

Wildlife Session

Deer and Cattle Diets on Longleaf Pine-Bluestem Range

Ronald E. Thill, *Southern Forest Experiment Station,
USDA Forest Service, Pineville, LA 71360*

Abstract: Seasonal diets of cattle and lead deer (*Odocoileus virginianus*) using three subunits of a rotationally burned longleaf pine-bluestem (*Pinus palustris-Andropogon* spp.) pasture receiving moderate yearlong grazing are compared with lead deer diets from 3 similarly managed, ungrazed subunits. Considering all plant species, diet overlap averaged 44.3, 34.7, 21.5, and 8.0% during winter, spring, fall, and summer, respectively. Summer diets were largely complementary. On the average, deer selected 15.5% more browse on ungrazed sites during winter, but 7.3 and 7.8% more browse on grazed sites during spring and summer, respectively. Prescribed burning reduced diet overlap during spring.

Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 36:410-419

Grazing of longleaf pine-bluestem range can provide landowners with an annual income while their timber crop matures. However, the effects that this grazing might have on deer and other wildlife are generally unknown. Western literature has many examples of deer and cattle competition under abusive grazing practices, but light to moderate cattle grazing has generally resulted in little competition (Thilenius and Hungerford 1967, Skovlin et al. 1968, Dusek 1975, Currie et al. 1977). Applicability of these findings to southern conditions is unknown.

Prescribed burning is advocated for cattle management within the long-leaf pine type. One recommendation is to subdivide a pasture by fire-lines into 3 burning units and to burn a different unit each year. Since cattle prefer the most recent burn, each burning unit receives varying degrees of use annually depending on how recently it was burned. Under a 3-year burning rotation, plants on the heavily grazed recent burn have 2 years of lighter use within which to regain vigor prior to subsequent burning (Duvall and Whitaker 1964).

First-year findings are presented for a long-term study of deer and cattle interactions on longleaf pine-bluestem range in central Louisiana. The objective of this research is to determine the degree of diet overlap between white-tailed deer and cattle during different seasons as influenced by rotational burning and its influence on grazing intensity. Findings will aid in developing cattle management systems which minimize competition with deer.

Methods

Study Areas

The study is located on the east and west units (about 63 ha each) of the Headquarter Pasture on the Longleaf Tract, Palustris Experimental Forest, Kisatchie National Forest, about 3.2 km north of Glenmora, Louisiana. Each pasture is divided by firelines into 3 subunits of approximately equal area, but neither pasture is cross-fenced. Subunits are designated as EA, EB and EC on the east pasture, and WA, WB, and WC on the west pasture. Both pastures have been control-burned periodically during late winter by backfires for many years. All subunits were burned in 1975, and all west pasture units were burned in 1980. Subunit EB was burned in 1979, EC in 1980, and EA and WA in 1981.

The east pasture was grazed most of the year from 1978 through 1980 at about 19 ha per animal. In 1981, stocking was decreased to about 33 ha per animal to achieve an overall herbage utilization of about 35 to 40%. Cattle have yearlong access to salt, bonemeal, and a molasses-urea supplement. The west pasture has not been grazed by cattle since 1956.

The overstory on both pastures is dominated by a natural stand of second-growth longleaf pine originating primarily from the 1955 seed crop. Stands in both pastures were thinned in 1976 to a basal area of approximately 11.5 m²/ha. Common hardwoods included *Quercus marilandica*, *Q. stellata*, *Q. falcata*, *Carya tomentosa*, *Cornus florida*, *Sassafras albidum*, and *Nyssa sylvatica*. Common shrubs and vines included *Rubus* spp., *Myrica cerifera*, *Rhus copallina*, *R. toxicodendron*, *Callicarpa americana*, *Vitis aestivalis*, and several species of *Vaccinium*. The herbaceous understory is dominated by grasses (principally *Andropogon scoparius*, *A. tener*, *Paspalum* spp., and *Panicum* spp.), but many forbs were also present.

Topography varies from nearly level to gently rolling hills with slopes up to 12%. Soils are predominantly fine sandy loam Ruston, Malbis, and Smithdale series, which are moderately to well drained upland soils of low natural fertility. Annual precipitation averages about 147 cm; monthly rainfall generally exceeds 10 cm, except in October.

