DEER AND CATTLE DIET OVERLAP IN LOUISIANA PINE-HARDWOOD FORESTS: PRELIMINARY FINDINGS

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Abstract: Seasonal food habits and diet overlap between white-tailed deer (*Odocoileus virginianus*) and cattle are being studied on grazed and ungrazed, forested and clearcut loblolly-shortleaf pine (*Pinus taeda-P. echinata*)-hardwood sites in Louisiana. Preliminary data from direct observation of cattle and captive deer suggest that little diet overlap is likely if cattle stocking is based primarily on grass supplies. Greatest overlap occurred during winter on forested sites and during summer on clearcuts. However, few plant species shared by deer and cattle contributed more than 1% of either animal's diet during any season. Summer and fall overlap mainly involved grasses. Winter and spring overlap centered on grasses and woody plants in clearcut areas, and on woody plants in forested sites. Diets on clearcuts appear to represent complementary use by deer and cattle of an abundant resource rather than direct competition.

The South's private and public lands produce both cattle and deer in many areas. Considerable concern exists regarding the extent of forage competition, particularly on pine-hardwood sites considered prime white-tailed deer habitat. Some contend that any use by cattle, regardless of type of management or forages supplies, seriously reduces the carrying capacity for deer; others think livestock can be managed to have little negative influence on deer. Unfortunately, adequate data have not been available to resolve this issue. For this reason, research was initiated in June 1978 to determine seasonal forage preferences of deer and cattle, and the extent of diet overlap on selected loblolly-shortleaf pine-hardwood sites. This paper summarizes preliminary first-year findings.

STUDY AREAS

Four study areas were established in the Kisatchie National Forest 48 km north of Alexandria, Louisiana. Soils are level to moderately sloping and are a Vaiden-Anacoco association having moderate to somewhat poor drainage. Annual rainfall between 1970 and 1978 averaged 135 cm with extremes of 89 and 180 cm. Loblolly pine site index is about 26 m at 50 years.

Two study areas (area 1--grazed forest; areas 3--grazed clearcut) were located within an 850-ha experimental forest range having a history of unrestricted cattle and hog use prior to 1966, cattle exclusion from 1966 to 1968, and yearlong cattle use at about 68 ha per animal from 1968 through 1978 (Thill and Wolters 1979). During 1979 cattle stocking was increased, resulting in 43 ha per animal. Four 16- to 24-ha clearcuts were made in the experimenal range from 1975 to 1976. These sites were sheared, logging slash was windrowed and burned, and sites were planted with loblolly pine seedlings at a 1.8- by 2.5- m spacing in 1976. Cattle use has been moderate to heavy in the clearcuts and light in the forested portions since logging occurred. Hogs are common throughout this area. Forest sampling occurred on a selected 7.3 ha area while clearcut sampling was confined to a 2.4 ha portion of 1 clearcut which was logged in 1975.

Two study areas (area 2--ungrazed forest; area 4--ungrazed clearcut) were located on an adjacent 1214-ha livestock exclosure fenced since 1951. The clearcut area (48 ha) was logged and sheared in 1975. Logging slash was windrowed but not burned. This areas was

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planted to loblolly pine in 1976. Forest sampling occurred on a 6-ha area while clearcut sampling was on a 2-ha area. Although young trees were present on clearcuts, only areas 1 and 2 will be referred to as forest sites throughout this paper.

Loblolly and shortleaf pines were the dominant tree species on both forest sites, but many hardwood tree species were also present (Table 1). Common woody understory plants included American beautyberry (*Callicarpa americana*), blackberry (*Rubus* spp.), greenbriers (*Smilax* spp.), blueberries (*Vaccinium* spp.), hawthorns (*Crataegus* spp.), grapes (*Vitis* spp.), and Carolina jessamine (*Gelsemiun sempervirens*). Longleaf uniola (*Uniola sessiliflora*) and spike uniola (*U. laxa*) were the principal herbaceous species in both stands. In addition to most of the above plants, the following genera were common on both 3-year-old clearcuts: *Andropogon, Panicum, Paspalum, Rhynchospora, Juncus, Carex, Eupatorium, Solidago,* and *Lespedeza.* Botanical names follow Radford et al. (1968).

