Food Habits of White-Tailed Deer in South Texas[1]

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Highlight

White-tailed deer were primarily grazers, rather than browsers, during the winter–spring periods of 1963, 1964, and 1965, in South Texas. There were only minor differences in distribution of major forage classes in deer diets from distinct range site groups, but major differences existed in species composition of diets in relation to site. Complexity of diet reduced the importance of any one or several species in the diet. Among high priority forage species, perennials were more important than annuals. Deer food habits varied according to availability and phenology of range vegetation, and were further modified by forage preferences.

Major emphasis in management of South Texas rangeland has been directed toward sustained production of domestic livestock. Much of the same rangeland also supports substantial populations of white-tailed deer (*Odocoileus virginianus* Boddaert). This dual use of rangeland compounds management problems (Glazener, 1958). The preferred and most-used foods of each class of grazing animal in a given locality must be known as a basis for sound management of common-use ranges.

Previous studies have shown that deer in the South and Southwest are primarily browsing animals, except during late winter and early spring when there is usually an increase in utilization of grasses and forbs (Hahn, 1945; Davis, 1952; Goodrum and Reid, 1954; White, 1961; McMahan, 1964). Similar trends have also been noted in other regions (Chapman, 1939; Korschgen, 1962).

McMahan (1964) reported that forbs appeared to be of greater importance in deer diets in the Texas Edwards Plateau region than generally believed.

In South Texas, Davis (1952) reported that total consumption and diet of deer on the King Ranch followed the annual progression of plant growth on the range. He found that browse comprised the major portion of the diet, with mast crops being sought after and consumed in quantity whenever available. Competition between deer and cattle for grasses appeared negligible except in late winter and early spring. Competition for forbs was also highest during this period.

This paper presents results of the first phase of deer food habits research on the Welder Wildlife Refuge in the Coastal Bend region of South Texas. The study was designed to determine composition of winter–spring deer diets on common-use ranges of the area and to develop food preference criteria as a basis for management.

Study Area and Methods

The study was conducted on the Rob and Bessie Welder Wildlife Foundation Refuge, near Sinton, Texas. The Welder Refuge consists of 7,800 acres of native rangeland, adjacent to the Arkansas River in San Patricio County. It is located in a transitional zone between the Gulf Prairies and Marshes, and the South Texas Plains described by Thomas (1962).

Climate, soils, topography, vegetation, and history of land use on the study area have been described in detail by Box (1961) and by Box and Chamrad (1966).

The flora of the study area consists of a complex of approximately 1,000 plant species (Jones, Rowell, and Johnston, 1961; Gould and Box, 1965). Some 16 plant communities have been mapped and described on the Refuge (Box and Chamrad, 1966). The area, in general, may be appropriately depicted as a grassland–bushland complex (Fig. 1).

Forage production in the area is normally limited during mid and late winter (January–February), while a period of peak production normally occurs from March through June (Box, 1960). During this study succulent green forage of all classes was especially scarce early in 1963, due to drought. It was much more plentiful during similar periods in 1964 and 1965. Initial vegetative response in late winter and early spring was very slow in 1963 and about normal in 1964, while unusually early and rapid in 1965. Drought conditions were pronounced during late April and May, 1963.

Ranching on the study area consists of a steer operation. A continuous grazing system with periodic deferments is practiced. Deer have continuous access to all pastures. Moderate stocking rates were in effect preceding and throughout the duration of the study. This included a local population of approximately 1,300 white-tailed deer and a total of about 500 steers. Ranges on the Welder Refuge were in fair to good range condition.

Composition of deer diets was determined through rumen analyses. Phenology and availability of forage species on the range were determined to complement rumen analyses.

Deer collections were conducted bi-weekly during the winter–spring period of 1963 (January through May); 50 deer were killed during this period. A smaller sample of five animals was taken in late March 1964. Five animals were also taken in mid-January 1965. Each field collection consisted of taking five adult deer during early morning feeding hours.

[1] Contribution No. 115, Welder Wildlife Foundation, Sinton, Texas. Dr. Clarence Cottam and Mr. W. C. Glazener of the Welder Wildlife Foundation staff are acknowledged for their helpful guidance and cooperation. Useful suggestions were made by Dr. Gerald W. Thomas, Dr. Joseph L. Schuster, and Dr. Frank A. Hudson of Texas Technological College. Portions of this paper were presented to the Graduate School of Texas Technological College in an M.S. Thesis by the senior author.

