



Summer range habits of the pronghorn antelope in central Montana with special reference to proposed sagebrush control study plots
by Harold James Wentland

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

A study of the range use, food habits and home range of the pronghorn antelope was conducted during the summers of 1966 and 1967 on an 83,597 acre area in central Montana which included four study plots on which sagebrush will be eradicated at a later date. The purpose of my study was to record data prior to sagebrush eradication on the study plots. These data will be available for comparison with those collected after the control of sagebrush.

The physiography of the area was described. The vegetation was classified into eight types as follows; Sagebrush-grassland, grassland, grease-wood, greasewood-sagebrush, shale slope, cropland, abandoned meadow and timber. Canopy coverage and frequency of occurrence was recorded for low growing vegetation. This provided data for quantitative descriptions of the first five types listed.

Population characteristics were determined by classification of 4,029 ground observations and 1,559 aerial observations of individual antelope by sex and age classes. Data from ground counts indicated 262 females per 100 males and 84 fawns per 100 females in 1966 and 190 and 71, respectively, in 1967. Data from aerial counts indicated 241 females per 100 males and 57 fawns per 100 females in 1967. Highest fawn-female ratios obtained during ground counts occurred in early August, 1966 and late July, 1967.

A total of 5,874 individual antelope observations were recorded by vegetation type. These data indicated declining use of the sagebrush-grassland vegetation type and a corresponding increase in use of the shale slope, greasewood, greasewood-sagebrush and cropland vegetation types combined, as the summer progressed in both 1966 and 1967. Despite this trend the sagebrush-grassland vegetation type received 50 percent or more of the total use both summers. The density of big sagebrush was recorded at 2,980 individual antelope observation sites in the sagebrush-grassland vegetation type. Both years at least 90 percent of these antelope were observed on areas where densities of big sagebrush were estimated to be scattered or common.

Antelope food habits data were obtained primarily by examination of 62 feeding sites and supplemented, in 1967, by analysis of the contents of 12 rumen samples. Forbs comprised 86 and 97 percent, shrubs 14 and 3 percent, and grasses a trace, of the total use at feeding sites in 1966 and 1967, respectively. In 1967 these forage classes averaged 85, 14 and 2 percent, respectively, of the total identifiable material in 12 rumen samples. Five forbs constituted 62 percent or more of the total use at feeding sites both years and averaged 35 percent of identifiable material in rumen samples. These included fringed sagewort (*Artemisia, frigida*), long-leaf sagebrush (*Artemisia longifolia*), three-leaved milkvetch (*Astragalus gilviflorus*), alfalfa (*Medicago sativa*) and sweetclover, (*Melilotus officinalis*). The latter four were the only plant species present in the antelope diet in significantly higher proportions than in the plant community. Four *Artemisia* species together constituted 28 and 14 percent of the total use at feeding sites in 1966 and 1967, respectively, and averaged 10 percent by volume of identifiable material in rumen samples.

Characteristics of summer home ranges were determined by successive observations of 19 individually recognizable antelope. Territorial males moved the shortest distances between successive observations and had the smallest home ranges. Males associated with male herds moved the greatest distances between successive observations and had the largest home ranges. Females associated with other females and fawns or with females, fawns and a single male were intermediate with respect to these measurements. Females moved 59 percent further between successive observations when not accompanied by a territorial male. The average size of home ranges of territorial males was 121 percent larger on the sagebrush-grassland vegetation type than on the greasewood vegetation type.

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WITH SPECIAL REFERENCE TO PROPOSED SAGEBRUSH CONTROL STUDY PLOTS

by

HAROLD JAMES WENTLAND

A thesis submitted to the Graduate Faculty in partial
fulfillment of the requirements for the degree

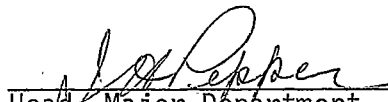
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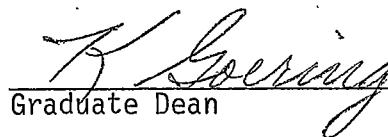
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ABSTRACT

A study of the range use, food habits and home range of the pronghorn antelope was conducted during the summers of 1966 and 1967 on an 83,597 acre area in central Montana which included four study plots on which sagebrush will be eradicated at a later date. The purpose of my study was to record data prior to sagebrush eradication on the study plots. These data will be available for comparison with those collected after the control of sagebrush.

The physiography of the area was described. The vegetation was classified into eight types as follows; Sagebrush-grassland, grassland, greasewood; greasewood-sagebrush, shale slope, cropland, abandoned meadow and timber. Canopy coverage and frequency of occurrence was recorded for low growing vegetation. This provided data for quantitative descriptions of the first five types listed.

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A total of 5,874 individual antelope observations were recorded by vegetation type. These data indicated declining use of the sagebrush-grassland vegetation type and a corresponding increase in use of the shale slope, greasewood, greasewood-sagebrush and cropland vegetation types combined, as the summer progressed in both 1966 and 1967. Despite this trend the sagebrush-grassland vegetation type received 50 percent or more of the total use both summers. The density of big sagebrush was recorded at 2,980 individual antelope observation sites in the sagebrush-grassland vegetation type. Both years at least 90 percent of these antelope were observed on areas where densities of big sagebrush were estimated to be scattered or common.

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antelope diet in significantly higher proportions than in the plant community. Four *Artemisia* species together constituted 28 and 14 percent of the total use at feeding sites in 1966 and 1967, respectively, and averaged 10 percent by volume of identifiable material in rumen samples.

Characteristics of summer home ranges were determined by successive observations of 19 individually recognizable antelope. Territorial males moved the shortest distances between successive observations and had the smallest home ranges. Males associated with male herds moved the greatest distances between successive observations and had the largest home ranges. Females associated with other females and fawns or with females, fawns and a single male were intermediate with respect to these measurements. Females moved 59 percent further between successive observations when not accompanied by a territorial male. The average size of home ranges of territorial males was 121 percent larger on the sagebrush-grassland vegetation type than on the greasewood vegetation type.

INTRODUCTION

In recent years there has been an increasing trend toward sagebrush (*Artemisia* spp.) eradication, and the consequent reduction of associated forbs (Martin 1965), to increase the volume of grasses for livestock on public and private rangelands. These changes in floral composition have caused much concern among wildlife biologists in Montana with respect to the possible effects on various non-game and game species. To study the short and long range effects on wildlife of ecological changes resulting from sagebrush eradication, a 10-year project was initiated in 1965 by the Montana Fish and Game Department, in cooperation with the Bureau of Land Management, in Central Montana. The current study is a part of that project.

The predominant role of sagebrush-grassland vegetation in the general ecology of the pronghorn antelope (*Antilocapra americana*) in Montana has been elucidated by Cole (1956) and Cole and Wilkins (1958). Quantitative data concerning the effects of sagebrush eradication on the pronghorn are lacking. Insight about possible effects may be gained by reference to studies of both pronghorn food and range use habits (Ferrel and Leach 1952; Cole, *op cit.*; Cole and Wilkins, *op cit.*; and Dirschl 1963) and the effects of sagebrush eradication on associated vegetation (Hurd 1955; Blaisdell and Mueggler 1956; and Hedrick *et al.* 1966). Results of these studies strongly suggest that the ecological changes in floral composition resulting from sagebrush eradication would produce results incompatible with pronghorn food and range use habits.

My study was conducted during the summers of 1966 and 1967 in central Montana to obtain quantitative data on range use, food habits and behavior of the pronghorn antelope in summer on and adjacent to sagebrush control study plots prior to the control of sagebrush. These quantitative data will be available for comparison with those collected after the control of sagebrush on the study plots.

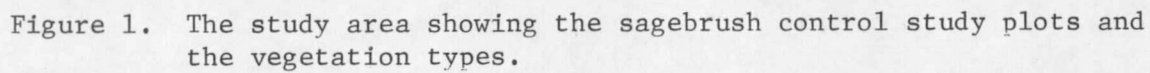
DESCRIPTION OF THE STUDY AREA

The study area, with boundaries as shown on Figure 1 and located approximately 50 miles east of Lewistown in central Montana, comprised about 83,597 acres including four sagebrush control study plots. Private lands constituted 57.9 percent of the area and public lands, which are administered by the Bureau of Land Management or the State of Montana, 42.1 percent (Appendix, Figure 13). Rangeland predominates. Croplands, restricted largely to bottoms, comprised 2 percent of the total. Alfalfa was the principal crop but some wheat was also grown.

The physiography is characterized by undulating and sharply rolling upland plains, gravel capped benches, shale slopes and bottomlands (Gieseke 1938). The latter two occur where erosion has dissected the upland plains. McDonald, Elk, Spring, Yellow Water, and Pike Creeks flow through the area. Yellow Water Storage Reservoir and numerous small stock ponds are also located here.

The soils have developed over cretaceous shales of the Colorado formation (Andrews *et al.* 1944). Upland soils range from heavy clays to shaly clay loams. Shale slopes have soils ranging from fine shale loams to coarse shale gravels. Bottomlands have thin surface horizons ranging from silty clays to clay loams interspersed with barren hardpan spots.

Gieseke (*op cit.*) describes the climate of the area as semiarid ".....characterized by a comparatively low rainfall, great temperature extremes, a large number of sunny days, and a relatively low humidity." The average annual precipitation at Flatwillow (U.S. Department of Commerce



Weather Station), on the east edge of the study area, is 12.57 inches. The average summer (June-August) precipitation is 5.76 inches. During the summers of 1966 and 1967 precipitation was 61.3 percent below and 12.7 percent above normal, respectively. The mean average annual temperature is 45.4 degrees. The highest temperature recorded during the study period was 105 degrees in July, 1966 and the lowest was 35 degrees in June, 1966. Monthly climatological data for both summers are shown in the Appendix, Table XI.

Major influent wild mammals on the area, besides the pronghorn antelope, include the white-tailed deer (*Odocoileus virginianus*) and the mule deer (*Odocoileus hemionus*).

VEGETATION

Cole (*op cit.*) and Bayless (1967) studied the vegetation of the same general area as that of the current study. My analysis follows closely that of the latter. His investigation made use of quantitative measurements and included my study area. The occurrence and distribution of vegetation types shown on Figure 1, with slight modification, are from Bayless. Plant nomenclature is that of Booth (1950) and Booth and Wright (1959).

Floral composition of the vegetation types of the study area, including the sagebrush control study plots, was determined by a modification of the technique of Daubenmire (1959). The canopy coverage and frequency of each taxon occurring within 2 x 5 decimeter plots, systematically placed within a relatively homogeneous and undisturbed portion of each vegetation stand, were visually estimated. The coverage classes were: Class 1=0-5 percent; Class 2=5-25 percent; Class 3=25-50 percent; Class 4=50-75 percent; Class 5=75-95 percent; and Class 6=95-100 percent. The midpoints of these classes were used in data tabulations. Ground cover was evaluated by making a visual estimate of the percent of bare-ground, rock and litter within the plot frames.

A sample unit consisting of twenty 2 x 5 decimeter plots placed at 10-foot intervals along 50-foot radial lines of a circle's cardinal points was examined within each of 79 vegetation stands on the area exclusive of the sagebrush control study plots (Table I and Appendix, Table XII). One sample unit was located at each of 48 antelope feeding sites as well as

TABLE I. CONSTANCY, CANOPY COVERAGE AND FREQUENCY OF TAXA FOR FIVE VEGETATION TYPES AS DETERMINED BY EXAMINATION OF 2 X 5 DECIMETER PLOTS.

Taxa ^{1/}	Vegetation Type				
	Sagebrush-	Grassland	Grassland	Greasewood-	Greasewood-
	Grassland	Grassland	Grassland	Sagebrush	Shale Slope
	46 Stands 920 Plots	5 Stands 100 Plots	7 Stands 140 Plots	8 Stands 160 Plots	13 Stands 260 Plots
	Cy/Cv/Fr ^{2/}	Cy/Cv/Fr	Cy/Cv/Fr	Cy/Cv/Fr	Cy/Cv/Fr
SHRUBS					
<i>Artemisia tridentata</i>	96/11/39	X		63/ 3/15	31/ 1/ 4
<i>Chrysothamnus nauseosus</i>	X3/		X	25/ 4/ 3	46/ 2/15
<i>Gutierrezia sarothrae</i>	74/ 3/26	60/ 1/16	X	50/ 1/ 9	31/ 1/ 9
<i>Rosa arkansana</i>	X		14/ 1/ 4	13/ 1/ 1	54/ 2/11
<i>Sarcobatus vermiculatus</i>	X		29/ 1/ 4	63/ 2/ 8	
Total Shrubs	100/12/40	80/ 1/18	43/ 1/14	88/ 5/26	85/ 8/44
FORBS					
<i>Achillea millefolium</i>	X		86/ 6/50	63/ 1/17	X
<i>Androsace septentrionalis</i>	X			38/tr/ 6	
<i>Arenaria hookeri</i>	48/ 1/15	X			15/ 8/ 1
<i>Artemisia frigida</i>	72/ 3/25	100/ 4/50	43/ 2/14	88/ 7/36	
<i>Artemisia longifolia</i>	X				92/ 5/32
<i>Artemisia ludoviciana</i>			29/ 1/ 8	X	
<i>Astragalus</i> spp.	X		29/ 1/ 6	38/ 1/ 6	
<i>Astragalus gilviflorus</i>	31/tr/ 7				
<i>Aster</i> spp.			14/ 1/ 9		
<i>Aster commutatus</i>	X		43/ 4/24		
<i>Chenopodium album</i>			29/tr/ 5		
<i>Eriogonum multiceps</i>	X				31/ 1/ 8
<i>Grindelia squarrose</i>	24/tr/ 5		29/ 1/ 6	63/tr/ 8	
<i>Haplopappus nuttallii</i>	33/tr/ 8				
<i>Hymenoxys richardsonii</i>	20/tr/ 7				
<i>Medicago sativa</i>	X		86/14/30	X	
<i>Melilotus officinalis</i>	30/ 1/ 9		57/ 9/41	88/ 9/38	

TABLE I. (CONTINUED).