TABLE 1. Average density and basal area of tree species on two loblolly-shortleaf pine-hardwood study areas.

Species	Stems/Hectar		Basal Area (m^2/ha)	
	Area 1[a]	Area 2	Area 1	Area 2
Pinus taeda	445	152	13.2	10.9
Pinus echinata	167	21	5.5	2.9
Pine subtotal	612	173	18.7	13.8
Quercus falcata	11	47	0.7	2.8
Quercus stellata	51	78	1.4	2.3
Liquidambar styraciflua	117	173	0.3	1.8
Quercus alba	9	120	0.5	0.9
Nyssa sylvatica	16	152	0.2	0.9
Acer rubrum	119	47	0.6	0.4
Prunus serotina	0	17	0.0	0.1
Carya tomentosa	0	7	0.0	0.1
Quercus velutina	0	2	0.0	0.1
Cornus florida	0	3	0.0	0.1
Fraxinus spp.[b]	25	0	0.2	0.0
Carpinus caroliniana	29	0	0.1	0.0
Hardwood subtotal	377	646	4.0	9.5
Total	989	819	22.7	23.3

[a] 1 = grazed forest and 2 = ungrazed forest.
[b] *F. pennsylvanica* and *F. americana.*

METHODS

Food habits information was obtained by direct observation of cattle and captive deer. Deer were obtained as fawns and trained under procedures described by Wallmo and Neff (1970) and Reichert (1972). Prior to each sampling period and throughout taming and training, deer were permitted to feed in a variety of forest habitats to acquaint them with available forage and with trial procedures. Cattle grazed native forested range

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between trials. Winter cattle diets were supplemented with hay and concentrates; salt and bonemeal were provided yearlong (Pearson and Whitaker 1972).

Feeding observations were begun at randomly selected starting points during 4 sampling periods: June 20-July 26 (summer), October 10-November 15 (fall), January 17-February 28 (winter), and April 3-May 11 (spring). Deer were held on leash, but cattle were unrestrained. Animals were allowed to graze at will as long as they remained within the study areas. Each animal was observed for 30-90 minutes each sampling day, generally between 0900 and 1400. Spring and summer trials on clearcuts were conducted between 0630 and 1130 because high temperatures made it difficult to keep animals in openings during afternoon hours.

Three yearling deer (1 female and 2 castrated males) were used during summer trials. Two of these deer (1 female and 1 male) and 7 deer raised during summer 1978 were used for fall, winter, and spring trials. Three heifer calves were used during the summer trial, and an additional heifer calf was added for the fall, winter, and spring trials.

Animal diets were quantified using bite-count procedures (Wallmo et al. 1972). When more than 1 species was taken per bite, each species was recorded as a separate bite. Bite counts were classified to the lowest possible taxonomic category and by plant parts, and recorded on a portable tape recorder. Percent of diet composition was calculated for each food item by dividing the number of bites of each item by the total bite count for the given area and season.

Similarity between deer and cattle diets was quantified using Kulcyznski's similarity index (SI): $SI = \frac{\Sigma 2W}{a+b} \times 100$

W is the lesser percentage of a food category in 2 diets being compared and a and b are the sum of the percentages of the food categories in the 2 diets (Oosting 1956:77). This index indicates the percentage of 2 diets that was identical.

Forest stands were categorized using the variable-plot method for basal area and stems-per-acre determination (Grosenbaugh 1952); diameter at breast height of trees selected with a 10-factor prism was recorded. About 50 sample points were inventoried on each area.

Current-year production of browse ($\leqslant 1.52$ meters in height), forbs, grasses, and grasslike plants was determined in September 1978 by a double-sampling, weight-estimate procedure (Wilm et al. 1944); 102-120 circular plots (.89 m^2) were sampled on forested sites and 60-70 circular plots (.30 m^2) were sampled on clearcut sites. Herbage utilization on grazed areas was estimated in October from the yield differences between 20 grazed and ungrazed (caged) paired plots. All vegetation measurements were taken at fixed intervals along randomly selected parallel transects.

