Diet of Pronghorn in Western Kansas

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Abstract

Pronghorn were common throughout most of Kansas before settlement of the region by European man. They had begun to decline in numbers, even in sparsely populated western Kansas, by 1877, and were nearly extirpated in the state by 1915. However, small herds of pronghorn persisted along the Kansas-Colorado state line, and these were augmented by herds introduced into several regions of Kansas during the years 1964–1979. The diet of the most successful population of pronghorn in western Kansas was found to consist largely of forbs in late spring, summer, and early autumn, of forbs supplemented with wheat and other dicots in late autumn and early spring, and of wheat in winter. Pronghorn are able to live and reproduce where 30% of the land is used for cultivated crops at least in part because they are able to use those crops as food during months when native foods are in short supply.

The pronghorn *(Antilocapra americana)* was a characteristic inhabitant of the High Plains of Kansas before settlement of that region by European man (Brennan 1932). Early biologists (Allen 1874, Knox 1875) and professional trappers (Mead 1899) commented on their distribution, abundance, and seasonal movements on the plains of Kansas. However, records kept at the Fort Hays Military Reservation (Choate and Fleharty 1975) suggested that pronghorn had begun to decline in number by 1877. This decline continued until, in 1905, Lantz noted that the species was "Fast disappearing" in spite of a law to protect it. By 1912 the only report of pronghorn in Kansas was of three individuals seen in the southwestern corner of the state (Kellogg 1915).

For the next 50 years, pronghorn were considered extirpated or extremely rare in Kansas (e.g. Cockrum 1952) although small herds periodically were seen in western counties (Nelson 1925). In 1962 the Kansas Fish and Game Commission conducted a census and located 37 pronghorn in Wallace and Sherman counties near the Colorado state line. This discovery led to formulation of plans to reestablish breeding populations of pronghorn in the state.

Subsequently, the Kansas Fish and Game Commission introduced herds from Colorado, Nebraska, Wyoming, and Montana. However, much of the prairie in Kansas had been either fenced for livestock grazing or plowed for crop production, and it thus was questionable whether the dietary and habitat requirements of pronghorn could be met in a patchwork of rangeland and cultivated crops. Although the introductions have proven successful (Choate and Sexson 1980), at least in westernmost Kansas, it still is not known how the available habitat has satisfied the dietary requirements of pronghorn.

The objectives of the study, therefore, were to determine the diet of the most successful population of pronghorn in Kansas, and to speculate regarding the prospect for pronghorn in the state.

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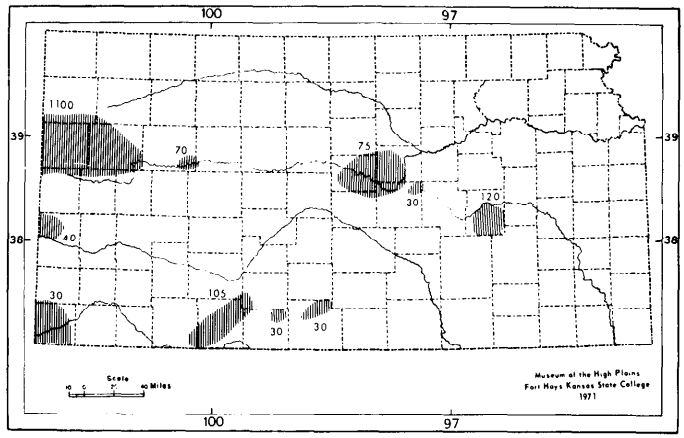

Fig. 1. *Geographic distribution and abundance of pronghorn in Kansas as of December 1979.*

Research Area

The research area was on the High Plains of western Kansas (Fig. 1). It comprised the western part of Wallace County, with its western boundary on the Colorado-Kansas state line. The southern boundary extended eastward from a point where the state line bisects the southern border of section 12, Township 13S, Range 41W, to the southeastern corner of section 8, T. 13S, R. 41 W. From this point, the eastern boundary extended northward to the northeastern corner of section 5, T. 12S, R. 41W. The northern boundary was formed by a line extending westward from this point to the state line.

The area encompassed 17,887 ha (44,220 A) of native shortgrass prairie and cultivated cropland. Shortgrass rangeland occurred on 12,664 ha (31,244 A), hard red winter wheat *(Triticum aestivum)* on 4,808 ha (11,880 A), feed grain and forages on 310 ha (766 A), and alfalfa *(Medicago sativa)* on 126 ha (310 A). Cultivated acreage occurred on level land throughout the research area. The study area was inhabited by approximately 100 pronghorn. During winter they generally were observed in large herds of about 50 to 75 animals.