Taxa	Vegetation Type				
	Sagebrush- Grassland	Grassland	Greasewood	Greasewood- Sagebrush	Shale Slope
	46 Stands 920 Plots	5 Stands 100 Plots	7 Stands 140 Plots	8 Stands 160 Plots	13 Stands 260 Plots
	Cy/Cv/Fr	Cy/Cv/Fr	Cy/Cv/Fr	Cy/Cv/Fr	Cy/Cv/Fr
<i>Microseris</i> spp.			14/ 2/ 3		
<i>Opuntia polycantha</i>	46/ 1/ 6	60/tr/12		63/ 1/ 6	
<i>Petalostemon candidum</i>	11/ 1/ 4				
<i>Phlox hoodii</i>	65/ 2/25	40/ 1/17			
<i>Plantago purshii</i>	43/ 1/12	100/tr/25		X	
<i>Polygonum aviculare</i>			X	X	8/tr/ 5
<i>Potentilla pennsylvanica</i>				13/tr/63	
<i>Psoralea tenuiflora</i>	X	X	14/ 1/ 3	13/ 1/ 2	
<i>Sphaeralcea coccinea</i>	78/ 1/22	100/ 1/36	X	X	X
<i>Taraxacum officinale</i>	X	X	57/ 4/27	63/ 1/ 4	
<i>Thermopsis rhombifolia</i>	X			X	100/ 6/43
<i>Tragopogon dubius</i>	X	X	57/ 4/16	X	
<i>Vicia americana</i>	57/ 1/16	60/tr/ 6	X	63/ 1/ 7	X
Unknown Forbs	63/tr/10	80/tr/12	X	75/ 1/13	X
Total Forbs	100/15/89	100/ 1/14	100/42/92	100/22/86	100/ 9/64
GRASSES AND GRASS-LIKE PLANTS					
<i>Agropyron desertorum</i>	X		14/ 1/ 5		
<i>Agropyron smithii</i>	98/14/70	100/12/76	100/44/86	100/23/86	85/ 3/17
<i>Agropyron spicatum</i>	52/ 3/18	X		X	38/ 2/13
<i>Bouteloua gracilis</i>	63/10/32	100/21/76	43/ 1/ 6	50/ 3/12	X
<i>Bromus tectorum</i>	11/ 1/ 4		43/ 4/20	50/ 3/19	
<i>Calamagrostis montanensis</i>	24/tr/ 5				62/ 6/32
<i>Calamovilfa longifolia</i>	X				77/16/53
<i>Carex</i> spp.	74/ 2/16	80/ 5/36	X	63/ 1/ 9	X

TABLE I. (CONTINUED).

Taxa	Vegetation Type				
	Sagebrush- Grassland	Grassland	Greasewood	Greasewood- Sagebrush	Shale Slope
	46 Stands 920 Plots	5 Stands 100 Plots	7 Stands 140 Plots	8 Stands 160 Plots	13 Stands 260 Plots
	Cy/Cv/Fr	Cy/Cv/Fr	Cy/Cv/Fr	Cy/Cv/Fr	Cy/Cv/Fr
<i>Distichlis stricta</i>	X		43/ 7/13	63/ 7/41	
<i>Festuca octiflora</i>	X	40/tr/13		X	
<i>Koeleria cristata</i>	78/ 4/35	80/ 1/24	X	75/ 2/21	15/ 1/ 3
<i>Phleum pratense</i>			14/ 6/11		
<i>Poa</i> spp.	57/ 1/15	80/ 1/18	57/ 8/24	100/ 6/38	23/ 1/ 6
<i>Schedonardus paniculatus</i>	37/ 1/ 7	40/tr/ 6		38/ 1/ 5	X
<i>Stipa comata</i>	59/ 3/17	80/ 6/55			
<i>Stipa viridula</i>	63/ 2/11	40/ 1/ 5	29/ 3/11	25/ 1/ 3	X
Total Grasses	98/42/98	100/49/100	100/65/94	100/49/96	100/26/84
OTHERS					
Lichens	65/ 2/40	80/ 1/40		38/tr/10	69/tr/15
<i>Selaginella densa</i>	28/ 5/15			25/ 1/ 3	
Bareground	100/48/94	100/44/100	71/16/51	100/30/71	100/78/100
Rock	48/ 1/ 9	80/ 3/33		25/tr/ 5	X
Litter I ^{4/}	100/31/95	- - -	57/34/54	50/21/44	23/ 4/21
Litter II	75/ 1/12	- - -		13/ 1/ 3	

- 1/ Includes taxa with at least 1 percent canopy coverage or 5 percent frequency of occurrence in at least one vegetation type. Others are included in Appendix, Table XII.
- 2/ Constancy (percent occurrence among stands)/Canopy Coverage (percent of area covered by foliage)/Frequency (percent occurrence among plots).
- 3/ X indicates taxon present but less than 1 percent canopy coverage and 5 percent frequency of occurrence.
- 4/ Litter I includes dead vegetative material lying on the ground. Litter II includes dead vegetative material still standing.

31 supplemental sites on five of the eight vegetation types. No measurements were taken for the cropland, abandoned meadow and timber vegetation types. Each of these was limited in distribution, of little importance to antelope and/or more or less homogeneous.

Sagebrush-Grassland Vegetation Type:

This type (Figures 2, 3, 4, and 5) was the most extensive on the study area comprising 59 percent. Big sagebrush (*Artemisia tridentata*), the dominant, was found in varying degrees of association with grasses and forbs, apparently dependent on slope, exposure and/or intensity of grazing. The common grasses included western wheatgrass (*Agropyron smithii*), blue grama (*Bouteloua gracilis*), junegrass (*Koeleria cristata*), bluebunch wheatgrass (*Agropyron spicatum*) and needle-and-thread (*Stipa comata*). Fringed sagewort (*Artemisia frigida*), Hood's phlox (*Phlox hoodii*), scarlet globemallow (*Sphaeralcea coccinea*) and American vetch (*Vicia americana*) were the common forbs.

Grassland Vegetation Type:

This type (Figure 6) comprised 7 percent of the area. Important grasses, occurring in varying degrees of dominance, were blue grama, western wheatgrass and needle-and-thread. Fringed sagewort was the most common forb.

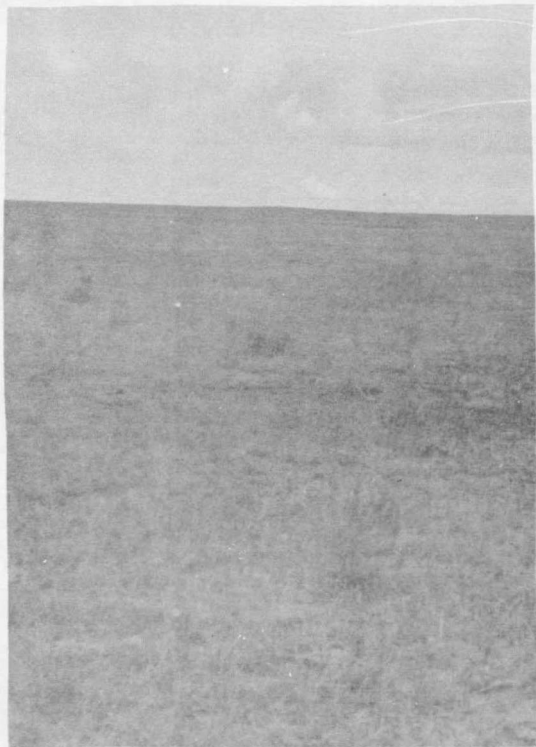


Figure 2. Sagebrush-Grassland Vegetation Type,
Sagebrush Aspect - Rare.



Figure 3. Sagebrush-Grassland Vegetation
Type, Sagebrush Aspect - Scattered.

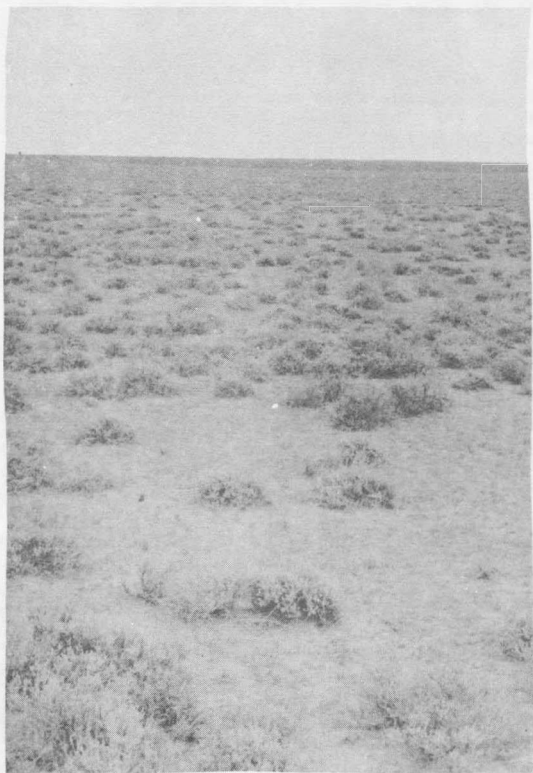


Figure 4. Sagebrush-Grassland Vegetation Type,
Sagebrush Aspect - Common.



Figure 5. Sagebrush-Grassland Vegetation
Type, Sagebrush Aspect - Dense.

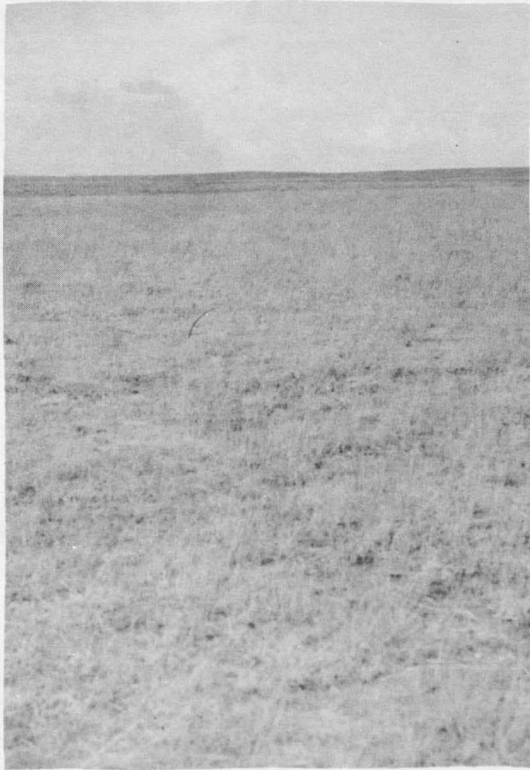


Figure 6. Grassland Vegetation Type.

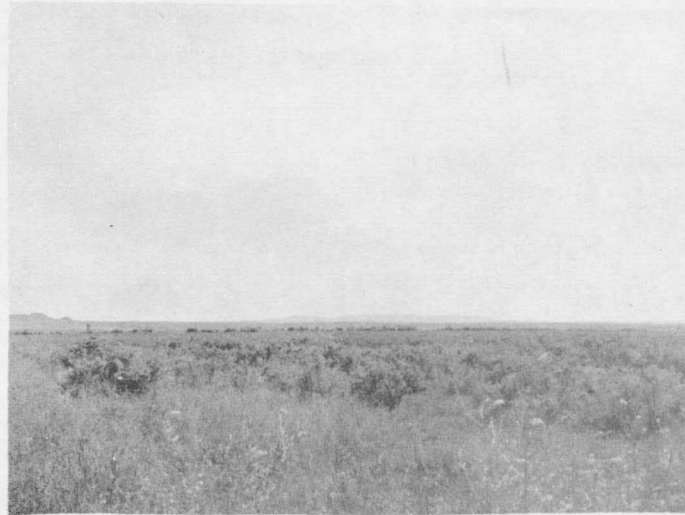


Figure 7. Greasewood Vegetation Type.

Greasewood Vegetation Type:

This type (Figure 7) occurred along the creek bottoms and covered 6 percent of the area. Greasewood (*Sarcobatus vermiculatus*) was the dominant shrub. Western wheatgrass and desert saltgrass (*Distichlis stricta*) were the dominant grasses. Important forbs included alfalfa (*Medicago sativa*), yellow sweetclover (*Melilotus officinalis*), yarrow (*Achillea millefolium*), common dandelion (*Taraxacum officinale*) and common salsify (*Tragopogon dubius*).

Greasewood-Sagebrush Vegetation Type:

This type (Figure 8) occurred on extensive depressions in the uplands and on the lower slopes adjacent to creek bottoms. It comprised 22 percent of the area. Greasewood and big sagebrush were the dominants. Western wheatgrass, desert saltgrass and bluegrass (*Poa* spp.) were the most common grasses. Common forbs included fringed sagewort and yellow sweetclover.

Shale Slope Vegetation Type:

This type (Figure 9) included 2 percent of the total area. Dominants included the shrubs, rubber rabbitbrush (*Chrysothamnus nauseosus*) and prairie rose (*Rosa arkansana*); the grasses, prairie sand reedgrass (*Calamovilfa longifolia*) and plains reedgrass (*Calamagrostis montanensis*); and the forbs, prairie thermopsis (*Thermopsis rhombifolia*) and longleaf sagebrush (*Artemisia longifolia*).



Figure 8. Greasewood-Sagebrush
Vegetation Type.



Figure 9. Shale Slope Vegetation Type.

Other Vegetation Types:

The cropland type (Figure 10) covered 2 percent of the area; the abandoned meadow type (Figure 11) 1 percent; and the timber type (Figure 12) 1 percent..

The cropland type included primarily alfalfa and some wheat fields. The abandoned meadow type was abandoned agricultural land reseeded naturally to native grasses or artificially with crested wheatgrass (*Agropyron desertorum*) and gradually reverting back to the native stands. The timber type, characterized by ponderosa pine (*Pinus ponderosa*), occurred along shaly rims and on the higher shale slopes.

A total of 146 sample units were examined on the four sagebrush control study plots all of which were in the sagebrush-grassland vegetation type. These measurements showed that vegetation characteristics were similar to those for the sagebrush-grassland vegetation type determined on other parts of the study area (Table I). They are included in the Appendix, Tables XIII, XIV, XV and XVI, because of their significance for comparison with post-treatment data.

The number, canopy intercept and height of big sagebrush plants encountered along 100-foot lines within each sample unit on the sagebrush control study plots were recorded (Table II).



Figure 10. Cropland (Alfalfa) Vegetation Type.



Figure 11. Abandoned Meadow Vegetation Type.



Figure 12. Timber Vegetation Type.

TABLE II. BIG SAGEBRUSH CHARACTERISTICS ON THE DIFFERENT PROPOSED TREATMENT SITES ON EACH OF THE SAGEBRUSH CONTROL STUDY PLOTS AS DETERMINED BY MEASUREMENTS ALONG 100-FOOT LINE TRANSECTS.

