%
2007	214	34	0	35	248	86.3%	13.7%
2008	195	25	0	72	220	88.6%	11.4%
2009	227	32	0	50	259	87.6%	12.4%
2010	213	27	0	75	240	88.8%	11.3%

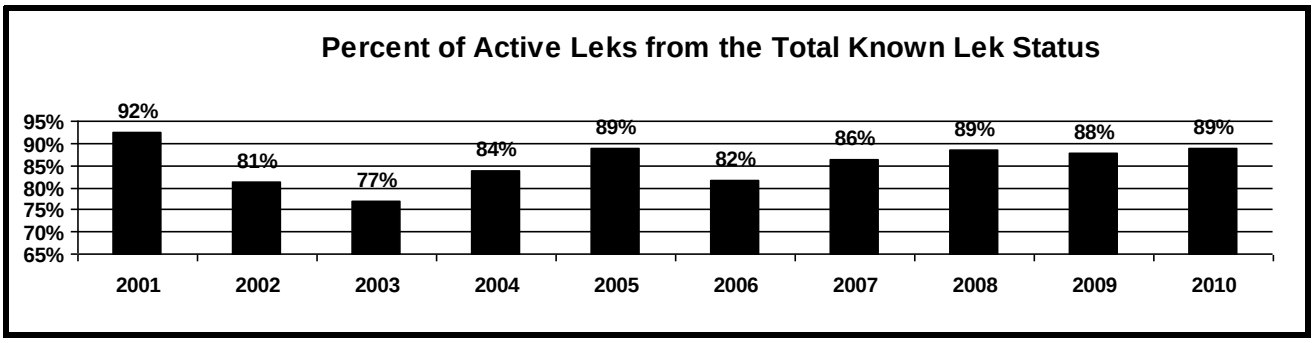
SAGE-GROUSE LEK ATTENDANCE SUMMARY

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









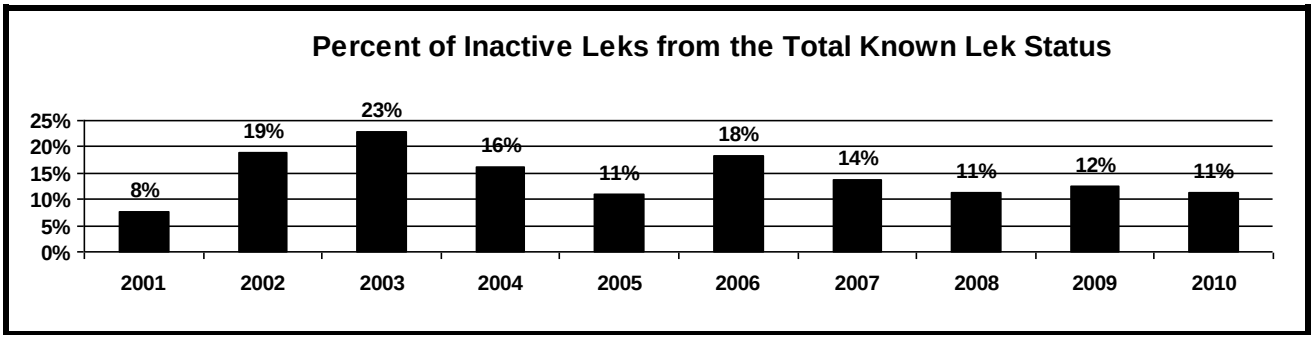


Table3. Summary of unoccupied (historic) leks and lek complexes.

a. Unoccupied Leks

Year	Total Number of Leks: Abandoned	Total Number of Leks: Destroyed	Number of abandoned leks checked
2001	74	13	10
2002	76	14	18
2003	81	14	64
2004	81	14	3
2005	82	14	1
2006	83	14	25
2007	83	14	14
2008	83	14	14
2009	81	14	25
2010	80	14	20

Sage Grouse Lek Characteristics – Southwest

Region	Number	Percent
Green River	358	88.0%
Pinedale	49	12.0%

Working Group Area	Number	Percent
Southwest	407	100.0

Classification	Number	Percent
Occupied	286	70.3%
Unknown	19	4.7%
Unoccupied	102	25.1%

BLM Office	Number	Percent
	0	0.0%
Kemmerer	181	44.5%
Pinedale	3	0.7%
Rawlins	1	0.2%
Rock Springs	220	54.1%

Unoccupied Leks	Number
Abandoned	87
Destroyed	14

Biologist District	Number	Percent
Baggs	8	2.0%
Green River	145	35.6%
Kemmerer	205	50.4%
Pinedale	49	12.0%

Game Warden District	Number	Percent
Baggs	1	0.2%
Cokeville	58	14.3%
Evanston	29	7.1%
Green River	69	17.0%
Kemmerer	58	14.3%
Mountain View	47	11.5%
Rock Springs	95	23.3%
South Pinedale	49	12.0%

County	Number	Percent
Fremont	3	0.7%
Lincoln	123	30.2%
Sublette	21	5.2%
Sweetwater	190	46.7%
Uinta	70	17.2%

Land Status	Number	Percent
BLM	300	73.7%
National Park	2	0.5%
Private	89	21.9%
State	10	2.5%
USFS	1	0.2%

Management Area	Number	Percen
4	94	23.1%
5	94	23.1%
6	84	20.6%
7	135	33.2%

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

a. Season

Year	Season Dates	Length	Bag/Possession Limit
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
2007	Sept 22-Oct 2	11	2/4
2008	Sept 22-Oct 2	11	2/4
2009	Sept 19-Sept 30	12	2/4

b. Harvest

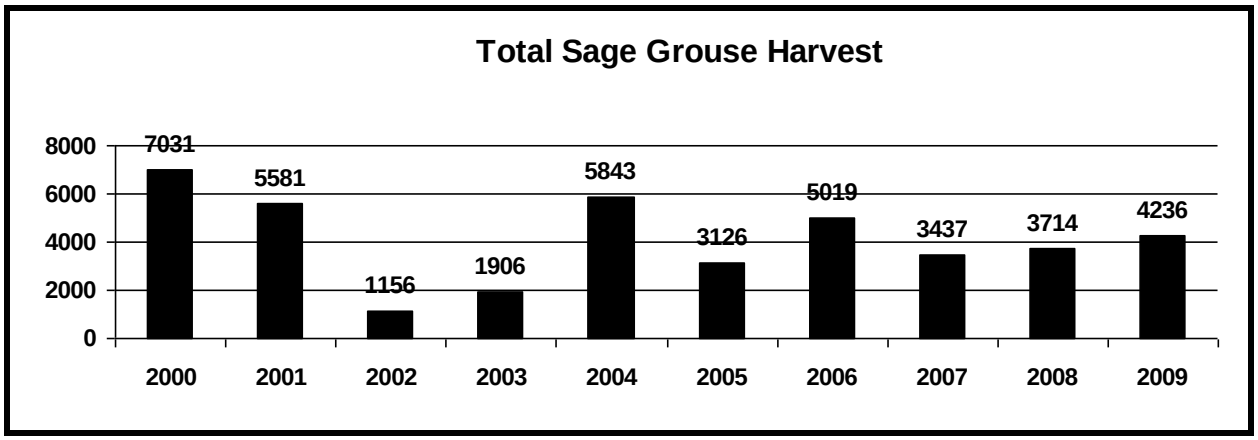
Year	Harvest	Hunters	Days	Birds/ Day	Birds/ Hunter	Days/ Hunter
1999	8,267	2,756	7,460	1.1	3.0	2.7
2000	7,031	3,061	7,278	1.0	2.3	2.4
2001	5,581	2,092	5,624	1.0	2.7	2.7
2002	1,156	694	1,824	0.6	1.7	2.6
2003	1,906	965	2,460	0.8	2.0	2.5
2004	5,843	2,400	6,692	0.9	2.4	2.8
2005	3,126	1,148	2,803	1.1	2.7	2.4
2006	5,019	1,968	4,825	1.0	2.6	2.5
2007	3,437	1,788	3,630	0.9	1.9	2.0
2008	3,714	1,653	3,451	1.1	2.2	2.1
2009	4,236	1,645	4,014	1.1	2.6	2.4
Avg.	4,483	1,834	4,551	1.0	2.4	2.5

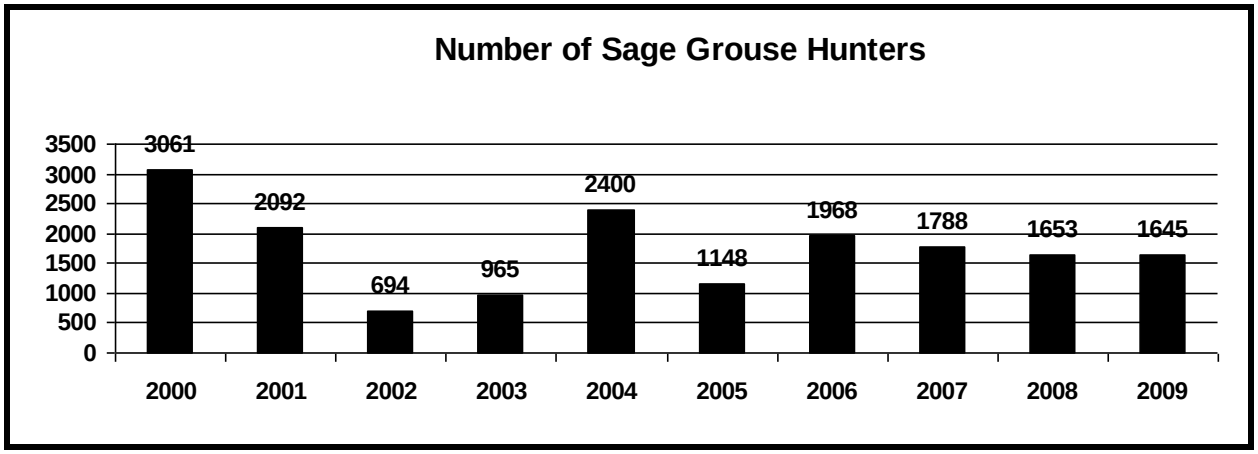
Table 5. Composition of harvest by wing analysis.

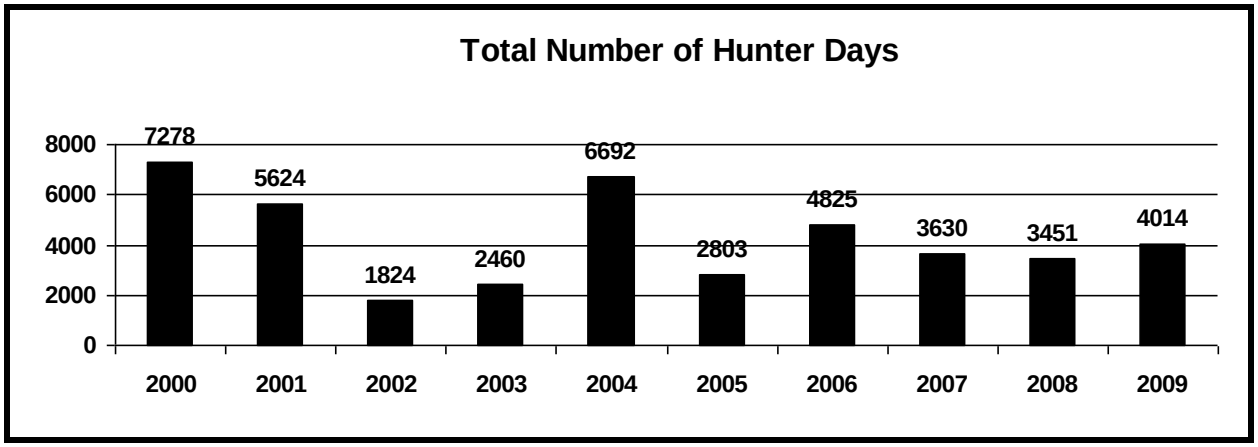
Year	Sample Size	Percent Adult		Percent Ylg		Percent Young		Chicks /Hen
		Male	Female	Male	Female	Male	Female	
2000	910	13.6	34.6	6.9	10.1	16.0	18.7	0.8
2001	842	11.3	35.0	2.7	4.9	21.5	24.6	1.2
2002	418	9.3	28.9	3.1	3.8	25.4	29.4	1.7
2003	530	10.0	28.1	1.7	5.5	23.4	31.3	1.6
2004	841	6.7	22.7	0.7	3.8	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
2007	509	18.5	26.5	3.3	3.7	22.6	25.3	1.6
2008	666	12.9	24.6	5.0	6.0	20.1	31.4	1.7
2009	887	11.7	30.0	4.4	6.7	20.0	27.3	1.3

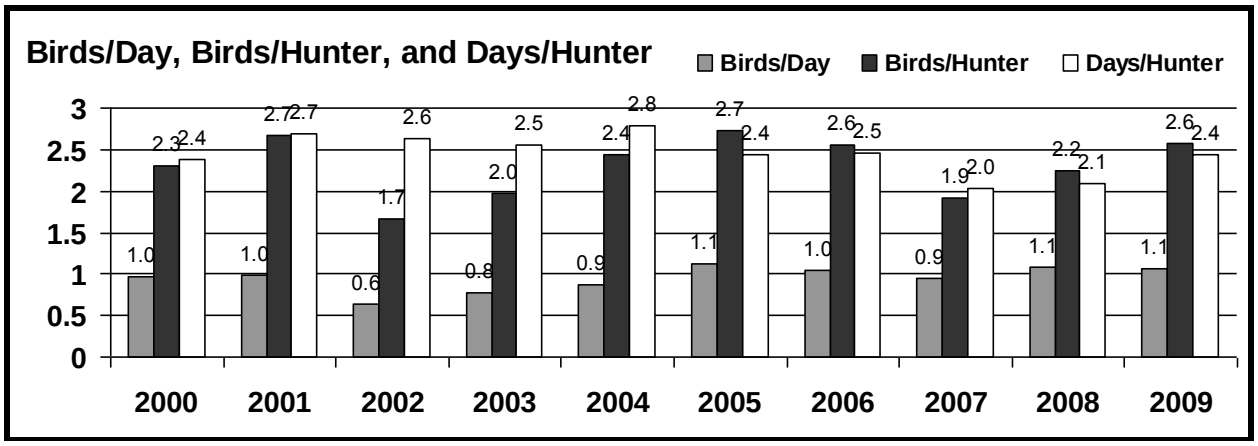
SAGE-GROUSE HARVEST SUMMARY

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









Sage-grouse Wing Analysis Summary 2009

Region: **Area :**

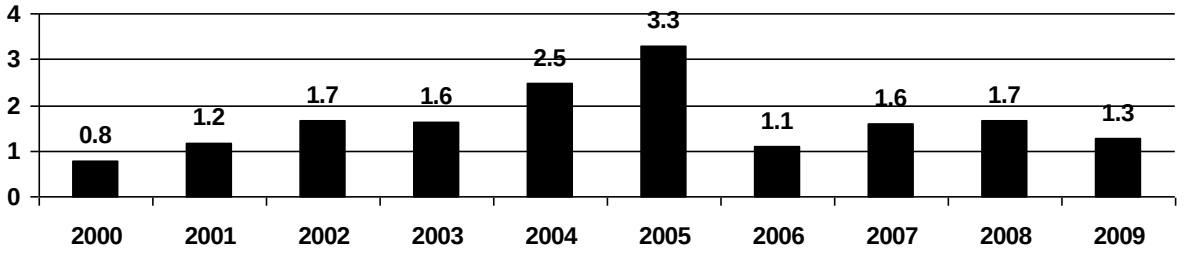
Working Group: Southwest

Adult Males:	104	**Percent of All Wings:**	11.7%
Adult Females:	266	**Percent of All Wings:**	30.0%
Adult Unknown:	0	**Percent of All Wings:**	0.0%
Total Adults:	370		
Yearling Males:	39	**Percent of All Wings:**	4.4%
Yearling Females:	59	**Percent of All Wings:**	6.7%
Yearling Unknown:	0	**Percent of All Wings:**	0.0%
Total Yearlings:	98		
Chick Males:	177	**Percent of All Wings:**	20.0%
Chick Females:	242	**Percent of All Wings:**	27.3%
Chick Unknown:	0	**Percent of All Wings:**	0.0%
Total Chicks:	419		
Unknown Sex/Age:	0	**Percent of All Wings:**	0.0%
Total for all Sex/Age Groups:	887		

Chick Males:	177	**Percent of All Chicks:**	42.2%
Yearling Males:	39	**Percent of Adult and Yearling Males:**	27.3%
Adult Males:	104	**Percent of Adult and Yearling Males:**	72.7%
Adult and Yearling Males:	143	**Percent of Adults and Yearlings:**	30.6%
Total Males:	320	**Percent of All Sex/Age Groups:**	36.1%
Chick Females:	242	**Percent of All Chicks:**	57.8%
Yearling Females:	59	**Percent of Adult and Yearling Females:**	18.2%
Adult Females:	266	**Percent of Adult and Yearling Females:**	81.8%
Adult and Yearling Females:	325	**Percent of Adults and Yearlings:**	69.4%
Total Females:	567	**Percent of All Sex/Age Groups:**	63.9%

Chicks:	419	**Percent of All Wings:**	47.2%
Yearlings:	98	**Percent of All Wings:**	11.0%
Adults:	370	**Percent of All Wings:**	41.7%
Chicks/Hen:	**1.3**		

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



2009 Annual Sage-Grouse Job Completion Report

Conservation Plan Area: **Southwest**
Biological Year: **June 1, 2009 – May 31, 2010**

INTRODUCTION

The Southwest Wyoming Local Sage-Grouse Working Group is one of eight local sage-grouse working groups in Wyoming (Figure 1). The local working groups were created in 2004 and are charged with developing and implementing plans to promote sage-grouse conservation and, whenever possible, conservation of other species that use sagebrush dominated habitats. The goal of these conservation plans is to identify strategies to improve sage-grouse numbers and prevent the need for listing of the species under the Endangered Species Act. The conservation plan for the SWLWG was completed in July 2007. This report focuses on analysis of data for the biological year June 1, 2009 - May 31, 2010.

Figure 1. Wyoming Local Sage-Grouse Working Group Boundaries

In response to range-wide sage-grouse population declines and loss of sagebrush habitats, upon which sage-grouse depend, there has been an increased emphasis on sage-grouse data collection over the past decade (Connelly et al. 2004). Those monitoring efforts have suggested that sage-grouse populations in the SWSGCA 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 populations did not fall to mid-1990s levels. Timely precipitation in 2004-05 increased chick survival and later lek attendance, however drought conditions from 2006-08 appear to have caused the populations to decline.

In addition to the continuing drought conditions and the impacts that drought might have on sage-grouse, some of the other causes of concern for sage-grouse populations in the Southwest Planning Area include continued pressure from natural gas development, livestock grazing practices and vegetation treatment practices. In addition to the aforementioned threats, the recent interest in wind energy development is a cause for concern and could potentially have dramatic impacts on sage-grouse populations throughout Wyoming. The issues of predation and the effects of hunting are concerns that are often raised by the public. Newly completed research in the Upper Green River Basin area suggests raven populations are heavily subsidized by human activities and raven predation may be impacting grouse in that area (Bui 2009). There is little documentation hunting has any population level impacts on sage-grouse in Wyoming (Christiansen 2008).

Governor Freudenthal released an Executive Order on Aug. 1, 2008 that requires state agencies to work to maintain and enhance greater sage grouse habitat in Wyoming. The executive order establishes a "core area" strategy of management. Figure 2 illustrates the core areas. See the 2008 and/or 2009 Statewide JCR for more information on the executive order and core area strategy.

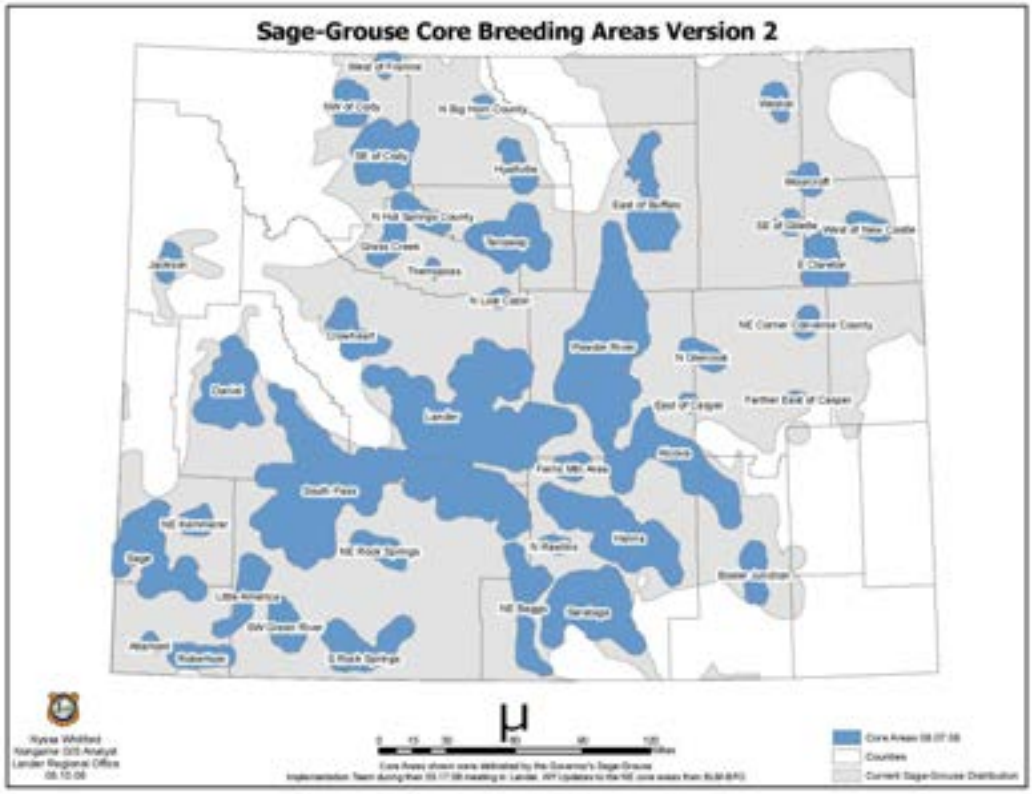


Figure 2. Wyoming sage-grouse core areas.

METHODS

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

Harvest information is obtained through a mail questionnaire of upland 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 a portion of Area 7 (Figure 3). The remainder of Management Area 7 is included in the Upper Green River Basin Conservation Planning Area (UGRBCA).

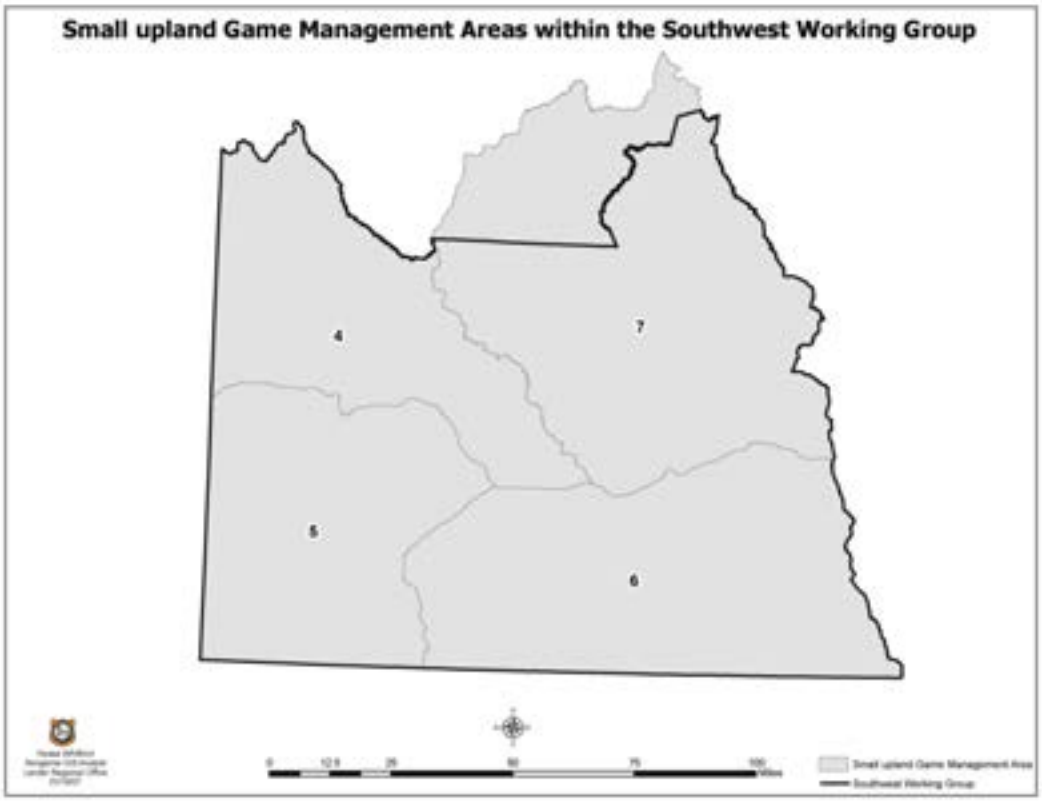


Figure 3. Management Areas within the Southwest Wyoming Sage-Grouse Conservation Planning Area.

In addition to the mail questionnaire, wings are collected from harvested sage-grouse in order to calculate the proportions of adults, juveniles, males, and females in the harvest. Wings were submitted voluntarily by hunters at wing collection barrels distributed throughout the SWSGCA.

Of primary interest is the chick to hen ratio, a statistic that provides an index of annual chick productivity and survival.

More specific 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

All lek monitoring data for the 2010 breeding season along with data from the past ten years for comparison are summarized in the JCR Data Tables 1 (a-d). There are 286 occupied leks known to exist in the SWSGCA as of the 2010 breeding season. There are also 102 unoccupied leks and 19 leks of unknown classification. Of these 407 total sites, 270 were checked in 2010 resulting in 213 being documented active, 27 inactive and 30 leks were of unknown or undetermined status. Because of the quantity of leks in the SWSGCA, data collection efforts were focused on lek surveys, which involved at least one visit to the lek during the breeding season over lek counts, which are more labor intensive and involve three or more visits during the breeding season.

The average number of males per active lek for all leks checked (both counted and surveyed) was 27 males per active lek. This is a reduction from an average of 36 males per lek in 2009, and is the lowest average observed since 2004 when an average of 24.1 males per lek was observed. The average number of males in attendance on the 77 count leks in 2010 was 27.6 males per lek. This number is a decrease from the observed averages of recent years and is the lowest observed average since 2003 when 24.7 males per count lek were observed. For the 196 leks that were surveyed in 2010, the average lek had 27.1 males in attendance. During lek surveys conducted in 2010, an average of 25.6 males was observed per active lek. This is the lowest observed number of males per active lek surveyed since 2004 when only 21.3 males per active lek were observed.

It is important to note that data collection efforts have increased considerably during the last decade. Because of this, the observed increase in the number of leks and the total number of males observed is an artifact of an increased sampling effort and does not represent an actual increase in the sage-grouse population. In 2000, only 59.6% of known occupied leks were checked, but since 2006, over 80% of the occupied leks have been checked.. Also efforts by WGFD personnel, volunteers, and other government and private industry biologist have led to increased numbers of known leks.

Note that the number of “known” leks on JCR table1 (a-d) include all “occupied” leks plus the number of unoccupied and unknown status leks checked during that year. So in 2010, 20 unoccupied and 9 unknown status leks were checked. This is confusing and needs to be corrected in the upcoming JCR database revision.

Currently, no method exists to estimate sage-grouse population size in a statistically significant way. However, the decreased male per lek averages indicates the population is declining.

Harvest

The 2009 hunting season for sage-grouse in the SWSGCA ran from September 20 to September 30 and allowed for a daily take of 2 birds with a limit of 4 grouse in possession (Table 4 a). The 2009 season was consistent with how the season has been run since 2002 when the season was shortened and the daily bag limit was reduced to 2 birds. The sage-grouse season had traditionally started as early as September first and ran for 30 days; during this time the daily limit was 3 grouse with a possession limit of up to 9 birds. Over time, the season was gradually shortened and the daily bag and possession limits reduced because of concern over declining sage-grouse populations. The opening date was moved back from the first of September to the fourth weekend because research suggested that hens with broods were concentrated near water sources earlier in the fall and therefore more susceptible to harvest. The later opening date allowed more time for those broods to disperse and therefore reduced hunting pressure on those hens that were successful breeders and on young of the year birds.

The data for all birds harvested in Management Areas 4, 5, 6, and 7 are included in the SWSGCA report even though a portion of Area 7 is located in the UGRBCA. Since the majority of Area 7 resides within the boundaries of the SWSGCA, the decision was made to include all of the data from Area 7 in this report.

Based on the harvest surveys returned by hunters, it was estimated that 1,645 hunters harvested 4,236 sage-grouse during the 2009 hunting season (Table 4 b). Both the number of hunters and number of birds harvested was slightly higher than those from 2008, slightly below the 10 year average and down from the 2006 hunting season, when an estimated 5,019 birds were harvested by 1,968 hunters. The annual trends in harvest statistics over the last 10 years are not highly correlated with average male lek attendance datum.

The number of grouse wings collected from hunters during the 2009 season was up slightly from previous years. A total of 887 wings were collected in 2009. This represents approximately 21% of the estimated total harvest for 2009, which is above the 16% ten-year average.

The main reason for the collection of wings from harvested sage-grouse is so that analysis of the wings can allow for the determination of the sex and age of the birds that were harvested. Assuming that harvest is random and that all ages and sexes are harvested at a proportion that is equal to what is the actual makeup of the population, chick production for that year can be estimated. Even if the rate of harvest between age/sex groups is not random, the information can be used as a tool for looking at population trends as long as the rates are relatively consistent across years. The most important ratio from the wing analysis is the chick to hen ratio, this ratio provides a general indication of if the population is increasing, decreasing or remaining constant. 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. The chick:hen ratio as determined from hunter submitted wings for the 2009 hunting season was 1.3 chicks/hen. This ratio suggests a stable to slightly

declining population. This ratio is up from the 2006 chick:hen ratio of 1.1 chicks per hen, but well below the 2.4 chicks per hen observed in 2004 and 3.3 chicks per hen observed in 2005 which resulted in a substantial increases in lek attendance in subsequent years.

Weather

Spring habitat conditions are one of the most important factors in determining nesting success and chick survival. Specifically, shrub height and cover, live and residual grass height and cover, and forb cover have a large impact on sage-grouse nesting success. The shrub and grasses provide screening cover from predators and weather while the forbs provide forage and also provide insects that reside in the forbs. Spring precipitation is an important determinant of the quality and quantity 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 dependent on the current year's precipitation.

The spring (March-June) precipitation and fall chick:hen ratios (as determined by hunter submitted wings) are given in Table 9 and Figure 4. Generally speaking, when spring precipitation is at or above 90% of average, chick to hen ratios are above average, but when spring precipitation is below average, chick:hen ratios are also below average.

In 2009, spring precipitation was 141% of normal however 2009 chick production did not correlate with this. We suspect the moisture arrived with cold temperatures during the peak of hatching which may have reduced hatching success and early chick survival.

Table 9. Spring precipitation compared to fall chick:hen ratios in the SWSGCA 2000-2009. Precipitation data from: 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 Precipitation	Chicks:Hen
2000	59%	0.8
2001	44%	1.2
2002	50%	1.7
2003	93%	1.6
2004	92%	2.2
2005	134%	3.2
2006	50%	1.1
2007	57%	1.8
2008	64%	2.1
2009	141%	1.4
2010	139%	N/A

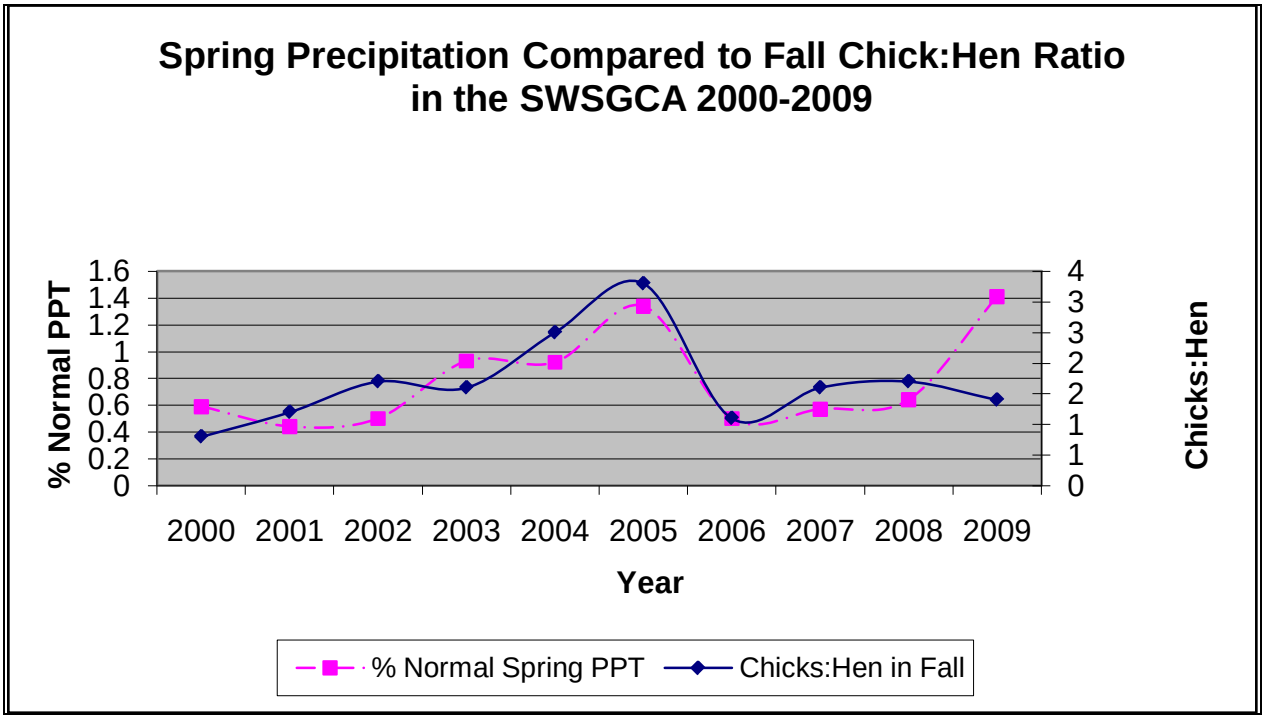


Figure 4. Percent of normal spring precipitation compared to fall chick to hen ratios in the Southwest Wyoming Sage-Grouse Conservation Planning Area

Winter weather has not been shown to be a limiting factor to sage-grouse except in areas with persistent snow cover that is deep enough to limit sagebrush availability. This condition is rarely present in the SWSGCA.

Habitat and Seasonal Range Mapping

While we believe that most of the currently occupied leks in Southwest Wyoming have been documented, other seasonal habitats such as nesting/early brood-rearing and winter concentration areas have not yet been adequately 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, WGFD and WYGIS of the University of Wyoming.

CONSERVATION PLANNING/IMPLEMENTATION

Since 2005, Local Working Groups have been allocated approximately $2.5 million to support implementation of local sage-grouse conservation projects. The source of this funding is the State of Wyoming General Fund as requested by Governor Freudenthal and approved by the legislature. See Attachment A for a list of the projects either completed or being implemented in the SWSGCA.

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.

CURRENT RESEARCH IN THE SWSGCA

- Conservation planning maps and winter habitat selection of greater sage-grouse in the Hiawatha Regional Energy Development project area – Colorado Division of Wildlife.

- Impacts of raven abundance on greater sage-grouse nesting success in southwest Wyoming – Utah State University.

- Effectiveness of raptor perch deterrents on electrical transmission lines – HawkWatch International.

LITERATURE CITED

Bui, T.D. 2009. The effects of nest and brood predation by common ravens (*Corvus corax*) on greater sage-grouse (*Centrocercus urophasianus*) in relation to land use in western Wyoming. M.S. Thesis. University of Washington, Seattle.

Christiansen, T. 2007. Chapter 12: Sage Grouse (*Centrocercus urophasianus*). Pages 12-1 to 12-51 in S.A. Tessmann (ed). Handbook of Biological Techniques: third edition. Wyoming Game and Fish Department. Cheyenne, WY.

Christiansen, T. 2008. Hunting and sage-grouse: a technical review of harvest management on a species of concern in Wyoming. Wyoming Game and Fish Department, Cheyenne.

RECOMMENDATIONS

1) Implement provisions of the Governor's executive order for sage-grouse core area management.

2) Implement the SWSGCA Conservation Plan.

3) Map seasonal habitats (nesting/early brood rearing, winter concentration areas)

4) Map and integrate into the WGFD database perimeters for all known sage-grouse leks. Special emphasis should be made to map large leks and leks with impending nearby development actions first.

5) Expand lek searched to ensure that all active leks within the SWSGCA have been identified

6) Ensure that all known lek locations are accurate and recorded using UTM grid coordinates in map datum NAD83.

