Sage Grouse Movements In Southwestern Montana

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Abstract

Sage grouse (*Centrocercus urophasianas*) populations have declined throughout the western United States and in southwestern Montana since the 1970s. Conservation efforts rely on knowledge of seasonal habitat distribution and sage grouse movement patterns between these habitats. Both of these factors are poorly understood and undocumented in southwestern Montana. An ongoing, cooperative study was initiated in 1999 to radio-track sage grouse in southwestern Montana to identify resident and migratory populations, key habitats, and movement patterns relevant to local sagebrush and sage grouse conservation. Thirty-seven sage grouse were fitted with radio transmitters and monitored ≤ 24 months in Horse Prairie, Sweetwater Basin, and Big Sheep Creek Basin in Beaverhead and Madison Counties near Dillon, Montana. Data collection included aerial monitoring supplemented with ground relocations obtained between flights. Results indicated that some groups of sage grouse were resident within a particular habitat complex while others traveled greater distances to utilize suitable breeding, summer, and winter habitat. This study helped identify locally important brood-rearing and summer habitats. Annual mortality of radio-tracked birds has averaged 58 percent over 3 years, with 50-83 percent losses for males ($n = 20$) and 14-50 percent losses for females ($n = 4$).

Key Words: key habitats, migration, mortality, radio telemetry, sage grouse

Introduction

Long-term population declines of sage grouse in southwest Montana have been documented for some time, but habitat quality and distribution have not been adequately investigated. Crowley and Connelly (1996) documented declining numbers of male sage grouse on nearly all leks in southwest Montana since the early 1970s, although numbers have stabilized or increased slightly since then. Martin (1970) described sage grouse habitat in Big Sheep Creek Basin and the effects of sagebrush removal on sage grouse use. An interagency, interstate study plan was proposed in 1987 to address this issue in southwest Montana and southeast Idaho, but funding problems limited implementation of the plan in Montana. Substantial sage grouse research information has been collected in southeast Idaho that is pertinent to southwest Montana, including some evidence that migratory sage grouse are moving between southwestern Montana and southeastern Idaho (Connelly, et. al 1988, Connelly, et al. 1991). By 1999 with increasing need for conservation planning, the USDI Bureau of Land Management (BLM), Dillon Field Office, and Montana Fish Wildlife and Parks (MFWP) initiated a cooperative study of sage grouse movements and habitat inventory that could serve as the basis for expanded research and habitat conservation. Support for the project was derived through Challenge Cost Share partnerships between the BLM, MFWP, Big Sky Upland Bird Association, Gallatin Wildlife Association, Western Montana College, and USDA Forest Service (USFS), Beaverhead/Deerlodge National Forest, and the effort of many volunteers.

Our goal is to provide baseline information on specific sage grouse populations and habitats in southwest

Montana to use in conservation planning and land management decisions. This project was not designed to meet the rigorous standards of classic scientific methodology and statistical validity but rather to provide baseline information on sage grouse distribution and movements that might serve as a catalyst for more definitive research into sage grouse habitat selection and population dynamics.

Study Area Description

Sage grouse radio telemetry work began in 1999 west and south of Dillon, Montana, from Argenta and Bannack southwest into Horse Prairie to the Continental Divide at Bannack Pass (Fig. 1). This area encompasses 11,331 ha. Work was extended in 2000 into the Sweetwater Basin (4654 ha) east of Dillon, and again in 2001 to include Big Sheep Creek Basin (5868 ha) southwest of Dillon. Elevations in the study area range from 1850 to 2850m. Public land (BLM, USFS, Montana DNRC) comprises 64 percent of the combined area with the largest blocks in Horse Prairie and the least public land and the most fragmented land pattern in Sweetwater Basin. Horse Prairie was chosen since it contained the greatest concentration of sage grouse leks and winter habitat located on public land in southwest Montana and has sustained the largest numbers of "resident" sage grouse. Big Sheep Creek Basin was selected since winter habitat is limited in this area, and sage grouse were considered migratory, possibly moving southward across the Continental Divide into Idaho. Sweetwater Basin was chosen for its isolation from other sage grouse habitat. Although there may be some interchange of birds between these habitat areas, they are mostly discreet groups of sage grouse, and are considered "sub-populations" of a larger southwest Montana population.

