SHORT-DURATION GRAZING MAY IMPROVE WILDLIFE HABITAT IN SOUTHEASTERN PINELANDS

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Abstract: In southeastern pinelands, continuous year-long cattle grazing often degrades wildlife habitat and range condition. Short periods of intensive grazing followed by long rest periods show potential for improving wildlife habitat. In 1976 we began a study in which small pastures on a mature longleaf pine (*Pinus palustris*) flatwoods site in northern Florida were grazed for 1 to 2 weeks×until 50 percent of the grazeable forage was removed. Pastures were then rested for 2, 4, or 6 months before grazing was repeated. Early results indicate that the 4-month period of rest will significantly reduce the occurrence of pineland threeawn (*Aristida stricta*) and saw-palmetto (*Serenoa repens*) 2 abundant and troublesome plants, and will favor the increase of some desirable wildlife plants, mainly herbs.

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Integrated timber, livestock, and wildlife production has great potential for increasing revenues from southeastern pinelands. Many such areas, which were once overgrazed by cattle and burned annually, are now primarily managed for timber production. However, recent economic trends in the cattle and timber industries have renewed interest in forest grazing. Rising energy and labor costs are reducing profits in both the cattle and the timber industry (White 1977). Because native forages are available at low cost, forest grazing can be more attractive than grazing on improved pasture (Pearson 1974). White (1977) believed that the economic advantage of native forages will increase.

Early range research concentrated on management of the native wiregrasses (*Aristida* spp. and *Sporobolus* spp.) as the primary forage species. Rotation grazing systems developed in the West were inadequate (Duvall and Hilmon 1965), and frequent burning and year-long grazing were prescribed to keep wiregrass forage palatable. These treatments, however, drastically reduced the occurrence of other palatable forage and fruit-producing species important to wildlife. Experience with year-round grazing has prompted many wildlife managers to consider cattle grazing at any level to be detrimental to wildlife habitat.

What is needed on low-quality wiregrass range is a grazing system that will improve the vegetative composition for wildlife as well as cattle. One promising alternative is short-duration grazing, which is beneficial to certain subtropical forested ranges (Goodloe 1969; Payne and Goodloe 1969). In such a system, the range is divided into a relatively large number of pastures which are grazed for short periods and rested for longer periods. A major assumption is that high-intensity, short-duration grazing forces utilization of all grazeable forages, including the less desirable species. The grazing period is short enough to prevent use of regrowth, thus preventing palatable species from being overgrazed and weakened. Lengths of grazing and rest periods probably are critical and must be carefully planned for recovery of desirable plants. Seed production and seedling establishment are emphasized objectives. If it ensures survival of the right plant speices, this type of grazing system may also benefit wildlife.

In 1976 we began a study of the effects of short-duration grazing by cattle on important understory plants. This paper reports some early results, emphasizing plants that are important as food for white-tailed deer (*Odocoileus virginianus osceola*), wild turkey (*Meleagris gallopavo*), bobwhite (*Colinus virginianus*), and other ground-dwelling birds.

STUDY AREA METHODS

The study site is on the University of Florida's Beef Research Unit near Gainesville in Alachua County, Florida. It contains 16 fenced pastures in a 50-year-old natural stand of longleaf pine. Pine basal area averages 13.5 m^2/ha, and hardwood basal area (mainly *Quercus* spp.) averages 0.5 m^2/ha. The understory is dominated by saw-palmetto and pineland threeawn.

The most common soils are of the Adamsville and Sparr series (Smith 1978). They are nearly level, somewhat poorly drained, fine acid sands of marine origin. Subsoils are saturated during the summer, when the water table often is near the surface. The climate is subtropical and humid with long hot summers and short mild winters. The frost-free season averages 276 days. Precipitation averages 140 cm per year, of which 74 cm fall from June through September. Winters are dryer, averaging less than 8 cm of rain per month (Smith 1978).

The study site has been burned and grazed for many years. In preparation for our study, it was burned by prescription in January 1976. Pretreatment sampling was done in late summer 1976. Grazing treatments were imposed for 1 year, and pastures were again sampled in late summer 1977.

