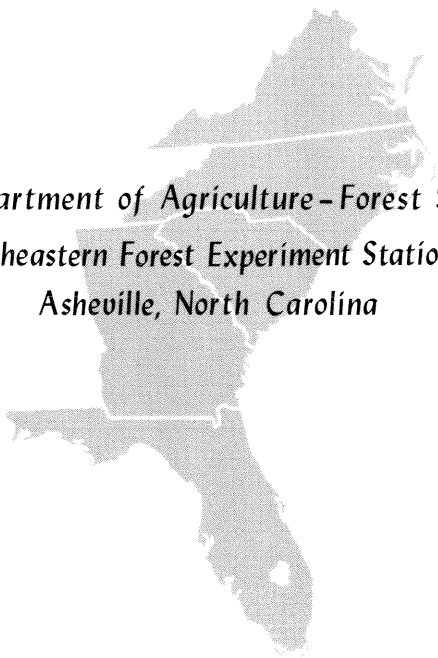
USDA Forest Service Research Paper SE-67 August 1970

The Importance of Woody Twig Ends to Deer in the Southeast

by

Charles T. Cushwa, Robert L. Downing, Richard F. Harlow and David F. Urbston



U.S. Department of Agriculture - Forest Service
Southeastern Forest Experiment Station
Asheville, North Carolina

The Importance of Woody Twig Ends to Deer in the Southeast

by

Charles T. Cushwa, Wildlife Biologist*

Robert L. Downing, Wildlife Biologist
Bureau of Sport Fisheries and Wildlife, USDI

Richard F. Harlow, Wildlife Biologist
Blacksburg, Virginia

and

David F. Urbston, Wildlife Biologist
Region 8, Savannah River Project
Aiken, South Carolina

INTRODUCTION

One of the basic assumptions underlying research on wildlife habitat in the five Atlantic states of the Southeast is that white-tailed deer (Odocoileus virginianus) rely heavily on the ends of woody twigs during the winter. Considerable research has been undertaken to determine methods for increasing and measuring the availability of woody twigs to deer. This study was conducted to determine the relative importance of woody twigs to deer in the Coastal Plain, Piedmont, Southern Appalachians, and the Ridge and Valley Province of the Southeast.

In earlier work, after analyzing 440 samples of deer rumina collected throughout the year in Missouri, Korschgen (1954) found that deer in that area rarely ate twigs. Dunkeson's (1955) observations of a tame deer in the Ozarks supported Korschgen's findings, as did Lay's (1964) in east Texas. Harlow (1961) analyzed 423 deer stomachs collected in Florida during the fall and winter. He found that, by volume, herbaceous matter contributed 11 percent, mast 40 percent, mushrooms

---

*Now affiliated with Pennsylvania Cooperative Wildlife Research Unit, Bureau of Sport Fisheries and Wildlife, USDI, Pennsylvania State University, University Park, Pa.

9 percent, miscellaneous items 3 percent, and woody plant material--primarily evergreen leaves--37 percent to the diet. Ruff,[1] working in Pisgah National Forest in North Carolina, found that twigs accounted for only 5 percent of the total volume of 35 deer stomachs collected during the winter but that succulent twigs accounted for 40 percent of the volume of nine deer stomachs collected during the spring and summer.

Even in the Northeastern States where winters are longer and colder, evidence has been accumulating that deer may prefer foods other than twig ends during this season. Stiteler and Shaw (1966, p. 210) state, "The concept that browse is the principal food of white-tailed deer in the Northeast is open to serious question. Results of these surveys indicate that the use of woody twigs for food by white-tailed deer in the Northeast is inversely related to availability of other winter foods." Shaw and Ripley (1966) calculated that the percent, by weight, of twigs in deer's diet was 5.6 percent for three northern forests and 3.2 percent for three southern forests.

Our study, which relates the importance of woody twigs to other foods in four physiographic provinces of the Southeast, is tentative. We were not able to obtain large numbers of samples from each province during all seasons. Knowledge of the availability of food items in each location during the study period was not available.

