Food Habits and Dietary Overlap of Elk and Mule Deer In Guadalupe Mountains National Park, Texas

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ABSTRACT

Botanical composition of elk *(Cervis elaphus nelsoni)* and mule deer *(Odeocoileus heminous crooki)* diets was determined using microhistological examination of fecal material from March, 1978 through February, 1979 in Guadalupe National Park, Texas. Annual diets of elk consisted of 48% browse, 32% grasses, and 20% forbs. Oaks *(Quercus spp.)*, desert ceanothus *(Ceanothus greggii)*, curlyleaf muhly *(Muhlenbergia setifolia)*, blue grama *(Bouteloua gracilis)*, and common horehound *(Marrubium vulgare)* were the major forages used by elk. Annual mule deer diets consisted of 77% browse, 21% forbs, and 2% grasses. Oaks, desert ceanothus, mountain mahogany *(Cercocarpus montanus)*, bladderpods *(Lesquerella spp.)* were the primary forages consumed by mule deer. Overall, annual dietary overlap was moderately high (58%). Overlap was greatest in the browse component and was highest during spring (91%) and summer (65%).

KEYWORDS: competition, elk, food habits, mule deer

Declines in elk (*Cervus elaphus nelsoni*) numbers over recent years in Guadalupe Mountains National Park, Texas (GMNP) has become a growing concern to GMNP resource managers and various wildlife groups. Elk inhabiting the southern Guadalupes in Texas and New Mexico are descendants of 45 animals released in McKittrick Canyon, Texas in 1929. After their introduction, elk dispersed throughout GMNP (Davis, 1940). Early information on elk population growth is limited. Wright and Thompson (1934) estimated that the herd of 45 had increased to 60 by 1934, while Davis (1940) estimated the population at 400 animals in 1938. Efforts to obtain information on elk population dynamics were initiated in 1954 when Texas Parks and Wildlife Department (TPWD) began annual censuses. The fist survey estimated 100-150 elk (Uzzell, 1954). Estimates during the early to mid-1960's indicated a peak population of 350 animals (TPWD, unpublished project reports). Beginning in 1966, TPWD censuses showed steady declines in elk numbers (TPWD, unpublished project reports). TPWD's last 3 censuses, conducted 1971 to 1973, each indicated a population of 225 elk (TPWS, unpublished project reports). Mammal surveys conducted in 1973 and 1975 by Genoways et al. (1977) estimated only 100-150 elk within GMNP. Censuses conducted during 1976 and 1978 put the elk population number at 104 and 111 animals, respectively (Moody, 1979).

Desert mule deer (*Odeocoileus heminous crooki*) are common in GMNP. A recently completed census estimated the population to be over 600 animals with little fluctuation in animal numbers observed over recent years (R. Reisch, pers. Comm.,1980). According to

Funding was provided by the National Park Service and Noxious Brush and Weed Control program at Texas Tech University. We thank Rex D. Pieper for comments on an earlier draft of this manuscript. This is Contribution No. T-9-937, College of Agricultural Sciences, Texas Tech University, Lubbock.
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Mike Hibson (Texas Parks and Wildlife, unpublished data) he found 35 mule deer per 1,000 acres in 1978 and 47 mule deer 1,000 acres in 1979. From the time period of 1980 to 1990, there were an estimated 23 mule deer per 1,000 acres and only 14 mule deer per 1,000 acres from 1991 to 2001.

The objective of this study was to evaluate potential competitive interactions between elk and mule deer for available forage and determine if this is a possible explanation for declining numbers of elk in Guadalupe Mountains National Park, Texas.

MATERIALS AND METHODS

The study was conducted in Guadalupe Mountains National Park in Culberson and Husdpeth counties in the Trans-Pecos region of Texas. Eleven vegetation types occur in GMNP (Glass et al., 1974) and are further described by Bunting (1978) and Krysl (1979). Four major vegetation types accounted for 92% of the total study area. These include: (1) the creosotebush type, which is found on the very shallow, rocky soils of the fans and flats, (2) the mountain shrub vegetation type, which is the most abundant type within the study area, (3) the desert shrub type, which usually occurs on more xeric sites that those occupied by the mountain shrub vegetation type, and (4) the coniferous forest type, which is found predominantly at higher elevations and at low elevations in the heads of major drainage systems.