Procedures

Pine and hardwood densities were determined by the variable-plot-radius method (Grosenbaugh 1952) using a 10-factor prism at fixed intervals along randomly selected transects; 36 points were inventoried in each subunit. Graminoid and forb production was estimated by clipping 27 quadrats of 0.89 m² in each subunit in September 1981. Current-year browse production estimates are based on clipping and weighing 54 quadrats of 0.89 m² in each subunit in June 1982. Samples were dried at 50 C in a forced-air oven to a constant weight. Quadrats in the east pasture were caged to exclude grazing. Production differences between each caged plot and 3 nearby grazed plots were used to estimate herbage disappearance from early spring through late September.

Plant frequency of occurrence data were obtained in September 1980 and 1981 from 162 permanent 0.89 m² quadrats in each subunit. Plots were located at fixed intervals along randomly selected parallel transects. Herbaceous species were tallied if basally rooted (entirely or partially) within the plot; woody species producing foliage extending over the plot to a height of 1.52 m were tallied.

Food-habits data were collected from October 1980 through August 1981 during 4 sampling periods: 14 October – 25 November (fall), 5 January – 4 February (winter), 23 March – 27 May (spring), and 22 June – 20 August (summer). In order to relate diet overlap data to grazing intensity and burning conditions, each burning subunit was treated as a separate sampling unit. During this phase of the study cattle grazed and were observed only on the east pasture. Each subunit was generally sampled 4 to 5 times during each season. Food-habits data were collected from 3 to 5 deer and 5 cattle each time a subunit was sampled. Deer were observed for about 30 to 45 minutes each, cattle 20 to 25 minutes each. Animal diets were quantified using bite-count procedures (Wallmo et al. 1972, Thill and Martin 1980). Diet similarities were calculated using Kulczynski's similarity index that represents the percent that 2 diets are identical (Oosting 1956:77).

Fall data were collected from 2 3½-year-old deer (a doe and a castrated male) and a 2½-year-old doe. Two additional does (born June 1980) were added for winter, spring, and summer trials. All deer had been tamed and trained to harness. Five mixed-breed heifers, varying in age from 1½ to 2½ years, were used throughout the first year. Cattle used in this study spent at least part of the year on the east pasture and the remaining time on similar forested range. Deer were familiarized with each subunit during many practice trials, and were maintained on a commercial horse and mule feed supplemented with a wide variety of native plants between trials. Deer were leashed during trials, but were restrained as little as possible; cattle were observed unrestrained.

Botanical nomenclature follows Radford et al. (1968). The term species refers to individual plant species as well as several species groups (e.g., *Rubus* spp.) where field separation of individual species was impractical. Graminoids refer primarily to grasses, as few species of grasslike plants were present.

Results

Data Base

Findings are based on total deer and cattle bite counts of 104,700 and 136,863, respectively. Hours of observation totaled 247 for deer and 90 for cattle. Bite counts were approximately equally distributed among subunits within each season. Deer diets were least represented during fall with 10,500 total bites across all 6 subunits, versus total bite counts of 27,876 to 37,889 for the other 3 seasons. Total bite counts for cattle on the east pasture varied from 10,390 during winter to 60,665 during summer.

Overstory/Understory Conditions

Pine basal area averaged 13.4m²/ha over the 6 subunits; hardwood basal area averaged 1.2 m² (Table 1). Longleaf pine diameters (dbh) ranged from 5.1 to 58.4 cm, but weighted averages varied from only 22.4 to 26.2 cm. *Cornus florida* was the only mast producing tree of consequence, as other hardwoods were generally too small.