The experiment consisted of 4 replications of a randomized complete block design containing 4 treatments-2, 4, and 6 months rest from grazing plus an ungrazed control. These prescribed periods of rest followed 1 to 2 weeks of intensive grazing. Grazing was terminated when 50% of the usable cattle forage had been removed. Grazing was by 2 herds of 5 cows each. Cows were mature crossbred Black Angus X Brown Swiss ranging in weight from 320 to 365 kg each.

Vegetative cover was estimated by the line intercept method. Four permanent 30 m lines were placed in each pasture for estimating understory composition. Each line was divided into 200 15 cm segments. A species was tallied as present in the segment if any part between the ground and 1.5 m intercepted the line. Data were segregated into 2 vertical strata, 0 to 0.75 m and 0.75 m to 1.5 m above ground. Results were expressed as frequency of occurrence per 30 m line.

Treatment effects were evaluated by analysis of covariance using pretreatment data as independent variables (Steel and Torrie 1960). Three orthogonal comparisons, each with a single degree of freedom, were made:

Control vs. grazed
Linear effect of grazing (2 months vs. 6 months)
Quadratic effects of grazing (2 months vs. 4 months vs. 6 months)

Two expressions of understory diversity were calculated:

1) The Shannon index of general diversity (Shannon and Weaver 1963),

$$\overline{H} = -\Sigma\left(\frac{ni}{N}\right) \text{Log}\left(\frac{ni}{N}\right)$$

where ni is the frequency value for each species and N is the total of frequency values,

2) The evenness index (Pielou 1966),

$$e = \frac{\overline{H}}{\text{Log } s}$$

where $\overline{H}$ is the Shannon index above and
S is the total number of species.

Effects reported as significant are statistically significant at the 0.05 probability level. Effects significant at the 0.10 probability level are interpreted as probable trends.

RESULTS AND DISCUSSION

Important understory plants are listed in Table 1, which indicates which plants are important foods for white-tailed deer, bobwhite, and wild turkeys. Seeds of plants indicated as useful to bobwhites are also useful to many songbirds.

TABLE 1. Plants on study area and their usefulness as wildlife food, 1977[a]

Botanical name[b]	Common name	White-tailed deer	Bobwhite	Wild Turkey
Grasses:				
Andropogon capillipes	Chalky Bluestem			
A. stolonifer	Creeping Bluestem			
A. virginicus	Broomsedge Bluestem			
Anthaenantia villosa	Green Silkyscale			
Aristida stricta	Pineland Threeawn			
Axonopus affinis	Common Carpetgrass		X	
Ctenium aromaticum	Toothachegrass			
Digitaria villosa	Shaggy Fingergrass		X	
Eragrostis spectabilis	Purple Lovegrass			
Eremochloa ophiuroides	Centipedegrass			
Panicum aciculare	Neddleleaf Panicum		X	X
P. anceps	Beaked Panicum		X	X
P. hemitomon	Maidencane			
Paspalum longepedunculatum	Barestem Paspalum		X	X
P. notatum	Bahiagrass			X
Setaria geniculata	Knotroot Bristlegrass		X	
Sorghastrum nutans	Yellow Indiangrass			
S. secundum	Lopside Indiangrass			
Sporobolus curtissii	Curtis Dropseed			
S. junceus	Pineywoods Dropseed			
Triplasis americana	Perennial Sandgrass			
Grasslikes:				
Scleria reticularis	Annual Razorsedge		X	
Rhynchospora spp.	Beakrush		X	X
Forbs:				
Ambrosia artemisiifolia	Common Ragweed		X	
Aster spp.	Aster	X		
Carduus carolinianus	Purple Thistle			
Cassia nictitans	Sensitive Partridgepea	X	X	X
Centella asiatica	Centella	X	X	X
Centrosema virginianum	Coastal Butterflypea	X	X	X
Desmodium spp.	Beggarweed	X	X	X
Diodia teres	Rough Buttonweed		X	X
Elephantopus tomentosus	Elephant's-foot	X		
Eryngium yuccifolium	Buttonsnakeroot			
Euphorbia spp.	Spurge		X	X
Galactia volubilis	Downy Milkpea	X		X

TABLE 1. (cont.)

