

SEASONAL FEEDING HABITS OF WHITE-TAILED DEER IN SOUTHERN MARYLAND*

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Abstract: Food habits of white-tailed deer (*Odocoileus virginianus*) were studied on a 526-ha mixed forest-grassland site at Blossom Point, on the coastal plain of Maryland. The rumen contents of 2 deer shot per month for a year and a winter browse survey were used to define seasonal variations in plant species utilization. Mushrooms and the fruits of dwarf sumac (*Rhus copallina*) and oaks (*Quercus* spp.) were utilized in the fall. In winter, a large portion of the diet was Virginia pine (*Pinus virginiana*), honeysuckle (*Lonicera japonica*), and rushes. In the spring, a shift to herbaceous material occurred, although red maple (*Acer rubrum*) flowers, rushes, and Virginia pine were browsed moderately. During the summer, honeysuckle and blackberries (*Rubus* spp.) were the most important food species, comprising 45% of the summer diet. Deer have a profound impact on the growth of waxmyrtle (*Myrica cerifera*) since 60% of the branches were browsed in winter. Sweetgum (*Liquidambar styraciflua*), red maple, and dogwood (*Cornus florida*) were also browsed at this time. Plant species from a variety of habitats are important food resources to Blossom Point deer.

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Effective management of white-tailed deer (*Odocoileus virginianus*) requires knowledge of the food habits and resources available seasonally to local populations. Many studies, conducted in different habitats, indicate that deer are adaptable opportunists that will browse, or graze, depending on the foods available.

Sossaman and Weber (1973), working in a pine pocosin in North Carolina, found woody plants to be important deer foods throughout the year, although fruit and leaves were more important than stem material. They found the fruits of shining sumac and pokeweed and greenbriars (*Smilax* spp.) were used by deer in the winter. Red maple and blackberry stems and leaves were important in the spring, while they were succulent. Summer foods included the leaves and stems of red maple, pokeweed, grape (*Vitis* spp.), greenbriars and swamp cyrilla (*Cyrilla recemiflora*).

Harlow and Hooper (1971) examined the rumen contents of deer from the coastal plain of 5 southeastern states: Virginia, North Carolina, South Carolina, Georgia and Florida. They, too, found little utilization of leafless twigs, even in the winter. In the spring, deer consumed succulent twigs, green deciduous leaves, green herbaceous stems, grasses and sedges. Honeysuckle and oak leaves were important, along with pine needles. In the summer, consumption of blueberry (*Vaccinium* spp.) fruits was high; mushrooms, green deciduous leaves and herbaceous material were also important. Fall diets were dominated by honeysuckle leaves and acorns. Winter diets were primarily composed of honeysuckle leaves, acorns, grasses and sedges.

Cushwa et al. (1970) showed that leafless woody twigs were relatively unimportant to deer of the southeast coastal plain, except in the spring. While herbaceous species accounted for 22 percent of the spring diet, leaves, fruits and succulent twigs of woody species were more important. Summer foods consisted primarily of leaves of woody species including honeysuckle and grape. Mushrooms were most important in this season. The fall diet was dominated by acorns. Honeysuckle leaves were also present. In the winter, deer of this region consumed honeysuckle leaves more than any other item.

Results from other parts of the country illustrate the adaptability of deer. Chamrad and Box (1968) investigated the winter-spring diet of deer in South Texas. Ninety percent of the spring diet consisted of forbs, while browse was rare. Winter diets showed a larger proportion of browse, but forbs and grass also dominated in this season. Deer in this area appear to be predominantly grazers, rather than browsers.

Deer in northeast Kansas (Watt et al. 1967) rely more heavily on agricultural crops than native plants. Woody species as a group were the most important native foods

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throughout the year, although leafy browse was far more important than woody parts. Forbs, as a group, were important, especially in the summer, but individual forb species were of little importance throughout the year.