Total herbage production varied from 483 to 1,264 kg/ha on the east pasture, versus 853 to 1,280 kg/ha on the west (Table 1). Graminoids dominated herbage production on all sites, but forbs contributed from 16 to

Table 1. Overstory Basal Area (m²/ha), Current-Year Herbage and Browse Production (kg/ha), and Number of Plant Species Encountered during September 1981 Survey of 162 Quadrats of 0.89 m² Located in Each of 6 Longleaf Pine-Bluestem Sampling Areas in Central Louisiana

Subunit ^a	Basal Area		Understory Production				Number of Species
	Pine	Hardwood	Total	Browse	Graminoids	Forbs	
EA	14.6	1.0	1,694	430	821	443	145
EB	12.8	0.2	1,413	302	980	131	157
EC	12.9	2.8	911	428	337	146	163
WA	12.5	1.5	1,523	288	1,012	223	139
WB	12.5	1.0	1,542	689	715	138	157
WC	15.4	0.5	1,872	592	1,035	245	178

^a Subunits EA and WA were prescribe-burned 23 February 1981.

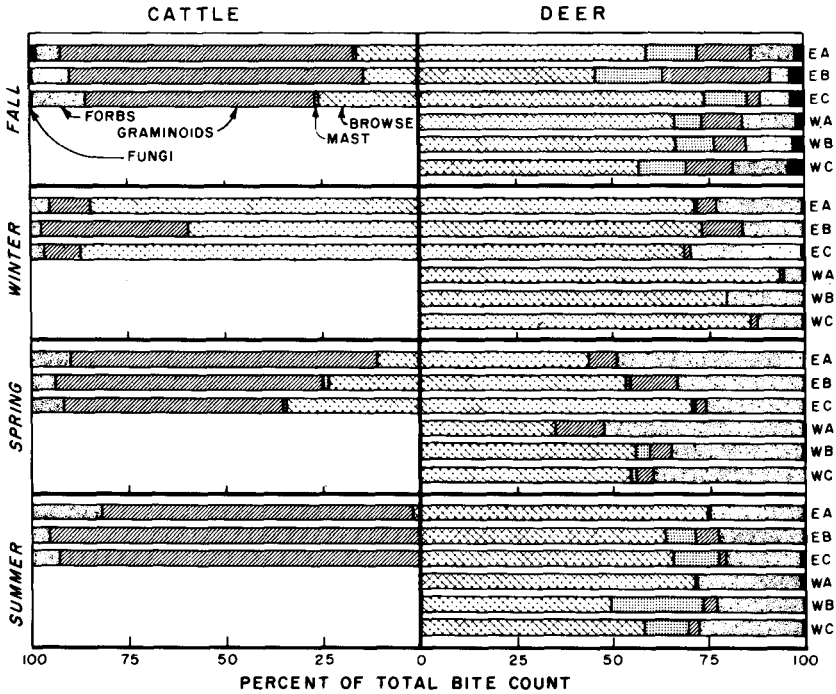


Figure 1. Seasonal use of 5 forage classes by cattle and lead deer on grazed (EA, EB, and EC) and ungrazed (WA, WB, and WC) longleaf pine-bluestem range in central Louisiana, October 1980 through August 1981.

19% of herbage production on the west pasture and 12 to 35% on the east pasture. Herbage utilization was highest (56%) on EA and least (36 and 29%) on EB and EC, respectively. Greater herbage production on EB than EC may have been the cause for greater utilization on EB than EC, despite the fact that EC was burned more recently than EB. Browse production averaged 387 kg/ha on the east pasture and 523 kg/ha on the west.

Fall Diets

Browse was the principal forage class utilized by deer on both pastures, averaging 63.1% of west pasture fall diets and 59.2% of east pasture diets (Fig. 1). Subunit EC produced the least herbage of any subunit, and cattle ate less grass and more browse on EC than on EA or EB. Deer diets averaged 9.8 and 13.8% mast on west and east pastures, respectively. Mast comprised <1% of the cattle diets. Graminoids contributed from 3.4 to 28.5%

of deer diets and from 60.9 to 76.8% of cattle diets. Deer diets averaged 11.2% forbs and 2.9% fungi across the 6 subunits, while cattle diets averaged 9.0% forbs and 1.0% fungi on the east pasture.

