Spring Population Responses of Cottontails and Jackrabbits to Cattle Grazing Shortgrass Prairie

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Highlight: *Spring population densities of black-tailed jackrabbits, white-tailed jackrabbits, and desert cottontail rabbits were estimated on pastures under four different grazing treatments by cattle on the shortgrass prairie of northeastern Colorado. Black-tailed jackrabbits were most abundant on pastures with light-summer and moderate-summer grazing treatments. White-tailed jackrabbits showed no strict preference for any grazing treatments but preferred all upland pastures. Desert cottontail rabbits were most abundant in pastures under moderate-summer and moderate-winter grazing treatment. The ratio of abundance between the three species of leporids is, in part, a function of the different levels of grazing intensity. Any future long-term changes in vegetational management in the area could be expected to affect populational ratios.*

Studies of wildlife species on rangelands usually do not take into account the effects of grazing by domestic livestock on wildlife population density and distribution (Hervey et al., 1970). This study shows how populations of black-tailed jackrabbits (*Lepus californicus*), white-tailed jackrabbits (*Lepus townsendii*), and desert cottontail rabbits (*Sylvilagus audubonii*) varied with four grazing intensities of cattle on the shortgrass prairie of northeastern Colorado.

These leporids are potential competitors with other wild herbivores and cattle for forage. They comprise a substantial portion of the trophic base supporting populations of mammalian and threatened avian predators. Therefore, practices of land and forage management that affect population densities and dispersion of leporids within this ecosystem could affect other important species of wildlife.

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Study Area and Methods

The study was conducted at the Central Plains Experimental Range 12 miles (19 km) northeast of Nunn, Colorado, and 25 miles (40 km) southeast of Cheyenne, Wyoming. The vegetation in this area is dominated by blue grama (*Bouteloua gracilis*), buffalograss (*Buchloe dactyloides*), red threeawn (*Aristida longiseta*), western wheatgrass (*Agropyron smithii*), and alkali sacaton (*Sporobolus airoides*). Common forbs include scarlet globe mallow (*Sphaeralcea coccinea*), tumbling Russian thistle (*Salsola kali*), and plains bahia (*Bahia oppositifolia*). The most conspicuous and abundant shrubs include rubber rabbitbrush (*Chrysothamnus nauseosus*), fringed sagewort (*Artemisia frigida*), sand sagebrush (*A. filifolia*), broom snakeweed (*Xanthocephalum sarothrae*), four-wing saltbush (*Atriplex canescens*), and plains pricklypear cactus (*Opuntia polycantha*).

Animal censusing was conducted along a 1-mile (1.6-km) transect line within each of eight 320-acre (129.5-ha) pastures that represented four different cattle grazing treatments. Heavily, moderately, and lightly grazed pastures that were grazed in the summers supported 45, 27, and 20 yearling heifers, respectively, from May 1 through November 1. The two pastures in the fourth treatment were ungrazed by livestock in the summer but were stocked at a moderate winter rate of 30 yearling heifers per pasture (320 acres) from November 1 to May 1. Four pastures (one representing each grazing treatment) were located in each of two shortgrass range subtypes (Klipple and Costello, 1960:13). The first subtype had blue grama-buffalograss vegetation on approximately 75% of the area. Four-wing saltbush and sand sagebrush were the dominant shrubs in this area. A dry meadow of alkali sacaton with a good understory of blue grama and buffalograss covered the bottomlands. The second subtype was an upland blue grama-buffalograss dominated area. Pastures in this subtype were well drained but the soil was somewhat shallow. Brush coverage was lighter in this area. Grazing treatments in the pastures had been randomly assigned in 1939. The number of cattle in each pasture had been adjusted periodically in an attempt to attain the degree of grazing use. Klipple and Costello (1960) documented the vegetational responses and condition in these pastures over a 13-year period.

For three consecutive nights in mid March, April, and May, 1971, animals were censused with the aid of a hand-held spotlight (100-watt, 13-volt aircraft landing light) by the same observer standing in the back of a pickup truck. Censusing began at dusk and an average of 3 hours and 43 minutes were spent each night in actual census activity. Each pasture was censused twice each night, and an average of 1 hour and 53 minutes elapsed between the beginning of the first and second census each night. The method of census was a modification of a technique developed for other studies of jackrabbits and cottontail rabbits on the shortgrass prairie (Flinders and Hansen, 1973). Animals were counted on one side of the 1-mile segments where the view of the observer was unobstructed for at least 100 yards. The observer continuously estimated the 100-yard perpendicular axis while traveling the length of each 1-mile segment, and recorded all leporids and other selected wildlife species within this area. A measurement of an estimated 100-yard distance within each segment each time it was traversed yielded a distribution of estimates from which a mean axis could be used with the 1-mile length of each segment to calculate the area of the belt transect within each pasture. The formula used to calculate an estimated population density per treatment from this data was presented by Flinders and Hansen (1973).