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FIG. 1. The most common habitat of white-tailed deer in South Texas consists of a grassland–brushland complex.

Deer collections were made on the basis of soils and range plant communities. In each collection, attempts were made to take two animals, at random, that had been feeding in plant communities of upland clay and clay loam sites, two animals at random from plant communities of upland sandy and sandy loam sites, and one animal at random from a lowland mixed soils site. The lowland sites represented less extensive areas of either swales, dry lake beds, or river bottomlands.

Rumen samples were handled and prepared for analysis according to standard procedures and technique modifications of Chamrad (1966). Rumen contents were sampled using the point analysis method of Chamrad and Box (1964), and a water suspension technique, aided by wide-field binocular microscope, and reference collections.

Working reference collections of plant materials in various stages of phenology were used as aids in identification. These consisted of (1) mounted specimens on 4 × 6 inch index cards, and (2) succulent materials preserved and stored in 2 × ⅝ inch plastic vials of 10% formalin. A complete verified herbarium of all plant species recorded for the study area was also utilized.

Vegetational attributes of the range were evaluated by ocular reconnaissance, the point method, and the line interception method (National Academy of Sciences–National Research Council, 1962). The phenology of vegetation on the area was also studied at periodic intervals during the winter–spring period.

Preference Ratings

In order to more accurately evaluate the relative importance of individual forage plants in the diet, *preference ratings* were calculated using (1) frequencies of occurrence in rumens, (2) volumetric percentages in rumens, and (3) availability of plants on the range. Frequencies of occurrence and volumetric percentages were derived through rumen analyses. Range sampling data were used to establish availability classes, with associated numerical availability factors, for all plant species or groups occurring in deer diets. The following availability classes were used: rare—1, occasional—2, frequent—3, abundant—4.

Preference values were calculated for each species or plant group in the diet by multiplying percent frequency of occurrence in rumens times percent volume in rumens. This preference value, calculated from rumen data, is comparable to that described by Dwyer (1961), using frequency of utilization and percent utilization of grazed plants on the range.

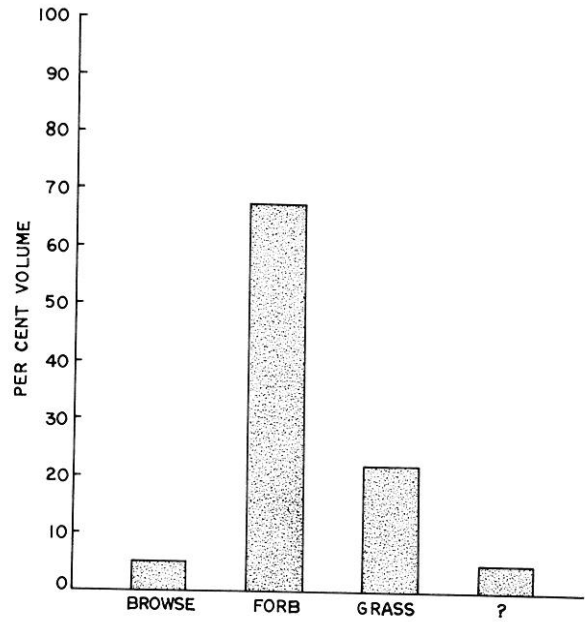

FIG. 2. Relative proportions of the major forage classes in the 1963 winter–spring diet of white-tailed deer.

Preference ratings were then calculated by weighing preference values against availability of species on the range. This preference rating is similar to the index of forage preference described by Van Dyne and Heady (1965).

The following formulae were used to arrive at relative preference ratings of species used by white-tailed deer on the Welder Wildlife Refuge:

$$\text{Preference Value} = \text{Percent Frequency} \times \text{Percent Volume}$$

$$\text{Preference Rating} = \frac{\text{Preference Value}}{\text{Availability Factor}}$$

The preference rating for any given species is relative to every other species with which it occurs on the range and in the diet during a given season or grazing period.

Results and Discussion

Distribution and Fluctuation of Forage Classes in Deer Diets

The extent of use of the major forage classes (browse, forbs, and grasses) constitutes a useful and valid criterion for evaluating and comparing diets of range animals.

Differences between the three major forage classes in deer diets on the Welder Wildlife Refuge were highly significant ($P < .01$). Deer on the Welder Wildlife Refuge were primarily grazers, rather than browsers during the winter–spring period (Fig. 2). Herbaceous plants made up 90% of the total diet for the winter–spring period. Forbs made up the highest percentage of the diet, 68%; grasses occupied an intermediate position, 22%; and browse was lowest, 5%. An unidentifiable portion, 5%, was assumed to be distributed among the three forage classes.

