Forage Ratings for Deer and Cattle on the Welder Wildlife Refuge[1]

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Highlight

Forage preferences of white-tailed deer and cattle on the Welder Wildlife Refuge in South Texas were determined by relating availability, percent utilization, and percent frequency of use of each plant species utilized by deer or cattle. Overall forage ratings showed that though both animals were grazers, deer preferred forbs and cattle preferred grasses. Selection of forage by both deer and cattle varied with the seasonal availability and palatability of the forage. Seasonal forage ratings showed that few species of the many utilized made up 50% of the forage ratings for deer and cattle. On clay soils, deer utilized all browse species present, while cattle utilized little browse. Four perennial grasses made up most of the preferences of cattle. During the winter, grass and grass seed heads were highly utilized by deer. Forbs were the most important deer forage class on sandy soils. Grasses made up about 25% of the total preference rating of deer in fall and winter on the sand. Cattle utilized forbs more in spring and summer, but utilized grasses more in the fall and winter.

The extent of competition for forage between livestock and big game is a major area of concern in range and wildlife management. Therefore, a basic need in land management is to determine the food habits of the animals present and to determine the extent to which their diets overlap.

Some work has been done on the food habits of cattle and white-tailed deer in South Texas. Davis (1952) used rumen contents in a study of deer–cattle competition and "animal equivalence." By comparing deer rumen weights to cattle rumen weights, he found that 13 deer ate as much as one steer. Seasonal changes in the availability of vegetation of each forage class caused changes in the carrying capacity of a range. Chamrad (1966) found that the deer on the Welder Wildlife Refuge were grazers rather than browsers during winter and spring, with almost 90% of their diet being herbaceous plants. Forbs made up 67% of the diet, grasses 22%, and browse 5%. During his study the food habits of the deer followed the phenology of the vegetation and fluctuated with forage availability.

In the present study the seasonal plant preferences of white-tailed deer and cattle were determined on the Welder Wildlife Refuge by relating availability of forage to utilization and frequency of use of each plant by each class of animal.

Study Area and Procedures

This study was conducted on the Welder Wildlife Refuge, located near Corpus Christi in South Texas. The climate of the area is mild, with warm temperatures throughout the year. Mean temperatures are around 55 F in January and 84 F in July. Average annual rainfall for the area is about 30 inches. Monthly rainfall patterns show peaks in spring and fall. Vegetative growth follows these rainfall peaks closely. The soils of the Refuge have been described as dark, calcareous to neutral clays and clay loams, with areas of eolian sand along the Aransas River (Box, 1961).

The Welder Refuge is in the southern part of the Gulf Prairies and Marshes Vegetational Area (Gould, 1962). Fifteen distinct plant communities have been described on the Refuge (Box and Chamrad, 1966). For this study, areas representative of the major plant communities were selected. These communities and the major species found in each are listed below.

Major species of the "Mesquite–buffalograss Community" are mesquite (*Prosopis glandulosa* Torr.) with infrequent mottes of chaparral (species to be enumerated below), buffalograss (*Buchloe dactyloides* (Nutt.) Engelm.), silver bluestem (*Andropogon saccharoides* Swartz var. *longipaniculata* Gould), spike bristlegrass (*Setaria leucopila* (Scribn. and Merr.) K. Schum.), Roemer threeawn (*Aristida roemeriana* Scheele), filly panic (*Panicum filipes* Scribn.), Texas wintergrass (*Stipa leucotricha* Trin. and Rupr.), vine mesquite (*Panicum obtusum* HBK), tridens (*Tridens* spp.), sawtooth frogfruit (*Phyla incisa* Small), prairie coneflower (*Ratibida columnaris* (Sims) D. Don.), western ragweed (*Ambrosia psilostachya* DC), Texas broomweed (*Xanthocephalum texanum* (DC) Shinners), and other grasses and forbs.

