The effects of rest-rotation grazing on the distribution of sharp-tailed grouse
by Lyndon Sidney Nielsen

A thesis submitted in partial fulfillment of the requirements for the degree of MASTER OF SCIENCE in Fish and Wildlife Management
Montana State University

Abstract:
The effects of rest-rotation grazing on the summer and winter distribution of the sharp-tailed grouse was studied during 1977 and 1978 on the West Hotchkiss Unit of the Cottonwood Grazing Association, Phillips County, Montana. Seventy-two grouse were captured during the spring and fall display periods and fitted with transmitters or poncho markers. Distribution data were obtained from 52 poncho observations, 309 radio bird locations, and 1617 general bird observations. Birds used an area within a one mile radius of their 1ek during the spring, fall and summer. Intensive grazing did not cause the grouse to move from their traditional use areas into the adjacent rest pasture or areas of taller grass. In these areas of short upland grass, grouse used available shrubs on the uplands or reverted to the breaks for cover. The area used during the winter extended up to two miles from the 1ek, and was associated with the distribution of buffalo-berry shrubs within the study area. Brood sizes decreased from 10.44 in 1975 to 3.38 in 1977. Display ground counts also indicated a decreasing population trend. This reduction was related to a heavy spring rain in 1977 and drought conditions during the summers of 1976 and 1977. Fall food habits were directly related to the availability of buffalo-berry fruit.

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Date May 30, 1978

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by

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A thesis submitted in partial fulfillment
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in

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ABSTRACT

The effects of rest-rotation grazing on the summer and winter distribution of the sharp-tailed grouse was studied during 1977 and 1978 on the West Hotchkiss Unit of the Cottonwood Grazing Association, Phillips County, Montana. Seventy-two grouse were captured during the spring and fall display periods and fitted with transmitters or poncho markers. Distribution data were obtained from 52 poncho observations, 309 radio bird locations, and 1617 general bird observations. Birds used an area within a one mile radius of their lek during the spring, fall and summer. Intensive grazing did not cause the grouse to move from their traditional use areas into the adjacent rest pasture or areas of taller grass. In these areas of short upland grass, grouse used available shrubs on the uplands or reverted to the breaks for cover. The area used during the winter extended up to two miles from the lek, and was associated with the distribution of buffalo-berry shrubs within the study area. Brood sizes decreased from 10.44 in 1975 to 3.38 in 1977. Display ground counts also indicated a decreasing population trend. This reduction was related to a heavy spring rain in 1977 and drought conditions during the summers of 1976 and 1977. Fall food habits were directly related to the availability of buffalo-berry fruit.

INTRODUCTION

The main factor limiting prairie grouse is rangeland condition (Henderson 1964). The management of most rangelands may have detrimental effects on sharp-tailed grouse *(Pedioecetes phasianellus jamesii)*. A rest-rotation grazing system is designed to improve rangeland condition, but the effects on grouse of pasture subjected alternately to rest and intensive grazing are not well known.

The primary objective of the study was to determine the effects of rest-rotation grazing on the summer and winter distribution of sharp-tailed grouse. Full time field studies were conducted from mid-June 1977 to March 1978.

DESCRIPTION OF THE STUDY AREA

The study was conducted on the West Hotchkiss Unit of the Cottonwood Grazing Association, twenty-five miles (40 km.) north of Malta, Montana (Fig. 1). The area consisted of 25,931 acres (10,478 hectares) and was divided into a four pasture rest-rotation system. Pasture 1 was composed of two sections, one-west and one-east. The four pastures ranged from 5443 to 7207 acres (2202 to 2916 hectares) in size. A summary of land ownership is given in Appendix Table 9. The entire unit is administered by the Bureau of Land Management.

The greater part of the area is a gently rolling or undulating plan dissected by Martin Creek, Lush Creek, and Whitewater Creek drainages which generally flow in a southeasterly direction to the Milk River. Elevations range from 2325 to 2725 feet (708 to 830 meters).

The surface of the study area is glacial till upon which the soils have developed. The soils are classed as Scoby loam, Scoby sandy loam, and Scoby stony loam. The Scoby soils are dark grayish-brown, containing varying amounts of coarse glacial till and boulders. Badland soils also occur in a few scattered locations along the Milk River (McBurney 1963).

The climate is described as mid-continental with cold winters, warm summers, and marked variation of precipitation which greatly influences the quantity and quality of the vegetation (McBurney 1963).

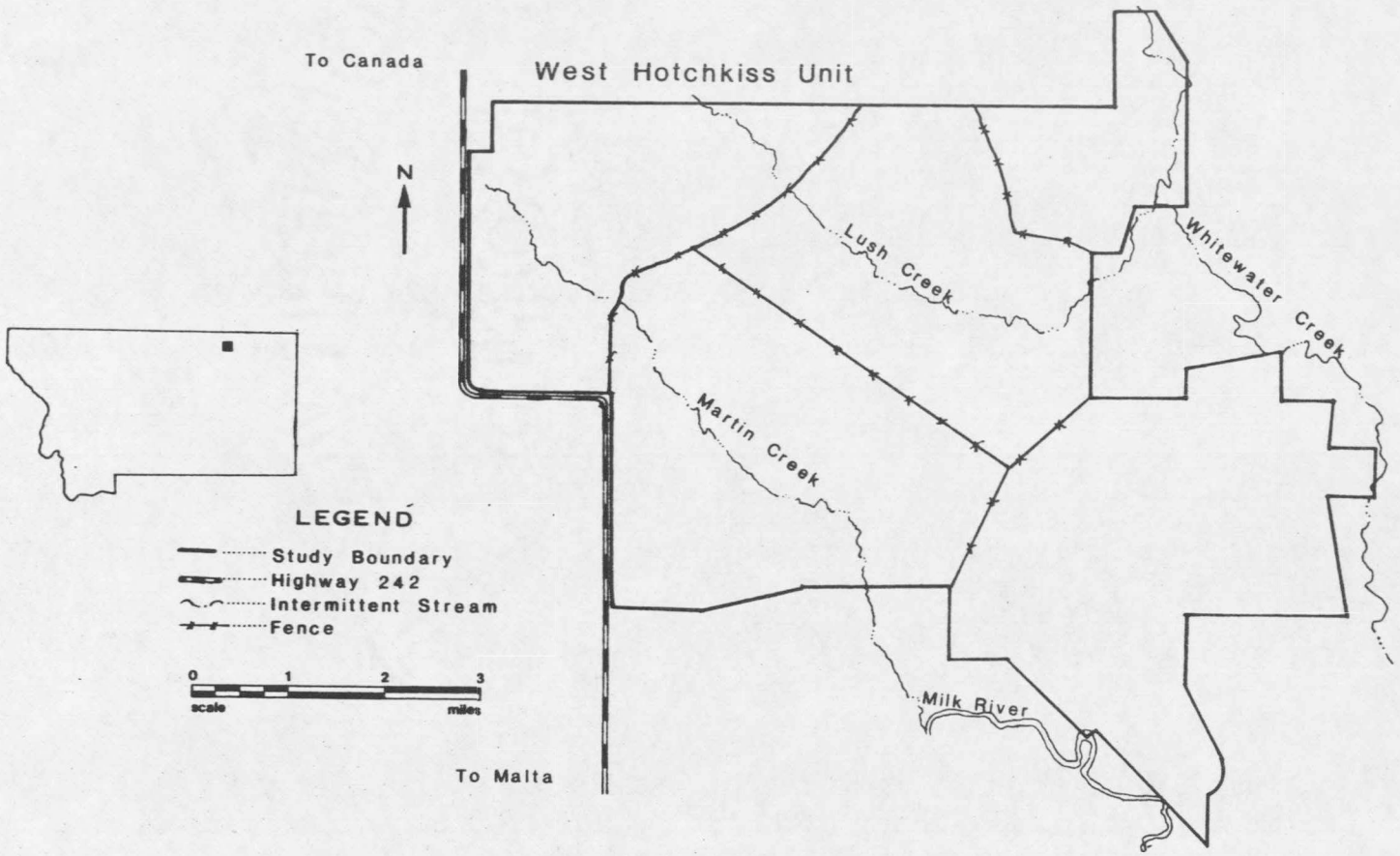

Figure 1. Map of the study area.

Climatological data were recorded at the Forks 4 NNE station (U.S. Department of Commerce 1966-1978) which is located approximately 5 miles (8 km.) northeast of the study area. The ten-year average (1966-1976) temperature range was -42° F(-41°C) to 104° F (40° C) with a yearly average temperature of 40° F(4.4° C). The ten-year precipitation average was 14.4 inches (36.8 cm). In 1977 the area received 12.5 inches (32 cm) of precipitation of which 40 inches (101.6 cm) was snowfall. The number of frost-free days has averaged 115.3 over the last ten years.

Three broad vegetational types, similar to those described by Yde (1977), were distinguished on the basis of topographic occurrence on the study area.

Uplands

This benchland area was a level to undulating plain. Major grasses present were needle-and-thread *(Stipa comata)*, western wheatgrass *(Agropyron smithii)*, blue grama *(Bouteloua gracilis)*, and green needlegrass *(Stipa viridula)*. Needleleaf sedge *(Carex eleocharis)* was also abundant on the uplands. Other grasses found in scattered areas are prairie sand reedgrass *(Calamovilfa longifolia)*, red threeawn *(Aristida longista)*, little bluestem *(Andropogon scoparius)*, foxtail barley *(Hordeum jubatum)*, junegrass *(Koeleria cristata)*, plains muhly *(Muhlenbergia cuspidata)*, pubescent wheatgrass *(Agropyron trichophorum)*,

and tumblegrass *(Schedonnardus paniculatus)*. Common forbs were fringed sagewort *(Artemisia frigida)*, Hoods phlox *(Phlox hoodii)*, curlcup gumweed *(Grindelia squarrosa)*, yarrow *(Achillea millifolium)*, small-leaf pussytoes *(Antennaria parvifolia)*, prairie thermopsis *(Thermopsis rhombifolia)*, and yellow sweetclover *(Melilotus officinalis)*.

Shrubs were uncommon, though scattered areas of silver sage-brush *(Artemisia cana)* and skunkbush sumac *(Rhus trilobata)* and occasionally mats of creeping juniper *(Juniperus horizontalis)* were found on this type.

