

# *NEVADA SAGE-GROUSE CONSERVATION PROJECT*

## **Nevada Department of Wildlife**



### **Interim Performance Report**

**FBMS Grant No.: F10AF00677**

*December 2012*

Nevada's Sage-grouse Conservation Project is a collection of jobs ranging from survey and inventory to conservation planning, research and project coordination. This document reports on all elements of the project.

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## SURVEY AND INVENTORY

### ***Lek Monitoring***

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### OBJECTIVES

- a) Determine population health and estimate the size of sage-grouse populations within distinct Population Management Units (PMUs) through lek counts and improved sampling schemes.
- b) Determine age structure, sex ratios, and nest success of various sage-grouse populations through collection and analysis of wings from hunter harvested sage-grouse as well as potential DNA samples collected from fecal transects.
- c) Determine genetic relationships or differences among various sage-grouse populations throughout Nevada.
- d) Verify and/or refine PMU boundaries that were delineated (based on little information or biologist judgment) through radio marking investigations. Determine migratory nature of specific populations. Determine response of sage-grouse populations due to various treatments, conservation efforts or disturbances such as wildfire and energy development.
- e) Maintain a comprehensive database for sage-grouse lek count, brood count and radio telemetry information.

### SUMMARY

Lek counts are an important annual duty conducted by various personnel within the Nevada Department of Wildlife (NDOW). NDOW field biologists, Bureau of Land Management (BLM) and U.S. Forest Service (USFS) personnel, and volunteers also collected data both from the ground (using accepted protocols) and air (using a helicopter). The following information was provided to report progress in achieving objective a) identified in the Grant Agreement, which states: "Determine population health and estimate the size of sage-grouse populations within distinct Population Management Units (PMUs) through lek counts and improved sampling schemes".

A sizeable effort by NDOW employees, federal agency personnel, volunteers and consultants was conducted to survey leks during the spring of 2012. Over 1,830 visits were made to 933 lek locations. Approximately 24% more leks were surveyed in Nevada in 2012 compared to the 10-year average of 755 leks surveyed annually. Being that the sage-grouse breeding period extends from about March 15 through May 15 (approximately 62 days), the 2012 effort equates to about 30 lek visits per day during that time frame across the state. A peak total of 9,668 males were observed on 517 active leks resulting in an average attendance rate of 18.7 males per active lek. This attendance rate was 5.1% less than the 2011 average of 19.7 males per active lek and approximately 2% less than the 10-year average attendance rate of 19.1 males per active lek. Average attendance rate of males has fluctuated between a low of 15.5 males per active lek in 2002 to 26.6 males per active lek in 2005 (see Table 1 and Figure 1 for annual lek count effort and survey results).

Year	No. of Males	Leks Surveyed	Active Leks	AVG/active lek
2002	5,198	648	335	15.5
2003	4,624	380	248	18.6
2004	6,813	487	309	22.1
2005	8,843	635	332	26.6
2006	9,580	881	448	21.4
2007	11,040	1,013	545	20.3
2008	7,671	923	483	15.9
2009	7,954	930	505	15.8
2010	7,399	742	420	17.5
2011	8,424	737	427	19.7
2012	9,668	933	517	18.7
AVG.	7,929	755	415	19.1

Table 1. Lek count summary from 2002 – 2012.

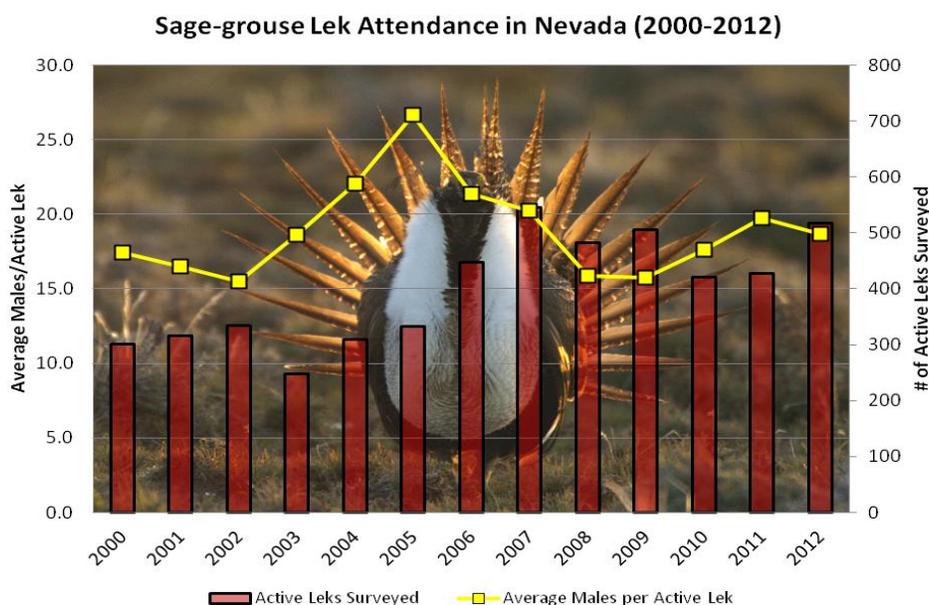


Figure 1. Lek count effort and average attendance from 2002-2012.

## FINDINGS

### **WASHOE-LASSEN-MODOC**

There are 5 PMUs within the Washoe-Lassen-Modoc planning area of which two are shared with California (Buffalo/Skedaddle and Vya). Sage-grouse utilize habitats in both states with some important migratory movements across state lines. Lek count data from both states are summarized here to provide a more accurate representation of the populations within the two PMUs that are shared between the two states.

The Buffalo/Skedaddle PMU is a large PMU (≈1.6 million acres) shared between Nevada and California and the California portion of the PMU is considered California's largest

sage-grouse population. A majority of the sage-grouse habitat in the California portion of this PMU burned during the summer of 2012 in the “Rush Fire”. Lek count data from California were not available for this report. In Nevada, 11 leks were visited of which 7 were considered active. A peak total from each lek resulted in 125 males classified for an average of 17.9 males per active lek. This represents a 3% decrease from the previous year’s average of 18.4 males per active lek. This PMU is facing a myriad of habitat related issues that are likely limiting population size.

A total of 24 leks were surveyed within the Massacre PMU during the 2012 spring breeding period of which 17 were considered active. Peak counts from these leks totaled 516 males per active lek for an average of 30.4. This represented a 21% increase over the previous year’s average of 25.2 males per active lek. The Massacre PMU contains the greatest amount of suitable sage-grouse habitat within the Nevada portion of the planning area at approximately 1.26 million acres. The population within this PMU is likely the largest within the planning area due in part to its size and the amount of suitable habitat; however, approximately 61,000 acres of important sage-grouse habitat was lost during the “Lost Fire” in early August of 2012.

The Sheldon PMU is located within the Sheldon National Wildlife Refuge, but is not the entirety of the Refuge. Eighteen leks were surveyed in 2012 of which 15 were considered active. Peak male counts totaled 552 for an average of 36.8 males per active lek. This average was 29% greater than the previous year’s average attendance of 28.5. Like the Massacre PMU, this population is also considered stable to slightly increasing in the short-term. Sage-grouse within this PMU utilize habitat within the Massacre PMU to the south as well as in Oregon to the north. No natural or manmade barriers exist in terms of movement between these areas; however, the recently constructed Ruby Pipeline (gas) has the potential to indirectly affect sage-grouse habitat both within the Sheldon and Massacre PMUs.

Located to the west of the Sheldon PMU is the Vya PMU; these PMUs share sage-grouse populations as habitats are contiguous across the identified boundaries. During the spring 2012 breeding season, 20 leks were visited of which 15 were considered active. Total lek attendance from peak counts was 256 resulting in an average of 17.1 males per active lek. This represents a 33% decrease from the previous year’s average. It is not clear why there is such a discrepancy between the Sheldon and Massacre attendance rates and the Vya PMU averages.

The Virginia/Pah Rah PMU is actually two PMUs combined. Collectively this PMU is 355,000 acres and is the smallest PMU in the planning area. Both of these PMUs are in proximity to the Reno/Sparks and North Valleys areas of southern Washoe County and thus are the most threatened to long term sustainability because of urbanization, roads, transmission lines, dispersed recreation, and renewable energy development. Cumulatively, these factors have diminished suitable sage-grouse habitats and sage-grouse population size. Three active leks were visited during the 2012 breeding season with peak counts totaling 110 males. This resulted in an average of 36.7 males per active lek and was 36% greater than the previous year’s average of 27.0 males per active lek.

PMU	Total Known Leks	# of Leks Surveyed	# of Active Leks Surveyed	# of Birds Counted	Avg. # of Birds/Active Lek
Buffalo/Skedaddle	74	11	7	125	17.9
Massacre	72	24	17	516	30.4
Sheldon	75	18	15	552	36.8
Virginia/Pah Rah	6	3	3	110	36.7
Vya	37	20	15	256	17.1
<b>TOTAL:</b>	<b>264</b>	<b>76</b>	<b>57</b>	<b>1559</b>	<b>27.4</b>

Table 2. 2012 lek count effort for the Washoe-Lassen-Modoc local conservation planning area.

As a whole, there were 76 lek locations surveyed within the Nevada portion of the Washoe-Lassen-Modoc planning area in 2012. A total of 57 leks were considered active with 1,559 sage-grouse observed. This resulted in an average of 27.4 males per active lek and was 9% greater than the 2011 attendance of 25.1 males per active lek. Overall, the Nevada portion of this population is considered stable to slightly increasing although two large fires (Rush Fire and Lost Fire) consumed over 100,000 acres of important sage-grouse habitat in Nevada with the Rush Fire destroying a much larger proportion of sage-grouse habitat in Lassen County, California.

### **BI-STATE PLANNING AREA**

The Bi-State planning area, like Washoe-Lassen-Modoc, is also a region where population management units (PMUs) are shared between Nevada and California. Four of the PMUs in this region are shared between the two states while one is entirely within California (South Mono PMU). Movement of sage-grouse across state boundaries is known to occur within the Pine Nut, Desert Creek/Fales and Mount Grant/Bodie PMUs. Relatively little is known regarding movement of birds and population size within the White Mountains PMU at the southernmost end of the planning area.

Average male attendance rates for the entire Bi-State Planning Area increased from 2011 to 2012. There were 1,383 male sage-grouse observed on 42 known active leks. This resulted in an average of 32.9 males and represented a 7.2% increase over the previous year and a 26.5% increase over the 2010 attendance rate of 26 males per active lek. Survey efforts and results for each individual PMU are displayed in Table 3 below.

