

Gunnison Sage-Grouse Use of Conservation Reserve Program Fields in Utah and Response to Emergency Grazing: A Preliminary Evaluation

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Abstract

Little information is available on the use of areas enrolled in the Conservation Reserve Program (CRP) by Gunnison sage-grouse (*Centrocercus minimus*) or the impacts of grazing on their habitat selection and movement patterns. Using radiotelemetry, we monitored 13 Gunnison sage-grouse in San Juan County, Utah, USA during 2001–2002 to determine their use of CRP. Additionally, in 2002 some of the CRP land used by the birds in 2001 was grazed under a drought emergency declaration. This afforded us an opportunity to monitor their response to livestock grazing. Although Gunnison sage-grouse used CRP for nesting, brood-rearing, and summer habitat, it was not selected in greater proportion than its availability ($P \leq 0.10$) on the landscape. Bird-use sites in the CRP did not entirely meet habitat guidelines recommended by the Gunnison sage-grouse Rangeland Steering Committee (2005). Most of the sage-grouse we monitored avoided CRP fields when livestock were present. The one exception to this was a hen with a brood. We believe long-term maintenance of CRP in San Juan County will result in achieving habitat conditions that are more desirable for Gunnison sage-grouse. Future livestock management practices in areas used by Gunnison sage-grouse should incorporate short-term, high-intensity deferred-grazing rotations. (WILDLIFE SOCIETY BULLETIN 34(4):957–962; 2006)

Key words

Centrocercus minimus, Conservation Reserve Program, emergency grazing, Gunnison sage-grouse, habitat use, Utah.

Gunnison sage-grouse (*Centrocercus minimus*) once inhabited the Gunnison Basin of Colorado, extreme southeastern Utah, northern New Mexico, and northeastern Arizona, USA (Young et al. 2000). Currently, there are 8 known populations in Colorado and Utah with fewer than 5,000 breeding birds.

The only known population of Gunnison sage-grouse in Utah exists in San Juan County. Historically, the species is believed to have once inhabited a 39,281-km² area located in the southwestern part of the county (Utah Division of Wildlife Resources [UDWR] 1974). Currently, Gunnison sage-grouse inhabit about 13,625 km² of their historic range in Utah. Over 90% of the species' current habitat in Utah is privately owned and primarily in agricultural production (Mitchell and Maxfield 2000).

One of the major conservation strategies supported by The San Juan County Gunnison Sage-grouse Working Group (SWOG 2000) was the establishment of permanent cover on agricultural lands through the Conservation Reserve Program (CRP). In 1998 San Juan County was designated as a CRP priority conservation area for Gunnison sage-grouse. This voluntary set-aside program, authorized under the Food Security Act of 1985, provided eligible landowners with an annual payment for establishing permanent cover on lands previously cropped. As of February 2000, over 21,600 ha had been enrolled in CRP. The total cost of establishing CRP in San Juan County was over US\$1.2 million. The leases generate in excess of \$1.0 million in annual income for participating landowners in the county. Most of the CRP

enrollments in the western United States occurred in agriculture-dominated landscapes similar to San Juan County. The value of CRP to sage-grouse (*Centrocercus* spp.) has yet to be demonstrated (Connelly et al. 2000).

In 2002 San Juan County also experienced a severe drought that lasted throughout the normal growing season. Drought has been implicated in range-wide sage-grouse population declines in the 1930s and from the late 1980s to the early 1990s (Patterson 1952, Braun 1998). Drought can cause a decrease in forb and insect abundance, thereby reducing the quality of brood-rearing habitat (Young 1994, Braun 1998).

In response to the drought emergency, some CRP fields in San Juan County were opened to emergency grazing by domestic livestock. Emergency grazing of CRP by domestic livestock is a management option every 5 years in areas suffering from severe drought. To qualify, a county must have suffered at least a 40% loss of normal moisture for the preceding 4-month qualifying period (D. Christensen, Farm Service Agency, personal communication).