Investigations of spring, summer, and fall food habits of deer in northern Wisconsin by McCafferty et al. (1974) revealed grasses, sedges and forbs as the most important food categories in the spring. In summer, leafy browse was the predominant item, but herbs were also important. In the fall, grasses and sedges were, again, the most important food; acorns were also used in this season. Woody browse was of little importance in any of the seasons studied.

The foregoing studies demonstrate that differences in regional diet depend upon the availability of palatable plants and plant community structure. This paper discusses the feeding habits of white-tailed deer on a forest-grassland site on Blossom Point, Charles County, Maryland. It identifies those plant groups most important to Blossom Point deer in terms of utilization and availability.

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MATERIALS AND METHODS

Study Area and Deer Herd

Blossom Point is a 526-ha tract of land which had been cultivated with corn and tobacco prior to 1942. The U.S. Army used the area for ordnance testing between World War II and July, 1974. Blossom Point is bounded on 3 sides by the Potomac River and a tributary, and is a typical coastal plain community in topography and vegetative cover (Brown and Brown 1972). It is part of the oak-pine forest of the southeastern coastal plain (Hunt 1972).

The U.S. Army maintained approximately 30 percent of the area as grassland by mowing and herbicide application. Since mid-1974, the natural plant succession of the fields has been allowed to develop. The dominant grass species in the fields are broom-sedge (*Andropogon virginicus*) and knotweed (*Paspalum laeve*), with an undergrowth of pink wild bean (*Strophostyles umbellata*), buttonweed (*Diodia virginiana*), and Japanese clover (*Lespedeza striata*). Firebreaks along the roads are disked annually, but cable paths and firebreaks through the forest were last disked about 1970.

A swamp nearly bisects the study area. Several tidal marshes occur on the periphery. Marshy areas comprise approximately 9 percent of the total area and contain such species as rose mallow (*Hibiscus moscheutos*), fresh-water cord-grass (*Spartina pectinata*), salt marsh grass (*S. alternifolia*), cat-tail (*Typha latifolia*) and lizard's tail (*Saururus cernuus*). Open water, surrounded by marshes, occurs in low places on Blossom Point and makes up approximately 1 percent of the surface area.

The remaining 60 percent of the study area is forested, one-fourth of it in Virginia pine and red cedar (*Juniperus virginiana*), and three-fourths in mature hardwoods. In most cases, the pines are being replaced by sweetgum, tulip poplar (*Liriodendron tulipifera*) and red maple. The understory of the pine area consists of American holly (*Ilex opaca*) and waxmyrtle. The dominant canopy species in the deciduous areas are white oak (*Quercus alba*) and red maple. The understory of the hardwood zones is composed of American holly, blueberries, dogwood and black gum (*Nyssa sylvatica*). In addition, small stands of black locust (*Robinia pseudoacacia*), typical of neglected farm land, are distributed throughout the area.

Since the U.S. Army occupied the area, deer hunting has been permitted irregularly. In the fall of 1974, during the duration of this study, hunting was allowed on the property for the first time in about 8 years; 40 deer with nearly equal numbers of males and females, were taken. The deer herd on Blossom Point has been studied incompletely. Welch (1975) estimated the size of the post-harvest herd at 65 using Petrides' (1949) method comparing pre- and post-hunting season sex ratios. The population density (1 deer for each 8 ha) is close to what Ripley and McClure (1963) and Moore (1967) consider normal for good deer range. The area is fenced in a manner which allows deer to travel between Blossom Point and the adjacent property.

Vegetation Analysis

Vegetation composition of the forested area was determined in the late spring and summer of 1975. The quarter-point method, described by Smith (1966), was used to

sample woody vegetation in each of 3 areas thought to be representative of the wooded habitat. Randomly selected stations were sampled in each area by dividing the station into quarters, and recording the species of the closest woody plant more than 1 m high in each quarter. A total of 57 random stations, from transects in each of the 3 areas, was obtained. Twenty stations fell within the pine habitat, and 37 within the deciduous zone.