<b>PMU</b>	<b>Total Known Leks</b>	<b># of Leks Surveyed</b>	<b># of Active Leks</b>	<b># of Males Counted</b>	<b>Avg. # of Males/Active Lek</b>
Desert Creek/Fales	25	11	7	196	28.0
NV Portion	(19)	(6)	(4)	(139)	(34.8)
CA Portion	(6)	(5)	(3)	(57)	(19)
Mt. Grant (NV)	12	12	7	215	30.7
Pine Nut (NV)	8	1	1	19	19.0
White Mtns. (NV)	2	2	2	17	8.5
Bodie Hills (CA)	22	17	13	510	39.2
South Mono (CA)	28	18	12	426	35.5
<b>TOTALS:</b>	<b>97</b>	<b>61</b>	<b>42</b>	<b>1,383</b>	<b>32.9</b>

**Table 3. 2012 lek count effort for the Bi-State local conservation planning area.**

The Nevada portion of the Desert Creek/Fales PMU continues to exhibit a population increase. In 2012, average attendance rate of males was 34.8 which was 50% greater than the 2011 average male attendance rate of 23.2. A total of 24 lek visits were conducted by volunteers, NDOW and federal agency personnel in 2012. Aerial survey efforts led to the discovery of one possible lek location within the Nevada portion of the PMU.

More thorough survey work in the Mount Grant PMU resulted in 215 sage-grouse observed on 7 active leks for an average of 30.7 birds per active lek. This represented a 40% increase over the 2011 average attendance rate of 22.0. Aerial lek surveys and searches proved lucrative in 2012 with high bird numbers observed in the upper elevations of the Wassuk Range as well as the discovery of one possible lek location near the Rosaschi Ranch area along the East Fork of the Walker River.

The only known active lek in the Pine Nut PMU (Mill Canyon Dry Lake Bed) continues to remain stable with 19 males observed during the spring of 2012. The peak count for 2011 was 18 males. Extensive aerial searches conducted in high use areas (obtained from radio marking studies being conducted by the USGS) did not result in the discovery of additional leks in the Pine Nut PMU although it is believed that others exist.

Two plausible lek locations were also discovered in the Nevada portion of the White Mountains PMU during aerial lek searches conducted in 2012. These leks are minimal in size with 12 birds observed at the new Trail Canyon lek and 5 birds observed at the Basalt lek location. These two leks represent the first known active lek locations in the Nevada portion of this PMU.

### **NORTH CENTRAL PLANNING AREA**

The North Central planning area is composed of Churchill, Pershing and Humboldt Counties with a total of 19 Population Management Units (PMUs). In Humboldt County, there are four main PMUs with sustainable populations of sage-grouse. These include the Santa Rosa, Lone Willow, Pine Forest and Black Rock PMUs. The largest populations occur in the Santa Rosa and Lone Willow PMUs. In Pershing County and Churchill Counties, the largest populations of sage-grouse are within the Sonoma PMU and Desatoya PMUs respectively.

During the spring 2012 breeding season there were 151 leks surveyed within the North Central Planning Area with 59 of those leks considered active. A total of 1,032 sage-grouse were observed yielding an average of 17.5 birds/active lek. This represented an 11.5% increase over the 2011 average attendance of 15.7 birds/active lek.

County	PMU	Total Known Leks	# of Leks Surveyed	# of Active Leks Surveyed	# of Birds Counted	Avg. # of Birds/Active Lek
Humboldt	Santa Rosa	125	78	29	545	18.8
Humboldt	Lone Willow	93	47	18	258	14.3
Humboldt	Pine Forest	13	4	3	51	17.0
Humboldt	Black Rock	25	22	9	178	19.8
Humboldt	Jackson	7	0	0	0	0.0
Pershing	Sonoma	24	18	13	86	6.6
Churchill	Clan Alpine	1	1	1	16	16.0
Churchill	Desatoya	10	7	7	223	31.9
<b>TOTALS:</b>		<b>263</b>	<b>151</b>	<b>59</b>	<b>1,032</b>	<b>17.5</b>

**Table 4. Results of Humboldt County lek counts conducted in 2012.**

The Santa Rosa PMU is the largest PMU within the North Central planning area (≈940,000 acres) and likely harbors the largest population of sage-grouse in Humboldt County. The population is connected with the Desert PMU to the east and Oregon (Owyhee Uplands) populations to the north. During 2012, 78 lek locations were surveyed either by ground or air and there were 545 sage-grouse observed on 29 active leks. This resulted in an average of 18.8 birds per active lek and represented a 12% decrease from the 2011 average of 21.4 birds per active lek. The long term population trend from 1990-2012 indicates that this population is declining. This population has been affected on its periphery by wildfire, particularly at lower elevations; however, the core sagebrush habitats within the upper elevations of the Santa Rosa Range, the Owyhee Desert, Martin Creek Basin and North Fork Little Humboldt Basin remain intact.

The Lone Willow PMU, which includes the Montana Mountains, Bilk Creek Range and Double H mountains, also harbors a significant population of sage-grouse within the North Central Planning Area. During the 2012 spring breeding season, 47 lek locations were surveyed of which 18 were considered active. There were 258 sage-grouse observed resulting in an average of 14.3 birds per active lek. This average was 43% greater than the previous year's average of 10 birds per active lek. In early August of 2012, a massive wildfire, known as the Holloway fire, burned approximately 214,000 acres in the Nevada portion of this PMU. A large majority (182,000 acres) of the Nevada portion of this fire were considered moderate to important sage-grouse habitat with approximately 85,000 acres considered essential and irreplaceable habitat.

Within the Black Rock PMU, 22 of the 25 known lek locations were surveyed either via ground or air utilizing a helicopter. Nine of the 22 surveyed leks were determined to be active and 178 birds were observed for an average of 19.8 birds/active lek. This average was 45% below the previous year's average of 36 birds/active lek. However, the 2012 average was 42% greater than the 2010 average of 13.9. Less aerial survey effort was conducted in 2012 than in 2011.

No aerial surveys were conducted in the Pine Forest PMU during 2012; however, 4 leks were visited from the ground. The lack of snow cover and dry conditions provided relatively easy access to at least some leks within the PMU. Three of the four leks were active with a high count of 51 males in attendance. The average attendance rate for these leks was 17.0 which represented a 91% increase over the previous year's average. However, all 13 known leks were surveyed in 2011, which likely included some smaller leks that would have driven the average down. Hunting seasons have remained closed in this PMU since 2009.

The Pershing County portion of this planning unit has suffered tremendous losses of sagebrush habitats due to wildfire over the last 10-15 years with some mountain ranges burning almost completely (e.g. Eugene Mountains). The most viable population in Pershing County is the Sonoma PMU. During the spring of 2012, 18 lek locations were surveyed aerially with 13 being considered active. There were 86 sage-grouse observed on these leks resulting in an average of 6.6 birds per active lek. This represents a 24% decrease from the previous year's average of 8.7 birds per active lek and a 30% decrease from the 2010 average of 9.4 birds per active lek. The short-term population trend for this PMU is declining. The long-term viability of other PMUs in Pershing County, such as the Eugene, Majuba, East Range and Humboldt PMUs, is considered very low, with some of these populations potentially extirpated already.

In Churchill County, the Desatoya and Clan Alpine PMUs continue to be regularly surveyed while little effort is placed in the Stillwater PMU even though it is likely that sage-grouse continue to occupy that PMU, but at low levels. One known active lek continues to be surveyed in the Clan Alpine PMU. This lek (Camp Creek) had 16 males observed on it in 2012 which was the same count as in 2011. In the Desatoya PMU, seven leks were surveyed of which all seven were found to be active. There were 26 lek visits conducted and the sum total of peak counts was 223 males. This resulted in an average of 32 males per active lek and was 31% greater than the 2011 average attendance of 24.4 males per active lek. Population trends within the Desatoya PMU appear to be stable to slightly increasing. A two day season for sage-grouse continues to be held within this PMU and has been instituted for the last six years after a brief period of being closed.

### ***SOUTH CENTRAL PLANNING AREA***

The South Central planning area consists of Lander, Eureka, and Nye Counties and includes 10 Population Management Units (PMUs). The peak count total for 78 active leks surveyed in 2012 was 1,809 males resulting in average attendance of 23.2 males per active lek.

This represented an 8.6% decrease from the 2011 average attendance of 25.2 males per active lek. However, when comparing trend lek attendance only, 25 trend leks counted in 2012 yielded an average of 36.9 males per lek while 23 trend leks counted in 2011 resulted in an average of 31.9 males per lek. The 2012 average trend lek attendance represented a 15.7% increase over the 2011 figures.

PMU	Total Known Leks	# of Leks Surveyed	# of Active Leks Surveyed	# of males Counted	Avg. # of males/Active Lek
Battle Mountain	7	7	3	44	14.7
Fish Creek	6	6	2	11	5.5
Shoshone	15	10	6	176	29.3
Cortez	28	21	7	126	18.0
Three Bar	51	25	19	319	16.8
Diamond	35	9	4	68	17.0
Toiyabe	68	33	20	495	24.8
Reese River	44	8	5	215	43.0
Monitor	69	16	12	355	29.6
Kawich	0	0	0	0	0.0
<b>TOTAL:</b>	<b>323</b>	<b>110</b>	<b>78</b>	<b>1,809</b>	<b>23.2</b>

**Table 5. 2012 lek count effort and survey results within the South Central planning area.**

The majority of Eureka County consists of the Cortez, Diamond and Three Bar PMUs. During 2012 spring lek surveys, 182 lek visits were made to 55 lek locations (3.3 visits/lek) of which 30 were considered active. Peak count totals observed was 513 resulting in an average of 17.1 males per active lek. This represented a 13% increase over the 2011 average male attendance of 15.1 males per active lek. Many of the trend leks in these three PMUs are intensively monitored as part of a larger, ongoing research project being conducted by the University of Nevada, Reno (Falcon to Gonder Transmission Line Study). Trend lek observations resulted in an average of 24.0 males per trend lek which represented a 16% increase over average trend lek attendance of 20.7 in 2011.

Four PMUs exist in Lander County including the Battle Mountain, Fish Creek, Shoshone and Toiyabe PMUs. The more robust populations are within the Shoshone and Toiyabe PMUs with the larger population being within the Toiyabe PMU. In this PMU, 33 leks were surveyed with 20 being considered as active. There were 495 males observed resulting in an average of 24.8 males per active lek. This result was very similar to the 2011 average male attendance of 24.6. In the Shoshone PMU, the average male attendance rate was 29.3 in 2012. In comparison, the average male attendance in 2011 was 41% less at 20.8 males per active lek.

Two large PMUs, the Reese River and Monitor PMUs, encompass most of the sage-grouse populations in Nye County. Eight leks were surveyed in the Reese River PMU with five being considered active. Average male attendance for these leks was 43.0 which were analogous to the 2011 attendance rate of 43.6 males per active lek. In the Monitor PMU, 16 leks were surveyed of which 12 were active. There were 355 males observed resulting in an average of 29.6 males per active lek. This represented a 25.6% decrease from the 2011 average attendance rate of 39.8 males per active lek. Reese River and Monitor PMU population levels continue to remain robust; however, it is unclear what may have caused the decline in lek attendance rates within the Monitor PMU.