Attachment A: SWSGCA Sage-Grouse Projects Supported with 2005-2010 General Fund Budgets

Project Name	Budget Biennium	Total Cost	SG $	Project Description	Partners	Status
12 - SG & Sagebrush Conservation I&E	2005-06	$2,600	$2,600 requested/approved; $2,597.00 spent	Educational displays including taxidermy mounts and restaurant activity placemats for youth.	WGFD	Complete
13 - South LaBarge Weed Control	2005-06	$15,000	$5,000 requested/approved/spent	Invasive/noxious weed control.	BLM, USFS, GR Basin Cooperative Weed Mgt Area.	Complete
14 - Rock Creek Prescribed Burn	2005-06	$150,000	$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.	BLM, RMEF, WGFD	Complete
15 - Winter Closure Signs (see also #63)	2005-06	$4,000	$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.	BLM, WGFD	Complete
39 - Exclosure & Guzzler maintenance	2007-08	$42,000	$20,000 requested/approved/spent	Monitoring and maintenance of 35 range exclosures and 11 guzzlers on BLM.	BLM	Complete
40 - Belle Butte Water Development	2007-08	$132,000	$34,500 requested/approved/spent	Attach 7 wildlife guzzlers to new livestock watering pipeline.	BLM, numerous grazing permittees	Complete
41 - Hiawatha Aerial Surveys	2007-08	$29,100	$10,000 requested/approved; $2,262 spent	Conduct aerial surveys to document grouse distribution esp. winter and leks.	BLM, Questar, WGF	Complete

Project Name	Budget Biennium	Total Cost	SG $	Project Description	Partners	Status
42 - Red Canyon/ Elk Mtn Rx Burn	2007-08	$300,000	$30,000 requested/approved/spent	Prescribed fire to improve upland plant communities.	BLM, RMEF, WGF	Complete
47 - Water trough escape ramps and fence markers	2007-08	$192,000	$36,000 requested/approved/spent with statewide LWG $	Provide pre-fab wildlife escape ramps and fence collision deterrents to private landowners throughout the state.	WY Natural Resources Trust, Landowners, WGF	Complete
51 - Hiawatha SG Habitat Mapping	2007-08	$417,120 (multiyear)	$30,000 requested/approved, $29,634.35 spent	Develop high-resolution seasonal sg habitat maps to help determine energy development influence.	Questar, Colorado Division of Wildlife	Complete
52 - Peterson Spring Protection (see also #94)	2007-08	$24,480	$17,280 requested, $8,500 approved, $8,194 spent	Develop and protect 3 springs to provide wildlife and livestock water but protect the source from livestock degradation	Owen Peterson	Complete
63 - Winter Range Signs (See also #15.)	2007-08	$6,000	$3,000 requested/approved/spent ($1,500 ea from SW and Upper Green River LWGs)	Improve effectiveness of existing public land big game and sage grouse winter range closures via new signing.	BLM, WGFD	Complete
94 - Petersen Ranch Project Phase II (see #52)	2009-10	$19,500	$9,000 requested, $3,500 approved/spent	Spring protection and water development	Landowner	Complete
98 - Seasonal Habitat Mapping	2009-10	$352,000 (multiyear - statewide)	$155,000 requested, $141,000 approved/spent with statewide LWG $	Use predictive habitat models to produce sage-grouse seasonal habitat maps	U.S. Fish & Wildlife Service, BLM, USGS Various energy development companies	On-going

Sage-Grouse Job Completion Report

PERIOD COVERED:6/1/2009 - 5/31/2010
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
2001	95	34	35.8	1198	470	35.2	13.8
2002	98	42	42.9	1213	456	28.9	10.9
2003	98	61	62.2	1462	577	24.0	9.5
2004	103	62	60.2	1541	212	24.9	3.4
2005	107	81	75.7	3003	650	37.1	8.0
2006	113	78	69.0	3869	689	49.6	8.8
2007	119	78	65.5	4290	313	55.0	4.0
2008	121	83	68.6	3721	609	44.8	7.3
2009	119	85	71.4	3850	1142	45.3	13.4
2010	130	93	71.5	3099	1176	33.3	12.6

b. Leks Surveyed

Year	Known	Surveyed	Percent Surveyed	Max Total	Avg Males/ Active Lek
2001	95	34	35.8	925	37.0
2002	98	23	23.5	605	40.3
2003	98	26	26.5	272	16.0
2004	103	24	23.3	503	35.9
2005	107	20	18.7	657	38.6
2006	113	25	22.1	923	48.6
2007	119	31	26.1	1393	66.3
2008	121	24	19.8	1414	78.6
2009	119	28	23.5	619	38.7
2010	130	29	22.3	500	26.3

c. Leks Checked

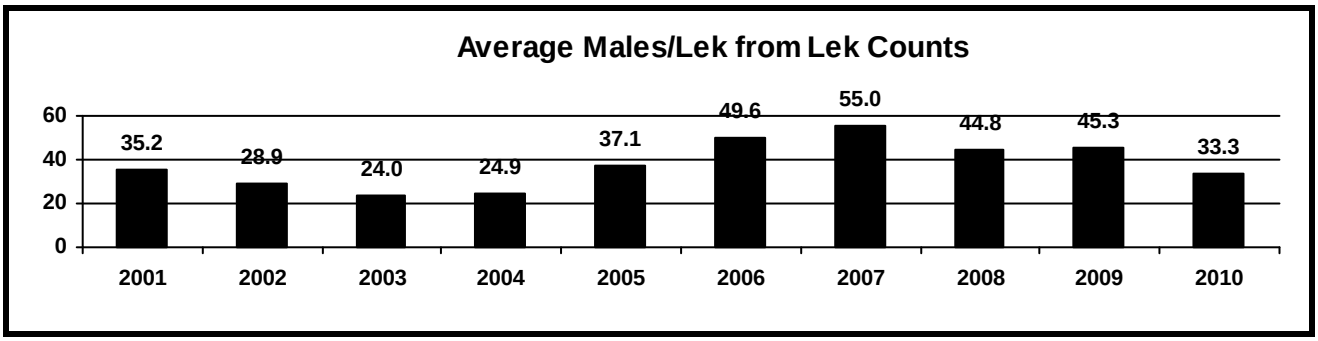
Year	Known	Checked	Percent Checked	Max Total	Avg Males/ Active Lek
2001	95	66	69.5	2047	35.9
2002	98	64	65.3	1761	31.4
2003	98	87	88.8	1734	22.2
2004	103	86	83.5	2044	26.9
2005	107	101	94.4	3660	37.3
2006	113	102	90.3	4781	49.8
2007	119	108	90.8	5683	58.0
2008	121	107	88.4	5135	50.8
2009	119	113	95.0	4469	44.2
2010	130	122	93.8	3599	32.1

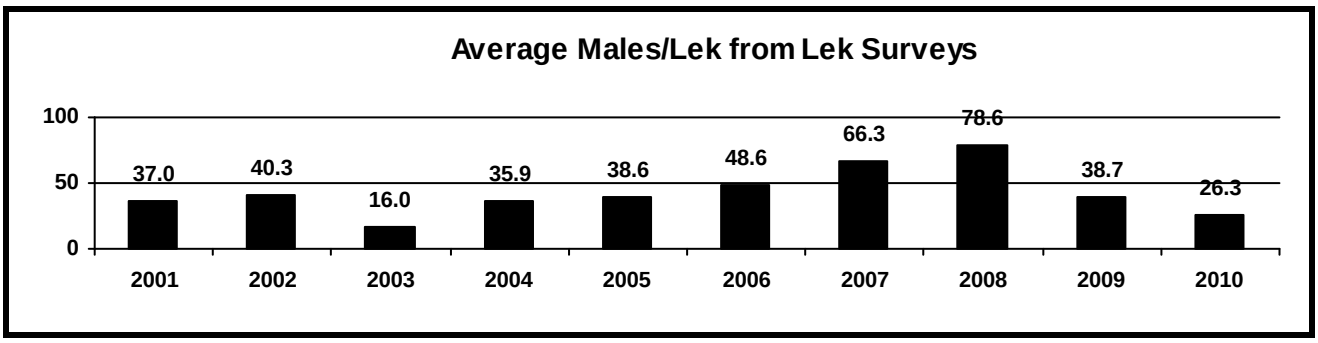
d. Lek Status

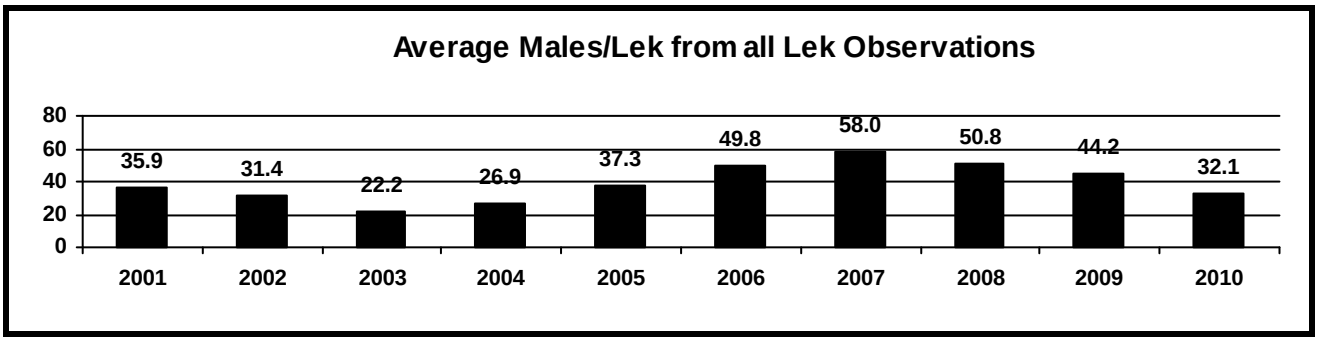
Year	Active	Inactive	Not Located	Unknown	Total	Confirmed Status Active	Confirmed Status Inactive
2001	50	13	2	30	63	79.4%	20.6%
2002	47	15	0	36	62	75.8%	24.2%
2003	59	24	1	14	83	71.1%	28.9%
2004	61	24	0	18	85	71.8%	28.2%
2005	76	25	0	6	101	75.2%	24.8%
2006	79	23	0	11	102	77.5%	22.5%
2007	82	25	1	11	107	76.6%	23.4%
2008	87	20	0	14	107	81.3%	18.7%
2009	86	27	0	6	113	76.1%	23.9%
2010	92	30	0	8	122	75.4%	24.6%

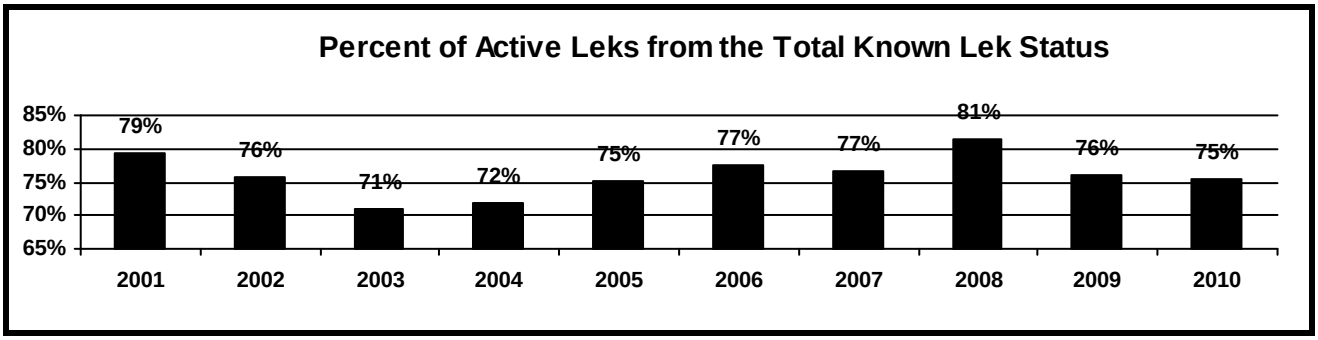
SAGE-GROUSE LEK ATTENDANCE SUMMARY

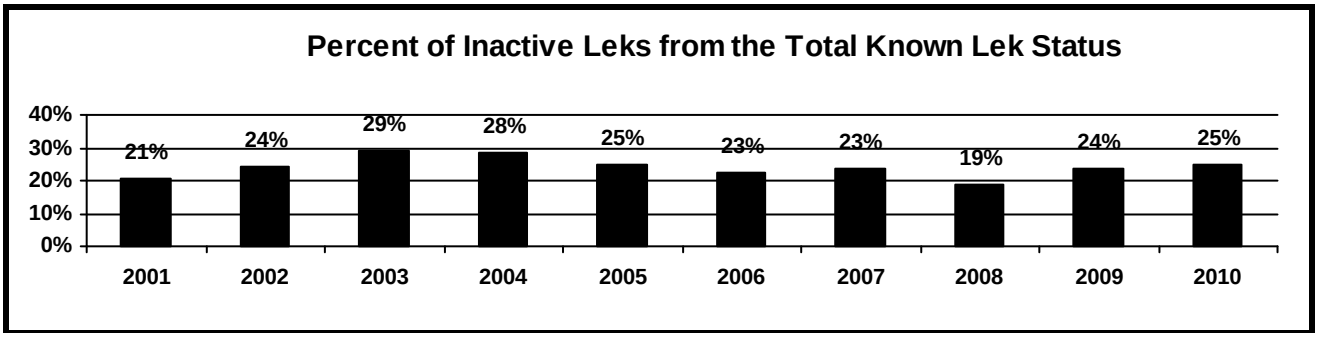
WORKING GROUP: Upper Green River **Area(s): All**











2. LEK COMPLEX ATTENDANCE SUMMARY (OCCUPIED COMPLEXES)

a. Lek Complexes Counted

Year	Number of Complexes	Maximum Totals		Avg./Active Complex		Number of Leks
		Males	Females	Males	Females	
2001	9	1089	358	121.0	39.8	59
2002	15	1183	454	78.9	30.3	82
2003	16	1090	345	68.1	21.6	85
2004	16	1514	208	94.6	13.0	90
2005	17	2572	492	151.3	28.9	95
2006	20	3108	564	155.4	28.2	111
2007	21	3502	252	166.8	12.0	112
2008	18	2742	505	152.3	28.1	110
2009	20	3003	870	150.2	43.5	117
2010	23	2456	978	106.8	42.5	137

b. Lek Complexes Surveyed

Year	Number Complexes	Max. Total Males	Avg. Males/ Active Complex	Number of Leks
2001	10	313	34.8	26
2002	1	82	82.0	4
2003	6	146	24.3	15
2004	2	148	148.0	5
2005	4	281	93.7	11
2006	3	288	144.0	6
2007	2	466	233.0	12
2008	5	629	209.7	14
2009	5	214	42.8	12
2010	2	12	6.0	3

c. Lek Complexes Checked

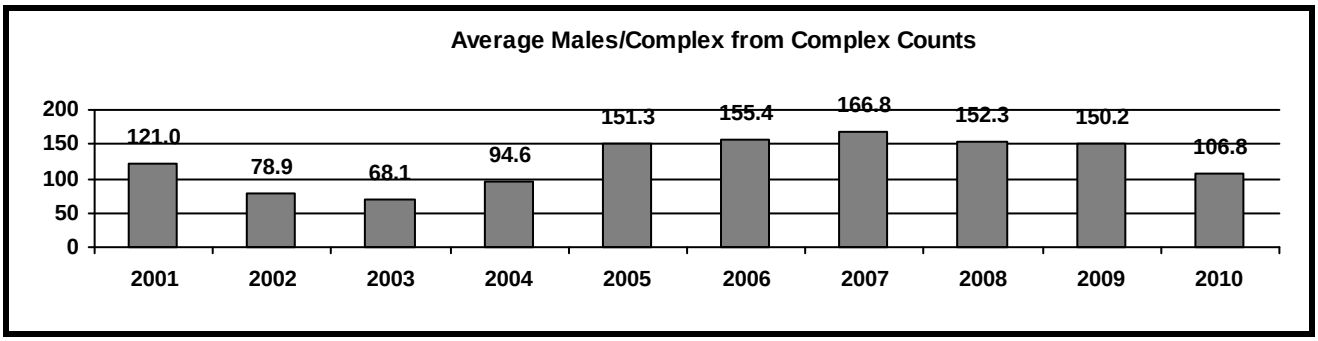
Year	Number Complexes	Max. Total Males	Avg. Males/ Active Complex	Number of Leks
2001	19	1402	77.9	85
2002	16	1265	79.1	86
2003	22	1236	56.2	100
2004	18	1662	97.8	95
2005	21	2853	142.7	106
2006	23	3396	154.4	117
2007	23	3968	172.5	124
2008	23	3371	160.5	124
2009	25	3217	128.7	129
2010	25	2468	98.7	140

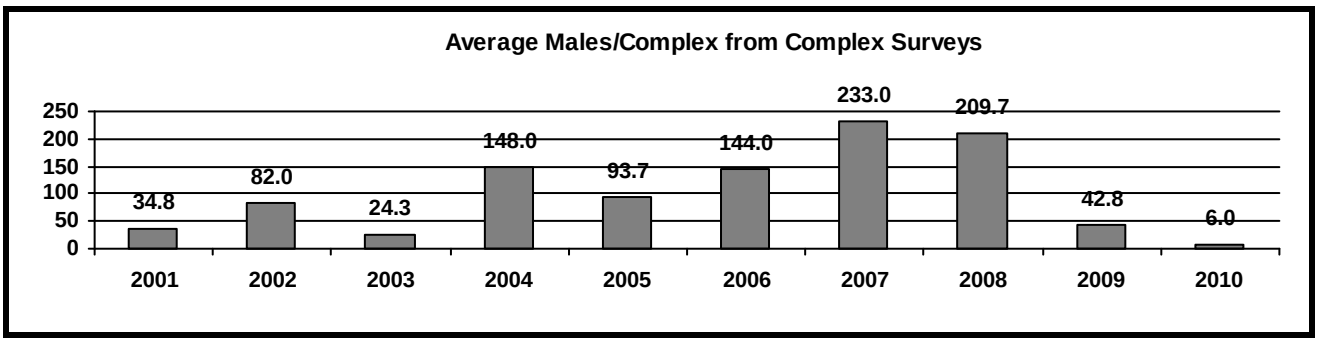
d. Lek Complex Status

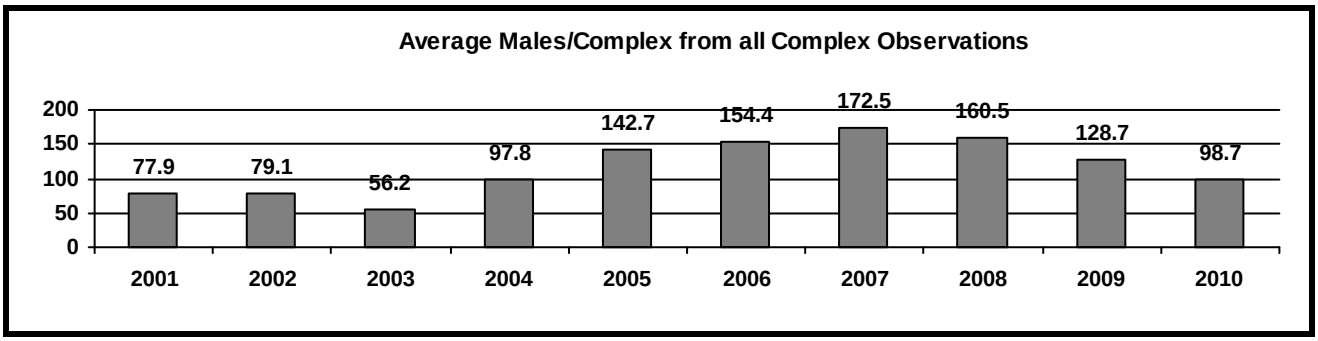
Year	Number of Occupied Complexes				Known Status		
	Active	Inactive	Unknown	Total	Total	Active	Inactive
2001	18	1	3	22	19	94.7%	5.3%
2002	16	0	6	22	16	######	0.0%
2003	20	2	0	22	22	90.9%	9.1%
2004	17	1	4	22	18	94.4%	5.6%
2005	20	1	1	22	21	95.2%	4.8%
2006	20	3	0	23	23	87.0%	13.0%
2007	21	2	0	23	23	91.3%	8.7%
2008	20	3	0	23	23	87.0%	13.0%
2009	24	1	0	25	25	96.0%	4.0%
2010	24	1	0	25	25	96.0%	4.0%

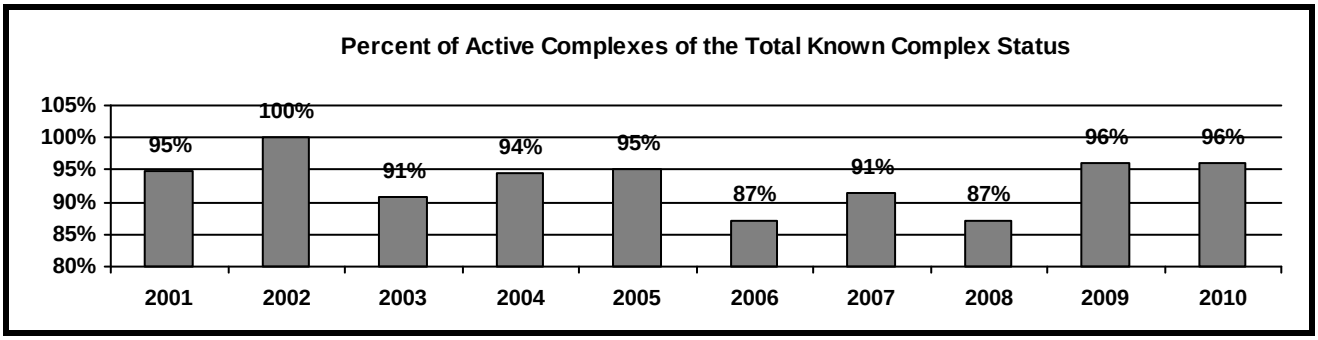
SAGE-GROUSE LEK COMPLEX ATTENDANCE SUMMARY

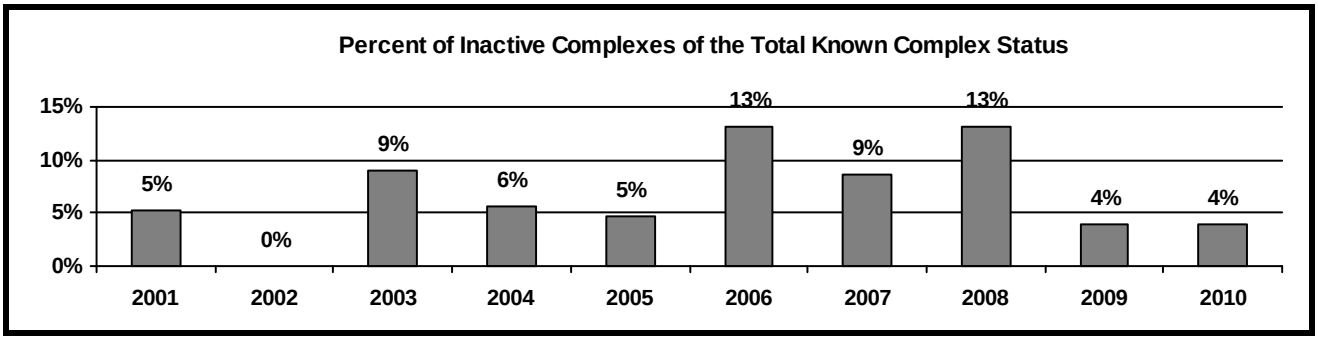
WORKING GROUP: Upper Green River **Area(s): All**











Sage Grouse Lek Characteristics

Region	Number	Percent
Pinedale	140	######

Working Group Area	Number	Percent
Upper Green River	140	######

Classification	Number	Percent
Occupied	120	85.7%
Unknown	4	2.9%
Unoccupied	16	11.4%

BLM Office	Number	Percent
Pinedale	126	90.0%
Rock Springs	14	10.0%

Unoccupied Leks	Number
Abandoned	7
Destroyed	1

Biologist District	Number	Percent
Pinedale	75	53.6%
South Jackson	65	46.4%

Game Warden District	Number	Percent
Big Piney	68	48.6%
North Pinedale	11	7.9%
South Pinedale	61	43.6%

County	Number	Percent
Sublette	140	######

Land Status	Number	Percent
BLM	127	90.7%
Private	8	5.7%
State	5	3.6%

Management Area	Number	Percent
3	94	67.1%
7	46	32.9%

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

a. Season

Year	Season Dates	Length	Bag/Possession Limit
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
2007	Sept 22-Oct 2	11	2/4
2008	Sept 20-Sept30	11	2/4
2009	Sept 19-Sept 30	12	2/4

b. Harvest

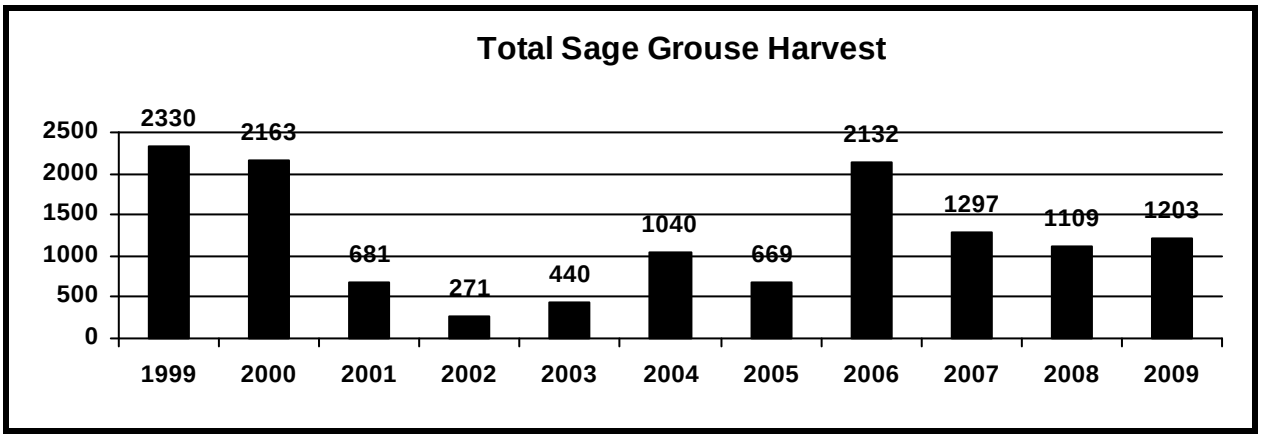
Year	Harvest	Hunters	Days	Birds/ Day	Birds/ Hunter	Days/ Hunter
1999	2,330	710	1,888	1.2	3.3	2.7
2000	2,163	731	1,600	1.4	3.0	2.2
2001	681	324	933	0.7	2.1	2.9
2002	271	231	615	0.4	1.2	2.7
2003	440	178	401	1.1	2.5	2.3
2004	1,040	398	1,020	1.0	2.6	2.6
2005	669	233	564	1.2	2.9	2.4
2006	2,132	781	1,885	1.1	2.7	2.4
2007	1,297	564	1,300	1.0	2.3	2.3
2008	1,109	453	1,116	1.0	2.4	2.5
2009	1,203	460	1,177	1.0	2.6	2.6
Avg.	1,212	460	1,136	1.0	2.5	2.5

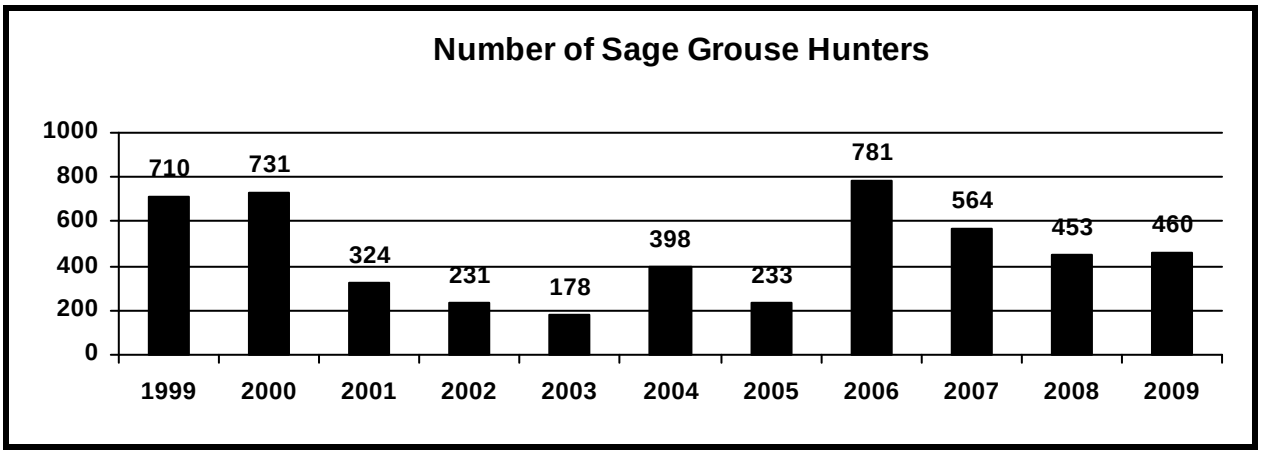
Table 5. Composition of harvest by wing analysis.

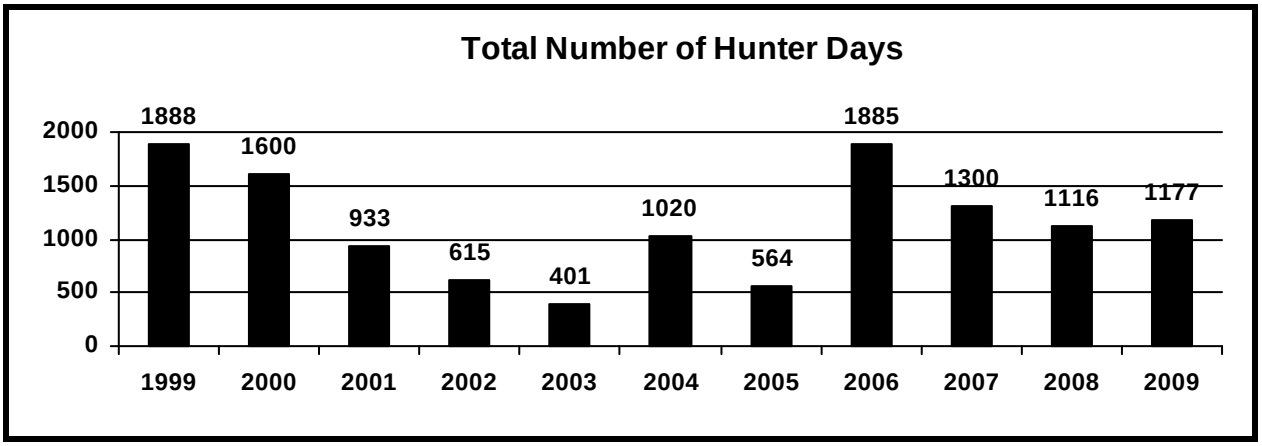
Year	Sample Size	Percent Adult		Percent Ylg		Percent Young		Chicks /Hen
		Male	Female	Male	Female	Male	Female	
2000	571	14.4	30.3	3.9	7.4	13.1	31.0	1.2
2001								
2002	250	15.2	40.0	2.8	0.0	20.0	22.0	1.1
2003	265	12.5	32.1	3.4	8.7	16.6	26.8	1.1
2004	402	11.7	28.6	0.5	3.2	28.6	27.4	1.8
2005	537	17.7	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
2007	485	20.0	39.2	2.3	8.5	13.6	16.5	0.6
2008	494	12.8	29.4	3.4	7.9	22.3	24.3	1.3
2009	445	14.8	38.7	3.4	5.8	15.7	21.6	0.8

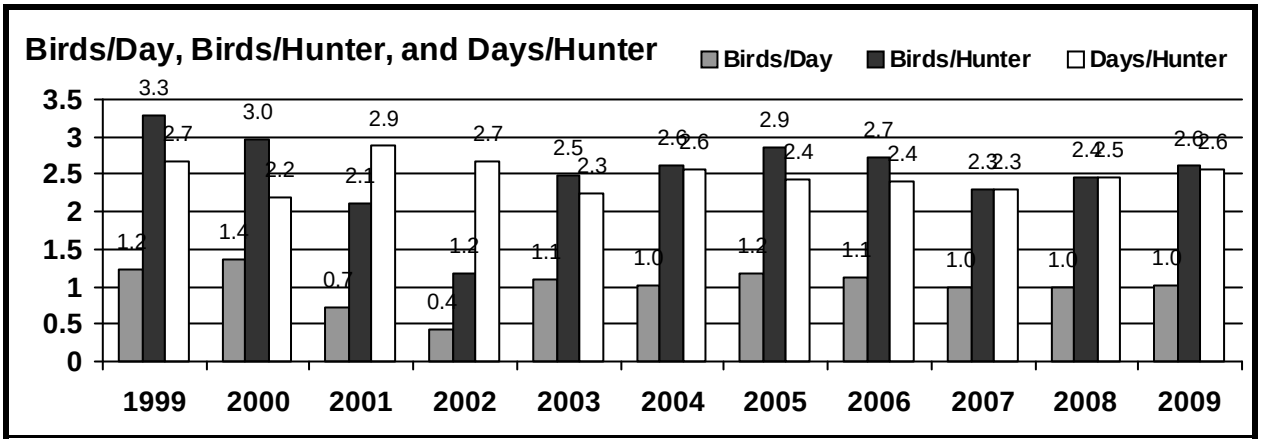
SAGE-GROUSE HARVEST SUMMARY

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









Sage-grouse Wing Analysis Summary 2009

Region: **Area :**

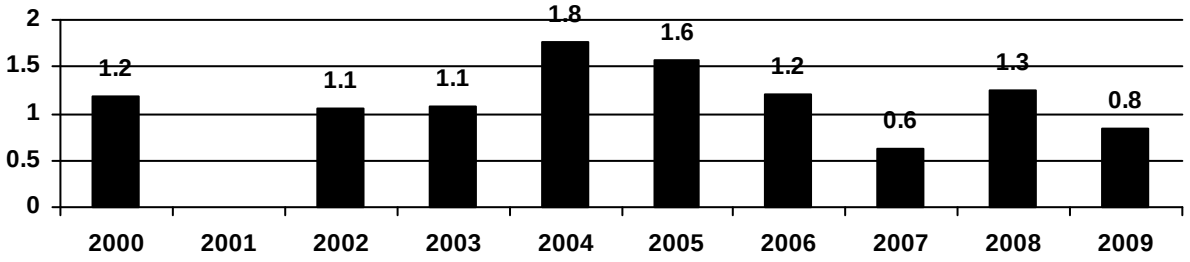
Working Group: Upper Green River

Adult Males	66	**Percent of All Wings:**	14.8%
Adult Females	172	**Percent of All Wings:**	38.7%
Adult Unknown	0	**Percent of All Wings:**	0.0%
Total Adults:	238		
Yearling Males:	15	**Percent of All Wings:**	3.4%
Yearling Females	26	**Percent of All Wings:**	5.8%
Yearling Unknown:	0	**Percent of All Wings:**	0.0%
Total Yearlings:	41		
Chick Males:	70	**Percent of All Wings:**	15.7%
Chick Females:	96	**Percent of All Wings:**	21.6%
Chick Unknown:	0	**Percent of All Wings:**	0.0%
Total Chicks:	166		
Unknown Sex/Age	0	**Percent of All Wings:**	0.0%
Total for all Sex/Age Groups:	445		

Chick Males:	70	**Percent of All Chicks:**	42.2%
Yearling Males:	15	**Percent of Adult and Yearling Males:**	18.5%
Adult Males:	66	**Percent of Adult and Yearling Males:**	81.5%
Adult and Yearling Males	81	**Percent of Adults and Yearlings:**	29.0%
Total Males:	151	**Percent of All Sex/Age Groups:**	33.9%
Chick Females:	96	**Percent of All Chicks:**	57.8%
Yearling Females	26	**Percent of Adult and Yearling Females:**	13.1%
Adult Females:	172	**Percent of Adult and Yearling Females:**	86.9%
Adult and Yearling Females	198	**Percent of Adults and Yearlings:**	71.0%
Total Females:	294	**Percent of All Sex/Age Groups:**	66.1%

Chicks:	166	**Percent of All Wings**	37.3%
Yearlings:	41	**Percent of All Wings**	9.2%
Adults:	238	**Percent of All Wings**	53.5%
Chicks/Hen:	**0.8**		

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



Narrative
Conservation Plan Area: **Upper Green River Basin**
Period Covered: **6/1/2009 – 5/31/2010**
Prepared by: **Dean Clause**

Introduction

The Upper Green River Basin Working Group Area (UGRBWGA) covers Upland Game Bird Management Area (UGBMA) 3 and the north portion of UGBMA 7 that lies within Sublette County. All lek data from that portion of Management Area 7 within the UGRBWGA 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.

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.

Traditionally, sage-grouse data collection within the Pinedale 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.

Information presented in this report includes data and trend analysis for lek monitoring, population trends, harvest rates, productivity rates, winter distribution surveys, and weather data. Other categories covered in this report include special projects/research, management summaries, and recommendations.

Data Collection Efforts and Methods

Lek monitoring consists of 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. 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 "Unknown" which is a lek that has not documented grouse activity in the past 10 years, but doesn't have sufficient data to be classified as 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 revealing no grouse. It is most likely these one-time observations were 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 is estimated from this data set, as the number of chicks/hen can be derived. Wing collections can 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.

On 1 August, 2008 Governor Freudenthal signed Executive Order 2008-2 entitled, "Greater Sage-

grouse Core Area Protection". The goal of the Executive Order is to maintain existing habitat conditions within core areas by permitting only development activities that will not cause declines in sage-grouse populations. *As a matter of general practice, this will be achieved by establishing a 0.6-mi. NSO around each occupied lek,* ***limiting well pad densities to an average of 1 per square mile within core area,*** *and implementing appropriate management practices. The number of well pads within a 2 mile radius of the perimeter of an occupied sage-grouse lek should not exceed 11,* ***distributed preferably in clumped pattern in one general direction from the lek.*** Development scenarios in non-core areas are more flexible, but should still be designed and managed to maintain populations, habitats and essential migration routes. Non-core areas should not be construed as "sacrifice areas" since this conservation strategy requires habitat connectivity and movement between populations in core areas. The goal in non-core areas is to maintain habitat conditions that will sustain at least a 50% probability of lek persistence over the long term. In some "non-core" locations, important habitat functions of other wildlife species will guide planning and mitigation considerations. Applicable standard management practices and sage-grouse BMPs should be applied to development within both core and non-core areas to achieve the goals of the Executive Order.

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. Since 2004, certain areas within the Upper Green River Basin were surveyed to document important sage-grouse wintering areas. These surveys have been conducted aerially with a helicopter during February using stratified transects at approximately 1 minute (1 mile) intervals or less to document sign and live observations of grouse. These aerial surveys, along with other existing data, are 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 140 leks are currently documented in the UGRBWGA. These leks are classified as follows; 120 occupied, 4 unknown, and 16 unoccupied. During 2010, a total of 122 leks (94%) were checked (survey or count). Lek monitoring efforts in 2010 primarily focused on counts (76%) over surveys (24%). Results from the counts and surveys showed that 75% of the leks were active and 25% were inactive. The average number of males/lek for all active leks declined to 32 in 2010, compared to 44 males/lek in 2009 and 50 males/lek in 2008. This declining trend is a change compared to increasing trends from 2004-2007 (27 males/lek in 2004, 37 in 2005, 49 in 2006, and 57 in 2007).

Generally, the proportion of leks checked that are confirmed "active" has stayed relatively stable during the past 10 years, ranging from 71% to 81%. Although there has been increased lek inactivity and abandonment in areas associated with gas development activity, additional lek monitoring efforts and searches have resulted in locating new or undiscovered leks (34 new leks since 2004) negating the downward trend in the proportion of active leks in the UGRBWGA .

An analysis was completed in 2008 to assess natural gas development impacts in the Pinedale area. This analysis compared leks within a 1-mile radius of any gas field activity (primarily based on well pads) to leks outside 1 mile of gas activity but within the same lek complex. Leks within the Pinedale Anticline Project Area (PAPA) that are located within gas development areas showed a 37% decline, compared to a 37% increase documented on leks away from gas development activities. Leks within the Jonah Project Area that are located within gas development areas showed a 47% decline, compared to a 193% increase (n=1) documented on leks away from gas development activities. See the 2008 or 2009 Sage Grouse JCR - Upper Green River Basin Working Group Area for this complete analysis and data tables.

In September of 2008 the Record of Decision for the Supplemental EIS on the PAPA included a "wildlife monitoring matrix" component that identifies sage-grouse thresholds and triggers for management intervention. Efforts were taken during 2010 to recommend modifications (for BLM consideration) to the "matrix" sage grouse monitoring components to better clarify data collection efforts, data analysis, and mitigation thresholds. Results from this matrix monitoring effort will be reported in future years once monitoring criteria modifications and data analysis are made.

There are currently 25 occupied lek complexes in the UGRBWGA containing 140 total leks (includes unknown and unoccupied leks). This equates to an average of 5.6 leks per complex, with a range of 1 to 22 leks per complex. Lek complex designations are somewhat arbitrary and can show great variation due to number and location of leks within each complex.

During 2010, 23 of 24 lek complexes (96%) were documented as "active". If one lek is active within a complex, the entire complex is classified "Occupied". Similar to the trend with lek data, the average number of males per lek complex has recently declined compared to 2007.

Population Trends and Estimates

No reliable population estimate can be made from data collected during 2010 (or any of the previous years), due to unknown male:female sex ratios 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. While 2008-2010 lek monitoring indicate a declining trend in the number of males/lek, compared to 2007.

Harvest

The 2009 sage-grouse season was September 19 through September 30, which allowed an 12-day hunting season. This 2009 season was similar to the 2004 – 2008 seasons. A nine-day hunting season was initiated during both 2002 and 2003. Essentially, hunting seasons since 2002 allowed 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 to reduce overall harvest.

Bag limits from 2003 to 2009 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 UGRBWGA, 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 2009 harvest survey estimated that 460 hunters bagged 1,203 sage grouse and spent 1,177 days hunting. The average number of birds per day was 1.0, the average number of birds per hunter was 2.6, and the number of days spent hunting was 2.6 during 2009. This data indicates there were similar hunter participation and overall harvest during 2009 compared to 2008, and a decrease compared to 2006 and 2007. Harvest rates (# birds/day, # birds/hunter, and # days/hunter) have remained similar the past seven years (2003-2009). From 1995 to 2002, overall harvest and harvest rates significantly declined following altered seasons (shortened and moved to a later date). Since 2003, hunter participation has varied somewhat, although the past 4-year period (2006-2009) has shown higher hunter participation than the previous 3-year period (2003-2005). Hunter participation in Management Area 3 has reflected similar trends to the sage-grouse population in the UGRBWGA.

Brood Count Surveys

A permanent brood survey route located on Muddy Creek near the Bench Corral elk feedground documented 2 hens, 0 chicks, and 0 males in 2009. This 2009 survey resulted in 0.0 chicks/hen, lower than the 0.8 chicks/hen in 2008. Muddy Creek surveys for the past eight 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; 26 hens, 21 chicks, 9 males, 10 unclassified in 2007; and 14 hens, 6 chicks, and 9 males in 2008. A new brood survey route was established on the Cottonwood Creek Ranch in 2007 where 1.1 chicks/hen (sample of 110 grouse) was documented. The Cottonwood Creek Ranch survey resulted in 0.47 chicks/hen (sample of 150 grouse) in 2008, and 0.34 chicks/hen (sample of 84 grouse) in 2009. Overall sample sizes have been relatively poor from these permanent brood surveys and fail to provide reliable production data. Most other documented brood count data has come from random searches or opportunistic sightings.

Sage-grouse research has been ongoing in the Upper Green River Basin for the past twelve years, which has provided some nest establishment, nest success, and brood production data. Although during 2008, most of the radio-collared hens had lost their radio signal resulting in no nesting and production data. Approximately 77 radio collared hens were tracked at the beginning of the nesting period and tracked through the brood rearing period during 2009. Results showed 45 chicks alive on August 1 from 72 collared hens being tracked (0.63 chicks/hen). Nest success was 47% and hen survival was 80% (April – July) for this collared sample of hens during 2009.

Wing Collections

A total of 18 sage-grouse wing barrels were distributed throughout Sublette County in 2009 (UGBMA 3 & a portion of 7). Barrels were placed prior to the sage-grouse hunting season opener and were taken down following the closing date. Wing collections were typically 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 445 sage-grouse wings were collected from barrels in the UGRBWGA during 2009, which is relatively similar to the collections during the past 5-year period, ranging from 402 to 537. Of the 445 wings collected in 2009, 54% were adult birds, 9% were yearling birds, and 37% were juvenile birds. The proportion of harvest by age class in 2008 was lower for adults at 42%, higher for yearlings at 11%, and higher for juveniles at 47%. In 2007, wing collections accounted for 59% adults, 11% yearlings, and 30% juveniles. The overall composition of wings in 2009 indicated a ratio of 0.8 chicks/hen (adult and yearling females), a decline from the survival of 1.3 chicks/hen during 2008, and a slight increase from 0.6 chicks/hen in 2007. During the previous five years (2004-2008) chick survival ranged from 0.6 to 1.8 chicks/hen. This chick/hen ratios from wing collections has provided a good indicator for future grouse population trends, as male lek attendance trends have correlated well with previous years production (# chicks/hen) data.

Winter Distribution Surveys

Winter sage-grouse surveys were conducted throughout the majority of the UGRBWGA during January of 2010, due to funds secured through the BLM. Winter surveys have been conducted periodically since 2004 in portions of the Upper Green River Basin. This winter data has been used to develop winter concentrations area maps (first map developed in 2008), and will continue to be updated as new data becomes available.

Weather Data

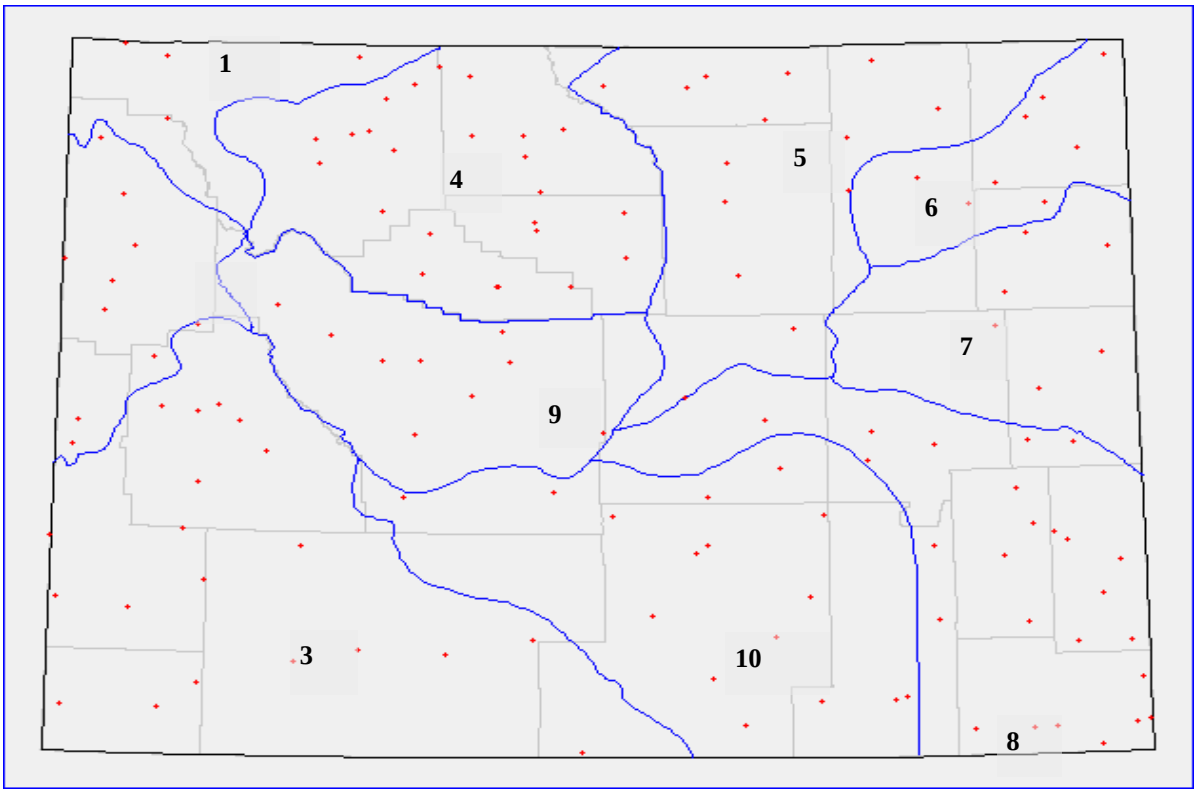
The Palmer Drought Severity Index was developed in the 1960s (http://www.drought.noaa.gov/palmer.html). The index uses temperature and precipitation data to determine dryness. It is most effective in determining long-term (several months) drought. Another index, the Crop Moisture Index (CMI) is more 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 2007, 2008, and 2009. 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.