Vegetation of the "Chaparral–bristlegrass Community" consists of chaparral species such as huisache (*Acacia farnesiana* (L) Willd.), blackbrush acacia (*Acacia rigidula* Benth.), agarito (*Berberis trifoliolata* Moric.), granjeno (*Celtis pallida* Torr.), brasil (*Condalia obovata* Hook), lotebush (*Condalia obtusifolia* (Hook) Weberb.), Mexican persimmon (*Diospiros texana* Scheele), mesquite prickly ash (*Zanthoxylum fagara* (L) Sarg.), and others. Grass and forb species are similar to those of the Mesquite–buffalograss Community.

Major plant species of the "Bunchgrass–annual Forb Community" are grasses such as seacoast bluestem (*Andropogon scoparius* Michx. var. *littoralis* (Nash) Hithc.), southern sandbur (*Cenchrus echinatus* L), hooded windmillgrass (*Chloris cucullata* Busch.), Pan American balsamscale (*Elyonurus trypsacoides* Humb. and Bonpl.), fall witchgrass (*Leptoloma cognatum* (Schult) Chase), thin paspalum (*Paspalum setaceum* Michx.), sandhill bristlegrass (*Setaria firmula* (Hitchc. and Chase) Pilger), and others; and forbs such as camphorweed (*Heterotheca latifolia* Buckl.), sunflower (*Helianthus debilis* Nutt. var. *cucumerifolius* Torr. and Gray), sawtooth frogfruit, wild buckwheat (*Eriogonum multiflorum* Benth.), croton (*Croton* spp.), skunk daisy (*Ximenisia encelioides* Cav.), and others.

Vegetation of the "Live oak–chaparral Community" consists of live oak (*Quercus virginiana* Mill.) chaparral, and herbaceous vegetation similar to that of the Bunchgrass–annual Forb Community.

Forage ratings were developed for the major plants by relating availability of forage to utilization and frequency of use by deer and cattle on each community. Preference values were calculated for each plant by multiplying percent utilization by percent frequency of use (Dwyer, 1961). Forage ratings, or relative forage values, were developed by multiplying the preference value by percent cover of each plant (Box and Powell, 1965). All percentages were used as whole numbers in computations. Plants that occurred in trace amounts (less than 1%) were considered to make up less than 0.5% of the cover, as this was the accuracy to which cover was measured. Methods of calculation are as follows:

Preference value = % utilization × % frequency of use

Forage rating = preference value × % cover

During the summers of 1965 and 1966, utilization surveys were made at six different locations in the major plant communities using existing cattle exclosures. Two other cattle exclosures were constructed on typical areas, and used during fall, winter, spring, and summer. The exclosures allowed deer free access to vegetation inside the exclosure, but eliminated cattle utilization. Utilization surveys were made both inside and outside each exclosure. By subtracting utilization by deer from that by deer and cattle, utilization by cattle was obtained. No attempt was made to remove the influences of grazing rodents, rabbits, and other small mammals on utilization.

Percent frequency of use was determined by examination of 25 plants of each species present in the study location. Percent utilization was determined by estimating the amount of each plant removed. Each plant was placed in a utilization category as follows: (1) 1–20% utilization, (2) 21–40%, (3) 41–60%, (4) 61–80%, and (5) 81–90%. At least five 300-ft transects were randomly established across each survey area. At intervals of 10 steps along each transect, five plant species nearest the toe of the right foot were examined.

Plant availability was determined by two methods. Point frame analysis was used to determine cover of herbaceous vegetation (Rader and Ratliff, 1962). The line intercept method was used to determine percent cover of woody vegetation (Canfield, 1941). Sampling of the major species was within 10% of the mean.

To facilitate discussion of results, percentages of preference were calculated for forage classes by dividing the total of all preference values for each area at each date into the total preference value for the forage class. Plant communities were combined as to soil type, i.e., clay areas—Mesquite–buffalograss Community and Chaparral–bristlegrass Community, and sand areas—Bunchgrass–annual Forb Community and Live oak–chaparral Community.