## ELKO COUNTY

There are 10 PMUs within Elko County that vary greatly in terms of population size. The smallest population resides within the East Valley PMU where only three known active leks occur. The largest populations reside within the O'Neil Basin and North Fork PMUs where 41 and 60 active leks are recognized respectively. Personnel from various agencies including NDOW, USFS, and BLM field offices, as well as volunteers assist with lek monitoring efforts each year. NDOW personnel normally focus on trend lek counts and ground-truthing of existing leks in the database while accompanying BLM personnel with directed efforts towards checking leks for activity associated with burned areas or in areas that have little historic data available. A continued effort will be made in Elko County to ground truth questionable leks and leks where surrounding habitat has burned over the last decade.

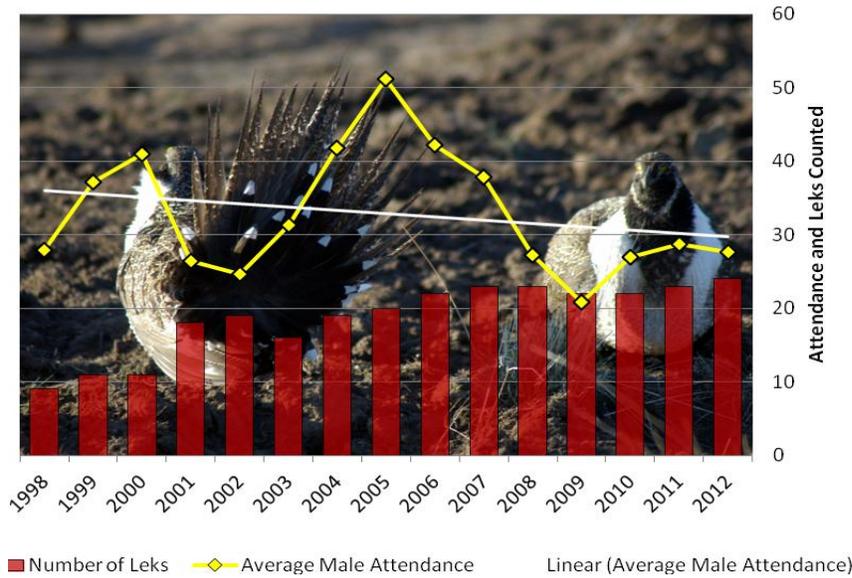
PMU	Total Known Leks	# of Leks Surveyed	# of Active Leks Surveyed	# of males Counted	Avg. # of males/Active Lek
Desert	46	15	10	319	31.9
East Valley	15	4	3	30	10.0
Gollaher	123	62	17	131	7.7
North Fork	127	96	60	906	15.1
O'Neil Basin	157	87	41	605	14.8
Ruby Valley	79	27	10	251	25.1
Snake	61	26	13	172	13.2
South Fork	65	33	21	298	14.2
Tuscarora	75	39	22	534	24.3
Islands	24	11	4	120	30.0
<b>TOTAL:</b>	<b>772</b>	<b>400</b>	<b>201</b>	<b>3,366</b>	<b>16.8</b>

**Table 6. Lek count effort and results from the 2012 spring breeding season in Elko County.**

A total of 707 lek visits were made to 400 leks during the 2012 spring breeding season. Approximately 11.4 leks were visited per day by various agency personnel and volunteers if one assumes that the breeding season extends for about a 62-day period from March 15 - May 15. A peak total of 3,366 male sage-grouse was observed on 201 active leks. The average attendance rate of 16.8 males per active lek was 17.2% less than the previous seasons attendance rate of 20.3, but very similar to the 16.4 males per active lek observed in 2010 (see Table 6 for results by PMU).

For a more accurate reflection of population trend, NDOW personnel aggressively monitor a specific set of leks multiple times throughout the breeding season. There were 24 trend leks monitored in 2012 with peak counts yielding an average of 27.6 males per lek. This represented a 3.8% decrease from the previous year's average of 28.7. These trend leks have indicated that the population in Elko County is declining for a 15 year analysis period beginning in 1998 (Figure 2). The average male attendance rate for the 15-year period was 32.5 and annual average male attendance rates have not exceeded that average since 2007.

**Elko County Trend Lek Performance (1998-2012)**



**Figure 2. Average male sage-grouse attendance rates on identified trend leks within Elko County from 1998-2012.**

**LINCOLN COUNTY TECHNICAL REVIEW TEAM**

The Lincoln County LACP consists of three separate PMUs: Lincoln, Steptoe/Cave, and the Quinn. The Quinn PMU is mostly within Nye County, but planning and implementation activities rest with this local working group. Very little data currently exists regarding recent sage-grouse activity within the Quinn PMU. On the other hand, intensive efforts to survey leks and the use of radio-marked sage-grouse in the Lincoln PMU has greatly contributed to a useful dataset and allowed the documentation of previously undiscovered lek locations.

During the spring of 2012, a total of 48 visits were made to 30 lek locations within both the Lincoln and Steptoe/Cave PMUs. In the Lincoln PMU, 15 leks were surveyed of which all 15 were considered active. Eighty-seven male sage-grouse were observed on these leks resulting in an average of 5.8 males per active lek. This represents a 56% decrease from the previous year's average of 13.1 males per active lek. A total of 19 lek visits were conducted during the spring of 2011 within the Lincoln and Steptoe/Cave (south portion) PMUs. Lek visits were reduced in 2011 because of above average snowpack and very limited access to leks. The total of peak counts from each active lek counted resulted in 159 male sage-grouse classified during the 2011 spring breeding season. The average male attendance across all active leks was 13.3 and reflected a 29% increase over the 2010 value of 10.3 and a 15% increase over the 2009 value of 11.5.

PMU	Total Known Leks	# of Leks Surveyed	# of Active Leks Surveyed	# of Birds Counted	Avg. # of Birds/Active Lek
Lincoln	23	15	8	87	10.9
Steptoe/Cave (south)	7	5	5	67	13.4
<b>TOTALS:</b>	<b>30</b>	<b>15</b>	<b>12</b>	<b>159</b>	<b>13.3</b>

**Table 7. 2011 lek count effort and results within the Lincoln LACP.**

### **WHITE PINE COUNTY LACP**

The White Pine local planning area mainly consists of three PMUs: Butte/Buck/White Pine, Schell/Antelope, and Snake Valley PMUs. These PMUs are within White Pine County. Two other PMUs, Diamond and Steptoe/Cave, are partially within White Pine County, but local working group responsibility is either shared with or handled by a separate planning group.

Spring lek surveys were conducted by NDOW, BLM, USGS, USFS, National Park Service (Great Basin), and the Southern Nevada Water Authority (SNWA) as well as consultants for a couple of mining projects. An excellent effort resulted in 110 leks being surveyed, which is up slightly from 104 leks checked in 2011. These efforts resulted in a total of 1,062 males being counted on 72 active leks for an average of 14.8 males/active lek in 2012. In comparison, 1,068 males were observed on 69 active leks for 15.5 males/active lek in 2011.

There were 31 comparable (trend) leks monitored in 2012 with 529 males observed yielding an average of 17.1 males/lek. Those same leks supported 16.6 males/lek in 2011. Overall lek trend in 2012 was up 3%. However, trend was actually down in the Spring/Snake PMU (-24%), the Schell/Antelope PMU (-15%), and the Steptoe/Cave PMU (-15%). The Butte/Buck/White Pine PMU was up 9% which offset the declines in other PMUs due to its considerably larger size and robust population.

<b>PMU</b>	<b>Total Known Leks</b>	<b># of Leks Surveyed</b>	<b># of Active Leks Surveyed</b>	<b># of Birds Counted</b>	<b>Avg. # of Birds/Active Lek</b>
Butte/Buck/WP	88	66	39	739	18.9
Schell/Antelope	32	15	12	154	12.8
Steptoe/Cave	21	15	14	166	11.9
Spring/Snake	15	11	8	58	7.3
<b>TOTAL:</b>	<b>156</b>	<b>107</b>	<b>77</b>	<b>1,117</b>	<b>14.5</b>

**Table 8. White Pine County lek count effort and survey results for 2012.**

## Population Demography

### OBJECTIVES

This section describes work conducted to achieve objective) stated in the Grant Agreement for Sub-grant I, Project #1 which states, “Determine age structure, sex ratios, and nest success values for various sage-grouse populations through collection and analysis of wings from hunter harvested sage-grouse...”

### METHODS

Sage-grouse demographic parameters can be reasonably estimated by analyzing wings collected from hunter harvested sage-grouse. The Nevada Department of Wildlife deploys modified barrels (approximately 75) placed at strategic locations and requests that hunters deposit one wing into the barrel or bring them to a regional office. The information gained from the collection of wings, as well as upland game questionnaire data, help determine if hunting season strategies meet the guidelines suggested by the Western Association of Fish and Wildlife Agencies (Connelly et al. 2000) for sage-grouse.

Wing barrels are equipped with large envelopes with questionnaire labels affixed to them. Questionnaires ask several questions relative to each person’s hunting experience, but the most important information gained from these envelopes is the location of harvest. This allows biologists to organize wings by Population Management Unit. After the hunting season, wings are analyzed at an annual Wing Bee where biologists gather from around the state to classify wings. The Braun (1970) wing key for age and sex classification of sage-grouse is utilized for proper identification.

### RESULTS

During the 2011 sage-grouse hunting season, a total of 2,014 wings were collected consisting of 1,035 adults and 979 juvenile birds. The total collection represented an 8.5% decrease from the previous year and was also almost 13% below the 10-year average of 2,312. Results of the 2011 Wing Bee are provided in Table 9 below.