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 from 2006-2009. Temperatures were generally above normal during the first 6 months of bio-year 2007, then below normal the last 6 months of bio-year 2007 (Figure 3). During bio-years 2008 and 2009, temperatures were generally normal (Figures 4 & 5). Bio-year 2007 saw above normal precipitation, while bio-years 2008 and 2009 were below normal, although June of 2009 received nearly three times the normal amount (Figures 6, 7 & 8).

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

Figure 2. Drought severity trend from 1982 – 2010, Wyoming Climate Division 3.

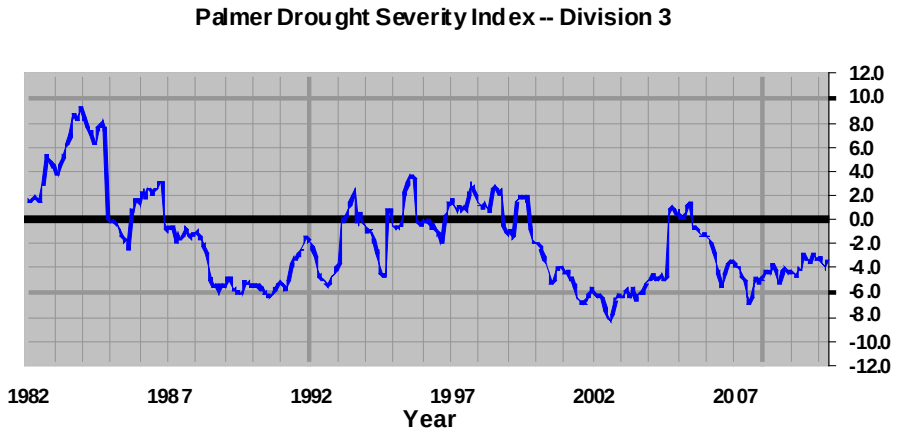


Figure 3. 2007 Bio-Year: Monthly temperature data (^{o}F), Wyoming Climate Division 3.

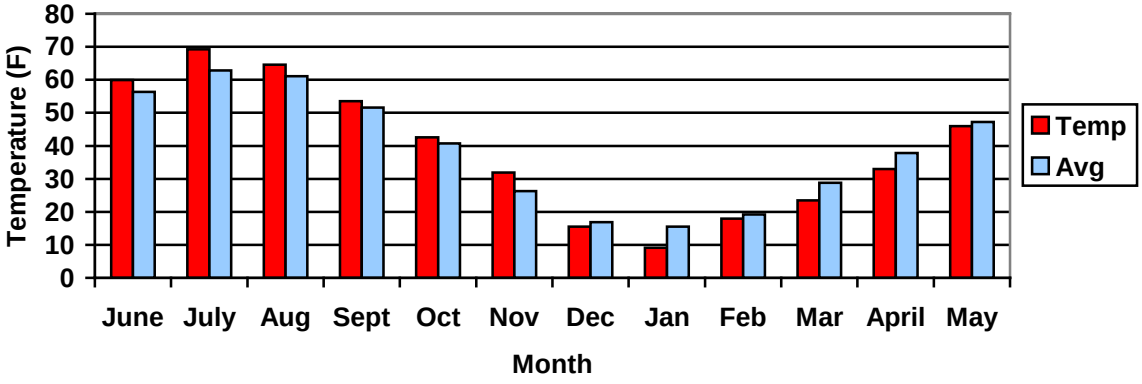


Figure 4. 2008 Bio-Year: Monthly temperature data (^{o}F), Wyoming Climate Division 3.

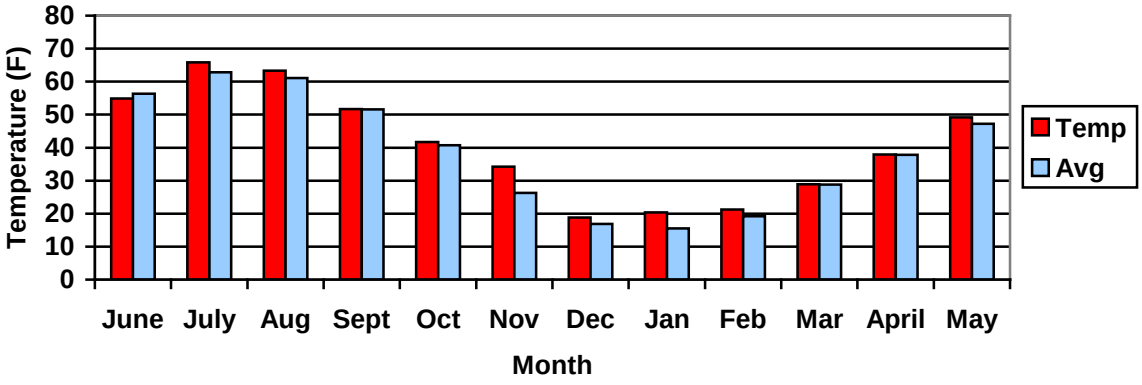


Figure 5. 2009 Bio-Year: Monthly temperature data (^{o}F), Wyoming Climate Division 3.

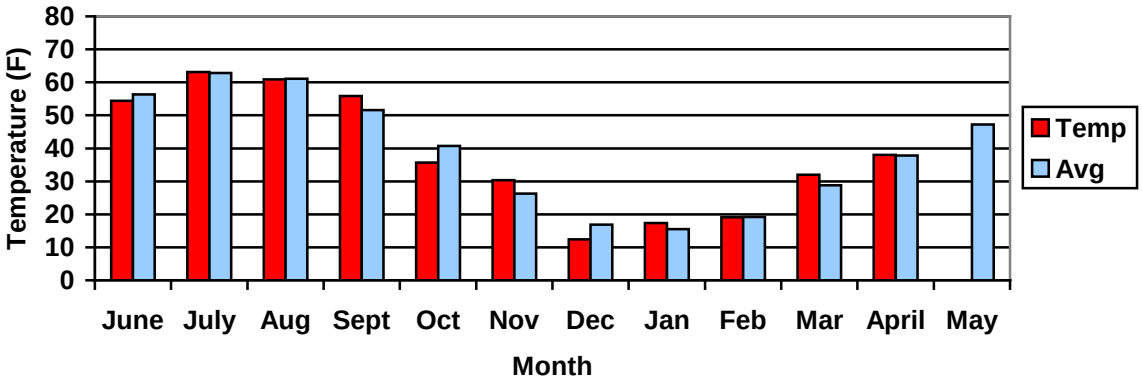


Figure 6. 2007 Bio-Year: Monthly precipitation data (in), Wyoming Climate Division 3.

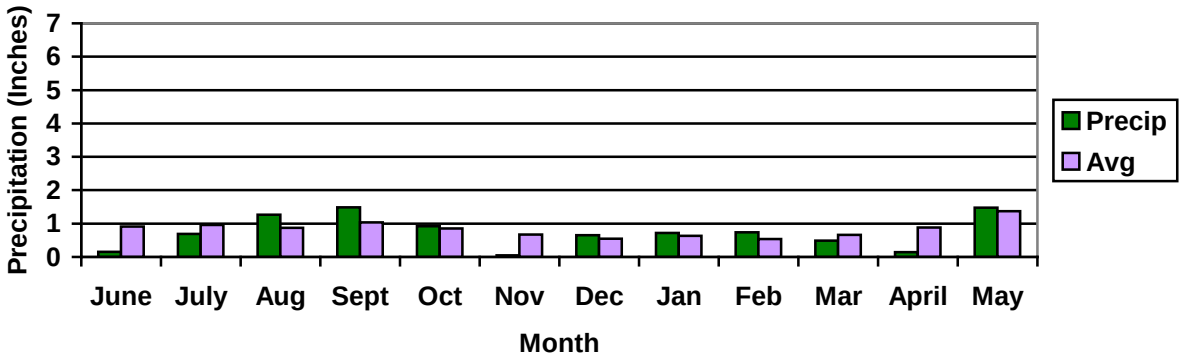


Figure 7. 2008 Bio-Year: Monthly precipitation data (in), Wyoming Climate Division 3.

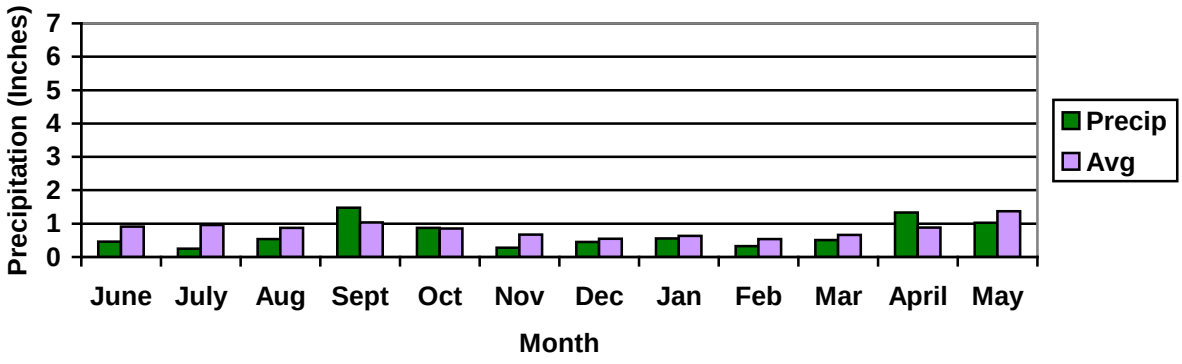
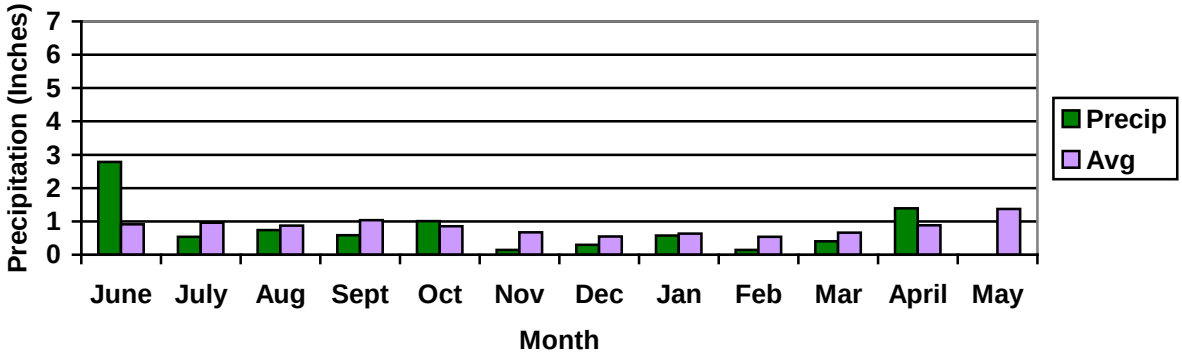


Figure 8. 2009 Bio-Year: Monthly precipitation data (in), Wyoming Climate Division 3.



Special Projects

Sage-grouse Research Projects

Within the last 14 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. During 2010 a new appropriation of State monies was identified for sage grouse projects which led to increased activity by the Working Group. There has been three new members added and one existing member voluntarily retire from the Working Group in 2010.

Management Summary

Data collected and reported in this 2010 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 from 2003 to 2007, dropped slightly in 2008, and have continued to decline in 2009 and 2010. Grouse populations were at the lowest level in 2003 during the past 10-year period.

Lek monitoring in the UGRBWGA showed a 161% increase in the peak number of males per lek from 2003 to 2007 as males increased from 22.2 males/lek to 58.0 males/lek. This trend then reversed since 2007, as the number of males/lek has declined by 45% dropping to 32.1 males/lek in 2010. Sage-grouse leks within developing gas fields have continued to show declines regardless of lek trends outside of gas development, indicating negative impacts to leks and populations in and near natural gas fields.

Sage-grouse hunting season dates, season length, and bag limits have remained similar since 2002 in UGBMA 3, running from late September to early October for 9-12 days with a daily bag limit of 2 birds and a possession limit of 4 birds. Although season length and bag limits have remained similar since 2002, overall harvest and hunter participation has varied, while harvest rates (# birds taken/day, #birds taken/hunter, and # days/hunter)

have remained similar. With grouse numbers steadily increasing since 2003, the progression of increasing hunter participation was expected. The fluctuation in hunter numbers is not very clear but may be attributed to hunters assessment of grouse populations due to annual or seasonal (spring/summer) precipitation levels instead of documented bird population trends. Variation in hunter participation can also be affected by weather conditions, especially during the current short seasons. Hunter participation declined in 2002 and 2003 as a result of shortened seasons starting in 2001 combined with lower grouse numbers and drought conditions. Hunter participation increased in 2004 with increasing grouse numbers and very wet spring/summer conditions; dropped in 2005 with increasing grouse numbers and average annual precipitation (but spring and summer drought conditions); drastically increased in 2006 with increasing grouse number and very wet conditions in June and August; dropped in 2007 with increasing grouse number and drought conditions; and dropped in 2008 & 2009 with declining grouse number and good spring moisture.

Wing collection samples sizes from wing barrels (drop locations) showed similar increasing trends to the harvest survey trends during 2003 and 2004, but showed conflicting trends in 2005 - 2007 (wing collections increased as reported harvest declined in 2005 and 2007, 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%. During 2008 and 2009, wing collections accounted for 45% and 37% of the reported harvest. These annual wing samples can vary significantly based off weather conditions affecting hunter participation, especially during the weekend days of hunting season. Overall, these wing trends have not shown good correlation between trends in sample sizes vs. harvest, but do provide managers the most reliable data for determining annual reproductive rates and trends in the UGRBWGA.

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, improving in 2008, and dropping in 2009. 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, increasing to 63% during 2007, no data available in 2008, and nest success at 47% in 2009. 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, no data available in 2008, and 0.63 chicks/hen in 2009. 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, dropped to 1.2 during 2006, dropped significantly to 0.6 chicks/hen in 2007, increased to 1.3 chicks/hen in 2008, and dropped to 0.8 chicks/hen in 2009. Chick/hen ratios derived from harvest (wings) has shown a direct correlation with populations trends and still provides the most useful and widespread data set for detecting reproductive rate trends. In general, a chick/hen ratio below 1.1 has shown declines in overall male lek attendance the following spring, 1.1 to 1.5 chicks/ hen has shown stable attendance, and a chick/hen ratio greater than 1.5 has shown increases in lek attendance in the UGRBWGA.

Above normal precipitation during 2004 and 2005 during key periods (specifically in the spring and early summer) has 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 7+ years. With the declining chick survival documented in 2006 and 2007 caused by drought conditions in the Upper Green River Basin during the spring and summer 2006 and 2007, male sage-grouse lek numbers declined by 9% during 2008 and 12% in 2009. Good to above average spring precipitation during 2008-2010 has led to good herbaceous production, which should have helped turn around the recent declining trends in the UGRBWGA. Although, it appears the cold temperatures during the spring of 2009 and 2010 have impacted reproduction resulting in lek numbers declining by 27% in 2010 with further declines anticipated during 2011.

The overall sage-grouse population in the UGRBWGA appears to be showing some fluctuation attributed to natural influences, such as spring precipitation and temperature. On a more localized level, the current amount and rate of natural gas development in the Upper Green River Basin has and will continue to impact sage-grouse habitat and local populations. Lek monitoring data has shown lower male attendance and in some cases total bird abandonment on leks within and adjacent to developing gas fields. Sage-grouse studies and research in the UGRBWGA has also indicated impacts to grouse from 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. Continue to monitor sage-grouse leks and look for new ones.
2. Continue to evaluate records and refine problems in the sage-grouse database.
3. Continue to monitor and provide input on natural gas development/sage-grouse research project being conducted.
4. Continue the Muddy Creek and Cottonwood Ranches sage-grouse brood survey route in the South Jackson Biologist District and establish new routes as time allows.
5. Continue to place wing barrels in enough locations to obtain an adequate and representative sample to derive sex/age and harvest trend information.
6. Continue existing efforts and encourage new efforts to document and identify important sage-grouse areas (breeding, brood rearing, and winter).
7. 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.
8. Continue to identify needed sage-grouse research, data collection efforts, project proposals, development mitigation, and funding.
9. 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 Investigators 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. A final study report is anticipated in 2010.

Greater Sage-grouse Winter Habitat Selection in the Upper Green River Basin, Wyoming: **The Principal Investigators are Matt Holloran and John Dahlke, Wyoming Wildlife Consultants LLC.** 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 2010. 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: **The Principal Investigators are Matt Holloran and John Dahlke, Wyoming Wildlife Consultants LLC.** 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. Final study report anticipated in the spring of 2010.

Estimating Sage-Grouse Population Demographics, Predation, And Critical Habitat For Recovery In Jackson Hole And Northwest Wyoming: The Principal Investigators are Bryan Bedrosian, Derek Craighead & Howard Quigley, Craighead Beringia South.

Project Description:--We are improving grouse population parameter estimates through base-line research involving marking and following adult females, adult males, and young sage-grouse. These marked birds allow for estimation of productivity, inter-lek movements, and brood survival, respectively. Bird locations are also being used to identify important seasonal habitat use patterns in the area covered by the Upper Snake River Basin Sage-Grouse Working Group. Concurrent with the sage-grouse work, Common Ravens are captured, followed, and observed to quantify the potential interactions between ravens and sage-grouse. The resultant information will be used to provide a better understanding of the limiting factors of the grouse population and more informed decision-making regarding management guidelines for this region.
Objectives***:***--The overall objectives of this project are to characterize the demographics of the sage-grouse populations in Jackson Hole and describe their seasonal use of habitat. Further, the study is designed to assess the potential impacts that Common Ravens have on nesting grouse; both in the Jackson and Pinedale areas. Sage-grouse will be marked and tracked for a three-year period, 2007 through 2009 to accomplish the demographic and habitat objectives of the study. As part of the predation aspect of the study, we will also document the role of scavengers, such as ravens, in the demographic dynamics of the sage-grouse. In addition, we will use telemetry locations of grouse to identify habitats used by sage-grouse in Jackson Hole and to delineate these habitats for nesting, brood rearing, and winter survival. Finally, we will be assessing genetic isolation of these mountain populations and the connectivity between sub-populations of sage-grouse in northwest Wyoming and eastern Idaho by assessing the divergence of microsatellites between populations.

Documenting Structural And Spatial Characteristics Of Sage-Grouse Nesting And Early Brood-Rearing Habitat Suitability At Selected Ecological Sites In The Wyoming Basin: The Principal Investigators are Dr. Ginger Paige (PI), Dr. Ann Hild, and Matt Holloran, University of Wyoming Department of Renewable Resources and Wyoming Wildlife Consultants LLC. This project is being conducted in the Upper Green River Basin. Objective 1 will have 2 field seasons and will be initiated in spring 2009. Objective 2 is currently pending funding. Objective 1: Quantify structural and spatial complexity of vegetation on ecological sites in sagebrush-dominated landscapes. We will a) quantify variation in sagebrush and vegetative structure within sage-grouse habitat on selected ESs by correlating intensive field-based monitoring and ground-based LiDAR, b) tie common vegetation sampling measures used in sage-grouse habitat studies to structural complexity, and c) develop a user-friendly tool to spatially display and analyze habitat and site characteristics using common field monitoring methods. Objective 2:

Determine the relationships among vegetative measures important for establishing vegetative spatial complexity at a site and sage-grouse nesting and early brood-rearing habitat selection, nesting success and early brood chick survival. Final study report anticipated in the spring of 2011.

Habitat Mitigation Planning For Greater Sage-Grouse In The Upper Green River Basin, Wyoming: The Principal Investigators are Matt Holloran and John Dahlke, Wyoming Wildlife Consultants LLC. The *Habitat Mitigation Planning for Greater Sage-Grouse in the Upper Green River Basin, Wyoming* project was initiated in April, 2006. Those involved in initiating the project were concerned that sagebrush habitat treatments aimed at enhancing areas for sage-grouse to mitigate population declines occurring in the Upper Green River Basin's (UGRB) natural gas fields (Holloran 2005) were proceeding without the pre-treatment data necessary to: (1) determine which projects had a high likelihood of success, (2) determine where projects should be conducted, and (3) monitor the effects of a project after implementation. This project aims to gather the baseline sage-grouse information necessary to effectively plan and monitor habitat treatment projects. This project was initiated in April 2006, field work will be finished in April 2009, and a final report will be issued by Spring of 2010.

The primary goal of the project is to provide information needed to effectively manage sage-grouse populations within areas in the UGRB west of the Green River (see Study Area description). We are gathering demographic information to be used in population growth models to identify the demographic parameter(s) most influential to population growth (e.g., survival, nesting success rates, chick survival rates); this information will be used to focus potential treatments on seasonal habitats having the largest influence on the area's population. These models will additionally be used to project the potential influence of a given habitat manipulation on population growth and persistence probabilities into the future. Seasonal habitat selection (nesting, early brood-rearing, late brood-rearing, summering, and wintering habitats) information is being collected for use in a GIS to investigate spatial inadequacies of different seasonal habitats, juxtapositional issues (e.g., nesting habitat devoid of potential early brood-rearing habitat in close proximity), seasonally critical areas, and to assist in locating potential treatments. We are identifying direct anthropogenic mortality sources; for example, are there water tanks or specific portions of fence lines where grouse are being killed, and if so, how can they be modified to reduce mortality? We are contacting private land owners throughout the project area informing them of this project in the hopes of fostering relationships that can be used in the future to generate mutually beneficial habitat enhancement projects. We do not anticipate finding unanimous consensus, but hopefully will identify several permittees willing to pursue management objectives aimed at enhancing sage-grouse populations on their private lands or allotments.

Species: Sage Grouse
Period Covered: June 1-2009 – May 31, 2010
Management Areas: 1 and 2
Working Group Area: Upper Snake River Basin
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 (Gros Ventre and Jackson Hole) and 2 (Hoback Basin and Star Valley,), which are covered in this report. The 2005 -2006 JCR was the first report produced under the new format.

The initial role of the Upper Snake River Basin Working Group was 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 was completed in December 2007 and accepted by the Wyoming Game and Fish Commission in January 2008. The plan identifies management practices and the financial and personnel resources needed 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. This population is an important component of the wildlife diversity associated with Grand Teton National Park and the National Elk Refuge. As such it was designated as a sage-grouse core area in 2008. 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 spring, summer, and fall.

Information presented in this report includes only lek monitoring data. Productivity data were collected from radio marked hens as part of the sage-grouse study conducted by Craighead Beringia South (CBS) during the 2009-2010 year but no brood surveys were conducted. 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 (Figure 1).

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 in the western foothills of Star Valley. Much of the remainder of the working group area is forested habitat that is not occupied by sage-grouse. The core population in Jackson Hole is found primarily in Grand Teton National Park and on the National Elk Refuge. Sage-grouse also use some of the foothill areas on the Bridger-Teton National Forest in Jackson Hole and private land on East and West Gros Ventre Buttes. The Jackson population was designated as a core area by the Governor's Sage-grouse Implementation Team in August 2008 (Figure 2).

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

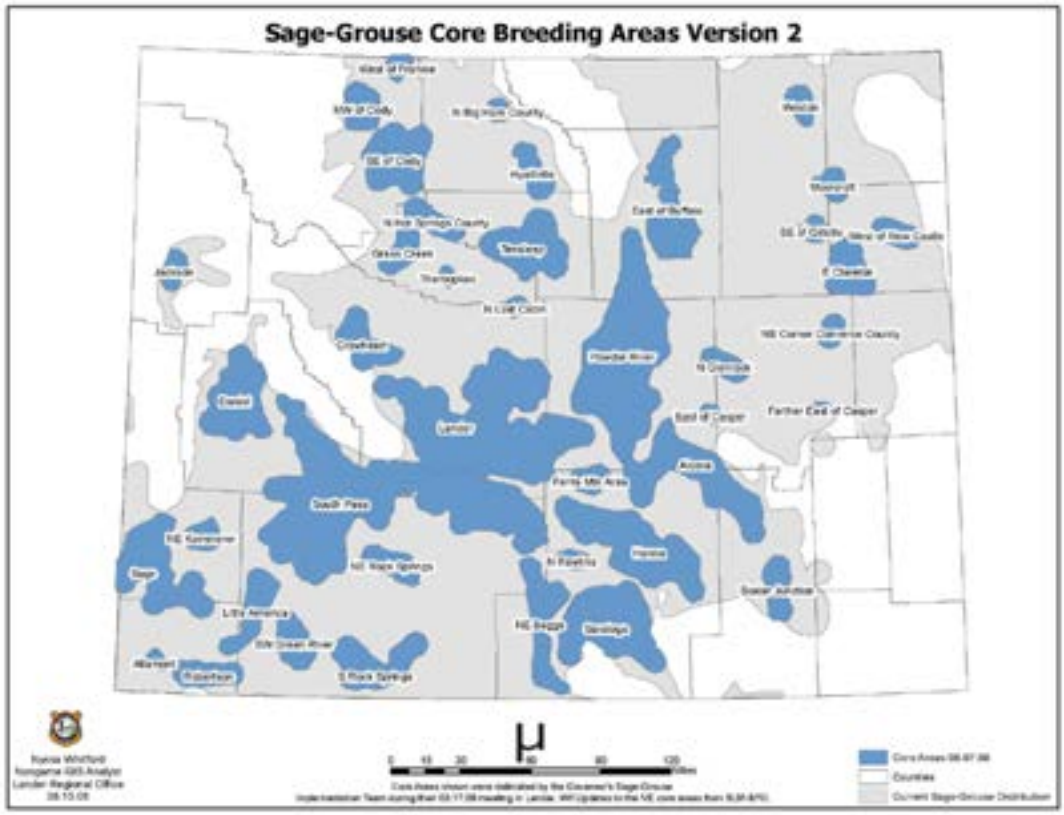


Figure 2. Wyoming Sage-Grouse Core Areas.

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 possible (Holloran and Anderson 2004).

Sage-grouse also use the sagebrush habitat in the Hoback Basin in the spring, summer and fall. A lek was discovered in the Clark Draw area in April 2010. The lek was checked 5 times and birds were present on all but the last survey. A high count of 13 males was observed on 2 occasions (Table 8). One hen was captured and fitted with a GPS radio and monitored by Bryan Bedrosian, Craighead Beringia South. This hen was bred on the Clark Draw lek and nested successfully on the nearby flank of Clark Butte

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 is 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 in Wyoming with most of the useable habitat for this small, isolated interstate population located in Idaho (Figure 3). The habitat in Wyoming may provide much of the remaining winter habitat for this small isolated population.

Lek Monitoring

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. 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 have been made to locate new leks, consistently collect data on leks by complex, and increase the number of visits to each lek. 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.

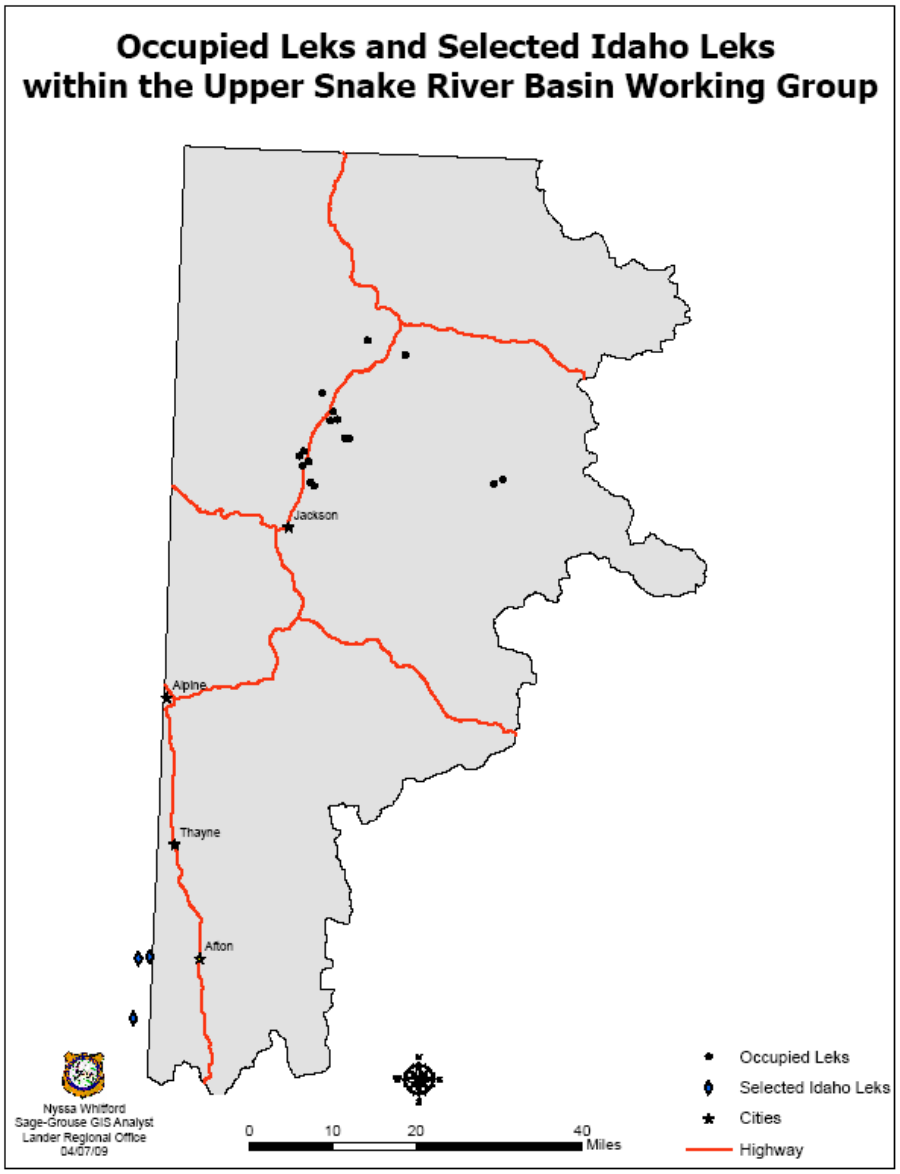


Figure 3. Occupied leks in the Upper Snake River Basin Working Group Area and adjacent selected leks in Idaho.

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.

In the past, lek complex counts were not routinely conducted due to manpower and logistical constraints. Most leks were surveyed or counted periodically but no concerted effort was made to count all leks on the same day. However, starting in 2005, 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 when it was logistically possible to observers out to the leks. 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, Bryan Bedrosian pers. com.).

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. Sage-grouse leks within the USRBWGA are summarized in Table 1 from 1948 through 2010. 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 and the average number of males counted on active leks based on the high counts at each lek. There is some movement of males between leks, particularly from the North Gap lek on the National Elk Refuge to leks in Grand Teton National Park and between leks in the lower valley with leks in the upper valley as the spring progresses and snow melt occurs on leks at higher elevations to the north. As a result, the total of the high counts on all leks 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 15 known or historic sage-grouse leks reported in Table 1. Twelve leks 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 and Simpson, formerly called Poverty Flats in the NER). The McBride lek is classified as occupied but has only been active on a sporadic basis in recent years (one male in 2007) and warrants additional scrutiny. It is unclear if the Airport Pit lek is really a lek, a satellite lek or a sporadic activity center for birds displaced off the airport lek by airport

operations. The Bark Corral lek may have 2 activity centers (East and West)) or the West lek may be a satellite of the Bark Corral East lek. The Cottonwood lek in the Gros Ventre drainage (reported in the 2006-2007 annual report) was dropped as a lek since birds were only observed there once. However, researchers suspect there may be an additional undetected lek somewhere in the area and additional searches in the Gros Ventre drainage in 2011 are warranted (Bryan Bedrosian pers. com).

After consulting with Susan Wolff, biologist for Grand Teton National Park, we combined the Moulton East and Moulton West leks in 2007 (reported as separate leks in previous reports) to be reported as the Moulton lek (one lek with two activities centers) in Table 1 starting in the 2008 annual report. In some years it appears the total birds counted on the same day for both activity centers 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 (Grand Teton National Park Database). 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.

The Spread Creek lek was located in 2007 near the east end of Wolff Ridge in the sagebrush flat between the ridge and Spread Creek. In 2010 birds were also seen strutting on the bare ridge top where there is considerable grouse sign. The lek was reported by other observers in the past but its location was never confirmed. The Spread Creek lek has been active in 2008 -2010.

A new lek was located in 2008 as a result of the study being conducted by CBS in the Pot Holes area of Grand Teton National Park (RKO Road lek). Birds were located on the RKO Road lek on a number of occasions in 2008 and one male was trapped and fitted with radio transmitters near this new lek. The lek was active again in 2009 with a high count of 15 males and again in 2010 with a high count of 13 males (Table 8).

A new lek was discovered in the Clark Draw area in the Hoback Basin in April 2010. The lek was checked 5 times and birds were present on all but the last survey. A high count of 13 males was observed on 2 occasions (Table 8). The lek has been given provisionally active status in spite of only

In 2010 there were 10 active leks, 2 inactive leks and 4 leks of unknown status (Table 1). The Beacon lek and the Airport Pit leks were inactive (Bark Corral West lek is not considered a separate lek in this table). The McBride, 3 Bar H, Antelope Flats, and the Simpson lek were not checked or not checked more than once and the status of these leks in 2010 are unknown (all but McBride lek are likely unoccupied however). The 2009-2010 Sage-grouse JCR database report contains a summary of the lek data collected in 2010 in Table 8.

Table 1. Sage-grouse lek counts (maximum males) by lek for the Jackson Hole, Wyoming population , 1948-2010
(Grand Teton National Park and Wyoming Game and Fish Dept. Unpublished data)

Year	Airport	Beacon	Airpot Pit	CircleBW/S BarH	McBride	Antelope Flats	Moulton	Spread Creek	Bark Corral	Timbered Island	North Gap	Simpson	Breakneck Flats	Dry Cottonwood	RKO Road	Clark Draw	Total	Average # males/active lek
1948	61			13	15	59	20		36		0						204	34
1949	51			18	14	62	32		14		0						191	31.8
1950	73			9	50	55	16		20		0						223	37.2
1951	61			7	52	46	28		20		12						226	32.3
1985				NC	27	NC	51*		NC		22						NA	NA
1986	25			NC	27	11	51		NC		14	22					150	25
1987	25			NC	18	1	30		NC		NC	NC					74	18.5
1988	26			NC	23	13	85		7		23	NC					177	29.5
1989	30			NC	21	7	91		6		8	NC					163	27.2
1990	52			NC	10	10	63		8		22	NC					214	35.7
1991	63			NC	13	10	48		16		29	NC					205	34.2
1992	51			NC	12	8	37		16		21	NC					168	28
1993	37	21		NC	16	5	24		8		9	54					198	24.8
1994	NC	NC		NC	27	NC	50		NC		7	NC					84	28
1995	18	15		NC	6	4	63		10		6	NC					122	17.4
1996	18	8		NC	4	2	33		8		19	NC					92	13.1
1997	15	1		NC	6	0	48		1		10	NC					81	13.5
1998	14	0		NC	4	0	33		0		7	NC					58	14.5
1999	17	0		NC	0	0	21		0		9	NC					47	15.7
2000	18	0		NC	0	0	28		NC		5	0	21				72	18
2001	15	0		NC	0	0	30		NC		6	0	19				70	17.5
2002	19	24		NC	0	0	28		NC		4	0	9				84	16.8
2003	25	0		NC	0	0	35		NC	8	3	0	17				88	17.6
2004	17	0		NC	0	0	64		2	15	4	NC	14				116	19.3
2005	17	0		NC	0	0	49		0	17	18	0	16	6			123	20.5
2006	20	4	6	0	0	0	44		0	20	30	0	20	9			153	19.1
2007	23	0		0	1	0	41	4	1	20	9	0	30	4			133	14.8
2008	16	0		0	0	NC	38	5	10***	26	23	NC	22	13	12**		165	18.3
2009	10	0	2	NC	0	0	33	4	5	22	11	NC	21	1	15		124	12.4
2010	10	0	0	NC	0	0	40	5	24	18	13	0	21	4	13	13	161	16.1

* includes males and females

** new lek in 2008 with multiple observations.

*** BarkCorral lek has 2 activity centers which may be separate leks. In the past birds have been observed at both sites but observations have been combined in this report.

In 2008 2 grouse seen at east lek and 8 seen at west lek.

The WGFD database reports a total of 18 leks in the USRBCA and includes the Moulton West lek and the Bark Corral West Lek as leks of record for the purposes of the 2009-2010 report (but not reported as leks in Table 1). As indicated above the latter lek should be considered as a potential lek and the Moulton West lek (combined with the Moulton lek east lek and reported as the Moulton lek in Table 1) is reported as inactive in the WGFD database. Ten leks were considered active in 2010. It is our intent to try to resolve the status of these leks with the completion of the sage-grouse study by CBS in time for in time for the 2010-2011 annual report.

Only the Moulton lek (now considered one lek with 2 activity centers) is a large lek, averaging over 40 birds. The other leks in the USRBCA are small leks (ranging from 2-30 birds). The discovery of a number of very small leks over the past 5 years (Timbered Island, Airport Pit, Dry Cottonwood, Spread Creek, RKO Road, and Clark Draw leks) has had the effect of reducing the average number of males per lek while the total number of males counted in the USRBCA increased from 1999 to 2008. However, the total number of males and average number of males per active lek dipped in 2009. In 2010 the total number of males increased while the number of males per active lek declined. The lek data presented in Table 1 differ slightly from the lek data in the WGFD database report in that the maximum number of males counted on each lek is based on the highest count over the survey period where as the maximum number of males observed in the lek counts in the WGFD database occurred on days when all leks were counted simultaneously (per the WGFD protocol).

It must be noted that that lek data in Table 1 must be interpreted with caution (as with all sage-grouse lek data)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) not all males attend leks on any day or within a lekking season: 7) 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 8) 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 or North Gap and Simpson 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. However, in some years prior to 2000 it appears totals may have been lumped.

Population Trends and Estimates

No reliable method for estimating the sage-grouse population for the USRBWGA exists at this time. Both the number of leks and the number of males attending these leks must be accurately quantified in order to accurately estimate the number of males in the population, population size and population trend. However, the number of males/lek provides a reasonable index of abundance of sage-grouse populations over time in response to environmental conditions.

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. Based on the high count at each lek in 2009 a total of 124 strutting males were observed in the USRBCA with 22 males on two leks in the Gros Ventre Complex and 102 males on 8 active leks in the Jackson Hole Complex. In 2010 the maximum count was 161 males with 25 males on the 2 leks in the Gros Ventre complex, 123 in the Jackson hole complex, and 13 on the Clark Draw lek in the Hoback. The maximum total counts of males range from 214 in 1990 to 47 in 1999 to 165 in 2008 (Table 1). However, the average number of males per active lek has been relatively stable since 2000 with the exception of dips in the average in 2007 and 2009. The average number of males takes into account the number of leks counted each year and perhaps is a more reliable measure of population trends over time. The lek count data in Table 1 suggests this population was at a low point in 1999 and a modest recovery started in 2000.

Based on the WGFD sage-grouse database report, from 2001 through 2010 the average number of male sage-grouse per lek for leks within planning area that were counted has declined from 16.0 males per lek in 2000 to 9.5 males per active lek in 2009 with a modest increase in 2010 to 11.6 males per active lek. The trend in total males counted increased from 64 in 2000 to 165 in 2008 and 161 in 2010. As with the analysis of trends reported in Table 1, the discovery of a number of very small leks in recent years (Timbered Island, Airport Pit, Dry Cottonwood, Spread Creek, RKO Road leks) has had the effect of reducing the average number of males per lek while the total number of males counted in the USRBCA increased from 2000 to 2008. Both analyzes suggest the population increased from a low point in 1999 or 2000 to the most recent peak in sage-grouse numbers in 2008, reflecting a slowly increasing trend. However, grouse numbers declined in 2009 but increased again in 2010 to about the 2008 level. With small populations erratic fluctuations from year to year can be expected as the recruitment of juveniles fluctuates from year to year and there is little to buffer populations.

In an attempt to develop another index in sage-grouse population trends, researchers for Craighead Beringia South conducted a winter census of sage-grouse on known winter areas outside the National Elk Refuge (which is closed to human entry during the winter). On February 2, 2008, 14 volunteers counted 443 grouse in Jackson Hole. Snow conditions were above normal and counting conditions for the ground survey were excellent. Since the National Elk Refuge provides winter habitat for sage-grouse this count is a minimum count for this population. The Gros Ventre was not surveyed due to logistical constraints and the big game winter range closures which make a ground survey impractical. The winter census in Jackson Hole in 2009 resulted in a count of 385 birds. The census was cancelled in February, 2010 due to lack of adequate snow in the valley floor (Bryan Bedrosian, pers.com.).

Productivity

In 2007 CBS researchers documented 14 of 15 (93%) instrumented hens initiated nesting. Of these nesting hens, 50 % (7/14) were success in their nesting attempts, hatching 23 chicks. An average of 3.3 chicks per successful hen or 0.67 chicks per all instrumented hens were documented in 2007. In 2008 24 of 25 (96%) instrumented hens initiated nesting. Of these nesting hens, 58.3 % (14/25) were successful in their nesting attempts, hatching 23 chicks. In 2009 15 hens with working radios initiated nesting (100%) and 10 (71%) were successful in hatching out a brood. An average of 3.3 chicks per successful hen or 0.67 chicks per all instrumented hens were documented in 2007. In 2008 the average

number of chicks present in late brood counts was 2.67 (11 successful nesting hens with VHS collars) and the number of chicks in 2009 brood survey was 3.0 chicks (8 successful hens with VHF collars). Vital rates for this population will be reported in the pending completion report for the sage-grouse study by Craighead Beringia South. A progress report is attached in Appendix 1. No brood surveys by regional personnel were conducted in 2007 - 2009 in the USRBCA.