Study Plots and Proposed Treatment Sites	No. of 100-Foot Line Intercepts	Average No. Plants/100-Foot Line	Average Intercept/ 100-Foot Line ^{1/}	Average Intercept/ Live Plant	Average Height of Live Plants ^{1/}	Average Maximum Height of Live Plants ^{2/}
		Live/Dead	Live/Dead			
WINNETT						
Complete Spray(1) ^{3/}	14	26.6/ 1.5	22.3/ 0.9	0.8	7.1	14.2
Strip Spray (3)	13	19.8/ 0.8	15.6/ 0.4	0.8	6.4	11.4
Defer Control (7)	17	24.1/ 0.4	26.4/ 0.6	1.1	8.7	16.9
KING						
Complete Spray(1)	5	16.6/ 0.2	16.1/ 0.1	0.9	7.6	13.8
Contour Furrow(5)	15	21.2/ 1.4	17.2/ 1.1	0.8	7.0	16.9
Interseed (6)	10	16.2/ 1.2	13.1/ 0.9	0.8	6.9	12.3
Defer Control (7)	2	6.5/ 0.5	4.0/ 0.2	0.6	5.8	15.0
Open Control (8)	10	15.8/ 1.0	15.9/ 0.7	1.0	8.9	15.3
SIBBERT						
Partial Spray (2)	10	23.1/ 1.0	19.7/ 0.9	0.9	11.9	17.7
Open Control (8)	9	14.1/ 0.7	11.1/ 0.3	0.8	9.5	19.7
IVERSON						
Partial Spray (2)	17	29.3/ 0.4	28.2/ 0.4	0.9	7.9	12.7
Defer Control (7)	12	35.6/ 1.0	31.9/ 0.7	0.9	6.8	11.4
Open Control (8)	12	28.0/ 0.8	28.1/ 0.9	1.0	9.6	16.0

^{1/} Intercept in feet and tenths of feet. Heights in inches and tenths of inches.

^{2/} Represents the average of the heights of the highest plants measured along the 100-foot line transects on each treatment site.

^{3/} Numbers in parenthesis identify the proposed treatment sites and indicate their locations on each sagebrush control study plot on Figure 14 in the Appendix.

PRONGHORN ANTELOPE POPULATION CHARACTERISTICS

A 50-mile vehicle route which covered most of the study area including the four sagebrush control study plots was established (Appendix, Figure 14). The occurrence of antelope was determined with the aid of 7 x 35 binoculars and a 15-60x spotting scope while driving the route at speeds not exceeding 20 miles per hour during mornings and evenings. The route was covered once during each of 27 weeks in the summers of 1966 and 1967. Five aerial censuses were conducted during the summer of 1967. Each was begun shortly after sunrise. Each successive 1-mile wide north-south strip was flown until the entire study area was covered.

The aerial censuses provided the best estimate of total numbers of antelope on the study area (Table III). The highest count was 406 on August 1.

A total of 4,029 individual antelope observations were classified by sex and age from the ground and 1,559 from the air (Tables III and IV). Data from ground counts indicated there were 262 females per 100 males and 84 fawns per 100 females in 1966 and 190 and 71, respectively, in 1967. Data from aerial counts for 1967 indicated 241 females per 100 males and 57 fawns per 100 females. Possible mortality among fawns due to excessive rainfall (Baker 1952; Buechner 1950) in June, 1967 may account for the relatively low fawn:female ratio that year. A total of 4.79 inches of rain fell during this month as compared to the normal of 3.17 inches. Ninety-five percent of the total fell during the first half of June. Highest fawn:female ratios obtained during ground counts were in early August

TABLE III. SEX AND AGE CLASSES OF ANTELOPE ON THE STUDY AREA AS DETERMINED DURING FIVE AERIAL COUNTS IN THE SUMMER OF 1967. 1/

Date	Weather Condition	Adults		No. Fawns	Total Classified	Females: 100 Males	Fawns: 100 Females
		No. F	No. M.				
6/18	Calm and Overcast	117	65	59	241	180	50
7/9	Calm and Clear	130	78	91	299	167	70
8/1	Calm and Clear	192	82	132	406	234	69
8/24	Calm and Clear	171	49	88	308	349	51
9/11	Calm and Clear	<u>175</u>	<u>52</u>	<u>78</u>	<u>305</u>	<u>337</u>	<u>45</u>
TOTAL		785	326	448	1,559	-	-

1/ Two observers, one being the pilot, were present on every flight.

for 1966 and in late July for 1967. Yearling females were included in the fawn:female calculations as they could not be distinguished in the field. Some workers have reported that antelope may breed as fawns (Buechner *op cit.*; Wright and Dow 1962). In the summer of 1966 Bayless (*op cit.*) conducted four aerial censuses of the Yellow Water Triangle which included my study area. He found 309 females per 100 males and 74 fawns per 100 females. He also reported that aerial censuses conducted by personnel of the Montana Department of Fish and Game in 1962 and 1963 on the same area disclosed fawn:female ratios of 90:100 both years.

TABLE IV. SEX AND AGE CLASSES OF ANTELOPE ON THE STUDY AREA AS DETERMINED DURING GROUND COUNTS, 1966-1967.

Time Period	Adults		Fawns	Uncl.	Total Classified	Females:		Fawns:	
	Females	Males				100 Males	100 Females	100 Males	100 Females
June 1-15									
1966	34	19	21	-	74	179	62		
1967	--	--	--	-	--	---	--		
June 16-30									
1966	130	41	80	42	251	317	62		
1967	232	128	136	8	496	181	59		
July 1-15									
1966	115	39	85	8	239	295	74		
1967	206	99	162	-	467	208	79		
July 16-31									
1966	97	38	79	22	214	255	81		
1967	264	164	215	4	643	161	81		
Aug. 1-15									
1966	77	26	103	31	206	296	134		
1967	262	147	178	7	587	178	68		
Aug. 16-31									
1966	77	37	78	59	192	208	101		
1967	276	113	193	87	582	244	70		
Sept. 1-15									
1966	34	15	29	18	78	227	85		
1967	--	--	--	--	--	---	--		
Combined									
1966	564	215	475	180	1,254	262	84		
1967	1,240	651	884	106	2,775	190	71		

USE OF VEGETATION TYPES

I recorded the vegetation type on which each individual antelope was first observed. Ground observations totaled 1,434 in 1966 and 2,881 in 1967. In addition, 1,559 observations were recorded from the air in 1967. The ground and aerial data were combined for this year (Table V).

During both summers a trend in the intensity of use of vegetation types was apparent. There was a progressive decline in use of the sagebrush-grassland vegetation type and a corresponding increase in total use of the shale slope, greasewood, greasewood-sagebrush, and cropland vegetation types combined (Table V). The latter three types occurred on mesic sites located in depressions and/or along creek bottoms. On these sites succulent vegetation persisted longer than on the dry uplands where the sagebrush-grassland type occurred. On the dry shale slope vegetation type somewhat succulent vegetation persisted throughout most of the summer. Data reported by Cole (*op cit.*) and Bayless (*op cit.*) show a similar trend.

Though this trend was apparent both summers, there was a difference between the summers. The magnitude of change in use of these vegetation types between successive periods in general and between early and late summer was far greater in 1966 than in 1967. A possible explanation is that during the first 2 months of the summer of 1966 rainfall was 65 percent below normal (85 percent-June; 19 percent-July). As a result much of the succulent vegetation on the upland sagebrush-grassland vegetation type became desiccated by late June. This may have resulted in the antelope shifting early to the mesic sites where succulent vegetation persisted.

TABLE V. PERCENTAGE DISTRIBUTION OF 5,874 OBSERVATIONS OF INDIVIDUAL ANTELOPE BY ONE-HALF MONTH INTERVALS ON SEVEN VEGETATION TYPES DURING THE SUMMERS OF 1966 AND 1967.

Time Interval	Grass-land & Abandoned Meadow	Sage-brush Grass-land	Shale Slope	Grease-wood	Grease-wood Sage-brush	Cropland (alfalfa)	Shale Slope-Grease-wood-Grease-Sage-Cropland Combination	Total Antelope
June 1-15								
1966	1	99	-	-	-	-	-	74
1967	-	-	-	-	-	-	-	-
June 16-30								
1966	5	87	tr	3	4	-	8	293
1967	1	77	9	2	11	tr	22	745
July 1-15								
1966	2	51	5	6	36	-	47	247
1967	5	69	6	33	16	2	25	770
July 16-31								
1966	-	50	9	20	21	-	50	236
1967	-	63	14	7	11	5	37	643
Aug. 1-15								
1966	7	32	11	8	36	5	61	237
1967	2	56	12	7	17	6	42	1,000
Aug. 16-31								
1966	-	28	16	18	9	29	72	251
1967	-	52	12	17	5	14	48	977
Sept. 1-15								
1966	-	7	6	1	31	54	93	96
1967	2	57	10	-	16	15	41	305
AVERAGE								
1966	2.1	50.6	6.7	8.0	19.6	12.6	47.3	
1967	1.7	62.3	10.5	6.0	12.7	7.0	35.8	

During the same period in 1967 rainfall was 42 percent above normal (51 percent-June; 21 percent-July). Succulent vegetation on the uplands persisted through a greater part of the summer. This may have resulted in the antelope remaining on the sagebrush-grassland vegetation type longer and in greater numbers than in 1966.

Despite differences in intensities of intrasummer use, the sagebrush-grassland vegetation type averaged 50 percent or more of the total use both summers. In general this also held true whether the observations of individual antelope were separated by sex and age classes or by group types (Appendix, Tables XVII and XVIII). Antelope seemed to prefer the sagebrush-grassland vegetation type and moved onto the other more restricted types in large numbers only when the succulent vegetation on the former became desiccated.

The density of big sagebrush was recorded at each of 960 and 2,020 individual antelope observation sites within the sagebrush-grassland vegetation type in 1966 and 1967, respectively. For both summers at least 90 percent of these antelope were observed on areas where densities of big sagebrush were estimated to be scattered or common (Table VI).

Locations of all antelope observed in 1967 are listed by coordinates and study areas in the Appendix, Tables XIX and XX, and Figure 14.

TABLE VI. PERCENTAGE DISTRIBUTION OF 2,980 INDIVIDUAL ANTELOPE OBSERVATIONS BY FOUR SAGEBRUSH DENSITY CATAGORIES ON THE SAGEBRUSH-GRASSLAND VEGETATION TYPE DURING THE SUMMERS OF 1966 AND 1967.

Year	Sagebrush Density ^{1/}				Total No. Antelope
	Rare	Scattered	Common	Dense	
1966	5	39	52	4	960
1967	3	52	44	1	<u>2,020</u>
TOTAL					2,980

^{1/} Sagebrush densities were visually estimated at each of 2,980 individual antelope observation sites. The basis for the estimates was provided by a 100-foot line intercept measurement of big sagebrush at each of 38 sites in the sagebrush-grassland type.

	Shrub <u>Intercept</u>	Average No. Plants/ <u>100-Feet of Line</u>	Average Distance <u>Between Plants</u>
Rare-	Less than 2%	-	-
Scattered-	2 - 5%	6	11.8 Feet
Common-	6 - 25%	20	5.1 Feet
Dense-	More Than 25%	41	1.5 Feet

SUMMER FOOD HABITS

I obtained antelope food habits data primarily by feeding site examinations and supplemented, in 1967, by analysis of the contents of 12 rumens. I examined each feeding site and recorded instances of plant use as soon as practicable after the antelope had vacated it. Use of a rooted stem or bunch of stems for grasses, a leaf or twig for shrubs, and leaves or a stem for forbs constituted one instance of use. Thirty-four feeding sites were examined in 1966 and 28 in 1967 yielding a total of 9,111 instances of use. Rumen samples were analyzed according to the method of Cole (*op cit.*) and others. Identifiable material was separated and measured volumetrically. Each plant species used was expressed as a percent of the diet for each feeding site or rumen sample. These percentages were totaled and averaged for each vegetation type and/or for each time period using the aggregate percentage method (Martin, *et al.* 1946). Results are shown in Tables VII, VIII, and IX.

The difference between the percent of the diet for each plant and its abundance in the plant community (expressed as percent canopy coverage) was determined at each of 20 feeding sites in 1966 and 28 in 1967. The average of these differences for each species was tested statistically where sample size permitted using a two-tailed t-test at the 5 percent level of significance. The hypothesis tested was: there is no significant difference between the percent of the diet constituted by an individual species and its abundance in the plant community (Bayless, *op cit.*).

TABLE VII. SUMMER FOOD HABITS OF ANTELOPE BY MONTH AND YEAR AS DETERMINED FROM 9,111 INSTANCES OF USE ON 62 FEEDING SITES IN THE SUMMERS OF 1966 AND 1967.

Taxa	MONTH									
	June		July		August		Summer			
	1966	1967	1966	1967	1966	1967	1966	1967		
	(6) ^{1/}	(9)	(16)	(8)	(12)	(11)	(34)	(28)		
	(582)	(773)	(1990)	(977)	(1567)	(3222)	(4139)	(4972)		
	Fr/% ^{2/}	Fr/%	Fr/%	Fr/%	Fr/%	Fr/%	Fr/%	t ^{3/}	Fr/%	t
SHRUBS										
<i>Artemisia cana</i>	-	-	-	-	-	9/3	-	-	3/1	-
<i>Artemisia tridentata</i>	-	-	13/6	-	8/8	-	7/5	2.06	-	-
<i>Chrysothamnus nauseosus</i>	-	-	6/6	-	25/12	18/3	10/6	3.05	6/1	-
<i>Gutierrezia sarothrae</i>	-	-	-	13/tr.	-	-	-	-	4/tr.	-
<i>Rosa arkansana</i>	-	-	13/8	-	17/2	27/2	10/3	2.11	9/1	3.03
<i>Sarcobatus vermiculatus</i>	17/tr.	-	-	-	-	-	6/tr.	-	-	-
Total Shrubs	17/tr.	-	25/20	13/tr.	42/22	36/8	28/14	-	16/3	-
FORBS										
<i>Achillea millefolium</i>	-	-	6/tr.	-	-	9/tr.	2/tr.	-	3/tr.	-
<i>Arenaria hookeri</i>	-	56/6	-	13/tr.	-	-	-	-	23/2	0.59
<i>Arnica sororia</i>	-	11/3	-	-	-	-	-	-	4/1	-
<i>Artemisia frigida</i>	17/17	33/10	6/1	-	17/17	-	13/12	2.23	11/3	1.12
<i>Artemisia longifolia</i>	-	11/11	13/3	-	42/28	18/18	18/11	3.78 ^{4/}	10/10	41.88s
<i>Aster commutatus</i>	-	-	-	25/2	-	18/2	-	-	14/1	-
<i>Astragalus bisulcatus</i>	-	11/tr.	-	-	-	-	-	-	4/tr.	-
<i>Astragalus gilviflorus</i>	33/29	33/13	13/12	63/37	-	9/9	15/14	-	35/20	4.81s
<i>Astragalus missouriensis</i>	17/1	-	-	-	-	-	6/tr.	-	-	-
<i>Comandra umbellata</i>	-	-	-	13/1	-	9/tr.	-	-	7/tr.	-
<i>Crepis occidentalis</i>	-	11/3	-	-	-	-	-	-	4/1	-
<i>Erigeron ochroleucus</i>	-	11/5	-	-	-	-	-	-	4/2	-
<i>Erigeron pumilus</i>	17/17	11/tr.	-	-	-	-	6/6	-	4/tr.	-
<i>Eriogonum multiceps</i>	-	-	-	12/1	-	-	-	-	4/tr.	-
<i>Gaura coccinea</i>	-	11/tr.	6/2	25/1	-	-	2/1	-	12/tr.	2.12
<i>Glycyrrhiza lepidota</i>	-	-	6/tr.	-	-	18/1	2/tr.	-	6/tr.	-
<i>Grindelia squarrose</i>	-	11/2	-	13/1	-	-	-	-	8/1	-

TABLE VII. (CONTINUED).

