



Range use of mule deer prior to initiation of rest rotation grazing for cattle on the Ft. Howes Ranger District, Custer National Forest, Montana
by Stephen James Knapp

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 was conducted on the Ft. Howes Ranger District of the Custer National Forest in southeastern Montana during the summers of 1970 and 1971 and the winter of 1971. The objectives were to obtain quantitative data on seasonal distribution, range use, food habits and interspecific relationships of mule deer and cattle. This was the initial phase of a long term study to evaluate the effects of rest rotation grazing systems for cattle on mule deer food habits and range use. The vegetation was described as constituting three zones: Ponderosa Pine, Big Sage-Grassland, and Grassland. Canopy coverages and frequencies of occurrence of the low-growing taxa were determined for the major vegetation types within each zone. Fifty permanent vegetation transects were established to allow for continuous evaluation of rangeland vegetation changes. Distribution of mule deer was determined by 890 deer observations. The Ponderosa Pine Zone accounted for 89 and 71 percent of the total deer observations for summer and winter, respectively. The Grassland Zone received no significant use. The Big Sage-Grassland Zone received minor use in summer but accounted for 29 percent of the winter deer observations. Cattle observations were split fairly evenly among the three zones. The Big Sage-Grassland Zone was used the heaviest by cattle. Food habits of mule deer were determined from the examination of 12 rumens and 54 feeding sites.

Forbs composed 47 percent of the total summer diet while browse and grasses accounted for 51 and 1 percent, respectively. Skunkbush sumac was the single most important plant in the summer diet of mule deer.

Use of forbs decreased from June to September while use of browse increased. Ninety-five percent of the mule deer feeding sites were in the Ponderosa Pine Zone. Rumen data disclosed 56 percent browse, 41 percent forbs and 3 percent grass for the October and November diet of mule deer. During winter big sagebrush and rubber rabbitbrush were the most important food items. Grass and grass-like plants accounted for 80 percent of the summer diet of cattle as determined from the examination of 32 feeding sites. Bluestem was the most important species. Use on grass increased from 79 percent in June to 93 percent in August. Browse and forbs each accounted for 10 percent of the summer diet. Fawn:doe ratios revealed low to fair productivity with 23 and 64 fawns per 100 does for the summers of 1970 and 1971, respectively. Data for the winter of 1971 showed 62 fawns per 100 does. There appeared to be some land use competition, but no significant forage competition between mule deer and cattle.

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RANGE USE OF MULE DEER PRIOR TO INITIATION OF REST ROTATION
GRAZING FOR CATTLE ON THE FT. HOWES RANGER DISTRICT,
CUSTER NATIONAL FOREST, MONTANA

by

Stephen James Knapp

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

of

MASTER OF SCIENCE

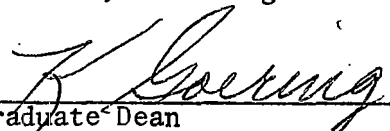
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TABLE OF CONTENTS

	Page
VITA	ii
ACKNOWLEDGMENT	iii
TABLE OF CONTENTS	iv
LIST OF TABLES	vi
LIST OF FIGURES	viii
ABSTRACT	ix
INTRODUCTION	1
DESCRIPTION OF STUDY AREA	3
METHODS	6
Vegetation	6
Animal Distribution and Range Use	7
Food Habits	7
Productivity	8
RESULTS	9
Vegetation	9
Ponderosa Pine Zone	9
Ponderosa Pine Type	9
Grassland Park Type	12
<i>Rhus</i> -Grass Type	12
Creek Bottom Type	14
Agricultural Type	14
Big Sage-Grassland Type	14
Juniper Type	15
Grassland Zone	15
Grassland Type	15
Big Sage-Grassland Type	17

TABLE OF CONTENTS

(Continued)

	Page
Big Sage-Grassland Zone	17
Big Sage-Grassland Type	17
Grassland Type	17
Creek Bottom Type	19
Agricultural Type	19
Silver Sage Type	19
Juniper Type	19
Distribution and Range Use	20
Mule Deer	20
Summer	20
Winter	24
Cattle	25
Food Habits	27
Mule Deer	27
Summer	30
Fall	32
Winter	33
Cattle	35
Productivity	38
DISCUSSION	41
APPENDIX	44
LITERATURE CITED	49

LIST OF TABLES

Table	Page
1. CONSTANCY, PERCENT CANOPY COVERAGE AND FREQUENCY OF LOW-GROWING TAXA FOR VEGETATION TYPES AS DETERMINED BY EXAMINATION OF TWENTY 2X5 DECIMETER PLOTS ON EACH OF 41 SITES	10
2. PERCENT OF MONTHLY AND SEASONAL OBSERVATIONS OF MULE DEER FOR THE SUMMERS OF 1970 AND 1971 AND THE WINTER OF 1971 FOR EACH VEGETATION ZONE AND TYPE	21
3. PERCENT OF MONTHLY AND SEASONAL OBSERVATIONS OF CATTLE FOR THE SUMMERS OF 1970 AND 1971 FOR EACH VEGETATION ZONE AND TYPE	26
4. SUMMER, FALL AND WINTER FOOD HABITS OF MULE DEER BY SEASON AND MONTH AS DETERMINED FROM THE EXAMINATION OF 54 FEEDING SITES AND THE CONTENTS OF 12 RUMENS	28
5. SUMMER AND WINTER FOOD HABITS OF MULE DEER BY VEGETATION ZONE AS DETERMINED FROM THE EXAMINATION OF 54 FEEDING SITES DURING THE PERIOD OF JUNE-SEPTEMBER 1970 AND 1971 AND JANUARY-MARCH 1971	29
6. PERCENT CANOPY COVERAGE AND FREQUENCY OF LOW-GROWING TAXA FOR VEGETATION TYPES DURING LATE WINTER (MARCH) AS DETERMINED BY EXAMINATION OF TWENTY 2X5 DECIMETER PLOTS ON EACH OF 10 SITES	34
7. FOOD HABITS OF CATTLE BY SEASON, MONTH AND VEGETATION ZONE AS DETERMINED BY EXAMINATION OF 32 FEEDING SITES DURING THE SUMMERS OF 1970 AND 1971	36
8. SEX AND AGE CLASSES OF MULE DEER AS DETERMINED BY GROUND OBSERVATIONS FOR THE SUMMERS OF 1970 AND 1971 AND THE WINTER OF 1971	39
9. CLIMATOLOGICAL DATA GATHERED BY THE U. S. DEPT. OF COMMERCE FROM THE BIRNEY 15N AND BIRNEY 2SE MONTANA WEATHER STATIONS FOR 1969, 1970 AND 1971	46
10. TAXA WITH CANOPY COVERAGES OF LESS THAN .5 PERCENT AND/OR FREQUENCIES OF LESS THAN 5 PERCENT IN ANY VEGETATION TYPE	

LIST OF TABLES
(Continued)

Table	Page
AS DETERMINED BY EXAMINATION OF TWENTY 2X5 DECIMETER PLOTS ON EACH OF 41 SITES	47
11. TAXA OCCURRING AT LEVELS OF LESS THAN 0.5 PERCENT BY MONTH AND VEGETATION ZONE IN THE SUMMER DIET OF CATTLE	48

LIST OF FIGURES

Figure	Page
1. Map of the study area showing vegetation zones	4
2. Ponderosa Pine Type within the Ponderosa Pine Zone. Grassland Park can be seen in center of photo	11
3. Grassland Park Type within Ponderosa Pine Zone	11
4. <i>Rhus</i> -Grass Type within Ponderosa Pine Zone. Creek Bottom Type can be seen at the bottom of the photo and the Ponderosa Pine Type is along the sky-line	13
5. Agricultural Type in foreground, Creek Bottom Type in center, and Ponderosa Pine Type in background. All are within the Ponderosa Pine Zone	13
6. Juniper Type within Ponderosa Pine Zone	16
7. Grassland Type within the Grassland Zone with Ponderosa Pine Zone in background	16
8. Big Sage-Grassland Type within Big Sage-Grassland Zone . .	18
9. Map of the study area showing distribution of cattle and mule deer during the summers of 1970 and 1971 and mule deer during the winter of 1971	22
10. Map of study area showing location of permanent vegetation transects	45

ABSTRACT

A study was conducted on the Ft. Howes Ranger District of the Custer National Forest in southeastern Montana during the summers of 1970 and 1971 and the winter of 1971. The objectives were to obtain quantitative data on seasonal distribution, range use, food habits and interspecific relationships of mule deer and cattle. This was the initial phase of a long term study to evaluate the effects of rest rotation grazing systems for cattle on mule deer food habits and range use. The vegetation was described as constituting three zones: Ponderosa Pine, Big Sage-Grassland, and Grassland. Canopy coverages and frequencies of occurrence of the low-growing taxa were determined for the major vegetation types within each zone. Fifty permanent vegetation transects were established to allow for continuous evaluation of rangeland vegetation changes. Distribution of mule deer was determined by 890 deer observations. The Ponderosa Pine Zone accounted for 89 and 71 percent of the total deer observations for summer and winter, respectively. The Grassland Zone received no significant use. The Big Sage-Grassland Zone received minor use in summer but accounted for 29 percent of the winter deer observations. Cattle observations were split fairly evenly among the three zones. The Big Sage-Grassland Zone was used the heaviest by cattle. Food habits of mule deer were determined from the examination of 12 rumens and 54 feeding sites. Forbs composed 47 percent of the total summer diet while browse and grasses accounted for 51 and 1 percent, respectively. Skunkbush sumac was the single most important plant in the summer diet of mule deer. Use of forbs decreased from June to September while use of browse increased. Ninety-five percent of the mule deer feeding sites were in the Ponderosa Pine Zone. Rumen data disclosed 56 percent browse, 41 percent forbs and 3 percent grass for the October and November diet of mule deer. During winter big sagebrush and rubber rabbitbrush were the most important food items. Grass and grass-like plants accounted for 80 percent of the summer diet of cattle as determined from the examination of 32 feeding sites. Bluestem was the most important species. Use on grass increased from 79 percent in June to 93 percent in August. Browse and forbs each accounted for 10 percent of the summer diet. Fawn:doe ratios revealed low to fair productivity with 23 and 64 fawns per 100 does for the summers of 1970 and 1971, respectively. Data for the winter of 1971 showed 62 fawns per 100 does. There appeared to be some land use competition, but no significant forage competition between mule deer and cattle.

INTRODUCTION

In the past few years, there has been increasing interest in and use of rest rotation grazing systems (Hormay 1970) for the management of livestock. Use of this system allows key forage plants to recover during periods of rest from the effects of intensive grazing and/or browsing by hoofed mammals. The U. S. Forest Service is developing a rotation grazing management plan for cattle on the West O'Dell Allotment of the Custer National Forest, south of Ashland, Montana. The present system is season long continuous grazing. In the late 1800's large numbers of horses, and more recently (1938-1970), 1100 cattle grazed the area from May 1 to November 30. According to standards of the Forest Service only 40% of the allotment is in good or fair condition with 60% in poor or very poor condition. The permittees realize there is a problem with proper forage use and overgrazing. They have voluntarily cut back on the number of cattle and length of season for grazing. The future Forest Service objective is a discontinuous grazing system favoring rest rotation.

This area is also used by mule deer (*Odocoileus hemionus*). Little consideration for these animals has been included in objectives for rest rotation grazing plans. In early 1970 plans for a cooperative project between the Montana Fish and Game Department and the U. S. Forest Service were formulated to evaluate the effects of rest rotation grazing on mule deer. The plan included a field study prior to the

implementing of a rotation grazing system to be followed by a similar study after the new system was in operation. The study reported here is the initial phase.