<b>2011 SAGE-GROUSE DEMOGRAPHY</b>						
<b>ESTIMATED VIA HUNTER HARVESTED WINGS</b>						
AREA (PMU)	ADULTS		JUVENILES		TOTAL SAMPLE	CHICKS /HEN
	Males	Females	Males	Females		
<b>Western Region</b>						
Sheldon NWR	28	62	49	47	186	1.55
Buffalo/Skedaddle	26	55	17	17	115	0.62
Massacre	19	44	32	47	142	1.80
Vya	2	14	5	3	24	0.57
Santa Rosa	18	29	13	7	67	0.69
Lone Willow	54	105	99	81	339	1.71
Desatoya*	15	67	52	54	188	1.58
Black Rock	1	4	3	2	10	1.25

<b>2011 SAGE-GROUSE DEMOGRAPHY ESTIMATED VIA HUNTER HARVESTED WINGS (continued)</b>						
AREA	ADULTS		JUVENILES		TOTAL SAMPLE	CHICKS /HEN
	Males	Females	Males	Females		
<b>Eastern Region</b>						
Desert	0	0	0	0	0	0
Tuscarora	14	9	11	11	45	2.44
Northfork	35	52	42	45	174	1.67
Island	0	0	0	0	0	0
O'Neil	21	30	7	15	73	0.73
Snake	3	7	0	1	11	0.14
Gollaher	1	12	2	0	15	0.17
Ruby Valley	1	3	11	4	19	5.00
Southfork	5	18	9	8	40	0.94
Diamond	3	4	4	4	15	2.00
Cortez	12	12	2	3	29	0.42
Three Bar	20	32	21	28	101	1.53
Shoshone	4	6	2	8	20	1.67
Toiyabe	16	37	28	19	100	1.27
Butte/Buck/WP	9	20	21	17	67	1.90
Schell/Antelope	2	4	0	1	7	0.25
Steptoe/Cave	0	1	3	2	6	5.00
<b>Southern Region</b>						
Monitor	30	39	35	41	145	1.95
Reese River	5	12	13	13	43	2.17
Other Central NV	3	5	4	5	17	1.80
<b>Totals:</b>	<b>351</b>	<b>684</b>	<b>490</b>	<b>489</b>	<b>2,014</b>	<b>1.43</b>

Table 9. Wing-Bee Results from the 2011 Nevada sage-grouse hunt.

\* The Desatoya PMU currently has a two day season, whereas other hunt units currently have a 10 or 15 day season.

Production for 2011 was estimated at 1.43 chicks per hen, which was almost 23% lower than the previous year's production of 1.85 chicks per hen. The 2011 production is lower than what is suspected to maintain a stable to slightly increasing population. According to Connelly et al. (2000) production values  $\geq 2.25$  chicks per hen are necessary to maintain a stable to slightly increasing population. However, over the last 10 years, production has either equaled or exceeded 1.9 chicks per hen just three times, suggesting that slightly lower production values may be adequate to maintain stable populations of sage-grouse.

Analysis of wings also allows biologists to estimate nest success through the progression of outer primary feather molt. Overall nest success was estimated at 52.4% for 2011, which represented the third year in a row where nest success values were greater than 50%. This is considered relatively high for sage-grouse and is greater than the 10-year average of 44.5%.

<b>SAGE-GROUSE PRODUCTION (chicks per hen)</b>						
<b>LAST FIVE YEARS</b>						
<b>AREA</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>AVERAGE</b>
Sheldon PMU	0.38	3.26	2.45	3.07	1.55	2.14
Massacre PMU	0.57	2.21	2.16	1.62	1.80	1.67
Vya PMU*	2.00	N/A*	2.50	2.20	0.57	1.82
Santa Rosa PMU	0.39	1.85	1.37	1.17	0.69	1.09
Lone Willow PMU	0.81	2.11	2.93	2.71	1.71	2.05
Elko County	0.67	1.28	1.90	1.79	1.27	1.38
Eureka County	0.55	1.55	2.28	1.19	1.29	1.38
Lander County	0.32	1.58	1.54	1.91	1.33	1.34
White Pine LACP	0.67	1.52	1.96	1.33	1.76	1.49
Nye County	0.67	1.42	1.56	1.82	1.98	1.49
Statewide Average	0.58	1.69	2.10	1.85	1.43	1.53
Sample Size	1,496	1,662	2,680	2,201	2,014	2,011
<b>Statewide Harvest</b>	<b>4,897</b>	<b>5,775</b>	<b>8,944</b>	<b>7,355</b>	<b>5,295</b>	<b>6,453</b>
% of Harvest in Sample	31%	29%	30%	30%	38%	31%

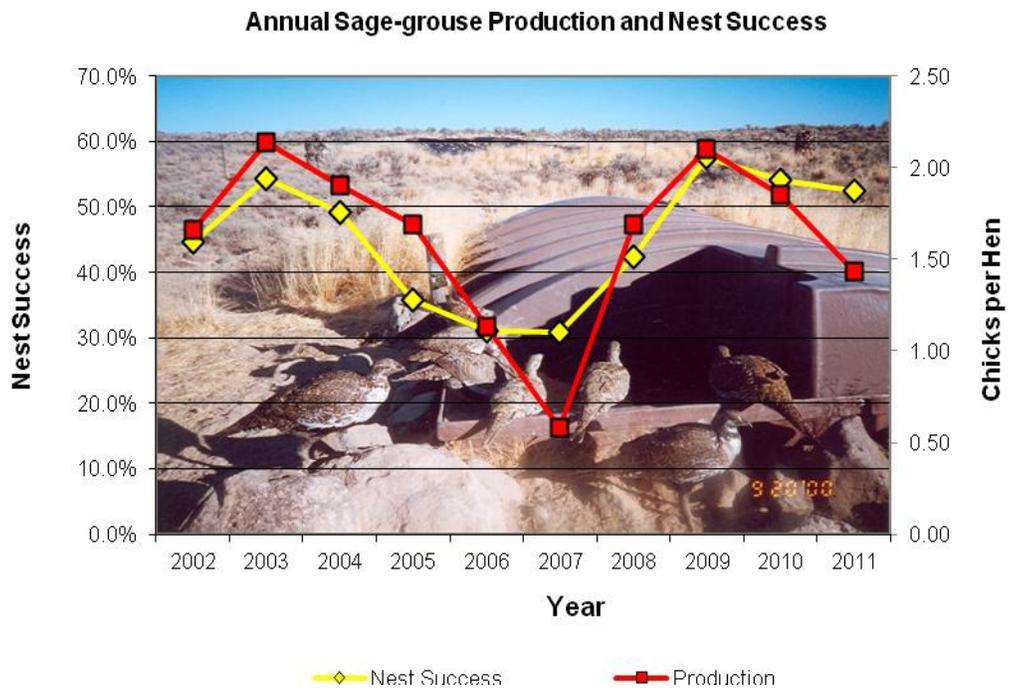
**Table 10. Five-year production values for sage-grouse via analysis of wings.**

\* Indicates inadequate sample size to calculate a reasonable estimate for this year.

## DISCUSSION

Production is the most important parameter estimate obtained through wing analysis. Because overwinter mortality is inherently low within sage-grouse populations, production values provide one of the most reliable indicators regarding population trends for the following year. Production was mixed across Population Management Units (PMUs), but was fairly consistent between the Western and Eastern Regions of the state (n=1.41, 1.45 respectively). The Southern Region exhibited the highest overall production value of 1.98 during 2011.

Consistent with higher production values observed over the last two years are the estimated nest success values. From the data collected since 2002 regarding nest success, production is highly correlated with nest success. A correlation analysis showed that nest success accounts for 79.5% of the variability in overall production from year to year (Figure 3). With nest success values  $\geq 50\%$  over the last three years, it is surprising that production values have not been greater. This could be due to multiple factors, most likely habitat conditions at the time chicks are hatched.



**Figure 3. Sage-grouse production and nest success values estimated from wing analysis from 2002 through 2011.**

## ***Population Delineation***

*Reports by: Matt Jeffress, Jeremy Lutz, Scott Roberts, Caleb McAdoo and Ken Gray*

### **OBJECTIVES**

This section describes the work conducted to help achieve objective d) identified in the Grant Agreement for Sub-grant I, Project #1. The statement basically identified three different objectives related to radio marking efforts and includes the following:

- Verify and/or refine population management unit boundaries that were delineated based on little information or biologist judgment;
- Determine migratory nature of specific populations; and
- Determine response of sage-grouse populations to various treatments or conservation efforts or disturbances such as wildfire and energy development.

### **SUMMARY**

The attachment of radio transmitters to sage-grouse is a technique widely used to delineate a population's seasonal distribution and movement corridors. Standard (VHF) transmitters require regular ground and aerial follow-up, which is labor and equipment intensive.

At the end of this reporting period 20 radio collared birds remained alive within the Eastern Region. Two new projects were initiated, four were continuations from the previous year and one project was concluded. In addition, NDOW remained actively involved in several projects across the State that were being conducted by either the USGS or UNR.

#### **Humboldt County**

##### ***Santa Rosa Range***

Trapping operations were conducted in a cooperative effort between USDA Forest Service and the Nevada Department of Wildlife to gain baseline information on important use areas of the sage-grouse population within the Santa Rosa PMU and possible movement between the Desert PMU and Oregon. Trapping operations took place during the summer of 2011. A total of six sage-grouse were radio-marked with both leg bands and telemetry collars. Within two months of collaring, five of the six birds had mortality signals. All five collars were recovered and determined that cause of mortality was predation. Prior to the mortality signals a couple of the birds collared made significant movements. Each bird traveled approximately seven miles with one making its way to the top of the Martin Creek Basin from Tom Basin and the other from Tom Basin to Hardscrabble. One bird remains on the air and has had minor elevation movements. Survey efforts included five fixed wing surveys since initial capture in August 2011 to present. Monitoring of the collared bird will continue as well as additional effort to radio-mark an additional 19 grouse.

#### **Elko County**

##### ***Willow Creek Ridge***

Eleven of the sixteen radio-marked sage-grouse remained alive as of July 1, 2012. Trapping operations focused on capturing females to document use of rehabilitated rangeland

for nesting and brood rearing following the devastating fires of 2005 and 2006. Males were also collared to assess seasonal habitat selection, particularly wintering areas. In addition to the two hens collared in 2011, five hens and nine males were collared during the spring months of 2012. Since July 1, 2011 a total of 14 surveys have been directed at monitoring these sage-grouse. Survey efforts included 10 ground surveys and four fixed-wing aerial surveys.