The study area provides a wide range of topography, soils, elevation, and precipitation that supports numerous sagebrush habitat types. Wyoming, mountain and basin big sagebrush (*Artemisia tridentata wyomingensis*, *A. t. vasayana*, *A. t. tridentata*) dominate most suitable sites with low sage, early sage, silver sage, and black sage (*A. arbuscula*, *A. longiloba*, *A. cana*, *A. nova*) present on specific sites. Tall three-tip sagebrush (*A. tripartita*) is common at mid-elevations on sites that have been disturbed by fire. A widely diverse herbaceous community occurs with these various sagebrush types depending on site characteristics and past disturbances. Sagebrush habitat has been extensively modified over the past 40 years through various attempts at rangeland improvement, conversion to agricultural production, and some instances of wildfire and prescribed fire. National Forest lands supporting Douglas-fir and lodgepole pine forests surround much of this habitat at higher elevations. Most major valley bottoms are in some type of agricultural production for small grains, hay, or pasture. Due to intermingled and limited public land ownership at these lower elevations, much of the historical sagebrush habitat has been fragmented into small, discontinuous blocks.

Methods And Materials

Sage grouse were captured on leks at night during March and April. Grouse were spotlighted from a vehicle and captured on the ground with large fishing nets. Trapping occurred early in the breeding season when hens and males were both present on leks. Dates were primarily scheduled to coincide with the new moon to take advantage of the darkest conditions possible. Trapping success was not affected by weather conditions but was definitely influenced by how well sage grouse could see. Time and manpower constraints limited efforts to selectively capture hen sage grouse, and all grouse captured were fitted with radio transmitters. Volunteers were the primary work force available for trapping over all 3 years.

Sage grouse were fitted with Advanced Telemetry Systems (ATS) Model 16M radio transmitters, each with a unique frequency.

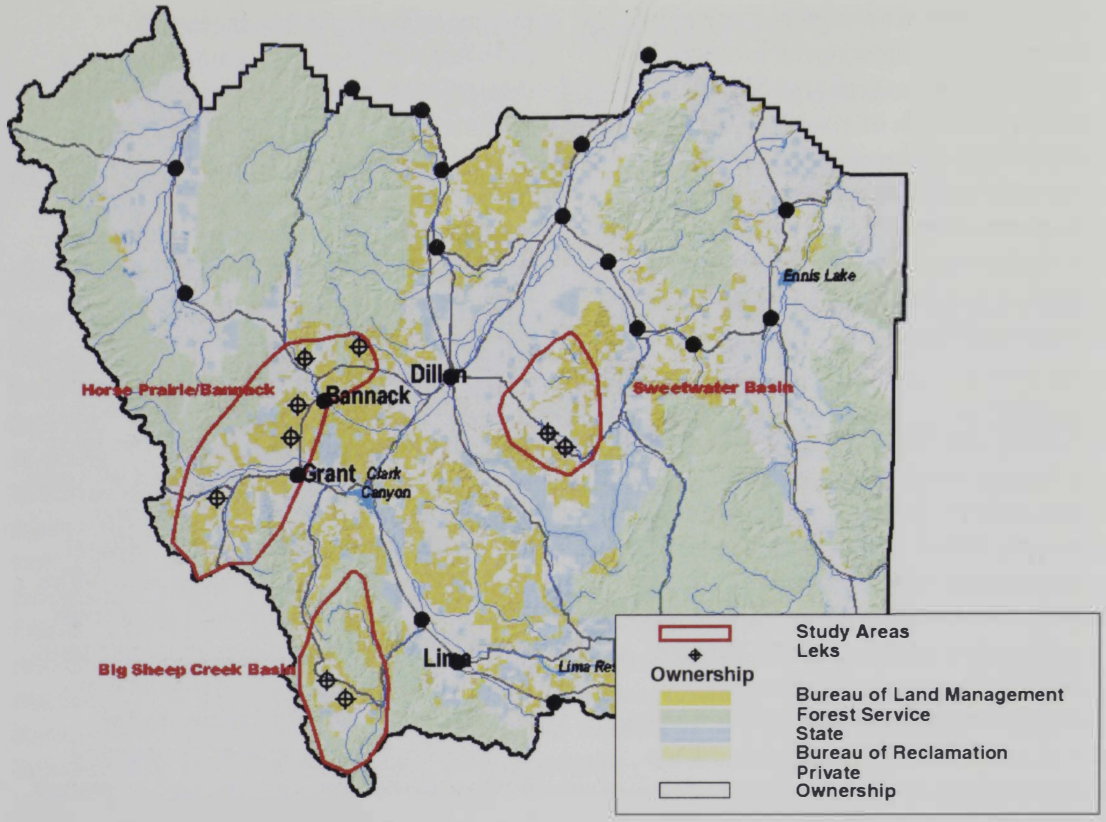

Figure 1. Sage grouse radio telemetry study areas, SW Montana, 1999-2001. Lek locations (⊕) indicate primary leks where trapping activity was concentrated.