Breaks

This area ranged from moderate to sharp breaks. Dominant grasses were western wheatgrass, needle-and-thread, little bluestem, prairie sand reedgrass, and plains muhly. Major forbs present were wild licorice *(Glycynrhiza lepidata)*, cudleaf sagewort *(Artemisia ludovicana)*, wild sunflower *(Helianthus* spp.*)*, and fringed sagewort. Common shrubs were buffalo-berry *(Sheperdia argentea)*, woods rose *(Rosa woodsii)*, snowberry *(Symphoricarpos* spp.*)*, chokecherry *(Prunus virginiana)*, golden currant *(Ribes aureum)*, skunkbush sumac, and creeping juniper. Present in lesser amounts were silver sagebrush, serviceberry *(Amelanchier alnifolia)*, silverberry *(Elaeagnus commutata)*, and Rocky Mountain juniper *(Juniperus scopulorum)*.

Lowlands

This area consisted primarily of flat creek bottoms. Common grasses were western wheatgrass, green needlegrass, saltgrass *(Distichlis stricta)*, and foxtail barley. Major forbs were curlcup gumweed, wild licorice, and cudleaf sagewort.

Silver sagebrush was the main shrub but scattered plants of wild rose, snowberry, buffalo-berry, big sagebrush *(Artemisia tridentata)*, greasewood *(Sarcobatus vermiculatus)*, and plains cottonwood *(Populus deltoides)* were also found.

METHODS

During April 1977, sharp-tailed grouse were captured on seven leks. Cannon nets (50 x 100 ft.) were used to capture the grouse as described by Jackson (1967). Solar-powered transmitters with a residual NiCd battery (Telemetry Systems, Milwaukee, Wisconsin) were fitted to 10 male grouse, which also received poncho markers (Fig. 2). Additional birds trapped received a numbered poncho (Pyrah 1970), color-coded to that specific lek.

"Radioed" birds were re-located by triangulation every fourth day. To keep disturbance to a minimum, the birds were not flushed unless the signal was received from the previous location point. All locations of "radioed" birds were plotted on a map. In addition, the date, topography, presence of cattle, and distance from the last loction were recorded. The vegetation was noted only to the major plant species present, to prevent disturbing the birds.

To detect possible changes in seasonal distribution for distributional responses to the presence and activities of cattle, an effort was made to delineate the area used (hereafter termed the use-area) by birds from each lek. This was done by plotting locations of all birds observed, relocation of poncho-collared and "radioed" birds, and direct observation of birds leaving the display area.

Figure 2. Grouse with transmitter and poncho marker.

Each day one pasture was searched for general grouse observations. The location of each observed bird, brood and nest sites were staked for vegetation analysis at a later date. The vegetation at each site was sampled later by a modification of the canopy-coverage technique described by Daubenmire (1959). Five 2 x 5 decimeter plots were used: one located at the center of activity; the others four meters from the center in each compass direction. These plots provided a species composition of the vegetation, percent canopy coverage, and height of each species of vegetation.

Common and scientific nomenclature and identification of the vegetation followed Booth (1950), Booth and Wright (1959), and Ryerson, Taylor, and Jefferies (1975). A plant collection made by Dusek (1971) also aided in identification.

Coverboard readings described by Jones (1968) and Yde (1977) were also taken at the center of each bird, brood, and nest site.

A shrub density index was determined at each activity site by using a modification of the quarter method (Cottam and Curtis 1956). The index was established by estimating the distance in meters, from the center of activity to the nearest shrub in each of the four quadrants. This distance was estimated up to 50 meters. If no shrubs were present, an index reading of 200 was recorded which was obtained by adding the 50 meters from each quadrant. An index number smaller than 200 indicates shrubs were present within a 50 meter radius.

Grass heights and shrub density indices were also determined generally on uplands within the four pastures. This was done by recording grass heights by species and a shrub density index from points located 160 meters (0.1 mile) apart along random vehicle routes. Data from all points were averaged to derive mean grass height and a density index for the area as a whole for comparison with similar data obtained at grouse observation sites.

Cattle locations were recorded every fourth day when possible. Included were estimates of cattle numbers on the uplands, breaks, and

lowlands as well as on specific concentration areas to show areas of heavy and light use.

Grouse on leks were counted during spring and fall to show annual trends (Evans 1968) and were observed to see if marked grouse remained specific to the ground on which they were captured.

Crops and wings were collected from hunters during the 1977 hunting season. Crop contents were identified and measured volumetrically by water displacement. The results were summarized by the percent frequency of occurrence of each food item and percentage of the aggregate volume as described by Martin *et al.* (1946).

During October 1977, sharp-tailed grouse were again trapped on six leks to place recovered transmitters on birds. This time the "radioed" birds did not receive a poncho marker since heavy mortality was experienced on the birds both radioed and collared in the spring.

During the winter the study area was covered on foot or snowmobile for grouse observations. The entire area was also flown systematically three times to plot bird distribution. Flights were made on sunny days after a fresh snow. Tracks and grouse were easily seen from a low, slow flying plane.

The date, location, major vegetation present, and topography of each location point sighted during the winter was recorded. No other vegetation work was done due to the snow depth.

RESULTS

Spring Banding and Display Ground Counts

Forty grouse were captured on seven leks during April 1977. Of these 33 percent were juveniles and 63 percent were adults. Only one captured grouse was a female. Eight of the grouse were recaptures from a previous study (Yde 1977), and all were caught on the same ground on which they were originally banded. Transmitter packs, each weighing 26 grams, were fitted on one juvenile and nine adult males. All birds received a numbered and color-coded poncho marker. Capture sites, numbers of relocations, and fates of the radio-equipped birds are given in Appendix Table 10.

The "radioed" birds experienced high mortality during the spring. By mid-June six of the original ten were found dead. The four survivors experienced no mortality throughout the summer and provided 186 relocations for plotting distribution. However, during September, one transmitter ceased functioning and two birds were lost to avian predation. The remaining bird (channel 8) was the only one that had not received a poncho marker. Probably the most significant predator of the sharp-tailed grouse in this area was the golden eagle. An eagle's nest on the study area contained numerous grouse remnants and the legbands or poncho markers of six grouse. Prairie falcons were common on the study area and one was observed feeding on a fresh grouse kill. Coyotes are possible predators based on teeth marks on trans-

mitter antennae and harnesses.

Counts were made on the leks throughout the spring 1977, and spring 1978 for comparison with Yde's (1977) counts on the same grounds in 1976. The results indicate a downward trend (Table 1).

TABLE 1. MAXIMUM BIRD COUNTS ON LEKS IN THE STUDY AREA.

DANCING GROUND	SPRING 1976 *	SPRING 1977	SPRING 1978
E	6	7	6
F	27	24	10
G	11	12	8
H	24	15	10
I	28	30	6
J	33	20	11
K	12	9	11
L	13	20	8
M	20	15	9
N	5	8	4
TOTAL	179	160	83

*From Yde (1977)

Marked birds were never observed on grounds other than the one on which they were captured. In 1977, spring display activity was last observed on June 24.

Summer and Fall Distribution

All bird locations from the summer and fall are shown in Figure 3. Lines drawn encircle the area used by birds from each lek. This area of use was usually within one mile (1.6 km) of the display ground.

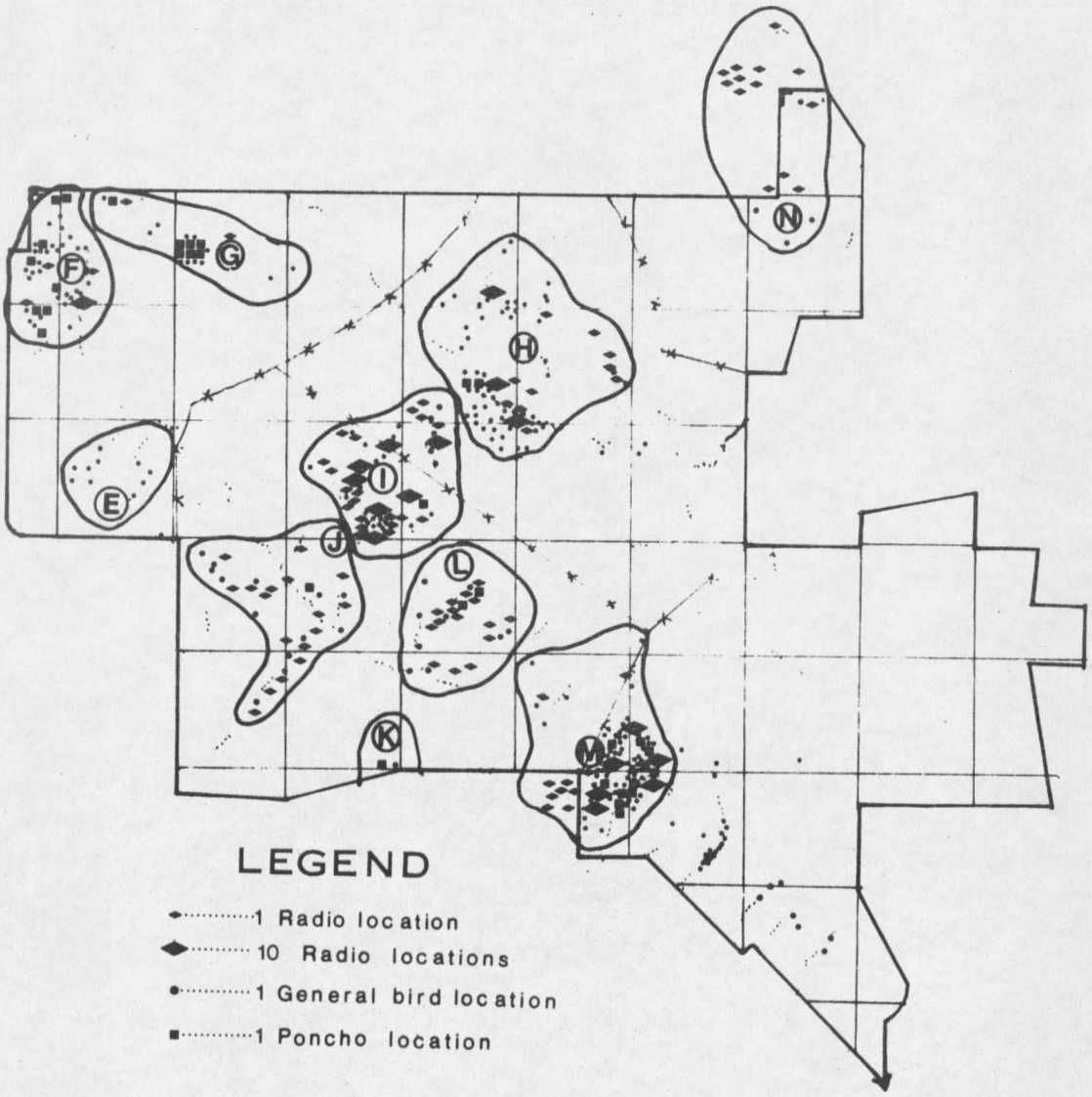

Figure 3. Summer and Fall bird distribution. Letters identify leks.