- Hen 159.245 wintered 18 miles to the southeast of her collaring site on the South Tuscarora Range between the Tuscarora and North Fork PMU's. Her fall and winter locations were within intact habitat surrounded by the devastating 2011 Indian Creek Fire that consumed over 110,000 acres. By May the hen had moved back to Willow Creek Ridge and was located 1.5 miles south of Willow Creek Res #01 and #06 leks. While nest and chicks were not documented, the hen was found in a drainage seeded with sagebrush, western yarrow and basin wild rye within the 2005 "Esmeralda Fire" perimeter. She was extremely reluctant to leave the drainage, as when flushed, she only flew 100 yards indicating she could have had a nest or young nearby.
- Hen 159.265 failed to raise a brood in 2011. In early July 2011 the hen was located by herself in a stand of basin wild rye within the 2006 "Winters Creek Fire" perimeter. This hen wintered near the confluence of Lewis and Toe Jam Creeks in an intact mountain brush community; it is important to note this wintering site burned in the August 2012 "Willow Fire". In April 2012 the hen's collar was emitting a mortality signal. In May the collar was retrieved from Nelson Creek. The collar was found 11" north of a fence in an intact low sage/ mountain brush community. Sage-grouse feathers were on the barbs above the collar and the collar molding holding the necklace had broke. The hen likely died from a fence strike. This site also burned in the August 2012 "Willow Fire".
- Hen 159.276 was collared on February 22, 2012 near the Willow Creek Res #06 lek. This hen was a yearling and no nest attempts were documented. She remained within two miles of the #06 lek and was last found with five other hens and no chicks, resting in mixed low sage/mountain brush community on May 23, 2012; this site burned in the August 2012 "Willow Fire".
- Hen 159.455 was collared on February 21, 2012 near the Willow Creek Res #01 lek. In April the hen was located within ¼ mile of the lek and in May the hen was found >8 miles north of the lek at the north edge of the 2006 "Winters Fire" within the Desert PMU. An attempt to document brooding in June found the collar to be in mortality mode. The collar was retrieved from the head of Trout Creek within a mile of the May location. Collar location and damage were indicative of avian predation.
- Hen 159.376 was collared on February 22, 2012 near the Willow Creek Res #01 lek. This hen remained around the #01 and #06 lek through April. In May the hen was located in a mixed low sage/mountain brush community with two class I chicks, 2.5 miles northwest of the #01 lek. A nest was found with 2-3 eggs at (NDA 83 UTM Zone 11 545892/ 4572443) within the same mountain brush community. This nesting/ brood rearing site burned in the August 2012 "Willow Fire".
- Hen 159.205 was collared on March 24, 2012 near the Willow Creek #06 lek. This hen moved 2.5 miles west of the #06 lek in an intact stand of mountain brush. On May 23, 2012 the hen was found in the same island of intact habitat. She did not flush and was observed walking through brush calling and clucking. The hen likely had a brood.
- Hen 159.387 was collared on March 23, 2012 near the Willow Creek Res #01 lek. This hen moved over four miles to the southwest in a seeded area of the 2005

Esmeralda Fire. On May 5, 2012 she was found on a nest with five eggs. On May 22, 2012 she was found in the same sagebrush, western yarrow and basin wild rye seeding. The hen only flushed 10 yards and remained in the area indicating she had a brood.

Of the six males that remained alive as of July 1, 2012, all but male 159.527 remained within three miles of their respective leks. Male 159.527 moved a little over five miles north of the Willow Creek Res 19 lek into intact habitat along Rock Creek. Two of the three males that perished were likely the result of avian or mammalian predation while the third was a collar slip.

Radio-marked sage-grouse on Willow Creek Ridge extensively used intact habitat along Toe Jam, Lewis and Nelson Creeks. Of the 75 sage-grouse locations recorded between July 1, 2011 and June 30, 2012, all but six were found in intact habitat or rehabilitated plots within the 2005 Esmeralda Fire and 2006 Winters Fire. Of great concern are the nesting, brood rearing and wintering habitats lost in the 42,000 acre 2012 Willow Fire. This fire burned the last large tract of intact sage-grouse habitat on Willow Creek Ridge. Now less than 6,000 acres remains.

### ***Midas Creek Lek***

Three radio-marked sage-grouse remained alive as of July 1, 2012 from capture operations conducted in the spring of 2011 (male 159.506), fall of 2011 (male 159.516) and spring of 2012 (female 159.496). Declining numbers of males attending the lek coincide with new vents installed at a nearby underground mine. These vents create a noticeable amount of noise that may have disturbed birds utilizing this lek. Nearly 50 sage-grouse were observed near the lek during the winter of 2011-2012, however only 6 males were counted on the Midas Creek Lek in 2012. This is down from 18 in 2006, prior to the installation of the vents. NDOW is interested in delineating movements of sage-grouse near the Midas Creek Lek throughout the year to document seasonal use, identify critical habitat and potentially identify avoidance of surrounding habitat, as it compares to noise modeling. A total of six surveys have been directed at monitoring these sage-grouse. Survey efforts include four ground surveys and two fixed-wing aerial surveys.

- Male 159.506 was collared on May 6, 2011. This male has remained within three miles of the Midas Creek Lek.
- Male 159.516 was collared on November 3, 2011. This male remained around the Midas lek through December. In April, the male was located next to the Six Mile Creek 24 lek 17.5 miles to the south. In May the male remained within close proximity to the Six Mile Creek 24 lek in the last remaining large block of sagebrush within the Tuscarora PMU.
- Female 159.496 was collared on February 22, 2012. This female nested on top of the Snowstorm Mountains four miles north of the Midas Creek lek. Through July 1<sup>st</sup> she remained on the Snowstorms with a brood of five young.

### ***Hot Springs Breeding Complex: Hot Springs 16NW Lek and Hot Springs Lek***

Two radio-marked sage-grouse remained alive as of May 14, 2012 from capture operations conducted in the spring months of 2011. Two males and one female from each lek were collared for a total of six birds. Sage-grouse were collared in an effort to monitor movements of birds associated with the construction of a geothermal power plant. A total of seven surveys have been directed at monitoring these sage-grouse. Survey efforts include three ground surveys and four fixed-wing aerial surveys. After the May 14, 2012 survey, responsibility for monitoring the remaining three collared birds was turned over to USGS. USGS is conducting

a ten year study of sage-grouse around the Ormat Geothermal Facility with >40 sage-grouse collared in the spring of 2012.

- Hen 159.256 was collared on 5/6/2011 near Hot Springs. No nest or nesting attempts were documented and this hen stayed within 2 miles of the capture site. In July 2011 the hen was found with two other hens on the edge of a dry meadow with no chicks. In May of 2012 USGS documented the hen was successful in bringing off a brood, but was killed by a hawk in the first ten days of brooding.

Two of the four remaining males perished prior to the 2012 spring lekking period. Both were likely avian predation. The two remaining males have remained within six miles of their respective collaring locations. Noteworthy locations include the use of rehabilitated areas within the 2006 Amazon Fire by male 159.215 the fall/ winter of 2011/2012 and use of rehabilitated areas within the 2006 Snow Canyon Fire by male 159.435 the winter of 2011/2012.

### ***Big Springs and Little Lake Pass Leks***

Newmont Mining Corporation is in the planning and permitting process for the Long Canyon Project in eastern Elko County. The project area lies within the East Valley Population Management Unit (PMU). The East Valley PMU represent the eastern edge of sage-grouse distribution in Elko County, and is comprised of large tracts of marginal habitat interspersed with small areas of suitable habitat and small populations of grouse. In order to obtain some baseline information on the sage-grouse population that utilize the habitat surrounding the proposed mining area a telemetry project was initiated.

Two nights in March (3/19, 3/22) and two nights in April (4/20, 4/24) were spent in an attempt to collar birds at the Big Springs Lek and the Little Lake Pass Lek. All attempts to capture birds were unsuccessful, with birds only being observed on the two nights in March. Additional attempts are planned for the upcoming winter if any concentrations can be located; if not, our efforts will be focused on the next lek season.

## **Lander County**

### ***Bates Mountain***

Wind energy exploration was initiated on Bates Mountain (Simpson Park Range, Lander County) in 2008. Two Met towers were built however both fell during the winters of 2008 and 2009. In order to obtain some baseline information on the high density sage-grouse population that inhabits this mountain, a radio-marking project was initiated from 2008 and radio collaring was conducted thru 2010. During this effort over 90 sage-grouse were captured and banded, one of which 40 were outfitted with VFH radio neck collars.

From January through May of 2012, three aerial telemetry flights were conducted to track the remaining collared sage-grouse from the 2010 capture. Movements were again typical of what earlier collaring data indicated in that come fall many of the sage-grouse start migrating off the top of Bates Mountain and moved to the west ending up in the vicinity of the McGinness Hills area. Others moved to the south of Hwy 50 in Monitor Valley around the Grimes Hills while others moved to the east and ended up in the Santa Fe/Ferguson Ranch in Kobeh Valley. Sage-grouse remained in these general wintering areas until the lekking season approached when they started to concentrate around the known leks in the McGinness Hills and the Dry Creek and Ackerman benches. By May of 2012 the battery life on the remaining collars was depleted.

Since 2008 over 30 aerial telemetry flights have been conducted as well as hundreds of hours of on the ground tracking. These collars have resulted in learning about the life history traits of sage-grouse in this population. This data has also resulted in the finding of unknown leks, new migration routes and has provided us with a better understanding of seasonal use areas. This data has been incorporated into NDOW's sage-grouse habitat use map, the BM BLM RMP revision, BLM allotment evaluations, current and future P-J thinning projects, the McGinness Hills Geothermal EA, future McGinness Hills Mitigation Projects and a multi-year USGS collaring project within the Toiyabe PMU. Collaring data has also shown that sage-grouse within the Toiyabe PMU use and seasonally depend on four different mountain ranges.

## **White Pine County**

### ***Blue Jay and Overland Radio-marking Project***

A large scale-mining expansion at Bald Mountain Mine, as well as a proposed habitat manipulation project near Overland Pass, prompted a radio-marking effort of sage-grouse in the vicinity of south Ruby Valley. More specifically, the Blue-Jay and Overland leks were targeted for bird captures in order to begin collecting baseline data of bird use and movement patterns. These leks were targeted due to their proximity to the project locations and with the highest potential to be impacted by either project. The Blue-Jay lek is the largest lek in south Ruby Valley.

A two night lek-trapping effort in April of 2012 resulted in four males being captured. Unfortunately, despite the best efforts of the capture crews, no female sage-grouse were captured. Each of the four males was outfitted with a VHF radio collar and a corresponding leg-band. Additional capture efforts will be made during the spring of 2013 with the primary objective of targeting hens to identify important nesting habitats

Aerial monitoring of the collars has been conducted on a monthly basis since capture, as well as periodic ground monitoring. Each of the four males remained alive, as of October 2012, with significant movements incurred by each of the birds from the initial capture location on the Blue-Jay and Overland leks. Three of the four birds spent a significant portion of their time within the Mining Operations areas, some of which is proposed for active mining. Even though these areas are over 9 miles away from the leks these data illustrate that seasonal habitats are important for bird survival. The fourth bird utilized areas adjacent to the proposed habitat improvement project.

The collared birds also provided valuable credence to the Sage-grouse Habitat Categorization Map developed by NDOW which had significant public criticism. By overlaying actual bird use locations onto the Habitat Categorization Map, accuracies or inaccuracies of the categorizations can be brought to light. For each of the four collared birds, 83 percent of their seasonal use between April and September occurred within Preliminary Priority Habitat (PPH), identified as the most important habitat for the birds. Additionally, 13 percent of the seasonal use was on the border with PPH habitat and "non-habitat" areas and were a result of a map scaling issue. Thus, 96 percent of bird use occurred in habitats identified as PPH habitat by NDOW.

Other noteworthy comments from this collaring effort include that while the Overland and Blue-Jay leks occur in the Ruby Valley Population Management Unit (PMU), a significant portion of the seasonal use from birds caught on these leks occurred within the Buck/Butte/White Pine PMU, indicating connectivity between populations currently.