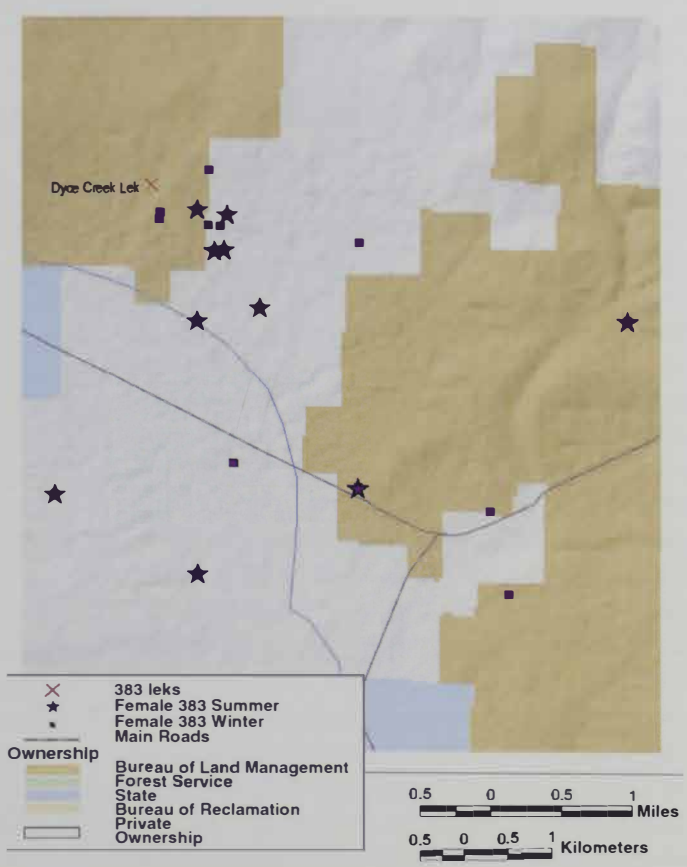

Figure 2. Typical female sage grouse movements (hen 383) in SW Montana, 1999-2001. December through May relocations are displayed as "winter" locations (■). June through November relocations are displayed as "summer" locations (★).

Continuous and 12-hr on/off transmitters were used. Transmitters were secured around the grouse's neck by a small-diameter plastic covered cable with the radio suspended beneath the bird's head and the antenna extending from behind the bird's head down along the back. Necklace cables were tightened enough to still allow a finger-width between the cable and neck so as not to interfere with feeding, breathing, or displaying.

Aerial monitoring of transmittered grouse was conducted monthly or bi-weekly during periods of greatest movement in spring and fall. Longer intervals between flights occurred during summer and winter when birds were more sedentary. I obtained relocations from the ground during intervals between flights to describe habitats characteristics and document the number of birds accompanying radio-equipped birds.

Results

Relocations 1999

Trapping was conducted in Horse Prairie between 16 March and 15 April 1999 with 9 sage grouse (6 males, 3 hens) radio-marked on four different leks (Table 1). Several hens but no males were observed on the Dyce Creek lek. Locations of radio-equipped birds were obtained from the ground beginning in early May while sage grouse were still in the immediate vicinity of leks where captured. Aerial monitoring flights were conducted on 30 June, 8 August, and 27 August 1999. I obtained 74 relocations between May 1999 and February 2000.

All sage grouse stayed within 2-4 km of leks where captured until early-mid June. The three hens then moved 3-5 km directly to a large wet meadow/hayfield complex on private lands where they stayed through September. At least three flocks of 15-35 sage grouse occupied this area throughout this time. Successful nesting was not confirmed until hen No. 54 was observed with a brood in mid-August.

This preferred habitat area near Grasshopper Creek historically supported extensive Wyoming big sagebrush stands that were converted to irrigated hayland. Irrigation overflows around these fields have extended moist habitat into the remaining stringers and patches of sagebrush in small drainages and on steeper slopes. Sagebrush patches provided important cover despite having declining, mostly decadent canopies. An adjoining sub-irrigated pasture receives yearlong grazing by bison, and grasshoppers offered a readily available food source by midsummer. This area represented the largest moist habitat available in a much larger area that was relatively free of disturbance during spring and early summer and provided good foraging conditions.

Male sage grouse movements were more irregular and wide-ranging than for females, but males from the same leks moved to the same general areas. Some males moved directly to large irrigated meadows and stayed there, as did the hens although other males moved continuously during the summer and fall, traveling 30-50 km utilizing a variety of habitats.

Males No. 84 and 95 from the Badger Gulch leks were tracked over the longest period of time and displayed the greatest range of movements in 1999. Although they moved separately and usually with other grouse, timing and direction of movements mirrored each other throughout summer and early fall. These two males followed a circular route covering approximately 32 km from early June through November, but never extending further than 13-16 km from the Badger Gulch leks. The greatest single movement of 20 km occurred in early July, traveling from dry mid-elevation Wyoming big sagebrush into mountain big sagebrush habitat near Forest Service lands. In August, these birds used the highest elevation sagebrush stands available, surrounded by forested habitat. Late summer and early fall use focused on tall

three-tip sagebrush habitat in upper Reservoir Creek and Watson Creek. By November, the only surviving male (No. 84) was back into Wyoming big sagebrush winter habitat within 3 km of the North Badger Gulch lek where he remained for the rest of the winter.