The main objectives of the study, conducted during the summers of 1970 and 1971, and the winter of 1971, were: to obtain quantitative data on seasonal distribution, range use and food habits of mule deer and cattle on the West O'Dell Allotment; to evaluate interspecific relationships; and to establish permanent vegetation transects for continuous evaluation of rangeland vegetation changes.

DESCRIPTION OF STUDY AREA

The study area, referred to as the West O'Dell Allotment, comprises approximately 30,000 acres of the Ft. Howes Ranger District, Custer National Forest. It is located, as shown in Figure 1, between the Tongue River and one of its tributaries, O'Dell Creek, approximately 13 miles southwest of Ashland, Montana. About 1% of this area is privately owned with the rest being National Forest land.

Relief elevations range from about 3150 to 4200 feet (U. S. Forest Service 1971a). In the rough breaks of the major drainages, relief of 500 feet commonly occurs within distances of 1/4 mile. The allotment was formerly a high plateau, with an elevational plane of 4000 to 4100 feet, which is now deeply trenched on the northern, western, and eastern portions by long, narrow valleys with abrupt, steep side slopes. North and south facing slopes predominate. The major drainages flowing in an easterly to northeasterly direction are Frees, Green, and Hay Creeks, all emptying into O'Dell Creek. Hackley Creek runs southwesterly with Black Eagle, Poker Jim, Poker Teechee, and Gate Creek, all flowing northwesterly, emptying into the Tongue River.

The exposed consolidated sedimentary rocks prevalent on this allotment were formed in the Paleocene Age and consist of the Tongue River member of the Fort Union Formation (U. S. Forest Service 1971a). Quarternary Age alluvium deposits occur in the major stream bottoms.

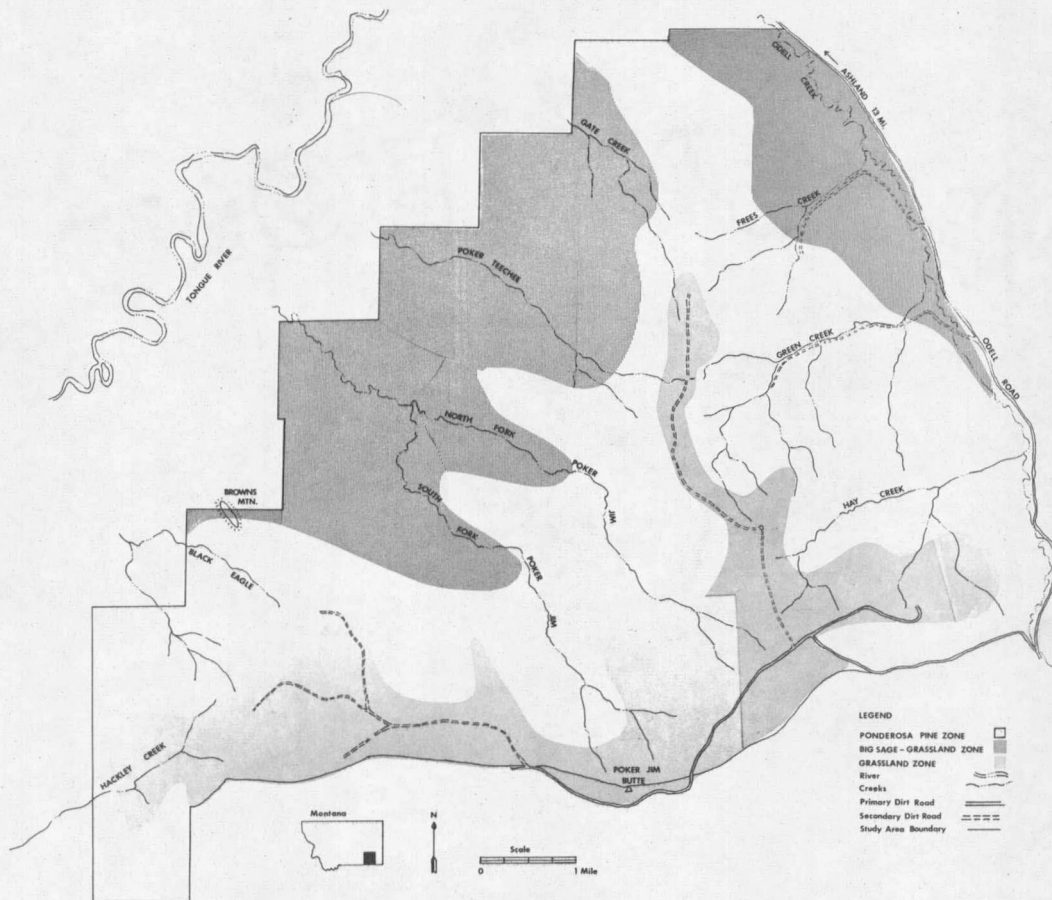


Figure 1. Map of the study area showing vegetation zones.

The Tongue River member consists of beds of shale, coal, and sandstone. Exposed sandstone commonly weathers to knobs, cliffs, and pinnacles. Clinker and baked porcellanite are characteristic of much of the area where burning coal beds underlaid the land surface.

Climate is characterized by cold winters and warm summers with a frost free growing period of approximately 105 days (U. S. Forest Service 1971b). Mean annual precipitation is estimated at approximately 15 inches. May and June are normally the months of greatest precipitation. Monthly variations can be found in Appendix, Table 9.

Vegetatively the allotment may be best described as a Ponderosa Pine (*Pinus ponderosa*) woodland interspersed with mixed grass prairie (U. S. Forest Service 1971b). Ponderosa Pine is a dominant and prevails on almost all the long, narrow valleys and north slopes. Rocky Mountain Juniper (*Juniperus scopulorum*) persists on lower slopes gradually fading into sagebrush-grassland at the lowest elevations.

METHODS

Vegetation

The vegetation of the study area was classified into three zones based on major vegetation characteristics. Each zone was subdivided into various types based on minor differences in vegetation characteristics. A reference collection of plants from the area was assembled to aid in the identification of the various species comprising the vegetation types. Common and scientific names followed Booth (1950) and Booth and Wright (1959). The low-growing species on the major types were quantitatively sampled by a method similar to that described by Daubenmire (1959). These vegetation measurements were recorded where mule deer and cattle feeding sites were obtained. At each site, the vegetation within twenty 2x5 decimeter plots was sampled. The plots were spaced at 5-foot intervals along each of two, 50-foot lines which were perpendicular to each other crossing at their centers. Canopy coverage and frequency for each low-growing taxon were estimated for each plot.

Permanent vegetation transects were established on most sites where vegetation measurements were taken. A can held in place by a 6-inch pipe driven in the ground marked the center of the site. A 6-foot metal fence post was placed 50 feet from the center of the site. A metal tag attached to the post identified the number of the transect, season and year established, and whether the transect was

a feeding site for deer or cattle.

Animal Distribution and Range Use

During the summers, deer and cattle were observed with the aid of a 7x35 binocular and a 20X spotting scope, either from a four-wheel drive vehicle or while on foot. In winter deer observations were also made from a snowmobile. To cover the study area as thoroughly as possible, established vehicle routes were followed, supplemented by random observations.

Deer observed were classified as to sex, adult or fawn, and activity. The area occupied was classified as to vegetation zone and type, slope and exposure. Cattle observations were recorded as to occurrence by vegetation zone and type. The approximate location of each observation of deer and cattle was plotted on both a topographic and planimetric map.

Food Habits

Fall food habits of mule deer were determined by examination of rumen samples from hunter-killed animals. A quart rumen sample was analyzed using a technique similar to that used by Wilkins (1957).

Summer and winter food habits of mule deer and summer food habits of cattle were determined by the use of feeding site examinations. Sites were examined shortly after being vacated by feeding animals. One bite on a plant constituted one instance of use as described by

Knowlton (1960). The number of instances of use for each species was computed as a percentage of the total for each feeding site. The aggregate percentage method (Martin *et al.* 1946) was used to tabulate by month and vegetation zone the results of feeding sites and by month for rumen samples.

In most cases, availability of various taxa on feeding sites was determined by the use of twenty 2x5 decimeter frames as previously described. These results when compared with the food habits data provided a basis for determining food preference.

Productivity

An index of productivity was determined for mule deer from male:female and fawn:doe ratios.

RESULTS

Vegetation

The vegetation within the study area was classified into three zones: Ponderosa Pine, Grassland, and Big Sage-Grassland (Figure 1). The species composition of vegetation zones and types for which quantitative measurements were taken are in Table 1 and Appendix, Table 10. The locations of these vegetation transects are shown in Appendix, Figure 10. Types not quantitatively studied but described from general observations include: Agricultural, Big Sage-Grassland, and Juniper Types within the Ponderosa Pine Zone; Big Sage-Grassland Type within the Grassland Zone; and the Agricultural, Creek Bottom, Juniper, and Silver Sage Types within the Big Sage-Grassland Zone.

Ponderosa Pine Zone

This was the major vegetation zone on the study area. It was found around the edge of plateaus, extending down into coulee heads, and along the long, narrow valleys, especially north slopes. This zone was divided into seven types.

Ponderosa Pine Type: The overstory was Ponderosa Pine varying from a dense canopy coverage with heavy seedling understory to extremely sparse, savannah-like coverage (Figure 2). Important shrubs were snowberry (*Symphoricarpos* spp.) and rose (*Rosa arkansana*) in the mesic coulee heads, and skunkbush sumac (*Rhus trilobata*) which became

TABLE 1. CONSTANCY, PERCENT CANOPY COVERAGE AND FREQUENCY OF LOW-GROWING TAXA FOR VEGETATION TYPES AS DETERMINED BY EXAMINATION OF TWENTY 2X5 DECIMETER PLOTS ON EACH OF 41 SITES.