## **CONSERVATION PLANNING**

### ***Governor's Strategic Planning***

*Report by: Shawn Espinosa*

#### **OBJECTIVES**

The major objective of the Nevada Governor's Sage-grouse Conservation Team (SGCT) is to address threats or develop guidance at a statewide level and to assist local working groups with the implementation of prioritized projects. Other objectives include completing the Second Edition of the Greater Sage-grouse Conservation Plan for Nevada and Eastern California and developing semi-annual workshops.

#### **SUMMARY**

The Nevada Governor's Sage-grouse Conservation Team (SGCT) held a total only 3 meetings in fiscal year 2012 before the group was disbanded by the Nevada Governor's Office. The team was supplanted in late March of 2012 by an appointed Nevada Sage-grouse Advisory Council. This group was charged with developing a sage-grouse conservation plan that would form the basis for an alternative within the BLM's Sage-grouse Conservation EIS. Before being disbanded, the SGCT was engaged in the following:

- Sage-grouse Habitat Categorization mapping
- Bi-State Sage-grouse Conservation Action Plan
- Ruby Pipeline Mitigation Project updates
- Local Working Group (facilitation and re-invigoration)
- Nevada Partners in Conservation Development

A critical assignment that was accomplished during fiscal year 2012 was the completion of the Sage-grouse Habitat Categorization map (Figure 4). This map delineated sage-grouse habitat into the following categories:

- Category 1 – Essential and Irreplaceable
- Category 2 – Important Habitat
- Category 3 – Habitat of Moderate Importance
- Category 4 – Low Value Habitat and Transitional Range
- Category 5 – Unsuitable habitat

The Sage-Grouse Habitat Categorization Map represents a tool that will support management of the species in Nevada. The map is a statement of sage-grouse habitat value based upon the best available information. The map will be modified from time to time as new information becomes available.



## ***Sage and Columbian Sharp-tailed grouse Technical Committee***

*Report by: Shawn Espinosa*

### SUMMARY

The Western States Sage and Columbian Sharp-tailed Grouse Technical Committee (Tech Committee) has engaged multiple issues facing both Greater Sage-grouse and Columbian Sharp-tailed Grouse for several decades. The Technical Committee is a scientific fact-finding body and recommendations, informational notes, and subcommittee reports are prepared by the Committee and forwarded to the Western Association of Fish and Wildlife Agencies (WAFWA) Western Bird Conservation Committee (WBCC) and finally the WAFWA Directors at their July Business Meeting. These items have required a considerable amount of time and effort to complete while at the same time, continuing normal job duties at the State level. The Upland Game Staff Specialist devoted considerable time to several tasks including the following:

#### ***Rangewide Energy Development Guidelines for Greater Sage-grouse***

A review draft of the Rangewide Energy Development Guidelines for Greater Sage-grouse was completed and provided to the WBCC; however, this item was tabled during the July business meeting so as not to usurp state efforts where agreements had already been agreed upon.

#### ***Guidelines for Managing Columbian Sharp-tailed Grouse Populations and Their Habitats***

The final draft of the Guidelines for Managing Columbian Sharp-tailed Grouse Populations and their Habitats was also completed during 2012. The following recommendations were made to the WBCC during their July meeting and unanimously passed:

- 1) Develop an authorship/citation page;
- 2) Complete a clean version of the document for the WBCC committee and Directors' (completed Appendix 1);
- 3) Send out for one final technical writer review;
- 4) Publish 500 copies for distribution to WAFWA and partners;
- 5) Synthesize a summary field handbook, from the guidelines. (need a sub-committee to handle this task);
- 6) Synthesize a technical peer-reviewed manuscript from the guidelines and publish in a journal. (Sub-committee needs to be empanelled to accomplish this task).

#### ***Decision Support Tool for Managing Sagebrush Habitats for Greater Sage-grouse***

The Tech Committee has accumulated the funds needed for development of the Sagebrush Habitat Management Decision Support Tool, submitted a RFP, selected a vendor and have contracted to have the document completed by June 2013. Funds have been received from the USFWS and NRCS as well and in-kind funds from various partners. There is a need for managers to have concise, science-based information to guide their efforts. Numerous sagebrush treatments have been used in the past 15+ years with the assumption of benefiting sage-grouse. Monitoring or anecdotal observations suggest that some treatments can result in harmful impacts to sage-grouse habitat. Under some circumstances treatments have been shown to be beneficial or benign. Additionally, inconsistent and improper use of terminology to describe certain habitat conditions relative to sagebrush can be confusing and can misdirect management decisions. This can lead to negative impacts to sage-grouse populations.

### ***Bureau of Land Management – National Technical Team Report***

The Bureau of Land Management's National Policy Team created the National Technical Team (NTT) to help ensure BLM management actions were effective and based on the best available science. State and federal agency personnel, including state wildlife agency biologists responsible for managing sage-grouse, were called upon to participate in the development of a set of recommendations that would help fulfill the BLM's objective to conserve and restore the Greater sage-grouse and its habitat on BLM administered lands on a range-wide basis over the long-term. This document was completed in late December of 2011 and is utilized as the premise for interim management actions until Environmental Impact Statements are completed that would amend or provide guidance to Resource Management Plans in order to incorporate management strategies conducive to sage-grouse populations.

### ***U.S. Fish and Wildlife Service – Conservation Objectives Team***

The FWS was tasked by its Director with the development of conservation objectives for the sage-grouse. The FWS created a Conservation Objectives Team (COT) of state and FWS representatives to accomplish this task recognizing that state wildlife agencies have management expertise and retain management authority for the species,. Each member was selected by his or her state or agency. The purpose of the COT was to develop conservation objectives by defining the degree to which the threats need to be ameliorated to conserve the sage-grouse so that it is no longer in danger of extinction or likely to become in danger of extinction, by 2013 for the Bi-state Distinct Population Segment (DPS), and 2015 for the Greater sage-grouse range-wide. A document was developed and provided to the U.S. Fish and Wildlife Service and a contracted peer review team during the late summer of 2012.

## Local Area Conservation Planning & Implementation

### OBJECTIVES

The following objectives were identified in the W-64-R-12 Grant Agreement for this particular job:

- Complete any unfinished population management unit plans, revise existing plans and refine projects identified within those plans; and
- Assist with and/or conduct implementation of suggested projects within completed plans.

The following summaries describe the work accomplished during state fiscal year 2012 including project implementation, population management unit planning and major habitat issues.

### SUMMARY

#### ***Stocks Creek/Holloway Meadow Restoration Project: North Central LACP***

The Stocks Creek/Holloway Meadow area serves as important brood-rearing habitat for Greater Sage-grouse within the Santa Rosa Mountain Range located in Humboldt County, Nevada. This area is managed by the U.S. Forest Service – Humboldt-Toiyabe National Forest. The meadow is within the North Fork Little Humboldt watershed and was diminishing in size and condition due to various factors.

The stream channel within the meadow had experienced incision due to an adjacent road crossing and other factors (Figure 5). Plans were developed by the U.S. Forest Service (USFS) to stabilize stream banks and elevate the stream channel through the use of modified check dams placed along approximately a quarter mile of stream channel. Additionally, a culvert/road crossing was re-constructed to alleviate the source of down-cutting. Over time, this will allow the water table to elevate, improving the condition and increasing the size of the existing meadow. As the water table increases, it is expected that some upland vegetation will be replaced with wetland species.

Work on the project was completed during the fall of 2011 by the U.S. Forest Service. The Nevada Department of Wildlife's Habitat Conservation Fee provided \$9,500 for the project which was utilized as a matching source of funding for this grant. This funding allowed NDOW to access \$28,500 in Wildlife Restoration federal aid funds for this project. The total budgeted cost of the project was \$38,000.



The success of the project is being monitored by the USFS and sage-grouse brood use will be documented by NDOW.

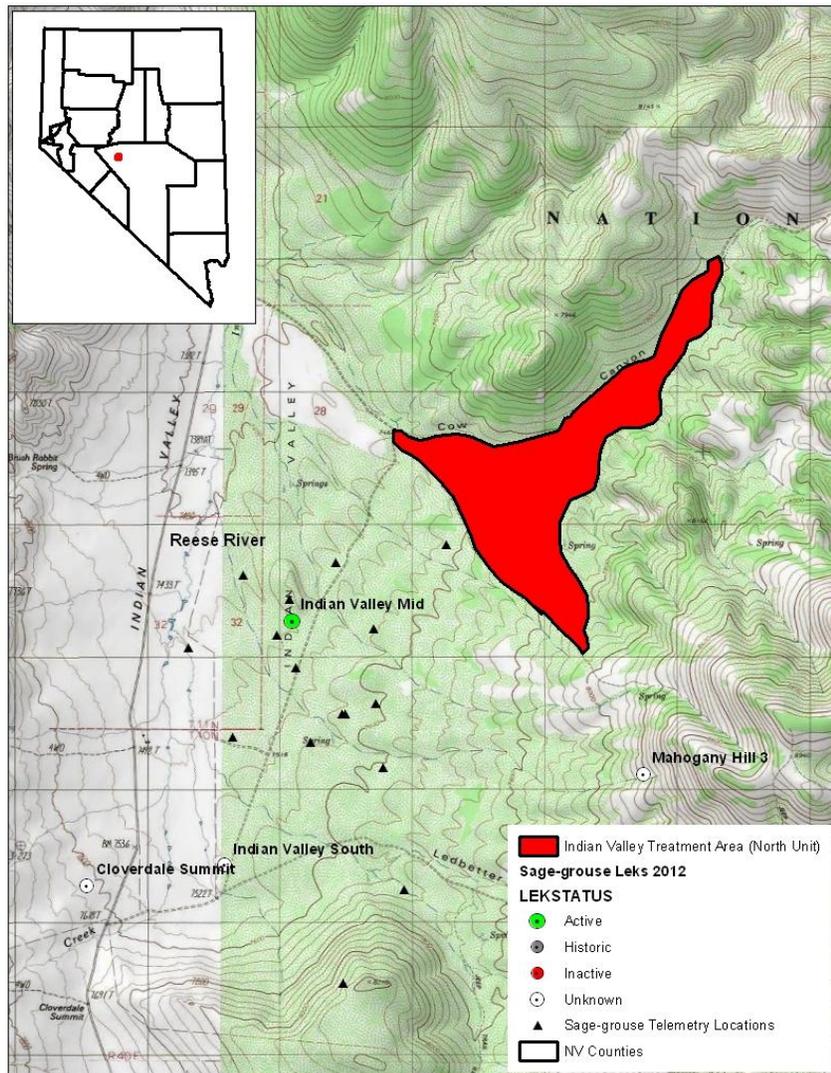
### **Indian Valley Sage-grouse Habitat Enhancement Project: South Central LACP**

The purpose of this project is to improve sage-grouse habitat in the Indian Valley area between the Shoshone Range and the Toiyabe Range in central Nevada (Figure 6). This area serves multiple seasonal needs for Greater Sage-grouse including breeding, brood-rearing and winter habitat uses.