By the end of 1999, two male sage grouse had been harvested by hunters, and cause of four additional male mortalities was undetermined. All three hens and one surviving male returned to the same winter habitat and leks where originally captured. One female was subsequently killed on winter range prior to the 2000 breeding season.

Relocations 2000

Trapping was conducted between 27 March and 11 April 2000 with 16 sage grouse (10 males, 6 hens) radio-marked on eight different leks in Horse Prairie and Sweetwater Basin. Radio transmitters for one male and two hens were still in service in March 2000 (Table 1). For the second year, sage grouse hens were captured on or near the Dyce Creek lek, but I observed no males anywhere near this lek. Aerial monitoring during 1 May, 3 June, 29 June, 24 July, 21 August, 25 September 2000 and 2 January 2001 yielded a total of 133 relocations.

Sage grouse movements in Horse Prairie were similar to those observed in 1999. Newly radio-equipped birds used the same seasonal habitats as radioed birds in 1999. During August and September, six of eight Horse Prairie males moved 2-10 km from several different locations to a large private irrigated meadow on S.F. Watson Creek. This area is heavily grazed with an abundance of grasshoppers during summer. One hunting mortality and two deaths of undetermined cause occurred in this area.

Males from the Brenner lek in upper Horse Prairie traveled 16-19 km south toward Bannack Pass during June and spent the summer on the Continental Divide between Nip and Tuck Creek in Montana and Little Eightmile Creek in Idaho. Male No.172 was not relocated after 3 June although limited searching extended into the Lemhi Valley in Idaho from Leadore northward to Tendoy.

Four of five hens in Horse Prairie again focused on the same wet meadow/hayfield complex used in 1999, and were again associated with at least two flocks of 25-40 other sage grouse. Movement from this area in late August roughly coincided with haying that might have displaced some sage grouse from the area. Based on repeated ground observations and movement patterns, none of the five hens in Horse Prairie nested during 2000.

The five sage grouse followed during 2000 in the Sweetwater Basin generally traveled directly from leks to a 1214-ha (3000-ac) area of sagebrush habitat on the northwest rim of Sweetwater Basin where they stayed most of the summer. This habitat included several small pastures along the ridge separating N.F. Sweetwater, M.F. Stone and Hoffman/Winnipeg creeks, and lies 10 km northwest of both Sweetwater leks. A mixed community of mountain big sagebrush/tall three-tip sagebrush and Idaho fescue (*Festuca idahoensis*) with a diverse herbaceous composition occurred in this area. Adjoining pastures generally have much less sagebrush canopy and structure. Only two of the Sweetwater Basin grouse survived the summer and fall. Hen No. 245 spent the following winter 20 km outside the Basin in the Beaverhead River Valley in an area with relatively little sagebrush that had previously been considered unsuitable for sage grouse.

By late February 2001, eight sage grouse had died in Horse Prairie and Sweetwater Basin of which hunters had killed two. All three of the Sweetwater mortalities occurred within 3 km of each other in the preferred habitat area. Five birds remained in Horse Prairie and three birds in Sweetwater Basin.

Relocations 2001

I observed none of the radio-equipped sage grouse monitored in 1999 and 2000 on

leks other than those from which they were captured. However, on 27 February 2001 four males and one hen visited leks that were 6-19 km from the leks where captured. One male and the hen were observed on their original leks by April while the other two males were not relocated. At the same time hen No. 245 was still outside Sweetwater Basin 11 km north of where she had spent the previous summer and 21 km northwest of the lek where she was captured in 2000.

Trapping in 2001 yielded only males, four in Sweetwater Basin, two in Horse Prairie, and seven in Big Sheep Creek Basin during12-17 April (Table 1). Only five hens were observed during four trapping nights on the Sweetwater leks, whereas no hens were observed on leks in Big Sheep Basin or on the Brenner lek. Trapping was intentionally delayed about 2 weeks in Big Sheep Creek Basin since I assumed breeding activity at these leks might occur later than lower elevations.

A new lek was found in mid-May about 3 km from the Simpson Creek lek in Big Sheep Creek Basin. Two of the males from the Simpson Creek lek attended this new lek on 24 May.