METHODS

Personnel from the Southeastern Cooperative Wildlife Disease Study[2] made available rumen samples from deer killed in Alabama, Florida, Georgia, North Carolina, and South Carolina. During each of the four seasons, a 1-quart sample was taken from each of five deer collected in one night from a single location within each of the six states. Additional rumen samples were collected by the investigators and cooperators from road kills and deer killed during hunting seasons in Georgia, North Carolina, South Carolina, and Virginia.

During the 1-year study period, spring 1967 to spring 1968, 489 samples of the contents of deer rumina were collected and examined. Of this total, 34 were collected during the spring, 39 during the summer, 372 during the fall, and 44 during the winter season. All items retained in a 6.35 mm. sieve after washing were separated according to five plant parts: (a) fruit, (b) green leaves, (c) dead leaves, (d) succulent twigs and buds, and (e) hardened twigs and buds. These plant parts were identified as to species whenever possible. Unidentified items were categorized into 20 groups: green herbaceous stems and leaves, dried herbaceous stems and leaves, succulent green woody stems, hardened woody stems, dried deciduous leaves from woody

[1] Ruff, F. J. The white-tailed deer of the Pisgah National Game Preserve. 249 pp. 1938. (Unpublished mimeographed report on file at Southeast. Forest Exp. Sta., USDA Forest Serv., Blacksburg, Va.)

[2] These deer were collected under the direction of Dr. Frank Hayes, Director, Southeastern Cooperative Wildlife Disease Study, School of Veterinary Medicine, University of Georgia, Athens.

plants, dried conifer needles, vines, fruit, green deciduous leaves from woody plants, green conifer needles, heath leaves, grasses, sedges, mushrooms, other fungi, insects, dead twigs, ferns, mollusks (snails), and other miscellaneous items.

The data on each plant part were analyzed for frequency of occurrence and percent of the total volume. Additional items analyzed were physiographic province, season, and location. Because the condition of the vegetation varied from north to south, from east to west, and according to altitude, winter was considered to be that period between the first occurrence of 20° F. temperature and the last occurrence of 28° F. temperature at each location. Summer was considered to be the months of June, July, and August for all locations. Because certain plants were known to have differences in availability, the data were grouped according to the four major physiographic regions within the Southeast.

We recognized that rumen analysis has some disadvantages. For example, Norris (1943) found that, in sheep, difficult-to-digest food items such as twigs remained in the rumen for as long as 3 to 4 days before elimination. Similarly, Elliott (1967) supported Norris' conclusions; he suggested that, in ruminants, low protein roughages were slowly digested. Our rumen analyses were probably biased in favor of twigs or other coarse materials; conversely, soft fruits and mushrooms may have been digested very rapidly, resulting in a low-biased estimate of their importance.

RESULTS

Spring Season

No rumen samples were obtained from the Ridge and Valley Province for the spring or summer seasons. In the other physiographic regions, green succulent leaves and stems of both woody and herbaceous species dominated the top-ranking foods during the spring (table 1). Other important food items were the fruit of pricklypear and hawthorn in the Coastal Plain, flowers of yellow-poplar in the Southern Appalachians, mushrooms in the Coastal Plain and Piedmont, and acorns in the Southern Appalachians.

Summer Season

Materials from succulent green plants continued to dominate the ranking of foods taken by deer in the three provinces (table 2). Mushrooms appeared to reach a peak of importance, ranking first in the Piedmont, second in the Southern Appalachians, and third in the Coastal Plain. Fruit did not receive the use that was expected during this season. Possibly these foods were digested rapidly, leaving no evidence in the rumen, or our sample was too small, or there were only limited amounts of these items available. Fruit was important only in

Table 1.--Food items collected from 34 deer during the spring, by frequency and percentage of total volume

