Sage Grouse Versus Sagebrush Control in Idaho[1]

DONALD A. KLEBENOW

Idaho Cooperative Wildlife Research Unit, Moscow.[2]

Highlight

Spraying with herbicides to control sagebrush was detrimental to nesting grouse and to sage grouse broods. Nesting ceased when one area was sprayed and another contained a nest five years after spraying. Broods were less affected. One area contained broods three years after it had been sprayed, but variation existed from one area to the next, for another that was sprayed in 1962 was not being used in 1966.

Spraying sagebrush with herbicides is generally considered to be detrimental to sage grouse (*Centrocercus urophasianus*) and evidence from studies where large areas were treated show sage grouse decreased in number (Rogers, 1964; June and Higby, 1965). Studies in Colorado (Carr, 1967) and Montana (Martin, 1965) where portions of the habitat were sprayed, either in strips or blocks, did not result in grouse declines; however, the birds indicated a preference for the unsprayed areas. Martin (1965) concluded that the lower abundance of favored food plants for grouse on the sprayed strips was an undesirable factor.

Other evidence indicates the reaction may be dependent upon the degree of control and the condition of the habitat before brush control. Studies in Utah (Trueblood, 1952) and Colorado (Rogers, 1964) have been conducted on areas reseeded to grass. Altering the sagebrush environment in this manner can definitely affect sage grouse, but Rogers believed that reseeding could be beneficial to grouse depending on the success of reseeding, the percentage of sagebrush destroyed, the number and size of sagebrush areas not destroyed because of topography or soils, and the vegetative succession following reseeding.

Almost no information exists on grouse numbers following fires, yet the literature suggests that fires are detrimental to grouse (Patterson, 1952; Rogers, 1964).

This study was conducted in southeastern Idaho during the summers of 1964, 1965 and 1966 to evaluate how sagebrush control by spraying with herbicides and by burning affected sage grouse.

Study Area and Procedures

The area studied was on the U.S. Sheep Experiment Station, between 5,400 and 6,000 ft elevation on the Upper Snake River Plains (Fig. 1). It is a native sagebrush-grass range and it is principally a nesting and brooding habitat for sage grouse (Klebenow, 1969). The vegetation was of two general shrub types: one dominated by threetip sagebrush (*Artemisia tripartita*) and the other dominated by big sagebrush (*A. tridentata*). Scattered over the station was considerable antelope bitterbrush (*Purshia tridentata*). Other associated shrubs were gray horsebrush (*Tetradymia canescens*), lanceleaf rabbitbrush (*Chrysothamnus viscidiflorus* var. *lanceolatus*), and broom snakeweed (*Gutierrezia sarothrae*). The major herbaceous species were bluebunch wheatgrass (*Agropyron spicatum*), thickspike wheatgrass (*A. dasystachyum*), prairie Junegrass (*Koelaria cristata*), Nevada bluegrass (*Poa nevadensis*), Sandberg bluegrass (*P. secunda*), arrowleaf balsamroot (*Balsamorhiza sagittata*), rose pussytoes (*Antennaria rosea*), purpledaisy fleabane (*Erigeron corymbosus*), and tailcup lupine (*Lupinus caudatus*).

The station contained 3,240 acres that had been sprayed for brush control. One area was treated during the study and others were treated up to five years before the study. The burns were all old. The oldest recorded was 1936 and the most recent 1957. All were wild-fires except one. The exception was a planned burn done for research on fire as a brush control technique (Blaisdell, 1953).

Forty-acre plots were searched for grouse nests and for signs of use by broods. Ten of these had been burned, 3 sprayed, 2½ had been both burned and sprayed and 18½ had received neither treatment. Only six plots were searched in 1964, but all 34 plots were searched in 1965. In 1966, 16 plots that had nests the previous years were searched again plus an additional

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[2] Presently Assistant Professor, Department of Range and Wildlife Management, Texas Tech University, Lubbock, Texas 79409.