Taxa	MONTH						Summer			
	June		July		August		1966		1967	
	1966	1967	1966	1967	1966	1967	1966		1967	
	(6)	(9)	(16)	(8)	(12)	(11)	(34)		(28)	
	(582)	(773)	(1990)	(977)	(1567)	(3222)	(4139)		(4972)	
	Fr/%	Fr/%	Fr/%	Fr/%	Fr/%	Fr/%	Fr/%	t	Fr/%	t
<i>Haplopappus nuttallia</i>	-	22/6	-	13/1	-	9/tr.	-	-	15/2	1.86
<i>Hymenopappus filifolius</i>	-	-	-	13/1	-	-	-	-	4/tr.	-
<i>Hymenoxys acaulus</i>	-	11/5	-	-	-	-	-	-	4/2	-
<i>Hymenoxys richardsonii</i>	-	-	-	13/tr.	-	9/tr.	-	-	7/tr.	-
<i>Medicago sativa</i>	-	11/4	19/12	50/19	8/3	45/29	9/5	-	35/17	4.21s
<i>Melilotus alba</i>	-	-	13/1	-	8/4	9/4	7/2	-	3/1	-
<i>Melilotus officinalis</i>	33/33	-	50/35	38/20	25/18	36/15	36/29	5.47s	25/12	3.85s
<i>Microseris cuspidata</i>	-	-	-	13/tr.	-	-	-	-	4/tr.	-
<i>Musineon divaricatum</i>	-	11/2	-	-	-	-	-	-	4/tr.	-
<i>Opuntia polycantha</i>	-	-	6/4	-	-	-	2/1	-	-	-
<i>Oxytropis sericea</i>	-	11/3	-	-	-	-	-	-	4/1	-
<i>Penstemon nitidus</i>	-	-	-	13/tr.	-	-	-	-	4/tr.	-
<i>Petalostemon candidum</i>	-	11/6	-	13/5	-	-	-	-	8/4	-
<i>Petalostemon purpureum</i>	17/4	-	-	13/5	-	-	6/1	-	4/2	-
<i>Polygonum aviculare</i>	-	-	6/5	-	-	-	2/2	-	-	-
<i>Pseralea tenuiflora</i>	-	33/1	6/1	13/1	-	9/tr.	2/1	-	18/1	1.22
<i>Ratibida columnifera</i>	-	-	-	-	8/tr.	-	3/tr.	-	-	-
<i>Sphaeralcea coccinea</i>	-	22/1	-	-	-	-	-	-	7/tr.	-
<i>Taraxacum officinale</i>	-	-	6/tr	-	-	9/9	2/tr.	-	3/3	-
<i>Thalaspisma marginatum</i>	-	11/1	-	-	-	-	-	-	4/tr.	-
<i>Thermopsis rhombifolia</i>	-	11/tr.	-	-	17/tr.	9/tr.	6/tr.	-	7/tr.	-
<i>Tragopegon dubius</i>	-	22/4	6/1	4/4	8/8	46/4	5/3	-	24/4	3.10
<i>Vicia americana</i>	-	44/14	6/tr.	25/1	-	9/tr.	2/tr.	-	26/5	2.27
Unidentifiable Forbs	-	11/tr.	6/tr.	-	-	9/tr.	2/tr.	-	7/tr.	-
Total Forbs	100/100	100/100	94/80	100/100	92/79	100/91	95/86	-	100/97	

TABLE VII. (CONTINUED).

Taxa	MONTH									
	June		July		August		Summer			
	1966	1967	1966	1967	1966	1967	1966		1967	
	(6)	(9)	(16)	(8)	(12)	(11)	(34)		(28)	
	(582)	(773)	(1990)	(977)	(1567)	(3222)	(4139)		(4972)	
	Fr/%	Fr/%	Fr/%	Fr/%	Fr/%	Fr/%	Fr/%	t	Fr/%	t
Grasses	17/tr.	11/tr.	13/1	13/tr.	-	-	10/tr.	-	8/tr.	-

1/ Numbers in parenthesis indicate number of feeding sites (top figure) and total instances of use (bottom figure).

2/ Frequency of use among feeding sites/Aggregate percent of diet.. Tr. indicates less than 0.5 percent of the diet.

3/ Indicates the calculated t-value.

4/ S indicates a significant t-value.

TABLE VIII. SUMMER FOOD HABITS OF ANTELOPE BY VEGETATION TYPE AS DETERMINED FROM 9,111 INSTANCES OF USE ON 62 FEEDING SITES IN THE SUMMERS OF 1966 AND 1967.

Taxa	VEGETATION TYPE ^{1/}									
	Grassland		Sagebrush-		Greasewood-		Greasewood-		Shale Slope	
	1966	1967	1966	1967	1966	1967	1966	1967	1966	1967
	(2) ^{2/}	-	(14)	(13)	(8)	(8)	(3)	(3)	(7)	(4)
	(108)	-	(1538)	(1419)	(1396)	(1838)	(415)	(1149)	(682)	(566)
	Fr/% ^{3/}	Fr/%	Fr/%	Fr/%	Fr/%	Fr/%	Fr/%	Fr/%	Fr/%	Fr/%
SHRUBS										
<i>Artemisia cana</i>	-	-	-	-	-	-	-	33/11	-	-
<i>Artemisia tridentata</i>	-	-	21/14	-	-	-	-	-	-	-
<i>Chrysothamnus nauseosus</i>	-	-	7/7	-	-	13/1	-	33/6	43/20	-
<i>Gutierrezia sarothrae</i>	-	-	-	8/tr.	-	-	-	-	-	-
<i>Rosa arkansana</i>	-	-	-	-	-	13/2	-	33/1	57/22	25/2
<i>Sarcobatus vermiculatus</i>	-	-	-	-	13/tr.	-	-	-	-	-
Total Shrubs	-	-	14/21	8/tr.	13/tr.	13/3	-	33/18	86/42	25/2
FORBS										
<i>Achillea millefolium</i>	-	-	1/tr.	-	-	13/tr.	-	-	-	-
<i>Arenaria hookeri</i>	-	-	-	38/2	-	-	-	-	-	25/8
<i>Arnica sororia</i>	-	-	-	8/2	-	-	-	-	-	-
<i>Artemisia frigida</i>	50/50	-	21/15	23/7	-	-	-	-	-	-
<i>Artemisia longifolia</i>	-	-	-	-	-	-	-	-	100/55	75/73
<i>Aster commutatus</i>	-	-	-	8/tr.	-	38/5	-	-	-	-
<i>Astragalus bisulcatus</i>	-	-	-	8/tr.	-	-	-	-	-	-
<i>Astragalus gilviflorus</i>	-	-	29/26	69/39	-	-	-	-	-	-
<i>Astragalus missouriensis</i>	-	-	7/tr.	-	-	-	-	-	-	-
<i>Comandra umbellata</i>	-	-	-	8/tr.	-	-	-	33/tr.	-	-
<i>Crepis occidentalis</i>	-	-	-	8/2	-	-	-	-	-	-
<i>Erigeron ochroleucus</i>	-	-	-	8/4	-	-	-	-	-	-
<i>Erigeron pumilus</i>	-	-	7/7	8/tr.	-	-	-	-	-	-
<i>Erigonum multiceps</i>	-	-	-	8/tr.	-	-	-	-	-	-
<i>Gaura coccinea</i>	-	-	7/2	23/tr.	-	-	-	-	-	-

TABLE VIII. (CONTINUED).

Taxa	VEGETATION TYPE									
	Grassland		Sagebrush-Grassland		Greasewood		Greasewood-Sagebrush		Shale Slope	
	1966	1967	1966	1967	1966	1967	1966	1967	1966	1967
	(2)	-	(14)	(13)	(8)	(8)	(3)	(3)	(7)	(4)
	(108)	-	(1538)	(1419)	(1396)	(1838)	(415)	(1149)	(682)	(566)
	Fr/%	Fr/%	Fr/%	Fr/%	Fr/%	Fr/%	Fr/%	Fr/%	Fr/%	Fr/%
<i>Glycyrrhiza lepidota</i>	-	-	7/tr.	-	-	13/2	-	33/tr.	-	-
<i>Grindelia squarrose</i>	-	-	-	8/1	-	13/1	-	-	-	-
<i>Haplopappus nuttallia</i>	-	-	-	31/5	-	-	-	-	-	-
<i>Hymenopappus filifolius</i>	-	-	-	8/1	-	-	-	-	-	-
<i>Hymenoxys acaulus</i>	-	-	-	8/4	-	-	-	-	-	-
<i>Hymenoxys richardsonii</i>	-	-	-	15/tr.	-	-	-	-	-	-
<i>Medicago sativa</i>	-	-	-	15/3	50/30	88/53	-	33/11	-	-
<i>Melilotus alba</i>	-	-	7/tr.	-	25/7	13/6	-	-	-	-
<i>Melilotus officinalis</i>	-	-	21/13	15/5	88/61	25/8	100/99	100/65	-	-
<i>Microseris cuspidata</i>	-	-	-	-	-	13/1	-	-	-	-
<i>Musineon divaricatum</i>	-	-	-	8/tr.	-	-	-	-	-	-
<i>Opuntia polycantha</i>	-	-	7/5	-	-	-	-	-	-	-
<i>Oxytropis sericea</i>	-	-	-	8/tr.	-	-	-	-	-	-
<i>Penstemon nitidus</i>	-	-	-	8/tr.	-	-	-	-	-	-
<i>Petalostemon candidum</i>	-	-	-	15/7	-	-	-	-	-	-
<i>Petalostemon purpureum</i>	-	-	7/2	8/3	-	-	-	-	-	-
<i>Polygonum aviculare</i>	-	-	7/6	-	-	-	-	-	-	-
<i>Psoralea tenuiflora</i>	-	-	-	31/1	-	-	-	-	-	-
<i>Ratibida colummifera</i>	-	-	-	-	-	-	33/1	-	-	-
<i>Sphaeralcea coccinea</i>	-	-	-	8/1	-	-	-	-	-	25/tr.
<i>Taraxacum officinale</i>	-	-	7/tr.	-	-	13/3	-	-	-	-
<i>Thalaspisma marginatum</i>	-	-	-	8/tr.	-	-	-	-	-	-
<i>Thermopsis rhombifolia</i>	-	-	-	-	-	-	-	33/tr.	29/1	25/1
<i>Tragopogon dubius</i>	50/50	-	7/2	15/3	-	75/9	-	67/2	-	-
<i>Vicia americana</i>	-	-	7/tr.	38/6	-	-	-	33/1	-	25/16

TABLE VIII. (CONTINUED).

Taxa	VEGETATION TYPE									
	Grassland		Sagebrush-Grassland		Greasewood		Greasewood-Sagebrush		Shale Slope	
	1966	1967	1966	1967	1966	1967	1966	1967	1966	1967
	(2)	-	(14)	(13)	(8)	(8)	(3)	(3)	(7)	(4)
	(108)	-	(1538)	(1419)	(1396)	(1838)	(415)	(1149)	(682)	(566)
	Fr/%	Fr/%	Fr/%	Fr/%	Fr/%	Fr/%	Fr/%	Fr/%	Fr/%	Fr/%
Unidentifiable Forbs	-	-	7/1	8/tr.	-	13/tr.	-	-	-	-
Total Forbs	100/100	-	86/79	100/96	100/99	100/98	100/100	100/80	100/56	100/98
Grasses	-	-	7/tr.	8/tr.	13/tr.	-	-	-	14/2	25/1

1/ Feeding sites were obtained only from five of the eight vegetation types.

2/ Numbers in parenthesis indicate number of feeding sites (top figure) and total instances of use (bottom figure).

3/ Frequency of use among feeding sites/Aggregate percent of diet. Tr. indicates less than 0.5 percent of the diet.

TABLE IX. FREQUENCY OF OCCURRENCE AND VOLUME PERCENTAGES OF PLANT TAXA AND FORAGE CLASSES AMONG 12 RUMEN SAMPLES COLLECTED IN OCTOBER, 1966 AND 13 RUMEN SAMPLES COLLECTED OVER A 5-MONTH PERIOD IN SUMMER, 1967.

Taxa	MONTH					
	1967					
	May 6	June	July	August	September	October 16, 1966
	(1) <u>1</u> / Fr/% <u>2</u> / 	(2) Fr/%	(4) Fr/%	(3) Fr/%	(3) Fr/%	(12) Fr/%
SHRUBS						
<i>Artemisia cana</i>					33/ 1	
<i>Artemisia tridentata</i>	100/99		50/ 1	67/ 1	33/tr.	58/ 6
<i>Chrysothamnus nauseosus</i>		50/ 2	50/ 7	33/ 4	67/ 3	100/22
<i>Rosa arkansana</i>		50/ 1	50/ 9	100/ 5	67/11	50/ 1
<i>Salix</i> spp.			25/tr.			8/tr.
<i>Sarcobatus vermiculatus</i>			25/tr.	33/tr.		
<i>Symphoricarpos</i> spp.					33/10	17/tr.
Unidentified Browse						42/ 1
TOTAL BROWSE	100/99	100/ 3	75/17	100/10	67/25	100/30
FORBS						
<i>Achillea millefolium</i>		50/ 1				25/tr.
<i>Antennaria rosea</i>						16/tr.
<i>Artemisia frigida</i>		100/ 2	50/ 6	67/tr.	100/ 8	100/33
<i>Artemisia longifolia</i>		50/ 1	75/ 2	67/17	33/tr.	50/12
<i>Arnica sororia</i>				33/tr.		
<i>Aster commutatus</i>				67/13	33/ 3	
<i>Astragalus gilviflorus</i>			50/ 2	33/ 3	67/ 6	
<i>Aster hesperius</i>					33/ 1	
<i>Aster</i> spp.		50/tr.	25/tr.			
<i>Astragalus</i> spp.			25/tr.			
<i>Camelina</i> spp.			25/ 2			
<i>Comandra umbellata</i>			25/ 1		67/tr.	
<i>Erigeron pumilus</i>		50/46				
<i>Eriogonum multiceps</i>		50/ 4				33/ 4

TABLE IX. (CONTINUED).