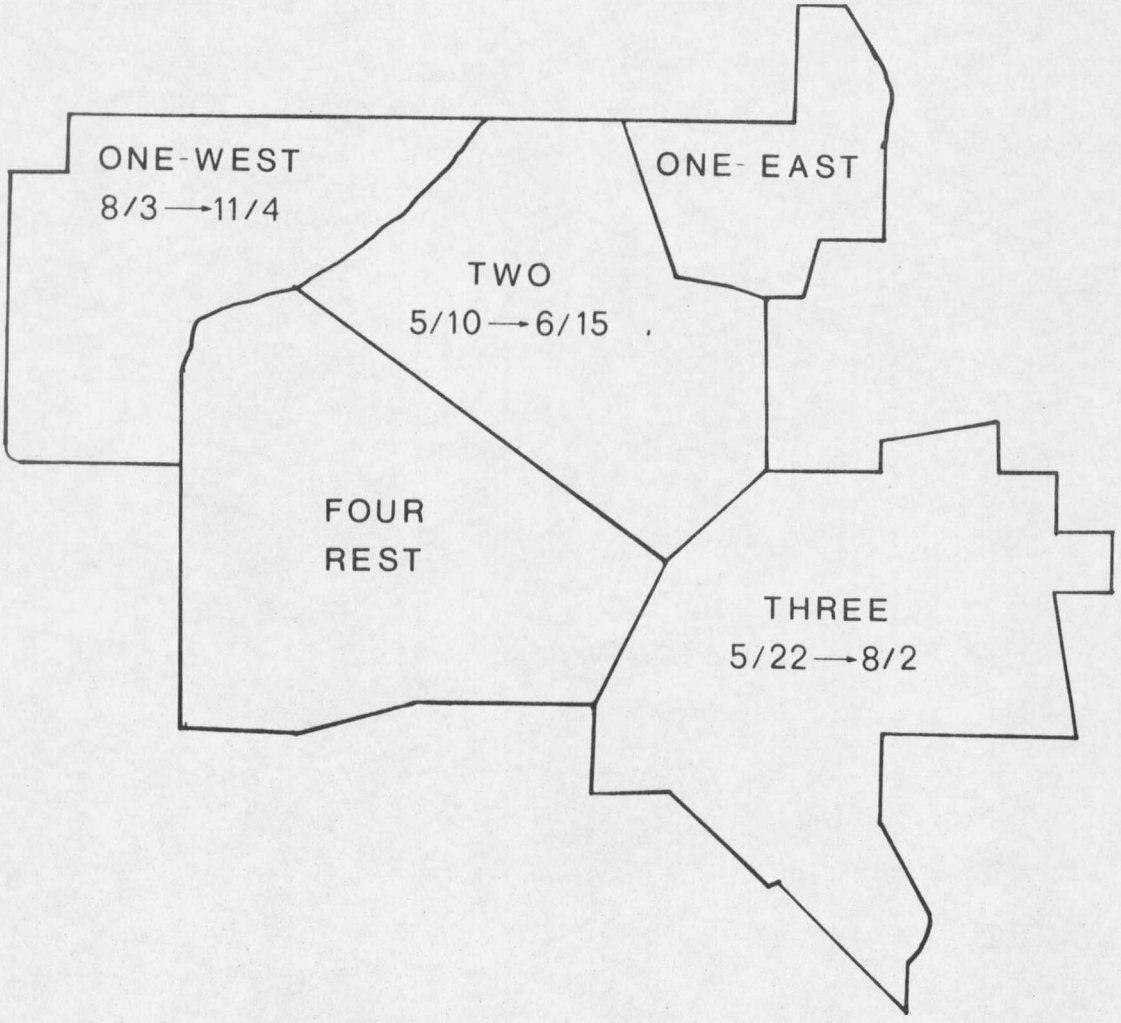

Figure 4. Pasture numbers and grazing dates for 1977 grazing season.

No exchange of grouse between the use areas of different leks was ever observed during the summer and fall. However, marked and "radioed" birds were males, which would tend to show a closer association to their specific display ground than females. Robel *et al.* (1972) found female sharptails had greater dispersal tendencies than did males.

The influence of cattle, grazing dates given in Figure 4, did not appear to affect the distribution of grouse during the summer and fall (Fig. 3). Birds from lek I frequently moved out of pasture 4 (rest pasture) and used pasture 2 which was subjected to early spring grazing (Fig. 3). Another example was provided by the distribution of birds from ground M, which was located on the fence line between pasture 4 (rest pasture) and pasture 3 which was grazed during the summer. Yde (1977) documented the grouse from ground M used pasture 3, which was the rest pasture in 1976. In 1977, these grouse still used pasture 3 despite very heavy use by cattle. The grouse had equal access to pasture 4 which had taller grass height and a good interspersion of shrubs, yet very few grouse from lek M utilized this pasture.

However, grouse avoided a close association with cattle. Only three of 1,279 general bird observations and 186 "radioed" bird locations during the summer and fall were within 150 meters of cattle. A spring developed for cattle water was located in pasture 3, seven-tenths mile (1100 meters) southeast of ground M. Cattle were continuously present in this coulee seeking water or shade. Figures 5 and 6

Figure 5. Effects of heavy cattle concentrations on Skunkbush Sumac by a water development in Pasture 3.

Figure 6. Effect of placing a water development in the bottom of a coulee. Pasture 3.

show the effects of this heavy cattle concentration. Only one grouse was observed in this coulee even though it was walked as many times as the others in this area. Grouse were frequently observed in coulees on either side.

Brood and Nest Locations and Production

A heavy local rain of approximately 2.5 inches (6.4 cm) fell within one hour on June 15. The brood size before this rain averaged seven chicks per brood; the average afterwards was three. The hard rain followed by a dry summer, both of which can contribute to chick mortality (Kobriger 1978), were probably the main causes of the low brood sizes. The average brood size observed in the West Hotchkiss Unit during the summer of 1977 is compared with average brood sizes for the summers of 1975 and 1976 (Yde 1977) (Table 2). The trend of decreasing brood size is commensurate with the lower ground counts and the lower numbers of grouse on the study area. Hunters also commented on the lower numbers of birds during the 1977 season than in the two previous hunting seasons.

TABLE 2. AVERAGE BROOD SIZE COMPARISONS ON THE WEST HOTCHKISS UNIT.

Year	1975*	1976*	1977
Average Brood Size	10.44	7.06	3.38
Sample Size	9	17	26

*From Yde (1977)

Only four brood observations on the study area were associated with the uplands. All other broods were observed in the breaks or lowlands in dense, woody cover.

Two nest sites were found incidental to other work. One, found on July 5, 1977, had nine eggs, which hatched on July 16, 1977. This probably indicates a renest attempt. The other nest, located on July 7, 1977, contained a successfully hatched clutch of seven eggs. Both nests were located in the bottoms of coulees in areas of tall uniform vegetation averaging 35 centimeters in height at the nest site.

Vegetation Analysis of Bird Activity Sites

Measurement of 1,250 plots provided data on vegetational characteristics of 250 bird observation sites. The vegetational composition is given as percent frequency of occurrence and average percent canopy coverage among the plots by pasture and topographical area. (Appendix Table 11)

On the uplands, dense clubmoss *(Selaginella densa)* had the highest frequency of occurrence (67.2%) and canopy coverage (30.2%). It was also the most abundant plant on the uplands (thus its high frequency of occurrence and canopy coverage at the bird activity sites.) Needle-and-thread had the highest frequency of occurrence of any grass. Fringed sagewort also had a high frequency of occurrence at observation sites on the uplands; and since this plant is not grazed by cattle, it

afforded some cover for grouse. Silver sagebrush was common on the uplands in scattered locations and was used most frequently for cover in pastures where the upland grass were short due to cattle grazing.

In the breaks, buffalo-berry received the greatest use. Grouse were observed as early as July 30 feeding on the fruit and leaves of the buffalo-berries, as very few succulent forbs were available. Buffalo-berry also provided shade for midday roosting on hot days.

Grouse use of the lowlands was mainly restricted to pasture 2 where significant amounts of buffalo-berry, woods rose, and snowberry were found.

The vegetational composition measured at the 26 brood sites is given in Table 3. Snowberry had the highest frequency of occurrence (52%) followed by wood rose (45%). The vegetational composition at two nest sites is presented in Table 4. Green needlegrass had the highest frequency of occurrence (40%) followed by snowberry (40%). The highest average percent canopy coverage was western wheatgrass and prairie sand reedgrass at 12.5% for both species.

Coverboard reading results are shown in Table 5. The number indicates the average number of squares visible at a 45 degree angle and at ground level from 30 feet. Therefore, a lower number indicates more cover. The data in the table illustrates the increase in cover the birds received in the breaks and lowlands compared to the uplands. The overall pasture average indicates pasture 1 had the best cover

TABLE 3. VEGETATION COMPOSITION OF BROOD OBSERVATION SITES.

