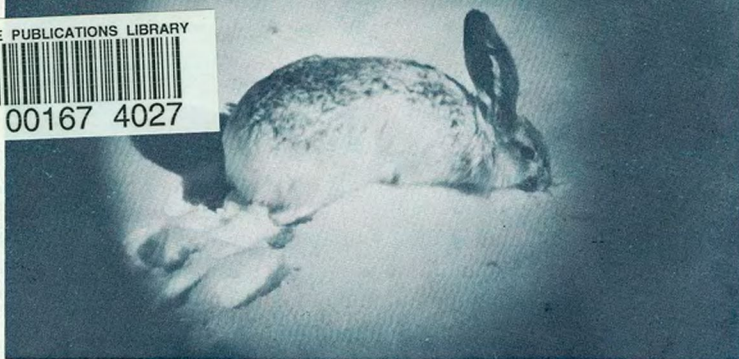


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food habits, growth and reproduction of white-tailed jackrabbits in southern colorado

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FOOD HABITS, GROWTH AND REPRODUCTION OF WHITE-TAILED JACKRABBITS IN SOUTHERN COLORADO

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PREFACE

White-tailed jackrabbits are native to the plains and semi-open montane areas from southern Canada to southern Colorado and west to the crest of the Sierra Nevada Mountains. Extensive studies have been made on some other species of jackrabbits but only a few have been made on the white-tailed jackrabbit.

White-tailed jackrabbits were once common in most parts of Colorado but are now relatively rare in eastern Colorado. Black-tailed jackrabbits have been spreading into the areas formerly occupied by white-tailed jackrabbits as the latter became scarce. Black-tailed jackrabbits appear better able to live on farming lands and intensively used ranges.

Jackrabbits damage a variety of crops, stored feeds and forage plants growing on rangelands and are blamed for the decline in range conditions in many areas. In some areas, especially northern and northwestern Colorado, white-tailed jackrabbits provide hunting recreation when closed seasons exist for most other game species. Whenever relatively dense populations occur they are marketed by hunters and the hides are used to make felt and the carcasses are used for mink food. They are sold without skinning or other preparation, usually during the winter. Prices range from about \$0.25 to \$0.75 per rabbit. In some years about 65,000 have been sold at a collection point at Craig, Colorado.

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ABSTRACT:

White-tailed jackrabbits (*Lepus townsendii*) were studied in southern Colorado from June 1959 through September 1962. The seasonal diet was determined by examination of the contents of stomachs from 131 jackrabbits. Tests to determine food preferences of adults and young were conducted in the summer in portable bottomless cages placed within four distinct habitat types. The vegetative composition and rabbit-days-use were measured on 200 meter square plots in each of the four habitats. The relation of weight to age for young up to 24 weeks was recorded for three young born in captivity and five additional young captured in the field for more than 800 recorded days of growth. Size and reproductive characteristics were taken from about 163 adults and 188 young. The rates of consumption and defecation were measured in pens with captive animals.

Grasses and forbs were the primary food items in the diet during spring, summer, and early autumn. Shrubs were major food items during the winter period. Grasses and forbs were preferred when they were succulent. The major foods were *Carex obtusata*, *Chenopodium* sp., *Taraxacum officinale*, *Trifolium* sp., *Artemisia frigida*, and *Chrysothamnus parryi*. There was a large amount of variation in the preference ranking for some plant species between the young and adults and between the different vegetative types. Some of the most preferred plants during the summer growing season were: *Carex* spp., *Juncus* sp., *Sitanion hystrix*, *Castilleja integra*, *Lesquerella montana*, and *Potentilla concinna*; while some of the least preferred species were: *Festuca arizonica*, *Muhlenbergia torreyi*, *Hymenoxys richardsonii*, *Pentstemon teucroides*, and *Artemisia tridentata*.

Pellet numbers on vegetative plots indicated jackrabbit-use per acre was approximately four times greater in the grassland type than in the meadow, rabbitbrush, or sagebrush vegetative types. The meadowlands contained the fewest pellets. Tests indicated that pellet disintegration was much more rapid on the meadowlands than on the upland sites.

Captive white-tailed jackrabbits consumed 0.19 lbs. of alfalfa hay and rolled barley per rabbit per day. A pregnant female consumed progressively larger amounts of food following parturition. The daily defecation rate was 277 pellets per jackrabbit per day. There was a weak positive correlation between the amount of air-dry forage eaten and the air-dry weight of the pellets.

From measurements of dissected jackrabbits it appears that the reproductive system reaches maximum development in May and begins to regress by July. In adult males the reproductive organs appear to develop more rapidly and earlier than in females. Spermatozoa were produced by all adult males from March through June but were absent in the epididymides of some adult males in August.

White-tail females, in some years, may produce several litters per breeding season. Females with embryos were collected from 2 May until 18 July. Litter size varied (based on numbers of embryos or recognizable recent implantation sites in the uterus) from 1 to 11 and averaged about 5/litter.

Adults and young could be differentiated until at least December. Adult males averaged 97 ounces and adult females 117 ounces in total weight. In December the weights of young males and young females averaged about 100 ounces.

Newborn young vary from about three to four ounces in weight. The weight of young averages about 42 to 51 ounces when 6 to 8 weeks old, 75 to 77 ounces when 14 to 16 weeks old, and about 87 to 89 ounces when 22 to 24 weeks old.

INTRODUCTION

The relationship of jackrabbits to grazing has been studied in some parts of the West. One of the most comprehensive appraisals was made by Vorhies and Taylor (1933) in Arizona for the antelope jackrabbit (*Lepus alleni*) and the black-tailed jackrabbit (*Lepus californicus*). In general, jackrabbits are more abundant on rangelands with recent histories of excessive use of livestock. Detailed studies have been conducted for some species of jackrabbits but information pertaining to the food habits, growth and reproduction of white-tailed jackrabbits (*Lepus townsendii*) is lacking. To properly manage the natural resources, it is essential to have a thorough knowledge of all plant and animal relations. The major aims of this study were to gain new facts on the biology of the white-tailed jackrabbit and to document these facts by a scientific publication.

The study was done in the vicinity of Cochetopa Park, T46N, R2E, 6th PM, Saguache County, Colorado. The study area ranges from 8,500 to 10,000 feet above sea level. The general area has large parks with rolling terrain and wide valleys surrounded by mountains (Figure 1). Vegetation on the drier sites is characterized by bunchgrasses and shrubs; fescue (*Festuca* spp.), muhly (*Muhlenbergia* sp.), bottlebrush squirreltail (*Sitanion hystrix*), needlegrass (*Stipa* spp.), big sagebrush (*Artemisia tridentata*), fringed sage (*Artemisia frigida*), and rabbitbrush (*Chrysothamnus* spp.) (Figure 2). Meadows along the streams are a grass-sedge-rush vegetative type (Figure 3). Higher ridges surrounding the study area are characterized by spruce-fir and aspen forests. Watercourses are Cochetopa Creek, Los Pinos Creek, West Pass Creek, and Razor Creek, which are tributaries of the Gunnison River. Much of the area is administered by the U. S. Forest Service, although most of the land along the streams is privately owned. Cattle and sheep graze on the public lands during the spring, summer, and fall months, but are confined to the private lands during the winter months.

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FIGURE 1. *Upper photo shows open valley between Cochetopa Dome and snow-capped Stewart Peak and Baldy Chato in the distance (March-1962). Lower photo shows northern part of Cochetopa Park with Cochetopa Hills in the background (June-1960).*



FIGURE 2. *Upper photo of benchland east of Old Agency Ranger Station, consisting of grassland in the immediate foreground, big sagebrush dominated draws and gentle slopes, and forests of aspen and spruce-fir on the steep slopes (August-1961). Lower photo shows an ecotone of bunchgrass and shrubs in Cochetopa Park (June-1960).*



FIGURE 3. *Upper photo shows irrigated meadow used to grow hay along Los Pinos Creek (July-1961). Lower photo, near Old Agency Ranger Station, is an example of meadowland used for grazing and having uneven terrain and willow-dominated streamsides (August-1961).*

MATERIALS AND METHODS

Collection Field observations and specimens were taken from June 1959 through September 1962. The stomachs of white-tailed jackrabbits used for the study of food habits were collected during the winter (December), spring (March), summer (June), and autumn (September); from December, 1960 to September, 1961. Sample sizes varied and included at least ten adult females in each. Jackrabbits usually were killed with a shotgun in the vicinity of roads in late evening or at night. A spotlight and the headlights of a vehicle were used to find animals. A few rabbits were collected by hunting during daylight hours. A tag designating the date, time of day, and location of collection was attached to the animal when it was collected. The jackrabbits later were dissected and records were kept on morphological and reproductive characteristics. The skull, a humerus and the stomach content of each specimen were saved for analysis at a later date.

Adult white-tailed jackrabbits used for measuring rate of food consumption were captured in November, 1961, along U. S. Highway 285 between Antero Junction and Jefferson, Park County, Colorado. Animals were found by driving along the highway and locating tracks made in fresh 10-15 inch deep snow. Most of the rabbits were resting in short tunnels dug into the snow. The jackrabbits had difficulty running, due to the deep snow, and were caught easily with a long handled fish net.

Young white-tailed jackrabbits were captured along roads at night with a net, by hand, or by a dog.

Reproduction and dissection Records for each dissected animal included: body weight, length of ear, length of humerus, characteristics of the humerus and skull. Female reproductive tracts were examined for embryos, ovarian width and length, uterine width, presence of uterine striations, uterine scars. The reproductive tracts were then preserved in an AFA fixative and were transferred about one week later to 70 percent alcohol for permanent storage. Males were examined for volume of testis,

presence of spermatozoa in the caudal epididymis, and whether the penis could be everted or not. The measurements were made with calipers to the nearest tenth of a millimeter and the volume of the testis was measured by water displacement in a graduate.

Food habits The contents of each stomach were thoroughly mixed and washed in cool water and a sample was placed on absorbent paper to dry. A portion of the sample was mounted on a microscopic slide using Hertwig's Solution (Baumgartner and Martin, 1939) and Hoyer's Solution (Baker and Wharton, 1952). The slides were dried in an oven at 60° C. One slide was made from the contents of each stomach.

Tissues of identified plants collected in the study area were prepared on microscopic slides. Food materials on the slides prepared from rabbit stomach contents were identified by comparison with the plant reference slides using a compound microscope. The percentage of each food item was estimated from ten random fields on each slide at 44 power magnification. An average was computed to determine the composition for each plant species or item in each stomach sample.

Preference and Utilization Plot-feeding experiments were conducted in the vicinity of Cochetopa Park from June, 1962 to September, 1962. Adults captured in Park County, three white-tailed jackrabbits born in captivity at Fort Collins, and additional young animals captured in the study area were used.

Bottomless cages, 3 feet square and 2 feet high were constructed from welded wire screen having a 1 inch by 3 inch mesh. The cages were held in place by metal stakes and covered with burlap to prevent the jackrabbits from becoming alarmed and injuring themselves (Figure 4). The burlap also protected the animals from the direct rays of the sun and from the weather. These feeding pens were placed in selected vegetative types.

The ocular-estimate-by-plot method, as described by Pechanec and Pickford (1937), was used to determine forage removal on the feeding plots. Practice sessions were conducted each day to check estimates. Practice plots were one-fourth the size of the feeding pens. The weight, in grams, of each species of green



FIGURE 4. *Bottomless cages, three feet square and two feet tall, were used to hold adult and young white-tailed jackrabbits for determination of forage removal. Upper photo shows feeding pens in the grassland and lower photo shows them in the meadowland, in Cochetopa Creek drainage. Photos taken in July (1962).*

plant was estimated on practice plots. The vegetation then was clipped and weighed to determine the actual amount of live forage present. This procedure was continued until the error of estimate was less than ten percent. The weight of each species of plant present in the feeding pens was estimated before the rabbits were placed in the pens. A single rabbit was placed in each cage. Plant weights were estimated again following the grazing period.

Jackrabbits are predominantly nocturnal in feeding and the experimental animals were placed in the pens approximately an hour before sunset. Preliminary observations showed utilization within the small feeding pens to be nearly 100% for all plant species if the rabbits grazed for a full night. Because a sequence of preference for foods was desired, the animals were left in the pens only for approximately three hours.

Preference tests were conducted in each of the four vegetative types within the study area: sagebrush, rabbitbrush, grassland, and meadow. Ten rabbits, five adults and five young, were used in the feeding tests thus giving a total of ten trials per day. Trials were conducted for two days in each of the four vegetative types. Feeding tests were conducted for two days each month in June, July and early September, 1962, in each of the four vegetative types.

Food preference (preference index) was computed by dividing the percent utilized by the percent composition for each species of plant on each preference-plot. Composition was computed by dividing the estimated weight for each species by the total estimated weight of all plants on the preference-plot.

Growth, Consumption and Egestion Gains in weight and growth of body proportions were measured for three young born in captivity at Fort Collins, and additional young animals captured in the study area.

Captive white-tailed jackrabbits were kept in large pens, 4 feet by 8 feet square and 4 feet high. The pens had solid walls and a partially screened top. The floor was covered with $\frac{5}{8}$ inch wire mesh, thus permitting pellets and wasted food particles to drop onto a catch-tray made from galvanized steel roofing material.

Small, covered boxes were placed in each pen to serve as shelter and hiding places for the jackrabbits. One animal was placed in each of the four pens. Animals were fed rolled-barley and alfalfa hay. A pan of water and a block of phosphorus rabbit salt also were kept in each pen.

Rations of rolled barley and alfalfa were measured to the nearest gram and placed in individual feeding trays from April 23, 1962 to June 1, 1962. The amount of each food item utilized was determined bi-weekly by weighing the amount of barley or alfalfa left in the tray and that retrieved from the catch-tray. Consumption in grams per day was computed for each rabbit. Fecal pellets on the catch-tray also were counted bi-weekly and the number of pellets defecated per rabbit per day was computed. The pellets were air-dried and weighed to determine the relationship between weight of dry forage consumed and the dry weight of pellets.