Southern Appalachians (11 samples)			Coastal Plain (13 samples)			Piedmont (10 samples)		
Item[1]	Frequency	Volume	Item[1]	Frequency	Volume	Item[1]	Frequency	Volume
	- - Percent - -			- - Percent - -			- - Percent - -	
Leaves (green)			Leaves (green)			Leaves (green)		
Woody spp.[2]	100.0	48.4	Woody spp.[2]	84.6	24.3	Herbaceous spp.[2]	100.0	59.7
Yellow-poplar	36.4	15.9	Herbaceous spp.[2]	46.2	22.1	Woody spp.[2]	90.0	34.2
Legumes[2]	27.3	12.4	Holly	15.4	10.4	Blackberry	30.0	.5
Herbaceous spp.[2]	36.4	11.7	Heath family	23.1	6.3	Greenbrier	20.0	.4
Sycamore	9.1	.3	Yellow-poplar	7.7	1.1	Honeysuckle	20.0	.1
Maple	36.4	.3				Plantain	10.0	.1
Subtotal		89.0	Subtotal		64.2	Subtotal		95.0
Fruit			Fruit			Twigs and stems		
Acorns[2]	27.3	4.1	Hawthorn	7.7	4.5	Woody, succulent[2]	70.0	4.7
Maple	9.1	.3	Pricklypear	7.7	1.6	Honeysuckle	10.0	.1
						Maple, succulent	10.0	.1
Subtotal		4.4	Subtotal		6.1	Subtotal		4.9
Twigs			Twigs			Mushrooms	10.1	.1
Woody, succulent[2]	63.6	2.8	Pine, succulent	7.7	14.9			
Rhododendron, succulent	9.1	.2	Woody, succulent[2]	61.5	10.4			
Subtotal		3.0	Subtotal		25.3			
Yellow-poplar flowers	63.6	3.4	Mushrooms	30.8	1.3			
Other items		.2	Other items		3.1			
Total		100.0	Total		100.0	Total		100.0

[1] Scientific names listed at end of Note.
[2] Unidentified.

Table 2.--Food items collected from 39 deer during the summer, by frequency and percentage of total volume

Southern Appalachians (12 samples)			Coastal Plain (16 samples)			Piedmont (11 samples)		
Item[1]	Frequency	Volume	Item[1]	Frequency	Volume	Item[1]	Frequency	Volume
	- - Percent - -			- - Percent - -			- - Percent - -	
Leaves (green)			Leaves (green)			Leaves (green)		
Woody spp.[2]	66.7	35.0	Woody spp.[2]	87.5	30.9	Woody spp.[2]	54.6	15.3
Herbaceous spp.[2]	25.0	21.3	Herbaceous spp.[2]	56.2	17.6	Herbaceous spp.[2]	45.5	10.5
Legumes[2]	41.7	5.8	Legumes[2]	31.3	9.7	Honeysuckle	54.6	4.3
Honeysuckle	8.3	3.7	Honeysuckle	18.8	5.5	Subtotal		30.1
Oak	33.3	2.0	Grape	6.2	1.6	Fruit		
Rhododendron	25.0	.8	Subtotal		65.3	Apple	54.6	6.4
Maple	41.7	.7	Twigs and stems			Blueberry	27.3	5.5
Subtotal		69.3	Woody, dead[2]	18.8	7.4	Oats	18.2	3.0
Acorns	16.7	.5	Woody, succulent[2]	43.7	3.9	Blackberry	36.4	2.4
Woody stems, dead	16.7	.7	Honeysuckle	18.8	3.1	Acorns	9.1	3.7
Mushrooms	83.3	28.0	Subtotal		14.4	Subtotal		21.0
Other items		1.5	Pecan (fruit)	12.5	1.9	Honeysuckle stems	45.5	5.6
			Mushrooms	75.0	11.9	Mushrooms	100.0	37.4
			Other items		6.5	Other items		5.9
Total		100.0	Total		100.0	Total		100.0

[1]Scientific names listed at end of Note.
[2]Unidentified.

the Piedmont. Acorns from the previous year continued to be important in the Piedmont and Southern Appalachians. For some unexplained reason, dead woody stems ranked within the top 10 food items in two provinces, but hardened live woody stems did not.

Fall Season

Acorns were by far the most abundant item found in deer rumina during the fall (table 3). Acorns ranked first in three of the four provinces and were second to Japanese honeysuckle in the Piedmont. Honeysuckle ranked high in every province except the Southern Appalachians, and it is probably second in importance to acorns during this season. Mushrooms and a variety of fruits such as grape, apple, pricklypear, sumac, blueberry, and honeylocust also ranked high. Leaves of woody species were frequently found in the samples, while woody twigs were notably absent.