Vegetation on the rangeland was predominantly warm-season perennial grasses and forbs. Most of the rangeland is grazed by cattle (cow-calf) in all except the winter months. Topography varies from flat to gently rolling, with numerous gullies draining toward the main drainage of the region, the Smoky Hill River. The highest elevation in the study area (and in Kansas) is 1,227 m (4,025 ft), reached in an area of native rangeland on a rise known as Mt. Sunflower. Two drainages (Goose Creek in the northeastern corner and Willow Creek across the southern edge) cross the study area and drain into the Smoky Hill River. Small ponds and stock tanks provide other watering facilities for cattle and pronghorn.

More than 90% of the cultivated land is planted to winter wheat every 2 years; therefore, in any year, half the fields are fallow and contain residue and half are planted. Wheat sometimes is used

Table 1. Mean relative percent frequency of plant species comprising 3% or more of the diet of pronghorn for at least one sample date between November 1977 and October 1978.

Months	Jan.		Feb.		Mar.		Apr.		May	
Collection dates	10	21	4	25	13	25	8	27	7	23
GRASSES:										
Agropyron smithii (Western wheatgrass)							0.6	2.1	7.0	3.9
Bouteloua gracilis (Blue grama)							0.6	0.4	1.3	3.9
Buchloe dactyloides (Buffalograss)			0.8				3.1	0.4	0.3	
Triticum aestivum (Winter wheat)	73.8	97.6	81.0	100.0	94.4	79.9	72.3	1.7	2.0	1.9
Other grasses								0.4	1.3	
BROWSE										
Artemisia filifolia (Sand sagebrush)								14.6	29.3	14.3
FORBS AND LEGUMES:										
Ambrosia psilostachya (Western ragweed)								5.2	3.3	15.5
Artemisia kansana (Kansas sage)									0.3	
Aster tanacetifolius (Tansyleaf aster)							0.6			
Astragalus pectinatus (Narrowleaf milkvetch)								2.6	0.7	2.7
Callirhoe involucrata (Purple poppymallow)									0.3	
Chrysopsis villosa (Leafy goldaster)								0.4	4.0	4.7
Dyssodia papposa (Prairie dogweed)										
Erysimum asperum (Plains erysimum)	3.5		0.8			3.6	1.3	1.3	2.0	4.7
Gaura coccinea (Scarlet gaura)							1.2	9.4	13.0	15.1
Kochia scoparia (Kochia)						0.7				0.8
Lesquerella ovalifolia (Ovalleaf bladderpod)	12.8									2.7
Medicago sativa (Alfalfa)						11.5	0.6	41.6	5.0	3.9
Oenothera serrulata (Serrateleaf eveningprimrose)								6.9		0.4
Psoralea tenuiflora (Slimflower scurfpea)								2.6	5.7	5.0
Ratibida columnifera (Upright prairieconeflower)							0.6	0.4	1.0	2.3
Sphaeralcea coccinea (Scarlet globemallow)							3.8	3.4	20.3	4.7
Verbena stricta (Woolly verbena)							6.3	1.3		3.1
Other forbs	5.7	2.4	2.3				3.3	3.6	2.6	9.2
CACTUS:										
Opuntia sp. (Pricklypear)	3.5		15.1		5.6	4.3	5.7	1.7	0.6	1.2

during winter for grazing cattle. The remainder of the cultivated land is planted to Sudangrass *(Sorghum bicolor)*, corn *(Zea mays)*, or alfalfa. Sudangrass and alfalfa are baled for feeding of cattle in winter, whereas corn is harvested in autumn as a grain crop. Roadside ditches and wheat fields that have been harvested commonly contain weedy plants, such as kochia *(Kochia scoparia)*, rough pigweed *(Amaranthus retroflexus)*, Russian thistle *(Salsola kali)*, and western ragweed *(Ambrosia psilostachya)*, and often contain winter wheat.

The study area received approximately 36 cm (14 in) of precipitation, or slightly less than average, during the research period (November 1977 through October 1978). Most snow fell in January, February, and March, with the heaviest snowfall (about 38 cm, or 15 in) in February. Rainfall was sparse until late April, when a 5-cm (2-in) rain was received. The remainder of the rainfall was spread evenly through the spring and summer months except in May, when only 1.25 cm (0.5 in) of precipitation was received.