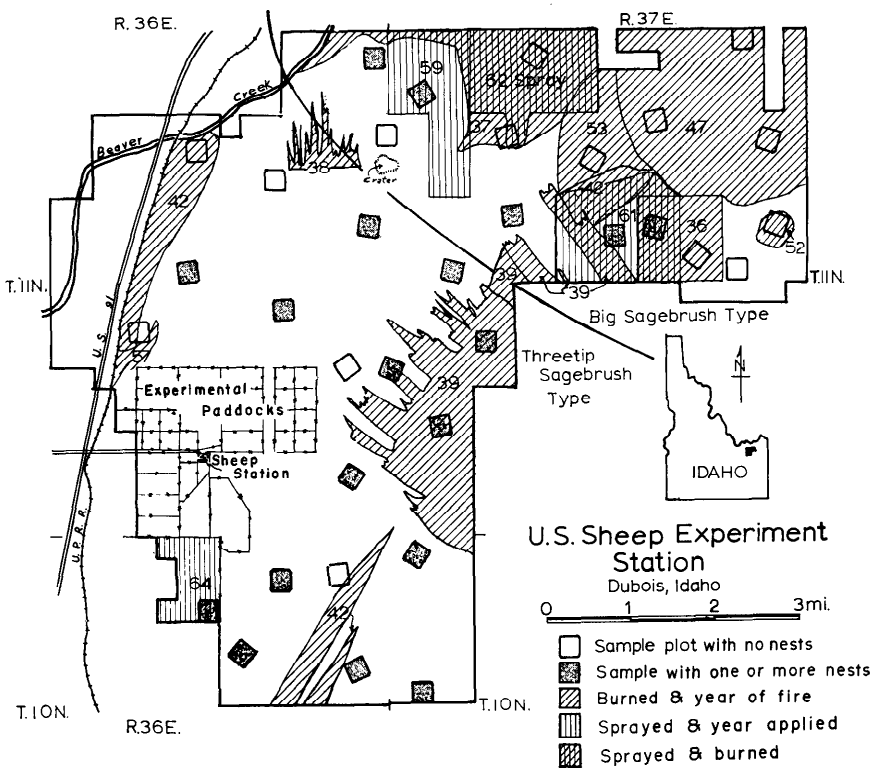

FIG. 1. A map of the sage grouse study area, U.S. Sheep Experiment Station, Idaho. The hatched portions have been sprayed, burned or both; the unhatched portions have no record of spraying or burning treatment.

460 acres of suspected nesting habitat.

After finding a nest, it was described in detail in regard to the condition of the egg shells and shell membranes, and the amount of litter covering the shells. The old nests were rechecked each year and from the descriptions, aging criteria were developed. At the end of the study, five nests were marked and these were re-examined in 1969. It was necessary to develop this means of estimating nest ages because some sprayed areas contained remains of old nests.

Broods were located by searching the 40-acre plots and additional areas, both on foot using bird dogs and with vehicles using binoculars and a spotting scope to determine their location.

To describe the vegetation, ten random samples were taken on each 40-acre plot plus a sample at each nest and brood location. Each sample consisted of the following information by species: the number of shrubs in a 400 ft² circle; the line intercept of the shrub crowns of two 50 ft lines crossing at the plot center; the height in inches of ten shrubs of each species occurring in the sample; and an estimate of the percentage basal area of each plant species, and the percentage ground surface covered by litter. The latter information was obtained from ten 1 × 2 ft plots systematically located along the two 50 ft lines.

The least squares analysis of variance (Harvey, 1960) was used to test the effect of year, past treatment, elevation and aspect on the percentage cover of shrubs, both by species and total; total basal area of forbs; height of shrubs; and the type of ground surface. Three analyses were made, one with each class of data—the random samples, the samples at nest locations and at brood locations. Duncan's new multiple range test was used to compare the means of the significant variables (Steel and Torrie, 1960).

The data from the brood sites listed in Table 2 were compared with data from the non-brood areas using the t test for unpaired observations and equal variances, $P < 0.05$ (Steel and Torrie, 1960).