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 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. 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 per /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, reported in past completion reports, 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, in the Gros Ventre drainage, and in Star Valley is warranted. It is unlikely that these populations will ever be large enough to support hunting. 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 August 2008 Governor Freudenthal issued Executive Order 2008-2 establishing core areas and draft stipulations to protect sage-grouse habitat and populations in those core areas. The Jackson Hole population was designated a core area while the remainder of the small grouse populations fell in the non-core area designation. 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 on BLM lands 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 sage-grouse winter habitat has been designated, avoid human activity from November 15 – March 14.

These habitat protection measures are currently under review for core and non-core areas. 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.

With long-term declines in sage grouse populations, both locally and range-wide, increased efforts have 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 known as the PXP Project 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 little is known about this small population. One hen was captured on the Clark Draw lek in 2010 and fitted with a GPS collar and we hope this bird will provide some insight into the movement patterns of birds into and out of the Hoback Basin and seasonal habitat use in the Basin, recognizing one bird may not be representative of the larger population in its movements and behavior

(Bedrosian pers com.). We hope to capture another grouse later in the summer. We assume these birds winter in the Green River Valley south of Daniel, WY. There is one known lek in the Hoback Basin that was discovered in 2010. Assuming the lek is active in 2011, we may gain more information about the breeding habitat for this group of birds in the coming year with the use of GPS radios on birds. However, consultants collecting predevelopment data for the proposed PXP gas field found a lek in 2008 just south of the Hoback Rim in the NE ¼, NE ¼, Section 36 T36N R113W during aerial lek surveys. About 40 males were present on the snow covered lek when observed for the first time in late April. The consultants were not able to gain access to the lek, which is on private land, to get a more accurate count on the numbers of sage-grouse present (ARCADIS 2008).

Special Projects

Airport Safety Study

The impact of the Jackson Hole Airport on the sage-grouse population is an issue which should be addressed. One active lek (Airport) and 1 inactive 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 is pending completion and release to the public. 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.

In 2009 the Jackson Hole Airport Board contracted with Craighead Beringia south to provide a baseline survey and inventory at the Jackson Hole Airport (JHA). The study was designed to provide a base for future studies in the event changes (habitat or disturbance rates) occur within the JHA (Bedrosian and Walker 2010). The report is attached as Appendix 2.

Objectives:
1. Obtain baseline information on current strutting behaviors and territory placement of males on the airport lek.

2. Map current, existing vegetation structure within the airport perimeter during the nesting and brood rearing phases.

3. Document potential male behavior and territory alterations due to disturbances (e.g., enplanements, predators) and lek habitat characteristics (e.g., snow placement and depths).

4. Describe current disturbances and rates of disturbance during lekking

Estimating Sage Grouse Population Demographics for Population Monitoring, Modeling, and Recovery.

Bryan Bedrosian, Principle Investigator and Dr. Derek Craighead and Dr. Howard Quigley, co-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 from 2006 through 2009. 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 is included as an appendix to this report (Appendix 1).

Returning Sagebrush to the Kelly Hayfields: A 150 Acre Restoration in Grand Teton National Park.

The sagebrush steppe vegetation within Grand Teton National Park (GTNP) forms the core habitat for sage grouse within the Upper Snake River Basin. While the Park contains 47,000 acres of big sagebrush, it has nearly 9,000 acres of abandoned hayfields that were once sagebrush. These hayfields are now dominated by a nearly shrubless monoculture of smooth brome (*Bromus inermis*). In the 30-50 years that these hayfields have been abandoned, sagebrush has re-established in only a limited area. However, where the sagebrush has returned, the native bunchgrass/forb understory hasn't always. Since 2006, Craighead Bergingia South has been collecting GPS points from collared sage grouse and has demonstrated that grouse do not utilize the hayfields nearly frequently as the intact sagebrush nearby. Clearly, for these hayfields to ever be prime habitat for sage grouse and other sagebrush obligates, they must be restored to their former sagebrush-steppe vegetation.

Restoring sage grouse habitat is in keeping with the goals of the Upper Snake River Basin Conservation Plan which lists grouse habitat as the #1 potential issue affecting sage grouse populations. Further, the first proposed action within the plan to address habitat is to "Manage vegetative communities to provide for nesting and early brood rearing habitats." Nesting and early brood rearing areas generally occur within 4 miles of a lek site. The Moulton lek site in GTNP has consistently been the most visited lek by sage grouse in the Upper Snake River Basin. The Moulton lek lies on the northern edge of a large area of abandoned agricultural land known as the Kelly Hayfields. Like most hayfields, the vegetation is dominated by non-native grasses, with few big sagebrush or leafy forbs. Consequently, the nesting and rearing habitat available to birds breeding at the Moulton lek is severely diminished (Figure 3). Nearly 4,500 acres of smooth brome dominated hayfield lie within 4 miles of the Moulton lek. Removing the smooth brome and restoring the native sagebrush-steppe vegetation would add a huge amount of sage grouse habitat, and remove a large reservoir of exotic plant species. For the benefit of sage grouse and many other species, the Park has begun to restore the Kelly Hayfields to native sagebrush-steppe vegetation. Currently the Park has begun the restoration treatments in the former Hunter-Talbot homestead and has put 150 acres under treatment. This project would fund the final 150 acre piece and complete restoration treatments on this particular hayfield.

The Hunter-Talbot hayfield was chosen for the first large scale treatments for several reasons. First, it would displace the fewest number of existing sage grouse (the area isn't heavily used currently). Second, habitat modeling has shown that the area should provide good year-round habitat (Figure 4). Finally, the area is relatively small and surrounded by intact native vegetation, which should allow native plants to disperse readily into the site.

This project addresses the #1 priority of the USRBCP—Sage grouse habitat. Further, it addresses two primary objectives:

Objective 1) Manage vegetative communities to provide for nesting and early brood rearing habitats. This project will begin an alternation of the landscape from vegetation that offers no valuable nesting or brood rearing habitat, to one that will in the first years would provide brood rearing (3 to 10 years post treatment) and after some development and maturation, nesting habitat (10+ years post treatment).

Objective 6) Rehabilitation of altered habitats. This project will be one of the early phases of the long-term restoration of the Kelly Hayfields. Restoring the Kelly hayfields is action item #6 under this objective. **"**Support Kelly hayfields restoration to native sagebrush grassland plant community in Grand Teton National Park."

Project Goal: Restore sagebrush steppe vegetation to a 150 acre portion of the abandoned Hunter-Talbot hayfield. This will complement the on-going restoration of 150 adjacent acres and complete restoration treatments on this particular homestead.

GTNP recently completed a sagebrush restoration study to determine the most effective techniques to remove smooth brome and restore sagebrush steppe vegetation. We have found that one precisely timed herbicide application (3% solution of glyphosate) is very effective in killing smooth brome. Following the smooth brome die-off, opportunistic weed invasion usually occurs. These weeds can be treated with herbicide (2-4-D or glyphosate), burned, or mowed depending on the type of weed and the level of infestation. Usually 15 months after the initial smooth brome treatment the site can be prepared for drill seeding and planting. Key bunchgrass and forb species are drill seeded during a late fall application.

We have discovered that planting "islands" of dense shrubs and forbs is an effective way of insuring that vital understory and overstory species will be established on the site. These islands also increase the patchiness of a landscape in a compressed timeframe and accelerate the natural succession from hayfield to shrub steppe. These islands would be fenced with 5 feet high x 16 feet long cattle panel with grid openings large enough to allow the movement of birds and small mammals but too small for larger predators and ungulates to enter. In addition to providing protect areas of habitat, the islands will also prevent excessive herbivory and help to build a seed source that will disperse outward into the project area.

The basic timeline:

<u>May 2009</u>
—Pre-treatment vegetation inventory.
<u>June 2009</u>
—Herbicide application to remove smooth brome and other non-native species.
<u>Summer 2009</u>
—Native seed collection and cleaning.
<u>May 2010</u>
—Post-treatment vegetation monitoring for efficacy of initial herbicide treatment and characterize the weed population that emerges from the soil seed bank.
<u>June 2010</u>
—Depending on results of monitoring, implement mowing, prescribed burn or herbicide

spot spraying.
Summer 2010
—Native seed collection and cleaning.
September 2010
—Drill seed grasses and forbs.
September 2010
—"Island installation". Plant shrubs, forbs, and erect fences.
June 2011
—Continued vegetation monitoring and spot spray for noxious weeds.

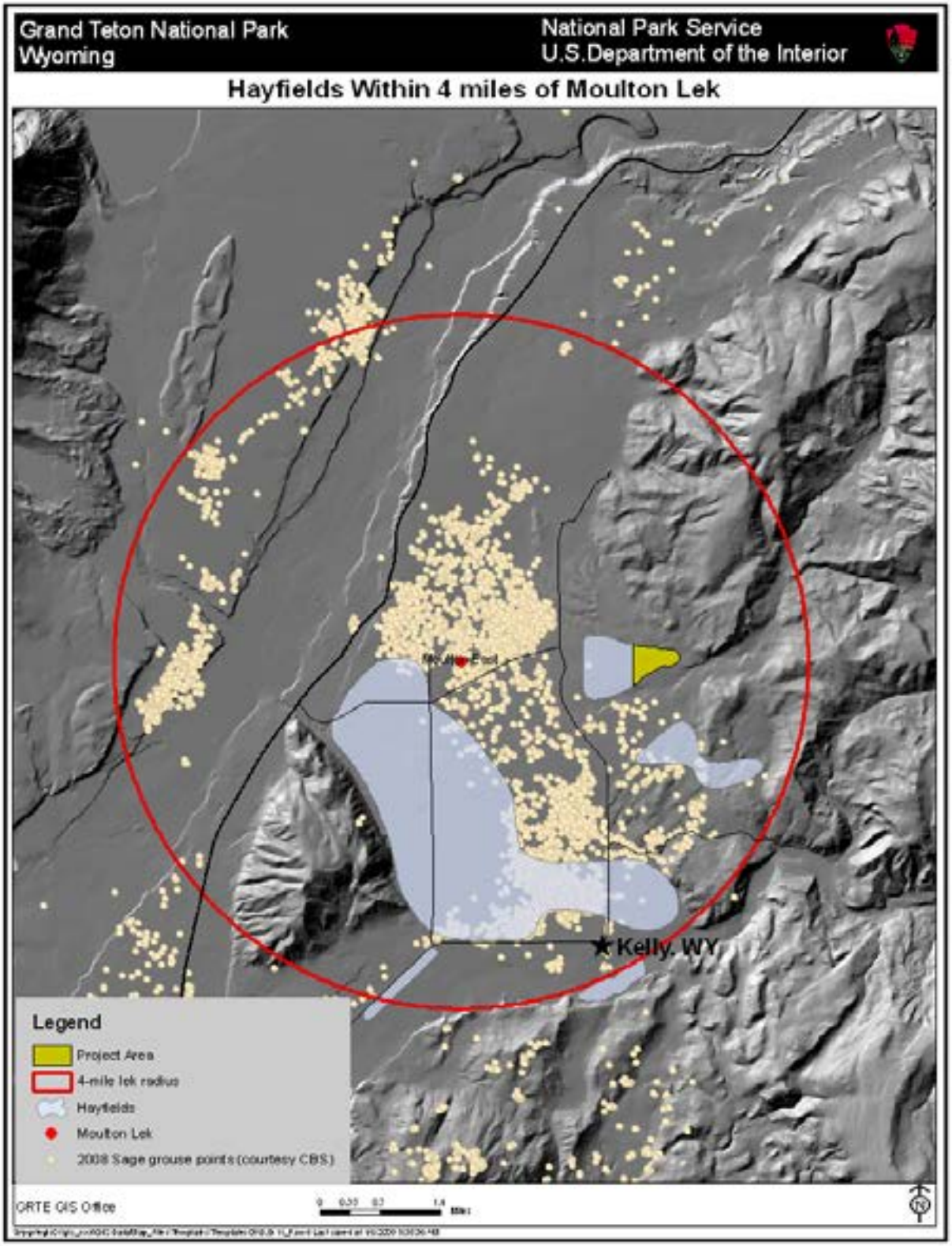

Grand Teton National Park
Wyoming
National Park Service
U.S.Department of the Interior
Hayfields Within 4 miles of Moulton Lek
Kelly, WY
Legend
Project Area
4-mile lek radius
Hayfields
Moulton Lek
2008 Sage grouse points (courtesy CBS)
GRTE GIS Office

Figure 3.

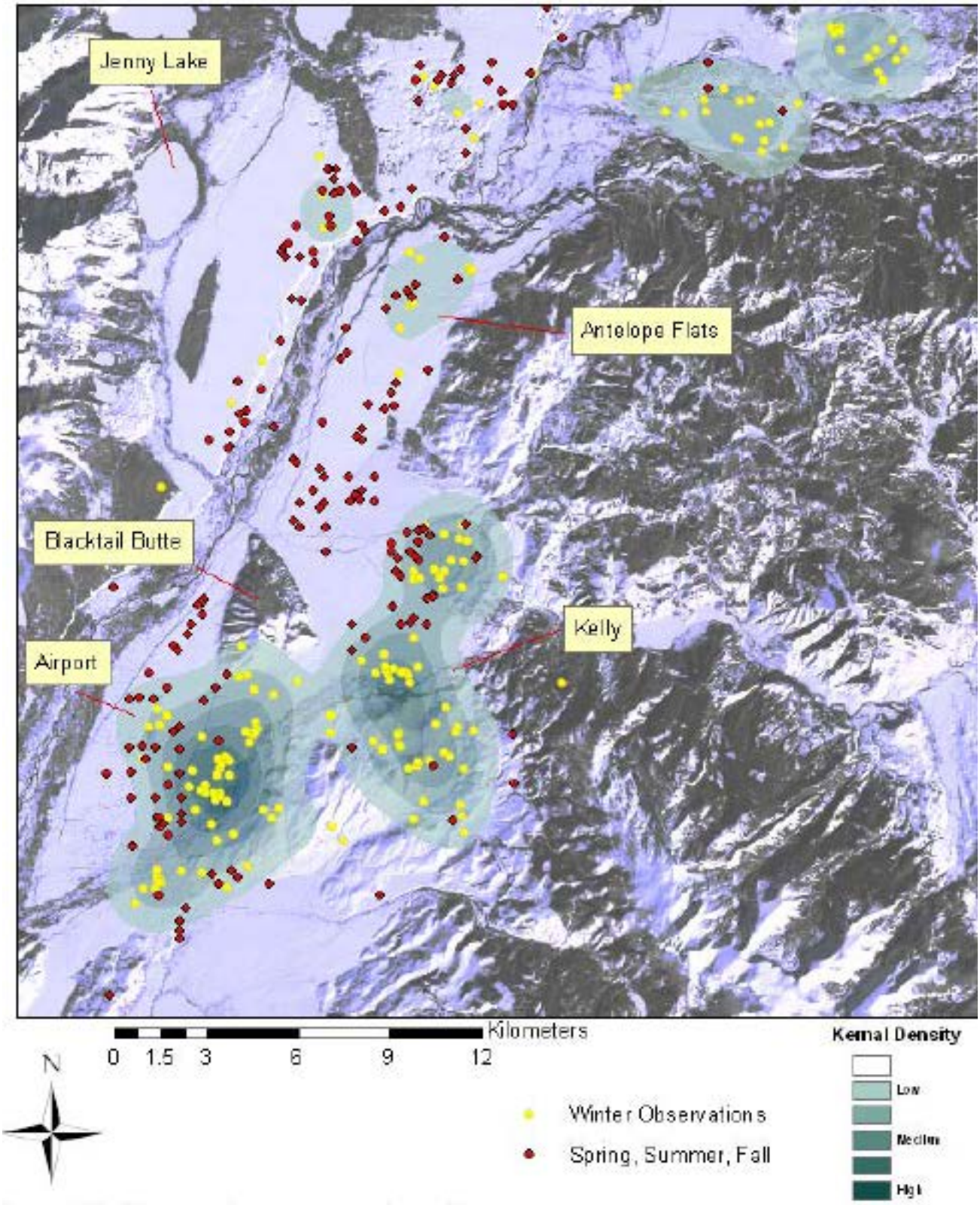


Figure 4. Grouse Density Mapping. Taken from the USBSG Conservation Plan.

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.

Bedrosian, B. and S. Walker. 2010. Sage-grouse baseline survey and inventory at the Jackson Hole Airport. Completion Report. Craighead Beringia South, Kelly, WY

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 165 in 2008 but declined to 124 males in 2009 before rebounding to 148 in 2010 (Table 1). Lek data must be collected consistently between jurisdictions and follow the established WGFD protocol.

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 on that habitat. Wildfire suppression should be a priority in most of the occupied sage-grouse habitat in Jackson Hole and the Gros Ventre drainage. Restoration of native sagebrush habitats on lands formerly farmed in Grand Teton National Park appear to have the greatest potential to expand and enhance habitat used by sage-grouse in the USRBCA.

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 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 and should be carefully evaluated. 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. The working group should continue to support and fund this project. The final report should be completed in November or December of 2010.

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. Consider the findings of 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. Since portions of the Hoback Basin are leased and one deep natural gas project (PXP) has been proposed, collecting data on sage-grouse using the project area should be a priority.
8. Cooperate with the Pocatello Region of the Idaho Fish and Game Department to gather more information on the interstate population in Star Valley along the Idaho-Wyoming state line
9. Support Grand Teton National Park's 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.
11. Habitat retention is the highest habitat management priority for the USRBCA. 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.
12. Implement the USRBWG Sage-grouse Conservation Plan. Work to implement the strategies and projects identified in the plan.

Literature Cited

ARCADIS. 2008. Eagle Prospect and Noble Basin Master Development Plan. Greater Sage-grouse Survey Report. November 2008. Highlands Ranch CO.13 pages.

Bedrosian, B. and S. Walker. 2010. Sage-grouse baseline survey and inventory at the Jackson Hole Airport. Completion Report. Craighead Beringia South, Kelly, WY

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.

Patterson, R.L. 1952. The sage grouse in Wyoming. Sage Books, Denver, Colorado, USA.

APPENDIX 1.

ESTIMATING SAGE GROUSE POPULATION DEMOGRAPHICS, PREDATION, AND CRITICAL HABITAT FOR RECOVERY IN JACKSON HOLE AND NORTHWEST WYOMING

CRAIGHEAD BERINGIA SOUTH

PI: Bryan Bedrosian
Co-Investigators: Derek Craighead & Howard Quigley

Project Description
We are improving grouse population parameter estimates through base-line research involving marking and following adult females, adult males, and young sage grouse. These marked birds allow for estimation of productivity, inter-lek movements, and brood survival, respectively. Bird locations are also being used to identify important seasonal habitat use patterns in the area covered by the Upper Snake River Basin Sage Grouse Working Group. Concurrent with the sage grouse work, Common Ravens are captured, followed, and observed to quantify the potential interactions between ravens and sage grouse. The resultant information will be used to provide a better understanding of the limiting factors of the grouse population and more informed decision-making regarding management guidelines for this region.

Objectives
The overall objectives of this project are to characterize the demographics of the sage grouse populations in Jackson Hole and describe their seasonal use of habitat. Further, the study is designed to assess the potential impacts that Common Ravens have on nesting grouse; both in the Jackson and Pinedale areas. Sage grouse will be marked and tracked for a three-year period, 2007 through 2009 to accomplish the demographic and habitat objectives of the study. As part of the predation aspect of the study, we will also document the role of scavengers, such as ravens, in the demographic dynamics of the sage grouse. In addition, we will use telemetry locations of grouse to identify habitats used by sage grouse in Jackson Hole and to delineate these habitats for nesting, brood rearing, and winter survival. Finally, we will be assessing genetic isolation of these mountain populations and the connectivity between sub-populations of sage grouse in northwest Wyoming and eastern Idaho by assessing the divergence of microsatellites between populations.

Specifically, the following are activities and goals of the Upper Snake River Basin sage grouse study designed to meet the above objectives:

1. To document nesting habitat and nesting production.
2. To monitor potential nest and adult sage grouse predators through telemetry, observation of sign, and point sampling of scavengers/predators in the area of sage grouse use.
3. Obtain a relative use area prediction map of raven abundance through point counts and relate raven use to grouse nest survival.

4. To mark and track young sage grouse to obtain seasonal habitat use and predators of this cohort.
5. To mark and track ravens in areas of sage grouse use.
6. To develop a population model of sage grouse population dynamics from the survival and production data obtained.
7. Determine alternative models for assessing population size for these generally isolated sub-populations (i.e., Jackson Hole and Gros Ventre).
8. To develop a characterization of habitat and critical habitat in the Jackson Hole area and compare to research results in other areas of Wyoming, particularly in the Pinedale area.
9. Determine the genetic connectivity of the grouse populations in Jackson Hole, the Gros Ventre, and surrounding areas.

GENERAL METHODS

Sage grouse were captured and female grouse were leg banded and given a necklace mount VHF transmitter or a figure-8 mounted GPS transmitter; males were leg banded and released, or leg banded and given a VHF or GPS transmitter. All birds marked with VHF telemetry were located a minimum of three times per week. Females that exhibited localized movements during the nesting season (May-June) we assumed to be attending nests. When they exited the localized area, the area was searched for evidence of a nest, and eggs were counted; if predation was detected, exhaustive efforts were made to determine the predator species. Transmitters also incorporated a mortality monitor that indicated if a study animal had been immobile for a long period of time. These signals, when detected, were immediately investigated for bird mortalities; all mortalities were thoroughly investigated.

Raven nest surveys and raven capture and marking were conducted in the areas in and adjacent to sage grouse habitat. Raven nest surveys were initiated in March and completed by mid-May. Selected nests were monitored for productivity and nestlings were marked. Raven trapping was undertaken from March through July to attach telemetry units.

Concurrent with field collection in the Pinedale area, raven point counts were conducted at random points, at nest sites, and at grouse brood locations obtained through telemetry. Sampling took place at each point two times from June through August, sampling defined areas for 20 minutes to record observation of ravens, raptors, and other potential predators of sage grouse and sage grouse nests.

Mapping was undertaken to document the distribution of sage habitats and to describe the use of these habitats by sage grouse.

STUDY AREAS

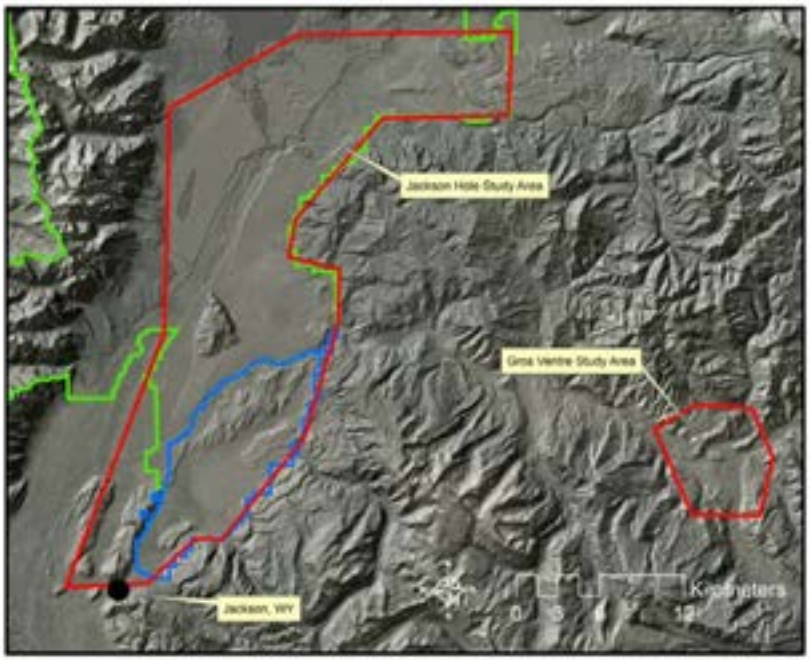


Figure 1. Upper Snake River Basin sage grouse study areas

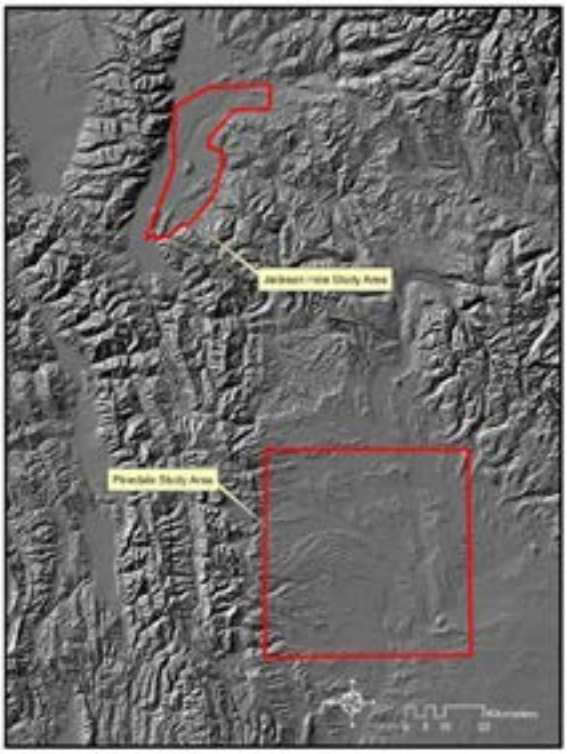


Figure 2. Study areas for sage grouse/raven interaction study.

RESULTS SUMMARY

We have tagged a total of 94 individuals since 2007, including outfitting 67 individual grouse with VHF transmitters and 14 with GPS units. We have obtained over 60,000 ground VHF locations and 18,000 GPS locations to help delineate seasonal habitat use and needs. To help describe critical winter habitat, we have gathered detailed vegetation data from winter GPS grouse locations and have re-visited the same sites in the summer to compare studies that gather winter habitat data during the summer months. We have gathered nesting data from a total of 47 nests over two years and have found average success and productivity, when related to other studies. The majority of predated nests were determined to have been predated by mammalian predators as evidenced by hair remains found in the nest site. The majority of adult predations were also determined to be mammalian, but to a less extent than nest predations. We are currently assessing the use of winter census counts to determine overall population size for small, isolated populations of grouse (e.g., the Jackson Hole population).

We have created raven utilization distribution maps for both the Pinedale and Jackson study areas. These measures of relative abundance determine the raven use of a given area. These utilization distributions will be fitted to nesting success data over the next few months to examine patterns of raven abundance versus grouse success. Of all point count types, city and road counts had the highest mean number of ravens detected. Point counts performed in riparian habitat had the highest mean number of raptors detected. All point count types, except for those performed near grouse nests, detected an average of zero mammals per 20 minutes. Overall, riparian, city, and road counts had the highest mean number of predator detections per 20 minutes. A similar comparison of detection abundance was made between successful and failed grouse nests and broods. For grouse nests, slightly more ravens were detected at successful than at failed nests, whereas the trend was reverse for raptors. However, the overall mean number of predators detected per 20 minutes was virtually the same between successful and failed nests. For grouse broods, there were more raptors and predators overall detected at failed than at successful broods, whereas only slightly more ravens.

TIMELINE & FUTURE STUDIES

Jackson Hole Population – Following the 2008/09 winter field season, we plan to scale back the habitat use component of the Jackson Hole population study. We will continue to monitor the VHF transmitter birds, but not get 3 quadrangulations/week, as we have been doing, in the southern half of the valley. Our efforts will be focused mainly on the northern half of the valley around the three newest leks (Timbered Island, RKO, and Spread Creek). We will continue to monitor nesting demographics of all marked individuals. We will continue to monitor leks for inter-lek movement of color marked males. We also hope to initiate more a more detailed nesting fate study using infra-red cameras and document post-hatching mortality rates and causes using small VHF transmitters on chicks.

Gros Ventre Population - We will continue monitoring efforts and increase sample size of marked birds in the Gros Ventre drainage. We also hope to survey for new leks in that region this spring.

Raven/Grouse Interactions (Pinedale and Jackson) – The study is completed and being written up by master's student Vivian Bui and is scheduled to be finished by next spring. We are currently discussing

continuation efforts that include marking ravens with VHF and GPS telemetry to monitor foraging behaviors of increasing populations to determine the extent of ravens feeding in sage grouse nesting habitats.

Inter-Population Genetic Analysis

1. Genetic isolation, dispersal, connectivity, and population viability of Jackson Hole – PhD student Sarah Shulwitz, under direction of Dr. Jeff Johnson at the University of North Texas, is analyzing samples collected by CBS. Samples were collected from Jackson Hole, Gros Ventre, Pinedale, INEL in Idaho, Cody, Wind River Reservation, Kemmerer, and Central WY This study will assess the potential genetic isolation of the Jackson Hole and Gros Vente populations and will be able to determine the extent to which individuals migrate in and out of these populations. Further, we will be able to document the direction of dispersal and determine source and sink populations. We will be working in collaboration with Dr. Jeff Johnson at the University of North Texas, who has been a pioneer in Prairie Chicken and Sage Grouse genetic research. Expected completion in 2011.

2. Genetic population analysis of the Pinedale sage-grouse population - PhD student Sarah Shulwitz, under direction of Dr. Jeff Johnson at the University of North Texas, is analyzing samples collected by Rusty Kaiser and Matt Holloran of sage-grouse in the Pinedale Region. Expected completion in 2011.

Other ongoing work:

1. Demographics and movements of sage-grouse in the Gros Ventre – Started in 2008, we began monitoring movements and demographics of the sage-grouse in the Gros Ventre. Expected completion by 2011.

2. Sage-grouse movements in Bondurant – Started in 2010, we are tracking one hen via GPS and anticipate outfitting several more if funding is available. Expected Completion 2012.
3. Male inter-lek movements in Jackson Hole – in 2010 we initiated a study of male inter-lek movements. We outfitted a number of males with VHF transmitters and used remote receivers to document presence on all valley leks. This will be continued in 2011.
4. Dynamic movement modeling of sage-grouse in Jackson Hole – With Dr. James Forester of the University of Minnesota, we will model movement parameters and home ranges from GPS and VHF locations in conjunction with covariates such as demographics, weather, and predators.

surface activity should be prohibited and roads present within 5.5 km should be seasonally closed during the sage-grouse breeding season (March-June).

The Jackson Hole Airport poses an anomaly to current disturbance impacts and grouse research. Not only is there an active airplane runway within yards of an active lek, airplane traffic is present throughout the breeding season and there are daily enplanements during prominent breeding hours. While the lek has not been abandoned as suggested by other research, it has experienced a decline in maximum male counts compared to historical numbers. However, it is unclear if this trend is due to overall population declines in the valley or increased disturbance at the lek.

Given that enplanements and other disturbance factors will likely increase over time at the JHA and associated lek, we described the current behaviors and available habitats so future studies can better understand direct effects of increased human activities on sage grouse in and around the JHA. Specifically, we documented strutting behaviors and breeding events during, pre- and post-enplanements, male placement over the breeding season and display rates. We also documented breeding display behavior as it relates to snow conditions and quantify available habitats within the airport perimeter.

Objectives:

1. Obtain baseline information on current strutting behaviors and territory placement of males on the airport lek.

2. Map current, existing vegetation structure within the airport perimeter during the nesting and brood rearing phases.

3. Document potential male behavior and territory alterations due to disturbances (e.g., enplanements, predators) and lek habitat characteristics (e.g., snow placement and depths).

4. Describe current disturbances and rates of disturbance during lekking.

APPENDIX 2.

SAGE-GROUSE BASELINE SURVEY AND INVENTORY AT THE JACKSON HOLE AIRPORT

Bryan Bedrosian[1] and Sarah Walker[2]

Craighead Beringia South; PO Box 147, Kelly, WY 83011

Citation: Bedrosian, B. and S. Walker. 2010. Sage-grouse baseline survey and inventory at the Jackson Hole Airport. Completion Report. Craighead Beringia South, Kelly, WY

General Purpose:

There is an increasing demand on the Jackson Hole Airport (JHA) to accommodate increasing visitor use of the valley and surrounding areas. As such, there are inevitable changes that will occur to the JHA in the coming years including increased air traffic, vehicle traffic, and overall anthropogenic use that could affect the natural resources in and around the JHA. Specifically, the JHA is home to one of the valley's most important leks (i.e., breeding grounds) of the Greater Sage-grouse (*Centrocercus uropasianus*), which is currently a candidate for federal endangered species status. It is important to understand the current sage-grouse use patterns and habitat quality at the JHA in the event significant changes occur in the future. Without baseline data on the current status of grouse and the JHA, it will be difficult to interpret how changes to the JHA affect the sage-grouse in Jackson Hole. We quantitatively documented the current lekking behaviors and habitats available within the JHA during 2009. This study was not designed to assess the current influences the JHA has on sage grouse, but rather provide a base for future studies in the event changes (habitat or disturbance rates) occur within the JHA.

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[2] Present Address: Teton Science Schools; 700 Coyote Canyon Rd, Jackson, WY 83001

Introduction:

There is currently a negative population trend for Greater Sage-grouse (*Centrocercus urophasianus*) in the Jackson Hole mountain valley of northwestern Wyoming (Holloran and Anderson 2004). While the current data indicates that the population has remained relatively stable for the past ten years, there has been a 50% decline of the population since 1950, indicating the population may be at risk for extirpation (Grand Teton National Park, unpubl. data). One of the ecologically most important leks and core sage grouse nesting and winter habitats occur in and around the JHA. The Upper Snake River Basin Working Group (USRBWG) suggests that "the single most important infrastructure feature in core sage grouse habitat in the Upper Snake River Basin Conservation Area is the existence and potential for expansion of the Jackson Hole Airport" (Bohne et al. 2008).

The lek at the JHA has historically been one of the valley's largest leks and has been active since at least the 1940's (Patterson 1956). Currently, the airport lek which is located at the north end of the Jackson Hole Airport's only runway in the grassy "over-run" area consists of roughly 10-15 males (unpubl. data) and associated females.. The grouse that utilize this lek are frequently subject to disturbances such as airplanes landing and taking off and being hazed by vehicles.

Past studies indicate that some anthropogenic disturbances, such as gas field surface activity and roadways negatively affect grouse populations (Lyon and Anderson 2003, Holloran 2005, Holloran et al. 2007, Dougherty et al. 2008). Natural predators have caused cessation of display activity, flight, and/or abandonment of leks for multiple days (Hartzler 1974, Bradbury et al. 1989). Several studies have found that an acoustic part of the male's display plays a significant role in attracting mates (Gibson and Bradbury et al. 1989, Gibson 1989, Dantzker 1999) and males may even choose lekking sites based on their acoustic abilities (Connelly et al. 2000). Therefore, noise disturbance is likely to affect lekking grouse. Braun et al. (2002) found that sage grouse attendance at leks within a mile of coal bed methane compressor stations in Wyoming was consistently lower than control (non-disturbed) sites. Holloran and Anderson (2005) also found lek activity decreased downwind of drilling activities. Braun (2006) suggests that all drilling stations be prohibited within 5.5 km of active leks and that compressor stations should have mufflers to reduce noise heard within 5.5 km of leks. Further, he suggests that *all*

surface activity should be prohibited and roads present within 5.5 km should be seasonally closed during the sage-grouse breeding season (March-June).

The Jackson Hole Airport poses an anomaly to current disturbance impacts and grouse research. Not only is there an active airplane runway within yards of an active lek, airplane traffic is present throughout the breeding season and there are daily enplanements during prominent breeding hours. While the lek has not been abandoned as suggested by other research, it has experienced a decline in maximum male counts compared to historical numbers. However, it is unclear if this trend is due to overall population declines in the valley or increased disturbance at the lek.

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METHODS

BREEDING

Lek Observations

Daily observations of the lek were made from vehicles parked ca. 200 m from the lek center typically by one observer from the day the first males arrived on the lek until one week after no male grouse arrived. Grand Teton National Park (GTNP) lek count protocols were followed to determine lek attendance rates of both males and females. Following those protocols, the observers arrived at the lek at civil twilight and counted both male and female sage grouse every 15 minutes. In addition, the placement of each male and female was mapped on aerial photographs of the JHA every fifteen minutes. Males were mapped without regard to individual identity due to difficulty in recognizing individuals and extreme variation in movements. Matings were also documented and mapped opportunistically. We documented the percentage of males strutting during each 15-min lek count. This was the percentage of males displaying within a roughly 30-60 sec time period every 15 min. When analyzing the data, we restricted the analysis dealing with the percentage of males strutting to the first influx of females to the lek (18-30 April).

We mapped the snow free areas on the over-run from 3/24 to 4/20 on a regular basis using aerial photographs of the lek. These maps were then digitized into ArcMap 9.3. The area of the snow-free sections was then calculated using Hawth's tools. We predicted the snow free area of days not mapped by assuming a constant rate of melt between days. We used a linear regression to test for a relationship between snow melt and male attendance.

We gathered weather data from the Moose, WY weather station for the duration of the study to correlate to variables such as male and female attendance and strut rates. We first tested for correlations among weather variables and then used a best subsets regression using non-correlated variables to predict male and female attendance, excluding models with >2 variables.

We tested for relationships between the total percentage of males strutting with factors such as time after first light, time after first female arrival, and the percentage of females present using regression analysis. We also tested the difference in percentage of males strutting on days when females were present with days when no females attended the lek using t-tests.

Utilization Distributions and Territory Mapping

We placed numbered, small wooden stakes in a grid on the lek to help facilitate territory mapping. All males present in a given day were mapped on aerial photographs every 15 min. Displaying males were differentiated to help determine territory placement and boundaries. All males, regardless of display, were also marked to help map overall land use in the JHA by lekking males. Wing fights were also mapped, assuming these fights likely took place at/near territory boundaries. Locations of females were also noted, as they likely influenced the rates of wing fights and male placement. These mapping placements were later digitized in ArcGIS 9.3 to help facilitate delineating territory boundaries and lek use.

The utilization distribution (UD) of the males and females on the lek were calculated using kernel analysis from Hawth's Tools in ArcMap 9.3. All UDs were calculated with a smoothing factor of 10 and a cell size of 1 to obtain enough precision for the small area of the lek. We calculated the UD of all male locations (mapped every 15 minutes every day) to obtain the total area used during the main two months of April and May and for the total observation period (Mar – Jun). We further divided the UDs from the males into days when females were present and when they were absent to see if female attendance shifted the UD of the males. In addition to this, we calculated the UD of all female locations from April-May to visualize female use of the lek site. We tested the male UDs from days of female presence and absence using paired t-tests on the areas of each kernel percentage (5-65%).

The male territory locations were approximated using a point density analysis in the Spatial Analyst package in ArcMap. By weighting each male location relative to the nearest other male location on days when females were not present, the pattern of territory use can be explored. We documented male locations every 15 min but did not record each individual's identity. If a male was prone to display at his territory center, his locations would have a greater weight the more time he spent at that center and therefore creating a density dependant distribution based on territory placement. We used point density analysis for days prior to female arrival to determine initial territory establishment and again during the peak lekking season using days when females were not present due to perceived territory "breakdown" when females were present.

Disturbance Observations

We documented the type, duration, and general effect of the lek of any potential disturbance for the duration of the lekking season. To determine the potential effects of anthropogenic disturbances on the strutting behavior of males, we performed focal observations of random males from 1 May – 23 May. Focal observations were made mainly with the aid of video recordings that were later analyzed to determine the strut rate (pops/minute; as defined by Wiley 1973) for a 60 minute time period, beginning ca. 20 min after civil twilight. Proximity of females and males, aggressive interactions, any matings, and movements of the focus male were also recorded.

To determine the accuracy of using an average strut rate over a male's full 60 minutes, we correlated this average strut rate (number of struts/full observation time) with the number of minutes displaying/full observation time (percent time) and the number of struts/min during continuous strutting (not including zero values). We compared the strut rate of a focal male in the 5 min prior to a disturbance to 5 min post-disturbance using paired t-tests. Further, a single factor ANOVA was used to compare strut rate 5 minutes prior to a disturbance (# struts/5min), strut rate through the full length of a disturbance (# struts/n min), and 5 minutes after a disturbance (# struts/5min). We also used an individual's strut rate to examine for correlations between a male's display activity and other environmental factors on that same day. We tested strut rate for correlations with variables such as female attendance, weather and date using a regression analysis and used paired t-tests to compare the differences in strut rates due to female attendance.

VEGETATION MAPPING

Locations for vegetation sampling were chosen in a stratified, non-random design. We first delineated usable habitat (i.e., not paved or built upon) in ArcGIS 9.3 and then chose sampling locations roughly equidistant and in all habitat patches. We purposefully chose locations in most over-run sections due to previous observations of grouse in these areas in addition to the lek site and surrounding sage-steppe habitat.

At the pre-defined sampling points, we measured vegetation along two 30-m perpendicular line transects following Canfield (1941) and Holloran and Anderson (2004). The point center was located using hand-held GPS devices (Garmin) and permanently marked using a

short (ca. 30-cm) piece of rebar with orange flagging to facilitate finding these location centers for subsequent studies. Using the line-intercept method, we estimated the total shrub canopy cover, sagebrush canopy cover, percent of live sagebrush, and percent dead sagebrush. We also measured maximum height (excluding flowering stalks), average canopy breadth, and species of each shrub encountered. Typically, these measurements did not apply to overrun plots, as they were devoid of shrubs.

To measure forbs and herbaceous vegetation at all sites, we used the Daubenmire (1959) methodology. We used a 20 x 50 cm quadrant to measure total herbaceous cover, bare ground, litter, residual grass cover, and forb cover at the plot center and 1.0 and 2.5 m on each transect. We identified all forbs to species and classified sage grouse food forbs based on Patterson (1952), Peterson (1970), Wallestad et al. (1975), and Barnett and Crawford (1994). We assessed food forbs based on information from Holloran (pers. comm.). We obtained a measure of forb diversity by calculating the average number of species in all Daubenmire quadrats within the plot. Following Holloran and Anderson (2004), we converted the Daubenmire (1959) categorical estimates into percentages for each of the 12 quadrates per plot and averaged the height and cover estimates to obtain single variable estimates for each plot.

We first investigated for potential differences between vegetation parameters measured using the line-intercept method among plots (excluding overrun plots) using ANOVA tests. We then tested for differences among all plots and between overrun and non-overrun plots for forb diversity and measures of understory as found using the Daubenmire method. We compared the non-overrun plots to vegetation plots measured at nest and brood rearing locations in the southern half of Jackson Hole as described by Holloran and Anderson (2004) using t-tests.

RESULTS

BREEDING

We began checking for male attendance March 11th and the date of 1st arrival was on the 13th (2 males). After the 13th of March, no males arrived until March 23rd at which point they attended the lek continuously. We attended the JHA lek daily from March 23rd through June 28th, for a total of 93 consecutive observation days (Figure 1). From March 23rd through April 13th, 1-2 males were consistently present on the hillside east of the airport pit. During this time, the

snowpack covered the overrun section of the airport (Figure 2). In total, we counted a maximum of 10 males and 17 females for the season (Figure 1).