Winter Season

Acorns continued to rank high in three of the four provinces (table 4). Grasses were important in two provinces. Japanese honeysuckle continued to rank high in all provinces, but it ranked first in only one, the Coastal Plain. Mushrooms continued to rank high in every province. Some fruits such as grape and sumac were taken in early winter. Rhododendron leaves dominated the samples from the Southern Appalachians. Succulent woody twigs appeared in the winter diet in the Coastal Plain, indicating that spring came earlier in this region during the sample year. Hardened woody twigs were not found in significant quantities in any sample.

DISCUSSION

An appraisal of the value of the various food items found in the samples appears below:

Fruits and Mast

Individual species of soft fruits may be limited in their period of availability, but, collectively, they are available almost year-round. Limited use was made of soft fruits during the spring and summer. Nevertheless, soft fruits should not be discounted. Because of their possibly high rate of digestibility, the limited sample size, or the limited availability, we may have underestimated their importance.

Acorns may rank high in the deer's diet every season of the year, depending upon the size of the acorn crop and the use made by other wildlife.

Table 3.--Food items collected from 372 deer during the fall, by frequency and percentage of total volume

Ridge-Valley (48 samples)			Southern Appalachians (15 samples)			Coastal Plain (188 samples)			Piedmont (121 samples)		
Item[1]	Frequency	Volume	Item[1]	Frequency	Volume	Item[1]	Frequency	Volume	Item[1]	Frequency	Volume
	--Percent--			--Percent--			--Percent--			--Percent--	
Leaves[2]			Leaves[2]			Leaves[2]			Leaves[2]		
Honeysuckle	25.0	2.8	Rhododendron	33.3	9.3	Honeysuckle	63.8	7.9	Honeysuckle	85.9	38.4
Heath family	20.8	1.4	Woody spp.[3]	40.0	2.8	Unidentified	14.9	1.1	Grape	21.5	1.7
Subtotal		4.2	Legumes[3]	46.7	2.5	Subtotal		9.0	Greenbrier	32.2	1.6
Fruit			Grape	20.0	1.8	Fruit			Woody spp.[3]	19.8	1.3
Acorns[3]	97.9	80.5	Woody spp., dry[3]	46.7	1.0	Acorns[3]	93.1	73.5	Honeylocust	19.8	1.3
Hawthorn	8.3	1.5	Subtotal		17.4	Sumac	27.1	2.0	Subtotal		44.3
Blueberry	16.7	1.0	Fruit			Hawthorn	9.6	.8	Fruit		
Sumac	6.3	.8	Acorns[3]	86.7	67.1	Legumes	8.5	.6	Acorns[3]	43.8	24.0
Subtotal		83.8	Grape	60.0	8.2	Subtotal		76.9	Corn	4.1	6.2
Twigs and stems			Apple	13.3	1.0	Stems			Sumac	27.3	3.3
Herbaceous[3]	10.4	1.9	Subtotal		76.3	Herbaceous[3]	44.2	4.1	Subtotal		33.5
Legumes, succulent[3]	8.3	.7	Mushrooms	46.7	1.8	Fleshy pricklypear	16.0	1.7	Herbaceous stems[3]	82.6	15.1
Subtotal		2.6	Grasses[3]	26.7	2.8	Subtotal		5.8	Mushrooms	76.9	4.2
Mushrooms	81.3	5.0	Other items		1.7	Mushrooms	64.4	2.2	Other items		2.9
Grasses[3]	35.4	.7				Grasses[3]	25.0	.6			
Other items		3.7				Other items		5.5			
Total		100.0	Total		100.0	Total		100.0	Total		100.0

[1]Scientific names listed at end of Note.
[2]Leaves are green unless otherwise noted.
[3]Unidentified.