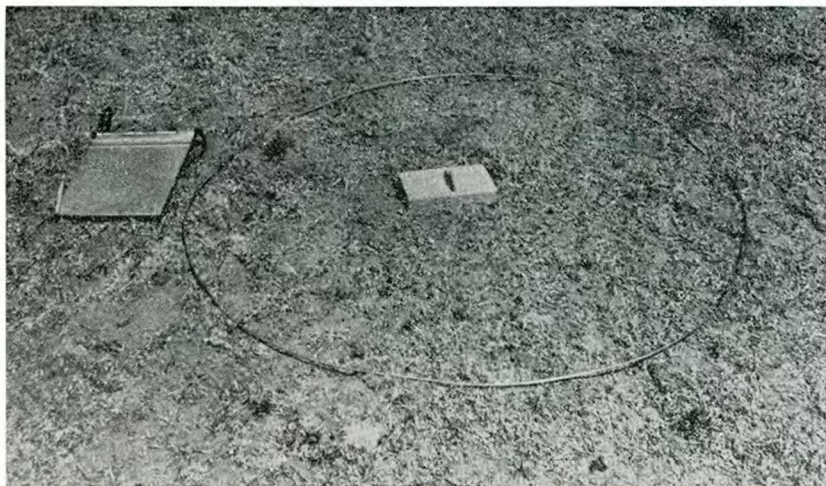


FIGURE 5. *Permanent plots were marked with a brick in each of the four habitats (July-1961). A metal hoop, one meter square, was centered over the plot to estimate plant cover and for counting jackrabbit fecal pellets. Note the abundance of lichens on this plot.*

Habitat Vegetative types within the study area were classified in one of four categories: (1) grassland type, (2) meadow type, (3) rabbitbrush type, and (4) big sagebrush type. The meadow type included the irrigated areas maintained as hay fields or pastures along the streams. Drier areas dominated by grasses were considered the grassland type. The big sagebrush and rabbitbrush types were the areas in which big sagebrush or rabbitbrush was the dominant vegetation.

Four transects were placed in each of the four vegetative types. The grassland transects are referred to as: G-1, G-2, G-3 and G-4; the meadow transects, M-1, M-2, M-3 and M-4; the rabbitbrush transects, R-1, R-2, R-3 and R-4; and the sagebrush transects are referred to as S-1, S-2, S-3 and S-4. Circular plots were placed at 25-foot intervals along a predetermined line. Each plot, one meter square, was permanently marked with a concrete brick placed at the center (Figure 5). Bricks were buried so they were flush with the ground level, thus reducing the chances of disturbance by livestock or machinery. Every tenth brick was numbered. There were 50 plots on each of the 16 transects, or 200 plots in each of the 4 vegetative types.

The coverage of each species of plant and the number of jackrabbit pellets were recorded for each plot during July, 1961. Coverage was determined by projecting the aerial parts of the plants onto the surface of the ground. The composition for each species of plant was computed by dividing the total plant coverage of plants into the total coverage for each species of plant times 100, and is expressed as percent. The crown height of the tallest shrub on the plot was measured to the nearest inch and recorded for the rabbitbrush and sagebrush transects. All rabbit fecal pellets were removed from the plots during the initial observations in July, 1961. Pellet counts only were recorded in July, 1962.

Sagebrush transects S-3 and S-4 were near and west of Razor Dome. This general area was characterized by extensive sagebrush flats. The other transects, S-1 and S-2, were in the vicinity of the Old Agency Ranger Station and Cochetopa Dome and were characterized by rolling terrain. Shrubs were the dominant vegetation in the low areas and grass was the most abundant

vegetation on the ridges (Figure 2). Three meadow types were selected: reseeded meadow (M-2), native meadow (M-1 and M-3), and a meadow containing many scattered willow clumps (M-4) (Figure 3). The latter meadow type was used as pasture land only and was not harvested for hay.

The term "trace" describes plant composition on a plot or in the diet amounting to less than 1%. Whenever a series of food items or plant names appear in sequence, they are listed in order of importance. The computed means are accompanied by plus or minus (\pm) one standard error in the text unless noted otherwise. Abbreviations follow the form presented in the A.I.B.S. Style Manual.

Vernacular names when first used in text, are accompanied by the appropriate scientific names. The names of plants follow Harrington (1954) or Hitchcock (1950). Rushes and sedges are included with grasses for the purpose of discussion.

RESULTS

HABITAT OF JACKRABBITS

Jackrabbits used the different vegetative types seasonally. Meadowlands were used seldom during the summer when plants were growing. Jackrabbits were observed in the meadows progressively more often following the harvest of the vegetation for hay during the autumn. In autumn and winter rabbits were flushed frequently in areas characterized by tall shrubs adjacent to meadows and open ridges. The higher grassland-dominated ridges were used by jackrabbits as travel lanes. Winds blow the snow from the ridges during the winter.

An attempt was made to estimate rabbit-days-use in the various habitats by counting the numbers of fecal pellets deposited by jackrabbits on the plots between July 1961 and July 1962. The average number and weight of fecal pellets for captive white-

TABLE 1. *Average numbers and weight of pellets defecated per day by captive white-tailed jackrabbits.*

Date	Pen Number									
	1		2		3		4		Total	
	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.
	(gms)		(gms)		(gms)		(gms)		(gms)	
April 30	23	218	19	146	16	153	11	154	69	671
May 7	35	417	15	184	27	312	27	328	104	1241
May 11	33	430	23	264	19	237	20	290	95	1221
May 14	29	426	29	319	21	236	25	306	104	1287
May 18	43	381	34	282	16	209	27	261	120	1133
May 22	30	408	22	280	16	158	20	285	88	1131
May 25	30	401	24	156	15	171	17	229	86	957
May 28	28	440	33	217	19	258	12	217	92	1132
June 1	33	376	42	312	18	249	21	250	114	1187
Total	284	3497	241	2160	167	1983	180	2320	872	9960
Mean	32	389	27	240	19	220	20	258	24	277
Standard error	2	22	3	22	1	17	2	18	3	29

tailed jackrabbits was recorded. The mean defecation rate was 277 pellets per rabbit per day (Table 1). It was estimated from pellet-counts that the sagebrushland, rabbitbrushland, grassland and meadowland received 35, 23, 140, and 10 rabbit-days-use per acre per year, respectively (Table 2). Observations were made on the rate of "weathering" of jackrabbit fecal pellets in caged plots in meadows and adjacent upland areas. Fecal pellets on the meadows completely disintegrated in less than one year and pellets in the upland plots showed only slight signs of weathering in one year. General observations indicated heavier jackrabbit-use on the meadows than was estimated by pellet-counts. Jackrabbit-use on meadows and grasslands during the winter appears about the same, although from pellet-count estimates of use, the meadows may appear unimportant.

TABLE 2. *Jackrabbit pellet numbers and rabbit-days-use per acre occurring on the vegetation plots at Cochetopa Park, Colorado.*

Vegetative Type	Transect Number				Total
	1	2	3	4	
Sagebrush					
1961	381	364	81	54	880
1962	224	150	55	59	488
Rabbit-days*	66	44	16	17	35
Rabbitbrush					
1961	203	180	64	17	464
1962	140	119	41	14	314
Rabbit-days	41	35	12	4	23
Grassland					
1961	1,235	962	91	88	2,376
1962	737	603	61	39	1,440
Rabbit-days	216	176	18	11	140
Meadow					
1961	1	31	33	77	142
1962	0	0	66	79	145
Rabbit-days	0	0	19	23	10

* Rabbit-days-use per acre were based on the pellets deposited on the study plots between July, 1961, and July, 1962. The defecation rate, 277 pellets per rabbit per day, found in the "consumption and excretion tests" was used to compute rabbit-days-use.

Correlation coefficients (r) were computed for the relationship between numbers of fecal pellets and shrub height on the plots of the sagebrushland and rabbitbrushland. The correlation coefficient for both habitats was 0.23 and was significant at the 5% level. Visual evaluation of the data, however, indicated that pellet numbers and cover were not correlated.

A yellowish-green lichen was abundant on some upland areas where it usually occurs free on the surface of the ground. On the grassland, rabbitbrush and sagebrush habitats this lichen made up 25%, 10% and one percent of the total plant cover and occurred on 99%, 87% and 21% of the plots, respectfully. It was not found in the meadows. Although abundant, the lichen did not appear to be of direct value to jackrabbits.

Grasslands The ridges and gentle slopes with shallow soils and good drainage were usually characterized by grasses and short shrubs. Grasses and sedges comprised 51% of the total plant cover on the grasslands (Table 3). Ring muhly (*Muhlenbergia torreyi*), blue grama (*Bouteloua gracilis*), and dryland sedge (*Carex obtusata*) were the dominant species.

Fringed sagebrush was a conspicuous feature of the grassland habitat and big sagebrush and little rabbitbrush (*Chrysothamnus viscidiflorus*) were common. Forbs were not abundant in grasslands.

Meadowlands The meadow habitat was adjacent to streams and at the time of snowmelt was usually flooded with water; the soil usually remained wet until late summer. Sedges (*Carex* spp.), a rush (*Juncus* sp.) and timothy (*Phleum pratense*) were the dominant plants (Table 4). Clover (*Trifolium* sp.) and common dandelion (*Taraxacum officinale*) were common forbs. Willows (*Salix* sp.) were found at the edges of streams.

Rabbitbrushlands Although grasses and grasslike plants made up half of the plant cover in the rabbitbrushland, shrubs were the dominant feature of the landscape (Table 5). Little rabbitbrush, Parry's rabbitbrush (*Chrysothamnus parryi*) and fringed sage were the important shrubs. Ring muhly and blue grama were the most common grasses. Although a variety of forbs were present, none were common or conspicuous. The rabbitbrush habitat occurred commonly at the edges of meadows and in the bottoms of draws where soils were wet or moist in spring and early summer, but were without standing water at spring runoff.

Sagebrushlands Land dominated by big sagebrush occurred in draws and on steep slopes where moisture accumulated in spring or after thunderstorms. In winter the junction between grassland and sagebrushland is characterized by deep snow drifts occurring in the sagebrushland. In spring snow remains longer and melts later in areas dominated by big sage than in adjacent areas.

TABLE 3. Vegetative composition and frequencies of plants occurring on plots in the grassland type at Cochetopa Park, Colorado.

Species	Transect Number								Mean %
	G-1		G-2		G-3		G-4		
	%	%	%	%	%	%	%	%	
	Comp.	Freq.	Comp.	Freq.	Comp.	Freq.	Comp.	Freq.	
Grasses and grass-like plants									
<i>Bouteloua gracilis</i>	18	32	6	10	12	18	12	38	12
<i>Carex obtusata</i>	11	60	14	34	1	6	18	100	12
<i>Festuca arizonica</i>	---	---	---	---	T	2	---	---	T
<i>Koeleria cristata</i>	3	52	3	24	2	32	T	2	2
<i>Muhlenbergia torreyi</i>	19	96	25	88	32	96	21	90	24
<i>Muhlenbergia richardsonis</i>	T	10	3	26	2	28	T	2	1
<i>Sitanion hystrix</i>	1	28	1	38	T	8	T	2	T
Total	52		52		49		52		51
Forbs									
<i>Arenaria fendleri</i>	T	2	---	---	---	---	T	4	T
<i>Chenopodium</i> sp.	1	38	T	16	2	38	---	---	1
<i>Echinocactus simpsonii</i>	T	16	T	16	2	38	T	6	T
<i>Erigeron</i> sp.	T	6	T	6	1	26	T	16	T
<i>Eriogonum umbellatum</i>	T	4	---	---	---	---	---	---	T
<i>Erysimum aspermum</i>	---	---	---	---	T	2	---	---	T
<i>Hymenoxys richardsonii</i>	T	8	---	---	1	34	---	---	T
<i>Lappula</i> sp.	---	---	---	---	---	---	1	14	T
<i>Lupinus</i> sp.	1	4	---	---	---	---	---	---	T
<i>Penstemon procerus</i>	T	2	---	---	---	---	T	14	T
<i>Penstemon teucroides</i>	T	4	---	---	T	6	---	---	T
<i>Phlox bryoides</i>	1	10	1	16	T	2	1	18	1
<i>Potentilla concinna</i>	T	14	T	2	---	---	---	---	T
<i>Potentilla pennsylvanica</i>	T	2	---	---	---	---	---	---	T
Total	5		2		7		3		4
Shrubs									
<i>Artemisia cana</i>	T	4	---	---	---	---	---	---	T
<i>Artemisia frigida</i>	2	66	15	88	19	20	20	100	14
<i>Artemisia tridentata</i>	9	16	---	---	7	8	---	---	4
<i>Chrysothamnus parryi</i>	T	22	1	50	1	28	T	12	1
<i>Chrysothamnus viscidiflorus</i>	8	46	T	2	4	42	T	10	3
Total	19		16		31		20		22
Lichens	24	94	30	100	13	100	25	100	23
Total	100		100		100		100		100
Percent coverage	42		31		37		50		

TABLE 4. *Vegetative composition and frequencies of plants occurring on plots in the meadow type at Cochetopa Park, Colorado.*