By mid-June sage grouse in Horse Prairie again followed the patterns exhibited in 1999 and 2000. Ground locations found no indication that either of the Dyce Creek hens had mated, nested, or hatched young. Two new Brenner males were on the Continental Divide west of Bannack Pass in the same area used by male sage grouse in 2000. Males in Big Sheep Creek Basin had split into two loose groups. I located one group of three with 40-50 other sage grouse about 3 km west of the Simpson Creek lek in a large irrigated meadow on private land. The other group of three males moved northward about 13 km out of Big Sheep Creek Basin into high-elevation mountain big sagebrush habitat.

Aerial monitoring in July, August, and September suggested that most sage grouse had moved relatively little. Between mid-April and mid-July, all seven sage grouse from Sweetwater Basin died. Two found in the Sweetwater Hills provided the first evidence of radioed grouse moving south out of Sweetwater Basin. In late August males in Horse Prairie and near Lima Reservoir moved 6-8 km from high-elevation, moist habitat onto lower, dry sagebrush habitats. The three males north of Big Sheep Basin moved back and forth 8-21 km along the top of the Tendoy Mountains. The other group of Big Sheep Basin males remained on preferred habitat in the Basin within 4-6 km of leks. Between mid-September and late October, both Horse Prairie males had died in the same area between North Divide Creek and Black Canyon Creek where male sage grouse were lost in 2000.

I located only three grouse during a flight on 3 January 2002: Horse Prairie hen No. 383 occupied the same area in Dyce Creek she had used for two years; male No. 324 was observed on the Simpson Creek lek in Big Sheep Basin where he spent the previous summer; and male No. 172 was found near the Brenner lek in Horse Prairie. The latter has displayed the greatest movements of any grouse monitored during this study. After being captured on the Benner lek in April 2000, and moving 20 km south onto the Continental Divide near Bannack Pass, he was not relocated after 3 June 2000. On 2 January 2001, he was in lower Horse Prairie 19 km northeast of the lek where captured, and 29 km from where last located. On 27 February, this bird had traveled another 10 km north to the Reservoir Creek lek. The 14 June flight relocated this male 3 km southwest of Lima Dam in the Centennial Valley, 80 km from the 27 February location in lower Horse Prairie. This long-distance movement perhaps explained the bird's "disappearance" in 2000. He remained south of Lima Reservoir through November.

Discussion

The results of 3 years of radio telemetry work have documented sage grouse movements similar to those reported

Table 1. Sage grouse numbers, capture locations, and fate, in southwest Montana, 1999-2001.

Bird number*	Sex	Year	Capture location	Number of Relocations	Fate	Date
003	F	1999	Dyce Crk. Lek	11	Replaced with .205	4/00
015	M	1999	Ermont lek	4	Mortality - raptor	6/99
023	F	1999	Reservoir Crk. lek	17	Radio failed	8/00
033	M	1999	Reservoir Crk. lek	7	Mortality - unknown	8/99
045	M	1999	Reservoir Crk. lek	10	Mortality - hunter	9/99
054	F	1999	Reservoir Crk. lek	10	Mortality - unknown	3/00
072	M	1999	Ermont lek	5	Mortality - hunter	9/99
084	M	1999	N. Badger G. lek	25	Radio failed	2/01
095	M	1999	S. Badger G. lek	8	Mortality - unknown	11/99
015	M	2000	L. Sweetwater lek	8	Mortality - unknown	1/01
063	M	2000	L. Sweetwater lek	11	Mortality - unknown	6/01
133	M	2000	L. Sweetwater lek	2	Mortality - unknown	6/01
164	M	2000	L. Sweetwater lek	2	Mortality - raptor	6/00
172	M	2000	Brenner lek	20		
192	M	2000	S.F. Watson lek	7	Mortality - hunter	9/00
205	F	2000	Dyce Crk. Lek	6	Radio failed	5/01
225	M	2000	S.F. Watson lek	3	Mortality - unknown	6/00
245	F	2000	U. Sweetwater lek	10	Mortality - raptor	7/01
262	F	2000	S. Badger G. lek	7	Radio failed	8/00
284	M	2000	Reservoir Crk. lek	11	Radio failed	2/01
301	F	2000	S. Badger G. lek	10	Mortality - unknown	5/01
324	M	2000	Brenner lek	9	Mortality - unknown	9/00
344	M	2000	N. Badger G. lek	7	Mortality - unknown	1/01
364	F	2000	L. Sweetwater lek	7	Mortality - hunter	9/00
383	F	2000	Dyce Crk. Lek	16		
003	M	2001	L. Sweetwater lek	2	Mortality - unknown	5/01
015	M	2001	Brenner lek	9	Mortality - unknown	9/01
033	M	2001	L. Sweetwater lek	2	Mortality - raptor	6/01
073	M	2001	Brenner lek	10	Mortality - unknown	12/01
164	M	2001	U. Sweetwater lek	4	Mortality - unknown	6/01
192	M	2001	L. Sweetwater lek	3	Mortality - unknown	7/01
225	M	2001	Simpson Crk. lek	11	Radio failed (?)	12/01
324	M	2001	Alkali Crk. Lek	13		
425	M	2001	Simpson Crk. lek	4	Mortality - unknown	6/01
464	M	2001	Simpson Crk. lek	12	Radio failed	12/01
483	M	2001	Alkali Crk. Lek	9	Radio failed (?)	12/01
503	M	2001	Alkali Crk. Lek	9	Mortality - hunter	10/01
523	M	2001	Simpson Crk. lek	8	Radio failed (?)	12/01