Methods and Materials

The duration of the study was November, 1977, through October, 1978. Vegetation of the prairie was analyzed by the modified step-point technique (Owensby 1973). Because additional data were needed on species composition of forbs, this technique was modified further by recording the nearest forb for each point taken even when there was a direct hit. Samples were

June		July		Aug.		Sept.		Oct.		Nov.		Dec.	
2	24	18	28	12	26	9	30	8	23	5	24	10	28
5.2	1.0	0.4	0.8	0.4			1.5						
	1.9			0.4			1.0			0.5			
0.4	2.6	0.4		1.0	1.0	1.0				0.5	0.8		0.7
3.2							2.7	59.2	74.1	41.2	82.1	98.4	85.0
			0.4	1.7	1.1	0.5	0.7	0.6	2.2				
5.2							2.0		1.5				
21.4	24.9	23.8	8.7	16.6	10.5	10.4	0.3	0.6				0.7	
2.8	2.6	7.9	26.9	20.0	11.1	8.3	2.0			22.2			
							18.0	0.6					
2.4	6.1	0.4				0.5							
0.4	8.9	3.8					11.0						
2.4	4.5	17.2	7.2	0.4			0.3	1.8					
0.4				13.6	2.8								
7.1	2.9			10.2	1.6	8.8	0.3						
10.3	9.6	5.0	14.0	5.5	3.3	1.0							
14.3	6.1	5.0	12.0	6.0		0.5	0.7						
	0.3			0.4	0.6		8.0						0.8
3.2	0.3	1.3	2.1	0.4	5.0	13.0				10.3	15.4		
	0.3		1.2				3.0	1.2	0.7				
3.6	11.2	10.5	3.7	1.3	3.3	2.6	2.0	0.6	0.7				
4.0							3.3	7.1	0.7				
2.8	4.2	3.3	7.0	4.3	2.8	7.8	14.0	20.7		2.1			
0.4	1.0	2.9	0.8			0.5		0.6				0.8	
10.1	10.6	11.8	7.8	15.4	26.8	23.3	25.6	4.0	16.4	2.6	0.1		3.6
0.4	1.0	5.9	7.0	3.4	31.1	21.8	3.6	3.0	3.7	20.6	1.6	0.8	9.9

obtained at three times (May 21, July 31, and September 10) during the growing season to monitor changes in species composition. Four sites were selected for analysis: high level prairie (T. 12S, R. 42W, NW 1/4 sec. 23); gently sloping prairie (T. 12S, R. 42W, NE 1/4 sec. 23); steeply sloping prairie (T. 12S, R. 42W, NW 1/4 sec. 25); lowland prairie (T. 12S, R. 42W, SW 1/4 sec. 13). During each sampling period, 100 points were taken on each of the four sites. Indices calculated included percent cover and percent composition of all species.

A standardized procedure for fecal collection and analysis was followed throughout the sampling period. Observation routes were traveled twice monthly, and pronghorn were observed for at least 15 minutes after they found. During this period, the animals would become nervous and defecate before running. Samples of their feces then were collected, placed in plastic containers with alcohol, and sealed for shipment.

Sampling consisted of two fecal collections semi-monthly from November, 1977, through October, 1978. On each sampling day, six specimens were collected and preserved until sent to the Department of Range and Wildlife Management, Texas Tech University, for standardized microscopic analysis (Sparks and Malachek 1968). An attempt was made on each sample day to obtain fecal specimens representative of the entire population of pronghorn on the research area. For this reason, if pronghorn were dispersed into several groups, samples were taken from as many individuals of as many groups as could be found. These samples subsequently were pooled per sample day.

Trophic diversity *(h)* for each sample was calculated as follows

(Margalef 1958):

$$h = -\sum_{i=1}^{S} (n_i/N)\ ln\ (n_i/N) \quad (1)$$

where S is the number of species in the sample, N is the total of individuals of all species, and n_i is the number of individuals of the i*th* species. Evenness *(e)* or equitability for each sample also was calculated using the following index (Pielou 1966):

$$e = h/lns \quad (2)$$

Species richness *(d)* of the diet was defined as the ratio of the total number of species *(s)* to the total importance *(N)* of all species. The index of Margalef (1958) was used to calculate species richness:

$$d = (s-1)\ (ln\ N)^{-1} \quad (3)$$

Vegetational Analysis

Because no apparent differences in plant composition were found among samples taken in May, July, and September, data from 1,200 points were combined to calculate total species composition. The most abundant plants found in the research area were short grasses. Buffalograss *(Buchloe dactyloides)* and blue grama *(Bouteloua gracilis)* were the most abundant, comprising 38.1 and 34.0% of the vegetation, respectively. Other common grasses were: western wheatgrass *(Agropyron smithii),* 11.3%; sideoats grama *(Bouteloua curtipendula),* 5.3%; sand dropseed *(Sporobolus cryptandrus),* 1.4%; red threeawn *(Aristida longiseta),* 1.3%; little barley *(Hordeum pusillum),* 1.2%. Each of the other plant species accounted for less than 1% of the total composition.

Considering only forb species composition data, pricklypear (*Opuntia* sp.), 20.6%, was the most common, followed by scarlet globemallow *(Sphaeralcea coccinea),* 17.3%, and broom snakeweed *(Xanthocephalum sarothrae),* 11.8%. Other forb species with values of 1% or more of the forb composition were: Russian thistle, 8.5%; Kansas sage *(Artemisia kansana),* 4.5%; heath aster *(Aster ericoides),* 43% upright prairie coneflower *(Ratibida columnifera),* 3.7%; rush skeleton plant *(Lygodesmia juncea),* 2.9%; slimflower scurfpea *(Psoralea tenuiflora),* 2.7%; ball cactus *(Neomammallaria radiosa),* 2.3%; western ragweed *(Ambrosia psilostachya),* 1.7%; scarlet gaura *(Gaura coccinea),* 1.7%; purple poppymallow *(Callirhoe involucrata),* 1.2%; wavy leaf thistle *(Cirsium undulatum),* 1.0%; annual sunflower *(Helianthus annuus),* 1.0%; woolly plantain *(Plantago purshii),* 1.0%. The remaining 13.6% was dispersed among 38 other forbs.

Fecal Analysis

Analysis of feces of the pronghorn herd from November of 1977 to October of 1978 revealed the presence of 11 species of grasses and 44 forb species (Table 1). The semimonthly data were averaged by month and pooled into five catagories: (1) wheat; (2) other grasses; (3) alfalfa; (4) other forbs; (5) pricklypear (Fig. 2). In each month from October through March, winter wheat made up at least 60% of the diet, ranging from a low of 41.2% on November 5 to a high 100% on February 25. The only other species important during winter were pricklypear, which was utilized throughout most of the year, and alfalfa, which made up more than 10% of the diet of pronghorn at certain other times of the year. On April 27, alfalfa made up 41.6% of the diet of pronghorn; that percentage was the greatest both for that date and for alfalfa.

By April, the percentage of forbs in the diet was nearly equal to that of wheat. Between the latter sample dates in March and April, the abundance of wheat in the diet decreased from 79.9 to 1.7%, whereas the proportion of forbs increased from 20.2 to 96.7%. This was reflected in the increase in dietary diversity and richness from 0.7 to 2.1 and 0.8 to 3.7, respectively (Table 2). By May, more than 83% of the diet consisted of forbs. This trend continued through June (90.4%), July (90.5%), August (78.3%), and September (77.1%), and richness of the species in the diet remained high

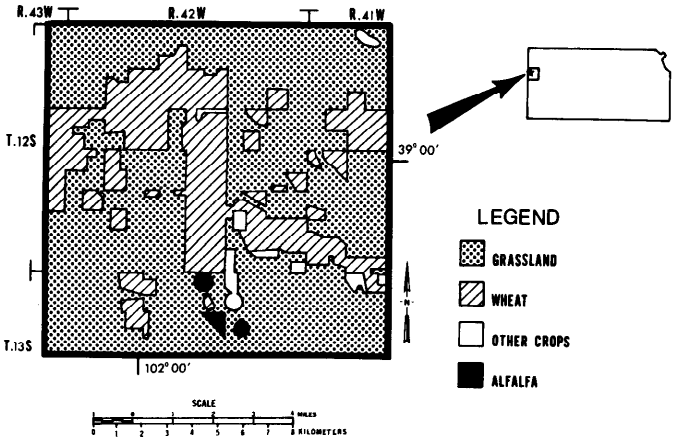

Fig. 2. *Geographic location and vegetation of the research area.*

(≃3.00). On June 24, the sample period with highest diversity, 28 species were identified. The most common of those species were western ragweed (24.9%), purple poppymallow (8.9%), scarlet gaura (9.6%), kochia (6.1%), and slimflower scurfpea (11.2%) (Table 1).