Several authors have suggested that grazing is one factor contributing to range-wide declines in sage-grouse populations (Johnsgard 1973, Connelly and Braun 1997). Beck and Mitchell (2000) identified 10 studies that reported on direct effects of grazing on sage-grouse. Negative direct effects of grazing included destruction of sagebrush (*Artemisia* spp.) by bedding sheep, deterioration of wet meadow habitat by overgrazing, trampled eggs, abandoned nests, and sage-grouse avoidance of heavily grazed areas (Beck and Mitchell 2000). Positive direct effects of grazing may include inducing sage-grouse to use meadow habitat

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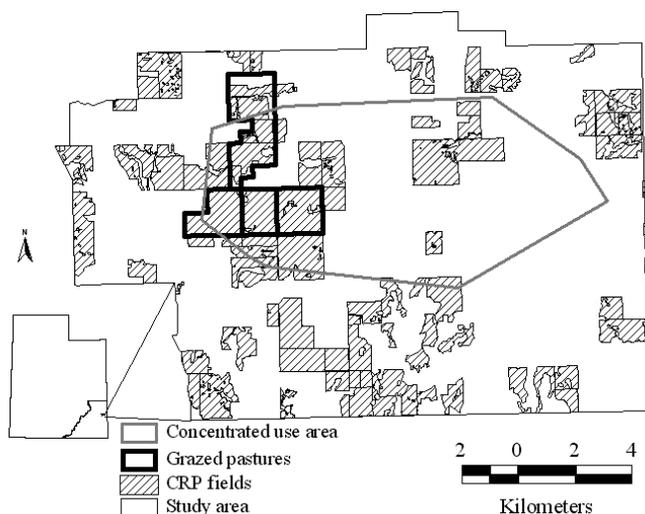


Figure 1. Conservation Reserve Program fields, grazed pastures, and the concentrated use zone as defined by the extent of radiocollared Gunnison sage-grouse locations in the study area, San Juan County, Utah, USA, 2001–2002.

with light to moderate grazing, simulated food forb growth, and increased recovery of food forbs on rest areas under a rest-rotation grazing system (Beck and Mitchell 2000).

The presence of CRP within the area currently inhabited by Gunnison sage-grouse in the county afforded a unique opportunity to study grouse habitat-use patterns relative to other available habitats. This study also could determine if CRP helped to achieve desired vegetation cover conditions specified in the Gunnison Sage-grouse Rangewide Conservation Plan (Gunnison Sage-grouse Rangewide Steering Committee 2005). Lastly, the emergency grazing of selected CRP fields allowed us to monitor Gunnison sage-grouse response to the practice.

Study Area

This study was conducted in San Juan County, Utah (Fig. 1). The county, 20,256 km² in size, is located in extreme southeastern Utah. There were 208 farms in the county and agricultural croplands made up about 6% of the land area (1,314 km²) and 10% of the county's total personal income. San Juan County was ranked fifth in the state in total grain production in 1996 (SWOG 2000).

For the purposes of this research, we delineated a study area that consisted of 2,417 km² (Fig. 1) and encompassed the remaining active lek sites, or strutting grounds, known to occur in the county. The study area is relatively flat with elevations ranging from 2,065–2,149 m. The study area was a mosaic of cover types dominated by CRP–grassland and sagebrush (*A. tridentata* and *A. nova*) cover types (SWOG 2000). Conservation Reserve Program fields comprised 60% (14,514 ha) of the study area. Some CRP fields in the study area were established in 1987. Many of these fields were re-enrolled in the program in 1998. In 1998, because San Juan County was considered a priority conservation area for Gunnison sage-grouse, several new fields also were enrolled in the program.

Precipitation and temperature from 1913–2002 for the study area was summarized from the Utah Climate Center, Logan, Utah. Average annual precipitation (1913–2001) was 55.4 cm. The mean annual high and low temperatures on the study area were 35.9°C and –21.2°C, respectively. From 2001–2002 the average annual precipitation on the study area was 54.9 cm with average annual high and low temperatures of 37.5°C and –18.3°C, respectively. In 2002 San Juan County experienced severe drought conditions. That year, from January–July, <3.81 cm (<1.5 inches) of rain fell, qualifying San Juan County for emergency drought status. Drought conditions persisted for the remainder of the study.