*bird number represents the last three digits of individual radio frequencies, i.e. 150.003

for other areas, particularly in southeastern Idaho (Connelly et. al 1988, 1991). Hen sage grouse generally move the least and occupy a relatively small area. Movements of hen No. 383 from the Dyce Creek lek were typical for hens in this study (Fig. 2). Most "resident" males, such as male No. 84 from the North Badger lek, were more wide-ranging than hens but suggested strong fidelity for specific leks and summer and winter habitats that surround those leks (Fig. 3). In contrast, other males (male No. 172) exhibited long-range movements between breeding, summer, and winter habitats (Fig. 4).

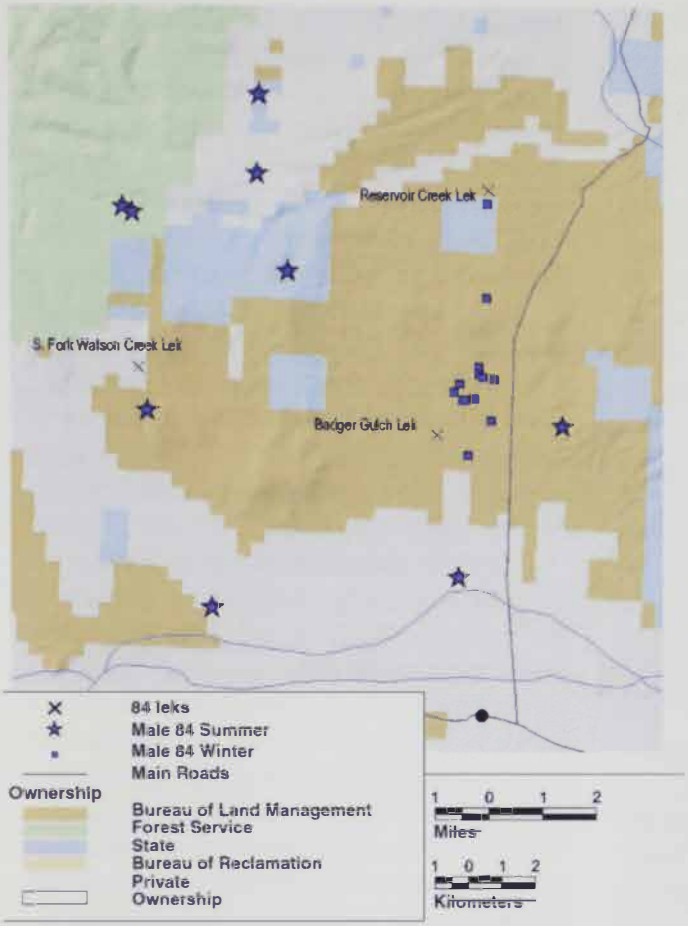

Figure 3. Typical "resident" male sage grouse movements (male 84) in SW Montana, 1999-2000. December through May relocations are displayed as "winter" locations (■). June through November relocations are displayed as "summer" locations (★).