Species	Percent Frequency	Percent Canopy Coverage
GRASSES		
Western Wheatgrass *Agropyron smithii*	39.6	10.6
Needle-and-thread *Stipa comata*	12.8	3.2
Green Needlegrass *Stipa viridula*	9.8	2.3
Blue Grama *Bouteloua gracilis*	12.0	3.4
Needleleaf Sedge *Carex eleocharis*	5.6	.6
Little Blue Stem *Schizachyrium scoparium*	4.8	1.4
Sandberg Bluegrass *Poa secunda*	5.	4.
Foxtail Barley *Hordeum jubatum*	1.6	.3
Saltgrass *Distichlis stricta*	2.4	.5
Plains Muhly *Muhlenbergia cuspidata*	.8	.1
Prairie Junegrass *Koeleria cristata*	.8	Tr
Red Threeawn *Aristida longiseta*	.8	.4
SHRUBS		
Snowberry *Symphoricarpos* spp.	52	22
Wood Rose *Rosa woodsii*	45	18.8
Buffalo-berry *Shepherdia argentea*	24.8	24.8
Silver Sagebrush *Artemisia cana*	12.8	3.2
Creeping Juniper *Juniperus horizontalis*	4.	4.

TABLE 3: (CONTINUED).

Skunkbush Sumac *Rhus trilobata*	.8	Tr
FORBS		
Cudweed Sagewort *Artemisia ludoviciana*	23.8	4.1
Curlcup Gumweed *Grindelia squarrosa*	10.4	2.8
Wild Licorice *Glycyrrhiza lepidota*	3.2	.8
Golden Rod *Solidago missouriensis*	3.2	.6
Western Stick Tight *Lappula redowski*	3.4	.2
Fringed Sagewort *Artemisia frigida*	7.2	.6
Yarrow *Achillea millifolium*	1.6	Tr
Prairie Coneflower *Ratibida columnifera*	2.4	Tr
Prairie Thermopsis *Thermopsis rhombifolia*	.8	.1
Prairie Sunflower *Helianthus petiolaris*	1.6	.1
Prickly Pear *Opuntia polycantha*	.8	.1
Unidentified Forbs	.8	Tr
Silverleaf Scurfpea *Psoralea argophylla*	.8	.1
Small-leaf Pussytoes *Antennaria parvifolia*	.8	Tr
Wavyleaf Thistle *Cirsium undulatum*	.8	.1
OTHER		
Bare Ground	13.	5.2
Litter	5.6	1.2
Rocks	2.8	.5

TABLE 4. VEGETATION COMPOSITION OF NEST SITES.

Species	Percent Frequency	Percent Canopy Coverage
GRASSES		
Western Wheatgrass *Agropyron smithii*	30	12.5
Green Needlegrass *Stipa viridula*	40	1.0
Sandberg Bluegrass *Poa secunda*	30	8
Prairie Sand Reedgrass *Calamovilfa longifolia*	10	12.5
Slender Wheatgrass *Agropyron trachycaulum*	20	2
FORBS		
Cudweed Sagewort *Artemisia ludoviciana*	30	4.1
Western Stick Tight *Lappula redowski*	10	Tr
Prairie Sunflower *Helianthus petiolaris*	20	7
Wild Licorice *Glycyrrhiza lepidota*	30	9.5
Unidentified Forbs	20	4
SHRUBS		
Snowberry *Symphoricarpos* spp.	40	12
Wood Rose *Rosa woodsii*	30	7.5
OTHER		
Bare Ground	10	3

followed by pasture 4 which was the rest pasture.

TABLE 5. AVERAGE COVERBOARD READINGS TAKEN AT EACH OBSERVATION SITE.

Pasture	Uplands	Breaks	Lowlands	Average
#1	63.7	3.6	16.3	27.9
#2	62.5	27.8	32.9	41.1
#3	82.7	13.6	--	48.2
#4	73.9	14.1	13.8	33.9

(A large number indicates less cover)

The results of the grass height and shrub density transect measurements are shown in Table 6. These data indicate grass was decidedly taller in pasture 1 and the shrub density index was similar on all pasture uplands.

TABLE 6. AVERAGE GRASS HEIGHT AND SHRUB DENSITY INDICES OF THE UPLANDS.

Pasture	Average Grass Height	Shrub Density Index	Sample Size
#1	22.80 cm	164.6	68
#2	8.87 cm	151.3	61
#3	6.81 cm	144.8	61
#4	11.50 cm	123.8	39

Data in Table 7, which compares grass height and shrub density, clearly indicates a substitution of shrubs for grass as a cover requirement on the uplands in pastures 2, 3, and 4. The shrub density index at upland observation sites in pasture 1, where grass height was noticeably greater than in other pastures, was comparable to the

overall average for that pasture.

TABLE 7. COMPARISON OF SHRUB DENSITY AT BIRD OBSERVATION SITES TO THE SHRUB DENSITY AND GRASS HEIGHT OF THE PASTURE UPLANDS.

Pasture	Shrub Density		Average Grass Height of the Pasture
	Bird Observation Sites	Pastures	
#1	156.5	164.6	22.8 cm
#2	37.8	151.3	8.9 cm
#3	22.1	144.8	6.8 cm
#4	22.7	123.8	11.5 cm

Figures 7 and 8 also document the importance of grass as a cover component by showing the topographical locations of birds. Upland areas in pasture 1, with grass height averaging 22.8 cm, received 100% of the grouse observations during the spring and early summer (Fig. 7). By contrast, grouse avoided upland areas of short grass, as in pasture 3, where the grass averaged 6.8 centimeters in height (Fig. 8). Yde (1977) found grass uplands to be important for grouse during the spring in this area. Grouse used the scattered shrubs on these heavily grazed upland areas (Fig. 9) for cover or moved to the breaks with its higher density of shrubs.

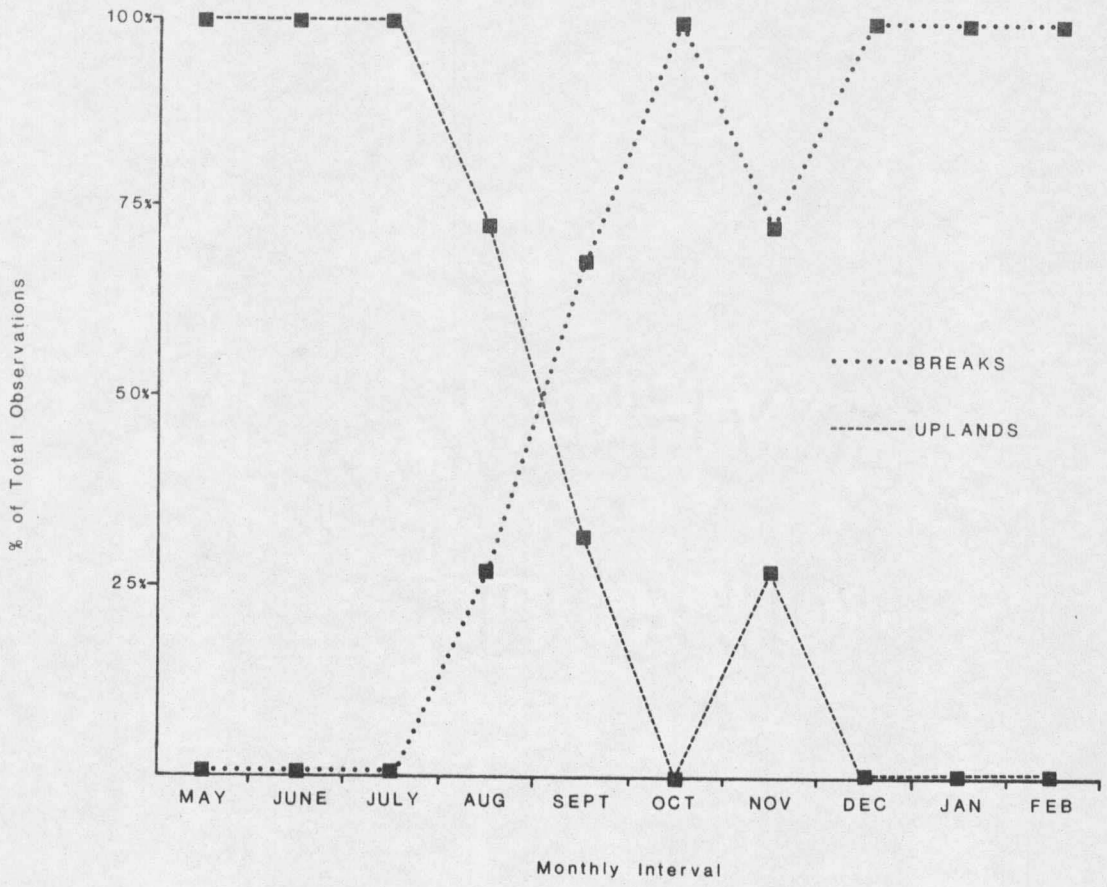

Figure 7. Topographical locations of birds in pasture 1 during 1977.