Methods

Radiotelemetry

We captured and radiocollared Gunnison sage-grouse in March and April of 2001 and 2002 on or near leks (Utah State University IACUC Protocol No. 1070). We captured sage-grouse during the night (2200–0600 hours) by spotlighting them and securing them with a long-handled net or net-gun, from the back of a truck or from an all-terrain vehicle (Giesen et al. 1982, Wakkinen et al. 1992, Young et al. 2000, Apa 2003). We conducted spotlighting on strutting grounds, in sagebrush rangelands, and in CRP fields up to 1.6 km from lek sites. We fitted all grouse captured with a programmed (mortality signal and 5 hr off, 19 hr on) necklace-style radiocollar (ATS Incorporated, Isanti, Minnesota) and released them at or near the capture site. We determined age (adult or juvenile) based on primary feather characteristics (Dalke et al. 1963, Young et al. 2000).

We located radiocollared birds up to 3 times a week between May and September of 2001 and 2002. We obtained visual locations of radiocollared birds using radio receivers (Communications Specialists Inc., Orange, California), 3-element hand-held Yagi antennae, and omni antennae (Telonics Inc., Mesa, Arizona). We exercised caution when locating nesting hens and hens with broods to avoid nest and chick abandonment (Young 1994). We estimated the locations of nesting and brood-rearing hens by circling the strongest signal until probable location could be determined. Nest sites were confirmed by visually identifying the nesting hen with the aid of binoculars. We recorded each location site using a global positioning system in Universal Transverse Mercator coordinates. We also recorded date, time of day, sex, number of birds in flock, cover type, and location description. We checked nests approximately 3 times a week until depredated, abandoned, or successfully hatched. We considered nests successful if ≥1 egg hatched, based on egg fragments remaining in the nest and subsequent observations of radiocollared hens with chicks. We considered broods successful if ≥1 chick survived to 50 days posthatch. We examined radiocollared Gunnison sage-grouse found dead to determine the probable cause.

Use of CRP

We examined data at 2 scales: landscape and bird-use sites. At the landscape scale, we considered CRP “selected” if it

was used by radiocollared birds in greater proportion than its availability. We defined a concentrated use zone (7,091 ha) within the study area as the land encompassed within the outermost bird locations (Manley et al. 2002). We considered this zone to be available for use by all radiocollared birds. Conservation Reserve Program lands constituted 31% (2,180 ha) of the concentrated use zone.

We obtained vegetation measurements for a subset of radiocollared bird locations. At bird-use sites, we took vegetation measurements along 2 perpendicular 20-m transects centered over the location site; we randomly determined the direction of the first transect. We visually estimated % canopy cover of grasses, forbs, and shrubs using a Daubenmire frame every 2 m (Daubenmire 1959). We classified canopy cover into the following categories: 0–5%, 5–25%, 25–50%, 50–75%, 75–95%, 95–100% (Bureau of Land Management 1996).

Response to Grazing

We identified the CRP fields opened to emergency grazing in the study area with the help of the Natural Resources Conservation Service (NRCS). We mapped field boundaries based on existing land-ownership coverage using a geographic information system (GIS) ArcView GIS 3.2 (ESRI, Redlands, California). We obtained estimates of biomass present on CRP fields prior to grazing from the NRCS (S. Deeter, NRCS, personal communication). We obtained stocking rates from the NRCS and individual ranchers.

We measured vegetation at approximately 2 location sites per week for one radiocollared hen with a brood affected by emergency CRP grazing. We measured vegetation at locations in grazed and ungrazed fields. We took vegetation measurements in the same manner as described above for bird-use sites.

Data Analysis

We analyzed sage-grouse use of CRP at 2 scales; landscape and bird-use sites. At the landscape scale, CRP selection was determined with a GIS system. We compared CRP use by radiocollared birds (observed locations) to the expected use by chi-square analysis (Neu et al. 1974, Byers and Steinhorst 1984, Sveum 1995, Leban 1999). Expected use was equal to the proportion of CRP in the concentrated use zone. We assumed that radiocollared birds had equal and independent access to the entire concentrated use zone (Aldridge and Ratti 1986, Aebischer et al. 1993). We considered all statistical tests significant at $P \leq 0.05$.