An average of 155 plant species were encountered on east pasture subunits during the September 1981 survey, compared with 158 on the west pasture subunits (Table 1). During fall, deer selected an average of 59 species on east pasture subunits and 82 on the west pasture. On the east pasture, deer selected an average of 20 species (which contributed from 9.7 to 20.2% of their diet) not eaten by cattle (Table 2). Deer and cattle shared an average of 39 species, 1 to 2 of which contributed $\geq 5\%$ to both their diets (Table 2).

If diet similarity indices are to be related to competition (i.e., shared use of a limited forage resource), it may be useful for discussion purposes to exclude commonly occurring plants from similarity index calculations. The question then becomes how to define which species are common and which are not. The September frequency of occurrence survey of 162 quadrats of 0.89 m² in each subunit provides a relative measure of yearlong availability of all woody species and most herbaceous plants except for ephemeral species such as *Oxalis violacea* and *Nothoscordum bivalve*. An average of 157 plant species were encountered per subunit during the September survey; of these, an average of 70% had frequency values of 10% or less. Given the

Table 2. Seasonal Diet Diversity, Number of Shared Species, and Diet Contribution of Plant Species Used Exclusively by Deer or Cattle on 3 Longleaf Pine-Bluestem Sites in Central Louisiana

Area	Season	Species Used Exclusively By				No. Shared Species		
		Deer		Cattle		Total	$\geq 1\%$ ^a	$\geq 5\%$ ^b
		No. Species	% of Diet	No. Species	% of Diet			
EA	Fall	25	20.2	45	16.9	36	5	1
	Winter	42	14.8	3	0.2	28	8	3
	Spring	28	7.1	28	6.3	72	8	1
	Summer	43	13.3	32	74.3	44	2	1
EB	Fall	19	9.7	38	14.4	45	3	2
	Winter	36	17.1	10	28.8	24	9	3
	Spring	35	5.9	28	2.4	72	8	2
	Summer	68	47.0	23	89.7	42	2	0
EC	Fall	16	16.2	50	66.5	36	7	1
	Winter	26	5.5	8	9.0	29	11	2
	Spring	32	6.8	25	5.6	76	9	2
	Summer	70	50.3	27	6.5 ^c	36	2	0

^a Number of plants eaten by deer and cattle that contributed $\geq 1\%$ of both their diets.

^b Number of plants eaten by deer and cattle that contributed $\geq 5\%$ of both their diets.

^c Value would be 85.6% had a deer not eaten one bite of *Andropogon scoparius*.

small quadrant size, species with a frequency of occurrence of $\geq 20\%$ would be considered common; some might argue that species with a frequency of $\geq 5\%$ are common enough to be excluded. Consequently, 5 diet similarity values were computed for each season and subunit, one where all species were included (total diet overlap) and 4 where those species with frequencies of ≥ 20 , ≥ 15 , ≥ 10 , and $\geq 5\%$ were excluded from similarity index calculations (Table 3).

Considering all shared species, fall diet similarities ranged from 18.1 to 25.8% and averaged 21.5% (Table 3). If species having frequency of occurrence values of $\geq 10\%$ are excluded, diet similarities ranged from 11.7 to 18.1% and averaged 14.3% (Table 3).

Winter Diets

Winter deer diets on west and east pastures averaged 86.2 and 70.7% browse, 1.0 and 5.9% graminoids, and 12.4 and 22.7% forbs, respectively (Fig. 1). East pasture cattle diets averaged 77.1% browse, 19.5% graminoids, and 3.3% forbs. Mast and fungi were limited in availability and were little used by deer or cattle. Deer selected an average of 62 species on east pasture units and 60 on the west. Deer utilized an average of 35 species on the east pasture (which contributed from 5.5 to 17.1% of their diet) not eaten by cattle (Table 2). Deer and cattle shared an average of 27 species

Table 3. Seasonal Similarities in Deer and Cattle Diets on 3 Longleaf Pine-Blue-stem Sampling Areas Grazed Yearlong in Central Louisiana