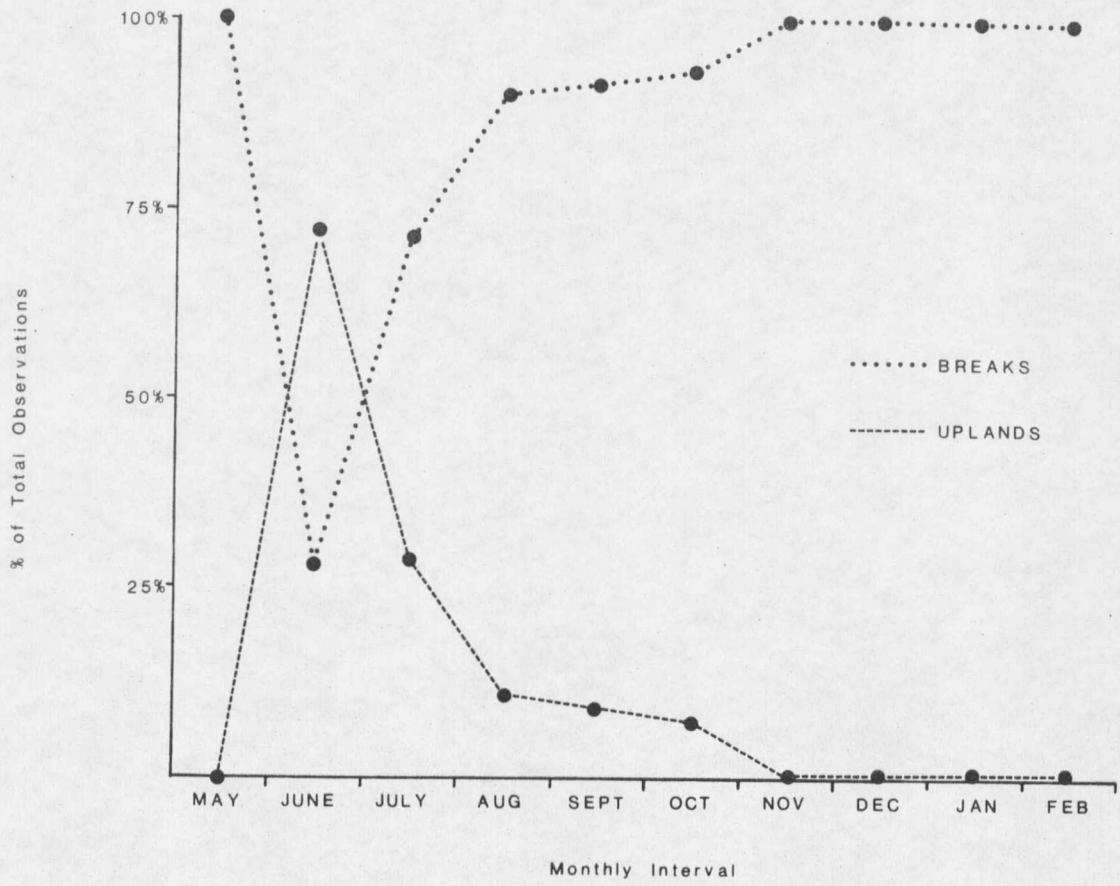

Figure 8. Topographical locations of birds in pasture 3 during 1977.

Figure 9. Heavily grazed upland area in pasture 3.

Fall Food Habits

The fall food habits as determined from crop contents are summarized in Appendix Table 12. These crops were taken from hunter harvested birds. The sample consisted of 45% juveniles and 55% adults. Buffalo-berries showed the highest percent of total volume (25.5%) followed closely by creeping juniper berries (24.9%). The year 1977 was considered average for buffalo-berry seed production, and berries from this plant and creeping juniper were about equal in percent of total crop volume. Yde (1977) presented comparable food habits data for 1975, an excellent year for buffalo-berry production, and 1976,

a year of poor berry production. During these two respective years buffalo-berries represented 45 and 0.2 percent by volume while juniper berries represented 1.2 and 40.1 percent. These data indicate sharp-tailed grouse select buffalo-berry fruit when it is available and in its absence, utilize creeping juniper berries.

Grazing Pattern

The grazing formula for the West Hotchkiss Unit is as follows: the spring use pasture is to be grazed from May 1 to June 15, the summer use pasture from June 15 to August 1, and the fall use pasture from August 1 to October 31. In the past this formula was not strictly adhered to (Appendix Table 13).

Results of Grazing

The effects of grazing are dramatic with a rest-rotation system. One hundred percent of the surveyed aums for this entire unit are used in approximately 75 percent of the area. This results in very intensive grazing on the use pastures. Appendix Table 14 illustrates this point. The West Hotchkiss Unit's grazing history has averaged 3.5 percent less than the surveyed capacity since 1974. Even though the overall average indicates the unit is grazed at less than its surveyed capacity, individual pastures were over-grazed as high as 121 percent.

Fall Banding

In the fall birds were first observed on leks on September 20, 1977 and were last seen on November 25, 1977. The display was very active on crisp, still, and clear mornings during mid-October. Thirty-two birds were captured during the fall display, 11 of which were recaptures from the spring trapping. Again, all recaptures were on the lek on which they were originally banded. Ninety-four percent of the birds trapped in the fall were adults and 6 percent were juveniles. No females were captured during the fall display. Transmitters from the summer mortalities were placed on new birds and again all additional birds received poncho markers. Data from the fall-trapped "radioed" birds are given in Appendix Table 11.

Some grouse required a period of about two weeks to adjust to the radio pack. During this period, they would not fly or only fly a short distance and then hide. These birds were easily caught by hand. Three were lost to predation. Since the fall display was still active, I was able to re-trap and place the transmitters on new birds. After the adjustment period, the radio package didn't seem to affect the birds. Boag (1972) found the activity and food intake of red grouse decreased up to two weeks after they were fitted with transmitters. At the start of cold weather in mid-December, most transmitters ceased functioning.

Winter Distribution

The locations of birds and activity signs seen during the winter are plotted in Figure 10. By comparing this figure to Figure 3 (summer and fall distribution) a seasonal shift in distribution was noted. Ground F birds, which during the summer ranged in an area having little buffalo-berry, moved south to areas of greater abundance of this shrub. Grouse from other leks also moved to areas of higher density of buffalo-berry, usually within their summer and fall use areas.

The exception was birds from ground N which moved into a farm yard and wintered in the feedlot or surrounding willows. During winter these birds tolerated close contact with the cattle.

Winter distribution of birds from ground G were not fully determined. Some tracks were seen from the air in a coulee south of the lek but not in sufficient numbers to account for all the birds from this ground.

Snow was commonly used as cover during storms and for night roosting (Fig. 11). Schmidt (1936) documented a big drop in numbers of sharp-tailed grouse following a near snowless winter as compared to a winter of deep snow.

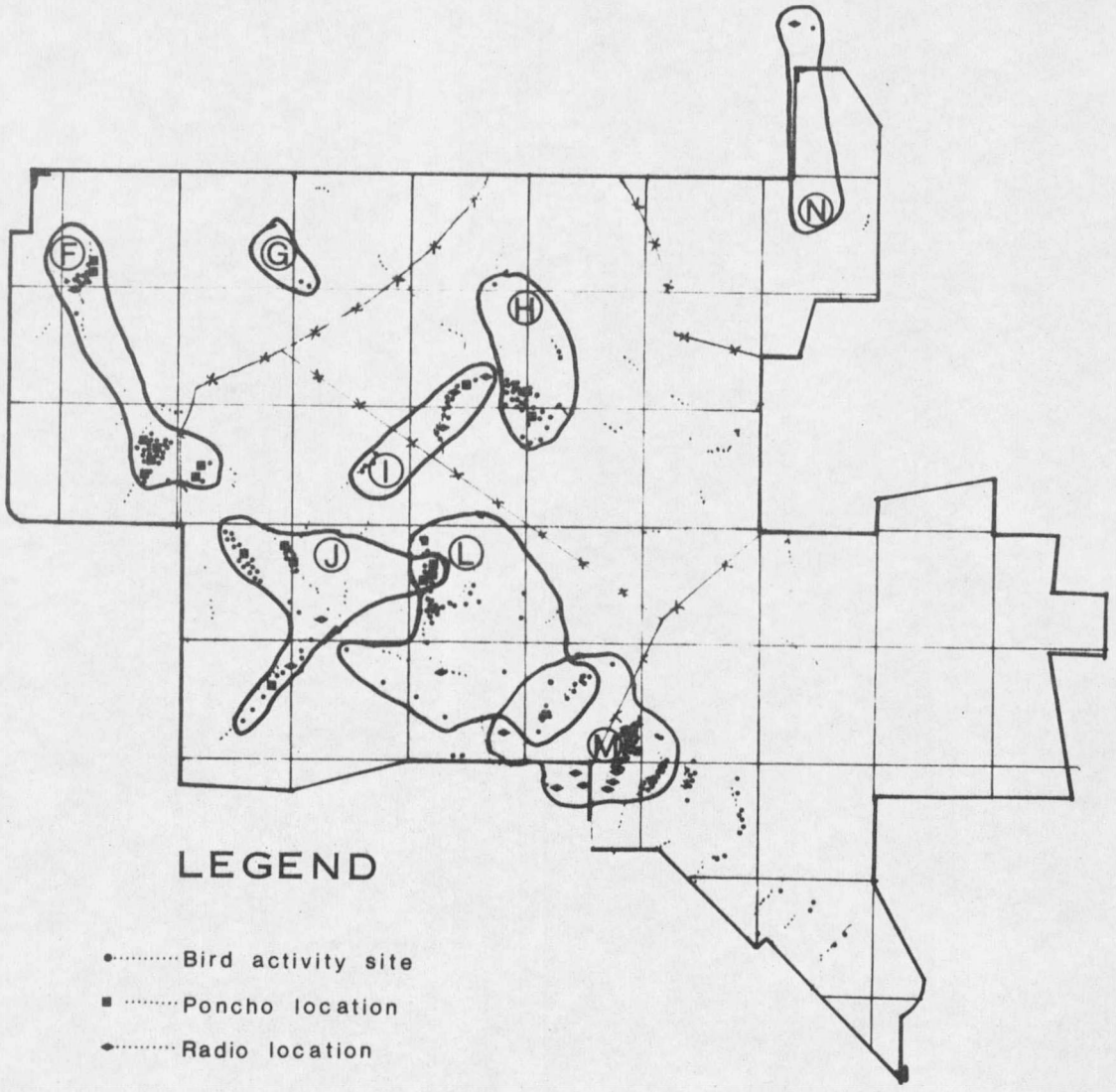

Figure 10. Winter bird distribution. Letters identify leks.

Figure 11. A snow burrow of a sharp-tailed grouse.

Winter Vegetation Use and Food Habits

Buffalo-berry was the major vegetation with which the birds were associated during the winter. The main food item was buffalo-berry buds since the berries were consumed by mid-October. Buffalo-berry is the best native winter food for sharp-tails (Evans and Dietz 1974). The birds either walked on the snow feeding on exposed buds or perched in the larger shrubs while feeding. Grouse occasionally dug through the snow to feed on creeping juniper mats. Other shrubs fed on were chokecherry, silverberry, snowberry, woods rose, and seed heads of silver sagebrush. Exposed curlcup gumweed and wild sunflower

seed heads were also fed upon. Table 8 indicates the frequency of occurrence of plant species at winter observation sites. The winter distribution of grouse was totally associated with buffalo-berry shrubs, except for birds from ground J which also fed heavily on woods rose and the previously mentioned birds from ground N which moved to a farmstead to winter. In the latter case, no buffalo-berry shrubs were located in the area. Figure 12 shows the relationship between the grouse's winter distribution and the distribution of buffalo-berry.