Results

All the plots that contained sage grouse nests are shown on Fig. 1. A total of 32 nests were found that were new nests the year of the search and 55 were old nest remains. The searches included 220 acres where sagebrush had been controlled by herbicides. There was only one new nest on the entire 220 acres where spraying had occurred and it had been destroyed by a predator before we found it. The area containing this nest had been sprayed five years before and no birds nested on the area during the sixth or seventh year. Nesting stopped on another area that was sprayed in 1964. It contained a nest that year and the remains of a nest from the previous year. Three more nest remains were

Table 1. The effect of past treatments on the amount (%) of shrub cover and basal area of forbs. (Averages taken from all nest sites are included for comparison but were not tested in the statistical analysis.)

Treatment	Shrub crown cover				Total basal area forbs
	Big & threetip sagebrush	Bitter-brush	Horse-brush	Total shrubs	
Untreated	13.5[b 1]	0.1[a]	0.4[a]	15[c]	3.2[c]
Burned	17.8[c]	0.3[a]	0.8[b]	20[d]	4.2[d]
Sprayed-burned	2.7[a]	1.5[b]	2.0[c]	4[a]	1.8[a]
Sprayed	5.8[a]	1.9[b]	0.6[ab]	7[b]	2.4[b]
Grouse nest sites	16.4	0.9	0.7	18	3.0

[1] a, b, c, d Values with similar letters within each column are not significantly different ($P > 0.05$).

found on the sprayed areas. These were old, judged to be pre-spray nests. In comparison to the 1 nest per 220 acres on the sprayed areas, adjoining land where no herbicide had been used had an average of 1 nest per 65 acres.

The treatment effects are summarized in Table 1. Means taken from all nest sites are included for comparison. The effects of the spraying treatments are particularly noticeable, and as far as the sagebrush and total shrubs are concerned, it is apparent that sage grouse select habitats for nesting that are more nearly like the untreated or burned than the sprayed areas. A similar relationship existed among forbs.

The one grouse nest on a sprayed area was under a bitterbrush clump on an area containing an average of 5% sagebrush and an average total shrub cover of 14%. At the nest site, the shrub cover was 17%. These amounts of cover are comparable to an untreated plot that had an average shrub cover of 13%. There, the birds nested where the shrub cover was 17%. The minimum shrub cover at any nest site was 12%.

Broods used the untreated and burned areas more than those sprayed, but did not react to herbicide treatments as strongly as did nesting birds. Of the good or potentially good brood habitat on the study area, 34% had been sprayed and 29% of the broods were found in these sprayed areas. Ninety-eight brood habitat sites were sampled.

With the exception of the areas that had been burned, broods selected habitats with greater than average total shrub cover (Table 2). Only in the sprayed-burned treatment, however, was the difference significant ($P < 0.05$). In the sprayed treatment, there was little sagebrush cover on the brood sites, but greater than normal amounts of bitterbrush and horsebrush. This resulted in there being similar amounts of total shrub cover in brood and non-brood habitat. On brood sites, the basal area of forbs on the untreated, sprayed-burned and sprayed treatments was greater ($P < 0.05$) than on non-brood sites. The range of differences in forbs was not as great on the areas grouse selected.

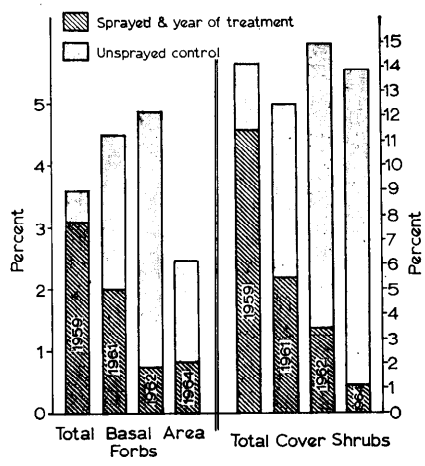

FIG. 2. The total basal area of forbs and the total cover of shrubs on areas sprayed with herbicides and on similar unsprayed areas (Sampled in 1965 and 1966). As the hatched column approaches the height of the gray, the two areas are more nearly alike.

