Effects of Pine Regeneration on Vegetation, Deer Hunting, and Harvest

Kenneth G. Johnson, *Alabama Department of Conservation and Natural Resources, Game and Fish Division, Wildlife Section, Andalusia, AL 36420*

Abstract: Regeneration of 10,000 ha of mixed forest to loblolly pine over 14 years resulted in extensive vegetative changes. One hundred forty-five herbaceous and 68 woody plant species were recorded from the study area. Forty-nine percent of herbaceous species encountered were forbs. Grasses were the most dominant plant group with 25.2% coverage at the initiation of the study. Mean percent coverage of all herbaceous plant groups increased through year 2, then gradually decreased. Plant coverage increased for all groups except woody vines following a controlled burn in year 11. Highest coverage of legumes (8.8%) occurred in year 11 following the controlled burn. Food availability (FA) was highest for white-tailed deer (*Odocoileus virginianus*) during years 2 and 3 of the study. Hunter effort and harvest for deer generally increased except for dog deer hunting. Physical condition of deer declined during the study.

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Wildlife populations and habitat conditions are directly affected by forest management (Johnson et al. 1961). In the southeastern United States, conversion of large tracts of mature pine-hardwood to even-aged, short rotation pine plantations is common. Conversion involves clearcutting existing stands, mechanical site preparation, and planting pine seedlings. These silvicultural activities cause soil disturbance and vegetation change.

Plant community characteristics have varying effects on different wildlife species (Brunswig and Johnson 1972, McKee 1972, Stransky and Halls 1978). The impact of large scale conversion of natural (i.e. uneven-aged) mixed pine-hardwood stands to pine plantations has been debated (Speake 1970, Fedkiw 1973). Data presented here chronicle plant succession and long-term trends in white-tailed deer hunter effort/harvest rate following conversion of pine-hardwood to pine plantation.

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Study Area

The study was conducted on the Butler Wildlife Management Area (WMA) which encompases 10,000 ha and is located 10 km south of Greenville (Butler County), Alabama. Butler WMA was established in 1953. Originally, the dominant vegetation was mature mixed pine-hardwood. Only select thinning and removal of inferior trees was practiced. Soils on the WMA are primarily of the Boswell-Sawyer Association. Topography consists of a series of low rolling hills.

Union Camp Corporation acquired the property in 1966 and immediately began a management regime of clearcutting and planting loblolly pine (*Pinus taeda*). By 1971 (when this study began), about 23% of the study area was in even-age pine plantations (Table 1). Approximately 63% was in even-age pine in 1985 (when this study ended).

Site preparation consisted of chopping, burning, disking, and bedding, followed by machine planting of loblolly pine seedlings. There was usually a 1-year interval between harvesting and planting. Prescribed burning was practiced in stands >10 years of age.

At the time Butler WMA was established, no huntable population of white-tailed deer existed. During 1953 and 1954 Alabama Game and Fish personnel

Table 1. Timber composition of Butler WMA, Alabama, 1971–1985.

Year	Old growth timber (ha)	Pine plantations (ha)			
	≥ 50	0–3	4–7	8–14	≥ 15
1971	7,662	1,956	382		
1972	7,042	1,976	982		
1973	6,702	2,056	1,242		
1974	6,414	1,248	2,338		
1975	6,142	900	2,576	382	
1976	5,822	960	2,236	982	
1977	5,602	892	2,264	1,242	
1978	5,212	1,130	1,320	2,338	
1979	4,992	950	1,100	2,958	
1980	4,916	806	980	3,298	
1981	4,916	296	1,202	3,586	
1982	4,428	564	1,030	3,596	382
1983	4,380	536	706	3,396	982
1984	3,968	948	486	3,356	1,242
1985	3,712	716	464	2,770	2,338

trapped and released 33 deer on the area (Allen 1965). Management and hunting regulations were instituted to benefit deer and maximize hunting opportunities. Public hunting for deer began in 1958.

Methods

The sample site was clearcut between February and April 1971; was sheared, raked, and bedded from April to June 1971; and planted to loblolly pine at a rate of 2,250 seedlings/ha in the first quarter of 1972. A 30-year rotation was planned. The site was control-burned in February 1983 at age 11 years. Similar regeneration practices were employed on the study area throughout the study.