Results

In 2001 we captured and radiocollared 5 Gunnison sage-grouse (4 M, 1 F). In 2002 we captured 8 additional birds (3 M, 5 F). Two radiocollared adult males died during the course of the study; one in September of 2001 and the other September of 2002. We were not able to determine cause of death in either case.

Three hens nested during the study and all nests were successful, hatching 6, 8, and 10 eggs. We located one of the nests in CRP. All nests were located under sagebrush. The

mean canopy cover values at the nest site located in CRP were 6.0% grass, 0.5% forbs, and 27.5% shrubs (Table 1).

We monitored brood movements for all successful hens. Two broods were successful. One contained 2–3 chicks and the other 2 chicks at 50 days posthatch. Most chicks were lost in the first 14 days posthatch. We obtained 48 locations for these 2 broods. Broods were located in CRP 73% of the time (35/48 locations). However, based on expected use, CRP was not selected ($\chi^2 = 0.058$, $P \leq 1$). Brood use sites exhibited mean canopy cover values of 9.4% grass, 10.7% forbs, 3.0% shrubs, and 6.8% litter (Table 1).

We monitored males during both 2001 and 2002. We only included broodless hens in the study in 2002. We located males 256 times during the study. We located males in CRP 74% of the time (189/256 locations). Based on expected use, males did not exhibit a preference for CRP (2001: $\chi^2 = 0.194$, $P \leq 1$; 2002: $\chi^2 = 7.856$, $P \leq 1$). Male use sites in CRP fields had a canopy cover of 24.1% grass, 6.4% forbs, 3.0% shrubs, and 7.9% litter. We located broodless hens 107 times in 2002 with 49% of locations in CRP fields (52/107 locations). Again, based on expected use, CRP was not selected for by broods ($\chi^2 = 7.674$, $P \leq 0.10$). The mean canopy cover values for sites used by broodless hens were 10.6% grass, 2.1% forbs, 10.0% shrubs, and 27.3% litter (Table 1).

Sage-Grouse Response to CRP Emergency Grazing

Four CRP fields in the study area (hereafter referred to as grazed fields) were opened for emergency grazing in 2002 (Fig. 1). Field 1 (538 ha) consisted primarily of crested wheatgrass (*Agropyron cristatum*), Luna pubescent wheatgrass (*Thinopyrum intermedium*), alfalfa (*Medicago* spp.), and sagebrush (*Artemisia tridentata*). Field 2 (308 ha) had similar species composition to Field 1. Field 3 (215 ha) consisted primarily of Luna pubescent wheatgrass, Rocky Mountain bee plant (*Cleome serrulata*), HyCrest (*Agropyron cristatum* × *desertorum*), tall wheatgrass (*T. ponticum*), intermediate wheatgrass (*T. intermedium*), and alfalfa. Field 4 (426 ha) consisted of crested wheatgrass, alfalfa, and western wheatgrass (*Pascopyrum smithii*). The total standing biomass for Fields 1–3 and Field 4 were estimated at 182 and 200 kg/ha, respectively (S. Deeter, NRCS, personal communication).

Cattle grazed all fields. Field 1 was stocked at approximately 4.3 animal-unit-month (AUM)/acre between 11 June and late July. Between 15 June and 2 August, Field 2 was stocked at approximately 2.6 AUM/acre. Field 3 had a stocking rate of 2.8 AUM/acre between 2 August and 2 September. Field 4 was stocked at 1.8 AUM/acre between 12 July and mid-September. Field 1 and Field 2, Field 3, and Field 4 were grazed to 75%, 80%, and 65% utilization, respectively (S. Deeter, NRCS, personal communication). All fields were fenced. Most fencing was 3-strand barbed wire or double-strand electric fencing.