Herbaceous vegetation within the wooded area was measured along 2 of the same transects. At each randomly selected point along the transect, the presence of selected herbaceous species within the quadrat was recorded. Only those non-woody species which were very abundant, or present in the rumen samples, were considered. The quadrat size was determined by use of the species area curve at each sampling point, and ranged from 1 m² to 6 m², with a median size of 4 m². Quadrats at 27 random points were sampled, 9 within the pine area and 18 in the deciduous zone.

Data from all 3 of the woody transects were combined so that the relative density of each woody species could be found over the entire forested area (Smith, 1966). Relative density for each recorded plant species was computed according to the following equation:

$$\text{Relative density} = \frac{n}{N} \times 100$$

where n = the number of individuals of a particular plant species recorded and N = the total number of individuals recorded (Smith, 1966). Likewise, data from the 2 non-woody transects were merged, and the percent occurrence for each selected herb species computed.

Food Habits

Rumen Analysis: Rumen analysis was used to detect seasonal differences in utilization. For a year, beginning in August 1974, two deer were shot each month, except February. Liter-sized rumen samples were collected, passed through a 5.7 mm sieve, and stored in 10 percent formalin. Aliquots were selected randomly from the samples for analysis. Initially, 6 complete 1-liter samples were sorted, requiring a large investment of effort and time. The data were recorded cumulatively and showed that no information on plant species presence or relative abundance was added by sorting more than 150 mls of material. Consequently, an aliquot of approximately 150 mls was analyzed for each of the remaining rumen samples. Each subsample required 3 hours, or less, to sort.

Each sample was separated into general plant form, and when possible, identified to species. After excess moisture had been removed, the volume of each category, or species, was determined to the nearest 0.1 ml by water displacement. Following sorting, identification and measurement by water displacement, each category was stored in a vial of 10 percent formalin.

Browse Survey: A winter browse survey was conducted to determine differences in utilization of woody twigs during the dormant season. Two available branches, i.e. less than 1 m high, on a minimum of 20 individuals of each of the 7 important plant species, were tagged in the fall. The length of the branch and all twigs were measured, with the current and old growth of each branch recorded separately, as outlined by DeVos and Mosby (1969). Orange plastic markers were placed near the tagged branch to facilitate relocation in the spring. The 7 species used in the experiment were: wax-myrtle, American holly, oak, blueberry, red maple, dogwood and sweetgum. Shortly before growth began in spring, the tagged branches were examined, and were remeasured in those cases where browsing by deer had occurred. The tagged branches were located along the same 3 transects used in the vegetation survey, plus 1 transect in another representative area.

RESULTS

Vegetation Analysis

Vegetation estimates showed that the dominant species in the wooded area were sweetgum, red maple, and American holly which cover 26 percent, 14 percent, and 13 percent, of the wooded area respectively. An additional 40 percent consists of six groups: oaks, Virginia pine, black gum, blueberry, tulip poplar and red cedar. Trace amounts (less than 1 percent) of waxmyrtle, maleberry (*Lyonia* sp.), dogwood and red mulberry (*Morus rubra*) occur. Table 1 presents the relative density of each woody species in the forested area, computed according to Smith (1966). Percent occurrence was computed for those nonwoody species which occurred very often, or were found in the rumen samples. As presented in Table 2, honeysuckle, greenbriar and partridgeberry (*Mitchella repens*) are present in much of the wooded area.

Table 1. Relative density^a of woody species in the forested area of Blossom Point Proving Grounds, Maryland, Summer, 1975.

<i>Species</i>	<i>Relative Density</i>
Sweetgum	26.32
Red Maple	14.04
Holly	13.16
Oaks	9.21
Virginia Pine	7.46
Black Gum	6.14
Blueberries	5.70
Tulip Poplar	4.82
Red Cedar	3.95
Black Locust	2.20
Sycamore (<i>Platanus occidentalis</i>)	1.75
Cherry (<i>Prunus</i> spp.)	1.32
Spicebush (<i>Lindera benzoin</i>)	1.32
Wax-myrtle	.88
Dogwood	.88
Red Mulberry	.44
Maleberry	.44

^aRelative density = $\frac{\text{number of species} \times}{\text{total number of individuals of all}} \times 100$
(Smith 1966)

Table 2. Percent occurrence of selected non-woody species in the forested area of Blossom Point Proving Grounds, Maryland, Summer, 1975.