TABLE 8. VEGETATION ASSOCIATED WITH SHARP-TAILED GROUSE WINTER ACTIVITY FROM GROUND OBSERVATIONS AND AERIAL FLIGHTS[1]

Species	Percent Frequency
Buffalo-berry *(Shepherdia argentea)*	88.2
Creeping Juniper *(Juniperus horizontalis)*	3.7
Grass	3.0
Silver Sagebrush *(Artemisia cana)*	1.3
Chokecherry *(Prunus virginiana)*	0.8
Snowberry *(Symphoricarpos* spp.*)*	0.8
Silverberry *(Elaeagnus angustifolia)*	0.2
Curlcup Gumweed *(Grindelia squarrosa)*	0.2
Woods Rose *(Rose woodsii)*	1.6
Wild Sunflower *(Helianthus* spp.*)*	0.2

[1]Based on tracks in snow and actual bird observations

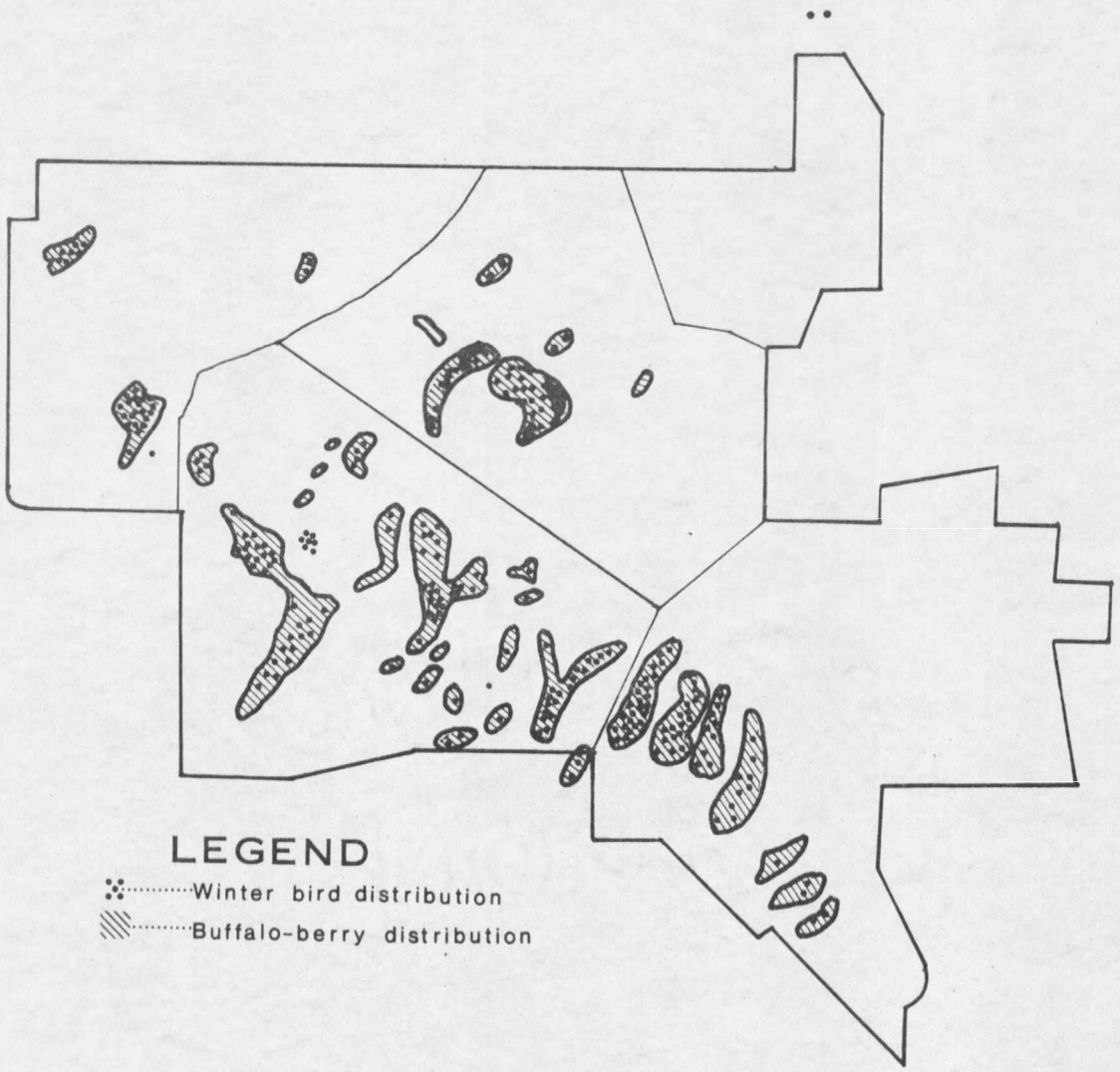

Figure 12. Winter distribution of sharp-tailed grouse in relation to the distribution of buffalo-berry.

DISCUSSION

The spring, summer, and fall distribution of male sharp-tailed grouse was generally within one mile of their lek. Birds from lek M, on the boundary between two pastures, maintained the same use area in 1976 and 1977 even though the grazing patterns changed drastically between the two years. In 1976, the grouse use area was in the rest pasture; in 1977 the average upland grass height in this pasture was 3.2 centimeters as a result of intensive grazing. Instead of moving to the immediately adjacent rest pasture, the grouse selected available shrubs for cover on the uplands or reverted to the breaks within their traditional use area. This suggests a strong behavioral attachment to their use area.

The area around the lek is also important for nesting sharptails since they prefer nesting on grassy uplands (Kohn 1976) within one mile of their lek (Marshall and Jensen 1937, Pepper 1972). They also require uniform grassy vegetation not less than 30 centimeters in height (Christenson 1970). Using these criteria only one upland area, a 60 acre pubescent wheatgrass field, would provide adequate cover for nesting sharptails.

The winter distribution of sharptails was associated with areas of high densities of shrubs. My data indicate almost a 100 percent dependence on shrubs, mainly buffalo-berry, for food in the winter. Henderson (1964) also documented the importance of woody

cover in draws for shelter and food.

Cumulatively, these data indicated that the key areas for grouse in this area are usually within a one-mile radius of the lek during the spring, summer, and fall and in shrubby coulees containing buffalo-berry shrubs during the winter. From the stand point of sharp-tailed grouse management, intensive grazing is detrimental to these traditional use areas (Brown 1968, Aldous 1943, and Sisson 1976) and decreases the value of woody draws (Renhowe 1968, and Severson and Bolt 1978). Grazing management plans should protect these areas from heavy cattle concentrations. Locating water developments and salting stations away from woody draws and grouse use areas would help reduce intensive grazing in these areas.

Even though one-fourth of the West Hotchkiss Unit is not grazed, heavy grazing in this rest-rotation system still remains a problem. To illustrate this point, the carrying capacity is determined by figuring a 55% utilization of grass, such as western wheatgrass, needle-and-thread, and green needlegrass, on the entire unit. However, since one-fourth of the unit each year is undergoing a rest treatment, this utilization would increase to approximately 73.2 percent. In a dry year, the grass utilization could easily reach 100 percent. Henderson (1964) documented the greatest grouse populations were found where livestock utilization of the grasses was light to moderate, usually less than 50 percent. The rest pasture undoubtedly

offers better habitat in a given year and provides residual cover the following spring. However, it is doubtful that this benefit would exceed the detrimental effects of the intensive grazing on the other three pastures, especially since grouse did not show any inclination to adjust their traditional use areas to changing grazing patterns.

Mattise (1978) found, by measuring the height and density of grasses, that season long grazing provided better sharptail habitat than a deferred rotation system. Based on my observations, I feel this rest-rotation system, under its present (1977) condition, is detrimental to grouse. This rest-rotation system would have less adverse effect on sharp-tailed grouse if the quantity and quality of vegetation were increasing. To date, the BLM's trend plots do not indicate vegetation is increasing.

MANAGEMENT RECOMMENDATIONS

1. All water developments should be located at least ½ mile from good shrubby coulees or high grouse use areas. This would prevent deterioration of the shrubs and grass in these areas and give better distribution of the cattle.

2. Adjustable stocking rates should be implemented on these units. In years of drought, reducing cattle numbers would prevent 100% utilization of the available grass.

3. Cattle should not be allowed into a pasture before the set grazing date. This would help prevent over-grazing and allow for the completion of nesting in the summer use pasture before the cattle are moved in; conversely, cattle should not be allowed to return to a used pasture, since regrowth may provide some residual vegetation for grouse use.

4. The wildlife consideration in the new range survey should take into account all wildlife on the area. In the original range survey, the only wildlife consideration was 0.6 antelope per square mile (Cosgriffe 1965).

APPENDIX

TABLE 9. SUMMARY OF LAND OWNERSHIP ON THE WEST HOTCHKISS UNIT.

	Pasture				
	#1	#2	#3	#4	Total Acreage
Private	4,062	1,738	1,642	2,044	9,486
Vacant	1,474	2,895	5,240	4,543	14,152
Indian	840	585	325		1,750
L.U.*		150		313	463
State		75		5	80
TOTALS	6,376	5,443	7,207	6,905	25,931

*Land Utilization

TABLE 10. DATA ON THE RADIO BIRDS.