Taxa	MONTH					
	1967					
	May 6 (1)	June (2)	July (4)	August (3)	September (3)	October 16, 1966 (12)
	Fr/%	Fr/%	Fr/%	Fr/%	Fr/%	Fr/%
<i>Gaura coccinea</i>			25/tr.			
<i>Haplopappus nuttallii</i>				33/14	100/ 9	
<i>Medicago sativa</i>		50/ 1	25/tr.	33/ 5	100/45	58/21
<i>Melilotus officinalis</i>			25/12	33/30		
<i>Opuntia polycantha</i>				33/tr.		
<i>Petalostemon candidum</i>			25/ 6			
<i>Petalostemon purpureum</i>		50/ 1	75/ 5	33/tr.		
<i>Psoralea</i> spp.			50/10	67/tr.	100/ 1	
<i>Taraxacum officinale</i>		50/ 1	75/ 2			
<i>Thermopsis rhombifolia</i>				33/tr.		
<i>Tragopogon dubius</i>		100/ 2	25/18	33/tr.	33/ 1	
<i>Vicia americana</i>		50/38	75/13	33/ 1		
Unidentified Forbs			25/ 1			33/ 1
TOTAL FORBS		100/97	100/80	100/89	100/74	100/71
Grass	100/ 1	100/ 1	75/	100/ 1	67/tr.	50/tr.
Lichens		50/ 1				17/tr.

1/ Number of rumen samples in parenthesis.

2/ Frequency of occurrence/Aggregate percent of total volume of identifiable material. Tr. indicates values less than 0.5 percent.

Forbs were the most important forage class during summer (June-August) constituting 86 and 97 percent of the total use at feeding sites in 1966 and 1967, respectively (Table VII). This class averaged 85 percent by volume of identifiable material in rumen samples for June through September in 1967. Five forbs constituted 62 percent or more of the total use at feeding sites both years and averaged 35 percent by volume of identifiable material in rumen samples (Table IX). These included fringed sage-wort, longleaf-sagebrush, three-leafed milkvetch (*Astragalus gilviflorus*), alfalfa and yellow sweetclover. The latter four were the only species to yield a significant positive t-value one or both years, indicating a significantly higher proportion in the diet than in the plant community.

Shrubs were the next most important forage class constituting 14 and 3 percent of the total use at feeding sites in 1966 and 1967, respectively, and averaged 14 percent by volume of identifiable material in rumen samples. Important shrubs included rubber rabbitbrush and prairie rose. There was a slight increase in use of shrubs and a corresponding decrease in use of forbs as the summer progressed both years.

Grasses were unimportant comprising less than 2 percent of the diet both summers.

Other workers including Cole (*op cit.*), Cole and Wilkins (*op cit.*), and Dirschl (*op cit.*) have reported similar findings.

There was a change in use of individual plant species from month to month. Comparison of Tables VII and VIII generally indicates declining use of plants characteristic of the antelope diet on the sagebrush-

grassland vegetation type and increasing use of those characteristic of the diet on the greasewood, greasewood-sagebrush and shale slope vegetation types. This was apparently due to desiccation of certain species on the former, persistence on the latter three, and a corresponding shift in intensity of use by the antelope (Table V). There was also a difference between years in numbers of species utilized (80 percent more in 1967 than 1966) and in the intensity of use of the same species. This may have been a result of differences in moisture conditions between years (see previous section).

It may be of interest to note that *Artemisia* species, including silver sagebrush (*Artemisia cana*), big sagebrush, fringed sagewort and long-leaf sagebrush constituted 28 and 14 percent of the total use at feeding sites in 1966 and 1967, respectively, and averaged 10 percent by volume of identifiable material in rumen samples.

The results of analysis of 12 rumen samples from hunter kills of October 16, 1966 and one road kill of May 6, 1967 are also given in Table IX.

SUMMER HOME RANGES

I determined characteristics of summer home ranges by successive observations of 19 individually marked or otherwise recognizable antelope from June 17 to September 11, 1967 (Table X). Ten of these were trapped and marked with neckbands on December 9, 1966 as part of the study conducted by Bayless (*op cit.*). Nine animals were recognizable by horn characteristics. Observations of these antelope were recorded by 1/10th mile intervals on a 1/2-inch scale map. The distance between successive locations and the distance between the geometric center of the home range and each location was determined for each antelope. A line was drawn around the outside points of observations of each individual antelope designating the perimeter of its home range. The area of each home range was calculated with the aid of a Polar Planimeter.

Territorial males occurring alone or with females and fawns moved the shortest distance between successive observations and had the smallest home ranges. Males associated with male herds moved the greatest distances between successive observations and had the largest home ranges. Females associated with other females and fawns or with females, fawns and a single male were intermediate with regard to these measurements. Distances were 59 percent greater between successive observations for females when not accompanied by a territorial male.

The average size of home ranges of territorial males was 121 percent larger on the sagebrush-grassland vegetation type than on the greasewood vegetation type (sample size three and two, respectively). The home range of one male located primarily on the greasewood-sagebrush vegetation type was 219 percent larger than the latter.

TABLE X. CHARACTERISTICS OF HOME RANGES OF ANTELOPE AS DETERMINED BY SUCCESSIVE OBSERVATIONS OF EACH OF 10 BANDED AND 9 OTHERWISE RECOGNIZABLE INDIVIDUALS.

	Territorial Males Observed Alone or With Females and Fawns	Males Associated With Male Herds	Females Associated With other Females and Fawns or With Females, Fawns and a Single Male
	(7) ^{1/}	(8)	(4)
Average Number of Observations/ Animal	10.9	7.4	14.0
Average Number of Days Between Successive Observations	7.3	11.4	6.7
Distance Between Successive Locations -- Maximum	2.30 ^{2/}	5.30	3.90
Mean	0.75	2.12	1.34
Distance Between Geometric Center of Home Range and Successive Locations			
Maximum	1.70	4.20	3.95
Mean	0.72	1.49	1.06
Average Size of Home Range	1.54 ^{3/}	6.43	4.46
Average Group Size	12.7 ^{4/}	7.8	13.0

^{1/} Number in parenthesis indicates number of banded or otherwise recognizable antelope.

^{2/} All distances in miles.

^{3/} Size of Home range in square miles.

^{4/} Average group size excluding singles.

APPENDIX

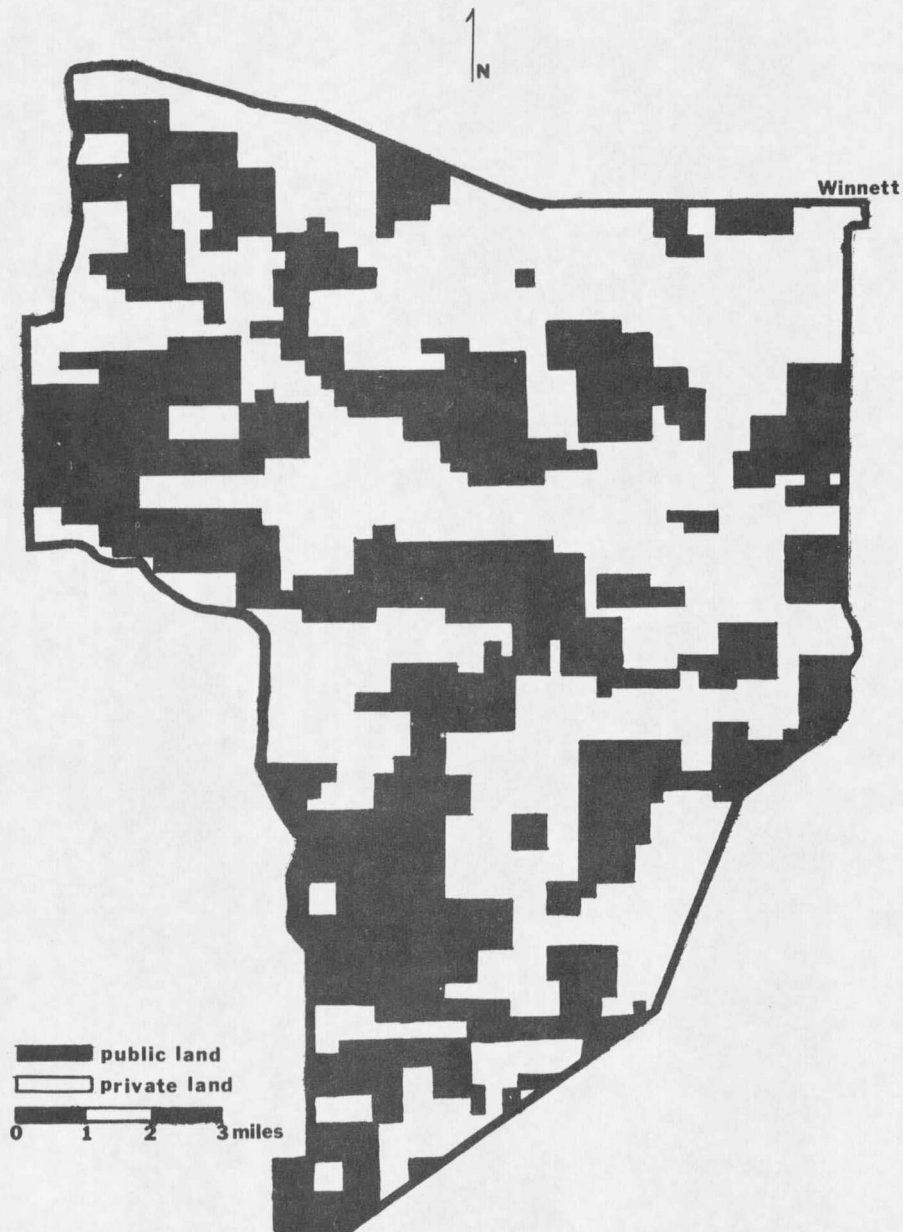


Figure 13. Study area showing land ownership.

TABLE XI. MONTHLY CLIMATOLOGICAL DATA FROM THE UNITED STATES DEPARTMENT OF COMMERCE WEATHER STATION AT FLATWILLOW ON THE EAST EDGE OF THE STUDY AREA.

Year	Month	Temperature in Degrees Fahrenheit					Precipitation in Inches		
		Average Maximum	Average Minimum	Average	High	Low	Total	Departure From Normal	Normal
1966	June	77.0	46.3	61.7	100	35	0.47	-2.70	3.17
	July	89.0	56.4	73.0	105	46	1.14	-0.26	1.40
	August	83.6	48.5	86.1	99	37	0.62	-0.57	1.19
Total							2.23	-3.53	5.76
1967	June	72.0	47.9	60.0	87	38	4.79	1.62	3.17
	July	86.2	52.3	69.3	94	39	1.70	0.30	1.40
	August	88.2	50.4	69.3	98	40	trace	-1.19	1.19
Total							6.49	0.73	5.76

TABLE XII. TAXA WITH LESS THAN 1 PERCENT CANOPY COVERAGE AND 5 PERCENT FREQUENCY OF OCCURRENCE..
IN VEGETATION TYPES AS DETERMINED BY EXAMINATION OF 2 X 5 DECIMETER PLOTS.

Taxa	Vegetation Type				
	Sagebrush- Grassland 46 Stands 920 Plots	Grassland 5 Stands 100 Plots	Greasewood.. 7 Stands 140 Plots	Greasewood- Sagebrush 8 Stands 160 Plots	Shale Slope 13 Stands 260 Plots
SHRUBS					
<i>Artemisia cana</i>				X	
<i>Atriplex nuttallii</i>	X				
<i>Juniperus horizontalis</i>					X
FORBS					
<i>Allium textile</i>	X			X	
<i>Antennaria rosea</i>	X				
<i>Arabis nuttallii</i>	X				
<i>Arnica sororia</i>	X				
<i>Astragalus agrestis</i>	X				
<i>Astragalus bisulcatus</i>	X			X	
<i>Astragalus gracilis</i>	X				
<i>Astragalus missouriensis</i>	X				
<i>Astragalus purshii</i>	X				
<i>Aster canescens</i>	X			X	
<i>Bahia oppositifolia</i>	X				
<i>Camelina microcarpa</i>	X				
<i>Cirsium undulatum</i>	X				
<i>Collomia spp.</i>	X				
<i>Comandra umbellata</i>	X				
<i>Erigeron spp.</i>	X				
<i>Erigeron canadensis</i>	X				
<i>Erigeron ochroleucus</i>	X				
<i>Erigeron pumilus</i>	X				
<i>Eriogonum flavum</i>	X				

TABLE XII. (CONTINUED).

Taxa	Vegetation Type				
	Sagebrush- Grassland	Grassland	Greasewood	Greasewood- Sagebrush	Shale Slope
	46 Stands 920 Plots	5 Stands 100 Plots	7 Stands 140 Plots	8 Stands 160 Plots	13 Stands 260 Plots
<i>Gaura coccinea</i>	X		X		X
<i>Glycyrrhiza lepidota</i>			X		
<i>Haplopappus spinulosus</i>	X				
<i>Hymenoxys acaulus</i>	X				
<i>Hymenopappus filifolius</i>	X				
<i>Iva axillaris</i>	X				
<i>Lepidium</i> spp.	X				
<i>Lepidium densiflorum</i>	X			X	X
<i>Linum lewisii</i>	X				
<i>Melilotus alba</i>	X				
<i>Musineon divaricatum</i>	X				
<i>Orobanche fasciculata</i>	X				
<i>Oxytropis sericea</i>	X	X			
<i>Penstemon nitidus</i>	X				
<i>Petalostemon purpureum</i>	X				
<i>Polygonum coccineum</i>	X				
<i>Potentilla</i> spp.	X				
<i>Psoralea</i> spp.	X				
<i>Psoralea argophylla</i>	X				
<i>Psoralea esculenta</i>	X				
<i>Ratibida columnifera</i>	X		X		
<i>Sagittaria caneata</i>	X				
<i>Sisymbrium loeselii</i>	X				
<i>Thelasperma marginatum</i>	X				

TABLE XII. (CONTINUED).