Results and Discussion

Relative percentages of browse, forbs, and grasses in deer and cattle preferences were determined for each season of the year from the preference values (Table 1). Deer preferences varied with the condition and abundance of the forage. The forage preferences of cattle followed the trends in the condition and availability of the vegetation much as did the preferences of deer.

Forage ratings were arranged in order of importance for each date of data collection, and only

Table 1. Seasonal fluctuations of forage classes[1] in the preferences of deer and cattle, in percent of total preference.

	Summer			Fall			Winter			Spring			Yearlong Average		
	B	F	G	B	F	G	B	F	G	B	F	G	B	F	G
Clay soils															
Deer	24	71	5	7	66	27	4	59	37	1	65	34	13	69	18
Cattle	8	14	78	12	12	76	4	11	85	0	42	58	6	19	75
Sandy Soils															
Deer	–	99	1	–	83	17	–	98	2	–	99	1	–	92	8
Cattle	–	81	19	–	13	87	–	16	84	–	72	28	–	53	47

[1] B = Brush; F = Forbs; G = Grass.

Table 2. Forage Ratings[1] for species in the upper 50% of forage ratings for deer and cattle on clay soils.

Species	June 1965 Deer	Cattle	Nov. 1965 Deer	Cattle	Jan. 1966 Deer	Cattle	Apr. 1966 Deer	Cattle	June 1966 Deer	Cattle
Browse										
Acacia farnesiana	938		1968		2296		164		2296	
Acacia rigidula	270		2922		797		0		531	
Prosopis glandulosa	1141		223		0		446		2232	
Other browse	3727		270		0		0		1476	
Forbs										
Ambrosia psilostachya	560		4792		3862		1978		6048	
Coreopsis cardaminaefolia	180		–		–		3694		342	
Oenothera speciosa	480		416		672		7296		360	
Ratibida columnaris var. *pulcherrima*	3951		2688		2128		7113		1082	
Other forbs	2516		2367		345		367		3140	
Grasses										
Andropogon saccharoides var. *longipaniculata*	960	4240	2268	1780	2128	236	152	0	160	13160
Andropogon scoparius var. *littoralis*	2160	8160	4600	19520	4464	30464	0	10718	3296	61800
Buchloe dactyloides		1900		4028		3579		1532		2728
Eriochloa sericea	60		600		4800		426		1344	
Setaria leucopila	0	8120	3072	2720	3800	5000	80	0	816	1149
Stipa leuchtricha	0		250		1114		3344		0	

[1] Qualitative ranking: 0–500 = low, 500–1000 = moderate, 1000–3000 = high, and 3000+ = very high. Blank spaces indicate the plant was not in the upper 50% of the ratings for the animal. Dashes indicate the plant was not growing at that season.

those plants in the upper 50% of the ratings were chosen for discussion (Tables 2 and 3). Although the species listed made up 50% of the total forage rating, over 150 species made up the remaining 50% of the ratings. Thus the importance of one plant or class of plants should not be overemphasized.

Deer utilized all browse species present on the clay at some time during the year (Table 2). The most frequently and heavily utilized browse species were huisache, blackbrush acacia, and mesquite. Forbs were the most important deer forage class on the clay. Perennial forbs made up most of the deer's forage except during spring when there was an abundance of palatable annuals. Grasses were most important during winter and

Table 3. Forage ratings[1] for species in the upper 50% of forage ratings for deer and cattle on sandy soils.