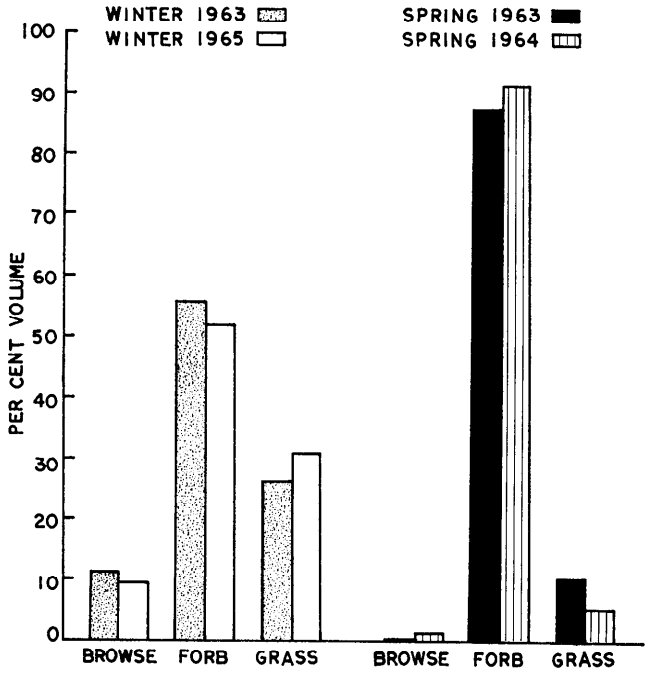

FIG. 3. Relative proportions of major forage classes in deer diets for specific periods in 1964 and 1965, compared with similar periods in 1963.

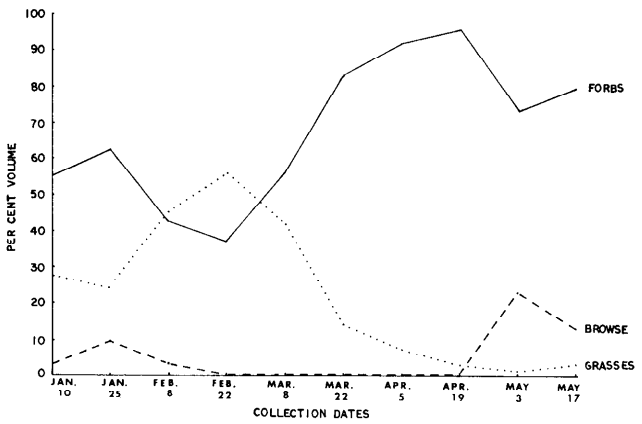

FIG. 4. Biweekly fluctuations in composition of the 1963 winter–spring diet of white-tailed deer.

Mast was of insignificant importance in deer diets on the Welder Refuge during this study. The limited amounts of mast which occurred in the diet were included in the forage classes of respective parent plants.

Mean values for forage classes in deer diets for specific periods in the spring of 1964 and the winter of 1965 are compared with those of similar periods in 1963 (Fig. 3). Growing conditions preceding and during these periods were much more favorable in 1964 and 1965 than in 1963. Although species compositions in deer diets were considerably different for the periods compared, relative proportions of the major forage classes in the diets were very similar.

Marked fluctuations occurred in the composition of deer diets during the winter–spring period. The distribution of major forage classes in the diet at biweekly intervals throughout the 1963 winter–spring period is presented in Fig. 4. Differences between dates within forage classes were highly significant. Values shown for each collection date are mean values including three major site groups. Differences between sites within forage classes in the diets were not statistically significant.

Heavy utilization of forbs and grasses, with only light to moderate browsing, was the general trend in deer food habits throughout the winter–spring period. The primary use of browse was during January and May, when green forage of herbaceous species was scarce on the range, and when mast was locally available from several browse species.

These results represent diets of freely foraging deer on *fair* and *good condition* range with a wide selection of species of all forage classes. In contrast with previous studies, there appeared to be a much stronger trend in preference for and utilization of herbaceous species throughout the winter–spring season.