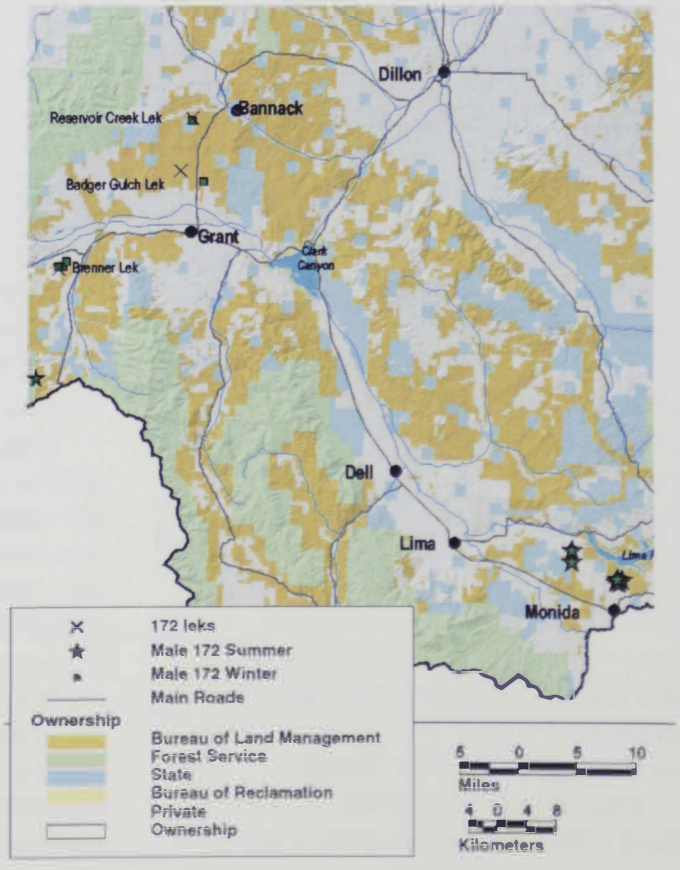

Figure 4. Long range male sage grouse movements (male 172) in SW Montana, 2000-2001. December through May relocations are displayed as "winter" locations (■). June through November relocations are displayed as "summer" locations (★).

Summer Habitat

Two different strategies were apparent for sage grouse summer habitat selection in the study area. One strategy included selecting the largest moist habitat area available and using it exclusively during summer. Large wet meadow/riparian habitats selected by hens and some males may or may not have a significant sagebrush composition or canopy. For example, shrubby cinquefoil (*Potentilla fruticosa*), willows, grasses, and sedges dominated a preferred habitat area in Big Sheep Basin. Use of meadow habitats by sage grouse seemingly occurred independent of the amount of disturbance. Some areas in Horse Prairie that attracted sage grouse also were hayed or sustained heavy season-long or yearlong grazing by cattle or bison, whereas others were essentially undisturbed throughout summer and fall. Sage grouse use of these areas most often concentrated within 100 m of an "edge" between sagebrush and a moist site if an edge was available. Edges may be natural or created by activity such as irrigation or winter livestock feeding that reduces sagebrush canopy. Whether birds are attracted to these sites by the prevailing conditions or if they continue to move to traditional sagebrush sites having been converted to artificial moist habitats is unclear. Availability of lush forage or insects, particularly grasshoppers, apparently was a more important factor than sagebrush canopy in attracting grouse to some of these areas.

A second strategy for selecting summer habitat was that in which sage grouse traveled much more widely through extensive sagebrush areas utilizing smaller, dispersed moist areas. This included mostly males that dispersed individually or in small groups completing seasonal routes of 32-48 km. Routes may be centered on leks and winter ranges, or may be directional. Some male sage grouse moved sporadically 15-20 km from a preferred area to similar habitat and returned within a few weeks.

Relocations for male No. 84 between March 1999 and February 2001 were representative of these seasonal movements (Fig.4). They show a distinct movement pattern from leks and winter habitat in Wyoming sagebrush to higher-elevation summer habitat dominated by mountain big sagebrush, often extending well into Douglas-fir and lodgepole forest. Sagebrush canopy in this habitat is fairly dense, often as high as 25-35 percent, and areas with the widest diversity of forbs, grasses and shrubs are preferred. Tall three-tip sagebrush is often a significant component in this habitat, whether occurring naturally or as a result of disturbance such as fire.

The bulk of sagebrush habitat in the Sweetwater Basin is in private ownership and has been altered significantly by burning, spraying, and conversion to agricultural crops. Sagebrush habitat on public land is more intact and occurs in small scattered blocks mostly around the perimeter of the Basin. Some private land that was previously treated now apparently provides suitable brood-rearing and summer habitat for sage grouse but which radioed birds bypassed to reach habitat on or near public lands. Many large wet meadow areas were available in Sweetwater Basin on private land but apparently do not attract sage grouse. Sheep graze most of these sites and could influence forage composition or insect availability. All birds monitored from the Sweetwater leks moved north 10 km from leks although suitable brood rearing and summer habitat apparently was available in the Sweetwater Hills 5 km south.

Winter Habitat

Winter habitat distribution was well defined in Horse Prairie prior to this study, and monitoring radio-equipped sage grouse relocations has validated major wintering areas centered on the Reservoir Creek, Badger Gulch, and Ermont leks.

A large block of private land between the Reservoir Creek lek and the preferred hayfield/wet meadow complex was dominated by tall three-tip sagebrush and received heavy winter and spring use by sage grouse. This stand of sagebrush was

more uniform in extent and structure than other stands used by sage grouse in the study area.