The Kolmogorov-Smirov test (Kraft and van Eeden, 1968:167-169) was used to test for normality of estimated population densities and nonnormal data were transformed to a normal distribution by the formula $\sqrt{X} + \sqrt{X+1}$ (Dixon and Massey, 1969:324). Analysis of variance tests were used to test for population differences between treatments, between nights, and between months while a group comparison *t*-test was used to test for differences between shortgrass subtypes (Woolf, 1968:127-134 and 62-66). Duncan's Multiple Range Test (A.R.S., 1957:23-31) was used to establish differences between mean population densities of leporids in grazing treatments. Statistical differences were established at the 95% level of probability and values close to the accepted level are shown in parentheses.

Results and Discussion

Weather conditions were consistently similar during the three nights animals were censused each month. Thus, there were no significant differences between nightly population estimates each month for each leporid species. If extreme changes in weather had occurred during the census periods, results could have been quite different. Tiemeier (1965) and Alkon (1969) indicated that strong wind, falling snow, and fog had an effect on normal nocturnal movements and activities of leporids.

Table 1. Estimates of population density (number/square mile) of leporids during March, April, and May, 1971, in pastures in northeastern Colorado under different grazing treatments by cattle.

	Cattle grazing treatments			
	Summer			Winter
Species and months	Heavy	Moderate	Light	Moderate
Black-tailed jackrabbits				
March	2.9	5.9	4.4	4.4
April	5.9	16.1	17.6	2.9
May	13.2	22.0	23.5	10.3
Average	7.3[a] [1]	14.7[b]	15.2[b]	5.9[a]
White-tailed jackrabbits				
March	0	7.3	1.5	1.5
April	0	1.5	0	1.5
May	1.5	4.4	2.9	13.2
Average	0.5[c]	4.4[c]	1.5[c]	5.9[c]
Desert cottontail rabbits				
March	2.9	5.9	1.5	10.3
April	0	7.3	0	8.8
May	1.5	10.3	4.4	4.4
Average	1.5[d]	7.8[e]	2.0[d]	7.8[e]

[1] Numbers followed by the same letter are not statistically different at the 95% level of probability.

There were significantly more black-tailed and white-tailed jackrabbits observed from March through May (Table 1). Estimates of the number of desert cottontails were not significantly different between months. This could indicate a bias in sampling in that the precocial young of jackrabbits are more easily observed than the altricial young of rabbits at this time of the year.

Black-tailed jackrabbits were most abundant in pastures under moderate- and light-summer grazing treatments (Table 1) and preferred the lowland areas in these pastures where cover was heaviest (Fig. 1). These findings seem to be in conflict with other studies. Taylor and Lay (1944) indicated black-tailed jackrabbits in eastern Texas increased in seeming response to removal of grasses by overgrazing by domestic livestock. They also noticed these jackrabbits moved into former pine forests that had been cleared by burning but would vacate these areas after 3 or 4 years, when the burns had filled in with shrubs. In the sandhills region of Colorado, Sanderson (1959) found higher densities of black-tailed jackrabbits on pastures heavily grazed by cattle and those pastures dominated by taller vegetation had fewer jackrabbits. Tiemeier (1965) noted a decrease in population density of Kansan black-tailed jackrabbits in areas that had revegetated to dense stands of weeds and grasses.

The differences in the results of the above studies may be resolved if black-tailed jackrabbits are considered to have maximum and minimum levels of tolerance to height, density, and species composition of vegetation in

Fig. 1. *Black-tailed jackrabbits were most abundant in those pastures under moderate-summer and light-summer grazing treatment. Desert cottontails also preferred areas having abundant brushy vegetation or other forms of good cover.*

Fig. 2. *Black-tailed jackrabbits selected those pastures where grazing treatment by cattle still left abundant vegetative cover.*

their habitat. Extreme height and density of vegetation would not be expected to limit habitat selection by black-tailed jackrabbits on the semiarid shortgrass prairie of northeastern Colorado. Instead, pastures moderately and lightly grazed by cattle in the summer have enough vegetation left to well satisfy the needs of black-tailed jackrabbits for food and cover (Fig. 2).

The population density of white-tailed jackrabbits was not significantly different (P = .08) between the four grazing treatments. However, significantly more of these jackrabbits were found in the upland pastures than in bottomlands (Fig. 3). Earlier studies on the shortgrass prairie indicated a yearly average of 659 lb/acre (738 kg/ha) of vegetation in habitats of white-tailed jackrabbits and 727 lb/acre (814 kg/ha) of vegetation in yearly habitats of black-tailed jackrabbits (Flinders and Hansen, 1972). Studies of an allopatric population of white-tailed jackrabbits in southern Colorado showed these hares used both upland and lowland areas and freely moved between various habitat types (Bear and Hansen, 1966). Currie and Goodwin's (1966) studies of an allopatric population of black-tailed jackrabbits in Curlew Valley (Utah) noted these hares occupied both upland and lowland areas and freely moved between these two different vegetational types. Evidence suggests that when black-tailed and white-tailed jackrabbits come into sympatric contact on the shortgrass prairie, the white-tailed jackrabbits tend to select more sparsely vegetated upland habitats.