Taxa	Vegetation Type				
	Sagebrush- Grassland 46 Stands 920 Plots	Grassland 5 Stands 100 Plots	Greasewood 7 Stands 140 Plots	Greasewood- Sagebrush 8 Stands 160 Plots	Shale Slope 13 Stands 260 Plots
GRASSES					
<i>Andropogon scoparius</i>	X				
<i>Danthonia unispicata</i>	X				
<i>Muhlenbergia</i> spp.	X				
Unknown Grasses	X				

TABLE XIII. CONSTANCY, CANOPY COVERAGE AND FREQUENCY OF OCCURRENCE OF TAXA ON THE DIFFERENT PROPOSED TREATMENT SITES ON THE WINNETT SAGE-BRUSH CONTROL STUDY PLOT. 1/

Taxa	Treatment Sites		
	Complete Spray 14 Stands 280 Plots	Strip Spray 13 Stands 260 Plots	Defer Control 17 Stands 340 Plots
	Cy/Cv/Fr	Cy/Cv/Fr	Cy/Cv/Fr
SHRUBS			
<i>Artemisia tridentata</i>	100/18/63	100/14/65	100/22/60
<i>Atriplex nuttallii</i>	14/tr/ 3		53/ 2/ 9
<i>Gutierrezia sarothrae</i>	43/ 1/10	46/tr/ 5	76/ 2/21
Total Shrubs	100/19/69	100/14/66	100/23/66
GRASS & GRASS-LIKE PLANTS			
<i>Agropyron desertorum</i>	14/ 2/10		
<i>Agropyron smithii</i>	100/24/85	100/16/69	100/24/84
<i>Agropyron spicatum</i>	50/ 7/26	77/10/40	35/ 6/21
<i>Agropyron trachycaulum</i>		8/tr/ 1	
<i>Bouteloua gracilis</i>	50/ 3/11	92/ 7/30	12/ 1/ 5
<i>Bromus tectorum</i>	29/tr/ 5	38/tr/ 4	29/ 1/11
<i>Calamagrostis montanensis</i>		15/tr/ 1	
<i>Carex</i> spp.		8/ 1/ 4	
<i>Carex eleocharis</i>	64/ 1/11	69/ 2/27	41/tr/ 5
<i>Carex filifolia</i>	7/tr/ 3		12/tr/ 1
<i>Festuca octoflora</i>	7/tr/ 1	38/ 1/13	
<i>Hordeum jubatum</i>		8/tr/tr	
<i>Koeleria cristata</i>	79/ 5/44	92/ 6/59	53/ 2/16
<i>Muhlenbergia cuspidata</i>	14/tr/ 2		
<i>Poa</i> spp.	21/ 1/ 8	38/ 3/22	18/tr/ 5
<i>Poa canbyi</i>	64/ 3/29		18/tr/ 6
<i>Poa compressa</i>		31/tr/ 3	
<i>Poa secunda</i>	36/ 1/10	46/ 1/22	18/tr/ 1
<i>Schedonnardus paniculatus</i>	7/tr/tr	46/tr/ 4	
<i>Stipa comata</i>	14/tr/ 3	23/ 1/ 6	35/ 1/ 7
<i>Stipa viridula</i>	86/ 5/29	62/ 4/19	53/ 2/10
Unknown Grass	7/tr/ 2	8/tr/tr	
Total Grasses	100/51/99	100/45/99	100/37/98
FORBS			
<i>Achillea millefolium</i>	21/ 1/ 4	15/tr/ 3	
<i>Allium textile</i>	79/ 1/14	77/tr/15	53/tr/ 3
<i>Androsace septentrionalis</i>	7/tr/ 2	15/tr/ 2	6/tr/ 1
<i>Antennaria rosea</i>		38/ 1/12	6/tr/ 3
<i>Arabis glabra</i>			6/tr/ 1

TABLE XIII. (CONTINUED).

Taxa	Treatment Sites		
	Complete	Strip	Defer
	Spray	Spray	Control
	14 Stands 280 Plots	13 Stands 260 Plots	17 Stands 340 Plots
	Cy/Cv/Fr	Cy/Cv/Fr	Cy/Cv/Fr
<i>Arenaria hookeri</i>	29/tr/ 3		18/tr/ 2
<i>Artemisia frigida</i>	79/ 2/18	77/ 2/21	71/ 2/24
<i>Aster canescens</i>		8/tr/ 1	24/tr/ 2
<i>Astragalus bisulcatus</i>		8/tr/ 2	6/tr/tr
<i>Astragalus gilviflorus</i>			12/tr/ 3
<i>Astragalus gracilis</i>			6/tr/tr
<i>Astragalus missouriensis</i>	7/tr/ 1	15/tr/ 3	12/tr/ 2
<i>Astragalus striatus</i>			6/ 1/ 5
<i>Atriplex</i> spp.		8/tr/tr	
<i>Atriplex argentea</i>	7/tr/tr		6/tr/tr
<i>Bahia oppositifolia</i>		8/tr/tr	24/ 1/ 8
<i>Camelina microcarpa</i>	43/tr/ 6		65/tr/12
<i>Comandra umbellata</i>	7/tr/ 1		18/tr/ 5
<i>Conringia orientalis</i>	7/tr/tr		18/tr/ 2
<i>Crepis occidentalis</i>	29/tr/ 3		
<i>Crepis runcinata</i>		8/tr/tr	
<i>Draba brachycarpa</i>			12/tr/ 2
<i>Erigeron ochroleucus</i>	7/tr/ 1	23/tr/ 5	6/tr/ 1
<i>Erigeron pumilus</i>	21/tr/ 2	77/tr/12	
<i>Eriogonum multiceps</i>			12/tr/ 3
<i>Euphorbia esula</i>		8/tr/ 3	
<i>Euphorbia glyptosperma</i>			6/tr/tr
<i>Gaura coccinea</i>		15/tr/ 2	35/tr/ 2
<i>Grindelia squarrose</i>	29/tr/ 4	8/tr/ 1	29/tr/ 4
<i>Haplopappus nuttallii</i>		8/tr/tr	12/tr/ 1
<i>Hymenoxys acaulus</i>		23/tr/ 2	18/tr/ 1
<i>Hymenoxys richardsonii</i>	21/tr/ 2	23/tr/ 1	6/tr/ 1
<i>Iva axillaris</i>	43/ 1/10	31/ 1/ 7	18/tr/ 5
<i>Lactuca serriola</i>	14/tr/ 1	8/tr/tr	
<i>Lappula echinata</i>		31/tr/ 5	6/tr/tr
<i>Lappula redowskii</i>	36/tr/ 4	8/tr/ 2	
<i>Lepidium densiflorum</i>	21/tr/ 2	46/tr/14	35/tr/ 5
<i>Linum lewisii</i>			6/tr/ 2
<i>Lomatium orientale</i>	7/tr/tr		
<i>Lomatium parryi</i>	7/tr/ 1	23/tr/ 3	
<i>Lotus corniculatus</i>	29/tr/ 8	23/tr/ 5	

TABLE XIII. (CONTINUED).

Taxa	Treatment Sites		
	Complete Spray 14 Stands 280 Plots	Strip Spray 13 Stands 260 Plots	Defer Control 17 Stands 340 Plots
<i>Mentzelia dispersa</i>		8/tr/tr	
<i>Musineon divaricatum</i>	7/tr/ 1		18/tr/ 2
<i>Oenothera albicaulis</i>		8/tr/ 1	
<i>Opuntia polycantha</i>	29/tr/ 1	62/ 1/ 9	24/tr/ 1
<i>Orobanche fasciculata</i>	7/tr/tr	8/tr/tr	6/tr/tr
<i>Penstemon albidus</i>		8/tr/ 2	6/tr/tr
<i>Penstemon nitidus</i>	36/tr/ 4	8/tr/ 2	6/tr/ 1
<i>Petalostemon purpureum</i>			12/ 1/ 6
<i>Phlox hoodii</i>	93/ 4/48	92/ 2/32	82/ 3/46
<i>Plantago purshii</i>	43/tr/ 6	77/ 1/37	12/tr/ 1
<i>Polygonum ramosissimum</i>	7/tr/tr		
<i>Psoralea argophylla</i>	21/ 2/13	8/tr/tr	
<i>Psoralea tenuiflora</i>	7/tr/tr	8/tr/tr	6/tr/ 2
<i>Rorippa curvisiliqua</i>	7/tr/tr	8/tr/ 3	24/tr/ 5
<i>Rorippa islandica</i>	43/ 1/12	8/tr/ 1	24/tr/ 5
<i>Sisymbrium loeselii</i>	21/tr/ 3		29/tr/ 5
<i>Sphaeralcea coccinea</i>	79/tr/16	85/tr/12	88/ 2/38
<i>Taraxacum officinale</i>	57/ 1/ 8	31/tr/ 5	35/tr/ 2
<i>Thlaspernea marginatum</i>		8/tr/ 5	29/tr/ 5
<i>Thlaspi arvense</i>	14/tr/ 5	15/tr/ 1	6/tr/ 1
<i>Tragopogon dubius</i>	36/tr/ 2		47/tr/ 4
<i>Vicia americana</i>	100/ 4/50	100/ 5/49	82/ 4/46
<i>Viola nuttallii</i>	36/tr/ 5	23/tr/ 2	18/tr/ 4
Unknown Forbs	57/ 1/13	38/tr/ 3	47/ 1/ 8
Total Forbs	100/17/96	100/13/93	100/19/96
OTHERS			
Rock	57/ 2/26	77/ 2/20	82/ 4/35
<i>Selaginella densa</i>	14/tr/ 1	54/ 5/19	6/tr/tr
Lichens	88/ 2/36	92/ 4/68	41/ 1/14
Litter I	100/24/89	100/24/91	100/33/98
Litter II	86/ 4/23	100/ 5/55	71/ 6/32

1/ Location and extent of proposed treatment sites are shown in the Appendix, Figure 14.

TABLE XIV. CONSTANCY, CANOPY COVERAGE, AND FREQUENCY OF OCCURRENCE OF TAXA ON THE DIFFERENT PROPOSED TREATMENT SITES ON THE KING SAGEBRUSH CONTROL STUDY PLOT. 1/

Taxa	Treatment Sites				
	Complete	Contour		Defer	Open
	Spray	Furrow	Interseed	Control	Control
	5 Stands 100 Plots	15 Stands 300 Plots	10 Stands 200 Plots	2 Stands 40 Plots	10 Stands 200 Plots
	Cy/Cv/Fr	Cy/Cv/Fr	Cy/Cv/Fr	Cy/Cv/Fr	Cy/Cv/Fr
SHRUBS					
<i>Artemisia tridentata</i>	100/15/57	93/13/55	100/13/54	100/16/68	100/13/56
<i>Atriplex nuttallii</i>			10/tr/ 1		
<i>Chrysothamnus nauseosus</i>		13/tr/ 1			
<i>Gutierrezia sarothrae</i>	60/ 1/ 6	47/ 1/10	30/tr/ 4	50/ 2/18	40/ 1/ 7
<i>Rosa arkansana</i>		7/tr/tr			
Total Shrubs	100/15/60	100/14/57	100/11/50	100/17/70	100/14/60
GRASSES AND GRASS-LIKE PLANTS					
<i>Agropyron desertorum</i>					10/ 2/ 7
<i>Agropyron smithii</i>	100/13/82	100/16/83	100/17/88	100/16/95	100/14/76
<i>Agropyron spicatum</i>	40/ 3/14	93/ 4/21	60/ 2/ 9		50/ 5/27
<i>Bouteloua gracilis</i>	100/ 9/39	93/12/59	100/28/82	100/12/75	80/ 6/35
<i>Bromus tectorum</i>	40/tr/ 2	13/tr/ 1			10/tr/ 2
<i>Calamagrostis montanensis</i>	20/tr/ 4	13/ 2/ 7	20/tr/ 2		20/ 1/ 5
<i>Calamovilfa longifolia</i>		7/ 2/ 6			
<i>Carex eleocharis</i>	100/ 3/25	80/ 3/27	90/ 3/32	100/ 3/40	90/ 6/36
<i>Carex filifolia</i>		13/tr/ 4			
<i>Distichlis stricta</i>		13/tr/ 2	20/tr/ 1		
<i>Festuca octiflora</i>	20/tr/ 5	53/tr/ 9	60/tr/ 7		20/tr/ 8
<i>Koeleria cristata</i>	100/ 5/45	93/ 4/50	100/ 5/49	100/ 5/53	90/ 4/37
<i>Muhlenbergia cuspidata</i>				50/ 1/ 5	
<i>Poa</i> spp.			10/tr/ 1		
<i>Poa canbyi</i>		13/tr/ 4	60/ 1/ 8		20/tr/ 1
<i>Poa compressa</i>	40/tr/ 2	53/ 1/16	20/ 1/10		70/ 2/19
<i>Poa secunda</i>	100/ 2/39	80/ 1/18	70/ 1/15	100/ 1/18	80/ 2/31

TABLE XIV. (CONTINUED).

Taxa	Treatment Sites				
	Complete Spray 5 Stands 100 Plots	Contour Furrow 15 Stands 300 Plots	Interseed 10 Stands 200 Plots	Defer Control 2 Stands 40 Plots	Open Control 10 Stands 200 Plots
<i>Schedonnardus paniculatus</i>	Cy/Cv/Fr 40/tr/10	Cy/Cv/Fr 53/tr/ 5	Cy/Cv/Fr 40/tr/ 4	Cy/Cv/Fr 50/tr/ 3	Cy/Cv/Fr 30/tr/ 2
<i>Stipa comata</i>	20/ 4/18	67/ 3/28	100/ 5/53	100/ 9/65	50/ 2/16
<i>Stipa viridula</i>	60/ 1/15	53/ 2/11	20/tr/ 1	50/ 1/ 3	90/12/48
Total Grasses	100/41/100	100/44/98	100/52/99	100/32/100	100/49/100
FORBS					
<i>Achillea millefolium</i>		27/tr/ 7	20/tr/ 2		10/tr/ 2
<i>Allium textile</i>	40/tr/ 4	73/tr/ 6	50/tr/ 5	100/tr/ 5	40/tr/ 5
<i>Androsace septentrionalis</i>	40/tr/ 2	27/tr/ 3	40/tr/ 6		30/tr/ 5
<i>Antennaria rosea</i>	60/ 1/ 4	47/ 1/ 9	20/tr/ 4		20/tr/ 2
<i>Arenaria hookeri</i>	20/tr/ 4	33/tr/ 9		50/ 2/40	20/tr/ 1
<i>Artemisia frigida</i>	100/ 5/41	87/ 5/39	100/ 6/50	100/ 5/43	80/ 4/25
<i>Artemisia longifolia</i>		7/tr/ 3			
<i>Astragalus gilviflorus</i>				50/ 1/13	10/tr/ 1
<i>Astragalus gracilis</i>	20/tr/ 2	13/tr/ 1		50/ 1/ 3	
<i>Astragalus missouriensis</i>	20/tr/ 1	7/tr/tr	10/tr/ 1		
<i>Astragalus purshii</i>		7/tr/tr	30/tr/ 3		20/tr/ 1
<i>Camelina microcarpa</i>		13/tr/ 1			10/tr/ 1
<i>Chenopodium album</i>	20/tr/ 1				10/tr/ 1
<i>Collomia linearis</i>		7/tr/tr			20/tr/ 6
<i>Crepis occidentalis</i>		13/tr/ 1			10/tr/ 1
<i>Draba brachycarpa</i>				50/tr/ 3	
<i>Erigeron ochroleucus</i>		7/tr/ 2			
<i>Erigeron pumilus</i>	20/tr/ 3	33/tr/ 7	80/tr/ 6	50/ 1/13	20/tr/ 2
<i>Fritillaria pudica</i>		7/tr/tr			
<i>Gaura coccinea</i>		7/tr/ 1			20/tr/ 1
<i>Grindellia squarrose</i>		13/tr/ 1			

TABLE XIV. (CONTINUED).