We attempted to correlate maximum male and female daily counts with a host of climatic information. Daily weather data was collected from the USGS Moose, WY weather station since the airport weather station did not record precipitation. We tested the following weather measurements with grouse numbers: date, minimum daily temperature (assuming this is indicative of early morning temperatures), maximum and minimum dew points, maximum and minimum humidity, minimum and maximum pressure, maximum wind speed, total precipitation, and a cloud cover index (0-8 scale). Using a best subsets regression, we found that the best model used minimum temperature and minimum dew point as predictors. The number of males can be predicted using the equation Max males = 1.04 + 0.311 Min Temperature - 0.201 Min Dewpoint ($P = 0.000$, $F = 14.37$, $r^2_{adj} = 24.1$). We found no such relationships for female attendance.

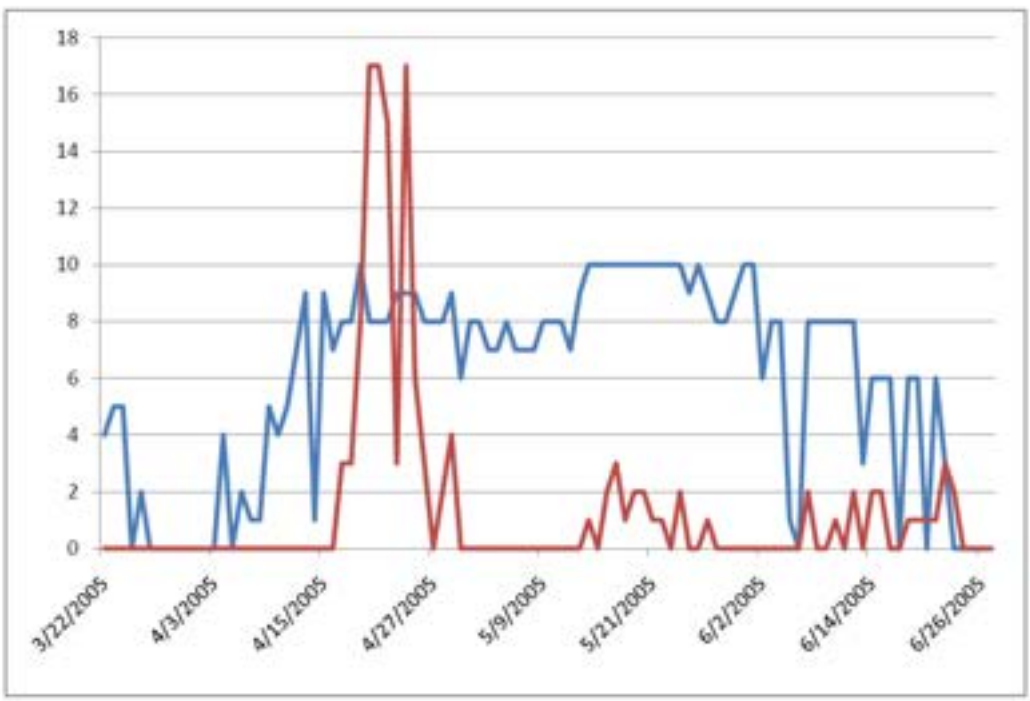

Figure 1. Male and female lek attendance at the Jackson Hole Airport, 2009

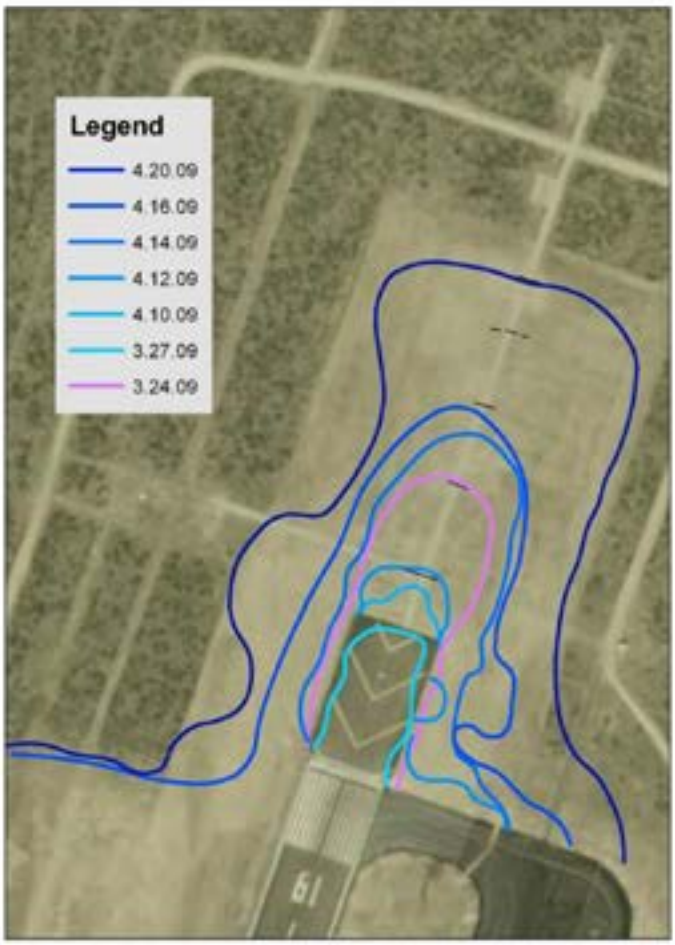

Figure 2. Snowpack regression during the 2009 lekking season.
Note that the snow-free area in pink (3.24.09) became snow covered again after heavy snowfall on 3.25.09

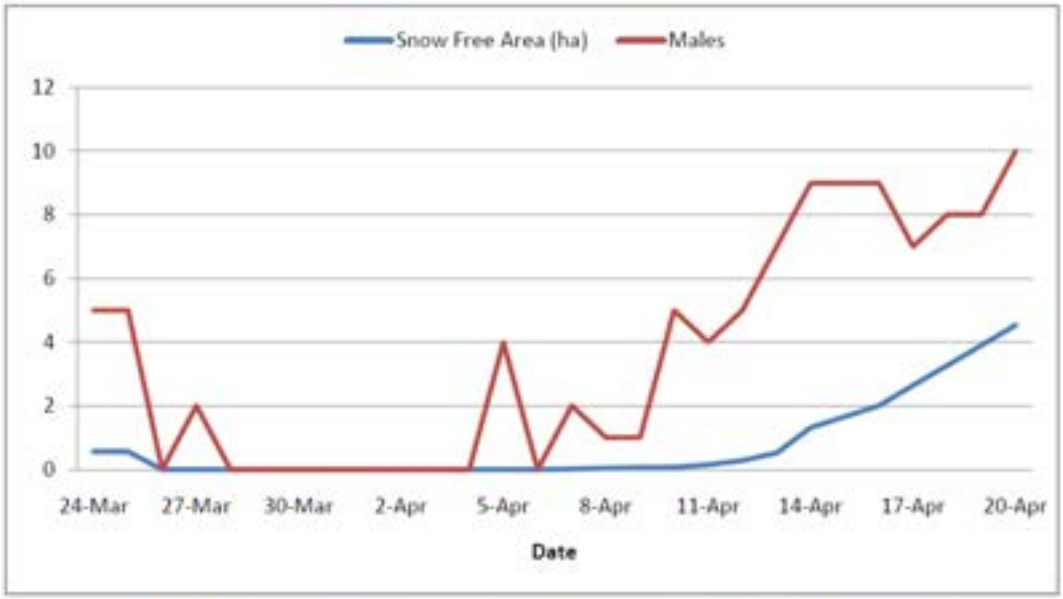

Figure 3. Positive relationship between the snow-free area on the lek and male attendance

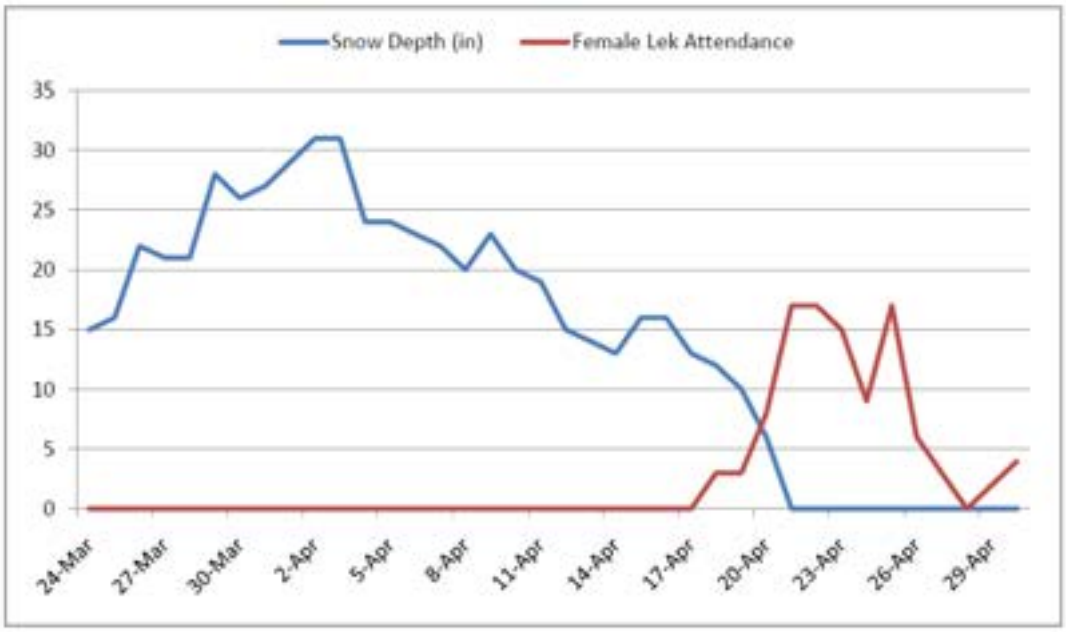

Figure 4. Negative relationship between snow depth (as measured at Moose, WY) and female lek attendance

We found that male attendance during the beginning of the lekking season (3/24 – 4/20) could be predicted by the amount of snow-free area on the over-run ($p < 0.01$, $r^2_{adj} = 58.9$, $F = 39.65$; Figure 3). Females did not start attending the lek until there were at least 3 ha of snow-free area on the overrun. Not surprisingly, the first females arrived at the lek 3 days prior to the Moose weather station recording 0.0 in of snow (Figure 4).

We found that the percentage of males strutting was inversely related to how long females were on the lek ($P < 0.001$, $r^2_{adj} = 28.3$, $F = 27.5$; fig 5). Further, we found a positive relationship between the percentage of males strutting and the percentage of female daily attendance rate ($P = 0.001$, $r^2_{adj} = 14.7$, $F = 12.55$). However, the relationship of male strutting with female attendance in the presence of time (multiple regression) is confounded by the fact that the female attendance is also inversely correlated to time. To account for this, we tested the percentage of males strutting with the time after the arrival of the hens on the lek using an ANOVA test and found that the percentage of males strutting decreased as the time after first hen arrival increased ($P = 0.006$, $F = 3.45$; fig 6). Excluding the lek counts in which no males were strutting, we calculated the average daily proportion of strutting males. Using a t-test, we found that the daily average proportion of strutting males was greater on days that females attended the lek ($P < 0.001$, $t = -6.14$, $df = 28$). The mean daily proportion of strutting males on days that females were present was 68% as compared to 36% when females were absent.

When possible, we recorded the direction the grouse exited the lek. This was most often by foraging and walking, but sometimes included flying off the lek. From the days recorded ($n = 56$), we found that the northern directions (N, NE and NW) accounted for 84% of the total movements away from the lek (fig 7). Only twice were the grouse observed to have moved in a manner from the lek that may have had the potential for airplane conflicts. These two observations were both made in the first three days the males first began attending the lek (March 24-25) and during a time in which no areas were snow free except for the paved areas of the JHA.

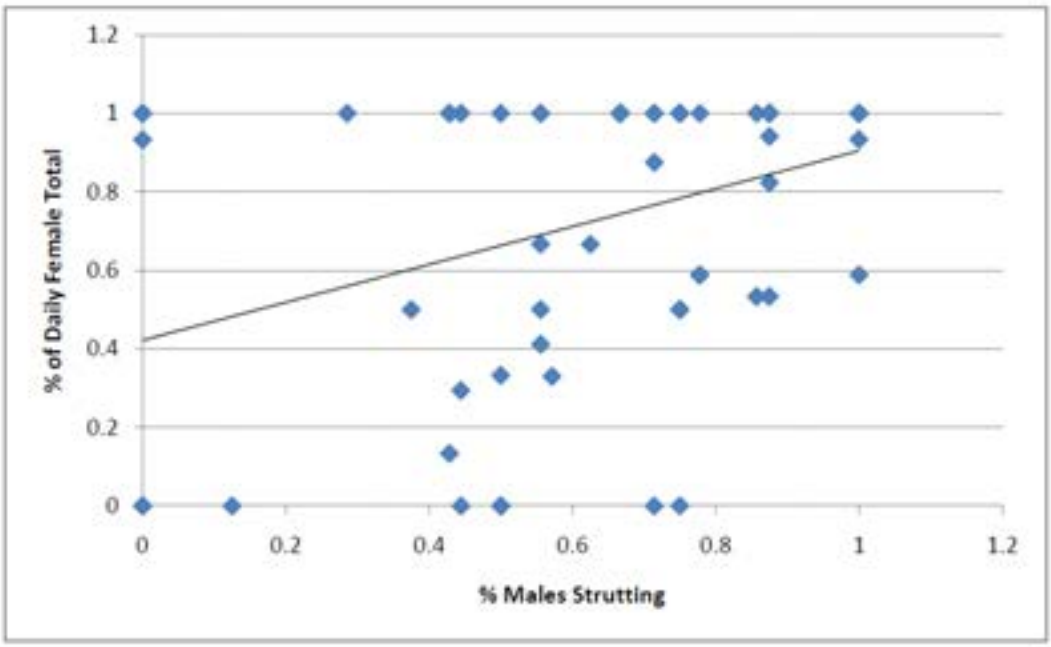

Figure 5. Significant positive relationship between the total percentage of males strutting and the percentage of total females present on the same day.

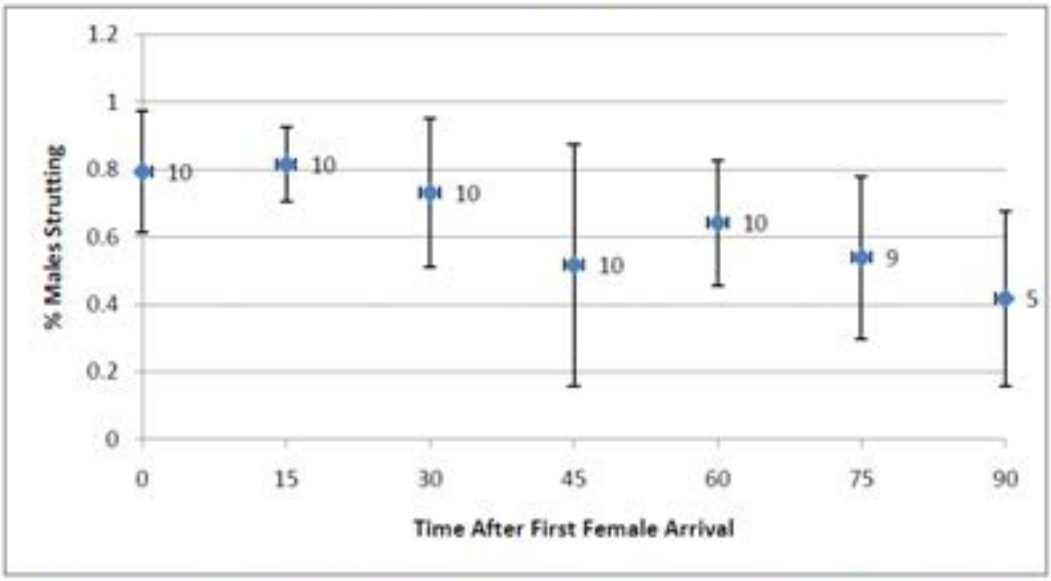

Figure 6. Significant relationship between the percentages of males strutting to the time after the first female arrived on the lek.

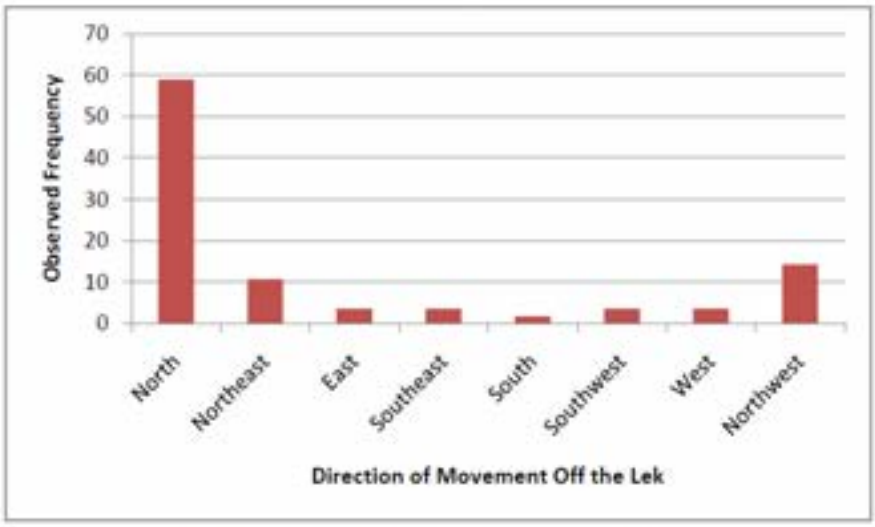

Figure 7. Direction frequency of movements off the lek.

We found a systematic tendency for males to utilize a smaller total area on days when females were present ($P < 0.001$, $t = -4.84$). Using utilization distributions (UD), it appears that the center of activity shifts north on days when females are present (fig 8). We also created female UDs for the duration of the lekking season (fig 9) and for the total observations of both males and females for the entire lekking season (fig 10).

We overlaid our general observations and impressions on top of the point density map to outline general territory locations in two ways. First, we used the point density analysis to determine the approximate territory locations at the beginning of the lekking season since territory establishment typically happens during this time (fig 11). We then estimated territory placement during the peak of lekking season using the days when females were not present (fig 12). Using the days when females were not present is important due to the shift in male UD during those days and the general breakdown of defended territory boundaries. Males tended to follow females and display where they were located rather than at defined territories. There appeared to be a large difference in territory placement after females arrived, counter to current theory on lek dynamics.

We opportunistically recorded matings. We recorded a total of 26 mating attempts between April 20th and June 8th (fig 8). Seventeen matings occurred in April, eight occurred in May and only one mating was observed in June.

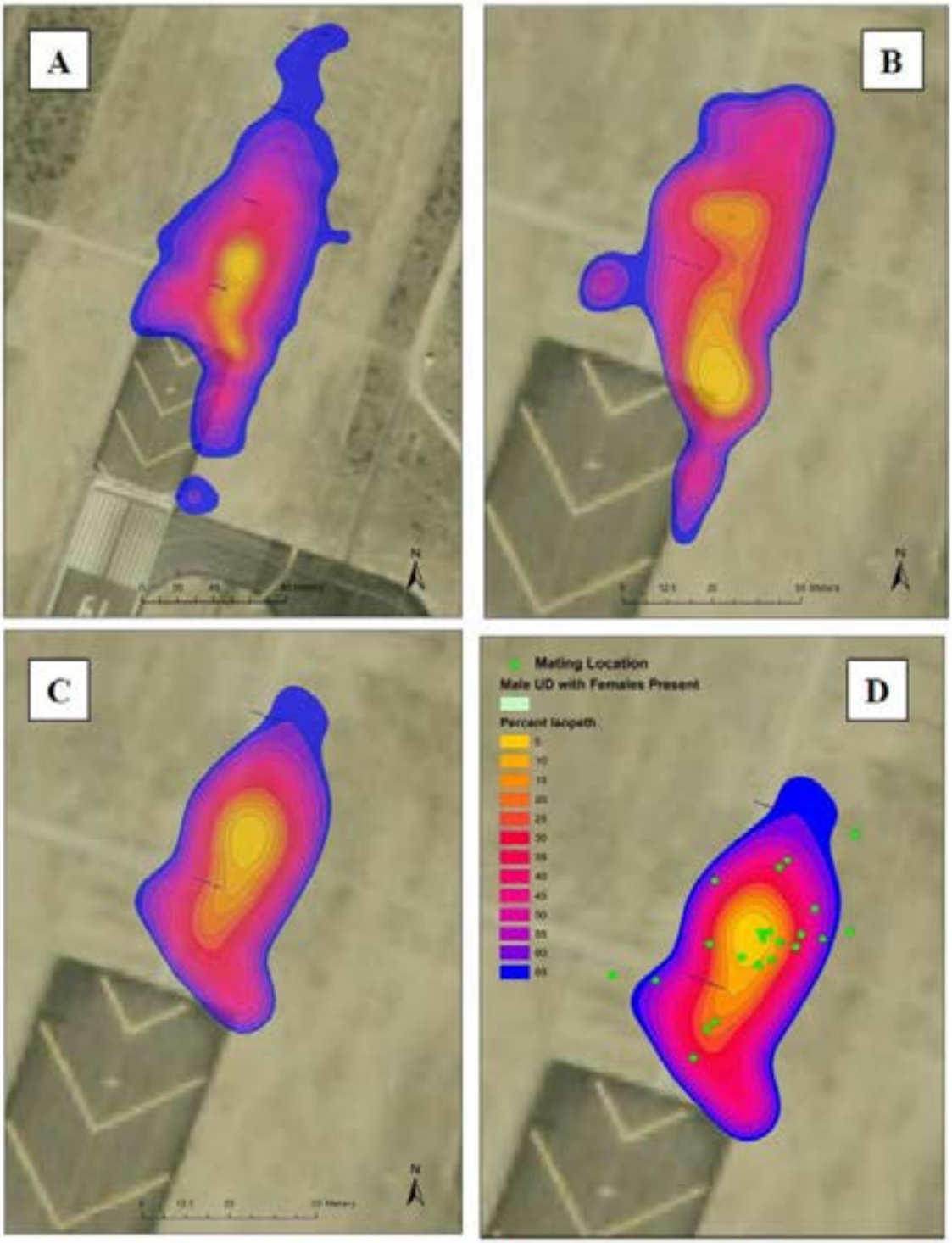

Figure 8. Kernel utilization distribution of sage-grouse on the JHA lek in 2009. A = UD of all male locations (every 15 min) from April - May. B = UD of all male locations on days when females were not present. C = UD of all male locations when females were present. D = C with mating locations overlaid.

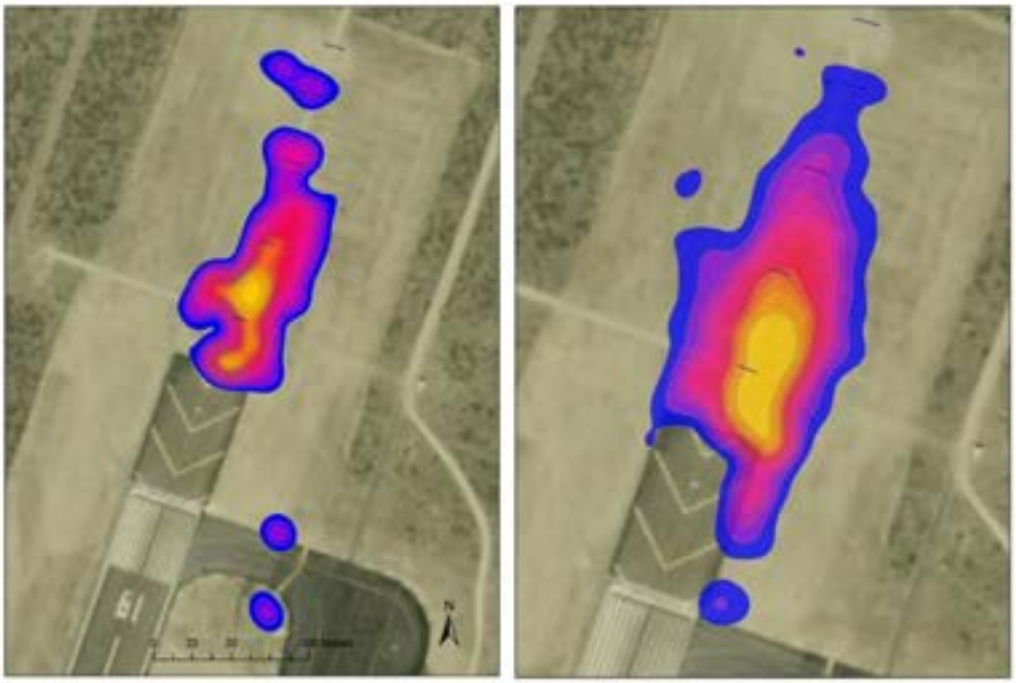

Figure 9 & 10. Kernel utilization distribution of females on the JHA lek, 2009 (left). Kernel utilization distribution of all locations (male and female) for the entire lekking season.

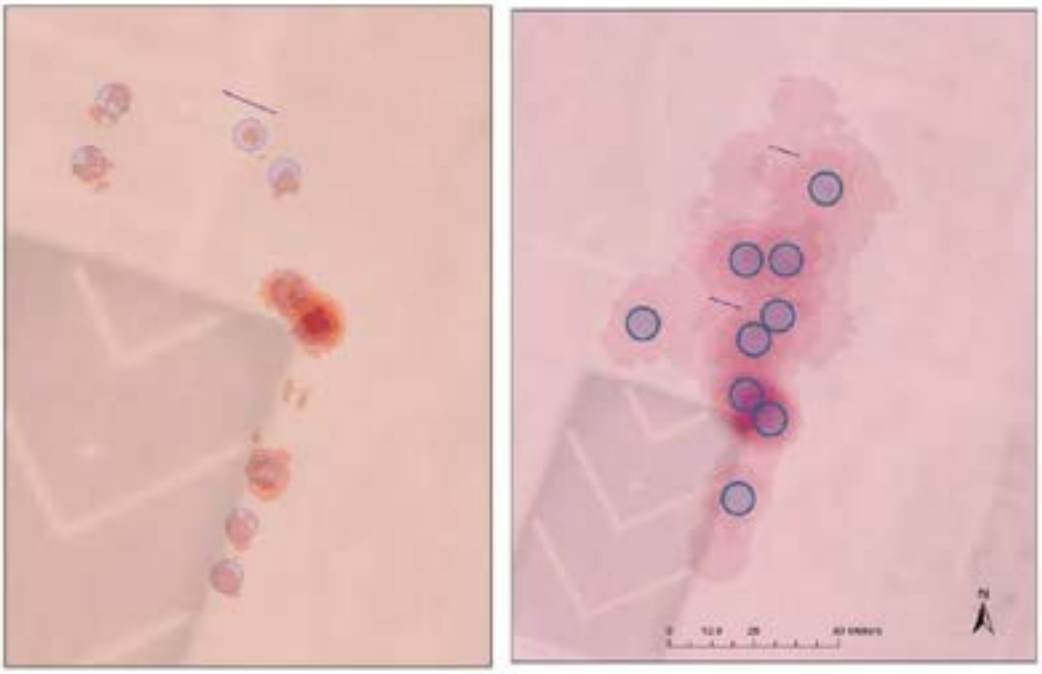

Figure 10 & 12. Estimated territory locations based on a point density analysis form days prior to female lek attendance (before 18 April 2009). Estimated territory locations based on a point density analysis from all days when females were not present. (right)

STRUT RATES & DISTURBANCES

We recorded and quantified the strut rates from focal males on 16 days between 24 March and 17 May 2009 using video recordings of the males. Females were present on four of those days. The mean observation time was 59 minutes (Table 1). The mean strut rate through males' total observation period was 2.085 struts per min (SD = 2.00) and the mean number of struts/minute during each bird's longest continual display was 3.991 (SD = 1.787). On average, males spent 42.4% of their observation time strutting based on number of minutes displaying during the observation period (SD = 31.653).

We found no relationships between the observation time and any strut rate variables (all P >0.05). All other variables were highly correlated with each other variable tested (Pearsons correlation; all P < 0.03). During each observation period, we identified the minute with the most struts. The highest number of struts recorded during that minute was 12, the lowest being zero (i.e. the focal male never strutted during the observation period). The average maximum number of struts per minute was 7.06 (SD = 2.515). We found that the strut rate was significantly higher when females attended the lek (P = 0.004, w = 78). The mean male strut rate was only 0.935 struts/min (SD = 0.46, n = 12) when females were absent, but averaged 5.22 struts/min (SD = 1.594, n = 4) when females were present. Not taking into account female presence, we found that strut rate can be predicted by minimum temperature in the presence of precipitation (P = 0.038, f = 4.26). Avg overall = - 2.49 + 0.179 Min Temp (°F) - 8.10 Precip (In).

We recorded all potential disturbances throughout the lekking season (fig 13, table 2). A sub-sample 15 focal days (one focal male per day) was used to examine the effects of disturbance on strut rate, or numbers of strut per minute. We examined the strut rate just prior to, during, and after an anthropogenic disturbance. We used departing flights to the south and vehicles on the lek as disturbances. The mean strut rate of individuals five minutes prior to disturbance was 2.186 struts/min (SD = 2.295, n = 15) and during and/or five minutes after a disturbance it was1.72 struts/min (SD = 2.217, n = 15). We found no evidence to suggest that disturbance had an effect on strut rate (P = 0.481, w = 250). Further separating the data into three categories of disturbance times (before, during and after a disturbance) failed to detect differences between treatments (f = 0.335, P = 0.717). We further investigated potential disturbance effects by testing two sub-sets of strut rates; when females were present and absent

and failed to find significant differences. We found no significant relationships for all variables tested (all P > 0.05 for both sub-sets).

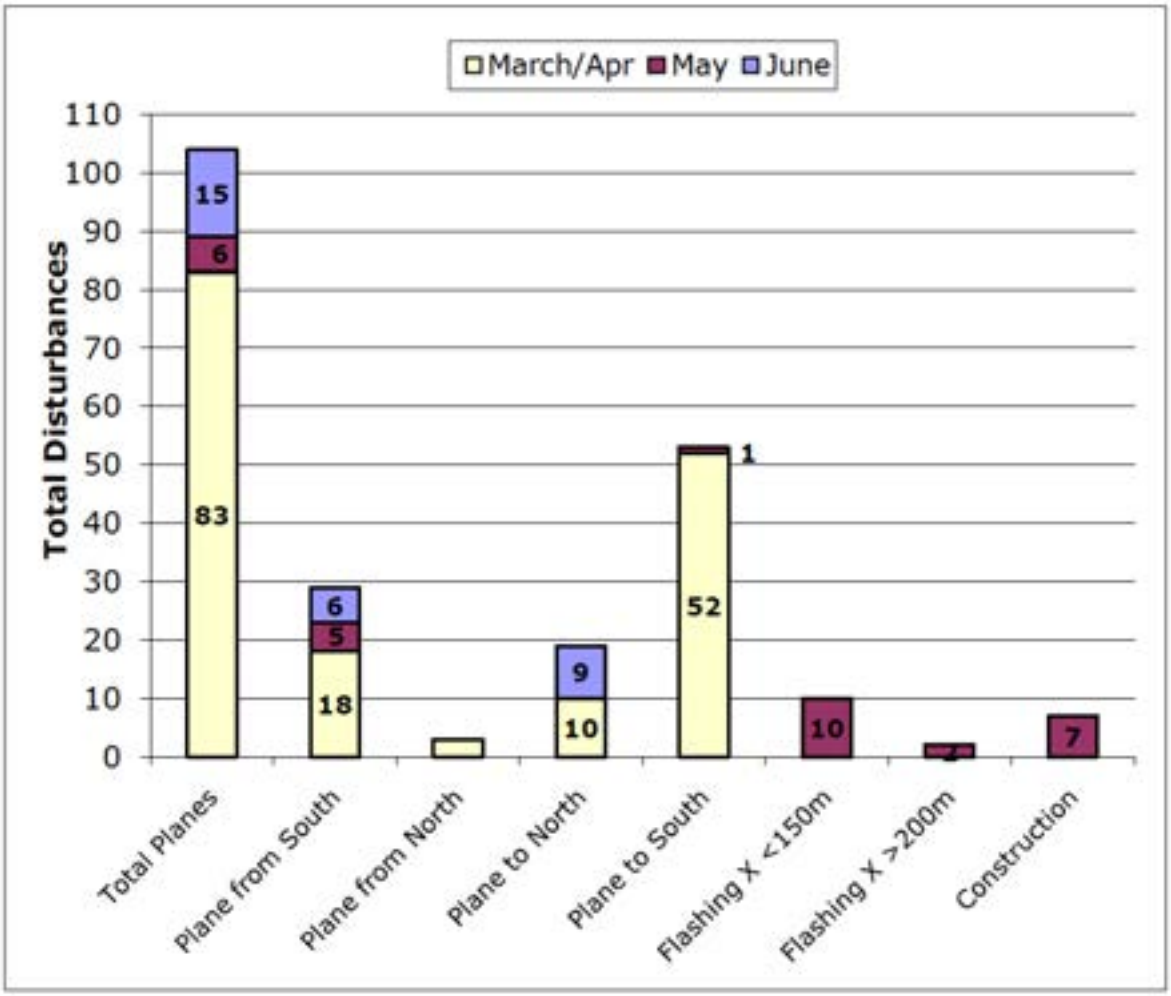

Figure 11. Number of anthropogenic disturbances to the JHA lek, 2009 by month.

Table 1. Strut rate summary statistics.

Date	Total Females Present	Time Recorded (min)	Time Displaying (%)	Max time continuous strutting (min)	Mean struts/min (total time)	Max struts/min	Mean struts/min (during display)
24-Mar	0	44	20.5	2	0.76	5	3.71
7-Apr	0	36	16.7	2	0.46	7	2.0
10-Apr	0	139	33.8	9	1.27	10	6.1
11-Apr	0	60	30.0	4	0.70	7	2.8
12-Apr	0	75	50.7	13	1.79	7	3.6
13-Apr	0	64	14.1	3	0.92	6	4.3
14-Apr	0	65	26.2	5	1.00	7	4.8
19-Apr	3	32	93.8	25	3.79	8	2.2
24-Apr	3	59	100.0	59	5.98	12	6.0
27-Apr	3	41	68.3	27	4.02	8	6.0
2-May	0	59	30.5	15	1.23	7	4.1
3-May	0	40	0.0	0	0.00	0	0.0
6-May	0	63	44.4	7	1.36	7	3.5
8-May	0	58	24.1	8	0.97	6	3.8
10-May	0	56	25.0	7	0.77	7	3.6
17-May	2	56	100.0	56	7.11	9	7.1
	Mean	59.19	42.37	15.13	2.01	7.06	3.99
	Range	(32 - 139)	(0 - 100)	(0 - 59)	(0 - 7.1)	(0 - 12)	(0 - 7.1)
	SD	24.4	31.7	18.3	2.1	2.5	1.8

Table 2. Disturbance frequencies and descriptions

Disturbance	Season Total (n=76)	Mar/April Total (n=24)	May Total (n=24)	June Total (n=22)	Description/ Effect
Total Planes	104	83	6	15	Includes incoming and outgoing planes, see below
Out to South	53	52	1	0	Most disruptive, jets facing birds, 200m within lek center
In from North	29	18	5	6	Planes fly low and directly above lek to land on north end of runway
Out to North	19	10	0	9	Planes fly overhead, but not as low, little effect
In from South	4	4	0	0	Land on south end, >1000m from lek, no effect
Vehicle <200m	67	27	40	0	Includes snow plows (in pairs), runway cleaners, security cars
Vehicle <100m	23	8	13	2	Includes snow plows, runway cleaners, security cars driving through lek
Canine	8	6	0	2	Coyote or fox within 200 m, little observed effect
Raptor	7	2	4	1	RLHA or unidentified hawk, caused flushing or cessation of activity
Purposeful Deterrence	5	3	2	0	Airport vehicles honking at or driving close to birds in an effort to move them
Construction	7	0	7	0	Newly paved runway or pavers on runway <200m from lek center
Flashing X Present	12	0	12	0	A large flashing "X" using a generator usually attached to a truck
X in lek center	6	0	6	0	X in lek center, on grassy over run, truck typically drives through to get X
X < 150m	4	0	4	0	Flashing on runway, <150m from lek center

Vegetation

We measured vegetation at a total of 20 plots within the JHA (fig 14, table 3). Of those, seven were located in over-run, or non-sage, areas of the airport. We recorded the herbaceous and forb cover at all sites and sage structure at 11 sites. We further classified the forb components by food forbs and cover forbs and tested for differences among similar sites (i.e., sage or over-run) and between sites.

We found differences between sage and over-run plots for all understory variables measured except total percent forb cover (table 4). However, while the total forb cover did not differ between site types, the forb diversity was significantly higher in the sage plots than over-run plots. Using ANOVA tests, we found no significant variation in live sage cover among sites ($P = 0.126$, $f = 1.53$, $df = 10$; table 5). We did find differences among sites for mean plot sage height ($P = 0.001$, $f = 3.04$, $df = 10$; fig 15).

To further investigate the importance of forb cover in the JHA, we analyzed the plots for food and cover forb components (table 6). To determine if the grouse could be attracted to the over-run sections of the JHA by food (in addition to lekking), we tested for differences between food forbs in the sage plots and the overrun plots. We found no differences between the sage and overrun plots for forbs that are important for adult sage-grouse. Because juvenile sage-grouse use a larger breadth of food forbs than adults, we also tested for differences between plots using all potential food forbs and found much more pronounced differences between the sage and over-run plots (tables 7, 8).

We compared the vegetation parameters measured within the JHA to a previous study that quantified nesting habitat in Jackson Hole (Holloran and Anderson 2004) to assess the habitat quality within the JHA. To conduct meaningful tests, we restricted the Holloran and Anderson (2004) data to nesting sites only in the southern half of Jackson Hole due to sage sub-species differences in other areas of the valley (i.e., the west side of the Snake River). Using only the sage plots within the JHA, we found differences in only percent bare ground and dead sage canopy cover (table 9). All of the important vegetation parameters for sage-grouse nesting were not different between the JHA and other used nest sites in the valley.

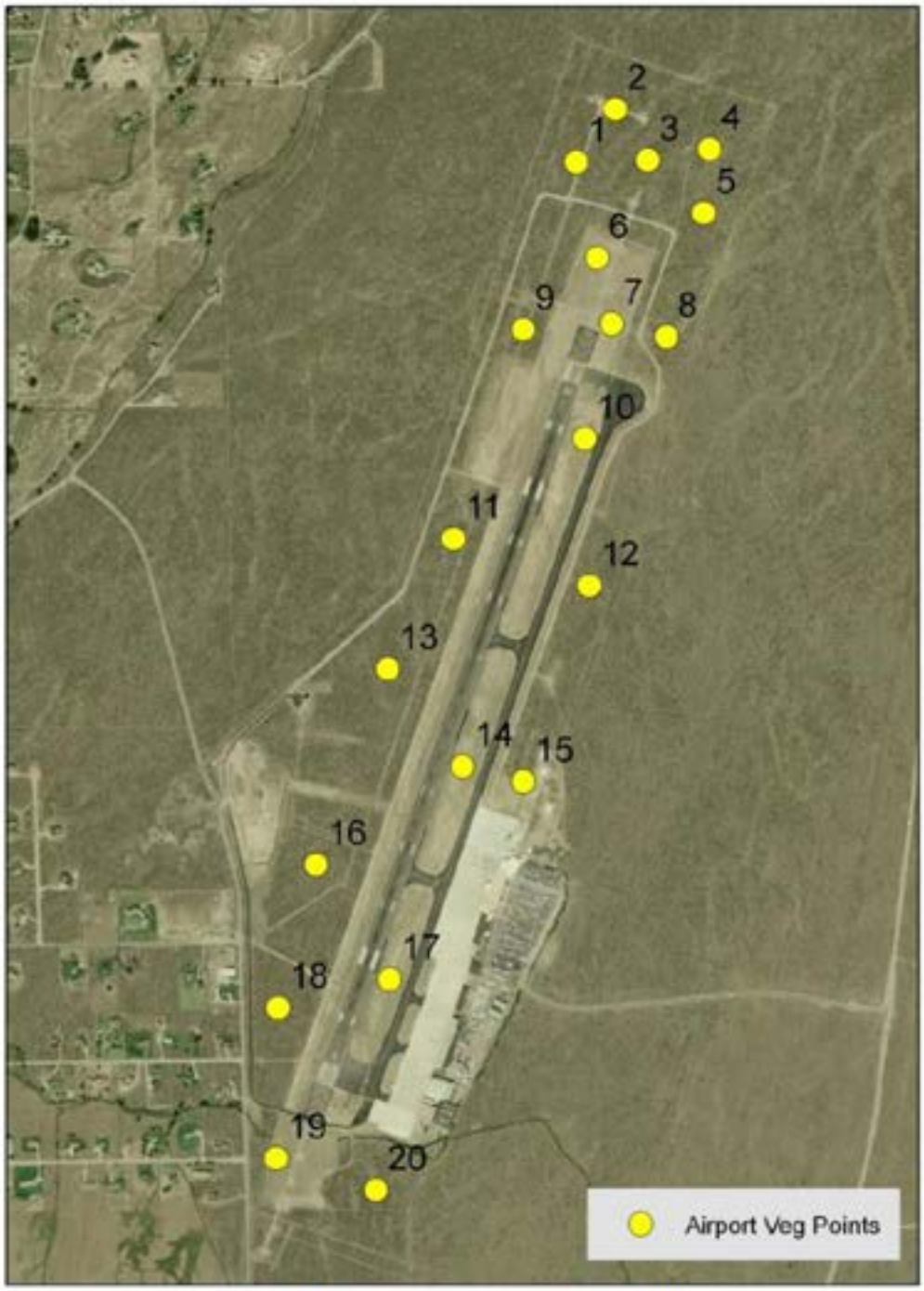

Figure 12. Locations of vegetation plots in the JHA.

Table 3. UTM (Nad 27) coordinates of vegetation plots measured in the JHA.

Plot Number	Longitude	Latitude
1	521540	4829497
2	521639	4829630
3	521720	4829502
4	521876	4829530
5	521862	4829369
6	521593	4829256
7	521630	2829090
8	521767	4829057
9	521407	4829076
10	521563	4828801
11	521232	4828550
12	521573	4828432
13	521066	4828223
14	521255	4827977
15	521407	4827939
16	520886	4827730
17	521071	4827441
18	520791	4827370
19	520786	4826991
20	521037	4826911

Table 4. Understory differences between sage and over-run plots.