Botanical name[b]	Common name	White-tailed deer	Bobwhite	Wild Turkey
Heterotheca graminifolia	Grassleaf Goldaster	X		X
Hypericum spp.	St. Johnswort	X		
Lespedeza spp.	Lespedeza	X	X	X
Liatris gracilis	Slender Gayfeather	X		
Pteridium aquilinum	Bracken Fern			
Pterocaulon pycnostachyum	Blackroot	X		
Rhexia mariana	Maryland Meadowbeauty	X		X
Rhynchosia spp.	Rhynchosia	X	X	X
Tephrosia spp.	Tephrosia	X	X	X
Trilisa odoratissima	Deer's-tongue	X		
T. paniculata	Hairy Trilisa	X		
Xyris spp.	Yelloweyegrass			X
Trees:				
Pinus palustris Miller	Longleaf Pine		X	X
Quercus virginiana Miller	Live Oak	X	X	X
Q. incana Bartram	Bluejack Oak	X	X	X
Q. nigra L.	Water Oak	X	X	X
Shrubs:				
Asimina parviflora (Michx.) Dunal.	Dwarf Pawpaw			X
Callicarpa americana L.	American Beautyberry		X	X
Chrysobalanus oblongifolius Michx.	Gopherapple			X
Gaylussacia dumosa (Andrz.) T. & G.	Dwarf Huckleberry	X	X	X
Ilex coriacea (Pursh) Chapman	Large Gallberry	X		X
I. glabra (L.) Gray	Common Gallberry			
Lyonia lucida (Lam.) K. Koch.	Fetterbush	X		
Myrica cerifera	Southern Waxmyrtle		X	X
Quercus pumila	Runner Oak	X	X	X
Rhus copallina	Shining Sumac	X	X	X
Rubus spp.	Blackberry	X	X	X
Serenoa repens	Saw-palmetto			

TABLE 1. (cont.)

Botanical name[b]	Common name	White-tailed deer	Bobwhite	Wild Turkey
Sorbus arbutifolia	Red Chokeberry	X	X	X
Stillingia sylvatica	Queensdelight		X	X
Vaccinium arboreum	Sparkleberry	X	X	X
V. myrsinites	Ground Blueberry	X	X	X
Vines:				
Gelsemium sempervirens	Yellow Jessamine	X		
Smilax auriculata	Earleaf Greenbrier	X	X	X
Vitus rotundifolia	Muscadine Grape	X	X	X

[a]Species marked with X produce plant parts of value to wildlife species indicated. Key references are Harlow and Jones (1965) for deer, Stoddard (1959) for bobwhite, and Hewitt (1967) for wild turkey.
[b]Botanical names of grasses are from Hitchcock (1959); those of other plants are from Radford, Ahles, and Bell (1968). All common names are from Kelsey and Dayton (1942).

Species Composition

After only 1 year of grazing, drastic changes in plant distributions did not occur, but several significant trends were detected. Pineland threeawn, the most abundant grass on the site, and one of little wildlife value, was significantly more abundant in ungrazed pastures than in grazed pastures as a group (Table 2). Grazing clearly reduced occurrence of this species. Although the reduction was only about 10%, this is viewed as an important first step toward improving wildlife habitat.

TABLE 2. Average frequencies of important herbaceous plants after 1 year of grazing, 1977.

Species or group	Ungrazed control[a]	Months rest after grazing[b] 6	4	2
	percent			
Pineland threeawn	51.5**	48.1	41.3	48.3
Panicum/Paspalum	16.8	14.7	27.6τ	15.8
Legumes	4.2	5.7	5.3	3.2
All forbs	43.0**	35.0	41.4τ	27.5
All wildlife foods[c]	61.2*	51.6	70.4τ	45.4

[a]Control means followed by * differ from the average for all grazing treatments in the same row at 0.10 level, according to covariance analysis. ** denotes a similar difference that is significant at the 0.05 level.
[b]For grazed pastures, τ signifies a quadratic effect of length of rest after grazing that is statistically significant for the species or species group at the 0.10 level, according to covariance analysis.
[c]Plants of value to white-tailed deer, wild turkey, bobwhites, and other birds.