Area	Season	Percent Diet Similarity*				
		All spp. Included	Excluding Species with Frequency of Occurrence of:			
			$\geq 20\%$	$\geq 15\%$	$\geq 10\%$	$\geq 5\%$
EA	Fall	20.6	12.8	11.9	11.7	5.7
	Winter	48.1	28.6	25.7	25.5	16.4
	Spring	27.1	15.1	10.7	8.8	5.0
	Summer	11.7	2.4	2.3	1.2	0.8
EB	Fall	18.1	13.3	13.1	13.1	11.4
	Winter	41.6	29.0	29.0	13.7	12.2
	Spring	37.6	23.9	23.8	23.3	10.1
	Summer	7.9	0.5	0.5	0.4	0.1
EC	Fall	25.8	21.9	21.8	18.1	1.1
	Winter	43.2	32.0	32.0	32.0	12.8
	Spring	39.3	28.0	21.5	15.0	4.2
	Summer	4.3	1.0	1.0	0.5	0.2

* Kulczynski's similarity index values represent percent identicalness of deer and cattle diets. Frequency of occurrence data are for 0.89-m² quadrats.

of which 2 to 3 contributed $\geq 5\%$ to both their diets. Diet similarity averaged 44.3% considering all species, and 23.7% if species having frequencies of $\geq 10\%$ are excluded (Table 3).

Spring Diets

As subunits WA and EA were burned 1 month prior to spring trials, browse was initially less available on both these sites. Spring deer diets contained 20.3 and 18.6% less browse on west and east burns, respectively, than averages for corresponding pairs of unburned subunits. Deer diets averaged 48.4 and 55.7% browse, 7.4 and 7.5% graminoids, and 42.1 and 35.9% forbs on west and east pastures, respectively. Forb use by deer was substantially higher on both burns, averaging 50.6 compared with 33.2% for the 4 unburned subunits. Cattle consumed more graminoids and forbs, but less browse on the recent burn than on EB or EC. Cattle diets averaged 68.4% graminoids, 22.8% browse and 8.2% forbs (Fig. 1).

Deer selected an average of 105 species on the east pasture and 110 on the west pasture. They selected an average of 32 species (which contributed from 5.9 to 7.1% of their diet) not eaten by cattle (Table 2). Deer and cattle shared an average of 73 species of which 1 to 2 contributed $\geq 5\%$ to both their diets. Diet similarity averaged 34.7% considering all species, and 15.7% if species with frequencies of $\geq 10\%$ are excluded (Table 3).

Summer Diets

Deer and cattle diets were complementary during summer; deer took primarily a combination of browse, mast, and forbs, while cattle took mostly graminoids (Fig. 1). Deer diets on all 6 subunits averaged 63.7% browse, 9.2% mast, 2.5% graminoids, 24.0% forbs, and 0.6% fungi. Cattle diets averaged 0.7% browse, 0% mast, 89.4% graminoids, and 9.8% forbs. Effects of burning on diet selections were still evident during summer. Mast comprised 0.1% or less of deer diets on both burns, but deer diets on unburned west and east subunits averaged 17.8 and 9.8% mast, respectively, which consisted principally of *Rubus* spp. and *Vaccinium stamineum* fruits. Cattle ate more browse and forbs on the recent burn, but ate no mast on any of the subunits during summer.

Deer selected an average of 101 species on the east pasture and 102 on the west. On the east pasture deer ate 60 species (contributing from 13.3 to 50.3% of their diet) not eaten by cattle (Table 2). Deer and cattle shared an average of 41 species, of which only 1 species on EA and none on EB and EC contributed $\geq 5\%$ to both their diets. Diet similarities averaged 8.0% considering all species, and 0.7% if species with frequencies of $\geq 10\%$ are excluded (Table 3).

Discussion

Data presented provide an estimate of the amount of diet overlap that might occur between cattle and deer if both were forced to utilize comparable areas. That both animal species were forced to use sites that may not be seasonally preferred, is recognized. This fact may have been the cause for substantial winter consumption of *Myrica cerifera*, a plant of supposedly low palatability for both deer and cattle. During winter this plant contributed from 18.0 to 51.1% of the cattle diet and from 8.8 to 15.3% of the deer diet on east pasture subunits. Although *M. cerifera* had a slightly higher frequency of occurrence on the ungrazed west pasture (12.6 versus 10.7%), it contributed less to winter deer diets (4.7%) than on the east pasture (12.6%). Whether or not this indicates poorer foraging conditions on the grazed pasture is unknown at this time.