An idea of the effectiveness and life expectancy of the sprayed areas may be interpreted from Fig. 2. Forty-acre plots in sprayed areas were compared with controls, these being the nearest unsprayed plot. The area sprayed in 1959 appeared to have nearly the same amount of forb and shrub cover as the unsprayed control. This area contained one nest in 1964. Broods used that area each year of the study plus the area sprayed in 1961. The 1962 and 1964 areas were devoid of broods. The forbs had not recovered in either area, particularly in the 1962 spray. One factor modifying the interpretation of Fig. 2 is that the area sprayed in 1959 contained 5% cover of bitterbrush and the control did not. The sagebrush had not recovered as much as Fig. 2 indicates for there was only 5% sagebrush on this area compared to 13% on the control. The sprayed area appeared to have originally contained both vigorous, dense sagebrush and bitterbrush. Much of the sagebrush was killed, but the bitterbrush still remained.

The results from the burned areas were inconclusive. The most recent burn on the study area occurred in 1957 and it was a small wildfire. Two hundred acres that had been burned and not sprayed contained three nests for a nest density of 1 per 67 acres. This density is nearly identical to the average nest density —1 per 65 acres. The data in Tables 1 and 2 also indicate the burns had recovered. They actually contained

Table 2. A comparison of the percent shrub crown cover and basal area of forbs on variously treated areas based on samples taken from locations where no sage grouse broods were found and from locations containing broods.

	Sites where no broods were found					Brood sites					
	Shrub crown cover				Total basal area forbs	Shrub crown cover				Total basal area forbs	Size of brood sample
Treatment	Big & threetip sagebrush	Bitter-brush	Horse-brush	Total		Big & threetip sagebrush	Bitter-brush	Horse-brush	Total		
Untreated	13.5[b][1]	0.1[a]	0.4[a]	15[c]	3.2[c]	14.6[c]	1.6[ab]	1.0[a]	18[c]	4.7[c]	39
Burned	17.8[c]	0.3[a]	0.8[b]	20[d]	4.2[d]	14.7[c]	2.1[b]	1.3[a]	19[c]	3.9[b]	29
Sprayed-burned	2.7[a]	1.5[b]	2.0[c]	4[a]	1.8[a]	9.7[b]	1.0[a]	2.7[b]	14[b]	3.8[ab]	12
Sprayed	5.8[a]	1.9[b]	0.6[ab]	7[b]	2.4[b]	1.7[a]	6.8[c]	0.9[a]	9[a]	3.5[a]	18

[1] a, b, c, d Values with similar letters within each column are not significantly different ($P > 0.05$).

a greater cover of shrubs than the untreated areas.

The annual re-examination of old nests showed that some nests remain evident as long as five years. During the three years of the study, the successful nests remained as the birds left them if they did not contain one or more unhatched eggs. Eggs left in nests were removed by scavengers within a year or two. The shells of eggs that had hatched decomposed slightly and slowly became covered with litter from the sagebrush. Nests destroyed before hatching seldom remained evident more than two years. On these, shells are often broken into small fragments and are scattered around the nesting area. They become inconspicuous in the litter or disappear. In 1969, a nest destroyed five years before contained only one small shell fragment. No other evidence of this nest remained. Successful nests have many large pieces of shell left that persist much longer. Some shells and shell membranes were still evident in one nest five years after the eggs hatched. Another marked nest contained shell fragments after five years although it had been damaged by sheep congregating in the corner of a pasture that had been fenced since 1966. In both cases, the nest itself was discernible. Another nest site was destroyed by the fencing operation and I was unable to find the remaining nest marked in 1966.