Taxa ¹	PONDEROSA PINE ZONE				GRASSLAND ZONE	BIG SAGE-GRASSLAND ZONE	
	Grassland Park Type 11 Sites	Ponderosa Pine Type 6 Sites	Rhus-Grass Type 5 Sites	Creek Bottom Type 4 Sites	Grassland Type 8 Sites	Big Sage-Grassland Type 4 Sites	Grassland Type 3 Sites
GRASS AND GRASS-LIKE PLANTS:							
<i>Agropyron smithii</i>	73/9/50 ²	83/5/35	80/4/16	25/tr/1	100/10/68	75/17/54	100/17/77
<i>Agropyron spicatum</i>	27/2/10	50/5/21	60/3/19	25/3/13	13/tr/3	50/8/38	--
<i>Agropyron</i> spp.	9/2/9	--	--	75/2/9	--	--	--
<i>Andropogon gerardi</i>	27/1/5	67/18/41	--	25/tr/1	38/6/15	--	--
<i>Andropogon scoparius</i>	--	17/1/4	--	--	13/1/3	--	--
<i>Aristida longiseta</i>	18/tr ³ /1	17/tr/1	20/1/1	--	13/tr/1	--	--
<i>Bouteloua curtipendula</i>	45/5/18	83/9/30	80/7/23	--	38/3/13	25/7/20	--
<i>Bouteloua gracilis</i>	64/3/14	--	20/1/4	--	88/7/34	75/22/41	--
<i>Bromus japonicus</i>	73/5/26	50/4/18	40/5/17	25/tr/1	75/13/53	75/12/43	33/3/15
<i>Bromus tectorum</i>	55/24/45	33/tr/6	100/34/75	25/1/6	25/1/3	50/11/24	67/16/65
<i>Carex filifolia</i>	--	17/1/3	20/1/6	--	13/tr/1	--	67/7/27
<i>Carex</i> spp.	73/9/47	83/9/47	20/2/6	50/5/23	100/27/94	--	--
<i>Elymus cinereus</i>	--	--	--	25/1/3	--	--	--
<i>Festuca idahoensis</i>	36/4/14	83/19/60	20/7/13	50/12/30	38/7/25	--	--
<i>Festuca oviflora</i>	9/tr/tr	--	--	--	13/tr/2	50/1/6	33/1/3
<i>Koeleria cristata</i>	55/3/23	83/3/23	40/1/6	75/2/9	100/8/59	50/3/20	67/9/33
<i>Poa secunda</i>	64/5/36	33/tr/8	40/1/11	25/1/5	63/6/43	25/1/10	33/tr/2
<i>Poa</i> spp.	9/6/9	--	--	--	--	--	--
<i>Stipa comata</i>	55/5/24	100/8/37	60/6/30	--	75/10/36	50/4/19	33/12/32
<i>Stipa viridula</i>	64/4/23	83/5/23	--	100/8/34	100/5/28	25/2/16	100/8/30
Unidentified Grass	9/tr/1	17/6/13	20/tr/2	100/29/60	13/tr/1	--	--
Total Grass and Grass-Like	100/87/99	100/93/98	100/73/98	100/64/100	100/104/99	100/88/98	100/73/100
FORBS:							
<i>Achillea millefolium</i>	55/2/14	83/3/26	40/1/6	75/3/25	38/2/9	25/tr/5	33/5/33
<i>Ambrosia artemisiifolia</i>	73/9/47	50/1/14	80/2/18	--	63/2/19	--	--
<i>Antennaria parvifolia</i>	18/1/6	33/2/14	--	--	63/2/13	50/tr/3	--
<i>Artemisia dracunculoides</i>	18/tr/1	33/tr/3	20/1/2	25/tr/1	13/tr/1	--	--
<i>Artemisia frigida</i>	55/1/10	17/tr/2	40/1/6	25/tr/3	63/2/16	75/1/13	33/1/5
<i>Artemisia ludoviciana</i>	45/2/15	83/6/26	20/1/4	50/5/33	75/5/22	25/tr/1	--
<i>Aster oblongifolius</i>	55/3/19	83/2/16	--	50/2/14	75/2/11	50/tr/4	--
<i>Aster occidentalis</i>	--	--	--	25/1/8	--	--	--
<i>Aster</i> spp.	--	33/2/8	--	--	--	--	--
<i>Balsamorhiza sagittata</i>	9/tr/tr	--	--	50/3/13	--	--	--
<i>Chrysoopsis villosa</i>	9/1/4	--	--	--	--	--	--
<i>Collomia linearis</i>	--	33/tr/7	--	--	13/tr/1	--	--
<i>Cruciferae</i>	36/1/5	17/1/5	20/tr/2	--	13/tr/1	50/1/19	--
<i>Eurotia lanata</i>	--	--	--	25/tr/3	--	25/1/5	--
<i>Gaura oocinea</i>	64/1/10	50/1/5	20/tr/1	--	88/1/18	--	33/tr/3
<i>Geum triflorum</i>	--	33/tr/3	--	25/1/4	--	--	--
<i>Glycyrrhiza lepidota</i>	--	17/1/8	--	--	13/tr/1	--	--
<i>Gutierrezia sarothrae</i>	9/tr/2	17/tr/1	--	25/tr/1	38/2/8	50/6/34	--
<i>Helianthella uniflora</i>	--	17/1/4	--	--	--	--	--
<i>Kuhnia eupatorioides</i>	9/1/3	--	--	--	--	--	--
<i>Lactuca scariola</i>	27/3/16	17/tr/3	60/tr/7	--	--	--	--
<i>Lappula redowskii</i>	9/tr/tr	33/tr/3	20/1/4	--	--	--	--
<i>Linum perenne</i>	18/tr/1	33/tr/3	20/1/5	25/tr/1	--	--	--
<i>Lupinus</i> spp.	18/1/3	50/tr/3	--	--	13/tr/3	--	--
<i>Lygodesmia juncea</i>	--	33/tr/3	20/tr/2	--	13/tr/1	25/1/5	33/1/10
<i>Monarda fistulosa</i>	--	--	--	25/1/1	--	--	--
<i>Petalostemon purpureus</i>	27/1/5	--	--	--	25/1/3	--	--
<i>Petalostemon</i> spp.	27/tr/3	33/2/7	--	--	13/tr/1	--	--
<i>Phlox hoodii</i>	45/3/19	17/1/3	--	50/tr/3	63/2/10	75/6/25	--
<i>Phlox longifolia</i>	36/2/16	33/2/18	20/1/8	50/1/5	13/2/11	25/1/5	--
<i>Peoralea argophylla</i>	45/2/15	50/1/13	20/1/8	--	63/4/33	--	--
<i>Peoralea</i> spp.	18/tr/1	--	--	--	25/1/7	--	--
<i>Ratibida columnifera</i>	18/tr/1	--	--	50/1/5	13/tr/3	--	--
<i>Sieversia albidissima</i>	9/1/2	--	40/1/8	--	--	--	33/6/20
<i>Sphaeralcea oocinea</i>	45/1/9	33/tr/8	60/1/9	--	100/4/40	50/tr/10	67/1/8
<i>Taraxacum</i> spp.	9/tr/tr	--	--	--	13/1/6	25/tr/3	33/3/18
<i>Tragopogon dubius</i>	27/tr/4	33/tr/4	40/tr/3	25/tr/1	38/tr/5	25/tr/1	33/tr/2
<i>Yucca glauca</i>	9/1/1	17/3/5	60/3/5	--	--	25/1/1	--
Unidentified Forbs	45/1/5	50/1/5	40/tr/4	75/2/14	25/tr/2	25/tr/1	33/tr/2
Total Forbs	100/38/84	100/30/89	100/15/60	100/20/73	100/33/87	100/18/49	100/17/68
SHRUBS:							
<i>Artemisia cana</i>	--	--	--	50/3/15	13/tr/3	25/tr/5	33/tr/2
<i>Artemisia tridentata</i>	--	--	20/tr/1	--	--	75/5/20	--
<i>Berberis repens</i>	--	17/tr/1	--	50/2/13	--	--	--
<i>Pinus ponderosa</i>	--	33/2/5	--	25/1/1	--	--	--
<i>Pinus virginiana</i>	9/tr/tr	--	--	100/9/34	--	--	--
<i>Rosa arkansana</i>	45/1/9	67/3/17	--	100/15/65	38/1/7	25/tr/1	--
<i>Rhus glabra</i>	--	--	--	25/1/5	--	--	--
<i>Rhus trilobata</i>	45/4/8	50/2/4	100/23/42	100/11/19	--	--	--
<i>Ribes cereum</i>	--	--	--	50/1/8	--	--	--
<i>Ribes</i> spp.	--	--	--	25/1/4	--	--	--
<i>Symphoricarpos</i> spp.	27/tr/4	50/5/24	--	75/17/53	13/tr/6	--	--
Total Shrubs	64/5/19	67/12/38	100/23/42	100/61/91	38/1/11	100/5/51	33/tr/2
BARE GROUND:	91/17/77	100/9/59	80/9/35	100/8/36	100/10/80	100/12/61	100/21/83

¹Includes those taxa with a canopy coverage of .5 percent or greater or a frequency of 5 percent or greater in at least one type. Others are listed in Appendix.

²Constancy (percent occurrence among sites)/canopy coverage (percent of area covered)/average frequency (percent occurrence among plots).

³tr = trace; a value less than .5 percent.



Figure 2. Ponderosa Pine Type within the Ponderosa Pine Zone.
Grassland Park can be seen in center of photo.



Figure 3. Grassland Park Type within Ponderosa Pine Zone.

more prevalent in the sparser pine stands. Major forbs included yarrow (*Achillea millefolium*), cudweed sage (*Artemisia ludoviciana*), several asters (*Aster* spp.), and scarlet gaura (*Gaura coccinea*). This type had one of the most varied forb compositions of any type. The most common grasses were big bluestem (*Andropogon gerardi*), Idaho fescue (*Festuca idahoensis*), a sedge (*Carex* spp.), side-oats grama (*Bouteloua curtipendula*), needle and thread (*Stipa comata*), green needlegrass (*Stipa viridula*), bluebunch wheatgrass (*Agropyron spicatum*), and bluestem (*Agropyron smithii*).

Grassland Park Type: These open parks within the pine forest occurred on plateau tops and gently sloping sidehills (Figure 3). This type was as varied in floral composition as the Ponderosa Pine Type. The only major shrub was skunkbush sumac. Rose was sparsely scattered throughout the type. Major forbs were ragweed (*Ambrosia artemisifolia*), yarrow, cudweed sage, aromatic aster (*Aster oblongifolius*), wild lettuce (*Lactuca serriola*), Hood's phlox (*Phlox hoodii*), longleaf phlox (*Phlox longifolia*), scarlet globemallow (*Sphaeralcea coccinea*), and silverleaf scurfpea (*Psoralea argophylla*). The important grasses were bluestem, Japanese chess brome (*Bromus japonicus*), downy chess brome (*Bromus tectorum*), sedge, bluegrasses (*Poa* spp.), green needlegrass, needle and thread, and side-oats grama.

Rhus-Grass Type: This type was found on gentle to steep slopes (Figure 4). The only significant shrub was skunkbush sumac. Forbs were rather scarce except for occasional local concentrations.

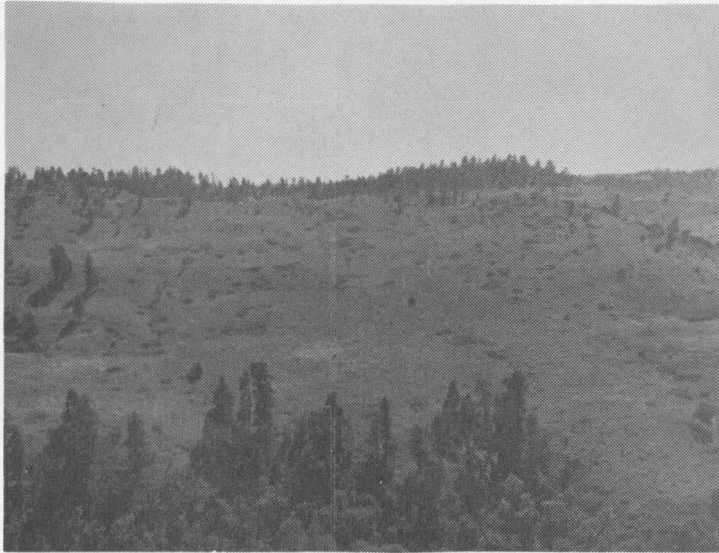


Figure 4. *Rhus*-Grass Type within Ponderosa Pine Zone. Creek Bottom Type can be seen at the bottom of the photo and the Ponderosa Pine Type is along the sky-line.



Figure 5. Agricultural Type in foreground, Creek Bottom Type in center, and Ponderosa Pine Type in background. All are within the Ponderosa Pine Zone.

Ragweed and soapweed (*Yucca glauca*) were the most predominant forbs. There were fewer species of grass associated with this type than previously mentioned types. The more prevalent grasses were downy chess brome, Japanese chess brome, side-oats grama, Idaho fescue, and needle and thread.