	Sage Plots (SD)	Overrun Plots (SD)	P	T	df
Total Herbaceous Cover (%)	38.2 (12.8)	24.9 (10.2)	**0.0240**	-2.52	15
Total Grass Cover (%)	25.8 (11.8)	12.4 (8.4)	**0.0097**	-2.94	16
Live Grass (%)	67.2 (13.0)	89.3 (5.4)	**0.0001**	5.34	17
Total Forb Cover (%)	12.3 (6.5)	13.1 (5.4)	0.7900	0.28	14
Total Litter	18.7 (9.2)	8.4 (3.3)	**0.0026**	-3.56	16
Total Bare Ground (%)	27.2 (13.1)	54.2 (15.8)	**0.0031**	3.88	10
Forb Diversity	2.2 (0.8)	1.5 (0.2)	**0.0095**	-2.97	15

Table 5. Raw data and summary statistics for sage plots in the JIRA.

Plot	Total Shrub Canopy Cover	Avg Live Shrub Height	Total Live Shrub Cover	Total Dead Shrub Cover	Avg Live Sage Height	Live Sage Cover	Dead Sage Cover	Live Bitterbrush Cover	Dead Bitterbrush Cover
1	40.42	55.31	38.3333	2.0833	58.0	29.8	2.1	8.6	0.0
2	19.23	49.00	16.8500	2.3833	50.2	11.7	1.6	5.2	0.8
3	34.97	50.42	31.9500	3.0167	53.5	22.0	3.0	10.0	0.0
4	46.00	60.94	43.4167	2.5833	65.1	23.7	2.0	19.8	0.6
8	25.50	53.00	23.5500	1.9500	51.8	15.2	1.2	8.4	0.8
9	35.02	53.72	32.6667	2.3500	52.5	29.0	2.4	3.2	0.0
12	31.13	52.29	28.7000	2.4333	53.2	22.2	1.4	6.5	1.0
13	24.48	57.28	21.9667	2.5167	57.4	17.3	2.5	4.7	0.0
16	38.50	64.31	35.1167	3.3833	64.6	18.9	3.4	17.4	0.0
18	41.62	64.75	37.2000	4.4167	64.3	21.2	1.0	16.1	3.4
20	38.33	50.07	32.0000	6.3333	49.4	20.2	4.6	11.8	1.7
Mean	**34.11**	**55.5541911**	**31.0682**	**3.0409**	**56.4**	**21.00**	**2.29**	**10.13**	**0.75**
SD	**8.20**	**5.60**	**7.81**	**1.29**	**5.92**	**5.39**	**1.07**	**5.52**	**1.04**

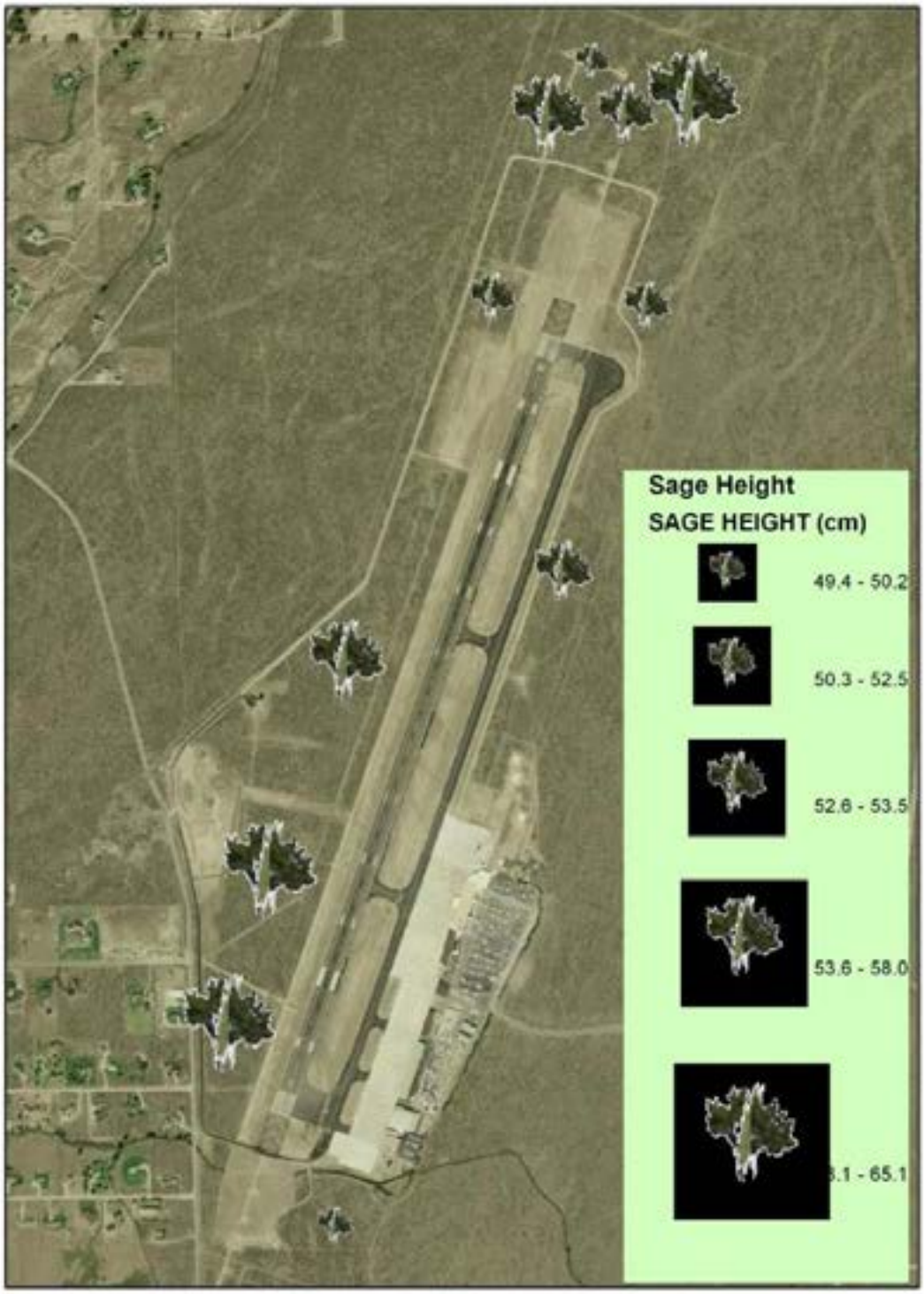

Figure 13. Visual representation of sage height measured at vegetation plots within the JHA.

Table 6. Forbs found at vegetation plots within the JHA and the food value for differing age classes of sage-grouse.

Scientific Name	Common Name	Sage Plots	Non-Sage Plots	Food Value*
Agoseris glauca	False Dandelion	X		b
Allamanda cathartica	Yellow Bell	X		c
Antennaria spp.	Pussytoes	X		a
Balsamorhiza sagittata	Arrowleaf Balsamroot	X		c
Castilleja thompsonii	Thompsons Paintbrush	X		
Comandra umbellata	Bastard Toadflax	X		
Crepis spp.	Hawksbeard	X		b
Delphinium spp.	Larkspur	X		
Erigeron spp.	Fleabane	X		b
Eriophyllum lanatum	Wooly Sunflower	X		b
Geranium viscosissimum	Sticky Geranium	X		
Lewisia pygmaea	Alpine Lewisia	X		
Lithophragma parvifolia	Woodland Star	X		c
Phlox longfolia	long leaf phlox	X		
Sedum spp.	Stonecrop	X		a
Senecio integerrimus	Western Groundsel	X		b
Vicia spp.	Vetch	X		b
Brassica spp.	Mustard	X	X	c
Collinsia parviflora	Maiden blue eyed Mary	X	X	c
Eriogonum umbellatum	Sulphr-flower Buckwheat	X	X	a
Hoary alyssum	hoary alyssum	X	X	
Lomatium dissectum	Desert Parsley	X	X	c
Lupinus spp.	Lupine	X	X	
Taraxicum officinale	Common Dandelion	X	X	
Asclepias spp.	Milkweed		X	b
Cerastium vulgatum	Mouseear Chickweed		X	
Matricaria perforata	Scentless Chamomile		X	b
Trifolium spp.	Clover		X	b

*a = adult food, b = adult/juvenile food, c = juvenile food

Table 7. Density (avg. plants/sq. m) of adult edible forbs* and cover forbs, bold equals significant difference.

	Edible Forbs (SD)	Cover Forbs (SD)	
Sage Plots	4.03 (0.91)	4.03 (0.84)	P = 1.0, T = 0.0
Non-Sage Plots	2.78 (1.00)	1.64 (0.46)	P = 0.33, T = -1.04
	P = 0.37, T = -0.93	**P = 0.022**, T = -2.51	

* based on Holloran 1999

Table 8. Density (avg. plants/sq. m) of edible forbs for all age classes* and cover forbs, bold equals significant differences.

	Edible Forbs	Cover Forbs	
Sage Plots	5.32 (1.08)	2.53 (0.52)	**P = 0.032, T = 2.33**
Non-Sage Plots	1.83 (0.59)	1.24 (0.34)	P = 0.41, T = 0.87
	P = 0.011, T = 2.85	P = 0.54, T = 2.07	

* based on Huwer 2004

Table 9. Vegetation characteristics at sage grouse nest sites* and the JHA vegetation plots.

Variable	Used Nest Sites (SD)	Airport Sage Plots (SD)	P	T	df
Sage Density	1.19 (.10)	1.03 (0.08)	0.24	1.21	22
Total Shrub Canopy Cover	37.4 (3.0)	34.1 (2.5)	0.42	0.83	22
Live Sage Canopy Cover	18.64 (2.6)	21.02 (1.6)	0.45	-0.78	20
Dead Sage Canopy Cover	3.75 (0.5)	2.29 (0.3)	**0.026**	2.4	20
Avg. Sage Height	58.7 (3.8)	56.4 (1.8)	0.57	0.57	18
Total Herbaceous Cover	37.6 (4.1)	38.2 (12.8)	0.91	-0.11	24
Total Forb Cover	9.87 (1.4)	12.33(1.8)	0.29	-1.08	23
Bare Ground Cover	2.86 (2.1)	27.2 (3.6)	**<0.001**	-5.8	19
Forb Diversity	1.85 (0.2)	2.19 (.22)	0.29	-1.08	24

*Holloran and Anderson (2004). Nests around BTB only

DISCUSSION

The sage-grouse lekking at the Jackson Hole airport is an anomaly to typical sage-grouse behavior. Virtually all other studies of disturbance at sage-grouse leks have found significant effects of noise, habitat alterations, and traffic on lek attendance and perseverance (e.g., Lyon and Anderson 2003, Aldridge 2005, Holloran et al. 2005, Walker et al. 2007). The lek at the Jackson Hole Airport has persisted since at least 1946 (Patterson 1952) despite frequent and substantial disturbances. However, considerable changes have taken place in the number of sage grouse utilizing this lek from former times. Patterson (1952) recorded as many as 73 males displaying in the late 1940's. In 2009, we had a maximum of 10 males recorded, which was the lowest recorded number of males on this lek in the past 50 years.

We found no one predominate factor that helps explain why sage grouse are using the airport as a lekking site. There are no major vegetative advantages to the over-run section of the airport for forage or predator deterrence. There is no difference in the immediate nesting habitat within the Jackson Hole Airport as compared to surrounding areas. Interestingly, what most would consider the biggest disadvantage of lekking at the JHA airport (disturbances) does not appear to significantly affect grouse behavior or mating. We found that major disturbances, such as vehicles driving through the lek and major commercial airplanes taking off <200 m away, had no effect on the sage grouse strutting behavior. Even further, the placement of a large (ca. 5m x 5m) flashing "X" with a running gas powered generator in the middle of the lek had no effect on male lek attendance. Female attendance during this time period was low, but also corresponded with the natural low in attendance due to the initiation of first nesting attempts (i.e. females were incubating).

Several patterns of lek utilization became apparent that may relate to public safety at the JHA. The most obvious is a very strong avoidance of the paved section of the runway and over-run during the lekking season by all grouse. Aside from an occasional grouse quickly moving across the paved over-run, the vast majority of documented movements and locations of both males and females was on the grassy over-run section north of the runway. On almost all days, we documented that the birds attending the lek would leave in a direction away from the runway. In fact, during our observations, we never documented birds leaving towards or crossing the runway after having left. After the end of daylight savings time, we observed few instances when the grouse were still present on the lek and the first commercial flight entered or left the JHA.

One notable sage grouse behavior we documented at the JHA was the tendency for females to attend the lek after the nesting season in mid to late June. The return of females with young to the JHA corresponds both to previous causal observations and the typically time period for bird strikes involving sage grouse. It is likely the broods and juveniles that are most involved in airplane strikes. There are no instances of females attending leks after nesting, barren or with young. Based on our observations of low food forb diversity and density, the occurrence of hens on the over-run is likely not a function of food availability.

The sage habitat in the JHA can and does support successful nesting of sage grouse. The habitat quality is no different than nesting habitat outside the JHA. As part of a concurrent study we documented two successful nests within the JHA perimeter, both in the northernmost section of sagebrush. It cannot be implied that greater nest success is achieved within the JHA perimeter since both of these nesting attempts were re-nests by adult hens, which typically have very high success rates (unpubl. data).

In future years, managers may address moving the sage-grouse lek from the JHA to an alternative location that is safer both for the birds and for humans. While we have no direct evidence to suggest if such a program would be a success or failure, some data from 2009 may be relevant. In May, the JHA contracted the re-pavement of the runway and the taxiway. During this time there was a plethora of intensive disturbances to the sage-grouse lek, including vehicles on the lek, human presence on and near the lek, loud construction noises, and a generator with a bright flashing "X" in the lek center. With the exception of minor displacement of grouse to the north to avoid the "X" (ca. 50-100m), we detected no difference in lek usage or behavior of the displaying grouse. Based on these observations, it would likely be extremely difficult find a viable way to deter grouse use of this area for breeding.

The use of the JHA for a lek may be a function of historical use with a gradual increase in disturbances over the years. In the 1940's when sage grouse were first using the JHA for a lek, the runway consisted of grass and had very little traffic, especially during the twilight hours of main lek attendance. Sage-grouse exhibit very high fidelity to lek sites across years and young birds learn and continue to use these sites over time. Without a shift in habitat quality (i.e., vegetation growth), there is often little impetus for grouse to move the lek site. Over the years, small annual increases in disturbances have occurred, likely allowing the strutting grouse to become accustom to increasing levels of disturbance.

In the 1940's, a lek site was located one mile southeast of the JHA that hosted roughly the same amount of males (Patterson 1952). This area has not been used for strutting since at least 1986, when GTNP began monitoring sage-grouse leks. There is currently a large brome grass dominated section located in roughly the same spot that is currently used for roosting throughout the summer and fall (unpubl data). The height of the brome grass likely precludes the sage-grouse from currently using this area as a lek site.

In the early 1990's the population of sage grouse was near the historical high density. Lek counts in 1991 documented a total of 63 males strutting on the over-run section of the JHA. The high population counts in GTNP lasted for at least four years and during that time a new lek was beginning to be formed in the JHA, further from the runway. That lek location was abandoned in 1999 as the grouse population in the valley sharply declined and a control tower was built on that site in 2001, precluding further use of this site for lekking. For several years, we have also observed sage-grouse lekking in or near the GTNP gun range (i.e., airport pit). Based on this study, we feel that this serves only as staging area for the grouse in the early lekking season when the over-run is still snow covered, as no grouse were observed at this location after they began using the JHA.

This study was designed to help assess effects of any future changes to the JHA and the associated sage-grouse lek. Movements of the lek center, matings, territory placement, and strutting behavior can all be easily assessed with a similar study in future years. Future monitoring will be needed to assess any long-term impacts that any new or sustained disturbances have on lek attendance. We suggest monitoring of the JHA lek using the methodologies outlined in this study to accurately detect any changes to grouse behaviors and habitat suitability on a five or ten year basis, coupled with annual monitoring of lek attendance. We suggest minimizing direct disturbances to the grouse while lekking (i.e., vehicle deterrence and construction within 200 m) until long-term impacts can be scientifically assessed. With the inevitable increase in anthropogenic use of the JHA, continued monitoring of the JHA lek will be critical to ensuring its persistence.

ACKNOWLEGMENTS

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Wind River/Sweetwater River Conservation Area
Job Completion Report

Species: **Greater Sage-grouse**
Mgmt. Areas: **8, 14, 18, & WRR**
Period Covered: **June 1, 2009 – May 31, 2010**
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 in central Wyoming (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 (57% Bureau of Land Management (BLM) and Bureau of Reclamation (BOR), or tribal lands on the Wind River Reservation (WRR – 26%). Approximately 12% of known leks are found on private land with the remaining 5% found on Wyoming State Trust lands (Appendix A).

Conservation Area

The Wind River/Sweetwater River Conservation Area features the Wind River 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 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 was completed in August 2007. This plan and other Wyoming sage-grouse information is located on the WGFD website at http://gf.state.wy.us/wildlife/wildlife_management/sagegrouse/index.asp

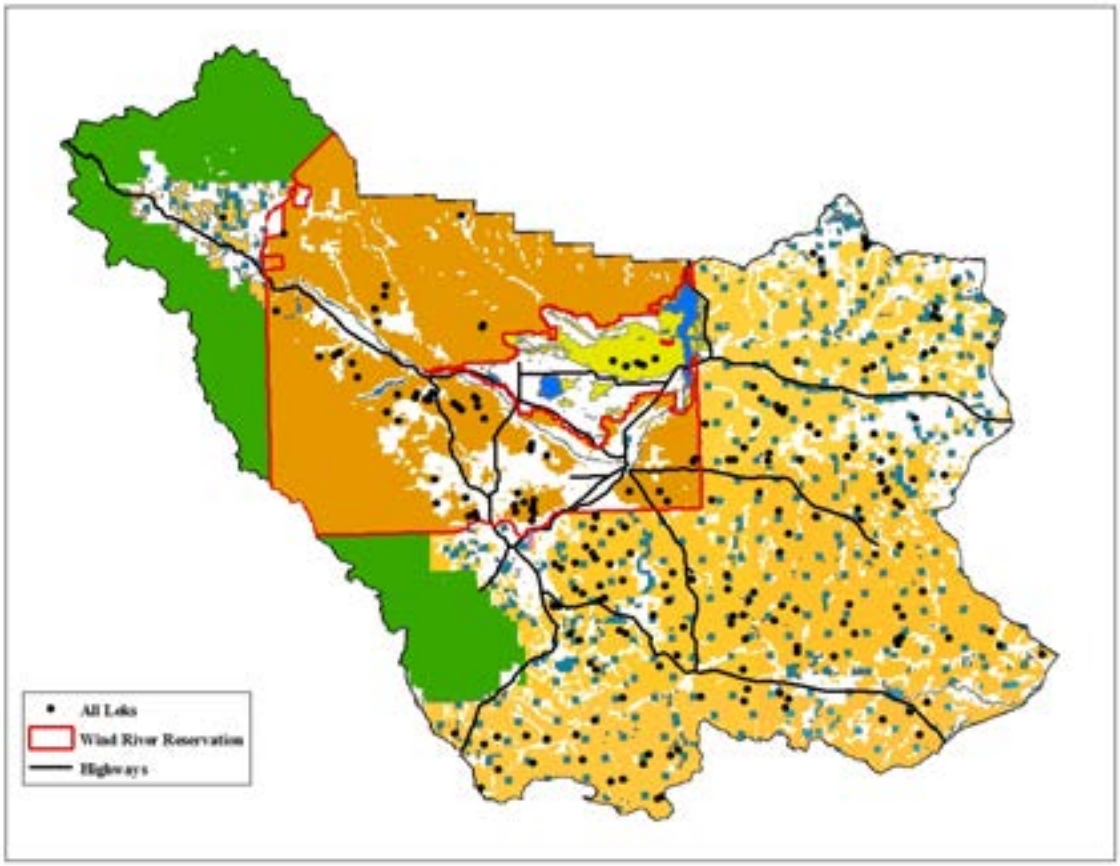

Figure 2. Land ownership within the WRSRCA (dots = leks). Source: WGFD, BLM.

The WRSRCA encompasses all of the WGFD's Small/Upland Game Management Areas 8, 14, 18, and the WRR (Figure 4). Management recommendations and conservation efforts apply to all tribal lands within the WRR in both Fremont and Hot Springs Counties. Management areas do not directly correspond to sage-grouse population boundaries, but are used for general data collection and reporting for all small and upland game species.

Wyoming Greater Sage-Grouse Core Areas

In 2008, Wyoming's Governor Dave Freudenthal issued Executive Order 2008-2, establishing "Core Areas" for greater sage-grouse in Wyoming. These core areas contain the highest densities of sage-grouse in Wyoming based on peak male attendance at leks. Stipulations developed by the Governor's Sage Grouse Implementation Team provide additional conservation measures to about 83% of the state's sage-grouse on about 25% of the land area. About 80% of the known leks in the WRSRCA are in core areas (Figure 3).

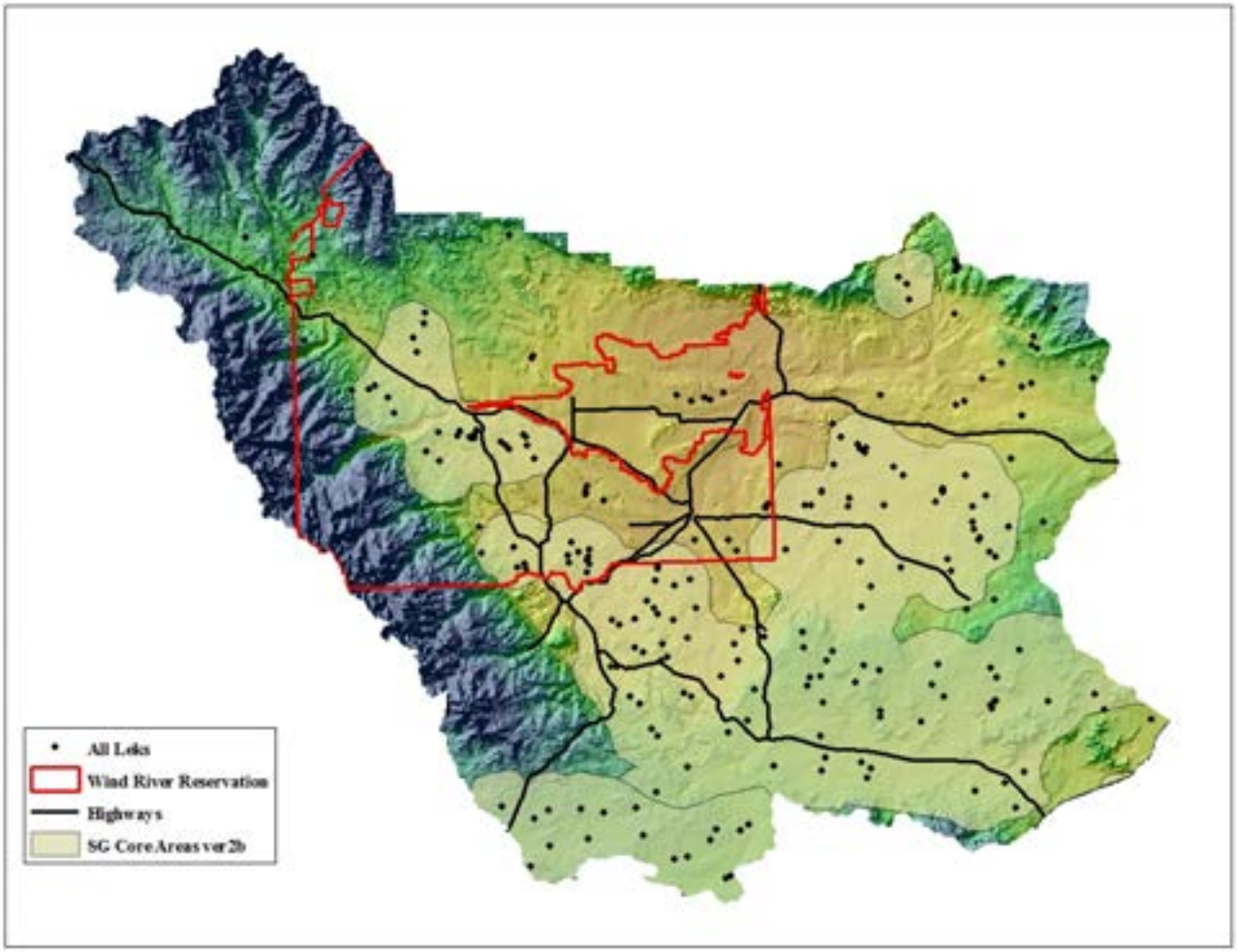

Figure 3. Wyoming Sage-Grouse Core Areas (Version 2b, 2008) within the WRSRCA (dots=leks). Source WGFD.

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. Known leks indicate sage-grouse distribution within the WRSRCA as represented in Figures 2, 3, and 4.

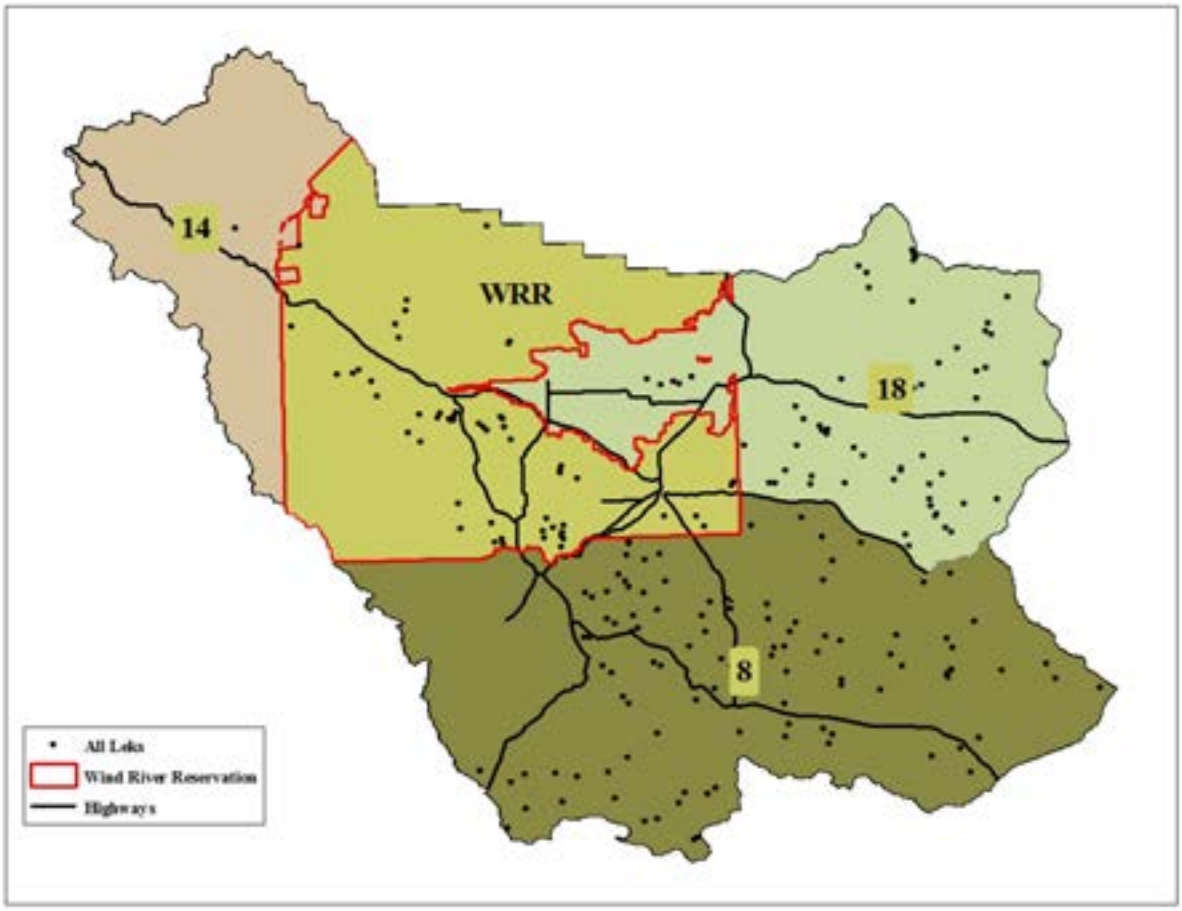

Figure 4. WGFD upland game bird management areas and known leks within the WRSRCA (dots=leks). Source WGFD.

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 6 Game Warden Districts, 4 BLM Resource Areas, 5 Wyoming counties, and WRR (Appendix A). There were 224 known occupied leks within the conservation area in 2010. 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 increased between 1995 and 2006, but has since declined. With intensified monitoring efforts since 1995, 86 new or newly discovered leks have been documented in the WRSRCA.

Of the 224 known occupied leks in the WRSRCA, 170 were checked in 2010 by WGFD, BLM, USFWS, and SATFG, assisted by several volunteers (Appendices A, B, and F). Of those checked, 55 were counted and 115 were surveyed. Of the 131 leks where status was confirmed, 120 (92%) were active and 11 (8%) were inactive. Data for 5 new leks were added in 2010. Average peak male attendance at count leks was 29.4, which is 21% lower than in 2009 (37.4) and 30.7% below the average since 2000 (42.4). Although average male attendance at leks declined across the WRSRCA, bad weather prevailed during the lek monitoring season in 2010, with deep snow and/or muddy roads limiting travel to numerous leks. These conditions may have contributed to attendance declines caused by poor monitoring conditions, whereas actual declines may have been less severe than observed.

A set of 18 leks in the Government Draw/Beaver Rim area have been continuously counted since 1995, and data trends reveal little difference between these intensive lek counts and those counted intermittently or all leks checked throughout the WRSRCA during the same time period (Figure 5).

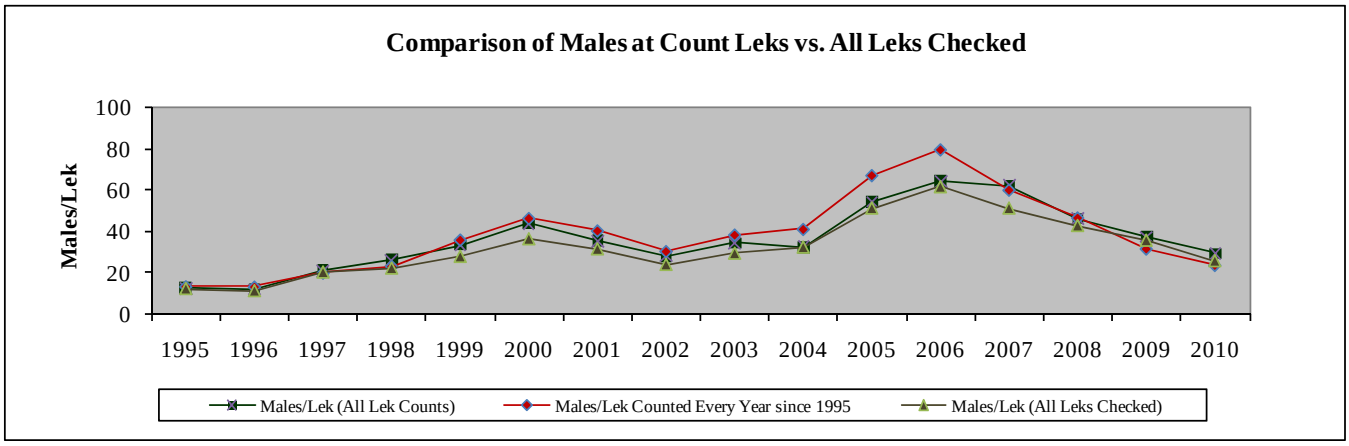

Figure 5. Male attendance trends for lek counts since 1995.

Of the 123 known complexes in the WRSRCA, 91 were checked in 2010 (Appendix C and G). Of those checked, 35 were counted and 56 surveyed. Of the 86 complexes checked where status was confirmed, 85 (98.8%) 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 2010 averaged 46.3 males, 58% below that observed at the peak of male attendance in 2006 (109.9 males) and 31% below the average since 2000 (67.4 males). Because the number of complexes counted has varied and designations of several complexes changed over the past decade, direct comparisons from year to year should be made with caution.

Lek Perimeter Mapping

With increased interest in developing Wyoming's energy resources, emphasis has arisen to map all known sage grouse leks, complete with perimeters outlining the extent of strutting activity on each lek. As of 2010, 132 lek perimeters were mapped in the WRSRCA. Distance and timing stipulations for developments are applied to the perimeter of each mapped lek, rather than a centralized point. This is a significant difference for many large leks with some total lek areas reaching up to 100 acres or larger.

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 counts and surveys have been conducted within the WRSRCA since the early 1960s. Beginning in 1995, lek monitoring intensified, and the number of "count" leks increased markedly; with 55 leks being counted in 2010. Concurrent with increased monitoring effort, the number of sage-grouse (total males observed) also increased (Figure 6), but the increase was more dramatic beginning in 2004, peaking at 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 rebounded rapidly in the late 1990s and early 21st century. Since 2006, lek attendance has declined rapidly, with the average attendance in 2010 being 58% lower than in 2006. The average number of males observed/all leks checked was 25.8 in 2010, 33% below the average since 2000 (38.4).

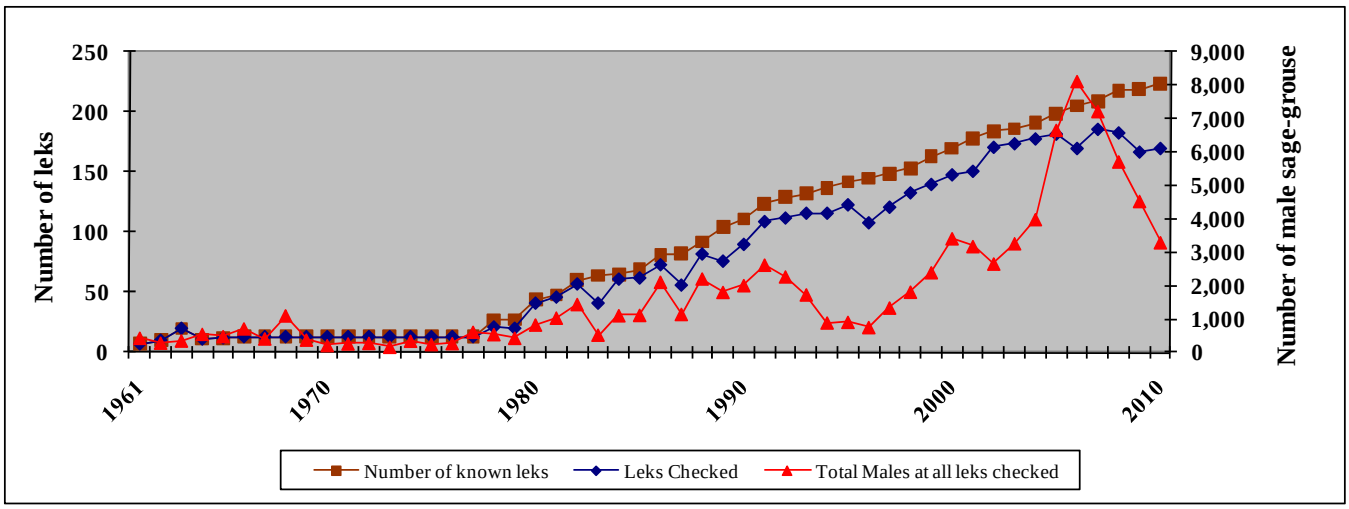

Figure 6. Lek numbers and total male attendance in WRSRCA, 1961 – 2001.

Productivity

Limited annual 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. No brood count protocol is established within the WRSRCA. Annual pronghorn classifications are conducted via ground observations and often allow personnel to observe numerous broods in August.

Where available, harvest wing data provide a more reliable indicator of recruitment than do brood data. Several wing barrels placed annually along major hunting area exit roads in Upland Game Bird Management Area 8 have typically provided significant wing data, due to a relatively high number of sage-grouse hunters. Table 1 indicates wing data from hunter harvested birds during the 2009 hunting season yielded an average brood size of 1.3 chicks per hen, suggesting meager chick survival, (sample size shown includes chicks and hens only).

Table 1. Brood data from harvest wing barrels for Upland Bird Management Area 8, 2000 - 2009.

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Chicks/Hen	1.1	2.3	1.3	1.8	5	1.7	1.3	1.3	1.4	1.3
Sample Size	595	467	227	236	369	633	366	397	538	598

Hunting Season and Harvest

In 2009, the sage grouse hunting season increased in length by 1 day (Sept. 19 – 30). Harvest did not increase appreciably, in part due to a mid-week closing date. Likewise, hunter effort (days/bird) and birds/hunter statistics did not change noticeably, and have generally followed numbers of grouse and hunters since 2000 (Figure 8 and Appendix E).

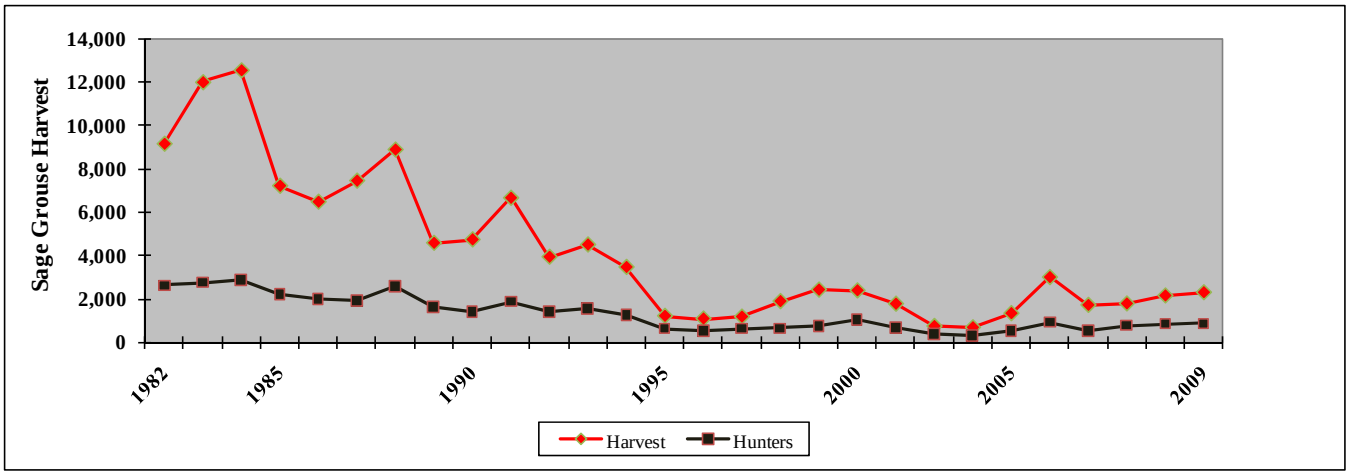

Figure 7. Total hunters and total sage-grouse harvested within the WRSRCA, 1982 – 2009.

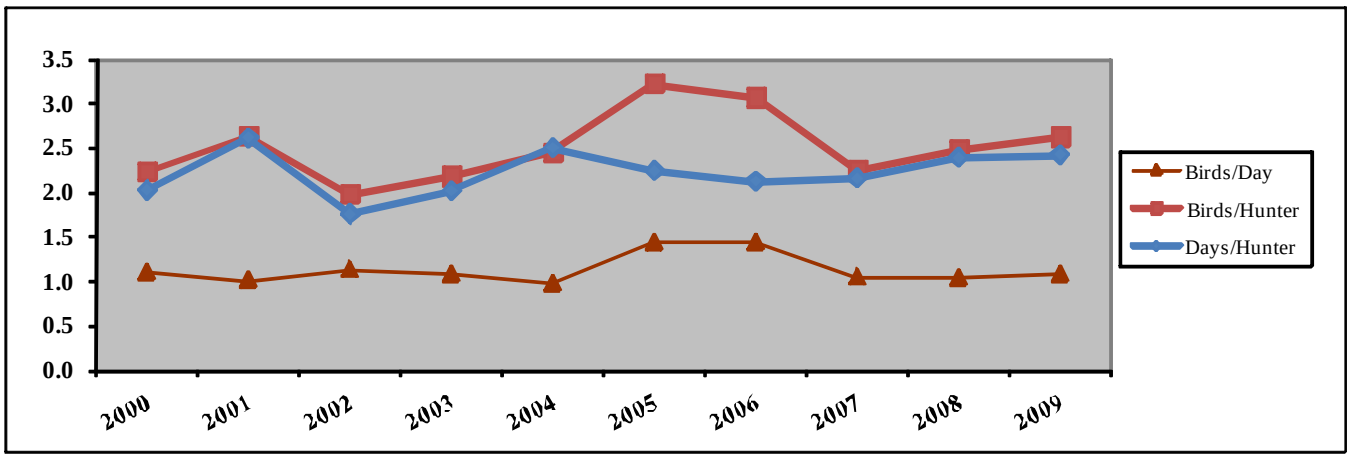

Figure 8. Hunter effort statistics for the WRSRCA from 1998 – 2009.

Weather

Generally favorable weather in 2004 and 2005 led to better habitat conditions and increased grouse numbers, validated by peak male lek attendance in 2006. However, spring and summer precipitation in 2006 was well below normal, which diminished habitat conditions 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. Spring precipitation improved substantially in 2008, with Lander and Riverton receiving precipitation 22% and 26% above normal, respectively. However, this improvement in precipitation did little to improve chick survival, as demonstrated by the ratio of 1.3 chicks/hen observed in the wing barrel data for fall 2009. Lek attendance also declined in most of the WRSRCA in 2010, confirming poor chick recruitment in 2009, which was most likely due to cool, heavy rains and snow in the nesting and early brood rearing period.

Habitat

Sage-grouse habitat quality has been affected by long-term drought throughout the WRSRCA. Disturbance (i.e., localized energy development, 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. In an effort to improve conditions 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 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*) tagged plants along each transect are measured in fall. Five measurements of current annual leader growth are recorded randomly on each tagged plant. Assessments of age and hedge class are also recorded for each plant. In 2009, sagebrush averaged 8.8 mm of new growth at the Moneta transect and 32.4 mm at the Yellowstone Ridge transect (Figure 9). In 2008, sagebrush production transects were established in Government Draw near Hudson, where mechanical sagebrush treatments of mowing and Lawson aerator were applied in February 2006. In 2009, after 3 years of regeneration in the treated sites, sagebrush leader growth was markedly greater in the mowed sites (33.9 mm) and aerated sites (41.3 mm), compared to the untreated control transect (30.6 mm), as well as the Yellowstone Ridge transect, which had nearly identical growth.