Discussion and Management Implications

The cessation of nesting on an area that was sprayed in 1964 and the near lack of nesting on other sprayed areas suggests that the herbicide treatment to control shrubs is detrimental. Finding a nest on the area sprayed five years before gives an indication of recovery, but this is nullified somewhat since no birds nested on that same plot during the sixth or seventh year. I would expect a sprayed area to be out of use for at least five years and perhaps more. I believe it would take at least ten years to regain the original carrying capacity. Judging from areas not sprayed, the shrub cover would have to be 10% or more before grouse would find sprayed areas suitable for nesting. The length of time for recovery would be dependent on: (1) the degree of kill originally, (2) the amount of other shrubs remaining on the area, and (3) the speed of recovery of sagebrush.

Sprayed areas recovered more rapidly for brooding than for nesting. Two areas, those sprayed in 1959 and 1961, had recovered enough to be used from 1964 through 1966, but not the area sprayed in 1962. Again, the effectiveness of shrub control is involved and the 1962 spray was quite effective. While the more successful control treatments may be quite detrimental, more generally, herbicide treatment appeared to have the effect of decreasing carrying capacity for broods rather than totally eliminating grouse. I would expect decreased numbers for about five years. The lack of shrub cover and the lack of food probably are the factors bringing about the decrease. The total basal area of forbs was less on the areas that had been sprayed and sprayed-burned, but the sample was inadequate to determine differences in individual species. Broods selected areas where food was available (Klebenow, 1969).

Although spraying with herbicides can result in decreased abundance of forbs (Keith et al., 1959), leading to a decrease in some food plants, sprayed areas may still be suitable for broods because other species of plants may become more abundant. Common dandelion (*Taraxacum officinale*) and common salsify (*Tragopogon dubius*) were important food plants (Klebenow and Gray, 1968). They were more abundant on brood sites than where no broods were found (Klebenow, 1969) and although not significantly different, there were higher frequencies of these two species in sprayed areas than in areas that had not had a spray treatment: common dandelion had a frequency of 5.6% on sprayed areas vs. 1.1% on areas not sprayed; common salsify, 0.6% and 0.2%, respectively.

Another factor that has management implications is that the grouse did not distribute themselves evenly throughout the sagebrush grassland. The grouse nested between 5,400 ft and 5,800 ft elevation and within these elevations, distributions were even if vegetation cover was adequate. In the areas with little shrub canopy cover, grouse nested in the more dense portions. Grouse did not nest in the most dense stands of sagebrush (Klebenow, 1969). During May and early June, broods were evenly distributed, but by mid-June, they had begun concentrating on the more mesic sites that contained green food plants after the vegetation on adjoining sites had dried. The swales that contained bitterbrush were such sites (Klebenow, 1969). Others (Gill, 1965; Carr, 1967) have reported birds concentrating in the stream drainages that run through the sagebrush areas. The effect of controlling sagebrush in these concentration areas should be carefully considered; we need studies to show conclusively how grouse react when such controls are made. I believe that carrying capacity would decrease considerably. Variation exists in the effectiveness in shrub control from one area to another, therefore, some areas recover faster and some take longer. Johnson (1969) reported that in 14 to 17 years, sagebrush regained its original abundance in central Wyoming. It would probably not take that long to recover for grouse.

Although the evidence from the burning treatments was inconclusive, I speculate that this shrub treatment technique has a place in sage grouse habitat management. The time that had elapsed since the last fire masked its effect in the habitat on the study area. Also, using wild-fires to determine the effect of this treatment is not a satisfactory means of judging this control method. Blaisdell (1953) and Pechanec et al. (1954) all stress the

necessity of careful planning of the burns, followed by proper range management. Planning does not occur with wild-fires. If planning included consideration of the time of year when fire could be used effectively, comparable to the stage-of-growth guidelines used in spraying and consideration of the conditions under which desirable vegetation receives the least damage, fire could possibly be useful in sage grouse habitat management. The increased forb production that follows burning and the mosaic of vegetation that results from burning (Blaisdell, 1953) are factors that favors further experimentation with this treatment in sage grouse habitat.

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