Table 4.--Food items collected during the winter, by frequency and percentage of total volume

Ridge-Valley (5 samples)			Southern Appalachians (13 samples)			Coastal Plain (12 samples)			Piedmont (14 samples)		
Item[1]	Frequency	Volume	Item[1]	Frequency	Volume	Item[1]	Frequency	Volume	Item[1]	Frequency	Volume
	- - Percent - -			- - Percent - -			- - Percent - -			- - Percent - -	
Leaves[2]			Leaves[2]			Leaves[2]			Leaves[2]		
Honeysuckle	60.0	19.0	Rhododendron	100.0	78.0	Honeysuckle	75.0	88.9	Herbaceous spp.[3]	21.4	14.4
Grape	40.0	6.0	Honeysuckle	7.7	2.7	Holly	16.7	.5	Woody spp., dry[3]	64.3	3.2
Legumes[3]	40.0	1.2	Galax	46.2	1.2	Oak	50.0	.3	Grape	14.2	2.1
Woody spp., dry[3]	20.0	.7	Mountain-laurel	7.7	.7	Woody spp.[3]	8.3	.2	Honeysuckle	28.6	1.1
Subtotal		26.9	Woody spp., dry[3]	53.9	.5	Subtotal		89.9	Greenbrier	35.7	.9
Fruit			Grape	7.7	.4	Fruit			Woody spp.[3]	21.4	.6
Acorns[3]	60.0	27.3	Greenbrier	7.7	.4	Sumac	41.7	1.6	Subtotal		22.3
Hawthorn	20.0	2.3	Subtotal		83.9	Greenbrier	16.7	.2	Acorns[3]	14.2	.9
Apple	20.0	.4	Fruit			Subtotal		1.8	Honeysuckle stems	7.1	.2
Persimmon	40.0	.3	Acorns[3]	30.8	6.6	Stems and twigs			Mushrooms	35.7	1.2
Subtotal		30.3	Grape	15.4	4.1	Fleshy pricklypear	25.0	4.7	Grasses[3]	42.8	74.6
Honeysuckle stems	40.0	8.8	Apple	7.7	3.3	Woody spp., succulent[3]	16.7	.6	Other items		.8
Mushrooms	40.0	.3	Subtotal		14.0	Honeysuckle	25.0	.1			
Grasses[3]	40.0	33.6	Mushrooms	53.8	1.1	Pine	8.3	.1			
Other items		.1	Other items		1.0	Subtotal		5.5			
						Mushrooms	50.0	2.4			
						Other items		.4			
Total		100.0	Total		100.0	Total		100.0	Total		100.0

[1] Scientific names listed at end of Note.
[2] All leaves are green unless otherwise noted.
[3] Unidentified.

Mushrooms

Mushrooms ranked within the top 10 foods in every province during every season, with only one exception. Their use seems to be least in the spring, perhaps because of low availability at this time, and highest during the summer.

Green Leaves from Woody Plants, Forbs, and Grasses

"If it's green, it's eaten" seems to be a suitable generality. Materials from fast-growing green plants were the major items found in those deer stomachs examined during the spring and summer months. It appears that anything which stays green throughout the winter has importance as food for deer.

Japanese honeysuckle was one of the most important producers of green winter food in the Southeast. Rhododendron in the Southern Appalachians and grass in the Piedmont and in the Ridge and Valley Province were important deer foods during winter.

Woody Twigs

Twigs were an important food item in all provinces during the spring. At this time, growing twigs are so succulent they could be classed as herbaceous in texture rather than woody. Hardened twigs did not occur in as much as $\frac{1}{2}$ of 1 percent of the food in our fall-winter sample of 416 deer. This low occurrence was noted in spite of the fact that woody twigs are more difficult to digest and remain in the rumen longer than other foods.

The following additional observations in North Carolina and Virginia contributed to our questioning the importance of woody twigs:

(a) In the mountain cove-hardwood region surrounding Curtis Creek in western North Carolina, 182 acres were clearcut; approximately $\frac{1}{2}$ ton of woody twigs was produced per acre during the year after cutting. Deer activity in these cuttings increased, but an analysis of 23 rumen samples collected during the third winter after cutting revealed that twigs occurred in small amounts in only 13 percent of the stomachs (table 5).