Desert cottontail rabbits were significantly more abundant in pastures under moderate-summer and moderate-winter grazing treatments. They showed no preference between upland and lowland pastures. These rabbits were usually found in areas adjacent to dense stands of four-wing saltbush or rubber rabbitbrush, along edges between vegetational types, or in areas with gullies or rocky outcrops.

The slight to moderate browsing use of four-wing saltbush by cattle in the pastures under moderate grazing intensity seems to increase the activity of adventitious buds with a resultant increase in density of branches on these shrubs. The area beneath the densely branched canopy of these shrubs thus provides favorable cover for desert cottontail rabbits. Our observations on desert cottontail rabbits concurs with studies of these rabbits in the Fort Bayard Experimental Forest, New Mexico, where occurrence was strongly related to shrub density (Kundaeli and Reynolds, 1972). Desert cottontail rabbits in the Bonneville Basin, Utah, were also strongly associated with shrub communities, especially those dominated by greasewood (*Sarcobatus vermiculatus*) (Vest, 1962; Flinders, 1968).

We had the opportunity to estimate population densities of other wild mammals occurring on the study area. While estimates were not practical for grazing treatments, those derived provide a greater understanding of the animal components of this shortgrass prairie community under grazing management for cattle.

In March, there were an estimated 0.4 coyotes (*Canis latrans*) per square mile on the shortgrass prairie. The observed estimate agrees well with densities reported for coyotes in other areas. Gier (1957) reported a spring breeding population density of 0.7 coyotes per square mile in six counties of Kansas. French et al. (1965) observed 0.3 coyotes per square mile after the breeding season in southeastern Idaho. Coyote population densities in a 700-mile^2 area in northern Utah were estimated to be 0.27, 0.25, 0.23, 0.29, and 0.37 coyotes per square mile each year from 1966 to 1970, respectively (Clark, 1972; Wagner and Stoddart, 1972). Knowlton (1972) cited the

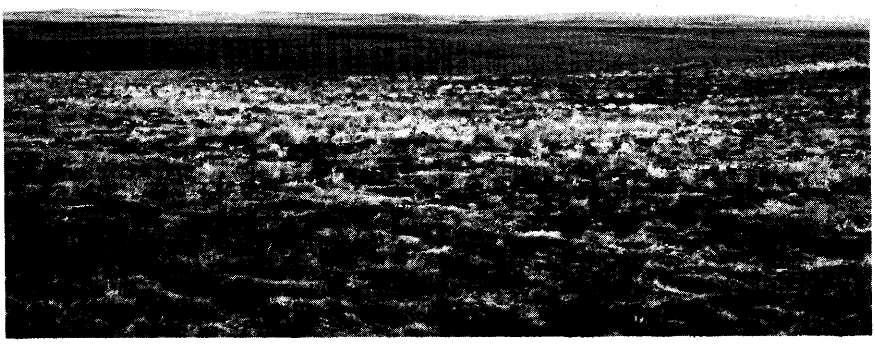

Fig. 3. *White-tailed jackrabbits were positively associated with the more open upland sites within pastures regardless of the grazing treatment.*

need for more precise means of estimating coyote population density and suggested that densities of 0.5 to 1.0 per square mile seem realistic for coyotes over much of their range.

In April and May we estimated 0.4 and 0.7 badgers (*Taxidea taxus*) per square mile, respectively. The adult population of pronghorn antelope (*Antilocapra americana*) in May was estimated at 1.1 per square mile. Kendeigh (1961:328) reported that in primitive times population densities of pronghorn antelope in good habitat were estimated at 4 per square mile. Buechner (1950) quoted Etheredge's estimate of 0.2 pronghorn per square mile in the Trans-Pecos Region of Texas.

In summary, this study, when compared with other research, provides evidence that intensity of grazing by cattle is an important form of habitat disturbance that, depending on area, vegetation, and level of grazing intensity, may enhance or detract from habitat suitability for black-tailed jackrabbits. White-tailed jackrabbits selected upland habitats more sparsely vegetated than those lowland habitats usually occupied by black-tailed jackrabbits and did not show a significant response to grazing treatment. Desert cottontail rabbits were most abundant in pastures under moderate-summer and moderate-winter grazing treatments. Cover components such as density of low-canopied shrub species, ecotones, gullies, and rocky outcrops seem especially essential for cottontails. Population estimates showed that moderate numbers of coyotes, badgers, and pronghorn antelope also occurred on the study area. Since the leporid populations seemed especially associated with vegetational factors in this shortgrass community, it is evident that future vegetational changes as a result of livestock grazing, fire, or farming could influence populational rations between the three species in the study area.

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