Diversity of diets selected by deer and cattle diminished during winter. In an attempt, presumably, to maintain diet quality, both animals sought a diet dominated by green forages. Consequently, substantial diet overlap occurred for such species as *Rubus* spp., *Gelsemium sempervirens*, *Heterotheca graminifolia*, *Ilex vomitoria*, *Lonicera japonica*, *Myrica cerifera*, *Baccharis halimifolia*, and basal-rosette-producing *Panicum* spp.

The effect of prescribed burning on diet overlap is significant since cattle and deer prefer recent burns (Duvall and Whitaker 1964, Lay 1967). During spring, cattle took only $\frac{1}{3}$ to $\frac{1}{2}$ as much browse on the fresh burn as they did on subunits EB and EC, and 15% more grass. Deer responded by taking less browse and more forbs. As a result, diet overlap (considering all species) was 11.4 percentage points lower on the burn than the average for subunits EB and EC. During summer, cattle and deer selected more browse on EA than EB and EC, presumably because browse produced on EA was of a higher nutritional value (phenologically less mature) than on the older burns. Nevertheless, little overlap occurred on any of the grazed units during summer.

First-year diet overlap was greatest during winter and least during summer. Deer diets from all subunits were dominated by browse yearlong except during spring when forbs were also important. Cattle diets were dominated by graminoids during all seasons except winter when browse comprised an average of 77.1% of their diet. On the average, deer selected 15.5% more browse on ungrazed than on grazed sites during winter, but 7.3 and 7.8% more browse on grazed sites during spring and summer, respectively. However, spring and summer deer diet differences seemed more related to burning than grazing.

Exclusion of commonly occurring species from diet overlap calculations may or may not be justified, depending on the response of these species to

grazing. So long as these species remain in abundance (in spite of or as a result of grazing), their exclusion may be justified. However, if these plants serve as buffer species, and thereby lessen cattle impact on less abundant preferred deer forage species, then their exclusion may be unjustified if grazing reduces their abundance. The response of these and other important deer forage species to continued grazing at present as well as higher stocking levels will be a key aspect of this continuing research.

Literature Cited

- Currie, P. O., D. W. Reichert, J. C. Malechek, and O. C. Wallmo. 1977. Forage selection comparisons for mule deer and cattle under managed ponderosa pine. *J. Range Manage.* 30:352-356.
- Dusek, G. L. 1975. Range relations of mule deer and cattle in prairie habitat. *J. Wildl. Manage.* 39:605-616.
- Duvall, V. L., and L. B. Whitaker. 1964. Rotation burning: a forage management system for longleaf pine-bluestem ranges. *J. Range Manage.* 17:322-326.
- Grosenbaugh, L. R. 1952. Plotless timber estimates — new, fast, easy. *J. For.* 50:32-37.
- Lay, D. W. 1967. Browse palatability and the effects of prescribed burning in southern pine forests. *J. For.* 65:826-828.
- Oosting, H. J. 1956. *The study of plant communities.* 2nd ed. W. H. Freeman and Co., San Francisco. 440pp.
- Radford, A. E., H. E. Ahles, and C. R. Bell. 1968. *Manual of the vascular flora of the Carolinas.* Univ. N.C. Press, Chapel Hill. 1183pp.
- Skovlin, J. M., P. J. Edgerton, and R. W. Harris. 1968. The influence of cattle management on deer and elk. *Trans. North Am. Wildl. and Nat. Resour. Conf.* 33:169-181.
- Thilenius, J. F., and K. E. Hungerford. 1967. Browse use by cattle and deer in northern Idaho. *J. Wildl. Manage.* 31:141-145.
- Thill, R. E., and A. Martin, Jr. 1979. Deer and cattle diet overlay in Louisiana pine-hardwood forests: preliminary findings. *Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies* 33:64-71.
- Wallmo, O. C., W. L. Regelin, and D. W. Reichert. 1972. Forage use by mule deer relative to logging in Colorado. *J. Wildl. Manage.* 36:1025-1033.