Creek Bottom Type: Green ash (*Fraxinus pennsylvanica*) was the dominant tree with an occasional box elder (*Acer negundo*). Serviceberry (*Amelanchier alnifolia*), snowberry, and rose were the most prevalent shrubs with skunkbush and chokecherry (*Prunus virginiana*) being fairly common. Some of the more prevalent forbs were yarrow, cudweed sage, aromatic aster, and balsamroot (*Balsamorhiza sagittata*). Major grasses were Idaho fescue, green needlegrass, and sedge.

Agricultural Type: This type included both alfalfa fields and abandoned meadows (Figure 5). The meadows contained common salsify (*Tragopogon dubius*) with some alfalfa (*Medicago sativa*), yellow sweetclover (*Melilotus officinalis*), scarlet gaura, and scarlet globemallow. Grasses were bluestem, Japanese chess brome, and green needlegrass.

Big Sage-Grassland Type: This was a minor type often found on steep slopes. The dominant shrub was big sage (*Artemisia tridentata*). Major forbs were fringed sage (*Artemisia frigida*), Hood's phlox, and snakeweed (*Gutierrezia sarothrae*). Prominent grasses were bluestem, blue grama (*Bouteloua gracilis*), downy brome, and Japanese brome.

Juniper Type: This type was an ecotone between the Ponderosa Pine Zone and the Big Sage-Grassland Zone (Figure 6). Rocky Mountain Juniper grew on the rough, rocky breaks down into the coulee bottoms. Solid stands were more obvious in the northwesterly flowing drainages. Various degrees of association existed between shrubs, forbs, and grasses within this type. Within the Ponderosa Pine Zone juniper was in association with and dominated by ponderosa pine. Understory plants were skunkbush, soapweed, Hood's phlox, asters, scarlet gaura, scarlet globemallow, bluebunch wheatgrass, and green needlegrass. Further down the ridges and coulees, juniper gained in abundance and in places occurred as almost pure stands. Understory vegetation was sparse. At the lower end of this ecotone juniper was found in association with big sagebrush and other species such as fringed sage, Hood's phlox, snakeweed, blue grama, bluestem, and bluebunch wheatgrass. The upper and lower boundaries of this ecotone were ill-defined due to patches of juniper occurring on favorable exposures extending up into the pine type or down into the sage-grassland.

Grassland Zone

This zone occurred on the open top of plateaus. It was comprised of two types.

Grassland Type: The major constituents of this type were the grasses (Figure 7). The most important grass species were bluestem, big bluestem, blue grama, Japanese brome, sedge, Idaho fescue,

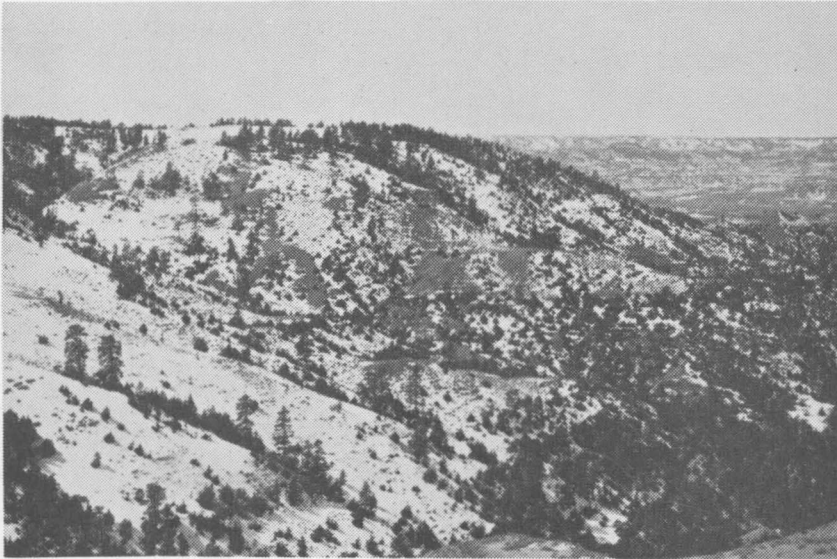


Figure 6. Juniper Type within Ponderosa Pine Zone.



Figure 7. Grassland Type within the Grassland Zone with Ponderosa Pine Zone in background.

junegrass (*Koeleria cristata*), sandberg bluegrass (*Poa secunda*), needle and thread, and green needlegrass. Forbs were not as abundant in this type as in the grassland type of the Ponderosa Pine Zone. Some of the more common forbs were cudweed sage, scarlet globemallow, silverleaf scurfpea, yarrow, ragweed, and pussytoes (*Antennaria parvifolia*). Rose was the only shrub of any significance.

Big Sage-Grassland Type: This was a minor type. Its distribution appeared to be influenced by exposure and related soil moisture. The dominant plant was big sagebrush with an understory of fringed sage, Hood's phlox, snakeweed, bluestem, blue grama, and bluegrass.

Big Sage-Grassland Zone

This zone usually occurred at the lowest elevations on the study area, mainly on the dried-up floodplains of major drainages (Figure 8). It was divided into six types.

Big Sage-Grassland Type: The dominant shrub was big sagebrush. The common forbs were fringed sage, snakeweed, and Hood's phlox. Major grasses were bluestem, bluebunch wheatgrass, side-oats grama, blue grama, downy brome, and Japanese brome.

Grassland Type: Scattered stands of the grassland type were found within the Big Sage-Grassland Zone. Yarrow, tumbled mustard (*Sisymbrium altissimum*), scarlet globemallow, and dandelion (*Taraxacum* spp.) were the most prevalent forbs. Dominant grasses



Figure 8. Big Sage-Grassland Type within Big Sage-Grassland Zone.

were bluestem, downy brome, Japanese brome, junegrass, needle and thread and green needlegrass.

Creek Bottom Type: Big sagebrush and rubber rabbitbrush (*Chrysothamnus nauseosus*) were the most abundant shrubs present. Other shrubs commonly found were saltbush (*Atriplex confertifolia*) and greasewood (*Sarcobatus vermiculatus*) with occasional Rocky Mountain Juniper. Most of the rest of the vegetation cover was composed of snakeweed and a sparse covering of grasses.

Agricultural Type: This was unused pasture which contained big sage, silver sage (*Artemisia cana*), common salsify, scarlet gaura, scarlet globemallow, green needlegrass, and needle and thread.

Silver Sage Type: This type was occasionally interspersed within the Big Sage-Grassland Type. Its presence was linked with mesic site conditions. Silver sage was the dominant plant with fringed sage, dandelion, snakeweed, green needlegrass, and bluestem as associates.

Juniper Type: This is the same type as described under the Ponderosa Pine Zone, but here referring to its extension into the Big Sage-Grassland Type. The juniper was found in patches with big sage-grassland parks intermixed. The major associated species were big sagebrush, snakeweed, Hood's phlox, fringed sage, bluestem, and bluebunch wheatgrass.

Distribution and Range Use

Mule Deer

Eight hundred and ninety observations of mule deer were recorded as to vegetation zone, type (Table 2), and location. Areas occupied by mule deer during the summers of 1970 and 1971 and the winter of 1971 are shown in Figure 9.

Summer: Eighty-nine percent of the total deer observations were in the Ponderosa Pine Zone. Thirty-one percent of these were in the Ponderosa Pine Type. Other types receiving significant use were *Rhus*-Grass and Juniper. The heaviest deer use of the Juniper Type was in the ecotone with the Ponderosa Pine. Together these three types accounted for approximately 71 percent of the total observations in the Ponderosa Pine Zone. The abundance of forbs and preferred shrubs plus the protection afforded by the pine cover probably accounted for the high use of this zone. Mackie (1970), working in the Missouri River Breaks of Montana, found the *Pinus-juniperus* type to be the single most important habitat type during summer for mule deer. Mackie (1970) also noted that variations in occurrence of mule deer on different types of habitat between seasons and years corresponded closely to changes in the availability of preferred forage and weather conditions. There was a noticeable difference in the utilization of vegetation types by mule deer during the two summers of my study. Compared to deer observations made during 1971, those in 1970 were

TABLE 2. PERCENT OF MONTHLY AND SEASONAL OBSERVATIONS OF MULE DEER FOR THE SUMMERS OF 1970 AND 1971 AND THE WINTER OF 1971 FOR EACH VEGETATION ZONE AND TYPE.

VEGETATION ZONE & TYPE	JUNE	JULY	AUG.	SEPT.	JUNE-SEPT.	JAN.	FEB.	MAR.	JAN.-MAR.
PONDEROSA PINE ZONE:									
Ponderosa Pine Type	3	10	7	7	27	15	6	11	32
Grassland Park	1	4	2	1	8	--	1	--	1
<i>Rhus</i> -Grass	1	6	6	4	17	--	--	--	--
Creek Bottom	1	2	1	tr	5	3	--	--	3
Agricultural	1	3	3	3	11	--	--	--	--
Big Sage-Grassland	tr ¹	1	1	tr	3	2	3	8	12
Juniper	<u>1</u>	<u>7</u>	<u>6</u>	<u>5</u>	<u>19</u>	<u>2</u>	<u>5</u>	<u>16</u>	<u>23</u>
Total	10	32	27	21	89	21	15	35	71
GRASSLAND ZONE:									
Grassland	--	--	tr	1	1	--	--	--	--
Big Sage-Grassland	--	--	--	--	--	--	--	--	--
Total	--	--	tr	1	1	--	--	--	--
BIG SAGE-GRASSLAND ZONE:									
Big Sage-Grassland	2	2	--	--	4	--	1	10	12
Grassland	--	--	--	--	--	--	--	--	--
Creek Bottom	1	--	--	--	1	--	--	--	--
Agricultural	2	1	tr	tr	3	--	--	--	--
Silver Sage	--	--	--	--	--	--	--	--	--
Juniper	<u>tr</u>	<u>2</u>	<u>--</u>	<u>--</u>	<u>2</u>	<u>1</u>	<u>3</u>	<u>13</u>	<u>17</u>
Total	4	5	tr	tr	10	1	5	23	29
No. of Deer Observations	92	247	186	143	668	50	44	128	222
Percent of total deer observations	14%	37%	28%	21%	100%	23%	20%	58%	100%

¹tr = trace. Less than .5 percent of the total animals occurring in a zone or type during a month or season.