Complexity of Diet

A minimum of 160 different plant taxa occurred in the Welder deer herd's diet during the winter–spring period of 1963. Nine additional plant taxa, not recorded in 1963, were determined from limited sampling in the spring of 1964 and the winter of 1965. The 1963 total included 107 taxa of forbs, 30 taxa of grasses and sedges, and 23 taxa of browse. The number of different plant taxa occurring in individual animals, collected during the winter–spring period, ranged from 5 to 34. All plants identified in deer diets during this study are recorded by Chamrad (1966).

The number of different plant taxa in deer diets fluctuated throughout the winter–spring period and varied according to forage class and site. The biweekly differences in the number of species occurring in deer diets can be related in some respect to the phenology and availability of plant species on the range.

Certain species made up as much as 50 to 60% of the volume of a few individual diets. Frequencies of occurrence reached 82%. These, however, were exceptional cases. Many other species occurred in individual diets in amounts of less than 5% by volume, and many occurred as only a trace (less than 1% by volume) in individual rumens and in the overall diet.

Many biologists consider low volumetric percentages (5% or less) for individual species as only trace items. A large portion of the Welder deer diet was a composite of items occurring in amounts of less than 5% by volume. Some plants in this

category have the potential to make significant contributions to deer diets in a dynamic habitat. Such individual food items were given due consideration in the total diet, since the point contact method of rumen analysis (Chamrad and Box, 1964) gave a quantitative measurement of items represented by volumes as low as 1%. The large number of species involved in the diet minimizes the overall importance of any one or several species.

Twelve to 15 species made up approximately 50% of the winter–spring diet of deer from each of three groups of range sites on the Welder Refuge. Many more species were involved to round out the other half of these deer diets. Some species with high frequencies of occurrence in the deer diet, as well as some with high percentages of volume, actually contributed a relatively small portion to the overall winter–spring diet of deer on the Welder Refuge.

The complexity of diet further limits the validity of any single expression of quantitative data. Some species had relatively high frequencies of occurrence in deer rumens but were low in volumetric percentages, and vice versa. Therefore, preference ratings were used to more accurately evaluate the relative importance of individual forage plants in the diet.

Diet in Relation to Range Sites and Plant Communities

Major differences in species composition exist between plant communities supported by different groups of range sites on the Welder Refuge (Box and Chamrad, 1966). In deer diets, there were no significant differences between site groups within *forage classes*; however, highly significant differences existed between the specific diets of animals feeding on different groups of range sites.

Rumen analyses revealed only minor instances of combined use of clay and sandy sites. In most instances, foraging immediately prior to collection had been restricted to either clay and clay loam sites or to sandy and sandy loam sites. However, there was combined use of closely associated plant communities within these broad edaphic groupings. Deer that had been feeding in lowland mixed soils sites had usually also fed in the surrounding upland areas, regardless of what the upland areas were. Likewise, animals that fed near lowland areas invariably ventured into these areas for a small portion of their diet.

Under certain conditions, large numbers of deer concentrate on the open sandy sites, dry lake beds, and brush controlled areas. Michael (1965) and Knowlton (1964) also reported such observations. It appears that deer have certain food preferences related to succulence of vegetation, or to some other associated attribute of new plant growth in these areas.

Grazing concentrations on the sandy sites are more apparent after vegetation begins to green up following rains. Vegetative response to improved moisture conditions is usually quicker on the sandy soils than on the fine-textured soils; also, vegetation responds to lighter precipitation on the sands than on the clays. Much of the rapid green-up on sandy soils following rains is in the form of ephemeral plants, but there is also a marked response among the perennial plants. Perennial species made greater contributions than annual species in the winter–spring diets of deer sampled in 1963, 1964, and 1965.

New plant growth is frequently more available and more abundant in recently treated brush-control areas. This is especially true relative to browse species (Box and Powell, 1965). Some mechanical brush-control treatments also generate early successional stages which produce an abundance of annual forbs and grasses. However, new growth is also generated among some perennial forbs and grasses. In January 1965, deer were collected from an area that had been rootplowed in the summer of 1963. Rumen analyses revealed that the composite of perennial plant species was considerably more important in these diets than the composite of annual species.

Deer concentrations on the dry lake beds are most pronounced during periods of severe drought. Under such conditions, some green vegetation persists for longer periods in these depressions than on the surrounding upland sites.

It is not known just how much significant shifting actually occurs between the major range site groups of clay and clay loam soils and those of sandy and sandy loam soils during grazing concentrations, or at other times. Based upon findings of Michael (1965), it is doubtful that the deer involved in these grazing concentrations have extended or gone beyond their normal home ranges.