We evaluated the movements of 3 males, 2 broodless hens, and 1 hen with a brood before, during, and after emergency grazing. Males and broodless hens appeared to avoid grazed fields during and after grazing. Prior to the initiation of emergency grazing, we located males in these 4 grazed fields

Table 1. Percent canopy cover of grass, forbs, shrubs, and litter for Conservation Reserve Program (CRP) field reference sites and Gunnison sage-grouse (GUSG) use sites in CRP in San Juan County, Utah, USA, 2001–2002. The percent canopy cover habitat guidelines as recommended by the Gunnison Sage-Grouse Rangewide Steering Committee (2005) are provided for comparison purposes.

% cover	Gunnison sage-grouse use sites				Rangewide guidelines ^a	
	Nests <i>n</i> = 1	Broods <i>n</i> = 9	Broodless hens <i>n</i> = 9	Males <i>n</i> = 45	Breeding ^b	Late summer–autumn ^c
Grass	6.0	9.4	10.6	24.1	10–30	10–25
Forb	0.5	10.7	2.1	6.4	5–15	5–15
Shrub	27.5	3.0	10.0	3.0	20–40	10–30
Litter		6.8	27.3	7.9		

^a Canopy cover measured according to Canfield (1941) and further described by Connelly et al. (2003); understory cover measured according to Daubenmire (1959).

^b Breeding habitat is defined by the Gunnison Sage-Grouse Rangewide Steering Committee (2005) as sagebrush communities delineated within 4 miles of a lek.

^c Summer–autumn habitat is defined by the Gunnison Sage-Grouse Rangewide Steering Committee (2005) as vegetation communities, including sagebrush, agricultural fields, and wet meadows (Connelly et al. 2000) that are within 4 miles of an active lek.

43% of the time (18/42 locations). Only 18% (2/11) of male locations were in Field 1 when cattle were present. We located males in Field 4, 38% (3/8) of the time when cattle were present. We never found males in Field 2 or 3 when cattle were present. Overall, we found broodless hens in these 4 fields 56% (14/25) of the time prior to the grazing initiation. Only 8% (1/12) and 5% (1/19) of broodless hen locations were in Field 1 and 2, respectively, when cattle were present. We did not find broodless hens in Field 3 and 4 when cattle were present.

The hen with a brood did not appear to exhibit avoidance. Prior to grazing, 50.0% of her locations were in Field 1. During and after emergency grazing, 72.7% (8/11 locations) of brood locations also were in this field. We never found her in Fields 2–4.

There were differences in the vegetation characteristics of sites used by the brood prior to and during and after emergency grazing. Prior to emergency grazing, the brood-use sites (*n* = 4) had an average canopy cover of 17.5% grasses, 1.8% forbs, 0.8% shrubs, and 36.3% litter. During and after emergency grazing the brood-use sites (*n* = 4) had less grass (2.5%), and greater forb (4.5%) and shrub (5.0%) cover. The litter canopy cover of brood-use sites was similar before and after grazing (34.0%).

Discussion

We monitored habitat use and movements for 13 radio-collared Gunnison sage-grouse during this study. We acknowledge that our sample is small; we believe it could represent 3–7% of the entire population present in the county at the time the study was conducted. In 2002 the entire population in the county was estimated to be between 175–300 birds (Lupis 2005).

Although most of the Gunnison sage-grouse radiotelemetry locations we recorded during this study were in CRP, there was no statistical evidence of preference established for males, broods, or broodless hens. This may be an artifact of how we defined the concentrated use zone a priori.

Commons (1997) and Apa (2003), in Colorado, also reported use of CRP by Gunnison sage-grouse. Other upland bird species reported to use CRP during brood-

rearing periods include greater prairie chickens (*Tympanuchus cupido*), sharp-tailed grouse (*T. phasianellus columbianus*), ring-necked pheasants (*Phasianus colchicus*), and northern bobwhite quail (*Colinus virginianus*; Allen 1994, Schroeder et al. 2000, Eggebo et al. 2003, Boisvert et al. 2005).