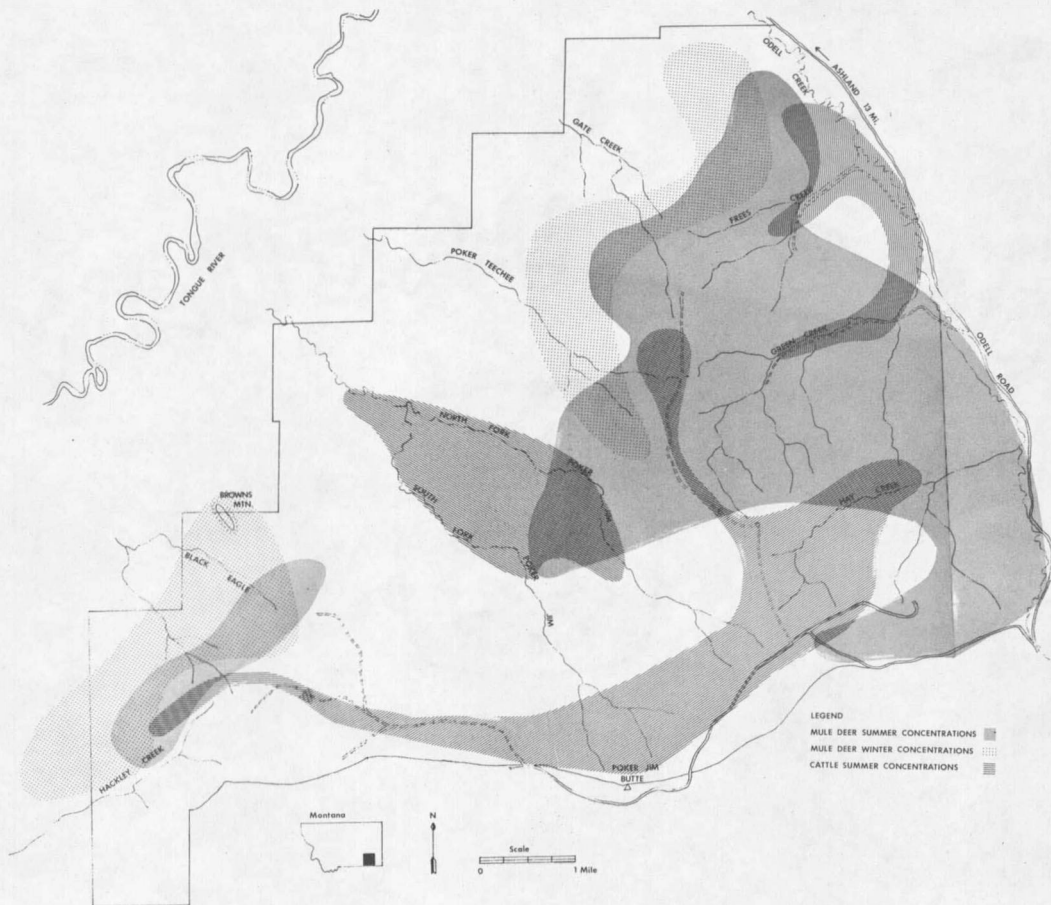


Figure 9. Map of the study area showing distribution of cattle and mule deer during the summers of 1970 and 1971 and mule deer during the winter of 1971.

fairly evenly distributed throughout the types of the Ponderosa Pine Zone, except for the Juniper Type which accounted for 33 percent of the observations in this zone. The two other important types, Ponderosa Pine and *Rhus*-Grass, together accounted for only 33 percent of the observations, whereas in 1971 sixty-three percent of the deer observations were in these types. The percent of observations within the Juniper Type decreased to 11 percent in 1971. In 1970 sixty-six percent of the total deer observations were in these three types within the Ponderosa Pine Zone and in 1971 seventy-four percent. These changes in habitat use may have been associated with drier conditions in the summer of 1971 which influenced the deer to seek out forbs in the moister sites and to use the browse skunkbush at an earlier date due to the earlier desiccation of forbs.

Mackie (1970) found what he called "buck habitat" areas with local concentrations of males. I recorded a difference in use of the *Rhus*-Grass Type by males and by females. In 1971 this type accounted for 19 percent of the males observed within the Ponderosa Pine Zone and 7 percent of the females. This differential use was probably related to exposure. The *Rhus*-Grass Type was most often on open hillsides. Possibly does with fawns avoided these areas at least during daylight hours.

The Big Sage-Grassland Zone accounted for 10 percent of all mule deer observations and the Grassland Zone 1 percent. In general, animals observed in these zones appeared to be traveling through.

Observations were fairly evenly distributed among vegetation types.

No differential monthly trends were apparent in any type.

Winter: Seventy-one percent of the total deer observations were in the Ponderosa Pine Zone as compared to 89 percent in summer. Forty-six percent of winter observations in this zone were in the Ponderosa Pine Type. This is a greater percentage than noted in the summer for this type, but this is due to concentrations of deer in winter on fewer types. The two other important types were Juniper and Big Sage-Grassland. These three types yielded 94 percent of the deer observations for this zone. The Ponderosa Pine and Juniper Types were important both summer and winter, but the Big Sage-Grassland only in winter. Use of the latter type appeared to compensate for non-use of the *Rhus*-Grass which was used significantly in summer. The use of the Juniper Type varied between summer and winter. As previously mentioned, in summer the deer used the upper part of the Juniper ecotone where it intergraded with the Ponderosa Pine. During winter the deer used the lower portion to a greater extent. They used this as escape cover when foraging on the Big Sage-Grassland plateaus and lower breaks.

The use of the Big Sage-Grassland Zone tripled from summer to winter. Twenty-nine percent of the total observations in winter were in this zone and all observations were confined to the Big Sage-Grassland and Juniper Types. Mackie (1970) found Sage-Grassland the major type used in winter with *Pinus-Juniperus* second. This seasonal change of habitat (Figure 9) was related to changes in food habits,

availability of food, and snow depth. Mackie (1970) stated similar conclusions. As compared to mule deer in more mountainous areas, these mule deer appeared to be non-migratory. There was considerable overlap between summer and winter ranges.

Cattle

The cattle on the West O'Dell Allotment are on a season long continuous grazing system. Cattle distribution is accomplished by herding, placement of salt blocks, and location of stock ponds and wells.

During the two summers, 1,101 observations of cattle were recorded as to occurrence on vegetation zones and types (Table 3). The Ponderosa Pine Zone had over one-third of the total observations. Over half of these were in the Grassland Park Type. The Grassland Park Type and the Big Sage-Grassland Type together accounted for 75 percent of the observations, and with the Ponderosa Pine Type, yielded 92 percent of all the observations within the Ponderosa Pine Zone.

The Grassland Zone produced less than one-third of the total cattle observations. Almost all of these observations were in the Grassland Type.

One-third of the total observations were in the Big Sage-Grassland Zone. The Big Sage-Grassland Type and Grassland Type included 70 percent and 17 percent of these observations respectively.

TABLE 3. PERCENT OF MONTHLY AND SEASONAL OBSERVATIONS OF CATTLE FOR THE SUMMERS OF 1970 AND 1971 FOR EACH VEGETATION ZONE AND TYPE.

VEGETATION ZONE & TYPE	JUNE	JULY	AUGUST	SEPTEMBER	JUNE-SEPTEMBER
PONDEROSA PINE ZONE:					
Ponderosa Pine Type	3	1	3	1	7
Grassland Park	3	10	5	2	19
<i>Rhus</i> -Grass	--	--	--	--	--
Creek Bottom	1	--	1	1	2
Agricultural	--	--	--	--	--
Big Sage-Grassland	3	2	3	--	7
Juniper	--	--	--	--	--
Total	9	13	11	3	36
GRASSLAND ZONE:					
Grassland	6	7	12	3	28
Big Sage-Grassland	--	1	--	1	2
Total	6	8	12	4	30
BIG SAGE-GRASSLAND ZONE:					
Big Sage-Grassland	--	10	2	12	24
Grassland	--	3	1	2	6
Creek Bottom	--	--	--	--	--
Agricultural	--	--	--	--	--
Silver Sage	--	3	--	1	4
Juniper	--	--	--	--	--
Total	--	15	3	15	34
No. of cattle observations	169	394	289	249	1101
Percent of total cattle observations	15%	36%	26%	23%	100%

The two major types in all three zones were the Grassland and Big Sage-Grassland. Eighty-six percent of all cattle observations were in these two types. Even though each zone provided about one-third of the cattle observations, differential use between zones could be readily seen. The Big Sage-Grassland Zone was the smallest, therefore its intensity of use was greatest. Part of this was due to topography. This zone was at the lowest elevations. It was the most accessible which partially accounted for the release of cattle here at the beginning of the season.

The Grassland Zone ranked second in intensity of use, but there was a great deal of movement between this zone and the Ponderosa Pine Zone. The cattle fed in early morning and evening and rested in the timber during midday. The Grassland Parks of the Ponderosa Pine Zone were often easily accessible from the Grassland Zone and cattle moved between these areas. No differential monthly trends were apparent in any type.

The creek bottoms were used heavily all season, especially as cover during the heat of the day.

Food Habits

Mule Deer

Trends in mule deer food habits were determined from the examination of 54 feeding sites for the summers of 1970 and 1971 and the winter of 1971 (Tables 4 & 5).

TABLE 4. SUMMER, FALL AND WINTER FOOD HABITS OF MULE DEER BY SEASON AND MONTH AS DETERMINED FROM THE EXAMINATION OF 54 FEEDING SITES AND THE CONTENTS OF 12 RUMENS.

Taxa ¹	SUMMER				FALL				WINTER			
	June 11 Sites 768 ²	July 11 Sites 972	August 13 Sites 1,515	Seasonal Average 35 Sites 3,255	September 5 Sites 152	October 7 Rumens 7 Rumens	November 5 Rumens 5 Rumens	Seasonal Average	January 2 Sites 131	February 4 Sites 2,084	March 10 Sites 3,639	Seasonal Average 16 Sites 5,854
GREEN GRASS:	--	--	1/15	tr/5	--	2/71	4/40	2/	--	--	1/10	tr/3
FORBS:												
<i>Artemisia frigida</i>	--	--	--	--	2/33	--	--	1/	--	--	--	--
<i>Aster oblongifolius</i>	--	--	--	--	--	9/57	tr/20	3/	--	--	--	--
<i>Aster occidentalis</i>	--	--	2/8	1/3	--	--	--	--	--	--	--	--
<i>Aster</i> spp.	--	--	1/8	tr/3	--	4/57	--	1/	--	--	--	--
<i>Astragalus drummondii</i>	1/9 ³	--	--	tr/3	--	--	--	--	--	--	--	--
<i>Astragalus</i> spp.	2/9	9/9	1/8	4/9	--	--	--	--	--	--	--	--
<i>Balsamorhiza sagittata</i>	--	--	--	--	--	--	2/20	1/	--	--	--	--
<i>Cirsium undulatum</i>	--	--	--	--	--	5/29	5/40	3/	--	--	--	--
<i>Collomia linearis</i>	1/9	--	--	tr/3	--	--	--	--	--	--	--	--
<i>Glycyrrhiza lepidota</i>	--	--	--	--	--	--	1/20	tr/	--	--	--	--
<i>Grindelia squarrosa</i>	--	--	--	--	--	--	--	--	--	--	1/10	tr/3
<i>Lactuca serriola</i>	2/18	21/27	1/8	8/18	--	--	--	--	--	--	--	--
<i>Medicago sativa</i>	4/9	9/9	23/23	12/14	--	1/29	tr/20	tr/	--	--	--	--
<i>Phlox hoodii</i>	--	--	--	--	--	--	--	--	--	--	7/40	2/13
<i>Sesuvio canus</i>	--	--	6/8	2/3	--	--	--	--	--	--	--	--
<i>Taraxacum</i> spp.	--	--	--	--	33/33	--	--	11/	--	--	--	--
<i>Tragopogon dubius</i>	45/55	11/18	tr/8	19/27	--	--	8/20	3/	--	--	--	--
<i>Yucca glauca</i>	4/18	--	--	1/6	--	4/29	tr/20	1/	--	tr/25	6/70	2/32
Unidentified Forbs	1/9	--	--	tr/3	--	16/86	26/100	14/	--	--	--	--
Total Forbs	60/100	50/55	34/62	47/72	35/67	39/100	42/100	39/	--	tr/25	14/80	4/35
SHRUBS:												
<i>Artemisia cana</i>	tr/9 ⁴	--	--	tr/3	--	tr/14	6/40	2/	35/50	2/50	18/30	18/43
<i>Artemisia tridentata</i>	--	--	--	--	--	--	--	--	--	38/100	35/70	24/57
<i>Atriplex confertifolia</i>	--	--	--	--	--	--	--	--	--	--	1/10	tr/5
<i>Chrysothamnus nauseosus</i>	--	--	--	--	--	1/29	tr/20	tr/	--	48/75	14/40	21/38
<i>Juniperus scopulorum</i>	--	--	--	--	--	tr/14	7/40	2/	4/40	2/25	5/30	4/35
<i>Pinus ponderosa</i>	--	--	--	--	--	1/29	1/40	1/	12/50	--	2/30	5/27
<i>Prunus virginiana</i>	--	--	7/23	2/8	--	--	--	--	--	--	--	--
<i>Rosa arkansana</i>	12/27	1/9	11/54	8/30	--	3/86	tr/20	1/	--	--	--	--
<i>Rhus trilobata</i>	27/37	47/55	49/62	41/51	64/66	17/43	38/80	40/	50/50	12/25	9/50	24/42
<i>Symphoricarpos</i> spp.	--	--	--	--	--	33/86	tr/40	11/	--	--	--	--
Unidentified Shrubs	--	--	--	--	--	4/43	tr/20	1/	--	--	--	--
Total Shrubs	39/55	48/55	67/38	51/49	64/67	59/100	52/100	58/	101/100	102/100	84/100	96/100

¹Includes taxa occurring at a level of at least .5 percent in at least one month or season. Plants occurring at levels of less than .5 percent in all months and seasons include the following: *Artemisia ludoviciana*, *Atriplex nuttallii*, *Berberis repens*, *Cryptantha bradburiana*, *Gaura coccinea*, *Geum* spp., *Petalostemon* spp., *Ribes* spp., *Sisymbrium altissimum*.