From the standpoint of management it is important to establish precedence and degree of use of individual forage species contributing to the diets of animals using a given range. Each site stands alone, relative to its potential contribution to the diet of a grazing animal. Therefore, evaluations of individual plant taxa in the diet should be made in relation to some ecological entity, such as plant community or range site.

High priority forage plants for each of three major range site groups were established on the basis of (1) preference ratings and (2) combined contributions of a minimum of 50% of the total volume of diet from a given site group.

Clay and clay loam sites.—High priority forage plants contributing to deer diets on clay and clay loam sites during the winter–spring season are presented in Table 1. This group of 12 forage plants

Table 1. High priority forage plants for white-tailed deer from clay and clay loam sites.

Taxon or group	Freq.[1] (%)	Vol.[2] (%)	A.F.[3]	P.R.[4]
Texas wintergrass (*Stipa leucotricha*)	81.8	9.4	4	192
Wild onion & falsegarlic (*Allium* spp. and *Nothoscordum bivalve*)	72.7	5.4	3	131
Falsemallow (*Malvastrum aurantiacum*)	63.6	6.8	4	108
Rescuegrass & Ozarkgrass (*Bromus willdenowii* and *Limnodea arkansana*)	50.0	4.8	3	80
Whorled nodviolet (*Hybanthus verticillatus*)	36.4	2.1	1	76
Lythrum (*Lythrum californicum*)	45.5	5.0	3	76
Sawtooth fogfruit (*Phyla incisa*)	45.5	5.5	4	63
Geranium (*Geranium carolinianum* and *G. texanum*)	36.4	4.9	3	59
Buffalograss (*Buchloe dactyloides*)	54.5	2.1	4	29
Primrose (*Oenothera* spp.)	40.9	2.6	4	27
Wildmercury (*Argythamnia humilis*)	36.4	0.9	2	16
Bladderpod (*Lesquerella* spp.)	31.8	1.7	4	14

[1] Frequency of occurrence in diet from this site.
[2] Percentage of volume in total diet from this site.
[3] Availability factor.
[4] Preference rating.

Table 2. High priority forage plants for white-tailed deer from sandy and sandy loam sites.

Taxon or group	Freq. (%)	Vol. (%)	A.F.	P.R.
Old-man's beard (*Clematis drummondii*)	58.8	11.4	3	223
Herbaceous mimosa (*Mimosa strigillosa*)	35.3	4.7	2	83
Texas wintergrass (*Stipa leucotricha*)	58.8	3.8	3	74
Snoutbean (*Rhynchosia americana*)	41.2	4.5	3	62
Rescuegrass & Ozarkgrass (*Bromus willdenowii* and *Limnodea arkansana*)	47.1	4.3	4	51
Sawtooth fogfruit (*Phyla incisa*)	41.2	4.3	4	44
Groundcherry (+mast) (*Physalis viscosa*)	17.6	2.5	1	44
Horsemint (*Monarda punctata*)	41.2	2.8	3	38
Anemone (*Anemone caroliniana* and *A. decapetala*)	11.8	2.4	1	28
Gaura (*Gaura* spp.)	35.3	1.7	3	20
Evening primrose (*Oenothera grandis*)	23.5	2.5	3	20
Wild onion & falsegarlic (*Allium* spp. and *Nothoscordum bivalve*)	35.3	1.3	3	15
Milkpea (*Galactia canescens*)	17.6	0.8	1	14
Hackberry (*Celtis laevigata* and *C. reticulata*)	11.8	2.2	2	13
Annual broomweed (*Xanthocephalum texanum* and *X. sphaerocephalum*)	23.5	1.4	3	11

made up 51% of the deer diet on clay and clay loam sites. The next twelve plants contributed only an additional 12% by volume to the diet. The high priority forage plants consisted of nine forbs and three grasses. Nine of the high priority forage plants were perennials.

At least 93 additional plant taxa contributed minor amounts to the diet from clay and clay loam sites in 1963, and a few others were recorded in 1964 and 1965.

Sandy and sandy loam sites.—The high priority forage plants contributing to deer diets on sandy and sandy loam sites are presented in Table 2. Fifteen forage plants contributed 51% by volume to the deer diet on these sites. The next 15 plants contributed 15% by volume to the diet. On the sandy and sandy loam sites the high priority forage plants included 13 forbs, two grasses, and one browse taxon. This group contained 10 perennials and five annuals.