Approximately 30 mule deer and 30 elk fecal group samples (+/- 2 samples) were collected each month from March, 1978 through February, 1979. We attempted to collect monthly fecal samples from all vegetation types within GMNP; however, this was not always possible because of the seasonal inaccessibility of some areas. Each vegetation type was visited at least once during each season of the year.

Microscopic slides were prepared of reference and fecal material as described by Free et al. (1970). Microhistological examination of fecal material followed the procedures outlined by Sparks and Malechek (1968). Twenty microscope fields were examined at 100x magnification for each sample. Similarity of diets between elk and mule deer was calculated using Kulcyznski's formula (Oosing, 1956). The similarity index represents the percentage of the 2 diets that are identical. For seasonal analysis of food habits, 4 seasons were used to correspond to plant phenology in GMNP. The seasons were: Winter (December-February), Spring (March- May), Summer (June-August), and Fall (September-November).

RESULTS AND DISCUSSION

Elk Food Habits

Annual diets of elk consisted of 48% browse, 32% grasses, and 20% forbs. Oaks (*Quercus undulata, Quercus pungens, Quercus grisea*) were the dominant browse used during all seasons of the year (Table 1). Heavier use of oaks have been attributed o their high protein level throughout the year than found in other shrubs (Swank, 1958). Forbs were consumed predominantly during the fall and winter seasons, whereas grasses were used primarily during spring and summer (Table 1).

The high percentage of browse in annual diets of elk (48%) was considerably higher than reported elsewhere (DeNio, 1938; Morris and Schwarts, 1957; Mackie 1970; Anthony and Smith, 1974). Annual diets of elk usually are dominated by grass rather than browse as demonstrated for Roosevelt elk (63% grass) in California (Harper, 1963), southern Colorado elk (73% grass) (Hansen and Reid, 1974), and Pecos Basin elk (83% grass) in New Mexico (Burt and Gates, 1959). Kufeld (1973) combined various studies conducted in

Table 1. Vegetation (mean %) making up 3 % or more of a seasonal diet for elk in Guadalupe Mountains National Park, Texas.

Forage	Season of Year			
	Spring	Summer	Fall	Winter
Grasses:				
Curly leaf muhly	8	3	2	2
Blue grama	7	8	6	4
Littlelawn needlegrass	5	1	2	5
Threeawns	5	1	2	5
Western wheatgrass	4	t	t	1
Sideoats grama	3	t	t	t
New Mexico needlegrass	3	t	t	t
Wolftail	t	4	3	2
Indiangrass	t	3	3	1
Forbs:				
Bladderpods	5	t	-	-
Common horehound	3	3	12	19
Leatherweed croton	t	6	9	6
Narrowleaf globemallow	t	2	4	3
Browse:				
Oaks	27	29	35	31
Desert ceanothus	9	9	2	t
Forage:				
Mountain mahogany	4	2	t	t
Alligator juniper	t	-	-	5
Total:	81	72	80	83

t = <1.0%

Montana and determined the year-long elk diet consisted of 68% grasses, 25% forbs, and 7% browse. Forbs were predominantly used during the summer season in Montana, accounting for 64% of the total seasonal diet in that area. The preponderance of browse in elk diets in our study, coupled with a lack of season variation in browse consumption, suggests high use was related to an abundance of palatable browse, rather than a preference for woody species. Grasses were readily available.

Elk can consume high levels of browse in winter. Trout and Leege (1971) reported that elk during the winter in Idaho used 82% browse. Similarly, Lang (1958) found mountain mahogany (*Cercocarpus montanus*) and oak to be the primary plants eaten during winter, comprising 32% and 16% of the diet, respectively.

Mule Deer Food Habits

Annual diets of mule deer consisted of 77% browse, 21% forbs, and 2% grasses. Browse was the major forage type taken by mule deer in all seasons (Table 2). Forbs were consumed by mule deer, predominantly during the winter and spring seasons with cool season species forming the majority of the forb component (Fig. 2 and Table 2). Mule deer used grasses primarily during summer (Fig. 2). Littleawn needlegrass (*Stipa lobata*) and *Muhlenbergia* sp. were the primary grass species in the deer's annual diet.