RESULTS

Observation time on each area and season varied between 6.6 and 12.5 hours for deer and 4.2 and 9.7 hours for cattle (Table 2). Total bite counts varied between 1,509 in winter and 7,676 in spring for deer and 2,406 in winter and 14,878 in spring for cattle. Bites per hour averaged 367 in deer and 1,035 in cattle for all seasons and areas. Bites per hour were highest in spring and lowest in winter for both deer and cattle.

While both forest areas had basal areas of about 23 m^2/ha, the ungrazed forest area had about one-fourth as many pine stems per ha as the grazed site, but nearly twice as many hardwood stems (Table 1). The grazed forest stand produced more than twice as much forage as the ungrazed forest, presumably due to these stand condition differences (Table 3). Grass and browse produced about equal amounts on both clearcuts. Quantities of forbs were higher on the grazed clearcuts; grasslike plants were more abundant on the ungrazed clearcut. Herbage utilization averaged less than 35% on both grazed areas.

TABLE 2. Days spent per area, number of animals observed, total hours of observation, total bite count, and average number of bites per hour for deer (D) and cattle (C) by season and area.

Season	Area[a]	Days per Area		Hours of Observeration		Avg. No. Animals per day		Bite Count		Bites per Hour	
		D	C	D	C	D	C	D	C	D	C
Summer	1	4	3	11.8	9.7	2.2	3.0	4,751	11,554	403	1,191
	2	5	2	11.0	4.2	2.0	2.0	3,488	3,703	317	882
	3	4	2	12.5	5.6	2.0	2.0	4,730	7,686	378	1,372
	4	5	2	9.6	5.8	2.0	2.0	3,985	5,781	415	997
Fall	1	3	2	7.5	5.2	3.7	4.0	2,782	4,042	371	777
	2	3	3	11.6	8.2	4.7	4.0	3,158	3,940	272	480
	3	3	3	8.1	5.9	3.7	3.3	2,789	5,906	344	1,001
	4	3	3	10.0	8.2	4.3	4.0	2,844	7,172	284	875
Winter	1	2	2	9.8	5.2	5.0	4.0	2,240	2,406	229	463
	2	2	2	9.8	5.4	5.0	4.0	2,424	2,536	247	470
	3	2	3	6.6	5.9	4.5	3.3	1,509	5,497	229	932
	4	3	2	10.1	5.2	4.3	4.0	1,785	4,352	177	837
Spring[b]	1	3	3	11.0	8.3	5.0	4.0	7,676	11,313	698	1,363
	3	3	3	10.3	7.5	4.7	4.0	5,597	14,878	543	1,984
	4	3	3	9.5	5.6	4.3	3.3	5,627	10,676	592	1,906

[a]1 = grazed forest, 2 = ungrazed forest, 3 = grazed clearcut, 4 = ungrazed clearcut.
[b]Area 2 dropped from study prior to spring trial due to fire.

TABLE 3. Current-year production (kg/ha oven-dry weight) of herbage and browse on 2 recent clearcut pine-hardwood sites, September 1978.

Forage Class	Study Area[a]			
	1	2	3	4
Browse	301	133	876	750
Grasses	69	17	1358	1308
Grasslikes	2	1	254	600
Forbs	32	17	839	222
Total	404	168	3327	2880

[a]1 = grazed forest; 2 = ungrazed forest, 3 = grazed clearcut; 4 = ungrazed clearcut.

Deer and cattle use of woody twigs produced in previous years was nearly nonexistent except during winter, and even then this material was less than 1% of the animals' diets. Therefore, in the following discussion, browse refers almost exclusively to current-year growth of leaves, petioles, and stems.

Summer Diets

Summer cattle diets were dominated by grasses, averaging 87% of the bite counts over all 4 areas (Table 4). On the ungrazed forest, grasses contributed 83% of the cattle diets

TABLE 4. Seasonal use of forage classes by deer and cattle as a percentage of total bite counts from 4 study areas.