²The number of instances of use.

³Percent of monthly or seasonal diet/frequency (percent occurrence among sites or rumens).

⁴tr = trace, percent of diet is less than .5 percent.

TABLE 5. SUMMER AND WINTER FOOD HABITS OF MULE DEER BY VEGETATION ZONE AS DETERMINED FROM THE EXAMINATION OF 54 FEEDING SITES DURING THE PERIOD OF JUNE-SEPTEMBER 1970 AND 1971 AND JANUARY-MARCH 1971.

Taxa ¹	SUMMER		WINTER	
	Ponderosa Pine 36 Sites 3,167 ²	Big Sage-Grassland 2 Sites 240	Ponderosa Pine 11 Sites 3,490	Big Sage-Grassland 5 Sites 2,364
GRASSES:	1/15 ³	--	1/9	--
FORBS:				
<i>Aster occidentalis</i>	1/3	--	--	--
<i>Astragalus</i> spp.	4/8	--	--	--
<i>Grindelia squarrosa</i>	--	--	1/9	--
<i>Lactuca serriola</i>	7/17	--	--	--
<i>Medicago sativa</i>	12/14	--	--	--
<i>Phlox hoodii</i>	--	--	5/27	3/20
<i>Senecio canus</i>	2/3	--	--	--
<i>Taraxacum</i> spp.	3/3	--	--	--
<i>Tragopogon dubius</i>	12/19	100/100	--	--
<i>Yucca glauca</i>	1/6	--	2/45	9/60
Total Forbs	43/69	100/100	8/45	12/80
SHRUBS:				
<i>Artemisia cana</i>	tr/3 ⁴	--	23/45	tr/20
<i>Artemisia tridentata</i>	--	--	30/54	34/100
<i>Atriplex confertifolia</i>	--	--	1/9	--
<i>Chrysothamnus nauseosus</i>	--	--	15/36	34/60
<i>Juniperus scopulorum</i>	--	--	6/45	--
<i>Pinus ponderosa</i>	--	--	4/36	--
<i>Prunus virginiana</i>	2/8	--	--	--
<i>Rosa arkansana</i>	8/31	--	--	--
<i>Rhus trilobata</i>	46/56	--	12/36	20/60
Total Shrubs	56/67	--	91/100	88/100

¹Includes taxa occurring at a level of at least .5 percent in at least one season in one zone. Plants occurring at less than this level include the following forbs: *Artemisia frigida*, *Aster* spp., *Astragalus drummondii*, *Collomia linearis*, *Cryptantha bradburiana*, *Gaura coccinea*, *Geum* spp., *Petalostemon* spp., *Sisymbrium altissimum*, unidentified forbs.

²The number of instances of use per season in a vegetation type.

³Percent of seasonal diet in a vegetation type/frequency (percent occurrence among samples).

⁴tr = trace, percent of diet is less than .5 percent.

Summer: Forbs constituted 47 percent of the summer diet.

Common salsify, alfalfa, and wild lettuce were the three most important forbs in the mule deer diet (Table 4). By comparing the use of these species with their availability in the community (Table 1), it was evident that these forbs were sought out by deer. Common salsify had less than a .5 percent canopy coverage in any of the seven vegetation types that were examined quantitatively. Its seasonal average in the diet was 19 percent. It grew mainly in abandoned meadows. Alfalfa was sought out by deer wherever it was available. Wild lettuce had a canopy coverage of 3 percent in its densest stands. Its seasonal average in the diet was 8 percent. From observing deer it was obvious they would utilize this forb wherever it was found. There is some doubt as to the validity of comparing canopy coverage of a species to its percent in the diet as an expression of preference. Deer preference towards a species probably changed throughout the summer based on the availability and condition of that as well as other species.

Common salsify was used heaviest in June along with soapweed and alfalfa. Wild lettuce reached its peak use in July. Common salsify, alfalfa, and *Astragalus* spp. were also utilized during this month. Alfalfa gained in importance throughout the summer with August feeding sites containing the highest percentage of alfalfa use. Spot-lighting deer in alfalfa fields during September indicated that this use

continued to increase. This observation is in accord with what Egan (1957) found while working on mule deer use of alfalfa fields in the same general area in 1956 and 1957. This high use appeared to be directly related to desiccation of forbs on the uplands. Skunkbush and rose were the two main browse species utilized throughout the summer. Comparing usage of rose with its canopy coverages in the various plant communities, it appeared to be a preferred species. Browse constituted 51 percent of the summer diet (Table 4). This was mainly due to the heavy use of skunkbush, which made up 41 percent of the total summer diet. This may be somewhat biased due to the greater observability of deer while feeding in the *Rhus*-Grass Type and the ease with which a feeding site could be obtained on this browse species. I noted use of skunkbush earlier in the season the second summer. Since drier conditions prevailed in 1971, earlier desiccation of forbs probably influenced the early use of skunkbush. It continued to gain in importance throughout the summer (Table 4). Skunkbush appeared to be the single most important species in the mule deer summer diet for the area. Mackie (1970) also considered skunkbush to be the most important plant. Grass formed an insignificant part of the diet.

Use of forbs decreased from 60 percent of the diet in June to 34 percent in August while browse usage increased from 39 percent in June to 67 percent in August.

Ninety-five percent of all deer feeding sites were in the Ponderosa Pine Zone (Table 5).

Fall: Twelve rumen samples obtained from hunter-killed mule deer during fall of 1970 and 1971 were analyzed (Table 4). Forbs made up 39 percent of the diet during October with unidentified forbs prevailing. Important identifiable forbs were aromatic aster, *Aster* spp., wavyleaf thistle (*Cirsium undulatum*) and soapweed. The author feels that the *Aster* spp. and possibly the thistle were eaten by deer during the summer, but due to growth form and sparseness in the community were not picked up during feeding site examinations. Important browse species were skunkbush, snowberry, and rose. Snowberry was the most important taxon for the month making up one-third of the diet. Grass comprised 2 percent of the diet. The percentage of forbs in the diet rose slightly in November. Besides unidentified forbs, common salsify and wavyleaf thistle were important species. Skunkbush was the most prevalent browse in the November diet, replacing snowberry. This was partially due to the areas from which the deer were taken. The majority of the October samples were from an area which favored growth of snowberry. Evergreens such as silver sage and Rocky Mountain Juniper appeared in the November diet of mule deer in substantial amounts. The rumen data indicated a higher percentage of forbs at this time of year than was suggested by the trend of summer feeding sites. Grass made up 4 percent of the diet for November. This was mostly due to a green-up from increased fall precipitation.

Winter: Browse comprised 96 percent of the mule deer winter diet (Table 4). Big sagebrush and rubber rabbitbrush were the predominant items. They appeared to have about equal importance in the diet totaling 45 percent of the food items for January through March. In February and March their percentages in the diet were approximately twice that of their canopy coverages in the plant community (Tables 4 & 6). Rubber rabbitbrush dropped in importance in March much faster than big sagebrush. Skunkbush appeared to be an important species in the diet but this resulted from biased observations. Only two feeding sites were obtained in January and skunkbush comprised 50 percent of the instances of use. This browse probably made up about 10 percent of the winter diet as determined by observations during the other winter months. Silver sage was the third heaviest used taxon. Ponderosa Pine and Rocky Mountain Juniper were used in small but persistent quantities throughout the winter.

By March deer began foraging on forbs. Browse decreased from 100 percent of the diet in January to 84 percent in March and forbs increased from zero to 14 percent. With the receding snow cover deer utilized dried forbs such as curlcup gumweed (*Grindelia squarrosa*), common salsify, and others not appearing in the table because of difficulties in obtaining quantitative data on usage. Hood's phlox and soapweed, which were green, were important in the diet during March. Green grass comprised 1 percent of this months diet.

TABLE 6. PERCENT CANOPY COVERAGE AND FREQUENCY OF LOW-GROWING TAXA FOR VEGETATION TYPES DURING LATE WINTER (MARCH) AS DETERMINED BY EXAMINATION OF TWENTY 2X5 DECIMETER PLOTS ON EACH OF 10 SITES.

Taxa	BIG SAGE-GRASSLAND ZONE		PONDEROSA PINE ZONE	
	Big Sage-Grassland Type	Creek Bottom Type 2 Sites	Big Sage-Grassland Type 2 Sites	Ponderosa Pine Type 2 Sites
FORBS:				
<i>Artemisia dracunculul</i>	1/1 ¹	--	--	--
<i>Artemisia frigida</i>	1/5	--	--	--
<i>Artemisia ludoviciana</i>	--	--	--	tr/2
<i>Aster</i> spp.	--	1/5	--	--
<i>Cirsium undulatum</i>	tr/1 ²	--	--	--
Cruciferae	tr/1	tr/2	--	--
<i>Cryptantha bradburiana</i>	--	--	tr/2	--
<i>Echinaceae pallida</i>	--	--	--	1/5
<i>Eurotia lanata</i>	--	--	3/7	--
<i>Grindelia squarrosa</i>	--	2/15	--	tr/5
<i>Gutierrezia sarothrae</i>	tr/5	2/15	4/20	tr/2
<i>Linum perenne</i>	--	--	--	tr/5
<i>Mentzelia</i> spp.	tr/1	--	--	--
<i>Opuntia polyacantha</i>	--	tr/2	--	--
<i>Phlox hoodii</i>	2/15	tr/2	3/22	2/10
<i>Psoralea esculenta</i>	--	--	tr/2	--
<i>Solidago</i> spp.	--	tr/2	--	--
<i>Tragopogon dubius</i>	tr/1	tr/2	tr/2	tr/5
<i>Yucca glauca</i>	tr/1	tr/2	15/30	--
Unidentified Forbs	tr/4	tr/2	1/10	--
Total Forbs	4/30	5/42	26/37	3/30
SHRUBS:				
<i>Artemisia tridentata</i>	17/47	3/15	3/27	--
<i>Atriplex nuttallii</i>	1/2	1/10	--	--
<i>Chrysothamnus nauseosus</i>	--	14/40	--	--
<i>Juniperus scopulorum</i>	--	tr/2	--	tr/2
<i>Rhus trilobata</i>	1/4	--	--	13/30
<i>Sarcobatus vermiculatus</i>	2/7	12/30	--	--
Total Shrubs	21/55	30/50	3/27	13/30
GRASS:				
Dried Grass	20/70	19/72	38/92	21/45
Green Grass	3/16	tr/7	1/12	1/17
Total Grass	23/70	19/72	39/92	22/45
SNOW:	18/22	17/22	--	59/70
BARE GROUND:	24/36	41/62	28/72	4/10
ROCK:	10/24	4/17	8/55	tr/12

¹Canopy coverage (percent of area covered)/frequency (percent occurrence among plots).