Vegetative sampling was conducted each September from 1972 to 1985 in a 300-ha pine plantation within the study area. Sample plots were located by using a map of the sample area to mark east-west transects at 4-chain (79.2-m) intervals along the south to north center line. From these, 8 east-west transects were randomly selected. Points were located at 6-chain (118.8-m) intervals along the transects. Sixty-three of these points were randomly selected and became sample plots. Sites were located on the ground using a compass and chain. One study plot was abandoned due to creation of a wildlife opening. Permanently marked 0.004-ha square plots were established, and 0.0004-ha subplots were subsequently located in the corner of these. Frequency of occurrence and percent cover were determined for woody species in the 0.004-ha plots and for herbaceous vegetation and woody vines in the 0.0004-ha plots (Gemborys 1966). Plant nomenclature followed Radford et al. (1971) and Small (1933).

Deer food availability (FA) was determined by selecting 10 indicator plant species. Indicator species were selected based on prior research of "preferred" food species (Warren and Hurst 1981). An index value was computed from mean percent cover and frequency of occurrence of the indicator species by year:

$$\text{Index} = \frac{\left[\sum_{1}^{10} (\text{Percent Cover})\,(\text{Frequency of Occurrence})\right]}{10}$$

The 10 species selected for evaluating deer FA were: *Ambrosia* spp., *Aster* spp., *Campsis radicans, Eupatorium* spp., *Helianthus* spp., *Lespedeza striata, Lobelia puberula, Rubus argutus, Smilax* spp., and *Solidago* spp.

Annual records of deer hunter effort and harvest on the study area were maintained. Gun deer permits were issued from a checking station each scheduled hunt. Hunters were required to check in and out daily and present each deer harvested for inspection. Total harvest and number of hunters were recorded each day. Results were published in report form at the close of each season (Lueth 1972, Guyse 1980, Nelson 1987). Gun deer harvests and hunter effort (expressed in man-days) represent actual figures.

Table 2. Mean percent cover by plant groups and food availability index (FA) for white-tailed deer on Butler WMA, Alabama, 1972–1985.

	Study year													
Plant groups	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Forbs	22.5	31.6	41.0	36.5	24.1	18.3	14.2	12.4	8.8	10.6	10.5	23.5	11.3	14.0
Ferns	0.1	0.2	0.5	0.6	0.7	1.0	0.9	1.0	0.8	1.0	0.8	1.3	0.8	1.0
Grasses	25.2	33.7	52.2	57.7	50.1	47.5	44.1	40.5	23.2	18.9	12.5	17.9	14.4	16.8
Sedges	0.0	0.0	0.0	0.2	0.2	0.5	0.2	0.0	0.1	0.1	0.0	0.1	0.0	0.1
Legumes	1.5	2.1	4.5	6.9	4.3	3.4	5.1	4.7	3.0	3.8	3.9	8.8	2.4	5.1
Woody vines	1.2	2.9	7.7	10.8	8.9	11.4	12.1	10.1	6.8	6.6	6.2	4.3	0.8	4.2
Herbaceous vines	13.3	29.0	37.1	51.9	39.1	37.5	40.5	36.2	22.9	19.0	18.7	26.1	9.9	13.6
FA	47.3	96.6	160.0	135.5	103.1	70.6	53.4	43.3	23.8	26.1	21.4	43.1	10.2	21.0

Results

Vegetative Characteristics

A total of 145 herbaceous and 68 woody plant species was encountered from 1972 to 1985. Species occurring in 0.0004-ha plots were divided into 7 groups: woody vines, herbaceous vines, forbs, grasses, legumes, ferns, and sedges. Seventy-two (49%) of these species were forbs. This group peaked at 41% in year 2 (Table 2). A gradual decrease in forb coverage was recorded for years 3 to 13, with the exception of an increase following a controlled burn in year 11. Nineteen species of grasses were encountered and grasses were the most dominant herbaceous group. Grasses increased through year 3 and then gradually declined until the post-burn year. Twenty-four species of woody and herbaceous vines were identified. Maximum mean woody vine coverage occurred at year 6; herbaceous vines reached maximum mean coverage (51.9%) at year 3. Woody vine coverage decreased in years 11 and 12 following the controlled burn; herbaceous vine coverage increased after the burn in year 11.