Species	Transect Number								Mean %
	M-1		M-2		M-3		M-4		
	% Comp.	% Freq.	% Comp.	% Freq.	% Comp.	% Freq.	% Comp.	% Freq.	
Grasses and grass-like plants									
<i>Agrostis</i> sp.	---	---	T	24	1	24	---	---	1
<i>Agropyron trachycaulum</i>	---	---	2	48	---	---	T	2	1
<i>Agropyron smithii</i>	---	---	T	4	---	---	---	---	T
<i>Bromus inermis</i>	---	---	5	66	---	---	---	---	1
<i>Carex</i> sp.	37	96	---	---	25	98	51	100	29
<i>Deschampsia caespitosa</i>	3	80	1	44	4	70	10	58	4
<i>Eragrostis</i> sp.	1	38	4	48	---	---	---	---	2
<i>Hordeum jubatum</i>	---	---	T	18	---	---	T	6	T
<i>Hordeum pusillum</i>	1	58	10	76	4	62	3	40	4
<i>Juncus</i> sp.	51	100	2	6	29	100	6	36	23
<i>Koeleria cristata</i>	---	---	---	---	---	---	T	18	T
<i>Muhlenbergia richardsonis</i>	---	---	---	---	7	44	4	20	3
<i>Phleum pratense</i>	---	---	55	94	2	38	---	---	12
<i>Poa pratensis</i>	T	40	2	50	3	80	1	12	1
Total	93		82		75		75		82
Forbs									
<i>Achillea lanulosa</i>	T	2	1	26	1	46	4	46	1
<i>Anemone globosa</i>	T	14	---	---	T	2	---	---	T
<i>Arenaria fendleri</i>	---	---	---	---	T	2	T	14	T
<i>Cirsium</i> sp.	---	---	T	16	---	---	---	---	T
<i>Dodecatheon pulchellum</i>	---	---	T	2	---	---	T	2	T
<i>Erigeron</i> sp.	T	2	T	2	T	42	T	20	T
<i>Galium boreale</i>	T	4	---	---	---	---	---	---	T
<i>Iris missouriensis</i>	T	2	---	---	T	2	---	---	T
<i>Lappula</i> sp.	---	---	---	---	---	---	T	2	T
<i>Lupinus</i> sp.	---	---	---	---	---	---	T	8	T
<i>Linum lewisii</i>	---	---	1	14	---	---	T	2	T
<i>Mertensia</i> sp.	---	---	---	---	---	---	T	6	T
<i>Mertensia lanceolata</i>	T	4	---	---	---	---	T	4	T
<i>Penstemon procerus</i>	---	---	---	---	---	---	T	2	T
<i>Polypodiaceae</i> (family)	---	---	---	---	---	---	T	10	T
<i>Potentilla pennsylvanica</i>	T	18	T	6	2	32	3	38	1
<i>Pseudocymopteris montanus</i>	---	---	T	4	---	---	---	---	T
<i>Senecio</i> sp.	1	20	T	4	T	2	T	2	T

(Table 4 Continued)

Species	Transect Number									
	M-1		M-2		M-3		M-4		Mean	
	% Comp.	% Freq.	% Comp.	% Freq.	% Comp.	% Freq.	% Comp.	% Freq.	% Comp.	% Comp.
<i>Taraxacum officinale</i>	T	12	T	62	8	80	T	10	3	
<i>Trifolium</i> sp.	4	40	15	68	13	96	T	2	8	
Total	7		18		25		9		14	
Shrubs										
<i>Artemisia cana</i>	---	---	---	---	---	---	1	10	T	
<i>Potentilla fruticosa</i>	---	---	---	---	---	---	3	34	1	
<i>Ribes cereum</i>	---	---	---	---	---	---	T	2	T	
<i>Salix</i> sp.	---	---	---	---	---	---	12	20	3	
Total	0		0		0		16		4	
Total	100		100		100		100		100	
Percent coverage	91		78		86		77			

TABLE 5. Vegetative composition and frequencies of plants occurring on plots in the rabbitbrush type at Cochetopa Park, Colorado.

Species	Transect Number									
	R-1		R-2		R-3		R-4		Mean	
	% Comp.	% Freq.	% Comp.	% Freq.	% Comp.	% Freq.	% Comp.	% Freq.	% Comp.	% Comp.
Grasses and grass-like plants										
<i>Agropyron trachycaulum</i>	T	2	---	---	---	---	---	---	2	
<i>Bouteloua gracilis</i>	7	20	6	26	21	32	15	34	11	
<i>Carex obtusata</i>	---	---	---	---	1	2	T	10	T	
<i>Festuca arizonica</i>	---	---	---	---	---	---	4	30	1	
<i>Koeleria cristata</i>	4	44	6	66	2	50	3	48	3	
<i>Muhlenbergia montana</i>	---	---	---	---	1	10	15	20	3	
<i>Muhlenbergia torreyi</i>	17	88	27	78	21	74	36	92	24	
<i>Muhlenbergia richardsonis</i>	6	42	3	24	1	12	---	---	3	
<i>Sitanion hystrix</i>	5	86	3	58	2	46	1	28	3	
Total	39		45		49		74		50	

(Table 5 Continued)

Species	Transsect Number								
	R-1		R-2		R-3		R-4		Mean %
	%	%	%	%	%	%	%	%	
	Comp.	Freq.	Comp.	Freq.	Comp.	Freq.	Comp.	Freq.	
Forbs									
<i>Antennaria parva</i>	---	---	---	---	---	---	7	14	7
<i>Chenopodium</i> sp.	7	14	1	10	7	18	7	2	7
<i>Echinocactus simpsonii</i>	7	8	---	---	---	---	---	---	7
<i>Erigeron</i> sp.	---	---	---	---	---	---	7	14	7
<i>Eriogonum umbellatum</i>	---	---	---	---	1	10	---	---	7
<i>Erisimum aspernum</i>	---	---	7	2	---	---	---	---	7
<i>Gilia calcaria</i>	7	4	7	22	---	---	7	4	7
<i>Hymenoxys richardsonii</i>	7	4	7	10	7	2	1	14	7
<i>Lappula</i> sp.	7	2	1	8	7	10	1	4	7
<i>Lupinus</i> sp.	7	2	---	---	---	---	---	---	7
<i>Linum lewisii</i>	7	4	1	22	---	---	---	---	7
<i>Mertensia</i> sp.	7	18	7	12	---	---	---	---	7
<i>Penstemon procerus</i>	---	---	7	2	7	6	7	14	7
<i>Penstemon teucroides</i>	7	6	7	10	7	4	7	4	7
<i>Potentilla concinna</i>	7	2	7	2	---	---	---	---	7
<i>Potentilla diversifolia</i>	7	2	---	---	---	---	7	12	7
<i>Potentilla pennsylvanica</i>	---	---	7	2	---	---	---	---	7
<i>Potentilla pulcherrima</i>	7	6	---	---	---	---	7	---	7
<i>Senecio</i> sp.	---	---	---	---	---	---	7	2	7
<i>Taraxacum officinale</i>	7	2	7	4	---	---	---	---	7
Total	3		5		2		4		5
Shrubs									
<i>Artemisia frigida</i>	11	92	6	82	5	78	5	90	7
<i>Artemisia tridentata</i>	---	---	7	2	---	---	---	---	7
<i>Chrysothamnus parryi</i>	9	44	19	48	9	56	9	68	10
<i>Chrysothamnus viscidiflorus</i>	23	82	17	74	25	100	2	36	17
<i>Potentilla fruticosa</i>	1	2	1	4	---	---	---	---	1
Total	44		43		39		16		35
Lichens	14	96	7	86	10	93	6	74	10
Total	100		100		100		100		100
Percent coverage	45		42		45		35		

TABLE 6. *Vegetative composition and frequencies of plants occurring on plots in the sagebrush type at Cochetopa Park, Colorado.*

Species	Transect Number								Mean %
	S-1		S-2		S-3		S-4		
	%	%	%	%	%	%	%	%	
	Comp.	Freq.	Comp.	Freq.	Comp.	Freq.	Comp.	Freq.	
Grasses and grass-like plants									
<i>Agropyron trachycaulum</i>	---	---	---	---	1	14	---	---	T
<i>Bouteloua gracilis</i>	T	2	1	10	1	4	T	2	1
<i>Bromus anomalus</i>	T	4	---	---	---	---	---	---	T
<i>Carex obtusata</i>	12	78	12	82	3	58	2	20	8
<i>Festuca arizonica</i>	1	14	T	12	T	6	---	---	T
<i>Festuca ovina</i>	---	---	T	2	---	---	---	---	T
<i>Juncus</i> sp.	---	---	T	8	---	---	---	---	T
<i>Koeleria cristata</i>	2	56	5	86	3	54	3	52	3
<i>Muhlenbergia montana</i>	---	---	T	2	T	2	---	---	T
<i>Muhlenbergia torreyi</i>	11	68	8	66	2	14	2	28	5
<i>Muhlenbergia richardsonis</i>	5	42	3	28	---	---	---	---	2
<i>Poa fendleriana</i>	---	---	---	---	5	48	---	---	1
<i>Sitanion hystrix</i>	T	30	T	12	2	46	2	42	1
<i>Stipa comata</i>	T	2	---	---	---	---	---	---	T
<i>Stipa lettermani</i>	3	58	7	36	9	78	7	88	7
Total	35		37		26		16		29

Forbs

<i>Arenaria fendleri</i>	T	2	---	---	---	---	---	---	T
<i>Aster coloradoensis</i>	---	---	---	---	---	---	T	6	T
<i>Castilleja integra</i>	---	---	T	2	T	6	---	4	T
<i>Chenopodium</i> sp.	T	6	T	4	T	2	T	6	T
<i>Echinocactus simpsonii</i>	---	---	---	---	T	8	---	---	T
<i>Erigeron</i> sp.	T	12	T	12	---	---	2	2	T
<i>Erigeron flagellaris</i>	---	---	---	---	T	30	1	70	T
<i>Erigonum alatum</i>	---	---	---	---	T	2	T	6	T
<i>Erigonum umbellatum</i>	T	6	T	10	T	10	1	26	T

(Table 6 Continued)

Species	Transect Number								
	S-1		S-2		S-3		S-4		Mean %
	%	%	%	%	%	%	%	%	
	Comp.	Freq.	Comp.	Freq.	Comp.	Freq.	Comp.	Freq.	
<i>Geranium</i> sp.	T	2	---	---	---	---	---	---	T
<i>Heuchera</i> sp.	---	---	T	4	---	---	---	---	T
<i>Hymenoxys richardsonii</i>	---	---	T	2	1	4	T	20	T
<i>Lappula</i> sp.	T	6	T	4	---	---	---	---	T
<i>Leptodactylon pungens</i>	---	---	---	---	15	92	12	94	6
<i>Lupinus</i> sp.	4	46	6	62	---	---	---	---	3
<i>Mertensia</i> sp.	1	52	1	34	---	---	---	---	T
<i>Penstemon procerus</i>	---	---	T	2	---	---	---	---	T
<i>Penstemon teucrioides</i>	---	---	T	2	T	12	T	24	T
<i>Potentilla concinna</i>	T	6	T	30	T	4	T	6	T
<i>Potentilla pulcherrima</i>	T	20	T	26	---	---	---	---	T
<i>Sedum stenopetalum</i>	---	---	---	---	---	---	T	20	T
<i>Salsola kali</i>	T	2	---	---	---	---	---	---	T
<i>Taraxacum officinale</i>	---	---	T	4	---	---	---	---	T
<i>Trifolium gymnocarpum</i>	---	---	---	---	T	32	T	36	T
Total	7		9		18		18		13
Shrubs									
<i>Artemisia frigida</i>	1	6	T	16	T	2	---	---	T
<i>Artemisia tridentata</i>	48	94	47	92	44	96	54	100	48
<i>Chrysothamnus parryi</i>	1	36	T	14	---	---	---	---	T
<i>Chrysothamnus viscidiflorus</i>	3	20	4	22	11	70	10	72	6
<i>Potentilla fruticosa</i>	5	8	2	10	---	---	---	---	2
<i>Symphoricarpus</i> sp.	---	---	---	---	---	---	1	10	T
<i>Tetradymia canescens</i>	---	---	T	2	1	16	1	12	T
Total	58		53		56		66		57
Lichens	T	4	1	12	T	2	---	66	1
Total	100		100		100		100		100
Percent coverage	43		51		34		36		

Jackrabbits rest frequently in snow tunnels, and in forms beneath the sagebrush and adjacent to the open, windswept, and barren ridges. When flushed, the jackrabbits escape by running along the ridges that separate the sagebrush-dominated draws.

About half of the plant cover is made up by big sagebrush in the sagebrushland (Table 6). Grasses and grasslike plants are less common in the sagebrushland than in the other three habitats. Dryland sedge and Lettermen's needlegrass (*Stipa lettermani*) were the common species. There were more species of forbs present in the sagebrushland than in the other habitats and lupine (*Lupinus* sp.) was the most common forb. Forb cover was higher here than in either the grassland or rabbitbrushland habitats and was similar to the meadowland.

DIET OF JACKRABBITS

Diet in summer The mean diet of both sexes in summer consisted of 70% forbs, 19% grasses and grasslike plants, and 7% shrubs (Table 7). The four most important plants comprised together 60% of the stomach contents. These plants, in order of their composition in the diet, were clover (*Trifolium* sp.), common dandelion, dryland sedge and indian paintbrush (*Castilleja integra*).

Diet in autumn In the fall the diet of both sexes of white-tailed jackrabbits consisted of 43% grasses and grasslike plants, 34% forbs, and 14% shrubs (Table 8). The four most important plants made up about 60% of the stomach contents. These plants, in order of their composition in the diet, were dryland sedge, goosefoot (*Chenopodium* sp.), fringed sage, and winterfat (*Eurotia lanata*).

Diet in winter The diet of both sexes of jackrabbits in winter consisted of 76% shrubs, of which Parry's rabbitbrush made up 72% of the stomach contents (Table 9). Three forbs, goosefoot, lupine, and *Trifolium* sp. together made up only 12% of the diet.

TABLE 7. Stomach contents of white-tailed jackrabbits collected during June, 1961, at Cochetopa Park, Colorado.

Species	10 Females		22 Males	
	% Comp.	% Freq.	% Comp.	% Freq.
Grasses and grass-like plants				
<i>Agropyron smithii</i>	3	50	1	23
<i>Bouteloua gracilis</i>	T	20	T	9
<i>Carex obtusata</i>	13	70	9	50
<i>Festuca arizonica</i>	1	10	---	---
<i>Koeleria cristata</i>	---	---	T	5
<i>Muhlenbergia torreyi</i>	T	10	---	---
<i>Poa fendleriana</i>	1	10	T	5
<i>Poa juncifolia</i>	---	---	T	5
<i>Sitanion hystrix</i>	6	60	3	41
<i>Stipa lettermani</i>	1	10	T	5
Total	25		14	
Forbs				
<i>Aster coloradoensis</i>	T	10	2	14
<i>Castilleja integra</i>	6	30	12	55
<i>Chenopodium</i> sp.	3	30	4	18
<i>Corydalis aurea</i>	2	10	---	---
<i>Kochia</i> sp.	---	---	4	14
<i>Potentilla concinna</i>	11	20	---	---
<i>Salsola kali</i>	6	10	1	14
<i>Sphaeralcea coccinea</i>	2	10	2	9
<i>Taraxacum officinale</i>	15	40	31	50
<i>Trifolium</i> sp.	20	70	21	55
Total	65		76	
Shrubs				
<i>Artemisia frigida</i>	7	40	7	23
<i>Eurotia lanata</i>	---	---	T	5
Total	7		7	
Unidentified vegetation	3		2	
Miscellaneous				
Hair	---	---	T	5
Insect	---	---	T	5
Total	---		T	
Total	100		100	

TABLE 8. Stomach contents of white-tailed jackrabbits collected during September, 1961, at Cochetopa Park, Colorado.