Poor survival of sage grouse in Sweetwater Basin prevented identifying key winter habitats, but winter sage grouse habitat appeared to be limiting in Sweetwater Basin. Relatively few stands of tall dense sagebrush were available due to widespread vegetation treatments. Small stands are available in drainages in the lower portion of the Basin and along the ridge at the head of the N.F. Sweetwater Creek. In contrast to Horse Prairie and Big Sheep Creek Basin where leks were surrounded by winter habitat, leks and winter habitat in Sweetwater Basin are widely separated.

Hen No. 245 utilized habitat east of Dillon along the East Bench that had not been considered suitable for sage grouse, particularly during winter. This area provided some relatively intact stands of big sagebrush in drainages but most sagebrush stands have been converted to hay, grain fields, or non-native pasture. Black sage was available in several areas. The lack of significant snow accumulation in this area probably allows some sage grouse to make use of the East Bench.

Populations

Groups of sage grouse that occupy particular lek and seasonal habitat complexes appeared to be discrete subpopulations and made use of the same preferred habitats. Where leks were close together, individual birds may visit more than one lek during the breeding season. Where leks are widely separated, as with the three study areas that are 55-65 km apart, I observed no interchange of sage grouse during the breeding season. However, this does not imply that these subpopulations were genetically isolated. I documented no large-scale seasonal movements by sage grouse that could be considered migrations. Individuals and small groups of sage grouse move substantially during summer, but none of the studied subpopulations vacated one area of seasonal use and traveled a significant distance to another. This might emphasize a need to manage individual groups of sage grouse such as those in Horse Prairie or Sweetwater Basin to minimize population and habitat loss since immigration into vacant suitable habitat may not occur. Apparent segregation of widely separated breeding subpopulations could explain why lek attendance and population numbers have declined in areas affected by large wildfires during the past 15-20 years in the Rocky Hills and Sweetwater Hills. Habitat conditions there have seemingly recovered to provide large areas of suitable, but currently unoccupied, habitat.

Sage grouse using lek/winter complexes centered in Badger Gulch in Horse Prairie seemingly found adequate habitat within this area and were not migratory. This area also supported birds during winter, which typically travel significant distances to breeding and summering habitat, perhaps even into Idaho. Residual snow cover around high-elevation leks in upper Horse Prairie and Big Sheep Creek Basin appeared to delay breeding and nesting activity until slightly later in the spring than on lower elevation leks in the Reservoir Creek/Ermont/Dyce Creek areas.

Two discrete populations of sage grouse apparently utilize habitat in Big Sheep Creek Basin. One group may winter in the Basin or at lower elevations in Horse Prairie or Idaho, and then move to leks in the Basin. Connelly (personal communication) documented another group of birds moving from breeding areas in Idaho across the Continental Divide to summer in Big Sheep Creek Basin. Both groups of sage grouse could be considered migratory. To identify seasonal habitat for sage grouse in Big Sheep Creek Basin, and determine whether known long-range migratory movements are representative of the subpopulation or simply reflect individuals will require additional monitoring of radio-equiped birds.

Table 2. Sage grouse mortality in Horse Prairie, Sweetwater Basin, and Big Sheep Creek Basin, southwest Montana, 1999-2001. Trapping years extended from March 1 through February 28 the following years.

MALES	# present March 1	# mortalities	# radios failed	# present Feb. 28
1999	6	5 (83%)	0	1
2000	11	8 (73%)	2	1
2001	14	7 (50%)	5	2
HENS				
1999	3	1 (33%)	0	2
2000	7	1 (14%)	2	4
2001	4	2 (50%)	1	1

Table 3. Seasonal distribution of sage grouse mortalities, southwest Montana, 1999-2001.

Season	# hens lost	# males lost
March - April	0	0
May - June	1	8
July - August	1	2
Sept. – Nov.	1 (1)*	7 (4)*
Dec. – Feb.	1	3

* (# hunting mortalities)

Mortality

Average sage grouse mortality for the term of this study was 58 percent. Annually, mortality of 50-80 percent occurred for male sage grouse, and 15-50 percent for hens (Table 2). Losses were spread throughout the year, but generally were less likely to occur during summer and winter (Table 3). Overall, 42 percent of the male mortality occurred in late May and early June, and 31 percent during fall. A few males always appear to be taken by raptors, probably golden eagles, shortly after leaving the lek in May. Hunting mortality accounted for 57 percent of the fall losses. Birds concentrated in moist habitats which, are directly accessible by roads, may be more vulnerable to opportunistic hunting harvest. Mortality was unexpectedly low for the male sage grouse in Big Sheep Creek Basin and the upper Medicine Lodge area since most of those birds remained in areas that are heavily hunted. Heavy sage grouse mortality in Sweetwater Basin may be a reflection of more widespread habitat fragmentation from agricultural conversion and regular sagebrush burning and spraying. This could be forcing sage grouse to travel longer distances through marginal habitat to small islands of preferred habitat.

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