Table 2. Vegetation (mean %) making up 3 % or more of a seasonal diet for mule deer in Guadalupe Mountains National Park, Texas.

Forage	Season of Year			
	Spring	Summer	Fall	Winter
Forbs:				
Bladder Pods	12	t	-	10
Grandleaf Midlwort	3	t	t	t
Flannel Mullein	-	-	3	1
Leatherweed croton	t	t	3	3
Browse:				
Oaks	20	38	38	31
Desert ceanothus	17	15	5	2
Mountain mahogany	16	8	17	10
Apache plume	6	4	3	3
Junipers	6	2	4	13
Skunkbush	t	6	3	t
Total:	81	84	76	74

t = <1.0%

Oaks, mountain mahogany, and desert ceanothus (*Ceanothus greggii*) were dominant browse plants consumed by deer in GMNP throughout the year, comprising 54% of the annual diet. Boeker et al. (1972) determined that oaks and mountain mahogany accounted for 56% of the annual diet in mule deer in southwestern New Mexico. Anderson et al. (1965) reported that wavyleaf oak (*Quercus undulata*), junipers (*Juniperus* spp.), hairy cercocarpus (*Cercocarpus montanus*) and yucca (*Yucca* spp.) species represented 54% of the annual diet. Stewart (1959) determined that oaks, junipers, mountain mahogany, and

ceanothus comprised 43% of the annual diet for mule deer in the Capitan Mountains, New Mexico. He reported that oaks accounted for 27% of the annual diet and was the primary browse species consumed, which was similar to the results found in our study.

Dietary Overlap

The overall dietary similarity indices suggests that the overlap between elk and mule deer was moderate for all seasons combined (Table 3). However, there was a high degree of overlap in the browse component during all seasons except summer. Elk and mule deer relied heavily on browse throughout the year.

Table 3. Seasonal mean similarity indexes (%) generated between mule deer and elk in Guadalupe Mountains National Park, Texas.

Forage	Season of Year				Annual
	Spring	Summer	Fall	Winter	
Grasses	8	5	16	13	11
Forbes	24	59	25	35	36
Browse	91	65	75	75	77
Overall	60	55	57	60	58

Among the browse, oaks were predominant, and accounted for 31% of the annual diets for both elk and mule deer. Mountain mahogany, desert ceanothus, and junipers comprised the majority of the remaining dietary browse component for both ungulate species. Our data generated a browse similarity index of 77% on an annual basis (Table 3), with the highest seasonal overlap occurring in browse in the spring diet (91%). This was a response by both animal species to new browse growth in spring, prior to initial growth of grasses in GMNP. With growth and foliation of the grasses occurring in late spring and early simmer, the elk diet changed toward grasses, hence the observed drop in the summer browse similarity indices (Table 3).

Annual diet similarity indices for forbs and grasses were low, averaging 37% and 13% respectively. Forbs in the diets of elk and mule deer overlapped primarily in the summer and winter seasons, while the overlap for grasses was greatest during the fall and winter seasons (Table 3).

Hansen and Reid (1974) found the overall dietary overlap between mule deer and elk in southern Colorado ranged from 3% in winter to 48% in summer. Our results suggest a greater dietary overlap during winter than they reported, which suggests that in GMNP there may be a greater potential for competition between mule deer and elk during this particular season than that found in southern Colorado.

CONCLUSIONS

At the time of this study, elk populations were about 100% greater than they are today, while mule deer populations were about 300% greater. Although diets of elk and mule deer were moderately similar, there is no direct evidence that competition for food affected populations of either species because both species have declined at this time. Browse plants are used significantly, but browse species are also abundant. The downward trend in elk numbers from the 1930 to 1960 era suggest population estimates at the time of this study may simply be a phenomenon of elk reaching a stable equilibrium with the habitat. It is unknown how much predation, changing habitat, and environmental factors have negatively affected populations since the early 1980s.

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