Species	28 Females		19 Males	
	% Comp.	% Freq.	% Comp.	% Freq.
Grasses and grass-like plants				
<i>Agropyron smithii</i>	T	4	2	26
<i>Agropyron trachycaulum</i>	T	4	---	---
<i>Bouteloua gracilis</i>	---	---	T	5
<i>Bromus anomalus</i>	1	4	---	---
<i>Bromus tectorum</i>	1	7	1	11
<i>Carex</i> sp.	---	---	1	16
<i>Carex obtusata</i>	31	71	31	47
<i>Festuca arizonica</i>	2	7	---	---
<i>Hordeum jubatum</i>	1	11	---	---
<i>Koeleria cristata</i>	2	11	1	5
<i>Poa</i> sp.	2	11	T	11
<i>Poa fendleriana</i>	T	4	1	5
<i>Sitanion hystrix</i>	3	14	5	37
<i>Stipa comata</i>	T	4	T	11
Total	44		42	
Forbs				
<i>Aster coloradoensis</i>	4	21	---	---
<i>Castilleja integra</i>	---	---	1	5
<i>Chenopodium</i> sp.	11	46	14	68
<i>Erigeron</i> sp.	1	4	---	---
<i>Gilia aggregata</i>	T	4	---	---
<i>Oxytropis lambertii</i>	T	4	---	---
<i>Penstemon</i> sp.	4	18	---	---
<i>Potentilla</i> sp.	8	11	1	5
<i>Senecio</i> sp.	---	---	T	5
<i>Sphaeralcea coccinea</i>	4	21	2	16
<i>Taraxacum officinale</i>	4	14	2	11
<i>Trifolium</i> sp.	5	14	5	21
Total	41		25	
Shrubs				
<i>Artemisia frigida</i>	5	29	11	47
<i>Eurotia lanata</i>	3	4	9	16
Total	8		20	
Unidentified vegetation	7		13	
Miscellaneous				
Hair	T	21	T	47
Total	100		100	

TABLE 9. Stomach contents of white-tailed jackrabbits collected during December, 1960, at Cochetopa Park, Colorado.

Species	19 Females		13 Males	
	% Comp.	% Freq.	% Comp.	% Freq.
Grasses and grass-like plants				
<i>Agropyron smithii</i>	---	---	1	15
<i>Agropyron trachycaulum</i>	T	5	1	8
<i>Carex</i> sp.	---	---	T	8
<i>Carex obtusata</i>	T	5	1	15
<i>Deschampsia caespitosa</i>	T	5	---	---
<i>Eragrostis</i> sp.	1	5	---	---
<i>Festuca arizonica</i>	T	11	T	8
<i>Koeleria cristata</i>	T	5	---	---
<i>Poa</i> sp.	T	5	T	8
<i>Poa juncifolia</i>	2	16	---	---
<i>Sitanion hystrix</i>	---	---	T	8
<i>Stipa lettermani</i>	T	5	---	---
Total	5		4	
Forbs				
<i>Chenopodium</i> sp.	3	26	4	23
<i>Draba nemorosa</i>	T	11	---	---
<i>Erigeron</i> sp.	1	5	---	---
<i>Lupine</i> sp.	T	5	7	15
<i>Mertensia lanceolata</i>	2	5	---	---
<i>Penstemon teucroides</i>	3	5	---	---
<i>Thermopsis divaricarpa</i>	5	11	---	---
<i>Trifolium</i> sp.	7	11	T	8
Total	21		11	
Shrubs				
<i>Artemisia frigida</i>	1	5	2	31
<i>Chrysothamnus parryi</i>	65	79	79	100
<i>Chrysothamnus viscidiflorus</i>	6	11	T	8
<i>Tetradymia canescens</i>	---	---	1	8
Total	72		82	
Unidentified vegetation	2		3	
Miscellaneous				
Hair	T	16	T	15
Total	100		100	

TABLE 10. *Stomach contents of white-tailed jackrabbits collected during March, 1961, at Cochetopa Park, Colorado.*

Species	9 Females		11 Males	
	% Comp.	% Freq.	% Comp.	% Freq.
Grasses and grass-like plants				
<i>Agropyron trachycaulum</i>	1	11	---	---
<i>Carex obtusata</i>	2	33	T	9
<i>Deschampsia caespitosa</i>	3	11	T	9
<i>Festuca arizonica</i>	---	---	1	18
<i>Sitanion hystrix</i>	T	22	---	---
<i>Stipa comata</i>	---	---	1	9
<i>Stipa lettermani</i>	T	11	---	---
Total	6		2	
Forbs				
<i>Chenopodium</i> sp.	2	11	5	18
Shrubs				
<i>Artemisia frigida</i>	21	56	8	36
<i>Chrysothamnus parryi</i>	63	78	76	100
<i>Eurotia lanata</i>	---	---	6	18
Total	84		90	
Unidentified vegetation	8		3	
Miscellaneous				
Hair	---	---	T	18
Insect	---	---	T	9
Total	---		T	
Total	100		100	

Diet in spring Observations indicated that the foods available in March (spring sample) and in December (winter sample) were not greatly different, and the mean diet of both sexes was similar for both periods (Table 10). The contents of stomachs in spring consisted of 87% shrubs, 4% grasses and grasslike plants, and 4% was a forb, goosefoot. Parry's rabbitbrush made up 70% and fringed sage 15% of the diet.

USE OF VEGETATION AND FOOD PREFERENCES

Grasslands Forage utilization and food preferences of adults and young on the grasslands during June, July, and September were higher for grasses and grasslike plants than for forbs or shrubs (Tables 11, 12, 13). Species of plants ranked by utilization and preference followed the same general order. Grasses and grasslike plants preferred and utilized heavily by jackrabbits were mat muhly (*Muhlenbergia richardsonis*), dryland sedge, sheep fescue (*Festuca ovina*), and bottlebrush squirreltail. Important forbs were Fendler sandwort (*Arenaria fendleri*), buckwheat (*Eriogonum alatum*), and indian paintbrush.

Meadowlands Plants eaten by jackrabbits in the meadowlands had lower mean indices for food preference and vegetation utilization than did most plants eaten by rabbits in the other three habitats (Tables 14, 15, 16.) The most utilized and most preferred grasses and grasslike plants were sedges, tufted hairgrass (*Deschampsia caespitosa*) and rushes. Only one forb, bedstraw (*Galium boreale*), and one shrub, a willow, appear to be used significantly by rabbits in the meadowland in summer.

Rabbitbrushlands Adults and young white-tailed jackrabbits preferred and utilized grasses and grasslike plants more than forbs and shrubs on rabbitbrushland in June. In tests conducted in July and September forbs were utilized and preferred to the other two classes of forage (Tables 17, 18, 19). There were many forbs that were highly utilized and preferred and the three of greatest value appeared to be *Potentilla concinna*, Colorado aster (*Aster coloradoensis*) and *Penstemon teucrioides*.

TABLE 11. Food utilization and preferences of jackrabbits in the grassland vegetative type, June, 1962, at Cochetopa Park, Colorado.

Species	Adult				Young			
	No. Plots	Mean Util.	Std. Dev.	Mean Pref.	No. Plots	Mean Util.	Std. Dev.	Mean Pref.
Forbs								
<i>Androsace</i> sp.	1	0.0	---	0.00	---	---	---	---
<i>Arenaria fendleri</i>	1	100.0	---	26.31	3	33.3	57.7	1.07
<i>Castilleja integra</i>	---	---	---	---	1	100.0	---	3.33
<i>Hymenoxys richardsonii</i>	10	10.0	31.6	0.26	10	1.6	5.8	0.02
<i>Penstemon</i> sp.	---	---	---	---	1	100.0	---	3.33
<i>Potentilla concinna</i>	---	---	---	---	5	53.3	50.6	2.39
<i>Senecio</i> sp.	1	0.0	---	0.00	1	100.0	---	3.33
Mean		15.4	37.6	2.23		32.5	46.1	1.21
Grasses and grass-like plants								
<i>Carex obtusata</i>	10	37.3	42.6	3.16	10	62.6	39.1	4.35
<i>Festuca arizonica</i>	6	0.0	0.0	0.00	8	9.6	18.5	0.33
<i>Festuca ovina</i>	4	0.0	0.0	0.00	3	12.8	18.0	0.75
<i>Koeleria cristata</i>	5	39.7	37.9	1.30	7	24.6	27.5	0.95
<i>Muhlenbergia torreyi</i>	10	2.0	6.3	0.05	10	0.3	0.8	0.01
<i>Sintanion hystrix</i>	3	0.0	0.0	0.00	2	47.7	---	4.95
<i>Stipa comata</i>	1	0.0	---	0.00	---	---	---	---
<i>Stipa lettermani</i>	---	---	---	---	4	22.3	35.8	0.77
Mean		15.2	30.5	0.89		25.0	34.0	1.57
Shrubs								
<i>Artemisia frigida</i>	7	35.7	47.6	1.15	8	0.0	0.0	0.00
<i>Chrysothamnus viscidiflorus</i>	6	0.0	0.0	0.00	5	0.0	0.0	0.00
<i>Leptodactylon pungens</i>	1	0.0	---	0.00	1	12.5	---	4.44
<i>Tetradymia canescens</i>	1	0.0	0.0	0.00	1	0.0	---	0.00
Mean		16.7	36.2	0.54		0.9	0.3	0.32

Most grasses and grasslike plants appeared to be highly utilized and preferred at some time during the summer. Two shrubs favored over other shrubs were little rabbitbrush and *Leptodactylon pungens*.

TABLE 12. Food utilization and preferences of jackrabbits in the grassland type, July, 1962, at Cochetopa Park, Colorado.

Species	Adult				Young			
	No. Plots	Mean Util.	Std. Dev.	Mean Pref.	No. Plots	Mean Util.	Std. Dev.	Mean Pref.
Forbs								
<i>Androsace</i> sp.	1	0.0	---	0.00	---	---	---	---
<i>Castilleja integra</i>	---	---	---	---	1	100.0	---	3.62
<i>Eriogonum alatum</i>	1	50.0	---	6.25	1	33.3	---	3.21
<i>Hymenoxys richardsonii</i>	7	2.9	6.9	0.14	9	0.4	1.1	0.04
Mean		7.8	17.2	0.80		19.7	39.5	1.01
Grasses and grass-like plants								
<i>Bouteloua gracilis</i>	---	---	---	---	1	0.0	0.0	0.00
<i>Carex obtusata</i>	10	97.0	6.8	5.04	10	92.6	33.6	6.16
<i>Festuca arizonica</i>	2	3.4	4.7	0.28	3	52.3	44.3	2.55
<i>Festuca ovina</i>	3	55.5	50.9	3.61	4	81.3	32.8	5.13
<i>Koeleria cristata</i>	8	65.5	36.8	3.27	5	49.0	40.3	1.62
<i>Muhlenbergia richardsonis</i>	---	---	---	---	2	93.8	8.8	7.08
<i>Muhlenbergia torreyi</i>	10	10.0	15.5	0.46	10	29.0	30.7	1.83
Mean		56.2	43.8	2.82		63.7	40.0	4.08
Shrubs								
<i>Artemisia frigida</i>	10	54.4	42.8	2.14	9	25.0	39.5	1.01
<i>Chrysothamnus parryi</i>	7	59.0	41.6	2.25	6	0.0	0.0	0.00
<i>Chrysothamnus viscidiflorus</i>	3	1.4	2.1	0.25	4	10.9	21.3	0.26
Mean		48.0	42.7	1.69		14.1	30.0	0.53

Sagebrushlands There were more kinds of plants eaten by rabbits in the sagebrushland than in the other habitats and the mean indices for food preference and vegetation utilization for edible plants appeared higher than within other types (Tables 20, 21, 22). Grasses and grasslike plants were preferred and utilized more than forbs and shrubs by jackrabbits in all three study periods. Most species of forbs and grasses and grasslike plants were highly utilized and preferred. Of the five species of shrubs tested, big sagebrush had the lowest rating for preference and utilization by jackrabbits (see Tables 20, 21, 22).

TABLE 13. *Food utilization and preferences of jackrabbits in the grassland type, September, 1962, at Cochetopa Park, Colorado.*

Species	Adult				Young			
	No. Plots	Mean Util.	Std. Dev.	Mean Pref.	No. Plots	Mean Util.	Std. Dev.	Mean Pref.
Forbs								
<i>Erigeron</i> sp.	1	0.0	---	0.00	2	6.3	---	0.62
<i>Hymenoxys richardsonii</i>	7	10.7	28.3	0.41	9	13.9	33.3	1.36
Mean		9.4	9.4	0.36		12.5	30.1	1.22
Grasses and glass-like plants								
<i>Carex obtusata</i>	10	80.8	15.8	3.80	10	77.6	22.4	5.67
<i>Festuca arizonica</i>	---	---	---	---	1	0.0	---	0.00
<i>Koeleria cristata</i>	6	45.8	40.1	2.17	5	10.0	22.4	1.96
<i>Muhlenbergia torreyi</i>	10	19.9	29.4	0.90	10	5.0	10.5	0.22
<i>Sitanion hystrix</i>	4	31.3	37.5	0.67	4	31.3	31.5	6.03
<i>Stipa lettermani</i>	1	100.0	---	5.00	1	0.0	---	0.00
Mean		48.6	38.6	2.18		32.3	37.9	3.00
Shrubs								
<i>Artemisia frigida</i>	3	33.3	57.7	1.91	9	0.0	0.0	0.00
<i>Chrysothamnus parryi</i>	8	17.7	26.8	0.86	7	18.8	36.1	0.83
<i>Chrysothamnus viscidiflorus</i>	10	14.4	24.6	0.41	7	14.1	25.5	0.39
Mean		18.4	30.3	0.79		9.2	23.7	0.34

FOOD CONSUMPTION AND DEFECATION IN JACKRABBITS

Food intake and defecation Arnold (1942) found the daily consumption of alfalfa hay and rolled barley by antelope jackrabbits was 0.28 pound, and by black-tailed jackrabbits was 0.23 pound. The ratio of alfalfa to barley eaten by antelope jackrabbits was 1.92 to 1, and 1.7 to 1 for blacktails. In the present study consumption rate of alfalfa hay and rolled barley by white-tailed jackrabbits averaged 88 ± 8 grams (0.19 pounds) per animal per day (Table 23). The ratio (by weight) of alfalfa to barley eaten by the whitetails was 0.54 to 1. The antelope jackrabbits in the feeding trials weighed 4.80 pounds, and the blacktails weighed 4.06 pounds. The weights of white-tailed jackrabbits used in our pen-feeding trials averaged 6.19 pounds.