Sagebrush habitat in this area has been encroached upon by pinyon and juniper trees and removal of these trees will improve breeding and brood rearing habitat for sage-grouse. The project area encompasses approximately 600 acres (Figure 6) that was treated with hand crews using chainsaws. On average, there are about 10-50 trees/acre. The treatment reduced the risk of continued invasion by pinyon-juniper, which causes future loss of existing sagebrush habitat. This project is supported by objectives outlined in the South Central Sage Grouse Conservation Plan (2004) for habitat enhancement.

The Indian Valley Sage-grouse Habitat Enhancement Project was completed during the summer of 2012. Hand crews from the Great Basin Institute – Nevada Conservation Corps were utilized to implement the project. Figures 7 and 8 display before and after treatment conditions within a portion of the project area.

This project was 75% funded by the Nevada Sage-grouse Conservation



**Figure 6. Indian Valley project area in Nye County, NV.**

Grant (W-64 grant) and 25% funded by a combination of Nevada Upland Game Stamp funds (\$7,500) and a gift from the Carson Valley Chukar Club (\$5,000).



Figure 7. Portion of Indian Valley Project prior to treatment.



Figure 8. Post treatment view of portion of Indian Valley project area.

***Bald Mountain Wildlife Habitat Enhancement Project: South Central LACP***

The ultimate purpose of this project was to reduce or reverse pinyon-juniper encroachment on up to 3,000 acres of important wildlife habitat in the Bald Mountain area of the Northern Toiyabe Mountains. This area is within the Toiyabe Population Management Unit (PMU) and serves several seasonal needs including brood rearing and winter habitat in some

instances. The project was necessary to enhance habitat for wildlife, particularly sage grouse, because pinyon and juniper trees have increased in both distribution and density at the expense of shrubs, grasses and forbs in the project area. Approximately 550 acres of encroaching trees were removed from Bald Mountain during 2012.

Trees were thinned by hand crews supplied by the University of Nevada Cooperative Extension's "Bootstraps" program (Figure 9). Treatments were conducted on foot using chainsaws. Trees less than 20 feet in height and 10 inches diameter breast height (DBH) were, in most cases, cut down (trees of this size or smaller are normally of post-European settlement age.) Thinning generally occurred in Phase I and early Phase II woodlands (see box below for pinyon-juniper woodland phase descriptions) where pinyon-juniper canopy cover exceeded 30%. This approach maximized the efficiency of chainsaw crews by allowing the treatment of the largest possible area of habitat with available funding. The approach also addresses the concerns of BLM fire/fuels specialists and others about the effects of pinyon-juniper thinning on ground-level fuel loading.

- Phase I – trees are present, but shrubs and grasses are the dominant vegetation that influence ecological processes (hydrologic, nutrient and energy cycles) on the site;
- Phase II – trees are co-dominant with shrubs and herbs, and all three vegetation layers influence ecological processes on the site;
- Phase III – trees are the dominant vegetation and the primary plant layer influencing ecological processes on the site. Shrubs no longer dominate the understory.



Figure 9. Bootstraps Crew at Rosebush Creek in the Toiyabe Range in 2012.

## **RESEARCH**

### ***Habitat Relationships***

Report by: Peter S. Coates, Zachary B. Lockyer, Michael L. Casazza, & David J. Delehanty

## **OBJECTIVES**

This project is intended to better understand habitat utilization, identify key habitats and determine movement patterns of sage-grouse between use areas within the Virginia Mountains. Several threats have been realized with regard to this population, emphasizing the timing of this project. Research efforts are expected to lead to identification of priority habitat areas and factors limiting this population. Research results will help to identify the following:

- 1) determine seasonal movement patterns of radio marked birds;
- 2) identification of nest sites and nest initiation rates;
- 3) determination of nest site vegetative characteristics including overstory and understory and determine if difference exist between successful and unsuccessful nest sites;
- 4) determination of predation rates of sage-grouse nests and identification of predatory species responsible (through use of videography);
- 5) determination of survival rates of adults and juveniles; and
- 6) determine recruitment rates.

## **SUMMARY**

In 2009, the Nevada Department of Wildlife (NDOW) contracted with the USGS to conduct research activities to fulfill the objectives described above. The USGS worked with Idaho State University to place a graduate student, Zach Lockyer, on the project. During State Fiscal Year 2012, a Master's Thesis was completed for the project. Below is an abstract summarizing the project and results.

### **Nest Site Selection and Reproductive Success of Greater Sage-Grouse in Northwestern Nevada**

**Zachary B. Lockyer<sup>1\*</sup>, Peter S. Coates<sup>2</sup>, Michael L. Casazza<sup>2</sup>, Shawn Espinosa<sup>3</sup>,  
and David J. Delehanty<sup>1</sup>**

#### **Abstract**

Identifying links between habitat-based decisions by wildlife and their reproductive success will help guide conservation actions that promote population persistence and recovery. Greater sage-grouse (*Centrocercus urophasianus*) are a species of great conservation concern and a better understanding of nesting habitat and survival in the Great Basin is needed. We conducted radio-telemetry of sage-grouse and monitored their nests (n = 71) within the Virginia Mountains of northeastern Nevada during 2009 – 2011. We measured multiple vegetation characteristics, which included invasive annual cheatgrass (*Bromus tectorum*), at multiple spatial scales (microhabitat in the field and macrohabitat within a Geographical Information System) at nest and random sites. We then conducted three analyses using an information-theoretic modeling approach, which were to: (1) identify environmental factors that were selected (defined as use disproportionate to availability); (2) identify environmental factors that influenced nest survival; and (3) evaluate nest survival as a function of a selection for sage-grouse. Our results provide evidence for a hierarchical nest site selection, such that sage-

grouse selected large expanses of sagebrush-dominated areas, and within those areas selected microsites with increased shrub canopy cover and decreased cheatgrass cover. However, we found that a mix of sagebrush and other shrub species, at the small spatial scales, was the single most explanatory factor selected by female sage-grouse that resulted in increased nest survival, likely because increased cover decreased probability of predation. These results suggest that managers should discourage growth of annual grass invasion and preserve and enhance large intact sagebrush-dominated stands with a mixture of shrub species.

## ***Mortality Relationships***

### **Effects of Utility Scale Transmission Line on Sage-grouse Population Dynamics**

*Report by: Dan Nonne, Erik Blomberg and Jim Sedinger*

#### OBJECTIVES

The goal of this study is to assess impacts of the FG line on the dynamics of the population of Greater Sage-grouse in the region. The basic study design calls for estimation of key demographic parameters as a function of distance from the line. Under the hypothesis that the line negatively affects local sage grouse, we expect that demographic responses to the line will be greatest for leks nearest the line. Distance from the line will be directly incorporated into models of demographic parameters to assess this hypothesis. For parameters for which we hypothesize a time delayed response (e.g., adult survival following an increase in raptors) the appropriate analysis includes a time by distance interaction.

#### SUMMARY

This year (2012) represents the final year of this particular study. It is likely that the official findings, relative to the effects of the transmission line on sage-grouse demographic parameters, will not be published until 2014. However, there are several manuscripts that have been published or are in press or review that are directly related to this research project and include the following:

- **Atamian, M.T., J.S. Sedinger, J.S. Heaton, and E.J. Blomberg. 2010.** Landscape-level assessment of brood rearing habitat for greater sage-grouse in Nevada. *Journal of Wildlife Management* 74:1533–1543.
- **Blomberg, E.J, J.S. Sedinger, M.T. Atamian, and D.V. Nonne. 2012.** Characteristics of climate and landscape disturbance influence the dynamics of greater sage-grouse populations. *Ecosphere* 3(6):55. <http://dx.doi.org/10.1890/ES11-00304.1>
- **Blomberg, E. J., J. S. Sedinger, D. V. Nonne., and M.T. Atamian. *In press.*** Seasonal reproductive costs contribute to reduced survival of female greater sage-grouse. *Journal of Avian Biology* 00:000-000.
- **Blomberg, E. J., J. S. Sedinger, D. V. Nonne., and M.T. Atamian. *In revision.*** The influence of breeding propensity on population indices of greater sage-grouse. *Journal of Wildlife Management* 00:000-000.
- **Blomberg, E. J., P. L. Wolf, and J. S. Sedinger. *In review.*** Geographic variation in liver metal concentrations of greater sage-grouse. *Journal of Fish and Wildlife Management* 00:000-000.
- **Blomberg, E. J., S. R. Poulson, J. S. Sedinger, and D. N. Nonne. *In review.*** Using feather stable isotopes ( $\delta^{15}\text{N}$ ,  $\delta^{13}\text{C}$ ) to reconstruct a dietary time series in pre-fledging greater sage-grouse. *Auk* 00:000-000.
- **Nonne, D. N., E. J. Blomberg, J. S. Sedinger, and M. T. Atamian. *In review.*** The effects of radio-collars on male sage-grouse survival and lekking behavior. *Condor* 00:000-000.

These journal articles can have implications for future management decisions. Preliminary abstracts are provided below for these and other publications that are forthcoming and considered a direct result of this particular study:

### **Estimating female breeding propensity**

Within the Greater sage-grouse (*Centrocercus urophasianus*) literature, reporting apparent breeding propensity, i.e. the ratio between nests found per unique female and the overall number of unique females monitored, has been the standard methodology for estimates of female breeding probability (see Connelly et al. 2011). However, apparent breeding propensity cannot account for variation in observer effort or methodology and mortality of females during the breeding season, which bias both estimates of breeding propensity and therefore, fecundity (Bond et al. 2007). Using capture-mark-recapture data, statistically more robust approaches have been developed to estimate breeding propensity for long distance migrants (e.g. Sedinger et al. 2001, Reed et al. 2004, Gauthier et al. 2010), by modeling non-breeding as a non-observable state, i.e. absence from the breeding area. Unfortunately, this approach is not appropriate for species without perceivable spatial separation between non-breeding and breeding individuals, as is the case with sage-grouse. Our goal is to develop a statistically robust approach for estimating breeding propensity for female sage-grouse in multistate framework in Program MARK, which accounts for the bias associated with apparent breeding propensity estimates. This will be accomplished by estimating daily transitions between observable 'breeding' states using repeated sampling of females across the duration of the breeding season.

Preliminary results are promising, as our methodology appears to have been successful. We observed substantial annual variation in female nesting propensity (0.52 – 0.92) and a significant positive relationship between female age on nesting propensity ( $\beta = 0.21$ , 85% C.I. 0.11 – 0.30). On average, estimates of apparent breeding propensity in our study system were 0.11 ( $\pm 0.04$ ) lower than the estimates of breeding propensity from the methodology we developed. We suggest that the difference between these two estimates of breeding propensity is a result of nest attempts that fail before detection through either hen mortality or nest depredation.