(b) A 2,322-acre enclosure at Dublin, Virginia, contains over 300 deer thriving on a range containing very little woody vegetation.

(c) Herd size remains low in an experimental 7,500-acre area in the Jefferson National Forest, Virginia, in spite of the fact that an abundance of twigs has been provided during 8 years of intensive cutting.

Table 5.--Analysis of 1-quart samples of the contents of 23 deer stomachs collected at Curtis Creek, North Carolina, on December 16 and 17, 1966

Item[1]	Frequency	Volume[2]
	- - - Percent - - -	
Leaves		
Rhododendron	100.0	27.0
Deciduous hardwood, dried[3]	82.6	9.0
Galax	73.9	8.0
Herbaceous spp.[3]	52.1	2.0
Mountain-laurel	4.3	2.0
Evergreen hardwood[3]	26.1	.4
Christmas fern	26.1	.4
Blackberry	8.7	.2
Greenbrier	8.7	.1
Ebony spleenwort	4.3	.1
Subtotal		49.2
Fruit		
Acorns[3]	26.1	13.0
Scarlet oak acorns	21.7	12.0
Red oak acorns	17.4	11.0
Chestnut oak acorns	4.3	1.0
Subtotal		37.0
Fungi		
Ascomycetes	39.1	4.0
Polyporus versicolor	26.1	3.0
Lichen	21.7	1.0
Agaricales	17.4	1.0
Subtotal		9.0
Grass[3]	43.4	2.4
Twig ends		
Woody, hardened[3]	13.0	.9
Miscellaneous		
Buds, stems, acorns, leaves, sprouts[3]	13.0	1.5
Total		100.0

[1] Scientific names listed at end of Note.
[2] Ocular estimate.
[3] Unidentified.

CONCLUSION

Twigs have been considered important in the Southeast in the past, but we suspect that this conclusion was reached mainly through examination of the plant and not of the deer itself. We concluded from analysis of 489 samples of deer rumina that virtually all browsing of twigs takes place during the spring and summer seasons, when this part of the plant is growing rapidly and is succulent.

It is quite clear that research and management in the Southeast should recognize all possible sources of food for white-tailed deer when attempting to determine the carrying capacity of deer range.

LITERATURE CITED

Dunkeson, R. L.
1955. Deer range appraisal for the Missouri Ozarks. J. Wildlife Manage. 19: 358-364.

Elliott, R. C.
1967. Voluntary intake of low-protein diets by ruminants. I. Intake of food by cattle. J. Agr. Sci. 69: 375-382.

Harlow, R. F.
1961. Fall and winter foods of Florida white-tailed deer. Quart. J. Fla. Acad. Sci. 24(1): 19-38.

Korschgen, L. J.
1954. A study of the food habits of Missouri deer. Mo. Conserv. Comm., Pittman-Robertson Program, 43 pp.

Lay, D. W.
1964. The importance of variety to Southern deer. Eighteenth Annu. Conf. Southeast. Assoc. Game & Fish Comm. Proc. 1964: 1-6.

Norris, J. J.
1943. Botanical analysis of stomach contents as a method of determining forage consumption of range sheep. Ecology 24: 244-251.

Shaw, S. P., and Ripley, T. H.
1966. Managing the forest for sustained yield of woody browse for deer. Soc. Amer. Forest. Proc. 1965: 229-233.

Stiteler, W. M., Jr., and Shaw, S. P.
1966. Use of woody browse by whitetail deer in heavily forested areas of northeastern United States. Thirty-First N. Amer. Wildlife & Natur. Resources Conf. Trans. 1966: 205-212.