The CRP we studied in San Juan County did not meet the overall guidelines recommended for breeding and late summer–autumn cover in the Gunnison Sage-Grouse Rangewide Conservation Plan (Gunnison Sage-Grouse Rangewide Steering Committee 2005). In general, bird-use sites had less shrub cover (range 3–10%) than recommended (range 10–40%). However, based on observed use by radiocollared birds, CRP does appear to provide critically important habitat for birds in San Juan County.

Hays et al. (1998) concluded that CRP provides important nesting habitat for greater sage-grouse (*C. urophasianus*) in Washington, USA. They reported that 40% of 60 nests found in Douglas County were located in CRP fields, and these nests were as successful as those located in other cover. In Washington, sage-grouse selected older CRP that appeared to provide better habitat conditions, including sagebrush (Hays et al. 1998).

The CRP we studied in San Juan County likely provided roosting cover and foraging opportunities for Gunnison sage-grouse. In San Juan County, CRP may provide greater abundance and diversity of arthropods because of higher grass and forb cover than adjacent rangelands and other cover types in the study area (S. Ward, Utah State University, unpublished data).

Although several authors have implied that livestock grazing has a negative effect on sage-grouse (Gregg et al. 1994, DeLong et al. 1995, Sveum et al. 1998, Beck and Mitchell 2000), no published studies have documented cause-and-effect relationships. The emergency grazing program implemented in San Juan County was a short-duration, high-intensity grazing regime. Our data suggest that Gunnison sage-grouse movements and habitat-use patterns were related to the actual presence of livestock in CRP. The Gunnison sage-grouse males and broodless hens we monitored avoided grazed CRP fields at the onset of emergency grazing and did not return until after the

livestock were removed. Only the brood-rearing hen remained in a grazed CRP during and after grazing. We suspect that this was because of the limited movement capacity of broods.

In 2003 and 2004, which were normal precipitation years for San Juan County, Gunnison sage-grouse subsequently returned to CRP that was previously grazed (S. Ward, Utah State University, unpublished data). These observations suggest that although the sage-grouse were temporarily displaced and vegetation degraded by short-term, high-intensity livestock grazing, the long-term effects were minimal.

Management Implications

Schroeder et al. (2000) suggest that CRP enrollment has provided some protection for sage-grouse habitat in Washington. Hays et al. (1998) argued that CRP provides a permanent cover and year-round security to sage-grouse and other wildlife populations in Washington. They also stressed the importance of long-term enrollment of fields in the CRP program which allows time for sagebrush and other slow-growing shrub species beneficial to sage-grouse to become established. We believe our research also supports the need for sustaining CRP over the long-term as a means of stabilizing Gunnison sage-grouse habitat in San Juan County. To expedite this process, the UDWR is having some success planting sagebrush seedlings in areas of CRP fields that are used by Gunnison sage-grouse (Lupis 2005). Additionally, SWOG has proposed several water-management projects as a means of increasing the amount of mesic and wet meadow habitat available to the birds in CRP.

The areas enrolled in CRP in San Juan County were previously used to grow winter wheat and beans. We do not have any information regarding Gunnison sage-grouse movements and habitat-use patterns in the county prior to 2002. Thus, the same fields currently in CRP might have provided sage-grouse habitat even when in agricultural production. Prior to the establishment of CRP in San Juan

County, Gunnison sage-grouse were observed by area landowners in winter wheat fields (J. Keyes, Utah State University, personal communication).

However, if CRP were eliminated in the county, the fate of the population will likely depend on the future land use of the fields they currently use. If the CRP is converted back to production agriculture, this conversion will result in an immediate loss of the habitat that has been established. Complete or partial loss of CRP could also concentrate the remaining birds in more marginal habitat, thus increasing mortality risks. If CRP were converted to seasonal livestock use, our observations suggest that any grazing regimes implemented should follow a deferred-rotation format, which offers the birds nonuse areas during both the spring and summer periods. Alternately, if CRP continues to exist on this landscape, livestock grazing may be a tool that can be used to increase sagebrush canopy cover in CRP (Crawford et al. 2004).

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