Season	Forage class	Area 1[a]		Area 2		Area 3		Area 4	
		Deer	Cattle	Deer	Cattle	Deer	Cattle	Deer	Cattle
Summer	Browse	80.3	3.9	79.9	10.9	26.9	0.4	44.0	1.4
	Fruits	0.0	0.0	0.1	0.0	0.2	0.0	0.6	0.0
	Grasses	12.0	94.4	14.9	83.2	24.8	81.6	41.3	90.4
	Grasslikes	0.4	0.3	0.3	0.0	3.6	3.1	1.7	6.4
	Forbs	7.3	1.4	4.6	5.9	44.4	14.8	12.4	1.8
	Fungi	0.0	0.0	T[b]	T	0.0	0.0	T	0.0
Fall	Browse	85.1	22.4	90.9	22.6	53.5	3.8	85.5	3.2
	Fruits	6.8	0.7	6.9	0.0	13.5	0.0	0.3	0.0
	Grasses	0.1	76.6	1.1	75.0	4.3	86.8	8.6	88.6
	Grasslikes	T	0.2	0.0	2.3	0.1	2.6	0.1	7.5
	Forbs	7.9	T	0.6	0.2	28.6	6.8	5.3	0.7
	Fungi	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
Winter	Browse	83.6	66.0	82.2	78.4	75.9	5.4	95.2	12.9
	Fruits	0.4	0.0	0.2	0.4	0.0	T	0.2	0.0
	Grasses	0.1	29.8	0.0	19.2	6.2	63.8	2.6	43.6
	Grasslikes	0.4	4.2	0.1	1.9	0.9	28.0	0.2	43.5
	Forbs	14.4	0.0	16.2	0.0	16.9	2.7	1.6	T
	Fungi	1.1	0.0	1.2	0.1	0.0	0.0	0.1	0.0
Spring	Browse	92.2	60.0			89.2	12.6	93.1	18.7
	Fruits	T	0.0			T	0.0	0.1	0.0
	Grasses	0.2	37.4			1.2	73.9	2.4	64.0
	Grasslikes	0.0	0.9			0.5	9.9	0.9	12.0
	Forbs	7.3	1.7			9.0	3.6	3.4	5.3
	Fungi	0.4	0.0			T	0.0	T	0.0

[a] 1 = grazed forest; 2 = ungrazed forest, 3 = grazed clearcut, 4 = ungrazed clearcut
[b] T = <0.1%.

even though grass production was only 17 kg/ha. Long-leaf and spike uniola, the principal grasses used by cattle on forest sites, accounted for 30% of the cattle diets on the grazed clearcut and 9% on the ungrazed clearcut.

Summer diets of deer on forest sites averaged 80% browse (Table 4). On the grazed clearcut, forbs were the most important forage class in the deer diets (44%), followed by browse (27%) and grasses (25%). Similar amounts of browse and grass were taken by deer on the ungrazed clearcut.

Two of 72 plants species (or species groups) taken by deer during summer on the grazed forest accounted for 1% or more of both deer and cattle diets (Table 5). Six of 62, 6 of 74, and 7 of 102 accounted for 1% or more of both their diets on the ungrazed forest, grazed and ungrazed clearcuts, respectively. The greatest overlap on both forest areas involved uniola grasses (Table 6). There was very little overlap on the ungrazed clearcut. Common lespedeza (*Lespedeza striata*) and low panicum grasses (*Panicum* spp.) were the principal plants shared on the grazed clearcut.