Taxa	Treatment Sites				
	Complete Spray 5 Stands 100 Plots	Contour Furrow 15 Stands 300 Plots	Interseed 10 Stands 200 Plots	Defer Control 2 Stands 40 Plots	Open Control 10 Stands 200 Plots
	Cy/Cv/Fr	Cy/Cv/Fr	Cy/Cv/Fr	Cy/Cv/Fr	Cy/Cv/Fr
<i>Haplopappus nuttallii</i>				50/ 1/18	
<i>Haplopappus spinulosus</i>					10/tr/ 1
<i>Hedeoma hispida</i>	40/tr/ 8				
<i>Hymenoxys acaulus</i>		20/tr/ 1	20/tr/ 2		10/tr/ 1
<i>Hymenoxys richardsonii</i>				50/ 2/28	
<i>Lappula redowskii</i>		7/tr/tr	20/tr/ 4		
<i>Lepidium densiflorum</i>	80/ 1/22	60/tr/10	20/tr/ 4		30/tr/ 6
<i>Liatris punctata</i>		7/tr/ 1			
<i>Lomatium orientale</i>	20/tr/ 2	20/tr/ 1	20/tr/ 2		30/tr/ 3
<i>Lomatium parryi</i>				50/tr/ 3	
<i>Lupinus argenteus</i>		7/tr/tr			
<i>Mamillaria vivipara</i>		7/tr/tr			
<i>Melilotus officinalis</i>		7/tr/tr			
<i>Microseris cuspidata</i>		7/tr/tr			
<i>Microseris nutans</i>	20/tr/ 1	7/tr/ 1			
<i>Musineon divaricatum</i>		27/tr/ 4			30/tr/ 4
<i>Opuntia polycantha</i>	40/ 1/ 4	53/ 1/ 6	70/ 1/ 6	100/ 3/15	40/tr/ 6
<i>Oxytropis sericea</i>					10/tr/ 1
<i>Penstemon albidus</i>	20/tr/ 2	7/tr/tr			10/tr/ 1
<i>Petalostemon purpureum</i>		7/tr/ 2			
<i>Phacelia linearis</i>			10/tr/ 1		
<i>Phlox hoodii</i>	20/ 1/ 6	47/tr/13	70/ 1/10	50/ 2/38	70/ 3/28
<i>Plantago elongata</i>		7/tr/ 1			10/tr/ 1
<i>Plantago purshii</i>	100/ 1/43	93/ 1/31	100/ 2/60	100/ 1/35	70/ 1/29
<i>Polygonum aviculare</i>	40/tr/ 3	7/tr/ 1			10/tr/ 1

TABLE XIV. (CONTINUED).

Taxa	Treatment Sites				
	Complete Spray 5 Stands 100 Plots	Contour Furrow 15 Stands 300 Plots	Interseed 10 Stands 200 Plots	Defer Control 2 Stands 40 Plots	Open Control 10 Stands 200 Plots
	Cy/Cv/Fr	Cy/Cv/Fr	Cy/Cv/Fr	Cy/Cv/Fr	Cy/Cv/Fr
<i>Potentilla gracilis</i>			10/tr/ 1		
<i>Potentilla pennsylvanica</i>		7/tr/ 1	10/tr/ 1	50/tr/ 3	
<i>Psoralea argophyll</i>		13/tr/ 2			
<i>Psoralea esculenta</i>			20/tr/ 2		
<i>Psoralea tenuiflora</i>		13/tr/ 2		100/ 1/13	40/tr/ 3
<i>Rorippa curvisiliqua</i>					10/tr/ 6
<i>Rorippa islandica</i>	20/tr/ 5	13/tr/ 1	20/tr/ 4		60/tr/14
<i>Sitanion hystrix</i>	20/tr/ 3				
<i>Sphaeralcea coccinea</i>	60/ 1/21	67/tr/10	80/ 1/17	100/tr/10	90/ 1/21
<i>Taraxacum officinale</i>	40/tr/ 5	53/ 1/15	70/tr/ 8		70/ 1/10
<i>Thermopsis rhombifolia</i>		7/tr/ 3			
<i>Thlaspi arvense</i>		7/tr/ 1	40/tr/ 8		
<i>Tragopogon dubius</i>	20/tr/ 1	20/tr/ 1	40/tr/ 4		
<i>Viola adunca</i>					10/tr/ 3
<i>Vicia americana</i>	80/ 1/16	87/ 3/34	60/ 2/21	100/ 5/58	90/ 5/45
<i>Viola nuttallii</i>	20/tr/ 1		20/tr/ 3		20/tr/ 1
Unknown Forbs		60/tr/10	40/tr/ 7	50/tr/ 3	30/tr/ 3
Total Forbs	100/10/88	100/14/86	100/12/92	100/17/95	100/13/94
OTHERS					
Rock	100/ 6/53	73/ 2/22	90/ 2/20	100/ 4/43	100/ 3/35
<i>Selaginella densa</i>	100/16/48	80/15/48	90/30/59	50/14/48	70/ 9/28
Lichens	100/ 4/89	100/ 4/74	100/ 6/88	100/ 7/88	80/ 3/58
Litter I	100/37/99	100/26/93	100/23/87	100/26/100	100/38/96
Litter II	80/ 9/64	100/ 4/52	100/ 5/49	100/ 5/70	100/10/73

1/ Location and extent of proposed treatment sites are shown in Appendix, Figure 14.

TABLE XV. CONSTANCY, CANOPY COVERAGE AND FREQUENCY OF OCCURRENCE OF TAXA ON THE DIFFERENT PROPOSED TREATMENT SITES ON THE SIBBERT SAGE-BRUSH CONTROL STUDY PLOT: 1/

Taxa	Treatment Sites	
	Partial Spray 10 Stands 200 Plots Cy/Cv/Fr	Open Control 9 Stands 180 Plots Cy/Cv/Fr
SHRUBS		
<i>Artemisia tridentata</i>	100/16/57	78/11/41
<i>Atriplex nuttallia</i>		11/tr/ 1
<i>Gutierrezia sarothrae</i>	90/ 1/18	56/tr/ .3
Total Shrubs	100/17/64	100/12/44
GRASS AND GRASS-LIKE PLANTS		
<i>Agropyron smithii</i>	100/24/97	100/19/92
<i>Agropyron spicatum</i>	10/tr/ 1	
<i>Bouteloua gracilis</i>	90/10/58	100/16/67
<i>Bromus tectorum</i>	40/ 1/11	44/ 1/ 8
<i>Carex eleocharis</i>	60/ 2/26	67/ 3/37
<i>Carex filifolia</i>	20/tr/ 6	22/ 1/ 7
<i>Festuca octiflora</i>	50/tr/ 5	67/tr/17
<i>Koeleria cristata</i>	100/ 9/72	89/ 8/64
<i>Poa spp.</i>	10/tr/ 1	
<i>Poa canbyi</i>	20/tr/ 3	11/ 1/ 5
<i>Poa compressa</i>	40/ 1/10	44/ 2/19
<i>Poa secunda</i>	100/ 3/47	89/ 1/29
<i>Schedonnardus paniculatus</i>	10/tr/ 1	22/tr/ 1
<i>Stipa comata</i>	60/ 3/23	67/ 2/24
<i>Stipa viridula</i>	80/ 2/18	56/ 3/29
Total Grasses	100/50/100	100/51/99
<i>Deschampsia caespitosa</i>		11/tr/ 1
FORBS		
<i>Achillea millefolium</i>	50/ 1/ 7	44/tr/ 7
<i>Allium textile</i>	80/tr/11	56/tr/ .3
<i>Androsace septentrionalis</i>	60/tr/12	67/tr/13
<i>Antennaria rosea</i>	50/tr/ 4	33/tr/ 3
<i>Arenaria hookeri</i>	10/tr/ 1	
<i>Artemisia frigida</i>	70/ 1/17	100/ 3/29
<i>Astragalus gracilis</i>	10/tr/ 1	
<i>Astragalus purshii</i>		11/tr/ 1
<i>Camelina microcarpa</i>	50/tr/ 6	56/tr/ 3
<i>Chenopodium album</i>	10/tr/ 1	
<i>Draba brachycarpa</i>		11/tr/ 1
<i>Draba crassa</i>		11/tr/ 1

TABLE XV. (CONTINUED)

Taxa	Treatment Sites	
	Partial Spray 10 Stands 200 Plots	Open Control 9 Stands 180 Plots
	Cy/Cv/Fr	Cy/Cv/Fr
<i>Erigeron pumilus</i>	70/tr/ 6	56/tr/ 7
<i>Grindelia squarrose</i>		11/tr/ 1
<i>Hymenoxys acaulus</i>		11/tr/ 1
<i>Lepidium densiflorum</i>	80/ 1/20	67/tr/13
<i>Lomatium orientale</i>	30/tr/ 2	22/tr/ 2
<i>Mamillaria vivipara</i>	10/tr/ 1	
<i>Medicago sativa</i>	10/tr/ 1	
<i>Melilotus officinalis</i>	40/tr/ 4	44/tr/ 4
<i>Oenothera caespitosa</i>	10/tr/ 1	
<i>Opuntia polycantha</i>	90/ 1/18	78/ 1/ 9
<i>Penstemon albidus</i>		11/tr/ 1
<i>Phlox hoodii</i>	70/ 1/ 8	44/tr/ 7
<i>Plantago purshii</i>	100/ 2/42	100/ 1/35
<i>Polygonum aviculare</i>	10/tr/ 1	
<i>Potentilla pennsylvanica</i>		11/tr/ 1
<i>Psoralea argophyl</i>	10/tr/ 1	
<i>Psoralea tenuiflora</i>		22/tr/ 2
<i>Rorippa islandica</i>	40/tr/ 3	33/tr/ 3
<i>Rorippa sinuate</i>	20/tr/ 3	
<i>Sphaeralcea coccinea</i>	70/ 1/18	56/tr/ 7
<i>Taraxacum officinale</i>	90/ 1/15	89/ 1/21
<i>Tragopogon dubius</i>	80/ 1/ 9	78/tr/ 5
<i>Vicia americana</i>	100/10/67	100/ 5/54
<i>Viola nuttallii</i>	30/tr/ 2	22/tr/ 2
Unknown Forbs	80/ 1/15	78/tr/ 9
Total Forbs	100/17/97	100/12/94
OTHERS		
Bareground	100/16/88	100/20/96
Rock	60/ 1/12	67/tr/ 8
<i>Selaginella densa</i>	90/12/38	100/15/49
Lichens	100/ 5/84	100/ 5/87
Litter I	100/41/95	100/37/96
Litter II	100/ 3/47	100/ 2/43

1/ Location and extent of proposed treatment types are shown in Appendix, Figure 14.

TABLE XVI. CONSTANCY, CANOPY COVERAGE AND FREQUENCY OF OCCURRENCE OF TAXA ON THE DIFFERENT PROPOSED TREATMENT SITES ON THE IVERSON SAGE-BRUSH CONTROL STUDY PLOT. 1/

Taxa	Treatment Sites		
	Partial	Defer	Open
	Spray 17 Stands 340 Plots	Control 12 Stands 240 Plots	Control 12 Stands 240 Plots
	Cy/Cv/Fr	Cy/Cv/Fr	Cy/Cv/Fr
SHRUBS			
<i>Artemisia tridentata</i>	100/25/66	92/22/68	100/21/69
<i>Gutierrezia sarothrae</i>	29/tr/ 3	42/tr/ 4	8/tr/ 1
Total Shrubs	100/25/68	92/23/68	100/22/72
GRASS AND GRASS-LIKE PLANTS			
<i>Agropyron desertorum</i>	18/ 1/ 5	25/ 6/24	
<i>Agropyron smithii</i>	100/12/88	92/16/71	100/13/82
<i>Agropyron spicatum</i>	18/tr/ 1		42/ 5/18
<i>Bouteloua gracilis</i>	88/17/46	50/ 4/20	92/10/60
<i>Bromus tectorum</i>	29/tr/ 2	42/ 2/14	8/tr/tr
<i>Carex eleocharis</i>	88/ 2/32	25/tr/ 5	67/ 2/30
<i>Carex filifolia</i>		8/tr/ 3	33/ 1/13
<i>Festuca octiflora</i>		25/tr/ 3	17/tr/ 1
<i>Hordeum jubatum</i>			8/tr/tr
<i>Koeleria cristata</i>	100/ 2/28	75/ 1/18	100/ 3/59
<i>Poa spp.</i>		8/tr/tr	
<i>Poa canbyi</i>	53/tr/10	50/ 1/18	17/tr/ 4
<i>Poa compressa</i>	6/tr/ 1	33/ 2/12	50/ 1/13
<i>Poa secunda</i>	6/ 1/27	83/ 2/25	75/ 1/28
<i>Schedonnardus paniculatus</i>	41/tr/ 6	50/tr/ 7	
<i>Stipa comata</i>	94/ 4/35	50/ 1/7	100/ 6/55
<i>Stipa viridula</i>	59/ 1/11	58/ 2/11	17/tr/ 2
Total Grasses	100/38/99	100/36/99	100/42/99
FORBS			
<i>Achillea millefolium</i>	47/ 1/ 4	25/tr/ 1	17/tr/ 1
<i>Allium textile</i>	18/tr/ 1		33/tr/ 5
<i>Androsace septentrionalis</i>	12/tr/ 1	8/tr/tr	58/tr/ 5
<i>Antennaria rosea</i>			17/tr/ 1
<i>Arenaria hookeri</i>	12/tr/ 1		
<i>Artemisia frigida</i>	100/ 2/33	58/ 1/10	67/ 1/20
<i>Astragalus gilviflorus</i>			17/tr/ 2
<i>Astragalus gracilis</i>	6/tr/ 1		8/tr/ 1
<i>Astragalus missouriensis</i>	12/tr/ 1		42/tr/ 3
<i>Camelina microcarpa</i>		33/tr/ 3	

TABLE XVI. (CONTINUED).