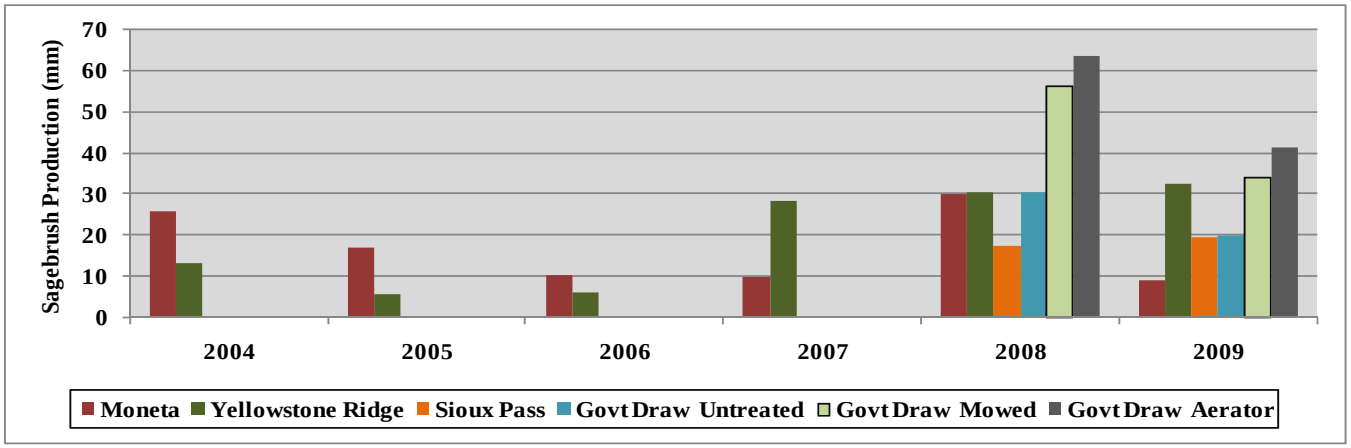

Figure 9. Sagebrush production at several transects in the WRSRCA, 2004 – 2009.

Big game winter ranges were monitored on WRR in 2008, and showed “normal” forage production, ranging from 430 to 698 pounds per acre and averaging 536 pounds per acre. This was 116% greater than the same 8 sites in 2007. Based on the NRCS range site guide, these sites should average 600 to 800 pounds of grasses and forbs per acre in a normal year. The forage available for wintering big game (that is, forage left by grazers and found outside exclosure cages) ranged from 277 to 744 pounds per acre and averaged 442 pounds per acre. Heavy May rains promoted forage growth and carried the area through extreme summer and fall drought. According to the Modified Palmer Drought Severity Index the Wind River Basin experienced 3 consecutive years of “severe” or "extreme" drought between 2000 and 2002, followed by “mild” drought in 2003, no drought in 2004 or 2005,

“severe” drought in 2006, “extreme” drought in 2007 and “slight dryness” in 2008. Forage production has fluctuated widely since 2000 due to swings in precipitation levels. While these sites were monitored with respect to big game winter forage, the results indicated that improved herbaceous cover likely provided better sage-grouse nesting habitat than during previous drought periods.

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 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. were completed by hand, and later were digitized into GIS layers. In all, 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.

In 2007, WGFD, Rocky Mountain Elk Foundation, Mule Deer Foundation, and The Nature Conservancy completed transactions with several property owners northwest of Lander to acquire conservation easements to 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.

Winter Habitat Survey

A series of fixed wing flights were conducted in late February 2008 to search for wintering sage-grouse flocks. A total of over 1,500 birds were observed in 3 days of flying. Most of the groups were scattered in areas with snow cover ranging from 30% to 100%. Two notable groupings were found. One of which had 5 groups of birds within 1 mile of each other totaling 245 (about 8 miles northeast of Jeffrey City). They were in the transition area between 100% snow cover and almost no snow. A less concentrated group had 205 birds on a single line (8 miles from one end to the other) in the area along Alkali Creek, north of Bison Basin. These birds weren't in the taller sagebrush along Alkali Creek, but were in the upland breaks within a mile or 2. Overall, 336 birds were found south of the Sweetwater River and north of Cyclone Rim, even though the snow cover was nearly 100% in most of the area, with almost no sagebrush showing above the snow. Detailed locations are recorded in the Wildlife Observation System database maintained by Wyoming Game & Fish Department. Several groups were gathered near leks, but several others were away from known leks. Since this survey was conducted just before breeding season, we plan to continue searching some of the more plausible areas for potential new leks.

Government Draw Habitat Improvement Project

The Government Draw 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, resulting 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 should consider grass, forb, and sagebrush recruitment goals and prevention of cheatgrass (*Bromus tectorum*) establishment and/or expansion. Initial results from the limited amount of burned areas indicate prescribed fire should not be considered as a high priority treatment in this habitat type.

The first 2 phases of mechanical sagebrush treatments have been completed. This pilot project is experimental in nature, and is designed to enhance herbaceous vegetation with the objective of increasing early brood-rearing habitat. Mechanical treatments were employed and included using a mower on 1,250 acres and Lawson pasture aerator on about 75 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. Treatment areas were deferred from livestock grazing for the first growing season. Initial monitoring indicated an increase in hawksbeard *(Crepis spp.)*, a forb utilized by sage-grouse, in the aerated treatment zone. Grasses appear to be increasing in vigor, but it is uncertain if cover has increased as yet. Dry summers have most likely minimized seedling establishment. 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 4-6 inches of new leader growth in the first year following treatment. In 2006, several sagebrush plants in the treatment zones produced seed stalks, which were not observed in virtually any of the untreated sites.

With measurable vegetation response observed following the first 2 phases of treatments, potential exists for expansion for several additional years. Several thousand acres of important sage-grouse habitat within the South Hudson area could benefit from these 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.

Habitat Improvement Projects on Wind River Reservation

Three habitat treatments were implemented on the Wind River Reservation in fall 2007 and spring 2008. Table 2 provides a projects summary of these treatments.

Project area	Type of Treatment	Completed	Acres treated	Acres in project boundary	Focus Area	UTME	UTMN	Zone
Mountain Meadows	Mow	Sept 2007	301	625	Owl Creek Front	635500	4827300	12
Spring Creek	Mow	Oct 2007	124	370	Wind River Front	641300	4788900	12
Argo Butte	Prescribed burn	Spring 2008	65	300	Wind River Front	668800	4783500	12

Table 2. Habitat improvement projects conducted on Wind River Reservation in 2007 and 2008.

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. Results from 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 with the University of Wyoming Cooperative Fishery and Wildlife Research Unit from 2003 through 2006. Results for this project were published in the 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.

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 WRR initiated a radio telemetry study by capturing 31 grouse in April 2006 (10 adult females, 10 adult males, 4 yearling females and 7 yearling males) from 3 different leks: Mule Butte North, Sharpnose and Willow Creek. In early April 2007, 5 additional grouse (2 adult females and 3 adult males) were captured from the Sharpnose Southeast lek. The intent of the study was to provide baseline information on movements, seasonal ranges, and survival that will assist in managing the sage-grouse population at sustainable levels.

A total of 476 relocations were made between early April 2006 and the end of May 2008. Males moved further than females averaging 11.2 miles (sd = 6.4 miles) from lek of capture to the furthest location compared to 4.9 miles (sd = 2.3 miles). Greatest distance moved from lek of capture was 25.2 miles by a male grouse. Migration from winter/spring range to summer/fall range followed 2 patterns. One pattern involved movement from low elevation winter/spring range to higher elevation summer/fall range in the foothills of the Wind River Mountains. This summer/fall range consisted primarily of moister sites of mountain sagebrush with a native forb and grass understory. These sites remained greener longer than winter/spring range. One male grouse was documented at 10,060 feet utilizing alpine habitat. The second migration pattern to summer/fall range involved shorter movements to fields of irrigated alfalfa bordered or interspersed with sagebrush habitat. The second pattern did not have significant elevation change. Each pattern was comprised of nearly the same number of males and females and survival did not differ.

Average annual survival from early April 2006 to the end of May 2008 for all grouse was 38%. This is on the low end of survival as compared to other studies. Counts of males on leks from which grouse were captured declined

by 64% during the 2 years of this study. Adult females had the highest survival at 52% while yearling females had the lowest survival at 16%. There were marked differences in survival when comparing by lek of capture. When considering adults survival by lek of capture, Sharpnose had 61%, Willow Creek Bench had 51%, Sharpnose Southeast had 34% and Mule Butte had 19%. The composition of adults and males to females was very similar between leks. Superficially, quality of habitat does not appear to differ between the Sharpnose leks and Mule Butte.

For mortalities, 93% (25 of 27) occurred between March 1 and September 15, with peaks in May and July. These peaks were related to predation and West Nile virus (WNv). No mortalities occurred during the fall and only 2 occurred during winter. Causes of mortality were 3 (11%) by raptor predation, 4 (15%) by mammalian predation, 3 (11%) by unknown predator, 3 (11%) by WNv and 14 (52%) that were unknown. Of the unknown, 5 (19%) were "possible" mortalities related to WNv based on evaluation of bird remains, and death in mid-summer, at lower elevation and near standing water. Of the 13 mortalities for which mortalities were determined, 77% were from predation and 23% were from WNv. Determining cause of death due to WNv is problematic and true loss is likely underestimated (Naugle *et al.* 2005). Birds that die are quickly scavenged, thus confounding one's ability to determine cause of death.

Conservation planning for greater sage-grouse at the landscape scale – Hayden-Wing Associates

This project was initiated in spring 2008 near Lysite, to quantify relationships among sage-grouse, energy development, and habitat, and to use this information in developing data-driven maps of critical seasonal habitat at the landscape scale. Landscape-scale resource use metrics will be collected based on GPS location data. These data will be used to build and validate resource selection models. Thirty sage-grouse (20 females, 10 males) were trapped and outfitted with GPS solar powered transmitters to monitor movements and habitat utilization. Project objectives follow, and a 2008 project update contains a more detailed account of project status.

Objectives:

- Generate science-based information on selection/avoidance of resources in all life-history phases including where and when sage-grouse use important areas.
- Generate high-resolution data-driven maps depicting critical seasonal habitat such as nesting, brood rearing, and wintering at the largest geographic extent possible.

Vocal and anatomical evidence for two-voiced sound production in the greater sage-grouse Centrocercus urophasianus – Krakauer, et al

Greater sage-grouse, Centrocercus urophasianus, have been a model system in studies of sexual selection and lek evolution. Mate choice in this species depends on acoustic displays during courtship, yet we know little about how males produce these sounds. Here we present evidence for previously undescribed two-voiced sound production in the sage-grouse. We detected this 'double whistle' (DW) using multi-channel audio recordings combined with video recordings of male behavior. Of 28 males examined, all males produced at least one DW during observation; variation in DW production did not correlate with observed male mating success. We examined recordings from six additional populations throughout the species' range and found evidence of DW in all six populations, suggesting that the DW is widespread. To examine the possible mechanism of DW production, we dissected two male and female sage-grouse; the syrinx in both sexes differed noticeably from that of the domestic fowl, and notably had two sound sources where the bronchi join the syrinx. Additionally, we found males possess a region of pliable rings at the base of the trachea, as well as a prominent syringeal muscle that is much reduced or absent in females. Experiments with a live phonating bird will be necessary to determine how the syrinx functions to produce the whistle, and whether the DW might be the result of biphonation of a single sound source. We conclude that undiscovered morphological and behavioral complexity may exist even within well-studied species, and that integrative research approaches may aid in the understanding of this type of complexity.

Tactical allocation of effort among multiple signals in sage grouse: an experiment with a robotic female – Patricelli and Krakauer

Males in many species have complex, multicomponent sexual signals, and there may be trade-offs between different signal components. By adjusting their signaling behaviors, males may be able to produce more attractive courtship displays in the face of these trade-offs, but this possibility has rarely been tested. In this study, we examined adaptive adjustment of display behaviors during courtship in a lek-breeding bird, the greater sage grouse (Centrocercus urophasianus). We measured the potential trade-off between display quantity (display rate) and quality (a temporal feature of displays) in a wild population of sage grouse using controlled approaches of a robotic female to experimentally induce changes in male display rate. We found that males who are more successful in mating can increase quantity without a decline in quality, with only unsuccessful males expressing an apparent trade-off. Male mating success was also positively correlated with responsiveness to changes in receiver distance, suggesting that successful males may avoid a trade-off by tactically adjusting their display rate—saving energy by displaying at low levels when females are farther away and at higher levels as females approach. Alternative explanations for this differential response to female proximity are discussed. Our results suggest that to be successful, males may need both the ability to produce attractive signals and the ability to effectively allocate their display effort by responding to female behaviors.

Diseases

In 2009, Wyoming's human cases of West Nile Virus (WNV) declined significantly, and no sage grouse cases are known to have occurred in the WRSRCA.

Management Recommendations

1. Incorporate recommendations outlined in Wyoming Governor's Executive Orders and associated "Stipulations for Development in Core Sage-Grouse Population Areas".

2. Implement the Wind River/Sweetwater River Local Sage-Grouse Conservation Plan and work with land management agencies to incorporate recommended management practices.

3. Inventory and map sagebrush and other associated sage-grouse habitats for all seasons across the Wind River/Sweetwater River Local Conservation Area as time and funding allow.

4. Continue to collect summer brood data in conjunction with other duties.

5. Continue to collect age and sex composition of the harvest via wing collection and analyses.
6. Continue intensive lek counts in the Government Draw area south of Hudson.

7. Continue ground checks of all non-intensively monitored leks.

8. Continue to search for new or undiscovered leks in remote areas of WRSRCA.

9. Continue to cooperate with private landowners and Federal/state land managers to reduce negative impacts to crucial sage-grouse habitats.

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Appendix A. Sage-grouse lek characteristics within the WRSRCA, 2010.

Category	Number of Leks	Percent of Category
WGFD Region		
Lander	230	100
Classification		
Occupied	224	97.4
Unoccupied	6	2.6
Unoccupied Leks		
Abandoned	6	
Biologist District		
Wind River Reservation	60	26.1
North Lander	70	30.4
South Lander	100	43.5
County		
Carbon	1	0.4
Fremont	206	89.6
Hot Springs	6	2.6
Natrona	16	7.0
Sweetwater	1	0.4
Upland Bird Management Area		
14	1	0.4
18	61	26.5
8	108	47.0
WR	60	26.1

Category	Number of Leks	Percent of Category
Working Group		
Wind River/Sweetwater River	230	100
BLM Office		
Casper	10	4.3
Lander	210	91.3
Rock Springs	7	3.0
Worland	3	1.3
Game Warden District		
Dubois	1	0.4
East Rawlins	3	1.3
Lander	60	26.1
North Riverton	28	12.2
South Riverton	71	30.9
West Rawlins	9	3.9
Land Status		
Bureau of Land Management	126	54.8
Bureau of Reclamation	5	2.2
Private	28	12.2
Wind River Reservation	60	26.1
State Trust Land	11	4.8

Appendix B. Lek attendance summary at occupied leks in the WRSRCA, 2001 – 2010.

a. Leks Counted

Year	Known	Counted	Percent Counted	Max Totals Males	Max Totals Females	Avg./Active Lek Males	Avg./Active Lek Females
2001	177	33	18.6	1173	570	35.5	17.3
2002	183	33	18.0	922	310	27.9	9.4
2003	185	37	20.0	1271	438	34.4	11.8
2004	190	40	21.1	1300	545	32.5	13.6
2005	199	41	20.6	2229	613	54.4	15.0
2006	205	65	31.7	4179	1392	64.3	21.4
2007	209	74	35.4	4613	979	62.3	13.2
2008	218	73	33.5	3366	865	46.1	11.8
2009	219	67	30.6	2506	548	37.4	8.2
2010	224	55	24.6	1615	535	29.4	9.7

b. Leks Surveyed

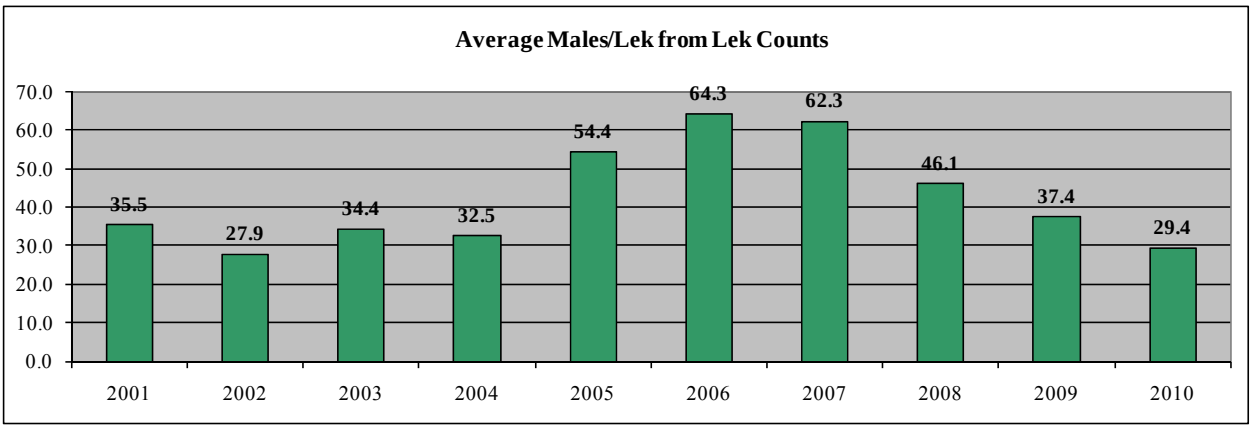
Year	Known	Surveyed	Percent Surveyed	Max Total	Avg Males/ Active Lek
2001	177	118	66.7	2009	29.5
2002	183	138	75.4	1738	22.3
2003	185	137	74.1	1997	27.0
2004	190	138	72.6	2691	32.4
2005	199	142	71.4	4438	49.3
2006	205	105	51.2	3949	58.9
2007	209	112	53.6	2621	39.1
2008	218	113	51.8	2409	38.2
2009	219	100	45.7	2029	33.8
2010	224	115	51.3	1684	23.1

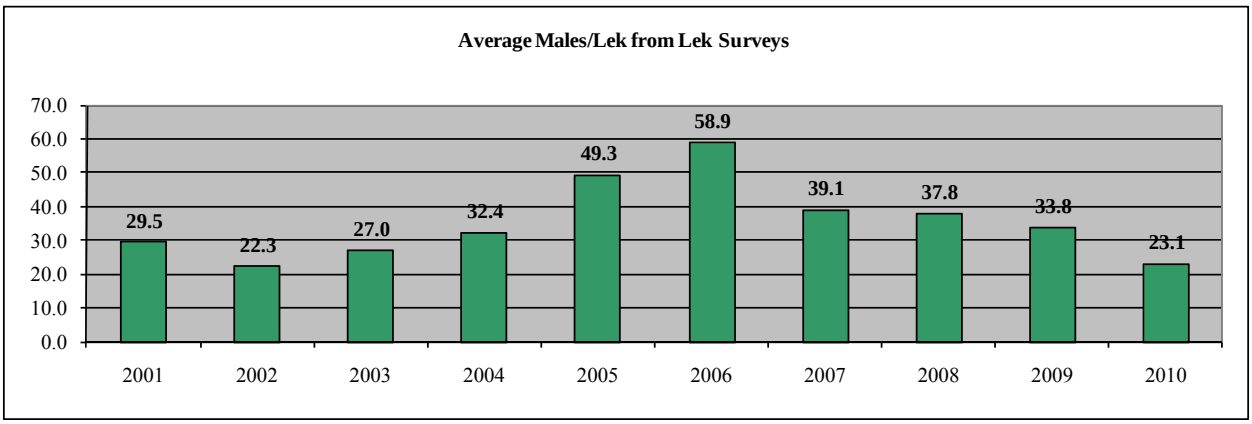
c. Leks Checked

Year	Known	Checked	Percent Checked	Max Total	Avg Males/ Active Lek
2001	177	151	85.3	3182	31.5
2002	183	171	93.4	2660	24.0
2003	185	174	94.1	3268	29.4
2004	190	178	93.7	3991	32.4
2005	199	182	91.5	6667	51.3
2006	205	170	82.9	8128	61.6
2007	209	186	89.0	7234	51.3
2008	218	183	83.9	5719	43.0
2009	219	167	76.3	4535	35.7
2010	224	170	75.9	3299	25.8

d. Lek Status

Year	Active	Inactive	Not Located	Unknown	Total	Confirmed Status Active	Confirmed Status Inactive
2001	98	8	1	70	106	92.5%	7.5%
2002	107	10	1	65	117	91.5%	8.5%
2003	109	8	1	67	117	93.2%	6.8%
2004	113	11	1	65	124	91.1%	8.9%
2005	125	8	1	65	133	94.0%	6.0%
2006	124	12	1	68	136	91.2%	8.8%
2007	135	12	1	61	147	91.8%	8.2%
2008	129	15	1	73	144	89.6%	10.4%
2009	115	16	0	88	131	87.8%	12.2%
2010	120	11	0	93	131	91.6%	8.4%


Average Males/Lek from Lek Counts
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
35.5
27.9
34.4
32.5
54.4
64.3
62.3
46.1
37.4
29.4
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010


Average Males/Lek from Lek Surveys
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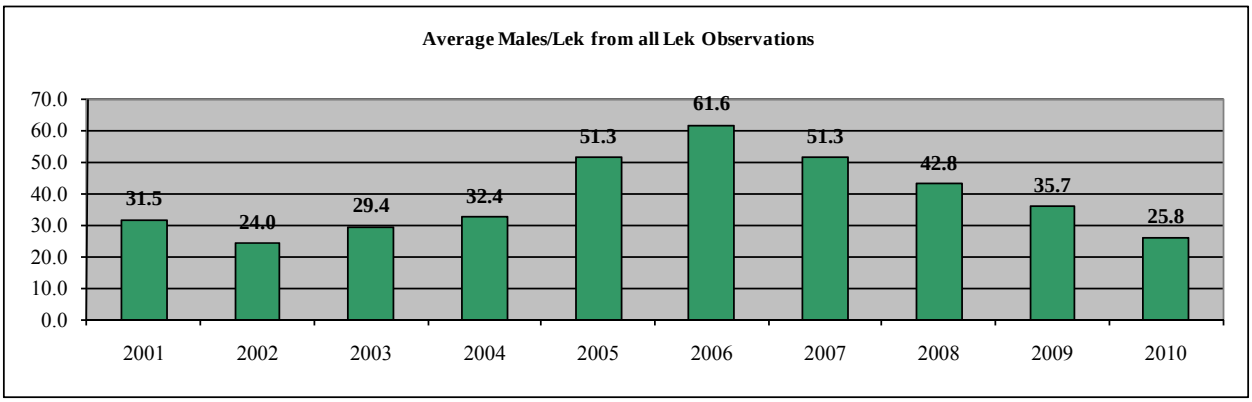
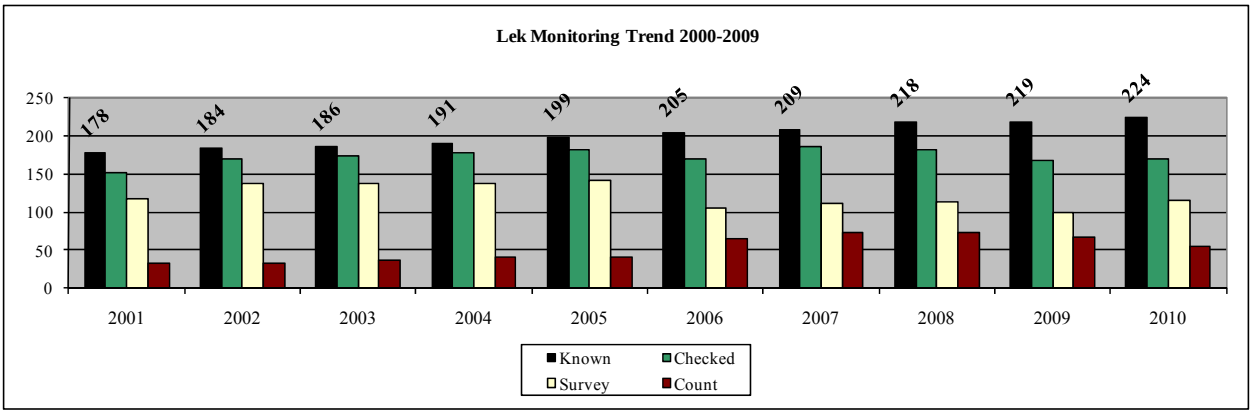
60.0
50.0
40.0
30.0
20.0
10.0
0.0
29.5
22.3
27.0
32.4
49.3
58.9
39.1
37.8
33.8
23.1
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010


Average Males/Lek from all Lek Observations
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
31.5
24.0
29.4
32.4
51.3
61.6
51.3
42.8
35.7
25.8
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010


Lek Monitoring Trend 2000-2009
250
200
150
100
50
0
178
184
186
191
199
205
209
218
219
224
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
Known
Checked
Survey
Count

Appendix C. Lek complex attendance summary of occupied leks in WRSRCA, 2001 – 2010.

a. Lek Complexes Counted

Year	Number of Complexes`	Maximum Totals Males	Maximum Totals Females	Avg./Active Males	Avg./Active Females	Number of Leks
2001	24	1157	560	48.2	23.3	40
2002	24	920	306	38.3	12.8	53
2003	25	1362	463	54.5	18.5	55
2004	25	1462	603	58.5	24.1	55
2005	25	2412	630	96.5	25.2	66
2006	39	4287	1386	109.9	35.5	77
2007	47	4673	978	99.4	20.8	106
2008	48	3296	769	68.7	16.0	103
2009	47	2540	539	54.0	11.5	94
2010	35	1619	531	46.3	15.2	79

b. Lek Complexes Surveyed

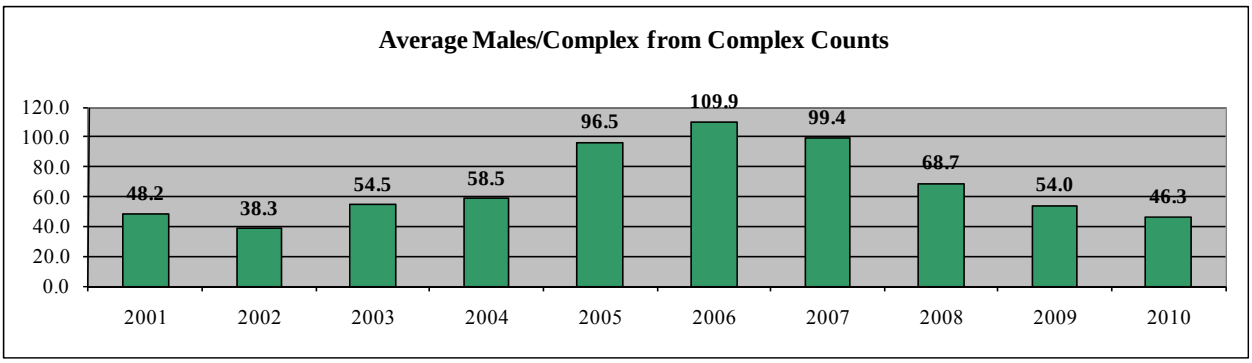
Year	Number Complexes	Max. Total Males	Avg. Males/ Active Complex	Number of Leks
2001	69	1979	37.3	126
2002	74	1644	28.3	124
2003	75	1832	32.7	124
2004	79	2457	41.0	131
2005	77	4126	67.6	123
2006	58	3436	78.1	101
2007	57	2229	47.4	94
2008	52	2078	50.7	94
2009	46	1834	44.7	89
2010	56	1462	29.2	103

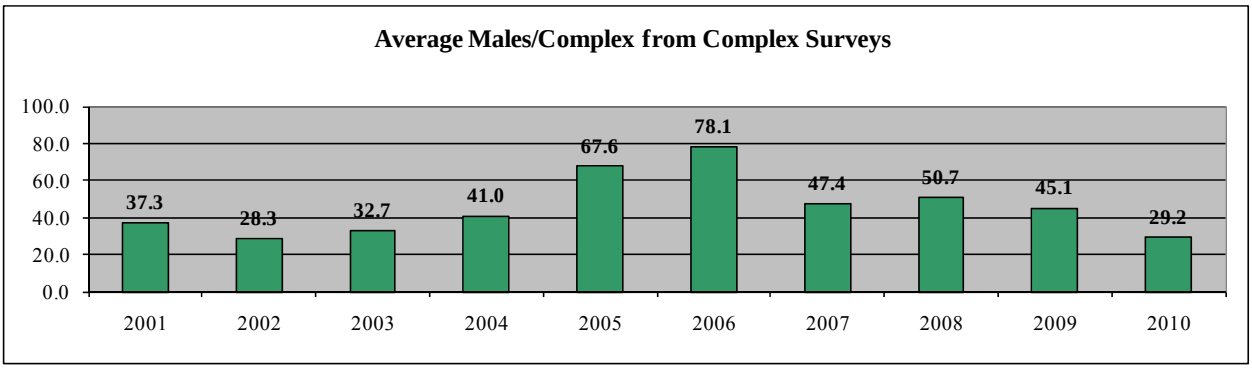
c. Lek Complexes Checked

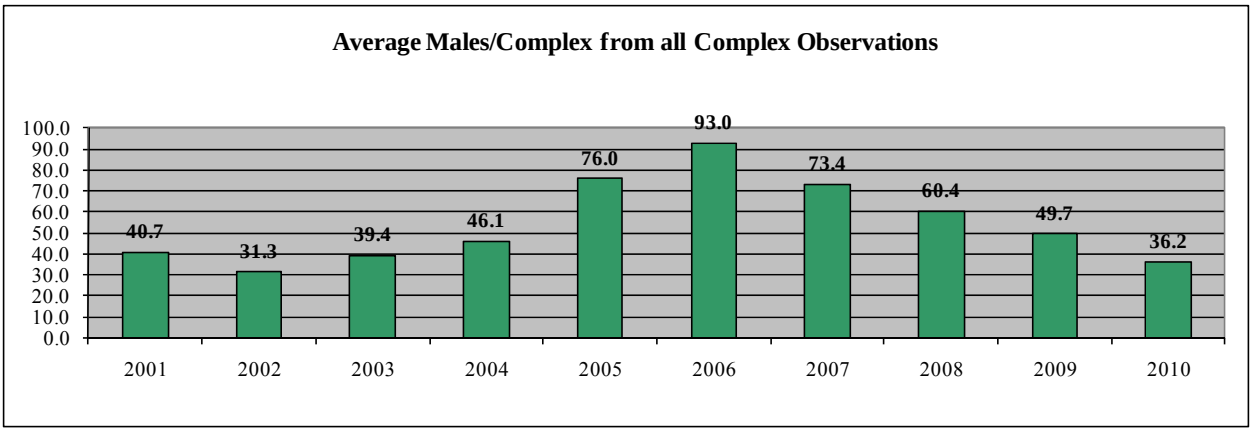
Year	Number Complexes	Max. Total Males	Avg. Males/ Active Complex	Number of Leks
2001	93	3136	40.7	166
2002	98	2564	31.3	177
2003	100	3194	39.4	179
2004	104	3919	46.1	186
2005	102	6538	76.0	189
2006	97	7723	93.0	178
2007	104	6902	73.4	200
2008	100	5374	60.4	197
2009	93	4374	49.7	183
2010	91	3081	36.2	182

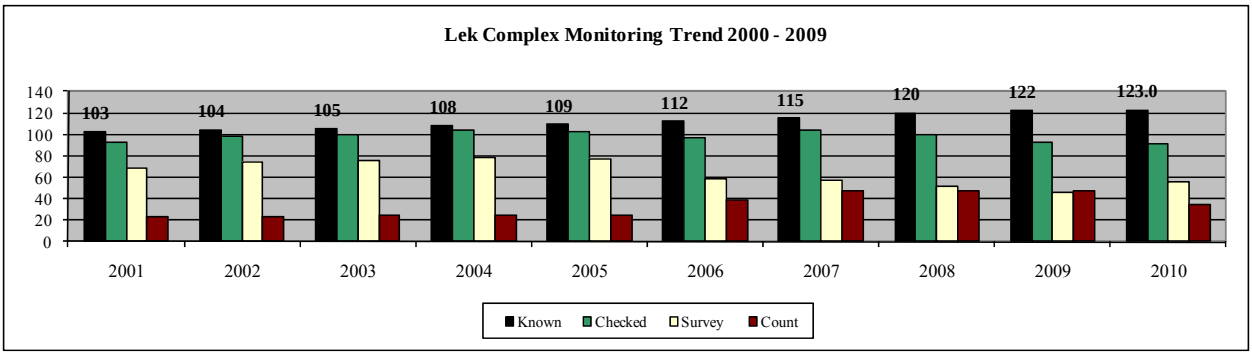
d. Lek Complex Status

Year	Number of Occupied Complexes: Active	Inactive	Unknown	Total	Known Status: Total	Active	Inactive
2001	76	3	24	103	79	96.2%	3.8%
2002	80	2	22	104	82	97.6%	2.4%
2003	82	2	21	105	84	97.6%	2.4%
2004	83	3	22	108	86	96.5%	3.5%
2005	85	1	23	109	86	98.8%	1.2%
2006	82	1	29	112	83	98.8%	1.2%
2007	96	0	19	115	96	100.0%	0.0%
2008	91	0	29	120	91	100.0%	0.0%
2009	86	2	34	122	88	97.7%	2.3%
2010	85	1	37	123	86	98.8%	1.2%


Average Males/Complex from Complex Counts
120.0
100.0
80.0
60.0
40.0
20.0
0.0
48.2
38.3
54.5
58.5
96.5
109.9
99.4
68.7
54.0
46.3
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010


Average Males/Complex from Complex Surveys
100.0
80.0
60.0
40.0
20.0
0.0
37.3
28.3
32.7
41.0
67.6
78.1
47.4
50.7
45.1
29.2
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010


Average Males/Complex from all Complex Observations
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
40.7
31.3
39.4
46.1
76.0
93.0
73.4
60.4
49.7
36.2
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010

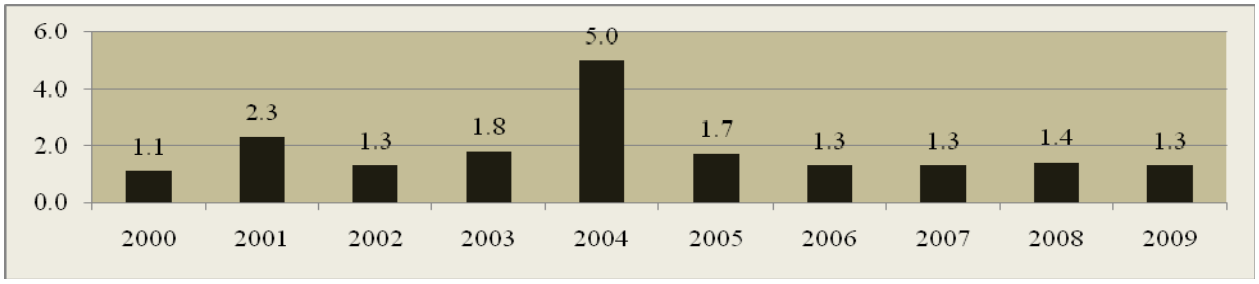

Lek Complex Monitoring Trend 2000 - 2009
140
120
100
80
60
40
20
0
103
104
105
108
109
112
115
120
122
123.0
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
Known
Checked
Survey
Count

Appendix D. Sage-grouse wing analysis for the WRSRCA, Harvest Year 2009.

Adult Males:	100	**Percent of All Wings:**	16.7%
Adult Females:	147	**Percent of All Wings:**	24.6%
Adult Unknown:	0	**Percent of All Wings:**	0.0%
Total Adults:	**248**		
Yearling Males:	41	**Percent of All Wings:**	6.9%
Yearling Females:	53	**Percent of All Wings:**	8.9%
Yearling Unknown:	0	**Percent of All Wings:**	0.0%
Total Yearlings:	**94**		
Chick Males:	88	**Percent of All Wings:**	14.7%
Chick Females:	169	**Percent of All Wings:**	28.3%
Chick Unknown:	0	**Percent of All Wings:**	0.2%
Total Chicks:	**257**		
Unknown Sex/Age	0	**Percent of All Wings:**	0.0%
Total for all Sex/Age Groups:	**598**		
Chick Males:	88	**Percent of All Chicks:**	34.2%
Yearling Males:	41	**Percent of Adult and Yearling Males:**	29.1%
Adult Males:	100	**Percent of Adult and Yearling Males:**	70.9%
Adult and Yearling Males:	141	**Percent of Adults and Yearlings:**	41.3%
Total Males:	**229**	**Percent of All Sex/Age Groups:**	38.3%
Chick Females:	169	**Percent of All Chicks:**	65.8%
Yearling Females:	53	**Percent of Adult and Yearling Females:**	26.5%
Adult Females:	147	**Percent of Adult and Yearling Females:**	73.5%
Adult and Yearling Females:	200	**Percent of Adults and Yearlings:**	58.7%
Total Females:	**369**	**Percent of All Sex/Age Groups:**	61.7%
Chicks:	257	**Percent of All Wings:**	43.0%
Yearlings:	97	**Percent of All Wings:**	15.7%
Adults:	247	**Percent of All Wings:**	41.3%
Chicks/Hen:	**1.3**		

Composition of harvest by wing analysis for WRSRCA, 2000 – 2009.