FOOD ITEM LIST

Common name	Scientific name
Acorns	Quercus spp.
Apple	Malus spp.
Blackberry	Rubus spp.
Blueberry	Vaccinium spp.
Chestnut oak	Quercus montana Willd.
Christmas fern	Polystichum acrostichoides (Michx.) Schott
Corn	Zea mays L.
Ebony spleenwort	Asplenium platyneuron L.
Fungi (mushrooms & other)	Ascomycetes
	Basidiomycetes
	Agaricales
	Polyporus versicolor
Galax	Galax aphylla L.
Grape	Vitis spp.
Greenbrier	Smilax spp.
Hawthorn	Crataegus spp.
Holly	Ilex opaca Ait.
Honeylocust	Gleditsia triacanthos L.
Japanese honeysuckle	Lonicera japonica Thunb.
Legume	
Maple	Acer spp.
Mountain-laurel	Kalmia latifolia L.
Oats	Avena sativa L.
Pecan	Carya spp.
Persimmon	Diospyros virginiana L.
Pine	Pinus spp.
Plantain	Plantago lanceolata L.
Pricklypear	Opuntia humifusa Raf.
Red oak	Quercus rubra L.
Rhododendron	Rhododendron maximum L.
Scarlet oak	Quercus coccinea Muenchh.
Shining sumac	Rhus copallina L.
Sycamore	Platanus occidentalis L.
Yellow-poplar	Liriodendron tulipifera L.
Miscellaneous	
Heath	Ericaceae

Cushwa, Charles T., Downing, Robert L., Harlow, Richard F., and Urbston, David F.
1970. The Importance of Woody Twig Ends to Deer in the Southeast. Southeast. Forest Exp. Sta., USDA Forest Serv. Res. Pap. SE-67, 12 pp.

Year-round samples of 489 deer rumina from six Southeastern States were analyzed to determine the relative importance of various types of foods. Green material, fruits, mast, and mushrooms were all important foods at every season of the year. The least important food was woody twigs, which did not occur in as much as $\frac{1}{2}$ of 1 percent of the food in the fall-winter sample of 416 deer. Virtually all browsing of twigs takes place during the spring and summer, when this part of the plant is succulent. Future habitat research and management in the Southeast should recognize all possible sources of food for deer, not just the woody component.

Cushwa, Charles T., Downing, Robert L., Harlow, Richard F., and Urbston, David F.
1970. The Importance of Woody Twig Ends to Deer in the Southeast. Southeast. Forest Exp. Sta., USDA Forest Serv. Res. Pap. SE-67, 12 pp.

Year-round samples of 489 deer rumina from six Southeastern States were analyzed to determine the relative importance of various types of foods. Green material, fruits, mast, and mushrooms were all important foods at every season of the year. The least important food was woody twigs, which did not occur in as much as $\frac{1}{2}$ of 1 percent of the food in the fall-winter sample of 416 deer. Virtually all browsing of twigs takes place during the spring and summer, when this part of the plant is succulent. Future habitat research and management in the Southeast should recognize all possible sources of food for deer, not just the woody component.

Cushwa, Charles T., Downing, Robert L., Harlow, Richard F., and Urbston, David F.
1970. The Importance of Woody Twig Ends to Deer in the Southeast. Southeast. Forest Exp. Sta., USDA Forest Serv. Res. Pap. SE-67, 12 pp.

Year-round samples of 489 deer rumina from six Southeastern States were analyzed to determine the relative importance of various types of foods. Green material, fruits, mast, and mushrooms were all important foods at every season of the year. The least important food was woody twigs, which did not occur in as much as $\frac{1}{2}$ of 1 percent of the food in the fall-winter sample of 416 deer. Virtually all browsing of twigs takes place during the spring and summer, when this part of the plant is succulent. Future habitat research and management in the Southeast should recognize all possible sources of food for deer, not just the woody component.

Cushwa, Charles T., Downing, Robert L., Harlow, Richard F., and Urbston, David F.
1970. The Importance of Woody Twig Ends to Deer in the Southeast. Southeast. Forest Exp. Sta., USDA Forest Serv. Res. Pap. SE-67, 12 pp.

Year-round samples of 489 deer rumina from six Southeastern States were analyzed to determine the relative importance of various types of foods. Green material, fruits, mast, and mushrooms were all important foods at every season of the year. The least important food was woody twigs, which did not occur in as much as $\frac{1}{2}$ of 1 percent of the food in the fall-winter sample of 416 deer. Virtually all browsing of twigs takes place during the spring and summer, when this part of the plant is succulent. Future habitat research and management in the Southeast should recognize all possible sources of food for deer, not just the woody component.