<i>Species</i>	<i>Percent Occurrence</i>
Greenbriar	55.56
Honeysuckle	33.33
Partridgeberry	25.93
Ferns	7.41
Ground Cedar	3.71
Field Garlic	3.70
Mushrooms	3.70

Food Habits

Rumen Analysis: Results of the rumen analyses are presented as a percent of volume in Table 3. Data from the semi-monthly samples were merged into seasons, such that summer consisted of samples taken in June, July, August, and September; fall—October and November; winter—December, January and March; and spring—April and May. The food items present in the March samples reflected the transition from winter to spring. Flowers or other parts of plants present only in early spring were found, notably red maple flowers and plant parts of cinquefoil (*Potentilla canadensis*), sheep sorrel (*Rumex acetosella*), and buttercup (*Ranunculus acris*). These plant parts were considered indicative of spring feeding habits and were recorded as such, whereas the remainder of the March sample was included with January and December as the winter sample.

In spring, herbaceous species dominated the rumen samples (44.1%). Much of the herbaceous material remained unidentifiable but those species identified included sheep sorrel, buttercup, cinquefoil, Japanese clover and partridgeberry. Woody species, mostly red maple and Virginia pine, comprised 25.7 percent of the total. Red maple was important at this time of year only, presumably because of the seasonal availability of flowers and succulent growing twig ends. Grasses and sedges were most prevalent in the

Table 3. Percent volume of rumen contents, by plant species and season, obtained from white-tailed deer at Blossom Point Proving Grounds, Maryland, 1974-1975.

<i>Food Item</i>	<i>Part Eaten</i>	<i>Spring</i> <i>n=4</i>	<i>Summer</i> <i>n=8</i>	<i>Fall</i> <i>n=4</i>	<i>Winter</i> <i>n=6</i>
<i>Woody Plants</i>					
Honeysuckle	leaf, twig	1.08	33.34	9.12	11.64
Virginia pine	leaf, twig	7.89	.14	.09	22.23
Blackberry	fruit, leaf, stem		11.57		
Dwarf Sumac	fruit, twig, leaf		.39	11.05	
Red Maple	twig, flower, leaf	10.67	.13	1.97	
Oaks	fruit			7.38	
Blueberry	twig, flower, fruit, leaf	3.93	7.22	2.41	.08
Greenbriar	leaf, twig	.32	.08		
Red Cedar	leaf, twig	.12	.05		.19
Wax-myrtle	leaf			.19	
Woody Twigs (Unidentified)		1.73	5.08	2.70	3.73
Total		25.74	58.05	34.92	37.87
<i>Herbaceous Plants</i>					
Japanese Clover	stem, leaf, flower	.50	5.37	.13	.09
English Plantain	leaf		.03	4.43	.22
Ground Cedar	leaf, stem				4.34
White Sweet Clover	stem, leaf, flower		4.16		
Ferns (Unidentified)	leaf, stem			.19	2.93
Beggar ticks	stem, leaf, flower		2.65		
Sheep Sorrel	stem, flower	1.52		2.52	
Cinquefoil	leaf	2.02	.32		
Field Garlic	stem, flower		.95		
Partridgeberry	stem, leaf	.29			.80
Buttercup	leaf, stem	.03			
Partridge pea	leaf		.02		
Herbaceous Material (Unidentified)	leaf, stem	39.75	20.36	37.72	25.49
Total		44.11	33.55	44.99	33.87
<i>Rushes</i>	stem, leaf, flower	15.95	.03	6.81	20.03
<i>Grasses and Sedges</i> (Unidentified)	stem, leaf, flower	13.78	5.58	3.21	7.58
<i>Mushrooms</i> (Unidentified)	plant	.15	2.44	6.44	.76
<i>Field Corn</i>	fruit			3.32	

rumen samples during this season (13.8%) but they were present throughout the remainder of the year in moderate quantities. Differentiation between grasses and sedges was not possible due to the similarity of leaf material. These groups could not be identified to lower taxa during this season because of the absence of flower parts. Rushes were very important food items (15.9%) during the spring, but could not be identified to smaller taxa.