Bird No.	Channel	Date Captured	Dancing Ground	Poncho Collar and Collar	Fate as of 2/23/78	No. of Relocations
1	8	4/15/77	I	None	Alive	76
2	13.4	4/15/77	I	(16) B on y	Probable avian predation	38
3	9.3	4/15/77	J	(18) w on g	Probable coyote predation	0
4	12.3	4/15/77	J	(19) w on g	Probable coyote predation	0
5	6.4	4/16/77	G	(1) w on b	Probable avian predation	3
6	10.8	4/16/77	F	(17) r on w	Probable avian predation	0
7	4.4	4/16/77	M	(1) w on r	Probable avian predation	0
8	17.4	4/16/77	M	(3) w on r	Radio ceased functioning	57
9	2.2	4/17/77	H	(75) b on w	Died from unknown cause	0
10	3.4	4/17/77	H	(74) b on w	Avian predation	37
11	2.2	10/11/77	F	None	Radio ceased functioning	12
12	12.6	10/11/77	F	None	Radio ceased functioning	1
13	10.8	10/12/77	J	(9) w on g	Avian predation	10
14	4.4	10/12/77	L	None	Probable coyote predation	16
15	13.4	10/13/77	H	None	Radio ceased functioning	9
16	6.4	10/14/77	N	None	Radio ceased functioning	11
17	9.3	10/14/77	M	None	Hunter kill	3
18	3.4	10/17/77	N	None	Probable coyote kill	3
19	9.3	10/23/77	M	None	Alive	17
20	3.4	11/ 3/77	M	None	Alive	8
21	10.8	11/ 6/77	J	None	Radio ceased functioning	8

TABLE 11: VEGETATION COMPOSITION OF OBSERVATION SITES

	Species	UPLANDS Pasture #1	#2	#3	#4	Average
GRASSES:						
Western Wheatgrass	*(Agropyron smithii)*	62.68[1]/17.6[2]	57.5/ 6.6	50.67/5	63.5/10.6	58.6/10.
Blue Grama	*(Bouteloua gracilis)*	31.6 / 4.6	53.8/14.8	60.7 /8.3	56.4/15.2	50.6/10.6
Needleandthread	*(Stipa comata)*	62.8 /17.4	76 / 8.9	67 /7.7	48.2/10.6	63.5/11.2
Green Needlegrass	*(Stipa viridula)*	20.9 /13.6	7.5/ 1.4	3.3 / .2	4.3/ .2	8.9/ 3.9
Needleleaf Sedge	*(Carex eleocharis)*	13 / 1.3	9.4/ .8	14.7 / .1	13 / .6	12.5/ .9
Junegrass	*(Koeleria cristata)*	7.6 / .8	4.7/ .2	0 / 0	9 / .2	5.2/ .3
Plains Muhly	*(Muhlenbergia cuspidata)*	.4 /tr[3]	10.6/ 4.1	4.7 / .2	.9/tr	4.1/ 1.1
Little Bluestem	*(Andropogon scoparius)*	0 / 0	0 / 0	.7 / .2	0 / 0	.2/ .1
Prairie Sandreedgrass	*(Calamovilfa longifolia)*	2.2 / 1.1			.9/tr	.8/ .3
Red Threeawn	*(Aristida longiseta)*	.5 / .1	1.2/ .6	2 / .2		.9/ .2
Foxtail Barley	*(Hordeum jubatum)*	.9 /tr	4.7/ 1.3			1.4/ .3
Pubescent Wheatgrass	*(Agropyron trichophorum)*	11.2 / 4.9				2.8/ 1.2
Tumblegrass	*(Schedonnardus paniculatus)*	.5 /tr			.9/tr	.4/ 0
Slender Wheatgrass	*(Agropyron trachycaulum)*	.8 / .3	1.2/ .3	.7 /tr		.5/ .2
Unidentified Grass				.7 /tr		.2/ 0
FORBS:						
Fringed Sagewort	*(Artemisia frigida)*	30.2 / 3.3	21.3/ 1.5	42 /4.1	33 / 2.9	31.6/ 3
Curlcup Gumweed	*(Grindelia squarrosa)*	16.9 / 3.5	12.5/ 3.1	6.7 / .5	7 / 1.6	10.7/ 2.2
Hood's Phlox	*(Phlox hoodii)*	.9 /tr	3.8/tr	9.3 / .4	7 / .6	5.2/ .3
Prairie Coneflower	*(Ratibida columnifera)*	5.8 / .7	2.5/tr		.9/ .1	2.3/ .2
Wavyleaf Thistle	*(Cirsium undulatum)*	6.2 / 1.4				1.6/ .4
Whitepoint Loco	*(Oxytropis sericea)*	3.6 / .2				.9/ .1
Broom Snakeweed	*(Gutierrezia sarothrae)*	.4 / .2	1.3/tr	4 / .1		1.4/ .1
Yarrow	*(Achillea millefolium)*	4 / .1	1.3/tr			1.3/tr
Cudweed Sagewort	*(Artemisia ludoviciana)*	3.6 / .1	3.8/ 1.1	3.3 / .3	1.7/ .4	3.1/ .5
Pale Bastard Toadflax	*(Comandra umbellata)*	.4 /tr	1.3/tr		1.7/tr	.9/ 0
Small-leaf Pussytoes	*(Antennaria parvifolia)*	1.3 /tr	6.3/ .4	5.3 / .1	.9/tr	3.4/ .1
Dotted Blazingstar	*(Liatris punctata)*	.9 /tr			5.2/ .5	1.5/ .1
Prairie Thermopsis	*(Thermopsis rhombifolia)*	.4 /tr	2.5/ .3	4.7 /tr	1.7/ .2	2.3/ .1
Golden-aster	*(Chrysopsis villosa)*	4.9 / .1		7.3 / .1	6.1/ .8	4.6/ .3
Silver Leaf Scurfpea	*(Psoralea argophylla)*	.9 / .2				.2/ .1
Salsify	*(Tragopogon dubius)*	.9 /tr		2 /tr		.7/ 0
Kochia	*(Kochia scoparia)*	10.2 / 2.5				2.5/ .6
Goldenrod	*(Solidago missouriensis)*	.4 /tr			.9/ .2	.3/ .1
Yellow Sweet Clover	*(Melilotus officinalis)*	.4 /tr				.1/ 0.
Rush Skeletonweed	*(Lygodesmia juncea)*		1.3/tr		4.3/ .3	1.4/ .1
Lambs Quarter	*(Chemopodium album)*				.9/tr	.2/ 0
Wild Licorice	*(Glycyrrhiza lepidata)*			.7/ .2		.2/ .1
Flixweed Tamseymustard	*(Descurainia sophia)*		1.3/ .1			.3/tr
Prickly Pear	*(Opuntia polycantha)*		5 / .4	.7 / .3	1.7/ .4	1.8/ .3
Unidentified Forbs		1.7 /tr				.4/
SHRUBS:						
Silver Sagebrush	*(Artemisia cana)*	7.1 / 2.4	17.1/ 7.2	32.9 / 8	25 / 9.8	20.5/ 6.9
Buffalo-berry	*(Shepardia argentea)*			2.9 / 1.2		.7/ .3
Woods Rose	*(Rosa woodsii)*	1.9 / .1	1.4/tr	1.4 /tr	1.8/ .5	1.6/ .2
Skunkbrush Sumac	*(Rhus trilobata)*			.7 / .7	.9/ .9	.4/ .7
Snowberry	*(Symphoricarpos spp.)*		1.4/ .6	2.1 / .5		.9/ .3
Creeping Juniper	*(Juniperus horizontalis)*			3.6 / 2.8		.9/ .7
OTHER:						
Dense Clubmoss	*(Selaginella densa)*	46.7 /13.7	65.3/34.9	82.9 /42.3	73.9/29.9	67.2/30.2
Rock		2.7 / .4	7.5/ 2.2	12.7 / 2.8	3.5/ .7	6.6/ 1.5
Litter		21.8 / 3.7	10 / 1.4	1.3 / .2	1.7/ .6	8.7/ 1.5
Bare Ground		26.7 / 4.9	12.5/ 3.2	20.7 / 7.2	35.7/ 7	23.9/ 3.6
Sample Size Plots		210	70	140	110	

TABLE 11: (CONTINUED).

	Species	BREAKS Pasture #1	#2	#3	#4	Average
GRASSES:						
Western Wheatgrass	*(Agropyron smithii)*	3.8/2	31.6/7.9	9 /2.4	20 /10.2	16 /5.6
Blue Grama	*(Bouteloua gracilis)*	2.4/ .6	14.7/6.2	6.34/1.8	0 / 0	5.9/2.2
Needleandthread	*(Stipa comata)*	3.2/1.1	10.5/2.7	3.6 /1.3	2 / 1.2	4.8/1.6
Green Needlegrass	*(Stipa viridula)*	4.2/6.4	4.2/ .7	3 / .5	0 / 0	2.9/1.9
Needleleaf Sedge	*(Carex eleocharis)*	1 / 3	16.8/3.3	1 / .2	.9/ .3	4.9/1.0
Sandberg Bluegrass	*(Poa seconda)*	6.3/4.9		1 / .8	.9/tr	2.1/1.4
Junegrass	*(Koeleria cristata)*	0 / 0	2.7/tr	0 / 0	0 / 0	.7/
Plains Muhly	*(Muhlenbergia cuspidata)*	0 / 0	4 / .9	3 / .2	1.7/ .3	2.2/ .4
Little Bluestem	*(Andropogon scoparius)*	1.3/1.6	6.7/5.1	3.5 /1.1	18.3/ 5.8	7.4/3.4
Prairie Sandreedgrass	*(Calamovilfa longifolia)*	3.8/ .1	1.7/tr	1.5 /1.2	13 / 9.4	5.2/2.7
Red Threeawn	*(Aristida longiseta)*		1.1/ .1	1.5 / .8		.6/ .2
FORBS:						
Fringed Sagewort	*(Artemisia frigida)*		6.3/ .2	3.4 /tr	7.6/ .7	4.3/ .3
Curlcup Gumweed	*(Grindelia squarrosa)*		1.1/ .1	1 / .1	3.8/ .6	1.5/ .2
Hood's Phlox	*(Phlox hoodii)*		1.1/tr	1.5 /tr	1 / .1	.9/tr
Prairie Coneflower	*(Ratibida columnifera)*		2.1/tr		1.9/tr	1 /
Wavyleaf Thistle	*(Cirsium undulatum)*	2.4/ .5				.6/ .1
Broom Snakeweed	*(Gutierrezia sarothrae)*	1.2/ .1		1 /tr	1 / .1	3.1/ .1
Yarrow	*(Achillea millefolium)*	1.3/tr	2.1/tr		1 /tr	1.1/
Cudweed Sagewort	*(Artemisia ludoviciana)*	5.9/ .7	16.8/3.2	7.3 / .3	10.5/ 1.3	10.1/1.4
Pale Bastard Toadflax	*(Comandra umbellata)*				1.9/tr	.5/
Western Stick Tight	*(Lappula redowskii)*	4.7/ .4		1.5 /tr		1.5/ .1
Wild Sunflower	*(Helianthus spp.)*	2.4/ .1	3.2/ .5		4.8/ .4	2.6/ .3
Prairie Thermopsis	*(Thermopsis rhombifolia)*	1.2/tr	2.1/ .1		1.9/tr	1.3/tr
Golden-aster	*(Chrysopsis villosa)*			2 / .1		.5/tr
Goldenrod	*(Solidago missouriensis)*		3.2/ .2			.8/ .1
Wild Licorice	*(Glycyrrhiza lepidata)*		1.1/ .2	.5 /tr	3.8/ .5	1.3/ .2
Poison Ivy	*(Rhus radicans)*				1 /tr	.2/
Unidentified Forbs					1 /tr	.2/
SHRUBS:						
Silver Sagebrush	*(Artemisia cana)*		18.9/ 3.9	14.1/ 6.2	24.3/ 3.1	14.3/ 3.3
Buffalo-berry	*(Shepardia argentea)*	73.7/73.7	38.9/38.9	52.3/49.5	69.6/69.6	58.6/57.4
Chokecherry	*(Prunus virginiana)*			29.5/14.3	2.6/ .9	8 / 3.8
Golden Currant	*(Ribes aureum)*			14.1/ .5		3.5/ .1
Woods Rose	*(Rosa woodsii)*	44.2/ 8.9	44.4/ 3.8	52.7/16.8	24.3/ 3.2	41.4/ 8.2
Skunkbrush Sumac	*(Rhus trilobata)*		5.6/ 2.8	15.5/ 3.8	14.8/ 6.7	8.9/ 3.3
Snowberry	*(Symphoricarpos spp.)*	47.4/16.1	52.2/23.5	56.4/15.2	24.3/ 9.7	45.1/16.1
Creeping Juniper	*(Juniperus horizontalis)*		17.8/17.8	19.5/17.7	4.3/ 3.5	10.4/10.
OTHER:						
Dense Clubmoss	*(Selaginella densa)*		9.4/3.4	4 / .38		3.3/1
Rock			3.2/1	8.3/ 2.1	10.5/ 2.5	5.5/1.4
Litter			11.6/2.5	5.9/ .8	3.8/ .4	5.3/ .9
Bare Ground		1.2/ .3	3.2/2.1	5.9/ 1.7	2.9/ 1	3.3/1.3
Sample Size Plots		95	90	220	115	