An additional 93 plant taxa contributed minor amounts to the winter–spring diet from sandy and sandy loam sites.

Lowland mixed soils sites.—The high priority forage plants of lowland mixed soils sites are presented in Table 3. Fourteen different plant taxa contributed 50% of the volume in deer diet from these sites. The next 14 plants made up only 15% of the diet. High priority forage plants on lowland mixed soils sites included 11 forbs, two grasses, and one browse taxon. Ten perennials and four annuals were involved.

Eighty-two other plant taxa were identified in rumen samples, representing the lowland areas. A few high priority forage plants, determined for the lowland sites, were possibly influenced by combined use of adjacent upland communities.

The determination of high priority forage plants is an important preliminary step toward establishing key utilization species and other valid management criteria for common use ranges in South Texas. Additional information must eventually be obtained for the more promising species, relative to their ecology on native ranges, grazing tolerances, forage potentials, nutritional values, seasonal usage, and common usage by deer and domestic livestock.

Summary

Rumen analyses were used to study winter and spring food habits of white-tailed deer on the Welder Wildlife Refuge in South Texas, during

Table 3. High priority forage plants for white-tailed deer from lowland mixed soils sites.

Taxon or group	Freq. (%)	Vol. (%)	A.F.	P.R.
Sawtooth fogfruit (*Phyla incisa*)	63.6	7.0	4	111
Herbaceous mimosa (*Mimosa strigillosa*)	27.3	6.6	2	90
Old-man's beard (*Clematis drummondii*)	45.5	6.6	4	75
Texas wintergrass (*Stipa leucotricha*)	54.5	5.3	4	72
Gaura (*Gaura* spp.)	54.5	3.2	3	58
Spiny aster and saltmarsh aster (*Aster spinosus* and *A. subulatus*)	36.4	5.6	4	51
Woodsorrel (*Oxalis dillenii* and *O. drummondii*)	36.4	2.0	2	36
Rescuegrass & Ozarkgrass (*Bromus willdenowii* and *Limnodea arkansana*)	54.5	2.5	4	34
Phlox (*Phlox cuspidata* and *P. goldsmithii*)	27.3	2.4	2	33
Geranium (*Geranium carolinianum* and *G. texanum*)	27.3	2.9	3	26
Dayflower (*Commelina erecta*)	18.2	1.7	2	15
Snoutbean (*Rhynchosia americana*)	27.3	1.1	2	15
Hackberry (*Celtis laevigata* and *C. reticulata*)	18.2	2.2	3	13
Wild onion & falsegarlic (*Allium* spp. and *Nothoscordum bivalve*)	27.3	1.4	3	13

the period of January through May 1963, the spring of 1964, and the winter of 1965.

Rumen contents were sampled with a point-frame analyzer and a water suspension technique. Availability of range forage was determined through standard vegetational sampling techniques.

Preference ratings, based on frequency of occurrence and percent volume in rumens and availability of forage on the range, were established for specific food items occurring in the diet.

Deer were primarily grazers, rather than browsers, during the winter–spring period in South Texas. Ninety percent of their diet consisted of herbaceous plants. Forbs made up 68% by volume of the diet, grasses 22%, and browse 5%; 5% was unidentifiable to forage class. Forbs were most heavily used by deer during April. Grasses were most important during February, when their volume in deer diets exceeded that of both forbs and browse. Browse, including mast, was of minor importance in the winter–spring diet. The primary use of browse was during January and May, when green forage of herbaceous species was scarce on the range. The volume of browse in the diet exceeded that of grasses only from mid-April through May, and it remained far below that of forbs throughout the season.

There were only minor differences in the distribution of the major forage classes in the diets from different range site groups. However, major differences existed between specific diets of deer from the different sites. Distinctive diets, relative to species composition, existed for clay and clay loam sites, for sandy and sandy loam sites, and to some extent for lowland mixed soils sites.

High priority forage plants for each site group were determined on the basis of preference ratings and combined volumetric contributions to the diet. A minimum of 160 different plant taxa occurred in the winter–spring diet. From 12 to 15 taxa were determined to be high priority forage plants for each range site group. Four plant taxa were common to all three sites as high priority forage plants in deer diets. From 66 to 75% of the high priority forage species were perennials.

During the winter–spring period in South Texas, the diet of white-tailed deer varied according to availability and phenology of range vegetation, but was strongly modified by forage preferences.

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