### **Effects of radio collars**

Monitoring avian species often requires the use of very high frequency (VHF) radios or satellite telemetry to enhance detectability of individuals. An implicit assumption in such studies is that radio marked individuals are representative of the population as a whole, which requires that radios do not influence an individual's behavior or demographics. We present results from a capture-mark-recapture (CMR) study using radio collared and banded-only male Greater sage-grouse in an experimental framework to assess whether radio collars influenced male behavior or survival. We generated encounter histories from 906 male sage-grouse and used a robust-design framework in Program MARK to estimate probabilities of annual survival, detection, and temporary emigration from the lek for the radio collared and banded segments of the sample population. Model results suggested that seasonal detection rates on breeding leks the year after capture were 3-6 times higher for banded-only males than for males equipped with radio collars. Model results also suggested a possible negative influence of radio collars on annual survival and annual lek attendance of males. In addition, analysis of audio recordings from a radio collared male showed impairment of multiple vocalizations important for breeding. We suggest researchers should exercise caution when designing studies or analyzing data that rely on radio collared male sage-grouse.

### **Pre-fledging chick survival**

Conservation of greater sage-grouse populations is currently a topic of great concern throughout the western United States. Range-wide declines in sage-grouse populations since the 1950's have been partially attributed to reductions of chick recruitment into the breeding population. We used flush count data from 2005-2012 from radio-marked female sage-grouse

with active broods in Eureka County, Nevada to estimate annual variations in early sage-grouse chick survival. Top models supported a strong positive relationship between pre-fledging chick survival and early spring (May) precipitation, which accounted for 72% of the annual variation in early chick survival. Estimates of chick survival until 45 days post-hatch ranged from 0.13 ( $\pm 0.03$  SE) in drier springs to 0.40 ( $\pm 0.04$  SE) in wetter springs. Model results supported an interaction between early brood movement and spring precipitation on chick survival that suggested farther brood movements were less deleterious during wetter springs than in drier springs. However, average daily brood movements were two times farther in drier years than wetter years, compounding the negative effects of poor habitat conditions on chick survival. This disparity most likely results from limited optimal brood rearing habitat during drier conditions within the study area.

## Harvest Impacts: Eureka County

Report by: Erik Blomberg, Dan Nonne and Shawn Espinosa

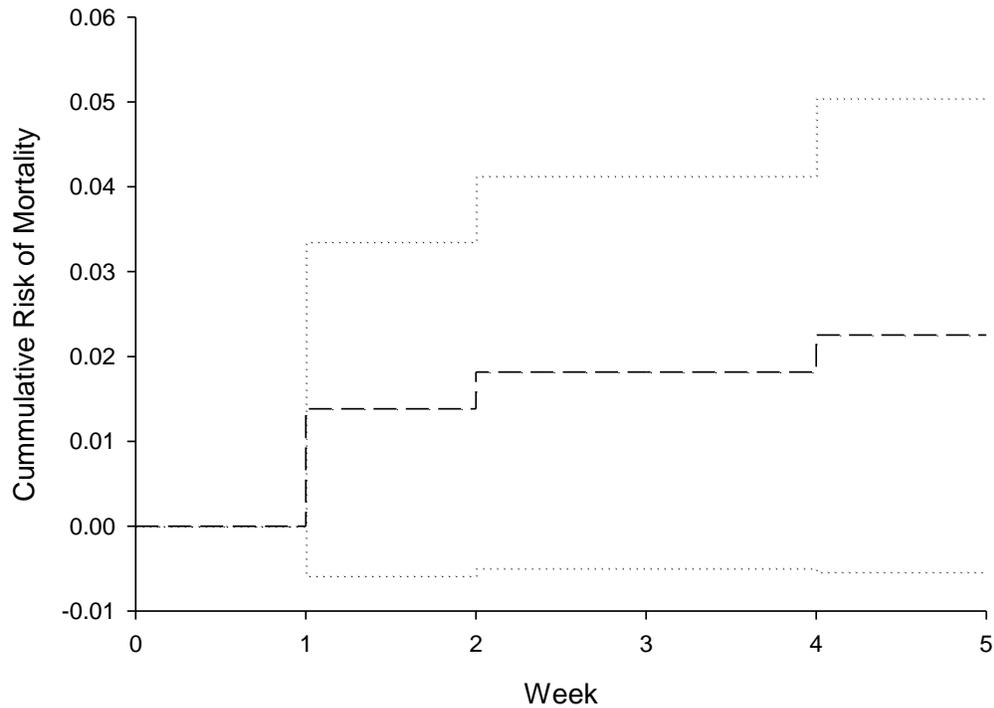
### OBJECTIVES

The objective for this particular job is to better determine harvest rates for certain areas distributed across Nevada to ensure that they are within acceptable levels according to Western Association of Fish and Wildlife Agency (WAFWA) guidelines (Connelly et al. 2000). The guidelines suggest, in part, that a) harvest rates should be less than 10% of the estimated fall population; and b) populations should not be hunted where  $\leq 300$  birds comprise the breeding population. A study being conducted by the University of Nevada, Reno researching the effects of a utility scale transmission line on sage-grouse population demographics provided an opportunity to assess the effects of harvest within the study area.

### SUMMARY

The mortality process is a key component of avian population dynamics, and understanding factors that affect mortality is central to avian conservation. A detailed study was conducted to determine cause-specific mortality of radio-marked sage-grouse in Eureka County, NV, during two seasons, nesting (2008-2012) and fall (2008-2010), when survival was known to be lower compared to other times of year. Known-fate and cumulative incidence function models were used to estimate weekly survival rates and cumulative risk of cause-specific mortalities, respectively. These quantitative methods accounted for temporal variation in sample size and staggered entry of marked individuals into the sample in order to obtain robust estimates of survival and cause-specific mortality. A total of 376 unique sage-grouse were monitored during the course of this study, and 87 mortality events were investigated. Predation was the major source of mortality, and accounted for 89% of all mortalities during the study. During the nesting season, mortality by raptor and mammal predation was relatively equal, resulting in cumulative risks of 0.10 (95% CI = 0.05 to 0.16) and 0.08 (95% CI = 0.03 to 0.13), respectively. In the fall, the cumulative risk of mammal predation was greater ( $M_{(mam)} = 0.12$ ; 95% CI = 0.04 to 0.19) than that of raptors ( $M_{(rap)} = 0.05$ ; 95% CI = 0.00 to 0.10) or human harvest ( $M_{(hunt)} = 0.02$ ; 95% CI = 0.0 to 0.06). During both seasons, relatively few additional sources of mortality (e.g. collision) and no instances of disease-related mortality (e.g. West Nile Virus) were observed.

In general, little evidence for intra-seasonal temporal variation in survival was discovered, suggesting the nesting and fall seasons represent biologically meaningful time intervals with respect to sage-grouse survival. Additionally, little direct human-induced mortality of sage-grouse was found during this study. Estimates of cumulative hazard risk for harvest-related mortality can be viewed as analogous to an overall harvest mortality rate for this population, and included both harvest and crippling loss of shot sage-grouse (Figure 10). This harvest rate estimate (2%) adds to the available literature on sage-grouse harvest (Reese and Connelly 2011), and falls well below harvest levels that have been demonstrated as compensatory for sage-grouse in other systems (Sedinger et al. 2010). It is therefore suggested that current harvest rates in the study system do not adversely impact sage-grouse populations and that current harvest rates fall well below the WAFWA recommended value of 10% of the estimated fall population. Furthermore, increased mortality during the fall period, coincident with harvest may provide a mechanism for compensatory mortality to occur (Reese and Connelly 2011).



**Figure 10. Estimates of hunting mortality risk (harvest + crippling loss) of radio-collared greater sage-grouse in Eureka County, NV, from 2008-2010. Week 1 represents the first week during which the annual 15-day hunting season was open, and increased risk following week three reflects loss due to unrecovered crippling following the close of the season. The total estimated risk due to harvest was 2.3%. Dotted lines represent 95% confidence intervals.**

Additionally, during this study researchers were also able to determine male population estimates during the spring from 2003-2012 (Table 12). These estimates show that the male segment of the population, in and of itself, averaged greater than 300 birds during the study period. Thus, the population was considered robust enough to hold a short hunting season, bearing in mind the WAFWA standards mentioned previously.

Year	Male Population Estimate	Standard Error
2003	318	23
2004	339	29
2005	431	35
2006	628	43
2007	381	26
2008	290	21
2009	247	18
2010	238	17
2011	258	20
2012	290	23
<b>Averages:</b>	<b>342</b>	<b>25.5</b>

**Table 12. Annual estimates of the male population of sage-grouse within the Eureka County, NV study area.**

## **COORDINATION**

### **OBJECTIVES**

The objective of this particular job is to ensure consistent monitoring efforts for the species across agencies and keep personnel abreast of pertinent planning and implementation efforts by coordinating within and amongst state and federal agencies.

### **SUMMARY**

A significant amount of time was spent coordinating with federal land management agencies, state agencies and the Nevada Governor's office during fiscal year 2012, largely in response to the Bureau of Land Management's "National Greater Sage-grouse Planning Strategy". Four sub-regional EIS amendments are being undertaken in the Great Basin Region. The Nevada and Northeastern California Greater Sage-grouse plan amendment will amend 10 BLM land use plans and two Forest Plans. Staff members from the Nevada Department of Wildlife have been extensively involved with these processes.

Additionally, staff provided support to the newly formed Nevada Governor's Sage-grouse Advisory Council which developed a recommendation for the future management of sage-grouse habitat in Nevada. This recommendation attempted to address the major threats facing sage-grouse in Nevada currently and identified a concept for determining possible mitigation requirements for pertinent land uses.

## **ADMINISTRATION**

### **OBJECTIVES**

This project provides oversight regarding personnel assignments, proper tracking of time spent on projects identified within the W-64-R-11 Grant Agreement and administrative issues regarding the development and implementation of contracts or agreements.

### **SUMMARY**

The majority of tasks associated with "administration" involve grant preparation, final performance report writing and working with NDOW's Fiscal Service Section to develop required work programs to acquire legislative spending authority, especially for certain projects or research efforts. Other miscellaneous items such as budget development, tracking, and cost accounting are responsibilities associated with this job title.

## **PROJECT VEHICLE**

### **OBJECTIVES**

Purchase a light duty pick-up truck to assist with conducting sage-grouse survey and inventory work, local conservation planning and implementation, and research work.

### **SUMMARY**

A 2011 Toyota Tacoma Double Cab 4X4 V6 Pick-up truck was purchased and delivered on December 31, 2010. Uses include lek surveys, sage-grouse captures, travel to and from local working group meetings, and habitat improvement project site visits and field trips.