TABLE 11: (CONTINUED).

	Species	LOWLANDS Pasture #1	#2	#3	#4	Average
GRASSES:						
Western Wheatgrass	*Agropyron smithii)*	20 /1.2	31.2/6.3		60 /40.4	37.1/16.
Blue Grama	*(Bouteloua gracilis)*	0 / 0	23.2/6.5		0 / 0	7.7/ 2.2
Needleandthread	*(Stipa comata)*	5 /3.2	10 /2.3		0 / 0	5 / 1.8
Green Needlegrass	*(Stipa viridula)*	50 /7.5	12.8/2.1		12 /tr	25 / 3.2
Needleleaf Sedge	*(Carex eleocharis)*	5 /	3.6/ .5		0 / 0	2.8/ .2
Sandberg Bluegrass	*(Poa secunda)*	35 /1	7.1/1.1		4 /tr	15.3/ .7
Junegrass	*(Koeleria cristata)*	0 / 0	.7/tr		0 / 0	.2/
Plains Muhly	*(Muhlenbergia cuspidata)*		.7/tr			.2/
Foxtail Barley	*(Hordeum jubatum)*	10 /4.8	11.4/1.6		12 / 4.8	11.1/ 3.7
Saltgrass	*(Distichlis stricta)*	25 /3.3	2.9/tr		4 /tr	10.6/ 1.1
Slender Wheatgrass	*(Agropyron trachycaulum)*	10 /1				3.3/ .3
FORBS:						
Fringed Sagewort	*(Artemisia frigida)*	5 /1	20 /2.4			8 / 1.1
Curlcup Gumweed	*(Grindelia squarrosa)*	20 /5.8	4 /1.6		20 / 2.8	14.6/ 3.4
Prairie Coneflower	*(Ratibida columnifera)*	5 / .8				1.6/ .3
Whitepoint Loco	*(Oxytropis sericea)*		.8/tr			.3/
Broom Snakeweed	*(Gutierrezia sarothrae)*		.8/tr			.3/
Yarrow	*(Achillea millefolium)*	5 /tr				1.6/
Cudweed Sagewort	*(Artemisia lucoviciana)*	25 /4.8	14.4/1.3		20 / 6	19.8/ 4.0
Western Stick Tight	*(Lappula redowskii)*		2.4/tr			.8/
Wild Sunflower	*(Helianthus spp.)*	10 /3.5			8 / 4	6 / 2.5
Prairie Thermopsis	*(Thermopsis rhombifolia)*		2.4/ .1			.6/tr
Golden-aster	*(Chrysopsis villosa)*		.8/ .06			.26/tr
Kochia	*(Kochia scoparia)*	15 /4.5				5 / 1.5
Goldenrod	*(Solidago missouriensis)*	20 /3.8	3.2/ .1			7.7/ 1.3
Yellow Sweet Clover	*(Melilotus officinalis)*	10 /7.5				3.3/ 1
Prairie Pepperweed	*(Lepidium densiflorum)*	5 /1.5				1.6/ .5
Lambs Quarter	*(Chemopodium album)*	10 /3.0				3.3/ 1
Wild Licorice	*(Glycyrrhiza lepidata)*	20 /5.3	16 /2.6		48 /17.4	24.6/ 8.4
Prickly Pear	*(Opuntia polyacantha)*		5.6/1.3			1.8/ .4
Unidentified Forbs		10 /2			16 / .8	8.6/ .9
SHRUBS:						
Silver Sagebrush	*(Artemisia cana)*		19.4/ 6.7		48 /24	22.4/10.2
Buffalo-berry	*(Shepardia argentea)*	0 / 0	36.1/36.1		20 /20	18.6/18.7
Golden Currant	*(Ribes aureum)*		16.1/ 7.4			5.3/ 2.5
Woods Rose	*(Rosa woodsii)*	30 /9.5	58.1/26.1		24 / 4	37.3/13.2
Skunkbrush Sumac	*(Rhus trilobata)*		6.5/ .6			2.2/ .2
Snowberry	*(Symphoricarpos spp.)*	10 /8.8	29.7/17.3		28 /14.8	22.5/13.6
Creeping Juniper	*(Juniperus horizontalis)*		3.2/ 1.6			1.1/ .5
OTHER:						
Dense Clubmoss	*(Selaginella densa)*		3.5/ 1.8			1.2/ .6
Rock					4 / .8	1.3/ .3
Litter			.8/ .2			.3/ .1
Bare Ground		30 /12	12.8/ 2.5			14.3/ 4.8
Sample Size Plots		20	155	0	25	

[1]Percent frequency of occurrence among plots.
[2]Average percent canopy coverage of plots.
[3]tr = trace; values below .05 percent.

TABLE 12. SUMMARY OF SHARP-TAILED GROUSE FOOD HABITS

Item	Percent Frequency	Percent of Total Volume
SHRUBS		
Wild Rose *Rosa* spp.	26.7	12.7
Buffalo-berry *Shepherdia argentea*	42.8	25.5
Snowberry *Symphoricarpos* spp.	33.9	4.8
Creeping Juniper *Juniperus horizontalis*	46.4	24.9
Golden Currant *Ribes aureum*	1.7	Tr
Silverberry *Eleagnas commutata*	5.3	1.3
Chokecherry *Prunus virginiana*	1.7	.5
Skunkbush Sumac *Rhus trilobata*	7.1	6.1
FORBS		
Small-leaf Pussytoes *Antennaria parvifolia*	26.7	4.0
Common Dandelion *Taraxicum officinale*	14.2	5.4
Flixweed Tamsey Mustard *Descuramia sophia*	1.7	Tr
Yellow Sweetclover *Melilotus officinalis*	10.7	1.7
Prairie Coneflower *Ratibida columnifera*	1.7	.2
Unidentified Composite Seed Heads	7.1	1.8
Unidentified Forbs	12.5	.5
GRASSES		
Grammineae	30.3	1.8

TABLE 12: (CONTINUED).

Item	Percent Frequency	Percent of Total Volume
ANIMAL MATERIAL		
Orthoptera	16.0	6.3
Lepidoptera	1.7	.1
Coleoptera	3.5	Tr
Hemiptera	3.5	Tr
Arachnida	3.5	Tr
Hymenoptera	1.7	Tr
OTHER		
Grit	3.5	Tr
Lichen	1.7	Tr

TABLE 13. DATES OF USE AND GRAZING SEQUENCE HISTORY OF THE WEST HOTCHKISS UNIT

Year	Pastures			
	#1	#2	#3	#4
1974	Rest	Fall	Summer	Spring
	(. . . . . No dates available . . . . . .)			
1975	Summer & Fall 5/31 - 11/1	Rest	Fall 8/27 - 11/5	Spring & Fall 5/3 - 6/17 8/27 - 11/3
1976	Spring 5/1 - 6/20	Summer & Fall 6/6 - 10/21	Rest	Summer & Fall 6/21 - 10/30
1977	Fall 8/3 - 11/4	Spring 5/10 - 6/15	Summer 5/22 - 8/2	Rest

TABLE 14. ACTUAL GRAZING USE HISTORY OF THE WEST HOTCHKISS UNIT.

	Pasture				
	#1	#2	#3	#4	Total
Surveyed Aums[1]	1144	1135	1420	1280	4979
1974	0 - Rest	----No Breakout Available----			4564 (8.3% under)
1975	1900 (40% over)[2]	Rest	732 (48% under)	1424 (11% over)	4056 (18.5% under)
1976	1260 (10% over)	2513 (121% over)	Rest	2290 (79% over)	6063 (21.7% over)
1977	2070 (81% over)	864 (24% under)	1597 (12% over)	Rest	4531 (9.0% under)

[1] Animal Unit Months

[2] Percent over or under grazing in relation to its surveyed capacity

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