Summer showed the greatest diversity in food items chosen, probably since more species of herbs were available and identifiable at that time. One-third of the summer sample was herbaceous material. Seven herbaceous species were identified: field garlic (*Allium vineale*), white sweet clover (*Melilotus alba*), English plantain (*Plantago lanceolata*), beggar ticks (*Bidens* sp.), cinquefoil, partridge pea (*Cassia fasciculata*) and Japanese clover. The last 3 species were also eaten in the spring. Woody species as a group were most important during this season, forming 58 percent of the summer samples. Honeysuckle, occupying one-third of the sample, was the single most important species in the summer. Virginia pine was no longer important in summer while blackberry and blueberry fruits and accompanying stem and leaf material were eaten to a moderate extent. Grasses and sedges were of less importance (5.6%) than in the spring (13.8%). Although

quantification of the grass and sedge species was not possible, some could be identified to genus from flower parts: *Bromus* sp. (June, July, August), *Festuca* sp. and *Carex* sp. (June and August), *Paspalum* sp. (August) and *Panicum* sp. (September). Rushes were of little importance during this season. Mushrooms were more prevalent in the summer samples (2.4%) than in spring (0.2%) but not as important as in the fall (6.4%).

In the fall, honeysuckle was still important (9.1%). It contributed to the woody plant portion of the diet, along with acorns (7.4%) and the fruits and leaves of dwarf sumac (11.1%). Red maple and blueberry were browsed to a small extent, but were more important in the spring and summer, respectively. Herbaceous material was still important, but much of it could not be identified. The leaves of some plants which remain green much of the year (ferns, sheep sorrel, Japanese clover and English plantain) were important. Mushrooms were consumed most during this season (6.4%), and rushes were eaten to some extent (6.8%). Corn (*Zea mays*), grown on the farms adjacent to Blossom Point, was used by deer during this season.

The least variety of food items was found in the winter samples. Virginia pine was the single most important woody species (22% of the winter sample) and honeysuckle continued to occupy a major portion of the diet (11.6%). Herbaceous material accounted for one-third of the winter diet. Evergreen herbs, such as ground cedar (*Lycopodium complanatum*) and partridgeberry were important at this time. Rushes were very important accounting for 20 percent of the winter diet. It is apparent that evergreen material is very important to the deer during winter.

Browse Survey: Of the 7 species monitored for winter utilization of woody twigs, 3 (American holly, blueberry and oaks) showed no browsing by deer (Table 4). Waxmyrtle was used heavily, with 60 percent of the tagged branches browsed. Ten percent of the labeled red maple branches, and nearly 23 percent of the sweetgum branches, had portions removed. Only 2.3 percent of the dogwood was browsed.

Table 4. Browse intensity of white-tailed deer on seven selected species of woody browse at Blossom Point Proving Grounds, Maryland, Winter, 1974-1975.

<i>Browse species</i>	% <i>Browsed branches</i>	<i>Average No. of twigs browsed per branch</i>	<i>Average amount eaten twig (mm)</i>
Holly	0	0	0
Oaks	0	0	0
Blueberry	0	0	0
Dogwood	2.33	1.00	14.00
Red Maple	10.00	1.25	35.20
Sweetgum	22.50	2.89	68.00
Waxmyrtle	60.00	2.50	33.75

DISCUSSION

The results of this study indicate the relative importance of general food categories in the diet of southern Maryland deer. Woody plants are a very important group; they were the dominant category in summer and winter. Honeysuckle was the only plant occupying more than 1 percent of the samples throughout the year. It was used most heavily in summer (33.4%) and winter (11.7%). Honeysuckle is also a very abundant plant. The importance of honeysuckle has been reported previously. Harlow and Hooper (1971) found that honeysuckle was a prevalent species throughout the year in the diets of deer inhabiting the southeastern coastal plan. They found it to be most important in the spring (13.5%) and winter (38.0%). Cushwa et al. (1970) working in the same area, found honeysuckle leaves in the rumen samples from all seasons but spring; winter utilization (38.9%) was far greater than at any other time. Lay (1969) mentioned the importance of evergreens, particularly honeysuckle, to deer in the South in winter.