²tr = trace, a value less than .5 percent.

One-third of the feeding sites were in the Big Sage-Grassland Zone. The predominant species utilized were big sagebrush and rubber rabbitbrush (Table 5). They each comprised equal percentages of the diet for this vegetation zone, but rubber rabbitbrush must have been preferred since it was much less prevalent than big sage. Two-thirds of the feeding sites were in the Ponderosa Pine Zone. The three most common species in the diet for this zone in order of usage were big sage, silver sage, and rubber rabbitbrush. Food habits were very similar to those reported by Mackie (1970).

Cattle

Summer food habits of cattle were determined by the examination of 32 feeding sites and the recording of 3,260 instances of use, Table 7 and Appendix, Table 11.

Grasses, forbs, and shrubs accounted for 80, 11, and 11 percent of the diet respectively. The percentage of grass in the diet continued to increase from June through August, however, it dropped off in September due to a large increase in browse consumption. Bluestem was the most important species overall. It made up 23 percent of the cattle summer diet. Other important grasses were big bluestem and sedge. The use of forbs remained fairly constant throughout the summer. Use was low, 11 percent, as compared with other studies. Firebaugh (1969) showed that forbs formed 28 percent of the diet and Dusek (1971) recorded 26 percent. Forbs appeared to be taken incidentally while

TABLE 7. FOOD HABITS OF CATTLE BY SEASON, MONTH AND VEGETATION ZONE AS DETERMINED BY EXAMINATION OF 32 FEEDING SITES DURING THE SUMMERS OF 1970 AND 1971.

Taxa ¹	MONTHS					ZONES		
	June 6 Sites 547 ²	July 7 Sites 621	August 10 Sites 1,118	September 9 Sites 974	June-Sept. 32 Sites 3,260	Ponderosa Pine 10 Sites 1,094	Big Sage-Grassland 11 Sites 1,076	Grassland 11 Sites 1,090
GRASS AND GRASS-LIKE PLANTS:								
<i>Agropyron smithii</i>	14/67 ³	24/100	29/70	23/56	23/73	19/70	37/73	13/73
<i>Agropyron spicatum</i>	--	1/14	--	--	tr/4	1/10	--	--
<i>Andropogon gerardi</i>	29/50	8/57	4/10	--	10/29	15/40	--	11/36
<i>Bouteloua curtipendula</i>	2/17	1/29	tr/10	tr/11	1/17	1/30	tr/9	1/9
<i>Bouteloua gracilis</i>	1/33	4/57	3/20	6/56	4/42	1/30	4/45	5/45
<i>Bromus japonicus</i>	--	--	5/30	1/22	2/13	--	1/18	5/27
<i>Bromus tectorum</i>	1/17	--	tr/10	--	tr/7	tr/10	--	tr/9
<i>Calamovilfa longifolia</i>	--	7/14	--	--	2/4	5/10	--	--
<i>Carex</i> spp.	25/83	18/71	22/50	--	16/51	17/60	--	28/82
<i>Festuca idahoensis</i>	1/33	1/14	2/20	--	1/17	3/40	--	tr/9
<i>Koeleria cristata</i>	--	--	tr/10	2/22	1/8	--	2/18	tr/9
<i>Poa secunda</i>	3/33	--	10/40	8/11	5/21	5/30	--	13/36
<i>Stipa comata</i>	tr/17 ⁴	13/43	17/80	--	8/35	5/30	6/27	14/55
<i>Stipa viridula</i>	3/33	5/43	1/30	17/44	7/38	2/40	14/45	4/27
Total Grass and Grass-Like	79/83	82/100	93/100	57/67	80/88	74/90	64/73	94/100
FORBS:								
<i>Ambrosia artemisiifolia</i>	--	--	1/20	tr/11	tr/8	1/20	tr/9	--
<i>Aster oblongifolius</i>	1/33	1/29	2/20	--	1/21	3/40	--	tr/18
<i>Aster</i> spp.	--	2/14	--	--	1/4	--	--	1/9
<i>Eurotia lanata</i>	--	--	--	11/11	3/3	--	9/9	--
<i>Glycyrrhiza lepidota</i>	--	--	1/10	--	tr/3	1/10	--	--
<i>Lupinus</i> spp.	--	4/29	--	--	1/7	3/20	--	--
<i>Melilotus officinalis</i>	--	--	2/10	--	1/3	2/10	--	--
<i>Petalostemon</i> spp.	--	1/29	--	--	tr/7	tr/10	--	tr/9
<i>Taraxacum</i> spp.	tr/17	--	--	1/22	tr/10	--	1/18	tr/19
<i>Tragopogon dubius</i>	2/17	1/43	--	--	1/15	1/20	--	1/22
<i>Yucca glauca</i>	5/17	1/14	--	--	2/8	1/10	3/9	--
Unidentified Forbs	1/17	1/14	1/20	--	1/13	1/30	--	1/9
Total Forbs	9/83	11/71	7/50	12/33	11/59	13/80	13/36	3/55
SHRUBS:								
<i>Rosa arkansana</i>	1/33	1/29	--	5/11	2/18	5/40	--	tr/9
<i>Sarcobatus vermiculatus</i>	12/17	--	--	20/22	8/10	--	23/27	--
<i>Symphoricarpos</i> spp.	--	3/14	tr/10	6/11	2/9	7/30	--	--
Total Shrubs	13/50	4/29	tr/10	31/33	11/31	12/50	23/27	tr/9

¹Taxa occurring at a level of .5 percent or more in the diet in at least one month or zone.

²The number of instances of use.

³Percent of the diet by month, season or vegetation zone/frequency (percent occurrence among sites).

⁴tr = trace, percent of the diet is less than .5 percent.

feeding on grass with no preference shown. Winterfat (*Eurotia lanata*) and the seed heads of soapweed were the most utilized forbs. Greasewood accounted for most of the browse use in early summer. In September browse use increased with rose and snowberry taken in moderate amounts. The author feels that the percentage of browse noted in the diet may be a little high. Browse was recorded in only a minority of feeding sites, but the instances of use were high. I also noted that cattle used Japanese brome, downy chess brome, and bluegrass much more than the feeding sites indicated. Cattle would pull up cheatgrass by the roots, chew on the seed heads, and spit out the stems. A culm of bluegrass could be pulled out of the base of a plant without leaving any trace of having been removed. These characteristics made it difficult to fully evaluate the importance of these species.

For June, bluestem, big bluestem, and sedge were the major grasses, and soapweed the most prevalent forb in the diet (Table 7). During July bluestem and the sedge were still prominent but big bluestem dropped off and was replaced by needle and thread. *Lupinus* spp. was the most commonly used forb. The bulk of the diet during August was bluestem, sedge, needle and thread, with bluegrass reaching its highest use. Bluestem and green needlegrass were the main grasses used in September with bluegrass and blue grama utilized in moderate amounts. Browsing increased substantially during this month.

One-third of the feeding sites were in the Ponderosa Pine Zone (Table 7). Grasses formed 74 percent of the diet. Bluestem, big bluestem, sedge, aromatic aster, lupine, rose, and snowberry were the principal species utilized. The Big Sage-Grassland Zone also contained one-third of the feeding sites. Grasses only made up 64 percent of the diet. This was due to the heavy use of greasewood which constituted 23 percent of the diet for this zone. Other major species were bluestem, green needlegrass, winterfat, and soapweed. Bluestem reached its greatest utilization in this zone. Grass comprised 94 percent of the cattle diet in the Grassland Zone. Forb usage was minor and browse usage insignificant. The major grasses were bluestem, big bluestem, sedge, bluegrass, and needle and thread.

The major grasses, bluestem, big bluestem, sedge, bluegrass, green needlegrass, and needle and thread were all present in the diet of cattle in much larger quantities than they were present in the plant community (Table 1). This gives some indication that these grasses were preferred, at least among those plants available.

Productivity

Classifying deer to age and sex provided data for determining fawn:doe ratios and hence productivity, Table 8. Data for the period June 15-September 20 of 1970 indicated the ratio was 19:100. For July 15-September 20 the ratio was 18:100 and if only August 15-September 20 data were utilized, the ratio was 23:100. The same

TABLE 8. SEX AND AGE CLASSES OF MULE DEER AS DETERMINED BY GROUND OBSERVATIONS FOR THE SUMMERS OF 1970 AND 1971 AND THE WINTER OF 1971.

Time Period	Total Observed	ADULTS			Fawns	RATIOS	
		Male	Female	Uncl.		Males: 100 Females	Fawns: 100 Females
June 15-30							
1970	27	19	8	--	--	238	--
1971	65	36	25	1	3	144	12
July 1-31							
1970	121	73	35	3	10	209	29
1971	126	66	40	7	13	165	33
August 1-31							
1970	94	42	37	11	4	114	11
1971	92	47	29	5	11	121	38
September 1-20							
1970	68	32	26	4	6	123	23
1971	75	20	30	4	21	67	70
Total June 15- September 20							
1970	310	166	106	18	20	157	19
1971	358	169	124	17	48	136	39
January 12- February 15							
1971	58	20	21	4	13	95	62

consideration for 1971 gave the ratios of 39:100, 47:100, and 64:100. Due to the increasing activity of fawns throughout the summer the most valid ratios appeared to be those for the last month of each summer, August 15-September 20. For this period during the summers of 1970 and 1971, the ratios were 23 and 64 fawns per 100 does, respectively. These ratios are low and indicate very poor to fair productivity. Mackie (1972) felt that 50 to 55 fawns per 100 does would maintain a stable population in the Missouri River Breaks, an area generally similar to this one. The second summer's data are comparable to Dusek's (1971) figures for prairie habitat and Firebaugh's (1969) for the Pryor Mountains in Montana.

Data for the winter of 1971 showed 62 fawns per 100 does, but this figure is based on a rather small sample. Fall and early winter figures for the Missouri River Breaks (Mackie 1970) showed ratios from 40 to 86 fawns per 100 does.

Summer male:female ratios were 157 and 136 males per 100 females for 1970 and 1971, respectively. The winter ratio was 95 males per 100 females. I have no explanation for these extremely high ratios. They seem to conflict in principal with the low fawn:doe ratios. Low fawn:doe ratios as well as low adult male:female ratios have been noted on over-used range (Gunvalson *et al.* 1952). For two summers Firebaugh (1969) reported 54 and 71 males per 100 females and Dusek (1971) reported comparable ratios of 42 and 87.

DISCUSSION

Smith and Julander (1953) expressed competition between mule deer and livestock in two ways, forage competition and land use competition. Forage competition implies forage species used in common are inadequate for the requirements of both animals. Land use competition may exist where no forage competition is present in the sense that an administrator may increase the number of one class of animals at the expense of another without exceeding proper use of any forage species. These considerations are important for both the immediate and long range objectives of this study, which is to be continued at a future date following the implementing of a rest rotation grazing system for cattle. The immediate goal was to collect data on seasonal distribution, range use, food habits and interspecific relationships of mule deer and cattle under present conditions of management. The long term objective is to evaluate the effects of a rest rotation grazing system for cattle on the food and range use habits of mule deer that occupy the same range.