TABLE 14. Food utilization and preferences of jackrabbits in the meadow type, June, 1962, at Cochetopa Park, Colorado.

Species	Adults				Young			
	No. Plots	Mean Util.	Std. Dev.	Mean Pref.	No. Plots	Mean Util.	Std. Dev.	Mean Pref.
Forbs								
<i>Achillea lanulosa</i>	4	0.0	0.0	0.00	6	0.0	0.0	0.00
Grasses and glass-like plants								
<i>Carex</i> sp.	10	3.2	4.6	0.99	10	0.8	1.7	0.13
<i>Deschampsia caespitosa</i>	10	1.8	2.3	0.84	10	1.0	2.1	0.49
<i>Juncus</i> sp.	10	4.0	5.4	0.94	10	4.4	4.3	1.20
Mean		3.0	4.3	0.92		2.0	3.3	0.62
Shrubs								
<i>Potentilla fruticosa</i>	10	2.2	6.6	1.09	10	0.0	0.0	0.00

TABLE 15. Food utilization and preferences of jackrabbits in the meadow type, July, 1962, at Cochetopa Park, Colorado.

Species	Adult				Young			
	No. Plots	Mean Util.	Std. Dev.	Mean Pref.	No. Plots	Mean Util.	Std. Dev.	Mean Pref.
Forbs								
<i>Achillea lanulosa</i>	10	0.0	0.0	0.00	10	8.3	2.6	0.13
<i>Erigeron</i> sp.	10	0.0	0.0	0.00	10	2.5	7.9	0.63
<i>Potentilla</i> sp.	10	0.0	0.0	0.00	10	0.0	0.0	0.00
Mean		0.0	0.0	0.00		1.1	4.8	0.28
Grasses and grass-like plants								
<i>Carex</i> sp.	10	18.1	12.4	1.31	10	20.7	29.5	0.88
<i>Deschampsia caespitosa</i>	10	7.9	7.3	0.93	10	10.5	10.8	0.98
<i>Juncus</i> sp.	10	31.6	22.6	2.12	10	30.9	36.1	1.73
Mean		19.2	17.9	1.45		20.7	28.0	1.20
Shrubs								
<i>Potentilla fruticosa</i>	10	2.2	5.1	0.11	10	2.0	6.3	0.23

TABLE 16. *Food utilization and preferences of jackrabbits in the meadow type, September, 1962, at Cochetopa Park, Colorado.*

Species	Adult				Young			
	No. Plots	Mean Util.	Std. Dev.	Mean Pref.	No. Plots	Mean Util.	Std. Dev.	Mean Pref.
Forbs								
<i>Achillea lanulosa</i>	10	10.0	31.6	0.70	8	3.1	8.8	0.53
<i>Erigeron</i> sp.	10	1.3	4.6	0.10	10	1.2	3.8	0.21
<i>Galium boreale</i>	2	37.5	—	4.10	1	0.0	—	0.00
<i>Potentilla</i> sp.	10	0.0	0.0	0.00	10	1.6	3.5	0.22
Mean		5.9	21.8	0.51		1.8	5.4	0.29
Grasses and grass-like plants								
<i>Carex</i> sp.	10	14.9	16.4	0.82	10	5.4	5.5	1.09
<i>Deschampsia caespitosa</i>	10	11.1	15.6	1.50	10	11.3	20.6	1.29
<i>Juncus</i> sp.	10	25.7	15.3	1.77	10	14.1	6.7	2.30
Mean		17.3	16.5	1.36		10.3	13.1	1.56
Shrubs								
<i>Potentilla fruticosa</i>	7	0.4	0.7	0.09	7	0.1	0.2	0.07
<i>Salix</i> sp.	5	17.3	35.1	0.88	4	0.8	4.5	0.12
Mean		7.4	22.9	0.42		0.3	2.5	0.09

Arnold and Reynolds (1943) found the defecation rate to be 531 pellets per day for captive antelope and black-tailed jackrabbits. The daily defecation rate averaged 277 pellets/rabbit/day for white-tailed jackrabbits and varied from 146 to 440 pellets per animal per day in our study. The mean air-dry weight per day of the pellets was 24 ± 3 grams (Table 1).

The relationship (percent per day) between the amount of food eaten and the amount of solid wastes eliminated from the body was computed by dividing the air-dry weight of the pellets by the air-dry weight of forage consumed times 100. The mean percent was 28 ± 2 (Table 24). Correlation coefficient (r) for comparing the weight of pellets to forage consumption was 0.53, which was significant at a 1% level.

A portion of the irregular pattern observed may have been due to the behavior of the animals used. The white-tailed jackrabbits were mature when captured and remained very wild

TABLE 17. Food utilization and preferences of jackrabbits in the rabbitbrush type, June, 1962, at Cochetopa Park, Colorado.

Species	Adult				Young			
	No. Plots	Mean Util.	Std. Dev.	Mean Pref.	No. Plots	Mean Util.	Std. Dev.	Mean Pref.
Forbs								
<i>Androsace</i> sp.	4	0.0	0.0	0.00	6	8.3	20.4	3.39
<i>Arenaria fendleri</i>	2	0.0	---	0.00	---	---	---	---
<i>Echinocactus simpsonii</i>	---	---	---	---	1	0.0	---	0.00
<i>Erigeron</i> sp.	5	20.0	44.7	0.90	---	---	---	---
<i>Eriogonum</i> sp.	2	50.0	---	11.83	2	45.9	---	7.36
<i>Eriogonum alatum</i>	2	0.0	0.0	0.00	---	---	---	---
<i>Hymenoxys richardsonii</i>	8	15.6	35.2	0.79	9	0.0	0.0	0.00
<i>Penstemon teucroides</i>	2	50.0	---	3.50	---	---	---	---
Mean		18.5	38.6	1.81		7.9	24.0	1.95
Grasses and grass-like plants								
<i>Koeleria cristata</i>	10	45.8	45.9	6.50	10	65.6	35.2	18.00
<i>Festuca arizonica</i>	---	---	---	---	4	16.7	33.3	0.90
<i>Festuca ovina</i>	3	41.7	52.0	57.06	3	66.7	28.9	18.59
<i>Sitanion hystrix</i>	4	50.0	57.7	2.53	9	50.0	48.0	17.75
<i>Muhlenbergia torreyi</i>	10	0.0	0.0	0.00	10	2.9	9.0	0.45
Mean		21.6	44.9	8.05		41.7	42.2	12.48
Shrubs								
<i>Artemisia frigida</i>	9	0.0	0.0	0.00	10	0.0	0.0	0.00
<i>Chrysothamnus parryi</i>	10	13.5	30.8	0.99	10	0.3	0.6	0.11
<i>Chrysothamnus viscidiflorus</i>	10	14.0	31.2	0.98	10	10.5	30.6	0.87
Mean		9.5	25.7	0.68		3.6	17.8	0.33

throughout the study. More regular feeding patterns may have been obtained if it had been possible to use semi-domesticated jackrabbits. The female in pen number 2 gave birth to three young on May 21, 1962, the day before the sixth recording period. The amount of forage she ate increased until the study was terminated on June 1, 1962 (Fig. 6). The increase in barley consumption was more pronounced than the increase in alfalfa consumption.

TABLE 18. Food utilization and preferences of jackrabbits in the rabbitbrush type, July, 1962, at Cochetopa Park, Colorado.

Species	Adult				Young			
	No. Plots	Mean Util.	Std. Dev.	Mean Pref.	No. Plots	Mean Util.	Std. Dev.	Mean Pref.
Forbs								
<i>Androsace</i> sp.	1	100.0	---	6.00	2	50.0	---	2.13
<i>Antennaria parva</i>	1	0.0	---	0.00	---	---	---	---
<i>Aster coloradoensis</i>	1	100.0	---	8.06	1	100.0	---	10.33
<i>Gilia calcaria</i>	1	25.0	---	2.43	---	---	---	---
<i>Hymenoxys richardsonii</i>	2	10.0	14.1	0.80	2	0.0	---	0.00
<i>Potentilla concinna</i>	4	100.0	0.0	63.01	6	100.0	0.0	20.07
<i>Potentilla diversifolia</i>	5	97.3	4.4	7.34	3	36.6	54.9	5.67
Mean		75.4	40.6	20.50		65.0	48.8	10.85
Grasses and grass-like plants								
<i>Bouteloua gracilis</i>	4	38.5	37.8	2.42	3	38.9	9.7	18.37
<i>Festuca arizonica</i>	4	5.0	7.9	0.86	1	2.5	---	0.58
<i>Festuca ovina</i>	2	12.5	17.7	3.22	5	38.4	27.1	6.72
<i>Juncus</i> sp.	3	100.0	0.0	18.96	1	80.0	---	13.43
<i>Koeleria cristata</i>	9	31.6	34.8	8.46	7	30.2	16.3	7.77
<i>Muhlenbergia montana</i>	5	19.0	34.5	0.67	5	7.4	12.6	2.00
<i>Muhlenbergia richardsonis</i>	---	---	---	---	2	75.0	---	21.50
<i>Muhlenbergia torreyi</i>	5	9.0	12.4	5.65	5	14.7	19.8	1.25
<i>Poa fendleriana</i>	---	---	---	---	1	25.0	---	2.56
<i>Sitanion hystrix</i>	2	3.2	44.0	1.32	4	56.3	42.7	8.49
Mean		27.3	35.7	5.49		32.5	29.2	7.59
Shrubs								
<i>Artemisia frigida</i>	9	8.2	19.8	2.23	9	0.4	0.6	0.70
<i>Chrysothamnus parryi</i>	9	0.3	0.7	0.51	10	2.8	5.1	0.26
<i>Chrysothamnus viscidiflorus</i>	8	3.8	7.2	0.44	9	7.9	16.2	0.54
<i>Leptodactylon pungens</i>	1	2.5	---	0.70	---	---	---	---
Mean		4.1	12.1	0.91		3.6	9.8	0.29

Reingestion Coprophagy is common in lagomorphs. Two kinds of pellets are produced in the ceca: an amorphous pellet coated with a thin layer of mucus; and a hard, more or less spherical pellet. Soft pellets are produced during the daylight hours when animals rest. Rabbits eat them directly from the

TABLE 19. Food utilization and preferences of jackrabbits in the rabbitbrush type, September, 1962, at Cochetopa Park, Colorado.

Species	Adult				Young			
	No. Plots	Mean Util.	Std. Dev.	Mean Pref.	No. Plots	Mean Util.	Std. Dev.	Mean Pref.
Forbs								
<i>Antennaria parva</i>	4	25.0	20.4	2.00	6	2.1	5.1	0.11
<i>Aster coloradoensis</i>	1	100.0	---	22.00	1	100.0	---	6.79
<i>Gilia calcaria</i>	---	---	---	---	1	0.0	0.0	0.00
<i>Hymenoxys richardsonii</i>	5	20.0	44.7	1.58	7	1.2	31.4	0.10
<i>Lesquerella montana</i>	---	60.4	---	5.70	---	---	---	---
<i>Penstemon teucrioides</i>	4	62.4	43.3	8.14	6	64.6	33.9	6.89
<i>Potentilla concinna</i>	3	85.0	13.2	10.60	4	87.5	28.0	11.76
Mean		48.7	41.3	5.89		34.3	42.8	3.86
Grasses and grass-like plants								
<i>Carex obtusata</i>	1	100.0	---	1.41	1	100.0	---	4.62
<i>Festuca arizonica</i>	2	0.9	---	0.87	5	2.5	2.5	0.46
<i>Juncus</i> sp.	2	87.5	14.6	8.08	4	68.6	47.3	4.58
<i>Koeleria cristata</i>	9	41.1	30.6	4.81	8	30.5	31.2	2.60
<i>Muhlenbergia montana</i>	4	25.0	30.4	5.76	5	3.7	5.6	0.60
<i>Muhlenbergia richardsonis</i>	---	---	---	---	2	12.5	---	0.85
<i>Muhlenbergia torreyi</i>	5	20.0	32.6	1.77	5	10.0	5.6	0.96
<i>Poa juncifolia</i>	---	---	---	---	1	0.0	0.0	0.00
<i>Sitanion hystrix</i>	2	56.3	---	2.84	3	12.5	---	2.06
<i>Stipa lettermani</i>	5	47.5	35.8	2.08	3	37.5	21.7	2.45
Mean		40.8	35.4	3.87		23.6	31.9	1.87
Shrubs								
<i>Artemisia frigida</i>	9	10.0	16.6	1.10	10	5.1	10.3	0.39
<i>Chrysothamnus parryi</i>	9	9.4	12.5	0.48	9	5.6	9.4	0.34
<i>Chrysothamnus viscidiflorus</i>	9	17.6	28.1	0.98	7	21.0	24.7	1.81
<i>Leptodactylon pungens</i>	---	---	---	---	2	71.5	---	2.62
Mean		12.3	19.7	0.85		13.0	23.0	0.89

TABLE 20. Food utilization and preferences of jackrabbits in the sagebrush type, June, 1962, at Cochetopa Park, Colorado.