	Sample	Percent Adult		Percent Ylg		Percent Young		Chicks /Hen
Year	Size	Male	Female	Male	Female	Male	Female	
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
2007	397	23.9	29.2	1.0	3.0	17.1	25.7	1.3
2008	538	21.6	24.5	5.6	5.6	17.8	24.7	1.4
2009	598	16.7	24.6	6.9	8.9	14.7	28.3	1.3



Appendix E. Sage-grouse hunting seasons, harvest, and wing analyses (2000 – 2009).

a. Season

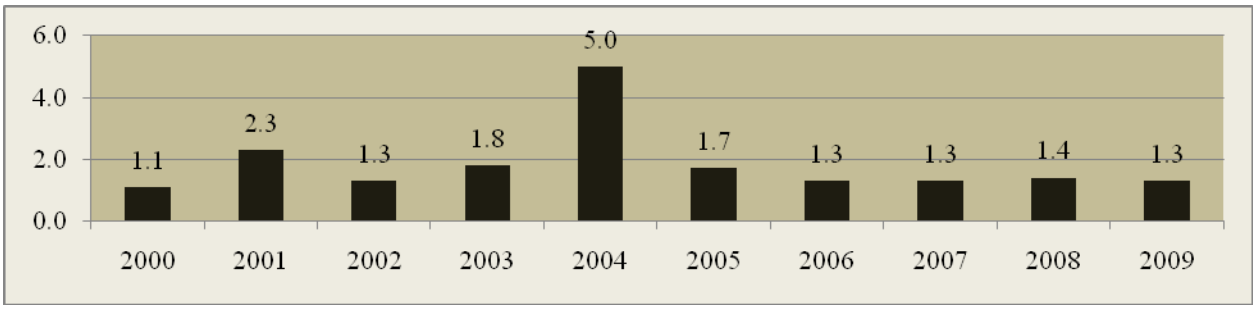
Year	Season Dates	Length	Bag/Possession Limit
2000	Sep 16-Oct 1	16	3/6
2001	Sep 22-Oct 7	16	3/6
2002	Sep 28-Oct 6	9	2/4
2003	Sep 27-Oct 5	9	2/4
2004	Sept 23-Oct 3	11	2/4
2005	Sept 23-Oct 3	11	2/4
2006	Sept 23-Oct 3	11	2/4
2007	Sept 22-Oct 2	11	2/4
2008	Sept 22-Oct 2	11	2/4
2009	Sept 19-Sept 30	12	2/4

b. Harvest

Year	Harvest	Hunters	Days	Birds/ Day	Birds/ Hunter	Days/ Hunter
1999	2,565	785	2,403	1.1	3.3	3.1
2000	2,428	1,086	2,193	1.1	2.2	2.0
2001	1,774	694	1,922	0.9	2.6	2.8
2002	733	377	655	1.1	1.9	1.7
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
2007	1,776	788	1,696	1.0	2.3	2.2
2008	2,144	863	2,059	1.0	2.5	2.4
2009	2,295	875	2,114	1.1	2.6	2.4
Avg.	1,862	712	1,670	1.1	2.6	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	
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
2007	397	23.9	29.2	1.0	3.0	17.1	25.7	1.3
2008	538	21.6	24.5	5.6	5.6	17.8	24.7	1.4
2009	598	16.7	24.6	6.9	8.9	14.7	28.3	1.3



Appendix F. Sage-grouse lek observations by complex in the WRSRCA, 2010.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Upland Bird Management Area 14									
Complex:									
Dubois	5	5	0630	Active	10	0		C Thompson	Ground
Upland Bird Management Area 18									
Complex:									
Cedar Ridge South	5	5	0620	Active	14	0		Greg Anderson	Ground
Complex: 9 Mile									
9 Mile North	4	28	0624	Unknown	0	0		Greg Anderson	Ground
9 Mile South	4	28	0630	Active	38	0		Greg Anderson	Ground
Complex: Alkali Creek									
Alkali Creek North	3	29	0730	Active	21	4		Greg Anderson	Ground
Alkali Creek North	4	27	0645	Active	14	0		Chad Olson	Ground
Alkali Creek North	4	29	0730	Active	8	0		Greg Anderson	Ground
Alkali Creek South	4	17	0620	Active	23	2		Chad Olson	Ground
Alkali Creek South	4	28	0630	Active	28	1		Logan (HW)	Ground
Alkali Creek South	4	29	0800	Active	20	0		Greg Anderson	Ground
Complex: Badwater									
Badwater Ranch - North	5	5	0655	Active	18	1		Greg Anderson	Ground
Badwater Ranch - North	5	18	0750	Active	8	4		Chad Olson	Ground
Badwater Ranch - South	5	5	0645	Unknown	0	0		Greg Anderson	Ground
Cedar Gap	5	5	0640	Active	11	0		Greg Anderson	Ground
Complex: Badwater Canyon									
Badwater Canyon	5	5	0730	Active	6	0		Greg Anderson	Ground
Complex: Bridger Trail									
Bridger Trail	4	14	0735	Active	14	1		Greg Anderson	Ground
Complex: Chalk Hills									
Chalk Hills	4	12	0719	Unknown	0	0		Greg Anderson	Ground
Complex: Conant Creek									
Conant Creek - North Twin	4	26	0625	Active	15	0		Greg Anderson	Ground
Conant Creek - South Twin	4	26	0615	Unknown	0	0		Greg Anderson	Ground
Complex: Davison Road									
Davison Road - 7 Mile	4	16	0623	Unknown	0	0		Greg Anderson	Ground
Complex: Davison Road - 12 Mile									
Davison Road - East 12	4	16	0740	Unknown	0	0		Greg Anderson	Ground
Davison Road - South 12 Mile	4	16	0658	Unknown	0	0		Greg Anderson	Ground
Falcon Nest	4	16	0718	Active	47	3		Greg Anderson	Ground
Complex: Davison Road - 8 Mile									
Davison Road - 8 Mile	4	16	0640	Active	17	0		Greg Anderson	Ground
Complex: Fuller Airstrip									
Fuller Airstrip	4	14	0645	Active	18	10		Greg Anderson	Ground
Fuller Airstrip	4	19	0605	Active	17	3		Logan (HW)	Ground
Fuller Airstrip	5	5	0745	Active	15	3		Chad Olson	Ground
Complex: Iron Horse									
Birdsfoot	4	15	0630	Active	0	0		Greg Anderson	Ground
Birdsfoot	4	17	0630	Active	0	0		Greg Anderson	Ground
Birdsfoot	4	19	0610	Active	1	0		Chad Olson	Ground
Iron Horse	4	15	0640	Active	16	7		Greg Anderson	Ground
Iron Horse	4	17	0640	Active	17	2		Greg Anderson	Ground
Iron Horse	4	19	0630	Active	16	0		Chad Olson	Ground
Iron Horse	4	28	0630	Active	17	0		Logan (HW)	Ground
Complex: Jackpot									
Jackpot	5	3	0730	Active	24	1		Carrie Dobey	Ground
Complex: Ocla Draw									
Ocla Draw	4	12	0805	Unknown	0	0		Greg Anderson	Ground
Ocla Draw	4	15	0730	Active	7	2		Greg Anderson	Ground
Complex: Pipeline									
Pipeline	3	12	0625	Active	14	0		Greg Anderson	Ground
Willow Springs Draw	4	12	0700	Unknown	0	0		Greg Anderson	Ground
Complex: Powerline									
Powerline	4	27	0550	Active	64	6		Greg Anderson	Ground

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Sand Creek Bench									
Sand Creek Bench	3	29	0645	Unknown	0	0		Greg Anderson	Ground
Sand Creek Bench	4	29	0645	Unknown	0	0		Greg Anderson	Ground
Complex: Sand Creek Ranch									
Sand Creek Ranch	3	29	0701	Unknown	0	0		Greg Anderson	Ground
Sand Creek Ranch	4	29	0701	Unknown	0	0		Greg Anderson	Ground
Complex: South Bridger Creek									
South Bridger Creek	4	14	0710	Active	1	1		Greg Anderson	Ground
South Bridger Creek	4	14	0700	Active	3	1		Greg Anderson	Ground
South Bridger Creek	4	19	0618	Active	0	0		Logan (HW)	Ground
Complex: Squaw Butte									
Squaw Butte East	4	28	0655	Active	9	0		Greg Anderson	Ground

Upland Bird Management Area 8

Complex: Agate Flats									
Agate Flats	4	11	0702	Active	32	1		Stan Harter	Ground
Agate Flats	4	15	0710	Active	37	13		Laurie Van Fleet	Ground
Agate Flats	4	21	0634	Active	35	8		Laurie Van Fleet	Ground
Agate Flats	4	28	0632	Active	33	5		Laurie Van Fleet	Ground
Agate Flats	5	9	0637	Active	36	5		Laurie Van Fleet	Ground
McIntosh Meadows	4	15	0722	Active	3	0		Laurie Van Fleet	Ground
McIntosh Meadows	4	21	0645	Active	0	0		Laurie Van Fleet	Ground
McIntosh Meadows	4	28	0641	Active	0	0		Laurie Van Fleet	Ground
McIntosh Meadows	5	9	0647	Active	0	0		Laurie Van Fleet	Ground
Complex: Antelope Springs									
Antelope Springs	4	21	0700	Active	12	0		Tom Ryder	Ground
Complex: Ballenger Draw									
Ballenger Draw	4	16	0716	Active	19	0		UC-Davis	Ground
Ballenger Draw	4	19	0740	Active	8	0		UC-Davis	Ground
Ballenger Draw	4	21	0705	Active	0	0		UC-Davis	Ground
Ballenger Draw	4	24	0650	Active	0	0		UC-Davis	Ground
Ballenger Draw	4	25	0630	Active	0	0		UC-Davis	Ground
Ballenger Draw	4	30	0630	Active	18	1		UC-Davis	Ground
Ballenger Draw	5	3	0637	Active	17	1		UC-Davis	Ground
Complex: Beaver Rim									
Government Meadows	4	21	0640	Abandoned	0	0		Tom Ryder	Ground
Complex: Beulah Belle									
Beulah Belle Lake	3	29	0630	Active	21	6		Jim Brown	Ground
Beulah Belle Lake	4	4	0645	Active	42	13		Jim Brown	Ground
Beulah Belle Lake	4	24	0600	Active	57	28	2	Jim Brown	Ground
Complex: Bill's									
Bill's	3	29	2242	Active	21			Greg Hiatt	Ground
Bill's	3	31	0715	Active	57	10		Stan Harter	Ground
Bill's	4	15	0720	Active	42	20		Stan Harter	Ground
Complex: Black Rock									
Black Rock	4	15	0700	Inactive	0	0		Nick Scribner	Ground
Black Rock	4	22	0650	Inactive	0	0		Nick Scribner	Ground
Black Rock	5	18	0636	Inactive	0	0		Nick Scribner	Ground
Black Rock Draw	4	12	0705	Active	42	0		Nick Scribner	Ground
Black Rock Draw	4	15	0640	Active	67	0		Nick Scribner	Ground
Black Rock Draw	4	22	0631	Active	63	0		Nick Scribner	Ground
Black Rock Draw	5	18	0623	Active	31	0		Nick Scribner	Ground
Complex: Blackjack									
Blackjack	3	31	1000	Active	15	0		Stan Harter	Ground
Blackjack	4	15	0740	Active	103	51		Laurie Van Fleet	Ground
Blackjack	4	21	0740	Active	112	35		Laurie Van Fleet	Ground
Blackjack	4	28	0610	Active	83	13		Laurie Van Fleet	Ground
Blackjack	5	9	0612	Active	92	15	7	Laurie Van Fleet	Ground
Complex: Buffalo Creek									
Buffalo Creek	4	17	0610	Active	14	0		Carrie Dobey	Ground
Buffalo Creek	4	28	0545	Active	8	0		Carrie Dobey	Ground
Buffalo Creek	5	8	0540	Active	10	1		Carrie Dobey	Ground
Complex: Carmody Lake									
Carmody Lake	4	21	0555	Active	45	13		Tom Ryder	Ground

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Carr Springs									
Carr Springs Draw	4	19	0704	Active	53	2		UC-Davis	Ground
Carr Springs Draw	4	24	0730	Active	28	0		UC-Davis	Ground
Carr Springs Draw	4	25	0750	Active	38	0		UC-Davis	Ground
Carr Springs Draw	4	30	0720	Active	42	0		UC-Davis	Ground
Carr Springs Draw	5	4	0617	Active	34	3		UC-Davis	Ground
West Carr Springs Draw	4	19	0715	Active	29	0		UC-Davis	Ground
West Carr Springs Draw	4	24	0720	Active	0	0		UC-Davis	Ground
West Carr Springs Draw	4	25	0720	Active	0	0		UC-Davis	Ground
West Carr Springs Draw	4	30	0700	Active	7	0		UC-Davis	Ground
West Carr Springs Draw	5	3	0546	Active	0	0		UC-Davis	Ground
West Carr Springs Draw	5	4	0535	Active	13	0		UC-Davis	Ground
Complex: Chugwater									
Chugwater Reservoir	3	22	0826	Active	19	0		Stan Harter	Ground
Chugwater Reservoir	3	29	0720	Active	24	16		Stan Harter	Ground
Chugwater Reservoir	4	16	0638	Active	33	0		UC-Davis	Ground
Chugwater Reservoir	4	22	0845	Active	25	1		UC-Davis	Ground
Chugwater Reservoir	5	1	0615	Active	25	2		UC-Davis	Ground
Chugwater Reservoir	5	3	0538	Active	31	3		UC-Davis	Ground
Chugwater Reservoir	5	18	0635	Active	0	0		Stan Harter	Ground
Complex: Coal Mine Gulch									
Coal Mine Gulch	4	21	0635	Active	28	0		UC-Davis	Ground
Coal Mine Gulch	5	5	0555	Active	8	0		Stan Harter	Ground
Coal Mine Gulch	5	18	0555	Active	16	0		Stan Harter	Ground
Upper Government Draw	5	5	0610	Active	21	0		Stan Harter	Ground
Upper Government Draw	5	18	0545	Active	6	0		Stan Harter	Ground
Complex: Cottontail									
Ballenger Reservoir	3	29	0745	Inactive	0	0		Stan Harter	Ground
Ballenger Reservoir	4	11	0640	Inactive	0	0		UC-Davis	Ground
Ballenger Reservoir	5	3	0730	Inactive	0	0		UC-Davis	Ground
Ballenger Reservoir	5	4	0650	Inactive	0	0		UC-Davis	Ground
Cottontail Reservoir	3	29	0735	Active	0	0		Stan Harter	Ground
Cottontail Reservoir	4	11	0634	Active	0	0		UC-Davis	Ground
Cottontail Reservoir	4	16	0651	Active	68	2		UC-Davis	Ground
Cottontail Reservoir	4	24	0620	Active	85	1		UC-Davis	Ground
Cottontail Reservoir	4	30	0604	Active	59	0		UC-Davis	Ground
Cottontail Reservoir	5	4	0706	Active	47	6		UC-Davis	Ground
Complex: Cottonwood Divide									
Chubby Springs	5	1	0600	Active	18	0		Brad Hovinga	Ground
Chubby Springs	5	7	0600	Active	14	0		Brad Hovinga	Ground
Chubby Springs	5	20	0615	Active	21	0		Brad Hovinga	Ground
Cottonwood Divide No. 1	5	1	0615	Abandoned	0	0		Brad Hovinga	Ground
Cottonwood Divide No. 1	5	7	0615	Abandoned	0	0		Brad Hovinga	Ground
Cottonwood Divide No. 1	5	20	0630	Abandoned	0	0		Brad Hovinga	Ground
Cottonwood Divide No. 2	5	1	0630	Inactive	0	0		Brad Hovinga	Ground
Cottonwood Divide No. 2	5	7	0635	Inactive	0	0		Brad Hovinga	Ground
Cottonwood Divide No. 2	5	20	0635	Inactive	0	0		Brad Hovinga	Ground
Complex: Coyote									
Coyote Lake	4	27	0628	Active	29	0		Stan Harter	Ground
Crofts	4	27	0645	Unknown	0	0		Stan Harter	Ground
Complex: Dickie Springs									
Dickie Springs	4	20	0840	Active	4	0		Stan Harter	Ground
Dickie Springs	4	27	0635	Active	9	2		Courtney Rudd	Ground
Dickie Springs	5	4	0555	Active	0	0		Rene Schell	Ground
Complex: Dickie Springs Creek									
Dickie Springs Creek	4	20	0805	Active	89	29		Stan Harter	Ground
Dickie Springs Creek	4	27	0709	Active	0	0		Courtney Rudd	Ground
Dickie Springs Creek	5	15	0710	Active	65	10		Stan Harter	Ground
Complex: Dishpan Butte									
Dishpan Butte	4	21	0625	Active	8	0		Tom Ryder	Ground
Complex: Dobie									
North Dobie	3	31	0855	Active	30	3		Stan Harter	Ground
North Dobie	4	11	0833	Active	32	1		Stan Harter	Ground

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Dry Cheyenne									
Dry Cheyenne	4	19	0640	Active	34	2		Greg Anderson	Ground
Complex: Dry Lakes									
Dry Lakes	4	15	0735	Active	18	9		Nick Scribner	Ground
Dry Lakes	4	22	0710	Active	24	0		Nick Scribner	Ground
Dry Lakes	5	18	0650	Active	3	0		Nick Scribner	Ground
Complex: East Long Creek									
East Long Creek No. 1	4	21	0624	Active	42	4		Dan Bjornlie	Ground
East Long Creek No. 1	5	3	0615	Active	0	0		Dan Bjornlie	Ground
East Long Creek No. 2	4	21	0645	Active	44	0		Dan Bjornlie	Ground
East Long Creek No. 2	5	3	0630	Active	14	0		Dan Bjornlie	Ground
East Long Creek No. 3	4	21	0715	Active	14	0		Dan Bjornlie	Ground
East Long Creek No. 3	5	3	0700	Active	6	0		Dan Bjornlie	Ground
Complex: Gas Hills									
West Canyon Creek	4	26	0945	Active	4	0		Greg Anderson	Ground
West Canyon Creek	4	27	0645	Active	14	1		Greg Anderson	Ground
Complex: Government Slide Draw									
Government Slide Draw	3	22	0735	Active	26	0		Stan Harter	Ground
Government Slide Draw	3	27	0720	Active	45	36		Stan Harter	Ground
Government Slide Draw	5	3	0730	Active	10	0		Stan Harter	Ground
Complex: Graham Road									
Graham Road	4	4	0730	Active	48	8		Stan Harter	Ground
Complex: Gustin-Preacher									
Gustin Reservoir	3	29	0815	Active	18	15		Stan Harter	Ground
Gustin Reservoir	4	10	0740	Active	23	1		UC-Davis	Ground
Gustin Reservoir	4	20	0710	Active	26	0		UC-Davis	Ground
Gustin Reservoir	5	1	0755	Active	20	0		UC-Davis	Ground
Gustin Reservoir	5	2	0714	Active	26	3		UC-Davis	Ground
Preacher Reservoir	4	10	0717	Active	10	1		UC-Davis	Ground
Preacher Reservoir	4	20	0625	Active	8	0		UC-Davis	Ground
Preacher Reservoir	5	1	0635	Active	6	1		UC-Davis	Ground
Preacher Reservoir	5	2	0545	Active	5	1		UC-Davis	Ground
Complex: Hall Creek									
Hall Creek No. 1	4	14	0620	Active	14	0		Stan Harter	Ground
Hall Creek No. 1	4	19	0755	Active	10	0		Stan Harter	Ground
Hall Creek No. 2	4	14	0632	Active	5	1		Stan Harter	Ground
Hall Creek No. 2	4	19	0819	Active	2	0		Stan Harter	Ground
Complex: Horseshoe									
Conant Fence	4	26	0735	Active	33	0		Greg Anderson	Ground
Homestead Flats	4	19	0740	Active	14	0		Greg Anderson	Ground
Horseshoe Playa	4	22	0605	Active	10	0		Greg Anderson	Ground
Signor Ridge	4	21	0635	Active	27	2		Greg Anderson	Ground
Complex: Lander Cutoff									
Sharps Meadows Creek	4	20	0725	Active	42	10		Stan Harter	Ground
Sharps Meadows Creek	5	15	0620	Active	25	0		Stan Harter	Ground
Complex: Lander Valley Reservoir									
Lander Valley Reservoir	4	11	0710	Active	22	3		UC-Davis	Ground
Lander Valley Reservoir	4	22	0650	Active	16	0	35	UC-Davis	Ground
Lander Valley Reservoir	5	4	0550	Active	35	1		UC-Davis	Ground
Complex: Long Creek									
Cedar Rim Pipeline No. 1	4	21	0635	Abandoned	0	0		Sue Oberlie	Ground
Cedar Rim Pipeline No. 1	5	7	0630	Abandoned	0	0		Sue Oberlie	Ground
Cedar Rim Pipeline No. 1	5	18	0625	Abandoned	0	0		Sue Oberlie	Ground
Cedar Rim Pipeline No. 2	4	21	0645	Active	64	8		Sue Oberlie	Ground
Cedar Rim Pipeline No. 2	5	7	0640	Active	53	5		Sue Oberlie	Ground
Cedar Rim Pipeline No. 2	5	18	0635	Active	26	1		Sue Oberlie	Ground
Long Creek No. 3	4	21	0700	Active	3	0		Sue Oberlie	Ground
Long Creek No. 3	5	7	0705	Active	0	0		Sue Oberlie	Ground
Long Creek No. 3	5	18	0700	Active	0	0		Sue Oberlie	Ground
Long Creek No. 4	4	27	0725	Inactive	0	0		Sue Oberlie	Ground
Long Creek No. 4	5	7	0720	Inactive	0	0		Sue Oberlie	Ground
Long Creek No. 4	5	18	0715	Inactive	0	0		Sue Oberlie	Ground
Complex: Long Gulch									
Long Gulch	4	25	0632	Active	33	12		Stan Harter	Ground
Long Gulch	5	1	0710	Active	19	6		Stan Harter	Ground

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: McGraw Flats									
McGraw Flats No. 1	4	30	0615	Inactive	0	0		Brad Hovinga	Ground
McGraw Flats No. 1	5	8	0600	Inactive	0	0		Brad Hovinga	Ground
McGraw Flats No. 1	5	19	0545	Inactive	0	0		Brad Hovinga	Ground
McGraw Flats No. 2	4	30	0630	Active	55	3		Brad Hovinga	Ground
McGraw Flats No. 2	5	8	0615	Active	62	4		Brad Hovinga	Ground
McGraw Flats No. 2	5	19	0600	Active	66	2		Brad Hovinga	Ground
Complex: McTurk Draw									
McTurk Draw	4	27	0700	Active	8	0		Bill Skelton	Ground
McTurk Draw	5	4	0640	Active	0	0		Bill Skelton	Ground
Complex: McTurk Ridge									
McTurk Ridge	4	27	0620	Active	0	0		Bill Skelton	Ground
McTurk Ridge	5	4	0610	Active	0	0		Bill Skelton	Ground
Complex: Mitten Springs									
Mitten Springs North	4	27	0725	Active	0	0		Stan Harter	Ground
Mitten Springs South	4	27	0748	Active	8	0		Stan Harter	Ground
Complex: Monument									
Monument Draw	3	29	0750	Active	16	0		UC-Davis	Ground
Monument Draw	4	4	0700	Active	27	35		UC-Davis	Ground
Monument Draw	4	5	0750	Active	31	23		UC-Davis	Ground
Monument Draw	4	14	0645	Active	24	3		UC-Davis	Ground
Monument Draw	4	15	0715	Active	25	4		UC-Davis	Ground
Monument Draw	4	17	0640	Active	19	3		UC-Davis	Ground
Monument Draw	4	19	0645	Active	7	0		UC-Davis	Ground
Monument Draw	5	5	0610	Active	13	2		UC-Davis	Ground
Complex: Nancy Creek									
Cottonwood Creek	4	11	0730	Inactive	0	0		Kim Olson	Ground
Cottonwood Creek	4	17	0700	Inactive	0	0		Kim Olson	Ground
Cottonwood Creek	4	25	0650	Inactive	0	0		Kim Olson	Ground
Nancy Creek	4	11	0650	Active	22	10		Kim Olson	Ground
Nancy Creek	4	17	0630	Active	17	5		Kim Olson	Ground
Nancy Creek	4	25	0625	Active	22	1		Kim Olson	Ground
Nancy Creek Reservoir	4	11	0625	Active	28	12		Kim Olson	Ground
Nancy Creek Reservoir	4	17	0615	Active	41	11		Kim Olson	Ground
Nancy Creek Reservoir	4	25	0610	Active	43	2		Kim Olson	Ground
Complex: Ninemile Draw									
Ninemile Draw	3	22	0802	Inactive	0	0		Stan Harter	Ground
Ninemile Draw	3	29	0640	Inactive	0	0		Stan Harter	Ground
Ninemile Draw	5	18	0650	Inactive	0	0		Stan Harter	Ground
Complex: Ninemile Reservoir									
Ninemile Reservoir	3	22	0815	Active	2	0		Stan Harter	Ground
Ninemile Reservoir	3	29	0703	Active	16	0		Stan Harter	Ground
Ninemile Reservoir	5	18	0645	Active	0	0		Stan Harter	Ground
Complex: North Long Creek									
Long Creek No. 1	4	21	0805	Active	22	1		Stan Harter	Ground
Long Creek No. 2	4	21	0815	Unknown	0	0		Stan Harter	Ground
Complex: North Sand Gulch									
North Sand Gulch	4	11	0731	Active	30	0		UC-Davis	Ground
North Sand Gulch	4	22	0715	Active	16	0		UC-Davis	Ground
North Sand Gulch	5	4	0636	Active	32	0		UC-Davis	Ground
Complex: Onion Flats									
Onion Flats No. 1	4	19	0634	Active	16	3		Stan Harter	Ground
Onion Flats No. 1	4	29	0615	Active	14	1		Brad Hovinga	Ground
Onion Flats No. 1	5	9	0600	Active	19	0		Brad Hovinga	Ground
Onion Flats No. 2	4	19	0652	Active	13	1		Stan Harter	Ground
Onion Flats No. 2	4	29	0640	Active	17	0		Brad Hovinga	Ground
Onion Flats No. 2	5	9	0630	Active	14	0		Brad Hovinga	Ground
Complex: Oregon Trail									
Oregon Trail	4	25	0734	Active	27	0		Stan Harter	Ground
Complex: Pacific Creek									
Pacific Creek Playa	3	24	0725	Active	23	0		Stan Harter	Ground
Pacific Creek Playa	4	20	0745	Active	22	3		Stan Harter	Ground
Pacific Creek Playa	4	27	0602	Active	10	0	7	Courtney Rudd	Ground
Pacific Creek Playa	5	4	0631	Active	0	0		Rene Schell	Ground
Pacific Creek Playa	5	15	0655	Active	17	3		Stan Harter	Ground

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Picket Lake									
Picket Lake	5	16	0700	Active	44	1		Greg Hiatt	Ground
Complex: Puddle Springs									
Puddle Springs	4	27	0745	Active	10	0		Greg Anderson	Ground
Complex: Rawlins Draw									
Rawlins Draw	3	31	0745	Active	36	2		Stan Harter	Ground
Rawlins Draw	4	15	0628	Active	36	20		Stan Harter	Ground
Complex: Sage Hen									
Sage Hen No. 1	4	15	0649	Inactive	0	0		Laurie Van Fleet	Ground
Sage Hen No. 1	4	21	0723	Inactive	0	0		Laurie Van Fleet	Ground
Sage Hen No. 1	4	28	0716	Inactive	0	0		Laurie Van Fleet	Ground
Sage Hen No. 1	5	9	0726	Inactive	0	0		Laurie Van Fleet	Ground
Sage Hen No. 2	4	15	0637	Active	3	5		Laurie Van Fleet	Ground
Sage Hen No. 2	4	21	0715	Active	0	0		Laurie Van Fleet	Ground
Sage Hen No. 2	4	28	0716	Active	2	0		Laurie Van Fleet	Ground
Sage Hen No. 3	3	26		Active	29	3		Stan Harter	Ground
Sage Hen No. 3	4	11		Active	28	10		Stan Harter	Ground
Sage Hen No. 3	4	15	0621	Active	35	9	2	Laurie Van Fleet	Ground
Sage Hen No. 3	4	21	0707	Active	29	6		Laurie Van Fleet	Ground
Sage Hen No. 3	4	28	0706	Active	22	3		Laurie Van Fleet	Ground
Sage Hen No. 3	5	9	0711	Active	26	4	1	Laurie Van Fleet	Ground
Sage Hen No. 4	4	15	0615	Inactive	0	0		Laurie Van Fleet	Ground
Sage Hen No. 4	4	21	0703	Inactive	0	0		Laurie Van Fleet	Ground
Sage Hen No. 4	4	28	0703	Inactive	0	0		Laurie Van Fleet	Ground
Sage Hen No. 4	5	9	0708	Inactive	0	0		Laurie Van Fleet	Ground
Complex: Scarlett Ranch									
Scarlett Ranch	4	27	0745	Active	21	1		Sue Oberlie	Ground
Scarlett Ranch	5	7	0740	Active	20	0		Sue Oberlie	Ground
Scarlett Ranch	5	18	0735	Active	18	0		Sue Oberlie	Ground
Complex: Signor Pipeline									
Signor Pipeline	4	21	0706	Unknown	0	0		Greg Anderson	Ground
Complex: Soap Holes									
Ice Slough	4	4	0845	Inactive	0	0		Stan Harter	Ground
Ice Slough	4	22	0605	Inactive	0	0		Amy Adams	Ground
Ice Slough	4	29	0605	Inactive	0	0		Amy Adams	Ground
Soap Holes	4	4	0854	Active	108	30		Stan Harter	Ground
Soap Holes	4	22	0615	Active	71	0		Amy Adams	Ground
Soap Holes	4	29	0615	Active	87	0		Amy Adams	Ground
Complex: South Pass									
Fish Creek	3	24	0710	Active	8	0		Stan Harter	Ground
Fish Creek	4	20	0615	Active	54	98		Stan Harter	Ground
Fish Creek	5	1	0602	Active	56	0		Stan Harter	Ground
Fish Creek	5	15	0601	Active	60	6		Stan Harter	Ground
Pine Creek	4	20	0658	Active	35	9		Stan Harter	Ground
Pine Creek	5	1	0620	Active	36	0		Stan Harter	Ground
Pine Creek	5	15	0535	Active	29	2		Stan Harter	Ground
Complex: Split Rock									
Dry Draw	3	31	0807	Active	15	0		Stan Harter	Ground
Dry Draw	4	15	0658	Active	36	11		Stan Harter	Ground
Complex: Spring Creek									
Spring Creek	3	31	0650	Active	46	0		Stan Harter	Ground
Spring Creek	4	15	0754	Active	42	9		Stan Harter	Ground
Complex: Stampede									
Radio Tower Draw No. 1	4	28	0655	Inactive	0	0		Carrie Dobey	Ground
Radio Tower Draw No. 1	5	8	0640	Inactive	0	0		Carrie Dobey	Ground
Radio Tower Draw No. 1	5	17	0615	Inactive	0	0		Carrie Dobey	Ground
Radio Tower Draw No. 2	4	28	0630	Active	48	0		Carrie Dobey	Ground
Radio Tower Draw No. 2	5	8	0618	Active	41	0		Carrie Dobey	Ground
Radio Tower Draw No. 2	5	17	0555	Active	18	0		Carrie Dobey	Ground

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Twin Creek									
East Twin Creek	4	19	0723	Active	29	3		Stan Harter	Ground
East Twin Creek	4	29	0700	Active	27	0		Brad Hovinga	Ground
East Twin Creek	5	9	0715	Active	24	0		Brad Hovinga	Ground
Twin Creek	3	22	0650	Active	28	15		Stan Harter	Ground
Twin Creek	3	28		Active	18	26		David Ledan	Ground
Twin Creek	3	29		Active	19	12		David Ledan	Ground
Twin Creek	3	30		Active	17	7		David Ledan	Ground
Twin Creek	3	31		Active	24	25		David Ledan	Ground
Twin Creek	4	1		Active	9		30	David Ledan	Ground
Twin Creek	4	3		Active	16	7		David Ledan	Ground
Twin Creek	4	4		Active	30	47		David Ledan	Ground
Twin Creek	4	5		Active	24	21		David Ledan	Ground
Twin Creek	4	19	0705	Active	28	5		Stan Harter	Ground
Twin Creek	4	29	0735	Active	18	0		Brad Hovinga	Ground
Twin Creek	5	9	0730	Active	22	1		Brad Hovinga	Ground
Complex: Warm Springs									
Warm Springs No. 1	4	21	0700	Active	19	0		Tom Ryder	Ground
Warm Springs No. 1	4	27	0601	Active	21	1		Stan Harter	Ground
Warm Springs No. 2	4	21	0710	Abandoned	0	0		Tom Ryder	Ground
Complex: West Long Creek									
West Long Creek No. 1	4	21	0653	Active	104	6		Stan Harter	Ground
West Long Creek No. 2	4	21	0624	Active	51	6		Stan Harter	Ground
Complex: Willow Creek State									
Willow Creek State Section	4	25	0646	Active	30	1		Stan Harter	Ground
Complex: Yellowstone Ranch									
Hays Draw	3	27	0850	Active	10	1		Stan Harter	Ground
Hays Draw	4	14	0738	Active	11	0		Stan Harter	Ground
Hays Draw	5	3	0635	Active	16	0		Stan Harter	Ground
Upland Bird Management Area WR									
Complex: Alkali Butte									
Alkali Butte (#26)	3	16	0716	Unknown	0	0		D. Skates	Ground
Alkali Butte North (#39)	3	16	0650	Active	23	16		D. Skates	Ground
Riverton Dome Oil Field (#25)	3	16	0729	Unknown	0	0		D. Skates	Ground

Table 8. Sage-grouse lek observations by lek complex for 2010.

Lek Name	Survey Date Mo.	Day	Time	Status	Observation Males	Females	Unk.	Observer	Method
Complex: Bighorn Draw									
Bighorn Butte (#4A)	3	25	0720	Unknown	0	0		P. Hnilicka	Ground
Bighorn Butte (#4B)	3	25	0800	Active	14	2		P. Hnilicka	Ground
Bighorn Butte (#4C)	3	25	0705	Unknown	0	0		P. Hnilicka	Ground
Bighorn Butte (#4D)	3	18	0655	Active	28	3		P. Hnilicka	Ground
Bighorn Butte (#4D)	3	25	0655	Active	26	5		P. Hnilicka	Ground
Bighorn Draw (#3A)	5	5	0515	Unknown	0	0		P. Hnilicka	Ground
Bighorn Draw (#3B)	5	5	0530	Active	4	0		P. Hnilicka	Ground
Bighorn Draw (#3C)	5	5	0540	Unknown	0	0		P. Hnilicka	Ground
Complex: Boulder Flat									
Boulder Flat (#8)	4	5	0640	Unknown	0	0		P. Hnilicka	Ground
Boulder Flat (#8)	4	14	0618	Unknown	0	0		D. Skates	Ground
Northwest Draw (#7)	4	14	0720	Active	37	0		D. Skates	Ground
Ray Lake (#17)	4	5	0725	Active	19	11		P. Hnilicka	Ground
Sacajawea (#29)	4	5	0830	Active	0	0		P. Hnilicka	Ground
Complex: Crowheart Butte									
Crowheart Butte (#9)	4	27	0545	Unknown	0	0		P. Hnilicka	Ground
Dry Creek	3	17	0720	Active	15	0		P. Hnilicka	Ground
Dry Creek	4	27	0635	Active	25	4		P. Hnilicka	Ground
Ega Butte (#11)	3	17	0755	Unknown	0	0		P. Hnilicka	Ground
Ega Draw (#10)	3	17	0700	Active	0	0		P. Hnilicka	Ground
Ega Draw (#10)	4	27	0555	Active	6	2		P. Hnilicka	Ground
Complex: Lookout Butte									
Lookout Butte Bottom (#35)	4	8	0640	Active	9	17		P. Hnilicka	Ground
Lookout Butte Tank (#35A)	4	8	0640	Unknown	0	0		P. Hnilicka	Ground

Complex: Mule Butte									
Mule Butte Pump House (#34)	3	25	0722	Unknown	0	0		D. Skates	Ground
Mule Butte South (#14)	3	25	0640	Unknown	0	0		D. Skates	Ground
Mule Butte Windmill (#13)	3	25	0706	Unknown	0	0		D. Skates	Ground
Complex: Riverton East									
Riverton East (#33A)	3	16	0750	Unknown	0	0		D. Skates	Ground
Riverton East (#33B)	3	16	0745	Unknown	0	0		D. Skates	Ground
Riverton East (#33C)	3	16	0755	Active	4	0	15	D. Skates	Ground
Riverton East (#33C)	3	17	0646	Active	4	10	0	D. Skates	Ground
Complex: Sage Creek									
Fred Harris (#37)	4	19	0610	Active	0	0		D. Skates	Ground
Fred Harris (#37)	4	21	0621	Active	45	8		D. Skates	Ground
Sage Creek Dry Pond	3	15	0730	Active	0	0		P. Hnilicka	Ground
Sage Creek Dry Pond	4	13	0755	Active	6	0		P. Hnilicka	Ground
Sage Creek Dry Pond	4	29	0635	Active	0	0		P. Hnilicka	Ground
Sage Creek Ridge (#18C)	4	29	0700	Unknown	0	0		P. Hnilicka	Ground
Sage Creek Sundance East (#19)	3	15	0723	Unknown	0	0		P. Hnilicka	Ground
Sage Creek Sundance East (#19)	4	13	0610	Unknown	0	0		P. Hnilicka	Ground
Sage Creek Sundance North (#19)	3	15	0725	Active	2	0		P. Hnilicka	Ground
Sage Creek Sundance North (#19)	3	26	0655	Active	2	0		P. Hnilicka	Ground
Sage Creek Sundance North (#19)	4	13	0612	Active	6	0		P. Hnilicka	Ground
Sage Creek Sundance North (#19)	4	29	0640	Active	6	0		P. Hnilicka	Ground
Sage Creek Sundance Northwest (#19)	3	15	0730	Active	20	0		P. Hnilicka	Ground
Sage Creek Sundance Northwest (#19)	3	26	0710	Active	7	0		P. Hnilicka	Ground
Sage Creek Sundance Northwest (#19)	4	13	0640	Active	19	7		P. Hnilicka	Ground
Sage Creek Sundance Northwest (#19)	4	29	0625	Active	25	0		P. Hnilicka	Ground
Sage Creek Sundance South (#19)	3	15	0725	Unknown	0	0		P. Hnilicka	Ground
Sage Creek Sundance South (#19)	4	13	0612	Unknown	0	0		P. Hnilicka	Ground
Sage Creek Tank (#18A)	4	29	0700	Unknown	0	0		P. Hnilicka	Ground
Sage Creek Tank (#18B)	4	29	0700	Unknown	0	0		P. Hnilicka	Ground
Winchester Draw (#21)	3	26	0737	Active	2	0		P. Hnilicka	Ground
Winchester Draw (#21)	4	13	0655	Active	1	0		P. Hnilicka	Ground
Winchester Draw (#21)	4	29	0600	Active	0	0		P. Hnilicka	Ground
Complex: Sharpnose									
Sand Hills (#38)	4	16	0632	Unknown	0	0		D. Skates	Ground
Sharpnose (#22)	3	15	0751	Active	0	0		D. Skates	Ground
Sharpnose (#22)	3	18	0655	Active	14	0		D. Skates	Ground
Sharpnose (#22)	3	31	0644	Active	9	2		D. Skates	Ground
Sharpnose (#22)	4	12	0705	Active	2	0		D. Skates	Ground
Sharpnose (#22)	4	16	0605	Active	32	33		D. Skates	Ground
Sharpnose (#22)	4	30	0535	Active	38	0		D. Skates	Ground
Sharpnose Draw	4	16	0645	Unknown	0	0		D. Skates	Ground
Sharpnose East	3	31	0714	Active	7	5		D. Skates	Ground
Sharpnose East	4	30	0555	Active	0	0		D. Skates	Ground
Sharpnose Southeast (#23A)	3	31	0735	Unknown	0	0		D. Skates	Ground
Sharpnose Southeast (#23B)	3	31	0745	Unknown	0	0		D. Skates	Ground
WyPo (#16)	3	15	0722	Unknown	0	0		D. Skates	Ground
WyPo (#16)	3	31	0800	Unknown	0	0		D. Skates	Ground
WyPo (#16)	4	16	0725	Unknown	0	0		D. Skates	Ground
Complex: Willow Creek									
Little Sand Draw	4	9	0625	Active	18	1		P. Hnilicka	Ground
Meadow Creek (#28A)	3	29	0645	Active	28	4		P. Hnilicka	Ground
Meadow Creek (#28A)	4	14	0705	Active	29	5		P. Hnilicka	Ground
Meadow Creek (#28B)	3	29	0640	Unknown	0	0		P. Hnilicka	Ground
Meadow Creek (#28B)	4	14	0700	Unknown	0	0		P. Hnilicka	Ground
Willow Creek Bench (#30)	4	14	0620	Active	11	6		P. Hnilicka	Ground

Appendix G. Sage-grouse lek complex status for the WRSRCA, 2010.

Upland Bird Management Area 18

Complex	Type	Status	Peak Males	Peak Females	Leks/ Complex
9 Mile	Survey	Active	38	0	2
Alkali Creek	Survey	Active	28	4	2
Arrowhead	Not Checked	Unknown			2
Badwater	Survey	Active	29	4	3
Badwater Canyon	Survey	Active	6	0	1
Bass Lake Road	Not Checked	Unknown			1
Big Flat	Not Checked	Unknown			1
Black Rocks	Not Checked	Unknown			1
Bridger Trail	Survey	Active	14	1	1
Bushwacker - East	Not Checked	Unknown			1
Bushwacker - West	Not Checked	Unknown			1
Canyon Creek	Not Checked	Unknown			5
Canyon Creek - Ranch	Not Checked	Unknown			1
Chalk Hills	Survey	Unknown	0	0	1
Coal Bank Hills	Not Checked	Unknown			1
Conant Creek	Survey	Active	15	0	2
Davison Road	Survey	Unknown	0	0	1
Davison Road - 12 Mile	Survey	Active	47	3	4
Davison Road - 8 Mile	Survey	Active	17	0	1
Devil's Slide	Not Checked	Unknown			1
Dry Pond	Not Checked	Unknown			1
East Canyon Creek	Not Checked	Unknown			1
Fuller Airstrip	Survey	Active	18	10	1
Iron Horse	Survey	Active	17	7	2
Jackpot	Survey	Active	24	1	1
Lysite Creek	Not Checked	Unknown			4
Maverick Butte	Not Checked	Unknown			1
Nebo	Not Checked	Unknown			1
Noble Ridge	Not Checked	Unknown			1
Ocla Draw	Survey	Active	7	2	1
Oil Playa	Not Checked	Unknown			1
Pipeline	Survey	Active	14	0	2
Pit	Not Checked	Unknown			1
Powerline	Survey	Active	64	6	1
Sand Creek Bench	Survey	Unknown	0	0	1
Sand Creek Ranch	Survey	Unknown	0	0	1
Sand Draw	Not Checked	Unknown			1
South Bridger Creek	Survey	Active	4	2	1
South Fuller Reservoir	Not Checked	Unknown			1
Squaw Butte	Survey	Active	9	0	1
Stock Pond	Not Checked	Unknown			1
Windmill	Not Checked	Unknown			1

Upland Bird Management Area 8

Complex	Type	Status	Peak Males	Peak Females	Leks/ Complex
Agate Flats	Count	Active	40	13	2
Antelope Flats	Not Checked	Unknown			1
Antelope Springs	Survey	Active	12	0	1
Ballenger Draw	Count	Active	19	1	1
Beaver Rim	Survey	Abandoned	0	0	1
Beulah Belle	Count	Active	57	28	1
Bill's	Survey	Active	57	20	1
Black Rock	Count	Active	67	0	2
Blackjack	Count	Active	112	51	1
Buffalo Creek	Count	Active	14	1	1
Carmody Lake	Survey	Active	45	13	1
Carr Springs	Count	Active	82	3	2
Cedar Rim Windmill	Not Checked	Abandoned			1
Chugwater	Count	Active	33	16	1
Coal Mine Gulch	Count	Active	29	0	2
Cottontail	Count	Active	85	6	2
Cottonwood Divide	Count	Active	21	0	3
Coyote	Survey	Active	29	0	2
Dickie Springs	Count	Active	9	2	1
Dickie Springs Creek	Count	Active	89	29	1
Dishpan Butte	Survey	Active	8	0	1
Dobie	Survey	Active	32	3	1
Dry Cheyenne	Survey	Active	34	2	1
Dry Creek	Not Checked	Unknown			2
Dry Lakes	Count	Active	24	9	1
East Long Creek	Survey	Active	100	4	3
Gas Hills	Survey	Active	14	1	1
Government Slide Draw	Count	Active	45	36	1
Graham Road	Survey	Active	48	8	1
Grassy Lake	Not Checked	Unknown			2
Gustin-Preacher	Count	Active	34	15	4
Hall Creek	Survey	Active	19	1	2
Horseshoe	Survey	Active	33	2	4
Lander Cutoff	Survey	Active	42	10	1
Lander Valley Reservoir	Count	Active	35	3	1
Long Creek	Count	Active	67	8	4
Long Gulch	Survey	Active	33	12	1
McGraw Flats	Count	Active	66	4	2
McTurk Draw	Survey	Active	8	0	1
McTurk Ridge	Survey	Active	0	0	1
Mitten Springs	Survey	Active	8	0	2
Monument	Count	Active	31	35	1
Nancy Creek	Count	Active	65	22	3
Ninemile Draw	Count	Inactive	0	0	1
Ninemile Reservoir	Survey	Active	16	0	1
North Long Creek	Survey	Active	22	1	2
North Sand Gulch	Count	Active	32	0	1
Onion Flats	Count	Active	33	4	2
Oregon Trail	Survey	Active	27	0	1
Pacific Creek	Count	Active	23	3	1
Picket Lake	Count	Active	44	1	2
Puddle Springs	Survey	Active	10	0	1
Radium Springs	Not Checked	Unknown			1
Rawlins Draw	Survey	Active	36	20	1
Sage Hen	Count	Active	38	14	4
Scarlett Ranch	Count	Active	21	1	1

Complex	Type	Status	Peak Males	Peak Females	Leks/ Complex
Signor Pipeline	Survey	Unknown	0	0	1
Silver Creek	Not Checked	Unknown			1
Soap Holes	Count	Active	108	30	2
South Pass	Count	Active	92	107	2
Split Rock	Survey	Active	36	11	1
Spring Creek	Survey	Active	46	9	1
Stampede	Count	Active	48	0	2
Twin Creek	Count	Active	57	47	3
Warm Springs	Survey	Active	19	0	2
West Long Creek	Survey	Active	155	12	2
Willow Creek State	Survey	Active	30	1	1
Wilson Gulch	Not Checked	Unknown			1
Yellowstone Ranch	Count	Active	16	1	1

Upland Bird Management Area WR

Complex	Type	Status	Peak Males	Peak Females	Leks/ Complex
Alkali Butte	Survey	Active	23	16	3
Bargee	Not Checked	Unknown			1
Bighorn Draw	Survey	Active	40	7	7
Boulder Flat	Survey	Active	37	11	6
Crowheart Butte	Survey	Active	31	6	4
Dinwoody	Not Checked	Unknown			1
East Fork	Not Checked	Unknown			1
Lookout Butte	Survey	Active	9	17	2
Mule Butte	Survey	Active	8	10	4
Odie Ranch	Not Checked	Unknown			3
Riverton East	Survey	Active	4	10	3
Sage Creek	Count	Active	45	8	11
Sharpnose	Count	Active	38	33	9
Willow Creek	Survey	Active	40	11	5