TABLE 5. Kulcyznski's similarity index values and related data for deer and cattle on the Kisatchie National Forest, 1978.

| Area | Season | Species Used Only By | | | | Species Shared | | Similarity Index |
| | | Deer | | Cattle | | | | |
		No. Species	% of Diet	No. Species	% of Diet	Total No.	No. ≥1%[a]	
1[b]	Summer	25	6.7	13	0.8	47	2	15.9
	Fall	27	22.7	7	3.7	26	4	21.4
	Winter	27	21.6	11	32.8	20	6	45.1
	Spring	22	5.6	21	2.4	59	12	33.0
2	Summer	41	39.1	4	7.9	21	6	24.6
	Fall	19	16.4	13	13.4	29	7	22.8
	Winter	13	20.1	8	30.4	26	7	47.8
3	Summer	48	24.0	12	0.8	35	6	30.8
	Fall	40	28.7	15	23.8	17	2	7.8
	Winter	17	19.4	11	38.0	17	2	10.8
	Spring	29	6.5	32	8.3	57	4	14.9
4	Summer	70	38.6	6	1.4	32	7	27.2
	Fall	34	22.5	16	19.9	28	2	11.0
	Winter	26	42.2	10	29.1	17	3	13.2
	Spring	28	8.2	30	22.0	60	7	19.2

[a]Number of plants taken in common that made up ≥1% of both deer and cattle diets.
[b]1 = grazed forest; 2 = ungrazed forest; 3 = grazed clearcut; 4 = ungrazed clearcut.

Fall Diets

Grasses contributed 76% and 88% of the fall cattle diets on forest and clearcut sites, respectively (Table 4). Use of browse by cattle increased on forest sites from 7% in summer to an average of 22% of the fall diet, but remained below an average of 4% on clearcuts. Nearly 7% of the cattle diet consisted of forbs on the grazed clearcut. Forbs made up less than 1% of cattle diets on the other areas.

Browse dominated fall deer diets, making up an average of 88% of the bite counts on forest sites, and 70% on clearcuts (Table 4). Fruits made up 7% of the deer diet on both forest sites, 14% on the grazed clearcut, but only 0.3% on the ungrazed clearcut. Forbs accounted for 29% of the deer diet on the grazed clearcut and over 5% on the grazed forest and ungrazed clearcut.

Four of 53 plants used by deer on the grazed forest during fall contributed 1% or more of both deer and cattle diets (Table 5). Seven of 48, 2 of 57, and 2 of 62 accounted for 1% or more of both their diets on the ungrazed forest, and grazed and ungrazed clearcuts, respectively. The overlap that occurred centered on use of woody plants on forest sites and grasses on clearcuts (Table 6). The greatest overlap observed was for fruits of American beautyberry. Diet similarity index values were lowest on clearcuts during fall (Table 5).

Winter Diets

Browse accounted for an average of 72% of the cattle diet on forest sites, but dead leaves made up 11% of this total on both forests. Uniola grasses provided 29% and 17% of

TABLE 6.   Plants contributing ≥5% of deer (D) and cattle (C) diets during any season.

Area	Species	Summer		Fall		Winter		Spring	
		D	C	D	C	D	C	D	C
1[a]	*Callicarpa americana*	0.2	T[b]	8.3	9.4	1.4	T	0.0	0.5
	Gelsemium sempervirens	8.9	0.1	7.4	0.6	27.0	38.3	2.2	0.6
	Quercus nigra	0.4	T	1.6	0.1	12.1	6.7	0.8	4.5
	Uniola spp.[c]	10.2	90.8	0.1	73.1	0.0	29.2	0.1	37.1
	Vitis rotundifolia	1.4	0.2	4.4	1.0	0.7	0.0	10.9	5.0
2	*Gelsemium sempervirens*	6.4	0.0	13.0	0.5	35.8	12.9		
	Myrica cerifera	0.9	0.0	0.5	0.2	15.6	16.6		
	Symplocos tinctoria	0.0	0.0	0.0	0.2	7.5	10.2		
	Uniola spp.	14.4	80.5	1.1	73.1	0.0	17.3		
	Vaccinium staminium	6.8	0.9	5.4	0.2	1.1	7.1		
3	*Lespedeza striata*	26.1	5.9	19.4	0.2	0.0	0.0	1.5	1.7
	Panicum spp.[d]	12.6	38.5	2.3	33.7	2.8	44.2	1.2	41.7
4	*Baccharis halimifolia*	T	0.3	0.0	0.1	5.2	7.4	0.3	0.1

[a] 1 = grazed forest, 2 = ungrazed forest, 3 = grazed clearcut, 4 = ungrazed clearcut.
[b] T = <0.1%
[c] *Uniola laxa* and *U. sessiliflora.*
[d] Low panicum grasses which produce winter basal rosettes.

the cattle diet on the grazed and ungrazed forest sites, respectively. Grasses and grasslike plants provided about 90% of the cattle diets on both clearcuts (Table 4).