Species	Adult				Young			
	No. Plots	Mean Util.	Std. Dev.	Mean Pref.	No. Plots	Mean Util.	Std. Dev.	Mean Pref.
Forbs								
<i>Achillea lanulosa</i>	2	0.0	---	0.00	---	---	---	---
<i>Allium</i> sp.	1	100.0	---	3.44	---	---	---	---
<i>Antennaria parva</i>	1	100.0	---	80.00	3	0.0	0.0	0.00
<i>Castilleja integra</i>	1	100.0	---	5.20	1	0.0	---	0.00
<i>Chenopodium</i> sp.	1	100.0	---	55.00	---	---	---	---
<i>Draba</i> sp.	1	100.0	---	44.00	1	0.0	---	0.00
<i>Erigeron</i> sp.	4	52.7	39.6	3.97	8	59.6	47.3	7.65
<i>Eriogonum alatum</i>	2	100.0	---	5.30	3	50.0	70.7	5.50
<i>Gilia calcarea</i>	---	---	---	---	2	50.0	---	6.10
<i>Hymenoxys richardsonii</i>	6	5.8	10.2	0.49	6	0.0	0.0	0.00
<i>Lesquerella montana</i>	3	95.8	7.2	23.00	3	16.7	28.9	1.85
<i>Linum lewisii</i>	---	---	---	---	1	0.0	---	0.00
<i>Penstemon</i> sp.	2	56.3	---	41.41	2	2.5	---	1.02
<i>Penstemon teucroides</i>	5	20.0	44.7	0.68	6	0.0	0.0	0.00
<i>Potentilla</i> sp.	---	---	---	---	1	0.0	---	0.00
<i>Potentilla diversifolia</i>	7	76.9	39.8	16.20	4	58.3	50.2	9.17
<i>Pseudocymopterus montanus</i>	3	50.0	86.6	3.04	2	0.0	---	0.00
<i>Taxaracum officinale</i>	1	0.0	---	0.00	2	0.0	---	0.00
Mean		53.4	49.1	14.50		22.6	39.1	2.99
Grasses and grass-like plants								
<i>Agropyron smithii</i>	1	100.0	---	44.00	2	62.5	---	24.00
<i>Bromus anomalus</i>	---	---	---	---	2	0.0	---	0.00
<i>Carex obtusata</i>	10	88.5	28.7	24.11	10	78.8	35.4	48.72
<i>Festuca arizonica</i>	7	30.8	27.7	8.26	6	5.5	6.0	0.96
<i>Festuca ovina</i>	4	35.0	47.3	21.75	5	60.0	54.8	11.94
<i>Juncus</i> sp.	3	67.7	57.8	37.00	---	---	---	---
<i>Koeleria cristata</i>	6	36.1	39.0	10.97	6	39.8	47.7	4.02
<i>Muhlenbergia montana</i>	4	21.9	43.8	0.27	5	4.4	5.7	4.68
<i>Muhlenbergia richardsonis</i>	1	0.0	---	0.00	---	---	---	---
<i>Poa fendleriana</i>	5	18.1	31.9	1.75	3	4.2	5.1	1.85
<i>Stipa comata</i>	4	64.6	29.2	13.87	3	26.4	35.5	9.45
Mean		48.7	42.6	12.71		38.0	43.9	16.23
Shrubs								
<i>Artemisia frigida</i>	5	10.0	22.4	4.70	2	0.0	---	0.00
<i>Artemisia tridentata</i>	9	0.3	0.8	0.06	10	0.3	0.5	0.03
<i>Chrysothamnus parryi</i>	6	52.0	40.7	3.77	5	2.0	4.5	0.16
<i>Chrysothamnus viscidiflorus</i>	1	0.0	---	0.00	2	0.0	---	0.00
Mean		17.4	32.2	2.22		0.7	2.2	0.06

TABLE 21. Food utilization and preferences of jackrabbits in the sagebrush type, July, 1962, at Cochetopa Park, Colorado.

Species	Adult				Young			
	No. Plots	Mean Util.	Std. Dev.	Mean Pref.	No. Plots	Mean Util.	Std. Dev.	Mean Pref.
Forbs								
<i>Androsace</i> sp.	2	0.0	0.0	0.00	2	0.0	0.0	0.00
<i>Antennaria parva</i>	9	0.0	0.0	0.00	10	0.0	0.0	0.00
<i>Astragalus</i> sp.	1	40.0	---	26.83	---	---	---	---
<i>Castilleja integra</i>	5	100.0	0.0	26.35	5	100.0	0.0	6.35
<i>Erigeron</i> sp.	1	100.0	---	21.94	---	---	---	---
<i>Eriogonum alatum</i>	3	66.7	57.7	17.33	---	---	---	---
<i>Geranium fremontii</i>	1	12.5	---	8.00	---	---	---	---
<i>Hymenoxys richardsonii</i>	9	1.1	2.3	0.54	10	2.0	6.3	0.12
<i>Penstemon</i> sp.	3	50.0	43.3	22.89	3	83.3	28.9	6.34
<i>Penstemon teucroides</i>	6	66.7	51.6	16.45	8	22.2	46.3	1.02
<i>Potentilla concinna</i>	2	62.5	---	5.84	5	80.0	44.7	5.84
<i>Potentilla diversifolia</i>	3	82.1	24.8	4.80	3	33.8	57.3	6.79
<i>Senecio</i> sp.	---	---	---	---	1	100.0	---	9.00
<i>Taraxacum officinale</i>	---	---	---	---	1	100.0	---	10.00
Mean		39.9	46.6	10.04		34.1	47.0	2.07
Grasses and grass-like plants								
<i>Bouteloua gracilis</i>	1	25.0	---	2.00	---	---	---	---
<i>Carex obtusata</i>	7	88.1	28.0	11.21	8	100.0	0.0	7.30
<i>Festuca arizonica</i>	5	10.9	15.1	1.45	8	22.9	16.3	1.70
<i>Festuca ovina</i>	8	50.2	36.7	16.20	10	54.6	30.4	3.77
<i>Juncus</i> sp.	5	58.3	53.4	6.18	2	75.0	33.9	2.45
<i>Koeleria cristata</i>	9	41.6	35.0	13.35	10	47.7	32.0	3.81
<i>Muhlenbergia montana</i>	5	52.5	45.8	14.99	4	35.6	32.0	1.75
<i>Muhlenbergia torreyi</i>	7	1.8	4.7	0.36	9	24.1	33.0	1.90
<i>Poa fendleriana</i>	1	6.3	---	1.32	2	36.5	42.7	4.94
<i>Stipa comata</i>	5	30.2	35.7	6.45	3	36.1	12.7	1.91
<i>Stipa lettermani</i>	2	3.3	4.4	0.10	2	35.0	21.2	4.16
Mean		41.2	40.4	8.86		50.0	35.3	3.41
Shrubs								
<i>Artemisia frigida</i>	---	---	---	---	5	15.0	33.5	2.49
<i>Artemisia tridentata</i>	10	1.7	4.2	0.17	10	0.4	0.6	0.02
<i>Chrysothamnus parryi</i>	3	66.7	57.7	33.79	3	43.3	51.8	2.51
<i>Chrysothamnus viscidiflorus</i>	3	57.8	51.8	17.55	5	13.7	12.1	1.24
<i>Leptodactylon pungens</i>	7	42.1	43.5	3.82	7	27.5	43.1	1.47
Mean		29.8	42.0	7.93		15.6	30.8	1.22

TABLE 22. *Food utilization and preferences of jackrabbits in the sagebrush type, September, 1962, at Cochetopa Park, Colorado.*

Species	Adult				Young			
	No. Plots	Mean Util.	Std. Dev.	Mean Pref.	No. Plots	Mean Util.	Std. Dev.	Mean Pref.
Forbs								
<i>Androsace</i> sp.	8	25.0	37.8	0.81	5	0.0	0.0	0.00
<i>Antennaria parva</i>	10	10.5	15.1	0.64	10	1.3	4.1	0.01
<i>Arenaria fendleri</i>	----	----	----	----	1	100.0	----	2.20
<i>Astragalus</i> sp.	1	100.0	----	5.42	----	----	----	----
<i>Castilleja integra</i>	----	----	----	----	1	100.0	----	5.14
<i>Erigeron</i> sp.	1	100.0	----	4.50	1	100.0	----	15.50
<i>Hymenoxys richardsonii</i>	1	0.0	----	0.00	3	0.0	0.0	0.00
<i>Iris missouriensis</i>	1	0.0	0.0	0.00	----	----	----	----
<i>Potentilla concinna</i>	9	90.8	16.0	7.47	7	70.4	30.8	4.61
Mean		42.6	44.0	2.90		28.8	50.3	1.97
Grasses and grass-like plants								
<i>Carex obtusata</i>	10	96.3	8.4	7.72	9	92.2	17.2	6.42
<i>Festuca arizonica</i>	10	20.5	19.8	1.04	4	2.3	2.9	0.16
<i>Juncus</i> sp.	4	100.0	0.0	5.03	6	81.3	24.7	6.37
<i>Koeleria cristata</i>	10	58.0	38.4	5.30	10	59.2	36.6	4.13
<i>Muhlenbergia montana</i>	1	25.0	----	0.47	2	25.0	----	6.00
<i>Muhlenbergia richardsonis</i>	1	50.0	----	1.15	2	12.5	----	2.28
<i>Muhlenbergia torreyi</i>	7	37.4	26.1	2.37	8	18.0	26.8	1.41
<i>Sitanion hystrix</i>	4	68.8	23.9	4.98	3	0.0	0.0	0.00
<i>Stipa lettermani</i>	2	50.0	----	5.89	8	29.2	33.3	2.26
Mean		58.3	36.8	4.30		45.6	40.9	3.54
Shrubs								
<i>Artemisia frigida</i>	----	----	----	----	1	12.5	----	0.10
<i>Artemisia tridentata</i>	10	7.2	15.8	0.17	10	1.1	2.6	0.13
<i>Chrysothamnus parryi</i>	7	14.0	24.1	0.28	8	15.2	25.1	0.36
<i>Chrysothamnus viscidiflorus</i>	2	0.0	----	0.00	2	2.9	----	0.38
<i>Leptodactylon pungens</i>	1	100.0	----	1.42	----	----	----	----
Mean		13.5	27.1	0.25		7.2	16.5	0.24

TABLE 23. *Forage consumption (g/day) of four captive white-tailed jack-rabbits.*

Date	Item	Pen Number				Total
		1	2	3	4	
April 30	Barley	39	27	33	39	
	Alfalfa	43	63	47	20	
	Total	82	90	80	59	311
May 7	Barley	56	48	57	66	
	Alfalfa	54	13	41	15	
	Total	110	61	98	81	350
May 11	Barley	57	54	70	64	
	Alfalfa	60	49	43	28	
	Total	117	103	113	92	425
May 14	Barley	71	58	61	17	
	Alfalfa	34	40	10	19	
	Total	105	98	71	36	310
May 18	Barley	77	42	42	48	
	Alfalfa	22	35	29	19	
	Total	99	77	71	67	314
May 22	Barley	73	56	54	7	
	Alfalfa	48	8	56	43	
	Total	121	64	110	50	345
May 25	Barley	57	96	28	59	
	Alfalfa	35	23	11	0	
	Total	92	119	39	59	309
May 28	Barley	71	111	79	70	
	Alfalfa	27	41	0	35	
	Total	98	152	79	105	434
June 1	Barley	37	125	37	----	
	Alfalfa	33	43	8	----	
	Total	70	168	45	----	283

(Table 23 Con't.)

Date	Item	Pen Number				Total
		1	2	3	4	
Total	Barley	538	617	461	370	1,986
	Alfalfa	356	315	245	179	1,095
	Total	894	932	706	549	3,081
Mean	Barley	60	69	51	46	57
	Alfalfa	40	35	27	22	31
	Total	100	104	78	69	88
Standard Error	Barley	5	11	6	8	8
	Alfalfa	4	6	7	4	6
	Total	6	11	7	7	8
Ratio						
Alfalfa:Barley		0.67:1	0.51:1	0.53:1	0.48:1	0.54:1

TABLE 24. *Relationship of pellet weights and forage consumed by four captive white-tailed jackrabbits.*

Date	Pen Number				Group	Standard Error
	1 (%)*	2 (%)	3 (%)	4 (%)		
April 30	28	22	20	19	22	2
May 7	32	26	28	33	20	2
May 11	28	22	17	22	22	2
May 14	28	30	30	68	39	9
May 18	43	45	23	40	28	5
May 22	25	35	14	40	25	6
May 25	32	20	37	28	28	4
May 28	29	22	24	11	21	4
June 1	48	25	40	---	40	6
Individual	32	26	24	33	28	2
Standard error	4	5	4	10		

* These percentages were computed by dividing the weight of the pellets per day by the total weight of the forage consumed per day.