After year 3, all plant groups showed a gradual decrease in coverage as the pine canopy increased (Table 2). Most plant life forms showed marked short-term increases in coverage following a controlled burn made early in year 11. Highest coverage (8.8%) of legumes occurred the year following the controlled burn.

Deer Food Availability

Maximum deer FA occurred in years 2 and 3, and a steady decrease occurred during years 4–13 with the exception of year 11 following the controlled burn (Table 2).

Hunter Effort and Harvest

Deer hunting pressure and harvest generally increased throughout the study (Table 3). Hunter effort increased for all types of deer hunting with the exception of dog deer hunting which increased through year 4 and then decreased. Hunter effort and harvests decreased to the point that dog deer hunts were discontinued in 1983. Deer harvested per man-day (hunter success) generally increased in direct relationship to the percent of area in pine regeneration (Table 4). However, physical condition of individual deer harvested continually declined (Table 5).

Discussion

Revegetation on the study area occurred rapidly following site preparation. Grasses and forbs were the pioneering plant groups, but these shade intolerant plants decreased in coverage as pine canopy increased. The controlled burn temporarily increased coverage of all plant groups except woody vines. Highest legume coverage during the study occurred the year following a controlled burn.

Heavy use of pine plantations by deer through year 5 was noted. Conversion of mature pine-hardwood to pine plantations initially produced an abundance of deer

Table 3. White-tailed deer harvest and man-days of effort for Butler WMA, Alabama, 1971–1985.

	Dog		Stalk		Primitive weapons		Total	
Year	Harvest	Man-days	Harvest	Man-days	Harvest	Man-days	Harvest	Man-days
1971	31	945	5	202			36	1,147
1972	59	1,506	13	323			72	1,829
1973	63	1,366	10	358			73	1,724
1974	79	1,930	21	581			100	2,511
1975	66	1,965	20	734			86	2,699
1976	50	1,654	13	477	7	93	70	2,224
1977	63	1,944	25	575	10	182	98	2,701
1978	26	1,036	47	1,107	62	478	135	2,621
1979	56	1,508	74	1,477	134	1,125	264	4,110
1980	34	1,537	104	2,169	188	1,780	326	5,486
1981	12	954	133	3,114	188	2,293	333	6,361
1982	4	401	86	3,382	244	2,506	334	6,289
1983			125	3,480	329	3,089	454	6,569
1984			112	3,320	336	2,766	448	6,086
1985			178	4,196	241	2,746	419	6,942

Table 4. Hunter success (*N* animals harvested/*N* man-days hunted) for white-tailed deer compared to percent pine regeneration on Butler WMA, Alabama, 1971–85.

Year	% pine regeneration	Hunter success deer/man-day
1971	23	.030
1972	29	.036
1973	33	.034
1974	36	.034
1975	39	.026
1976	42	.030
1977	44	.031
1978	48	.045
1979	50	.053
1980	51	.037
1981	51	.046
1982	56	.046
1983	56	.044
1984	60	.059
1985	63	.054

forage and created favorable habitat. Deer FA steadily decreased following year 5, and the deer population eventually expanded beyond habitat carrying capacity. This became apparent as the physical condition of harvested deer deteriorated. Deer browse evidence increased to the point that a browse line was detected. Deer hunter efforts and success generally increased.

Table 5. Average live weights (kg) of male white-tailed deer harvested on Butler WMA, Alabama, 1971–1985.

Year	*N*	Age class		
		1	2	≥3
1971	36	45.0	58.5	66.6
1972	72	48.6	59.4	67.5
1973	73	46.4	63.9	74.3
1974	100	48.2	64.8	77.9
1975	86	50.0	65.3	80.6
1976	63	46.8	60.8	78.3
1977	88	49.1	61.2	78.3
1978	73	47.3	59.4	74.3
1979	130	40.5	54.0	73.8
1980	138	43.7	56.3	74.3
1981	145	36.5	49.5	62.6
1982	90	38.3	51.8	69.8
1983	125	38.3	54.0	67.5
1984	112	39.2	54.9	65.7
1985	178	38.7	54.9	68.0

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