Virginia pine appears to be a staple food for Blossom Point deer during the winter and spring. It occupied 22.2 percent of the winter sample, 7.9 percent of the spring sample, and trace amounts of the summer and fall samples.

Blueberry was moderately important in the summer, occupying 7.2 percent of the summer sample, but it was also used in spring (3.9%) and fall (2.4%). Neither the

summer samples nor the browse survey indicate any significant utilization of blueberry during winter. Twig utilization appeared to be dependent on the presence of flowers, fruit or leaves.

Blackberry was used extensively in the summer (11.5%) when in fruit. Blackberry was eaten in summer by deer in Kansas (Watt et al. 1967), Wisconsin (McCaffery et al. 1974) and Ohio (Nixon et al. 1970).

Acorns were important only in the fall (7.4%) on Blossom Point. Others (Harlow and Hooper 1971) reported much heavier and more prolonged utilization of acorns, which probably is a reflection of different habitat or annual variations in the availability of acorns.

Dwarf sumac was an important component of the fall diet at which time fruits, leaves and twigs were found in the rumen samples.

Red maple was most important during the spring when twigs and flowers made up 11 percent of the sample. Minor utilization of leafy twigs also occurred in summer and fall. Some red maple twigs were browsed in the winter, according to the browse survey but no evidence of this was found in the rumen samples. Sweetgum, waxmyrtle and dogwood were also eaten according to the winter browse survey but were not present in the winter rumen samples. These discrepancies are probably a result of the wide variety of food items available even in winter and the small number of rumens sampled.

Leafless woody twigs were of some importance in the winter to the deer on Blossom Point. During winter 22 percent of the labeled sweetgum branches were browsed; an average 68 mm of the current twig growth was removed from each browsed twig. Considering that sweetgum comprises over one-fourth of the woody species more than 1 m high, a large amount of sweetgum is being consumed during the winter. Red maple, too, is fairly abundant; 10 percent of its branches were browsed by deer in winter.

Woody and herbaceous evergreens were very important to the deer on Blossom Point during winter. Much of the winter diet is composed of evergreens—Virginia pine, honeysuckle, ground cedar, ferns, partridgeberry rushes. Although not an abundant species, waxmyrtle was heavily browsed (60%) during the winter, indicating that deer have a preference for its leafy, aromatic branches.

Herbaceous plants were important as a group throughout the year but especially in spring (44.1%) and fall (33%). Much of the herbaceous material remained unidentifiable, and no species was of particular importance. Utilization of herbaceous species reflected seasonal availability, e.g. beggar ticks, cinquefoil, buttercup, white sweet clover, partridge pea and field garlic. Evergreen herbaceous material was important in the winter, comprising 8 percent of the winter diet. McCaffery et al. (1974) in Wisconsin also identified evergreen ground plants as important food items for deer in spring and fall. Japanese clover was most important in Wisconsin in the summer, but dried leaves and stems were also used in small quantities in the remainder of the year. Sossaman and Weber (1973) identified *Lespedeza* as an important genus in a North Carolina pine pocosin, particularly in the summer. Korschgen (1954), too, reached this conclusion in a study of deer food habits in Missouri.

Grasses and sedges were important food items throughout the year, but especially in the spring. Lay (1969) remarked that deer utilization of grasses during the spring is common in the South. In Wisconsin, McCaffery et al. (1974) found that grasses and sedges were the most important foods for deer in the spring. Their seasonal utilization was similar to that for Blossom Point deer, i.e. highest in spring and winter, lowest in summer and fall.