Sand sagebrush *(Artemisia filifolia)* was an important component of the diet from April 27 through June 2, comprising 29.3% of the diet on May 7. Western ragweed constituted an average of 14% of the diet from April 27 through September 9. During the period July 18 through September 9, Kansas sage comprised an average of 14.8% of the diet; on November 5, it increased to 22.2%. Scarlet globemallow was important through most of the spring, summer, and fall: on May 7, it comprised 20.3%; on July 28, 7.0%; on September 9, 7.8%; on September 30, 14.0%; on October 8, 20.7%. Forbs still were an important dietary component in October (30.9%), but had been replaced by wheat (66.7%) as the most abundant constituent. Pricklypear was found in feces in all months of the year and was most abundant (17.3%) in August. Grasses other than wheat were relatively unimportant in the diet, being represented by a percentage only as high as 8.9% in May.

Table 2. Richness, diversity, and evenness of species in diets at each sampling date from November 1977 through October 1978.

Date	Richness	Diversity	Evenness
10 Jan.	2.22	1.03	0.41
21 Jan.	0.62	0.14	0.10
4 Feb.	1.03	0.64	0.36
25 Feb.	0.00	0.00	—
13 Mar.	0.21	0.22	0.31
25 Mar.	0.81	0.72	0.45
8 Apr.	2.96	1.24	0.45
27 Apr.	3.67	2.05	0.67
7 May	4.03	2.30	0.72
23 May	4.32	2.76	0.86
2 June	4.37	2.63	0.82
24 June	4.52	2.52	0.77
18 July	4.02	2.37	0.76
28 July	3.64	2.29	0.75
12 Aug.	4.40	2.54	0.79
26 Aug.	3.66	2.26	0.76
9 Sept.	3.04	2.29	0.81
30 Sept.	4.56	2.63	0.80
8 Oct.	2.92	1.51	0.55
23 Oct.	1.43	0.66	0.32
5 Nov.	1.90	1.52	0.64
24 Nov.	0.62	0.56	0.40
10 Dec.	0.42	0.10	0.09
28 Dec.	1.03	0.50	0.28

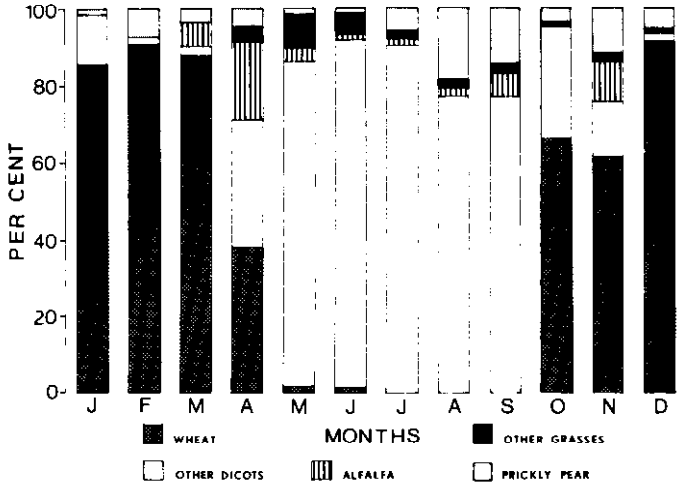

Fig. 3. *Monthly dietary percentages of wheat, other grasses, alfalfa, other dicots, and pricklypear in the diet of pronghorn in western Kansas for the period November 1977 through October 1978.*

Discussion

Forbs constituted an important component of the diet of pronghorn in late spring, summer, and fall. On the study area, forbs made up only 5.2% of the species composition of the short-grass prairie ecosystem but accounted for more than 90% of the diet of pronghorn during certain months of the year. During May through September, an average of 95% of the diet of pronghorn consisted of plants other than grasses. Forbs also were important, but to a lesser degree, in April, October, and November. Similar results have been obtained in other studies of pronghorn on the High Plains of Kansas; Hlavachick (1968), for example, reported that the diet of pronghorn in Kansas consisted of 78% non-grass species, of which pricklypear made up 40% and Kansas sage made up 16%. Two of the forbs (scarlet globemallow and pricklypear) utilized extensively by pronghorn in this study were common on the research area. Sand sagebrush, on the other hand, was an important forage plant during April, May, and June even though it was found growing only in the lower drainages. Pronghorn seldom were seen in those areas except during those months. Barrington (1975) explained that, in southeastern Colorado, "Areas where sand sage was moderately dense and the understory vegetation was vigorous and diverse, seemed to be more heavily utilized by pronghorn does for fawning." Autenrieth (1976) also suggested that fawning often is associated with woody habitats. Most forbs, other than pricklypear, scarlet globemallow, and sand sagebrush, were not plentiful in the vegetation samples but were conspicuous because of their size and showy apearance.