Deer diets consisted of an average of 83% browse on forest areas and 86% on clearcuts (Table 4). An average of 6% of this browse use consisted of dead leaves. Forbs contributed 17% to the deer diets on the ungrazed clearcut. Fungi accounted for 1% of deer diets on both forest sites.

Six of 47 plants taken by deer on the grazed forest during winter contributed 1% or more of deer and cattle diets (Table 5). Seven of 39, 2 of 34, and 3 of 43 contributed 1% or more of both their diets on the ungrazed forest, grazed and ungrazed clearcuts, respectively. Forty-two percent of the deer diets on the ungrazed clearcut and about 20% on the other areas consisted of plants not utilized at all by cattle (Table 5). The contribution of plants used exclusively by cattle was consistently highest during winter, averaging 32% over all areas. Plants used exclusively by deer had their greatest contribution during summer or fall, except on the ungrazed clearcut where their greatest contribution was during winter.

On forest areas greatest overlap occurred for Carolina jessamine, water oak (*Quercus nigra*), waxmyrtle (*Myrica cerifera*), and common sweetleaf (*Symplocos tinctoria*) (Table 6). Eastern baccharis (*Baccharis halimifolia*) was actively sought by both deer and cattle on the ungrazed clearcut. Similarity index values were highest during winter on both forest study areas.

Spring Diets

A fire precluded sampling the ungrazed forest area during spring. On the grazed forest 60% of the cattle diet consisted of browse; on clearcuts cattle diets averaged almost 80% grasses and grasslike plants (Table 4). Cattle took an average of 6% more browse on clearcuts during spring than during winter, even though grass was more plentiful during spring.

Deer diets during spring averaged 92% browse across all three sampling areas. Twelve of 81 plants taken by deer on the grazed forest during spring contributed 1% or more of both deer and cattle diets (Table 5). Four of 86 and 7 of 88 plants contributed 1% or more of both their diets on the grazed and ungrazed clearcuts, respectively. The greatest overlap observed on the grazed forest was for muscadine (*Vitis rotundifolia*), which provided 11% and 5% of the deer and cattle diets, respectively (Table 6). Use of grasses by deer on both clearcuts was lower in spring than any other season.

DISCUSSION

On forested areas where grass supplies were limited, diet overlap was greatest during winter. Normally, however, cattle prefer clearcuts or more open stands over dense timbered stands producing little forage. In this study both deer and cattle were forced to use areas which were not necessarily preferred habitats. Captive deer readily grazed clearcuts during cooler morning hours. Clearcuts are also apparently attractive to wild deer as long as these areas are not too large or vegetation too dense. Consequently, data for clearcuts may be more representative of deer-cattle interaction situations for sites where both animals have access to a variety of habitat conditions. The limted diet overlap that we observed on clearcuts would probably not be considered competition, but rather complementary use of an abundant forage resource.

The significance of browse use by cattle on deer welfare is dependent on many factors including degree of utilization, season of use, plant parts utilized, growth responses of previously browsed plants, and availability of alternate foods supplies. For example, late fall cattle use of leaves of deciduous woody plants is less detrimental to both plants and deer than heavy winter use of Carolina jessamine which is an important year-round deer food. Fall cattle use of mast preferred by deer, while not detrimental to the plants, could be detrimental to deer.

With the exception of several grass species, only limited diet overlap was observed during summer or fall on any of the study areas--despite the fact that both timbered sites produced little grass forage. Grass species used in common by deer and cattle are those which are most common on these and similar areas. Consequently, if cattle stocking is based on grass abundance, little competition would be expected during these seasons on comparable areas.

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