Eighty-nine percent of all deer observations in summer were in the Ponderosa Pine Zone and within this zone they utilized the Ponderosa Pine, *Rhus*-Grass, and Juniper Types. Most cattle in this zone were found in the Grassland Park Type. Sixty-four percent of all cattle observations were in the Grassland and Big Sage-Grassland Zones which the deer hardly utilized. When the deer moved into the Big Sage-Grassland Zone during winter cattle were concentrated on feeding lots.

Plants used in summer by cattle were generally not the same plants used in winter by deer in this zone. Deer were most often seen on steep slopes and ridges and cattle on plateaus and rolling hills.

Summer food habits differed substantially between the two species. Eighty percent of the cattle diet was grass. Ninety-nine percent of the mule deer diet was forbs and shrubs. There appeared to be no direct forage competition under present conditions. Dusek (1971) made the statement "In areas where a systematic grazing program is not employed, an overgrazed range may cause cattle to use more deciduous shrubs . . ." On my area mule deer were seldom observed in creek bottoms where rose, chokecherry, and snowberry were common. Heavy use of these bottoms by cattle possibly precluded the use of the bottoms by deer. A lesser use by cattle possibly would favor greater use by deer which might include increased use of the three aforementioned shrubs. If these assumptions are correct, some land use competition may exist. Firebaugh (1969) suggested an avoidance by deer of areas of cattle concentrations. Whether the cattle have any profound effect on deer distribution is difficult to determine. Possibly the implementing of a rest rotation grazing system for cattle will help answer this question. However, the presence of both deer and cattle under present conditions makes for efficient land use.

Firebaugh (1969) stated that the low productivity of deer in the Pryors could possibly be attributed to heavy use by cattle of the summer range. I would hesitate to make such a statement considering

the dissimilarity of food habits and range use of the two animals in my area. Dusek (1971) concluded that cattle on his area had no detrimental effects on mule deer reproduction.

Eustace (1971) showed that in southeastern Montana mule deer production and spring rainfall levels have a positive correlation. A dry spring and summer could be reflected in lowered fawn production the following year. From May 1 to October 31 of 1969, rainfall was 6.4 inches as compared to 8.3 inches for the same period in 1970 (U. S. Forest Service 1969-70). Annual precipitation for 1969 was 13.3 inches as compared to 19.6 inches in 1970 (Climatological Data, U. S. Dept. Commerce 1969-71). This might help account for the wide difference in fawn:doe ratios for the summers of 1970 and 1971.

APPENDIX

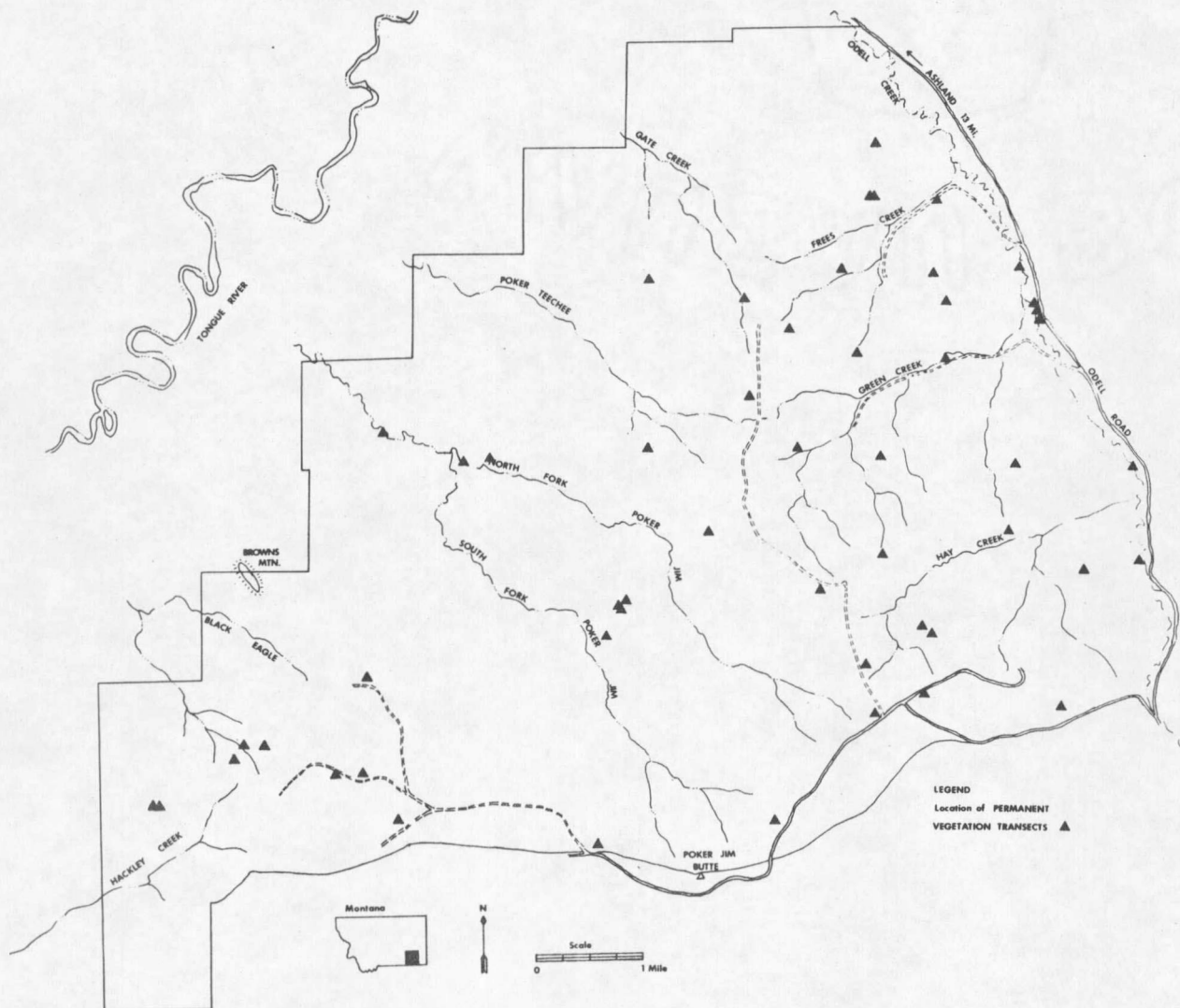


Figure 10. Map of study area showing location of permanent vegetation transects.

TABLE 9. CLIMATOLOGICAL DATA GATHERED BY THE U. S. DEPT. OF COMMERCE FROM THE BIRNEY 15N AND BIRNEY 2SE MONTANA WEATHER STATIONS FOR 1969, 1970 AND 1971.

Station	TEMPERATURE (Degrees F)												Yearly Ave.
	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Birney 15N 1971	15.6	18.8	27.0	39.8	50.1	60.1	62.5	70.1	51.7	39.8	30.0	14.2	40.0
Birney 15N 1970	14.4	26.3	23.7	32.8	51.7	61.1	65.9	66.8	50.8	39.0	28.9	19.0	40.0
Birney 2SE 1969	5.1	19.4	28.7	50.7	57.2	59.7	70.3	72.8	--	--	31.6	26.0	--
Station	PRECIPITATION (Inches)												Yearly Ave.
	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Birney 15N 1971	3.28	2.60	.50	1.66	2.19	.92	.24	2.21	.57	5.74	.40	.73	21.04
Birney 15N 1970	1.08	1.28	2.44	2.54	5.59	1.84	.24	.03	1.08	1.35	1.37	.72	19.56
Birney 2SE 1969	1.08	.11	.19	2.33	1.08	3.75	2.16	.38	.18	1.47	.35	.22	13.30

TABLE 10. TAXA WITH CANOPY COVERAGES OF LESS THAN .5 PERCENT AND/OR FREQUENCIES OF LESS THAN 5 PERCENT IN ANY VEGETATION TYPE AS DETERMINED BY EXAMINATION OF TWENTY 2X5 DECIMETER PLOTS ON EACH OF 41 SITES.

Taxa	PONDEROSA PINE ZONE				GRASSLAND ZONE	BIG SAGE-GRASSLAND ZONE	
	Grassland Park Type 11 Sites	Ponderosa Pine Type 6 Sites	Rhus-Grass Type 5 Sites	Creek Bottom Type 4 Sites	Grassland Type 8 Sites	Big Sage-Grassland Type 4 Sites	Grassland Type 3 Sites
GRASSES:							
<i>Calamovilfa longifolia</i>	X	X	X	--	--	--	--
<i>Muhlenbergia cuspidata</i>	--	X	--	--	--	X	--
FORBS:							
<i>Allium textile</i>	--	X	X	X	--	--	--
<i>Arnica sororia</i>	X	X	--	--	--	--	--
<i>Astragalus drummondii</i>	--	--	X	X	--	--	--
<i>Cirsium undulatum</i>	X	X	--	--	X	X	--
<i>Clematis linquisticifolia</i>	--	--	--	X	--	--	--
Compositae	--	--	--	X	--	--	--
<i>Echinaceae pallida</i>	X	X	--	--	X	--	--
<i>Galium</i> spp.	--	--	--	X	--	--	--
<i>Geum</i> spp.	--	X	X	--	--	--	--
<i>Grindelia squarrosa</i>	X	--	--	X	--	--	--
<i>Hedeoma</i> spp.	--	--	X	X	--	--	--
<i>Melilotus officinalis</i>	X	--	--	--	--	--	--
<i>Opuntia polycantha</i>	X	--	X	--	X	X	X
<i>Plantago purshii</i>	X	--	--	--	X	--	--
<i>Polygala alba</i>	X	X	--	--	--	--	--
<i>Solidago missouriensis</i>	--	--	--	--	X	--	--
<i>Vicia americana</i>	X	X	--	--	--	--	--
SHRUBS:							
<i>Chrysothamnus nauseosus</i>	X	--	--	--	--	--	--
<i>Juniperus scopulorum</i>	--	--	--	X	--	X	--

TABLE 11. TAXA OCCURRING AT LEVELS OF LESS THAN 0.5 PERCENT BY MONTH AND VEGETATION ZONE
IN THE SUMMER DIET OF CATTLE.

Taxa	MONTH				ZONE		
	June 6 Sites	July 7 Sites	Aug. 10 Sites	Sept. 9 Sites	Ponderosa Pine 10 Sites	Big Sage- Grassland 11 Sites	Grass- land 11 Sites
FORBS:							
<i>Arnica sororia</i>	X	--	--	--	X	--	--
<i>Artemisia ludoviciana</i>	X	--	--	--	X	--	--
<i>Astragalus</i> spp.	X	--	--	--	X	--	--
<i>Chrysopsis villosa</i>	--	X	--	--	X	--	--
<i>Echinacea pallida</i>	--	--	X	--	--	--	X
<i>Gaura coccinea</i>	--	X	--	--	--	--	X
<i>Lactuca serriola</i>	--	--	X	--	X	--	--
<i>Psoralea argophylla</i>	X	X	--	--	X	--	X
<i>Sphaeralcea coccinea</i>	--	--	X	--	--	--	X
SHRUBS:							
<i>Fraxinus pennsylvanica</i>	--	--	--	X	X	--	--

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