The most abundant grasses important to wildlife were beaked panicum and barestem paspalum. At this early date grazing has not significantly affected their distribution, but the 4 month rest appears to slightly favor their abundance (Table 2).

Legumes, some of the most important wildlife foods in the pinelands, were common on the study area. Most abundant were partridgepea, butterflypea, pidgeonwings, and milkpea. Significant changes in legume distribution are not apparent at this time, but short rest periods seem to be most deterimental while the longer rest periods may favor legumes. Legumes are relished by cattle and many wildlife species. For this reason, many wildlife biologists consider grazing even at low levels to be undesirable when legumes are an important component of the habitat. Many of these plants, however, are rather intolerant of dense understories, and frequent disturbance is often required for their maintenance and increase.

Forbs (broadleaf herbs) were numerous. Most common were the legumes and composites. In addition to the legumes listed above, grassleaf goldaster, elephant's-foot, trilisa, gayfeather, and a number of asters were most numerous. Other important forbs were centella, yelloweyegrass, meadow-beauty and spurge. These plants were significantly more abundant in ungrazed pastures (43%) than in grazed pastures as a group, but their abundance in pastures rested for 4 months was almost as great (41%). Pastures rested 4 months contained more forbs than those rested 2 and 6 months.

Herbs important to wildlife were grouped for treatment comparisons. The grouping included all plants listed above (except pineland threeawn) plus razorsedge and beakrush. These herbs were somewhat more numerous in control pastures (61% occurrence) than in grazed pastures as a group (56% occurrence). They were also more numerous in pastures rested 4 months than in other grazed pastures.

Short duration grazing followed by rests of 2 to 6 months significantly reduced the occurrence of woody understory plants (Table 3). This reduction averaged 25% in the lower (0 to 0.75m) stratum. In the lower stratum, a significant linear relationship was observed between grazing intensity and reduction in woody plant occurrence.

Saw-palmetto was rather heavily used by cattle, which reduced its occurrence in grazed pastures significantly below that in control pastures. The reduction due to grazing averaged 43%.

In the lower stratum, oaks were only slightly more abundant in ungrazed pastures than in all grazed pastures combined. In the upper stratum, however, their occurrence was significantly lower in grazed pastures. This was largely due to the high occurrence of runner oak in the lower stratum which was rather lightly used by cattle. The larger oaks were often heavily browsed. With strata combined, reduction due to grazing averaged 21%.

As a group, woody plants important as wildlife food producers had a significantly higher occurrence in ungrazed pastures. Most prominent in this group were the oaks, blueberry, blackberry, queensdelight, smilax, huckleberry, and yellow jessamine. The large oaks, blackberries, and smilax were often heavily used by cattle (Gumaa 1977).

Diversity

A comparison of Shannon indices (H) failed to reveal diversity differences between ungrazed pastures and all grazed pastures (Table 4). However, a significant linear relationship was observed among the grazed pastures, in which diversity was generally reduced by more intensive grazing. Similarly, a species evenness difference was not detected between the control and all grazed pastures, but among grazed pastures a significant quadratic relationship was observed. The number of species encountered per intercept varied little among most treatments. A linear relationship, however, was observed among the grazed pastures, with high frequency grazing resulting in significantly fewer species.

TABLE 3. Average frequencies of important woody plants after 1 year of grazing, 1977.