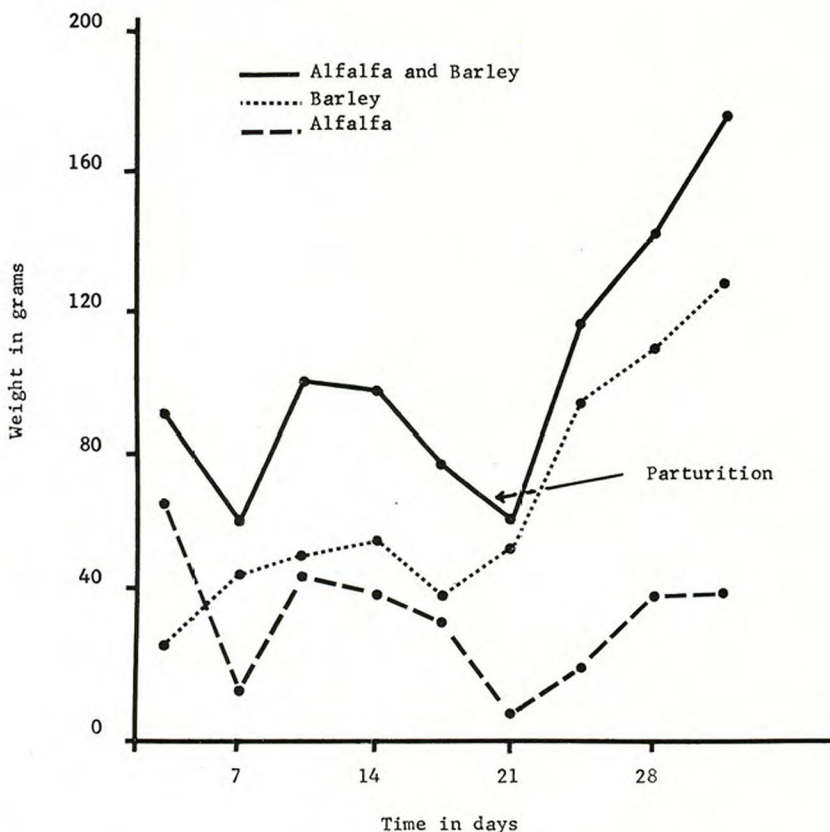


FIGURE 6. *Forage consumption of a female white-tailed jackrabbit immediately before and after parturition.*

anus. Rabbits obtain additional energy from the ingested food by passing it through the digestive tract a second time. Reingested pellets are high in protein and contain large quantities of certain B vitamins. Rabbits start reingesting pellets at a very early age. They very likely obtain essential intestinal bacteria by eating pellets produced by the mother (Schwartz and Schwartz, 1959). Taylor (1939) estimated one-fourth to one-half the jackrabbits' stomach contents to be reingested pellets. The reingested pellets were usually found in the cardiac end of the stomach.

Spencer (1955) studied reingestion in white-tailed jackrabbits, snowshoe hares, and New England cottontails. One-half of the animals killed from 9:00 a.m. to 5:00 p.m. had reingested pellets in their stomachs, and 21 of 25 animals killed at 1:00 p.m. had reingested pellets. Adams (1959) observed snowshoes reingesting pellets by orally picking them from their anuses. Soft pellets were being produced in all black-tailed jackrabbits collected from 8:00 to 10:00 a.m. in California, and it appeared that some rabbits were reingesting them (Lechleitner, 1957). Watson and Taylor (1955) observed reingestion in the European hare. Amorphous pellets were found only in the hares killed from 6:00 a.m. to 4:00 p.m. and in the recta of all animals killed from 8:00 to 12:00 a.m. In our study amorphous masses of vegetation were observed in the cardiac portion of stomachs of white-tailed jackrabbits. It is presumed that these were reingested pellets. It appears that reingestion takes place in white-tailed jackrabbits, black-tailed jackrabbits, snowshoe hares, and European hares in late morning hours.

REPRODUCTION IN JACKRABBITS

Breeding season Roadside observations of white-tailed jackrabbits in Colorado indicate that young occur from early spring through summer. Reproductive data were taken from 287 dissected white-tailed jackrabbits. Females with embryos were collected from 2 May until 18 July on the study area. Burnett (1926) reported having taken gravid females from 7 May to 12 August in Colorado. Behavior, presumed to be nuptial chases, was observed from March through August. Groups of from three to five individuals frequently are seen slowly hopping, with their noses sniffing the ground. These animals stop often to sit and observe their surroundings. These activities were most frequently seen in subdued light or at night with the aid of a spotlight. Often rabbits chase one another, and less frequently the groups appear to be chasing a larger sized jackrabbit. Invariably the animals collected from groups would be males, and solitary animals were most frequently females. When a group of jackrabbits was observed chasing a single one of larger size

it was presumed to be a group of males following a female in oestrous.

The reproductive tracts of white-tailed jackrabbits show definite seasonal changes in morphology (Figures 7, 8). The adult reproductive system reaches its maximum size and development in May and begins to regress by July in specimens from the study area.

The December sample of adult females had a mean uterine width (standard deviation of mean) of 4.8 ± 0.7 mm; increasing to 6.8 ± 1.2 mm in March and reaching a maximum, 13.7 ± 6.4 mm in June. By August the uterine width of adult females averaged 6.4 ± 2.6 mm, thus indicating an average regression. Lechleitner (1959) stated that uteri and ovaries of the black-tailed jackrabbit vary in size according to the reproductive state. He also indicated that the uteri quickly become smaller after parturition. The presence of new scars and evidence of lactation in June may indicate that some females had already given birth to young. In March the uteri were slightly swollen, which may indicate uterine development prior to ovulation. Lactating females were taken in the June sample, and by August the mammary tissue was regressed and most adult females appeared not to be lactating.

Ovaries followed a similar growth and regression pattern as the uteri. The mean (\pm SD) ovarian index was 84.2 ± 18.8 mm in December; 137.8 ± 41.4 mm in March; 209.5 ± 70.3 mm in June; and 114.9 ± 40.7 mm in August. According to Lechleitner (1959), in the black-tailed jackrabbit the enlargement of the ovaries is due to development of the corpora lutea and, therefore, the ovaries are largest following ovulation. It appears that the mean ovarian index was greatest in late May for animals in our study.

The reproductive system of adult males appears to develop more rapidly and at an earlier date than in adult females. The mean testis volume of adult males in December was 3.1 ± 1.5 cc, and increased to a mean of 9.8 ± 2.0 cc in March. In June, the mean was 10.2 ± 1.8 cc, which was only slightly larger than the mean for March. By August, the mean volume of adult testes was 4.3 ± 1.2 cc, indicating regression. Due to the lack of

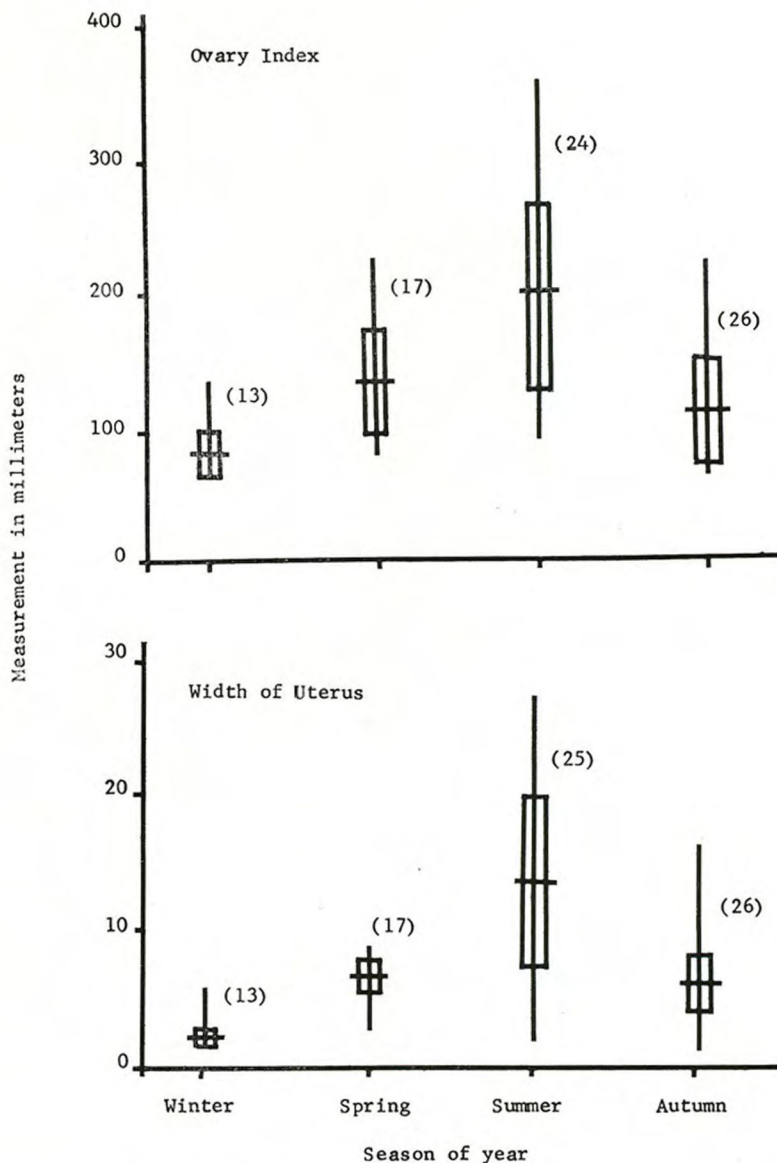


FIGURE 7. The average plus or minus one SD and the observed range in size for the ovary and uterus of adult female white-tailed jackrabbits in southern Colorado. Sample size is indicated within parentheses.

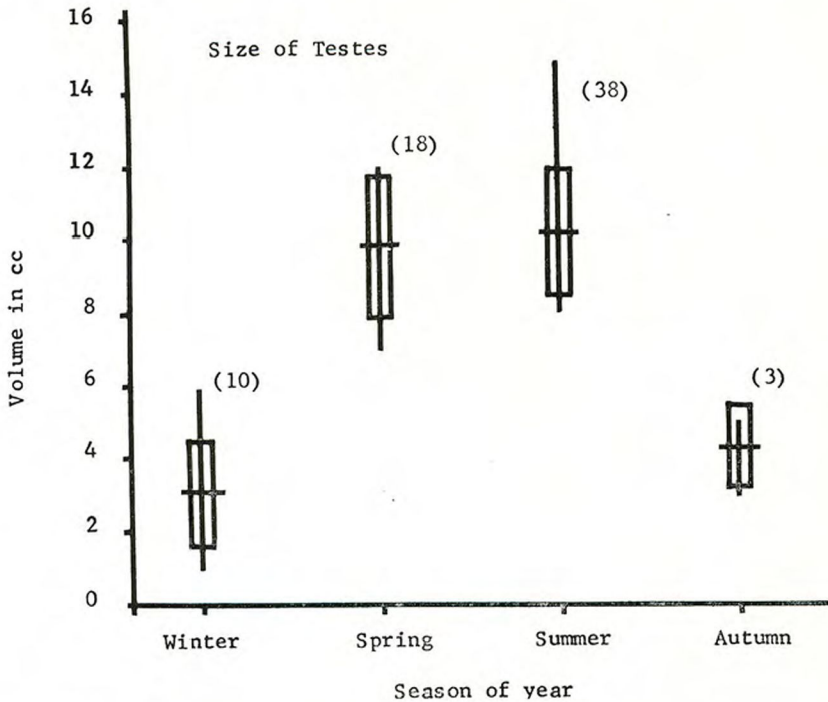


FIGURE 8. *The average plus or minus one SD and the observed range in volume of testicle for each season of the year for adult male white-tailed jackrabbits in southern Colorado. Sample size is indicated within parentheses.*

sampling between March and June, it is impossible to predict if the volume had greatly increased and was regressing in June or if it had remained constant. The testes appeared somewhat flabby and soft in January but were turgid by March. This turgidity was retained by adult males until August when the testes were soft.

The presence or absence of spermatozoa in the epididymides closely correlated with size of the testes. In December, spermatozoa were not observed in any specimens examined. In March and June spermatozoa were abundant in epididymides of all

adult males examined. Spermatozoa were absent in some adult males taken in August and there were a reduced number of spermatozoa in the epididymides of some adult male white-tailed jackrabbits collected in August. Lechleitner (1959) in his study on the black-tailed jackrabbit, found that the epididymides retain the spermatozoa for "some time" after the testes stopped production of spermatozoa. This may explain the reduced numbers of spermatozoa observed in some August-taken adult males.

Litters Size and numbers of litters for white-tails appear to vary. Because of the conspicuous lack of small sized jackrabbits by mid-summer and the short duration in spring when females with embryos can be collected, in some years, as in 1961, there appears to be an average of but one litter per adult female. Burnett (1962) reported female white-tails in Colorado produce as many as three litters per year with an average of 4.1 young per litter. Gunderson and Beer (1953) found that females in Minnesota have one litter each year, and Bailey (1926) reported the same for white-tailed jackrabbits in North Dakota. Kline (1963) reported females producing "perhaps even three or four litters each per season" in Iowa where the breeding season extends from February through early July. White-tail females may produce several litters per breeding season during especially favorable years when the population density is sharply increasing. Perhaps the length of the breeding season is controlled primarily by the numbers of litters per female more so than by other factors.

Litter size (based on numbers of embryos or recognizable recent implantation sites in the uterus), in 25 adult females taken from June through July, varied from one to 11 and averaged about 5/litter.

GROWTH IN JACKRABBITS

Aging There are several ways to estimate the age of jackrabbits but the most reliable method is to classify animals according to the appearance of the proximal epiphysis of the humerus.

The ossification of the epiphysis of the humeri gives relatively close estimates of ages even after black-tailed jackrabbits reached an adult weight (Lechleitner 1959). In new-born mammals a thick plate of epiphyseal cartilage is found between the diaphysis and the epiphysis. The cartilage is replaced by bone in the first winter in cottontails (Hale 1949). At seven months the epiphyseal cartilage is a distinct line and in older rabbits it is entirely missing when this portion of the humerus becomes smooth. Body weights are useful for establishing general age relationships in very young animals. The presence of uterine striations can be used to tell adult females from young females, assuming all old females have given birth to young. The striations result from stretching of the uterus during pregnancy and leaves longitudinal striations on the uterus. The penis can be everted in adult males but not in young males. Young white-tails had a mottled dark-brown pelage that was easily detected in August. Adult summer pelages were uniformly lighter and grayish-brown in color. The winter pelage of animals from the study area varied from a grayish color to almost pure white (Hansen and Bear 1963).

Size in adults There were no significant differences in the seasonal weights of either adult male or adult female white-tailed jackrabbits (Table 25). However, adult females averaged larger in size than adult males and females with large embryos tended to weigh heavier than other females. Adults and young could be told apart until at least late December. By mid-March, practically all young jackrabbits were grown and sexually developed to a stage which made them no longer distinguishable from other adults.