Species	June 1965 Deer	Cattle	Nov. 1965 Deer	Cattle	Jan. 1966 Deer	Cattle	Apr. 1966 Deer	Cattle	June 1966 Deer	Cattle
Forbs										
Amblyolepsis setigera	–	–	0	–	1360	–	1760	1220	–	0
Commelina erecta	1344		200		–		–		520	
Helianthus debilis		13760		–		–		416		450
Heterotheca latifolia	574	2330	3798	2100	0	–	10080	0	7000	6540
Linum alatum	1480		–		–		280		2000	
Oenothera lacinata	1320		–		–		1600		1300	
Phyla incisa	168		1200		900		0		1540	
Ratibida columnaris var. *pulcherrima*	–		240		–		4900		4200	
Rudbeckia hirta	–		–		–		–		5924	
Sphaeralcea lindheimeri	70		30		1526		96		308	
Verbena halei	1002		280		1047		340		208	
Other forbs	1170	–	370	–	568	–	1363	1745	1229	0
Grasses										
Andropogon scoparius var. *littoralis*	2660	35720	1248	10080	315	28100	672	1820	600	12800
Brachiaria ciliatissima		9840		0		0		0		1860
Chenchrus echinatus	400	34800	1120	1350	0	170	0	40	180	840
Paspalum setaceum	2240		1228		0		448		390	
Setaria firmula		12563		6730		704		0		1536
Other grasses	–	–	2700	0	330	–	0	2272	–	–

[1] Qualitative ranking: 0–500 = low, 500–1000 = moderate, 1000–3000 = high, and 3000+ = very high. Blank spaces indicate the plant was not in the upper 50% of the ratings for the animal. Dashes indicate the plant was not growing at that season.

spring. During these two seasons five grasses, silver bluestem, seacoast bluestem, Texas cupgrass, spike bristlegrass, and Texas wintergrass were in the upper 50% of the deer's forage ratings. During the early winter, grass seed heads were the main portion of the plant being eaten. Chamrad (1966) also found that grasses made up a high percentage of the Refuge deer's diet during the winter.

Four perennial grasses made up 50% of the preferences of cattle on the clay (Table 2). In order of decreasing importance these grasses ranked as follows: seacoast bluestem, silver bluestem, spike bristlegrass, and buffalograss.

More annual species were utilized by deer on the sand than on the clay. Forbs were the most important deer forage class on the sand (Table 3). Only three grasses, seacoast bluestem, southern sandbur, and thin paspalum, were in the upper 50% of deer forage ratings.

Three species of forbs and four species of grasses made up most of the upper 50% of the forage ratings for cattle on the sand (Table 3). Grasses were more important than forbs to cattle on the sand. As on the clay, seacoast bluestem was the highest ranked forage for cattle.

Forage ratings can be a useful tool for managing rangelands by indicating the best forage for each class of animal under given conditions.

LITERATURE CITED

Box, T. W. 1961. Relationships between plants and soils of four range plant communities in South Texas. Ecology 42:794–810.

Box, T. W., and A. D. Chamrad. 1966. Plant communities of the Welder Wildlife Refuge. Contrib. 5, Series B. Welder Wildlife Foundation, Sinton, Texas. 28 p.

Box, T. W. and J. Powell. 1965. Brush management techniques for improved forage values in South Texas. Trans. N. Am. Wildl. Conf. 30:285–296.

Canfield, R. H. 1941. Application of the line interception method in sampling range vegetation. J. Forestry 9:388–394.

Chamrad, A. D. 1966. Winter and spring food habits of the white-tailed deer on the Welder Wildlife Refuge. M.S. Thesis. Texas Technological College, Lubbock. 181 p.

Davis, R. B. 1952. The use of rumen contents data in a study of deer–cattle competition and "animal equivalence." Trans. N. Am. Wildl. Conf. 17:448–458.

Dwyer, D. D. 1961. Activities and grazing behavior of cows with calves in Northern Osage County, Oklahoma. Okla. Agr. Exp. Sta. Bull. 588. 61 p.

Gould, F. W. 1962. Texas plants—A checklist and ecological summary. Tex. Agr. Exp. Sta. MP-585. 112 p.

Rader, L., and R. D. Ratliff. 1962. A new idea in point frames. J. Range Manage. 15:182–183.