Species or group	Ungrazed control[a]	Months rest 6	after 4	grazing[b] 2
	percent			
		0 to 0.75 meter stratum		
Saw-palmetto	16.2**	13.5	10.5	5.2τ
Oaks	29.4*	24.8	27.5	26.5
All wildlife foods[c]	39.2**	32.9	29.4	36.1
Total woody	65.8**	53.2	50.0	45.7$\tau\tau$
		0.75 meter to 1.50 meter stratum		
Saw-palmetto	4.7*	1.7	2.3	2.4τ
Oaks	5.1**	0.5	0.7	1.3
All wildlife foods[c]	2.7**	0.2	0.3	0.1
Total woody	6.4**	2.8	3.7	4.2

[a]Control means followed by * differ from the average for all grazing treatments in the same row at 0.10 level, according to covariance analysis. ** denotes a similar difference that is statistically significant at the 0.05 level.
[b]For grazed pastures, τ signifies a linear effect of length of rest after grazing that is statistically significant for the species or species group at the 0.10 level, according to covariance analysis. $\tau\tau$ denotes a similar difference that is significant at the 0.05 level.
[c]Plants of value to white-tailed deer, wild turkey, bobwhites, and other birds.

TABLE 4. A comparison of several diversity indices after 1 year of grazing, 1977.

Index[a]	Ungrazed control	Months rest 6	after 4	grazing[b] 2
$\overline{H}$	1.063	1.097	1.097	1.038$\tau\tau$
e	0.748	0.734	0.767$\tau\tau$	0.709
sp	27.9	31.0	28.1	26.3$\tau\tau$

[a]$\overline{H}$ = Shannon index of general diversity
e = the evenness index
sp = average number of species per line intercept
[b]For Grazed pastures, $\tau\tau$ signifies a linear effect of length of rest after grazing that is statistically significant for the index at the 0.05 level, according to covariance analysis. $\tau\tau$ denotes a quadratic effect of length of rest after grazing that is statistically significant at the 0.05 level.

These data include that pastures rested 4 and 6 months generally had a higher understory diversity than the others tested. While these statistical differences are not great numerically, they do indicate trends that may, in time, become substantial.

CONCLUSIONS

Given free choice, cattle usually select grasses first, then forbs, and finally shrubs. High grazing pressure for a short time reduces the tendency to select certain species, and no regrowth is consumed until after the plant has been rested for a period. Most available plants are utilized to some degree. During the study, Gumaa (1977) found all 3 classes of plants to be heavily utilized during all seasons. Short-duration grazing reduced the overabundant pineland threeawn and saw-palmetto. Selectivity, however, was not eliminated entirely; cattle grazed grasses and forbs, as a group, mostly during the growing season and woody plants mostly during the winter. Forbs were apparently most heavily consumed during the early part of the growing season, while the grasses were selected most often during late summer and fall.

It was probably a mistake for us to consider pineland threeawn as a grazeable species throughout the year in our determinations of grazeable forage removed. Pineland threeawn was desirable forage for only a short time after burning. Thereafter, it was only grazed after all other plants, including shrubs, were heavily utilized. As a result, most forbs and the more palatable grasses were overgrazed before this species was utilized. Pineland threeawn should be considered desirable forage for only 60 days after burning.

Among the treatments tested, intensive grazing for about 2 weeks followed by 4 months of rest seems most beneficial for roughage reduction and desirable plant stimulation. Such a grazing system requires a minimum of 9 pastures and 3 years to complete the grazing cycle.[a] Cattle are only stocked on a little more than 10% of the range at a time. This low frequency of use and relatively long grazing cycle appears to provide ample time for species to gain vigor and reproduce. Additional research is planned to test this hypothesis.

Prescribed burning complements grazing by consuming additional roughage, removing surface litter, and exposing seeds to mineral soil for germination and to wildlife for consumption. Burning is recommended on forested ranges when pine needles and other litter exceed 2200 kg/ha-every 2 years in most places. That much litter smothers understory vegetation and should be removed.

Cattle grazing can improve wildlife habitat in several ways. It reduces competition to plants important to wildlife by reducing the excessively abundant pineland threeawn, saw-palmetto, and other species of low value. Grazing and trampling by cattle break up the rough, expose many seeds, and provide access to ground-feeding birds. Moderate trampling for a short time prepares a seedbed and stimulates development of a variety of useful plants. Preliminary results indicate that 2 weeks of intensive grazing followed by 4 months of rest will provide high-quality forage for both cattle and wildlife.

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[a]Time required to return to the same pasture on the same dates.

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