Growth and development Newborn young jackrabbits are rarely obtained for study. Young, judged to be full-term, were taken by caesarian operation from slaughtered female black-tailed and Allen's jackrabbits by Vorhies and Taylor (1933). Four of the young taken from Allen's jackrabbits averaged 121 grams in weight; one young weighed 184 grams, while three from the same litter, weighed 108, 103 and 90 grams. Two of these young when five days old had hind feet 40 and 45 mm in length, and

TABLE 25. *Morphological measurements of adult white-tailed jackrabbits from Cochetopa Park, Colorado, 1959-1962.*

Measurement	Sex					
	Male			Female		
	Mean \pm SD	Range	No.	Mean \pm SD	Range	No.
Weight (ounces)	97 \pm 10	71-124	82	117 \pm 11	93-156	81
Total Length (mm)	576 \pm 27	514-645	34	602 \pm 28	470-650	42
Tail Length (mm)	90 \pm 7	76-106	34	92 \pm 10	79-110	42
Hindfoot Length (mm)	153 \pm 5	140-163	81	156 \pm 5	141-167	81
Ear Length (mm)	115 \pm 5	102-127	81	114 \pm 6	99-123	81

TABLE 26. *Average length of hind foot and length of ear from notch for young white-tailed jackrabbits according to weight-age-classes, Cochetopa Park, Colorado.*

Body weight (ounces)	Age class* (weeks)	Measurements (mm)			
		Length of hind foot		Length of ear	
		Mean \pm SD	No.	Mean \pm SD	No.
4-10	1-2	59 \pm 9	6	45 \pm 11	6
11-27	2-4	92 \pm 12	18	78 \pm 11	18
28-41	4-6	116 \pm 10	28	95 \pm 6	28
42-51	6-8	129 \pm 7	25	104 \pm 6	25
52-60	8-10	136 \pm 5	20	109 \pm 5	20
61-69	10-12	141 \pm 5	22	110 \pm 4	22
70-74	12-14	145 \pm 3	8	113 \pm 5	8
75-77	14-16	150 \pm 5	19	113 \pm 4	19
78-80	16-18	149 \pm 3	13	114 \pm 3	13
81-83	18-20	151 \pm 7	11	115 \pm 5	11
83-86	20-22	155 \pm 3	7	115 \pm 3	7
87-89	22-24	155 \pm 3	11	117 \pm 3	11

* Ages were estimated from growth records of young raised in captivity.

ears from the notch were 37 and 40 mm in length. Four full-term young black-tailed jackrabbits gave the following average measurements one day after they were obtained: total weight,



FIGURE 9. *Photo of a one-day old white-tailed jackrabbit which was born in captivity (May 22, 1962).*

65 grams; hind foot length, 34 mm; and ear length from notch, 27 mm.

Unsuccessful attempts were made to raise young white-tails taken from slaughtered females from the study area. The weights of nearly full-term young (same litter) taken on 2 May 1962 were 93, 84, 91 and 89 grams. Only two young white-tails, judged to be near the size of newborn, were found on the study area and they weighed 84 and 90 grams.

A female in captivity gave birth to three young on 21 May 1962 and one day later the newborn weighed 110, 101 and 105

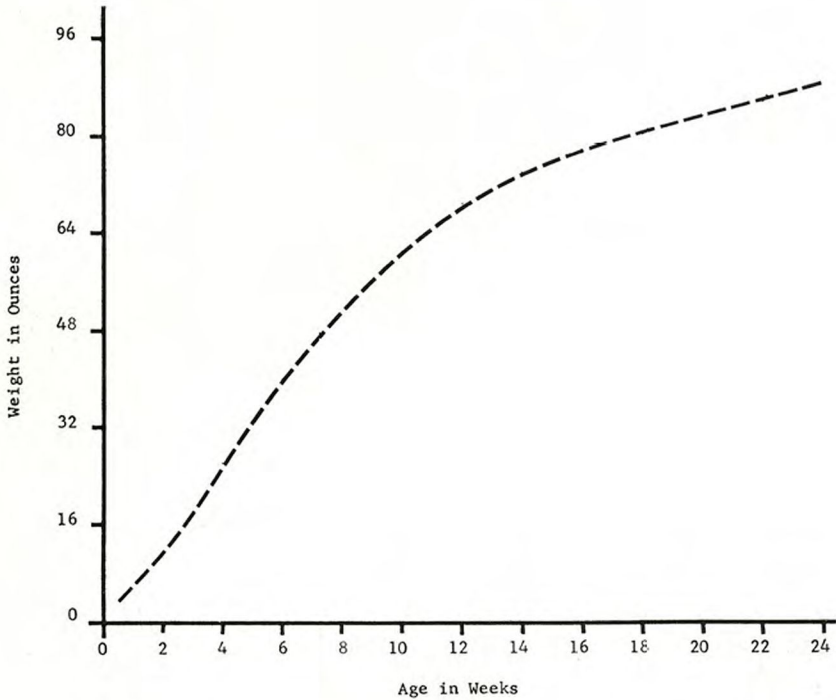


FIGURE 10. *An estimated age-growth curve for young white-tailed jackrabbits for southern Colorado. Weight gains were measured for eight young for 800 growth-days and the curve was hand-fitted.*

grams (Figure 9). At one week of age they weighed 172, 170 and 134 grams. Their respective lengths of hindfeet at one day of age were 60, 59 and 56 mm; and the ear-lengths from the notch were 41, 41 and 40 mm. Size and growth were measured for these young at 7 day intervals until the last one died when about 3 months old.

Growth was measured for the three young born in captivity and for five additional young captured in the study area. These eight young provided more than 800 days of growth records. An estimate of the relation between body weight and age was

made for young up to about 24 weeks of age when the animals averaged about 89 ounces (Figure 10). The growth curve was hand-fitted, based on the previously mentioned records. In December, the mean weights of young males and females are not significantly different from each other and average about 100 ounces, but adult females are heavier than adult males. Therefore, it appears that age and growth are similar in males and females until sexual maturity is gained.

The average lengths of the hind feet and ears were computed for weight-age classes of 188 young white-tails (Table 26). Size of the hind feet and ears increases toward adult size more rapidly than does body weight. The ears of young jackrabbits approach adult length when body weights are about 56 ounces (half-grown). Growth rate of ears is about 8 times as great between 6 and 8 weeks of age than for young between 8 and 24 weeks of age. Whereas the hind feet increase in length about 8 mm in 4 weeks when young are from 6 to 10 weeks in age, there is only an 8 mm increase in length of foot between 10 and 24 weeks in age. The growth rate for increased length of hind feet is about three times as great in young 6 to 10 weeks old as in older aged young.

DISCUSSION

Life history and behavior A concerted effort was made to locate young and nests of white-tailed jackrabbits on the study area. Field personnel carefully searched localities where several lactating females had been taken. Several burrows large enough to permit a jackrabbit to enter were excavated. Many of the burrows contained hair and tracks of jackrabbits but no nests or nestling jackrabbits were found. Young jackrabbits, judged to be approximately 2 to 8 weeks old, frequently sought protection in burrows when closely pursued. Adult jackrabbits in the winter months often retreated in burrows when soft snow prevented an easy escape from an approaching person. On one

occasion a young whitetail (90 grams) was caught in a museum special trap set for small mammals in census trap line. Investigation disclosed a used burrow approximately 25 feet from the trap site. There were three jackrabbit forms located within a ten-foot radius of the den entrance. Jackrabbit fur was found on a root inside the burrow. The burrow extended downward about three feet and then widened slightly into a small cavity. However, no additional young jackrabbits could be located in the den or vicinity.

The young whitetails taken in North Park on May 9, 1962, by caesarian operation were fully furred, their eyes were open and their incisors were exposed beyond the gum line. They could move feebly within half an hour after being taken. The following day they could hop clumsily about, but stopped after each hop to regain their balance. They slept during daylight hours and were active during darkness. The young jackrabbits reacted readily to squeaking sounds made by a person's lips and would come to the sound when they were two days old. Also, they would readily follow a person walking across the room. The young whitetails groomed each other. They tended to remain huddled together and showed nervousness whenever isolated. By the time the young whitetails were five days old they were agile and could jump over objects approximately 3.5 inches above the floor. The young jackrabbits were fed evaporated milk mixed with water in the morning and evening. Apparently this was not a proper diet, because they developed digestive disorders and died when they were six to eight days old. Two young jackrabbits found in the field, and estimated to be from two to three days old, did not develop any attraction toward a person attempting to feed them.

Reproductive data were taken from 287 dissected white-tailed jackrabbits, which included 81 sexually adult females, 82 sexually adult males, 73 young females and 51 young males. Although the sex ratio deviates significantly from equality in young the divergence resulted from selective hunting methods. Females are usually solitary. Females with embryos and young were more difficult to find than were adult males in the breeding season. In the summer sample there were 41 adult males and only 25

adult females even though an attempt was made to collect solitary animals which were more likely to be females than were jackrabbits found in groups. During the non-breeding season the males and females were obtained with about equal success.

It appears that white-tailed jackrabbits grow at a rate similar to that of other jackrabbits. Haskell and Reynolds (1947) have shown that adult weights are attained by black-tailed jackrabbits at an average age of 32 weeks. The epiphyseal lines of the humeri of all species of jackrabbits seem to disappear between 7 and 11 months. Breeding by young-of-the-year has not been observed in Iowa (Kline 1963) or in Colorado for white-tails. This situation appears to be characteristic for all species of jackrabbits although Bronson and Tiemeir (1958) examined a young female black-tail in Kansas that was in the process of resorbing an early stage embryo.

Feeding patterns White-tailed jackrabbits on the study area fed between sunset and sunrise, and were seldom seen feeding in sunlight. Young weighing less than a pound were never observed foraging or moving about in daylight. Observations suggested that lactating females fed earlier in the evening and later in the morning than did other rabbits. Feeding behavior varied during the spring and summer months. Pregnant or lactating females collected were usually solitary, while males were most often found in groups of 2 to 5 animals when feeding.

Fautin (1946) and Currie (1962) observed black-tailed jackrabbits clipping branches from shrubs and eating only the older woody growth. White-tailed jackrabbits also preferred the woody stems of shrubs and of pinyon more than the leaves or recent growth. They clipped the stem and ate only the woody portion and the remainder of the stem was dropped on the ground. This feeding pattern was observed during all seasons of the year. Fringed sage plants were often completely consumed.

Jackrabbits fed extensively on barrel cactus during an extremely dry period in 1962.

White-tails feeding on test plots during the summer showed preference for the seed heads of grasses. This preference was quite evident even for less desirable species, such as Arizona

fescue. The seed heads were eaten readily when they first emerged from the sheaths, but this preference declined after the seed heads bloomed.

The preference for a plant species shown by jackrabbits often varied from one vegetative type to another. This difference may have been determined by a number of factors including kinds of plants present, quantity of plants available, or the condition of the plants present. Dryland sedge was preferred on the grassland and sagebrush types, but was moderately-preferred on the rabbitbrush type. Bottlebrush squirreltail was preferred in the rabbitbrush and grassland types. June grass, Letterman's needlegrass, and sheep fescue were preferred on the rabbitbrush plots, and moderately preferred on the grassland and sagebrush plots. Mountain muhly was moderately-preferred in the rabbitbrush and sagebrush-feeding trials. Mat muhly was preferred in the grassland and rabbitbrush trials, but was in the less-preferred group of plants in the sagebrush-feeding trials.

Fautin (1946), Lechleitner (1958), and Sanderson (1959) found jackrabbits preferred open areas adjacent to dense cover. The jackrabbits have freedom of movement and greater visibility in the open areas and occupy dense cover during the day. The grassland vegetative type in this study was characterized by low growing vegetation, approximately three inches in height. This type usually occurred between the ridges and draws which were characterized by shrubs. During the winter months the snow was swept off the ridges into the draws by strong winds. Therefore, the grassland ridges were selected travel routes the year around. The adjacent sagebrush and rabbit-brush areas afforded cover. Rabbit-use was approximately four times as great on the grassland transects as on the other transects. The rabbitbrushlands received a similar amount of use to the sagebrush dominated areas.

The sagebrush vegetative type had a larger number of plant species than the other habitats with more variation in the preference ranking of the plants occurring here.

The whitetails fed primarily on grasses and grass-like plants and forbs when they were succulent, but selected a diet primarily consisting of shrubs during the winter months when the grasses

and forbs were dry. Many forbs "greened-up" earlier in the spring than did the grasses, and forbs were selected by rabbits at this time. Most of the grasses did not "green-up" until mid-June, and some were not green until after the rainy season in August. Therefore, grasses were the primary food item in September, although forbs were still of major importance.

Young jackrabbits tested on the feeding plots generally consumed a larger percentage of grasses and a smaller percentage of shrubs than did adult whitetails on similar plots. This difference was less pronounced for the rabbitbrush habitat than in the other three vegetative types. Grasses and grass-like plants were highly preferred by both age groups. However, forbs were the most preferred class of vegetation in July and September on the rabbitbrush vegetative type.

Grazing relations The existence of domestic stock and wild animals side by side sometimes results in competition for forage and in other instances results in the improvement of ranges for the increased production of forage for both classes of users. Wild animals are produced on rangeland and their abundance and vigor are an expression of the range characteristics and quantities of food produced and available.

To estimate properly the relationship of white-tailed jackrabbits to grazing would require information not now available. Vorhies and Taylor (1933) arrived at equivalent amounts eaten by antelope jackrabbits, black-tailed jackrabbits, sheep and cattle through experiments. Thirty black-tails ate as much as one cow. Fifteen antelope jackrabbits ate as much native forage as one sheep, and 74, as much as one cow. It is suspected that the white-tails in this study may exert about the same equivalent influence as that of antelope jackrabbits, but without knowledge of the food habits of sheep and cattle on these grazing lands, the estimate could be inaccurate.

Jackrabbits are believed to influence range condition and trend. On moderately deteriorated ranges jackrabbits may exert forces favoring range improvement and on ranges that have deteriorated to a point where there are more weeds than grasses the influences would be toward further deterioration (Bond,

1945). In eastern Colorado, Sanderson (1959) found the highest blacktailed jackrabbit densities on ranges that were heavily grazed. Norris (1950) indicated that in semi-desert rangeland of New Mexico rabbits and rodents alone can exert sufficient grazing pressure to practically eliminate vegetative improvement. Most studies have indicated a trend toward more jackrabbits on heavily used ranges and fewer on lightly used or unused ranges. (Couch 1927; Costello 1944; Phillips 1936; Taylor *et al.* 1935).

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