Rushes were found in the rumen samples in greatest quantities in winter (20%) and spring (15.9%), while they were of very little importance in summer.

Mushrooms were used predominantly in the fall (6.4%), although small quantities were used in the other seasons as well. Lay (1969) mentioned that mushrooms are excellent food for deer in the South.

The results of this study indicate that deer utilize a variety of plants species and habitats on Blossom Point, and probably on similar areas within the southeastern coastal plain. Plant species were found in the rumen samples which characteristically inhabit fields (Virginia pine, sweetgum, rushes, forbs, grasses and sedges), deciduous forest (honeysuckle, blackberry, red maple, blueberry, oaks, greenbriar) and pine forest (red maple, various forbs). The woody browse survey, too, demonstrates the importance of subcanopy species within the pine and deciduous forest as a food resource for deer.

LITERATURE CITED

- Brown, R. G., and M. L. Brown. 1972. Woody plants of Maryland. Port City Press, Baltimore. 347 pp.
- Chamrad, A. D., and T. W. Box. 1968. Food habits of white-tailed deer in south Texas. *J. Range Manage.* 21(3):158-164.
- Cushwa, C. T., R. L. Downing, R. F. Harlow, and D. F. Urbston. 1970. The importance of woody twig ends to deer in the Southeast. U.S. Dept. Agri. For. Serv. Res. Paper SE-67, 12 pp.
- DeVos, A., and H. S. Mosby. 1969. Habitat analysis and evaluation. Pages 135-172 in R. H. Giles, ed. *Wildlife management techniques*. The Wildlife Society, Washington, D. C.
- Harlow, R. F., and R. G. Hooper. 1971. Forages eaten by deer in the Southeast. *Proc. Annual Conf. Southeastern Assoc. Game and Fish Comm.* 25:18-46.
- Hunt, C. B. 1972. *Geology of soils*. W. H. Freeman and Company. San Francisco. 344 pp.
- Korschgen, L. J. 1954. A study of the food habits of Missouri deer. *Missouri Cons. Comm., Div. of Fish and Game.* 43 pp.
- Lay, D. W. 1969. Foods and feeding habits of white-tailed deer. Pages 8-13 in U.S. Dept. Agri. For. Serv., *White-tailed deer in the southern forest habitat*. South. For. Exp. Sta., New Orleans, LA.
- McCaffery, K. R., J. Tranetzki, and J. Piechura, Jr. 1974. Summer foods of deer in northern Wisconsin. *J. Wildl. Manage.* 38(2):215-219.
- Moore, W. H. 1967. Deer browse resources of the Atomic Energy Commission's Savannah River Project Area. U.S. Dept. Agri. For. Serv. Res. Bull. SE-6. 28 pp.
- Nixon, C. M., M. W. McClain, and K. R. Russell. 1970. Deer food habits and range characteristics in Ohio. *J. Wildl. Manage.* 34(4):870-886.
- Petrides, G. A. 1949. Viewpoints on the analysis of open season sex and age ratios. *Trans. N. Amer. Wildl. and Nat. Res. Conf.* 14:391-409.
- Ripley, T. H., and J. P. McClure. 1963. Deer browse resources of North Georgia, U.S. Dept. Agri. For. Serv. Res. Bull. SE-2. 20 pp.
- Smith, R. 1966. *Ecology and field biology*. Harper and Row, Publishers. New York. 686 pp.
- Sossaman, E. C., and A. J. Weber. 1973. Seasonal food-habits of white-tailed deer in a treated eastern North Carolina pocosin. *Proc. Annual Conf. Southeastern Assoc. Game and Fish Comm.* 27:125-142.
- Watt, P. G., G. L. Miller and R. T. Robel. 197. Food habits of white-tailed deer in northeastern Kansas. *Trans. Kan. Acad. Sci.* 70(2):226-240.
- Welch, J. L. 1975. Seasonal feeding habits of white-tailed deer in Southern Maryland. M.S. thesis. University of Maryland, College Park. 35 pp.