Taxa	Treatment Sites		
	Partial Spray 17 Stands 340 Plots	Defer Control 12 Stands 240 Plots	Open Control 12 Stands 240 Plots
	Cy/Cv/Fr	Cy/Cv/Fr	Cy/Cv/Fr
<i>Chenopodium glaucum</i>		33/tr/2	
<i>Cirsium undulatum</i>		8/tr/tr	
<i>Collomia linearis</i>		8/tr/ 1	
<i>Erigeron pumilus</i>	6/tr/tr		33/tr/ 2
<i>Gaura coccinea</i>	12/tr/ 1	8/tr/tr	17/tr/ 2
<i>Grindelia squarrose</i>	6/tr/tr		
<i>Lappula echinata</i>	6/tr/ 1	17/tr/ 3	17/tr/ 3
<i>Lappula redowskii</i>	29/tr/ 2	17/tr/ 1	17/tr/ 2
<i>Lepidium densiflorum</i>	47/tr/ 5	42/tr/ 8	75/ 1/22
<i>Lomatium orientale</i>			25/tr/ 1
<i>Melilotus officinalis</i>		17/tr/ 4	
<i>Microseris nutans</i>	6/tr/tr		
<i>Monolepis nuttalliana</i>		25/tr/ 4	
<i>Opuntia polycantha</i>	71/ 1/ 8	25/tr/ 3	67/ 1/ 7
<i>Penstemon albidus</i>			25/tr/ 3
<i>Phlox hoodii</i>	76/ 2/28	33/ 1/ 8	100/ 2/34
<i>Plantago lanceolata</i>		8/tr/ 2	
<i>Plantago purshii</i>	100/ 1/39	83/ 1/23	75/ 1/21
<i>Polygonum aviculare</i>		8/tr/tr	
<i>Potentilla pennsylvanica</i>	18/tr/ 1		
<i>Psoralea tenuiflora</i>	6/tr/tr		
<i>Sphaeralcea coccinea</i>	65/tr/ 9	67/tr/ 7	75/tr/11
<i>Taraxacum officinale</i>	29/tr/ 2	25/ 1/ 7	75/tr/ 7
<i>Thlaspi arvense</i>	18/tr/ 2	8/tr/ 1	
<i>Tragopogon dubius</i>	18/tr/ 2	8/tr/tr	42/tr/ 3
<i>Vicia americana</i>	88/ 1/19	75/ 1/18	100/ 6/59
<i>Viola nuttallii</i>	6/tr/tr		
Unknown Forb	24/tr/ 3	17/tr/ 2	50/tr/ 5
Total Forbs	100/ 6/84	100/ 6/75	100/11/94
OTHERS			
Bareground	100/35/98	100/44/99	100/22/97
Rock	94/ 1/23	92/ 2/32	75/ 1/13
<i>Selaginella densa</i>	18/tr/ 3	17/tr/ 2	58/tr/ 3
Lichens	100/ 3/56	67/ 1/29	100/ 5/58
Litter I	100/21/90	100/25/89	100/34/97
Litter II	65/ 1/14	92/ 2/31	75/ 3/42

1/ Location and extent of proposed treatment sites are shown in Appendix, Table 14.

TABLE XVII. PERCENTAGE DISTRIBUTION OF OBSERVATIONS OF INDIVIDUAL ANTELOPE IN EACH OF FIVE GROUP TYPES BY VEGETATION TYPE DURING THE SUMMERS OF 1966 AND 1967.

Vegetation Type	Group Type 1/				
	Female- Fawn	Female- Fawn-Male	Female- Male	Female	Male
Sagebrush-Grassland					
1966	54(6.3) ^{2/}	37(10.1)	78(4.6)	75(2.9)	64(5.5)
1967	70(5.9)	65(13.8)	44(4.1)	82(2.8)	45(4.9)
Grassland					
1966	2(4.5)	--	6(2.5)	4(2.0)	3(3.0)
1967	2(7.3)	1(7.3)	3(3.0)	2(2.0)	5(6.8)
Greasewood					
1966	11(8.6)	10(11.0)	--	--	--
1967	2(8.5)	10(12.9)	1(2.0)	2(2.0)	4(6.3)
Greasewood-Sagebrush					
1966	26(10.3)	25(15.3)	7(6.0)	15(4.0)	24(4.2)
1967	13(5.8)	12(10.8)	19(4.6)	7(2.3)	13(6.5)
Shale Slope					
1966	6(8.0)	11(20.3)	8(3.5)	4(2.0)	8(3.5)
1967	7(6.0)	6(10.8)	24(6.3)	5(2.3)	31(6.8)
Cropland (alfalfa)					
1966	1(1.7)	17(18.2)	--	4(2.0)	--
1967	6(6.8)	7(14.7)	9(3.8)	2(3.0)	2(9.0)

TABLE XVII. (CONTINUED).

Vegetation Type	Group Type				
	Female- Fawn	Female- Fawn-Male	Female- Male	Female	Male
Total No. Antelope					
1966	397	547	83	55	86
1967	948	2,232	212	131	578
Total No. Groups					
1966	57(7.0)	42(13.0)	19(4.4)	19(2.9)	18(4.8)
1967	158(6.0)	172(13.0)	48(4.4)	49(2.7)	100(5.8)

1/ Includes group types commonly seen during both summers. Each group included two or more animals.

2/ Numbers in parenthesis indicate average group size.

TABLE XVIII. PERCENTAGE DISTRIBUTION OF 5,874 OBSERVATIONS OF INDIVIDUAL ANTELOPE BY SEX AND AGE ON SIX VEGETATION TYPES DURING THE SUMMERS OF 1966 AND 1967.

Vegetation Type	Adults		Young	Unclassified	Total Antelope
	Females	Males			
Sagebrush-Grassland					
1966	54	67	43	45	728
1967	66	50	68	16	2,751
Grassland					
1966	2	3	1	8	35
1967	2	3	1	-	80
Greasewood					
1966	8	3	10	21	138
1967	7	5	7	34	308
Greasewood-Sagebrush					
1966	21	16	27	2	288
1967	12	15	12	3	548
Shale Slope					
1966	8	8	8	2	107
1967	7	25	6	-	471
Cropland (alfalfa)					
1966	8	3	10	23	138
1967	6	2	6	47	282
Total Antelope					
1966	564	215	487	168	1,434
1967	2,031	976	1,322	111	4,440

TABLE XIX. NUMBERS OF INDIVIDUAL ANTELOPE OBSERVED DURING TEN GROUND AND FIVE AERIAL COUNTS FROM JUNE 16 TO SEPTEMBER 15, 1967, LISTED BY SQUARE MTLES.

Location ^{1/}	Adults		Fawns	Total ^{2/} Antelope	Location	Adults		Fawns	Total Antelope
	F	M				F	M		
19-K	13	2	9	24	22-P	21	9	23	53
20-K	33	27	20	80	23-P	8	2	1	11
21-K	3	3	2	8	24-P	29	4	19	52
17-L	23	2	10	35	25-P	33	3	13	49
19-L	6	1	7	14	26-P	3	-	1	4
20-L	6	97	2	105	27-P	-	1	-	1
21-L	5	4	-	9	28-P	9	-	6	15
17-M	16	1	7	24	29-P	50	7	54	111
18-M	1	-	-	1	30-P	14	7	9	30
20-M	27	26	16	69	19-Q	5	1	-	6
21-M	8	17	4	29	20-Q	23	12	15	50
22-M	5	1	1	7	21-Q	37	6	29	92
28-M	-	6	-	6	22-Q	46	25	37	108
16-N	1	-	1	2	23-Q	-	2	-	2
17-N	25	5	9	39	25-Q	2	7	-	9
18-N	31	15	14	60	26-Q	6	-	-	6
19-N	7	-	7	14	27-Q	1	2	1	4
20-N	68	10	58	136	28-Q	4	1	3	8
21-N	9	3	2	14	29-Q	54	6	48	108
22-N	4	6	3	13	30-Q	21	4	25	50
23-N	3	5	2	10	18-R	1	-	-	1
27-N	3	1	-	4	19-R	10	4	9	23
29-N	20	2	17	39	20-R	47	17	25	89
30-N	9	1	6	16	21-R	7	13	4	24
17-O	18	2	13	33	22-R	30	21	23	74
18-O	10	2	8	20	23-R	-	3	-	3
19-O	11	2	9	22	25-R	7	3	2	12
20-O	26	5	19	50	26-R	8	20	2	30
21-O	16	10	9	35	27-R	4	12	2	18
22-O	17	8	5	30	28-R	44	12	21	77
23-O	10	3	2	15	29-R	23	3	13	39
24-O	58	11	17	86	30-R	22	4	17	43
25-O	48	3	15	66	14-S	-	7	-	7
26-O	17	1	9	27	15-S	7	-	7	14
27-O	13	2	2	17	18-S	3	-	-	35
28-O	1	1	-	2	19-S	8	7	6	21
29-O	12	3	15	30	20-S	40	41	22	103

TABLE XIX. (CONTINUED)

Location	Adults		Fawns	Total Antelope	Location	Adults		Fawns	Total Antelope
	F	M				F	M		
30-O	6	3	4	13	21-S	43	45	21	109
31-O	4	4	2	10	22-S	14	63	5	82
17-P	12	6	11	29	23-S	4	10	-	14
18-P	16	6	9	31	25-S	64	10	42	116
19-P	9	3	3	23	26-S	24	9	27	60
20-P	67	8	48	146	27-S	25	4	16	45
21-P	23	3	19	45	28-S	25	3	15	43
29-S	7	1	4	12	18-U	40	5	26	71
14-T	2	3	-	5	19-U	3	1	3	11
16-T	1	-	-	1	20-U	24	39	9	72
17-T	2	-	1	3	21-U	59	6	49	114
18-T	7	1	-	8	22-U	19	2	17	38
19-T	14	19	11	44	25-U	-	-	1	1
20-T	34	82	16	132	26-U	22	8	38	84
21-T	13	31	7	51	15-V	-	1	-	1
22-T	23	6	6	35	18-V	36	6	20	62
23-T	15	7	5	27	19-V	33	4	21	58
24-T	3	-	-	3	20-V	76	16	44	136
25-T	3	1	6	10	21-V	10	9	11	30
28-T	5	1	6	12	22-V	4	-	3	7
14-U	1	3	-	4	25-V	6	1	11	18
15-U	2	2	-	4	26-V	6	3	12	23

- 1/ See Figure 14 for locations. Sample size within study area boundaries was 4,416. (This includes multiple observations of individual antelope.)
 2/ The total figure includes unclassified antelope.

TABLE XX. NUMBERS OF INDIVIDUAL ANTELOPE OBSERVATIONS MADE ON THE DIFFERENT PROPOSED TREATMENT SITES OF EACH OF THE SAGEBRUSH CONTROL STUDY PLOTS DURING TEN GROUND AND FIVE AERIAL COUNTS IN THE SUMMER OF 1967.

Proposed Treatment Types	Sagebrush Control Study Plots ^{1/}			
	Winnett	King	Sibbert	Iverson
	3 Treatment Sites	5 Treatment Sites	2 Treatment Sites	3 Treatment Sites
	F/M/Fawns	F/M/Fawns	F/M/Fawns	F/M/Fawns
Complete Spray (1) ^{2/}	-/6/-	6/1/-		
Partial Spray (2)			-/-/-	-/-/-
Strip Spray (3)	-/2/-			
Contour Furrow (5)		4/-/3		
Interseed (6)		15/14/6		
Defer Control (7)	-/-/-	15/3/5		-/-/-
Open Control (8)		148/194/84	4/1/4	6/3/4
TOTAL	-/8/-	188/212/98	4/1/4	6/3/4

^{1/} Sagebrush control study plots are shown on Figure 14.

^{2/} Numbers in parenthesis identify the proposed treatment sites and their locations on each sagebrush control study plot on Figure 14.

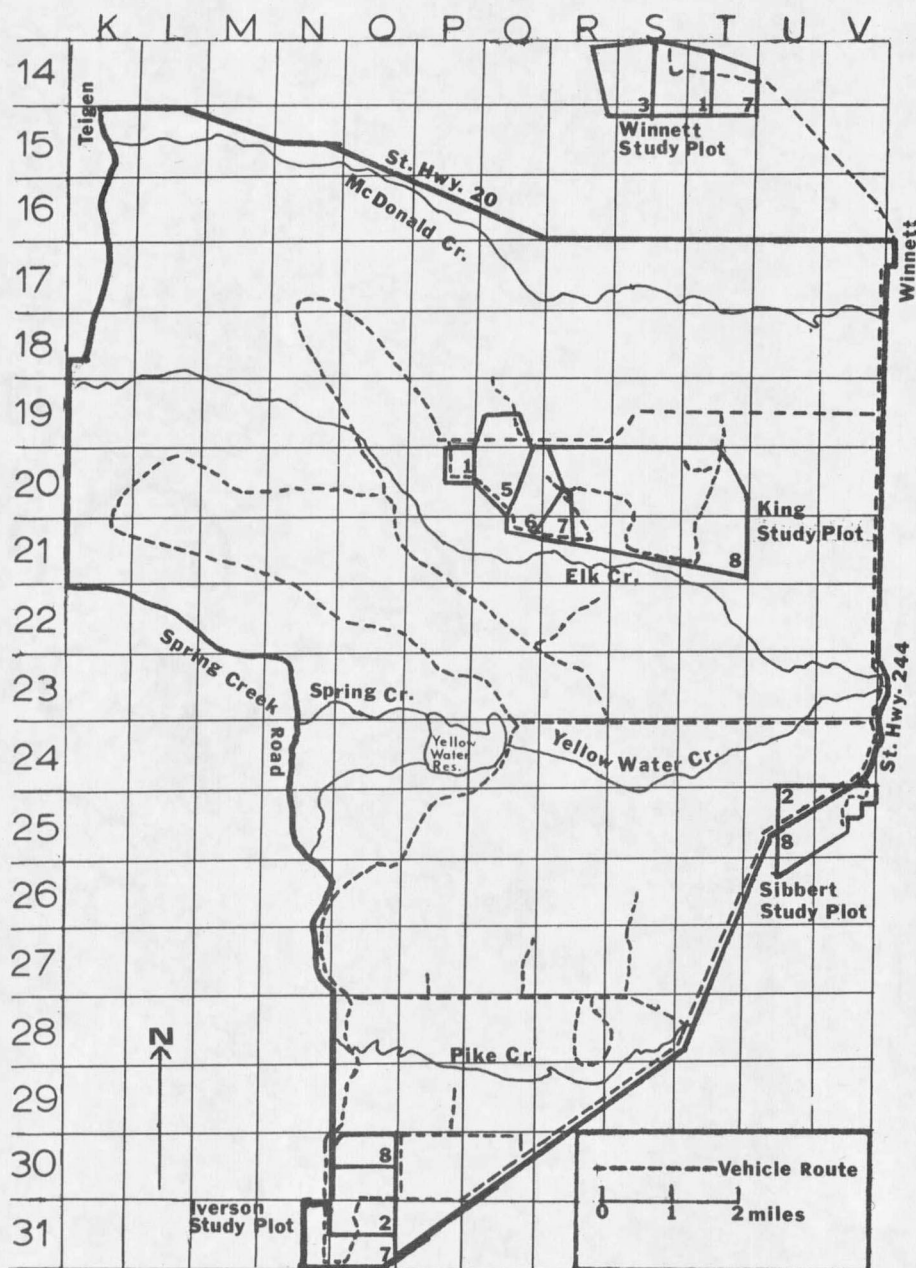


Figure 14. Grid map of study area for use with Tables XIX and XX in showing locations of antelope observations and locations of sagebrush control study plots and treatment sites.

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