Winter wheat made up a substantial part of the diet of pronghorn during late autumn, winter, and early spring (October through March), and alfalfa was consumed more in April and November than in other months. These observations suggest that pronghorn in western Kansas utilize wheat as a substitute for green forbs during months when green forbs are not available. In spring, when alfalfa emerges but rangeland forbs are not yet abundant, pronghorn use alfalfa to supplement their diet of native dicots. Cultivated crops are an insignificant component of the diet during summer, but increase in importance when green forbs become scarce in autumn. Damage to winter wheat by pronghorn is unlikely. Grazing of wheat by livestock in this region is not common; however, the period (mid-October to mid-April) during which pronghorn consume wheat coincides with the time when wheat might possibly be used for grazing.

Pronghorn, which once occurred throughout most of Kansas but were nearly extirpated after the state was settled, have proven their ability to live and reproduce where at least 30% of the land is cultivated for crops. This ability depends, at least in part, on their consumption of winter wheat and alfalfa (in much the same way as by jackrabbits) during months when native foods are in short supply. Accordingly, the re-established populations of pronghorn have the potential to disperse into many of the regions of Kansas that were inhabited by pronghorn before the arrival of European settlers. Although extensively cultivated regions may prove unsuited for habitation by pronghorn, there is reason to believe that the isolated populations of pronghorn in Kansas eventually might re-establish a continuous gene pool.

Literature Cited

Allen, J.A. 1874. Notes on the mammals of portions of Kansas, Colorado, Wyoming and Utah. Part I. On the mammals of middle and western Kansas. Bull. Essex Inst. 6:43-52.

Autenrieth, R. 1976. A study of birth sites selected by pronghhorn does and bedsites of fawns. Proc. 7th Bien. Pronghorn Antelope Workshop, p. 127-234.

Barrington, M.R. 1975. Habitat factors related to pronghorn productivity on the southern High Plains. Unpubl. M.S. thesis, Oklahoma State Univ., 162 p.

Brennan, L.A. 1932. Mammal extinction in Kansas. I. The pronghorned antelope. Aerend 1932:231-236.

Choate, J.R., and E.D. Fleharty. 1975. Synopsis of native Recent mammals of Ellis County, Kansas. Occas. Paper Mus., Texas Tech Univ. 37:1-80.

Choate, J.R., and M. Sexson. 1981. Historical biogeography of the pronghorn in Kansas. Trans.Acad. Sci. 84:128-133.

Cockrum, E.L. 1952. Mammals of Kansas. Univ. Kansas Publ., Mus. Nat. Hist. 7:1-303.

Hlavachick, B.D. 1968. Foods of Kansas antelope related to choice of stocking sites. J. Wildl. Manage. 32:399-401.

Kellogg, R. 1915. The mammals of Kansas. Unpubl. M.A. thesis, Univ. Kansas, 241 p.

Knox, M.V.B. 1875. Kansas Mammalia. Trans. Kansas Acad. Sci. 4:19-22.

Lantz, D.E. 1905. A list of Kansas mammals. Trans. Kansas Acad. Sci. 19:171-178.

Margalef, R. 1958. Information theory in ecology. Gen. Syst. 3:26-71.

Mead, J.R. 1899. Some natural history notes of 1859. Trans. Kansas Acad. Sci. 16:280-281.

Nelson, E.W. 1925. Status of the pronghorned antelope, 1922-1924. U.S. Dep. Agr. Bull. 1346:1-64.

Owensby, C.E. 1973. Modified step-point system for botanical composition and basal cover estimates. J. Range Manage. 26:302-303.

Pielou, E.C. 1966. The measurement of diversity in different types of biological collections. J. Theoret. Biol. 13:131-141.

Sparks, D.R., and J.C. Malachek. 1968. Estimating percentage dry weight in diets using a microscopic technique. J. Range Manage. 21:264-265.