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RESPONSE OF LEGUMES TO PRESCRIBED BURNS IN LOBLOLLY PINE STANDS OF THE SOUTH CAROLINA PIEDMONT

Abstract. --The effects of prescribed burns in spring or summer on the leguminous plant cover and on seed production of legumes were studied at nine locations on the Sumter National Forest in the Piedmont of South Carolina. Numbers of legumes did not differ statistically from those on unburned control plots. Seed production on plots burned during the summer was significantly greater, statistically, than on plots burned during the spring or on unburned plots. Results are tentative.

Published information on the response of quail food plants, primarily legumes, to prescribed burning in timber stands of the Southeastern Piedmont fails to supply comparative data on density of plant cover and seed production before the burns were conducted. Neither have the effects of prescribed burning during different seasons with varying amounts of pine overstory been assessed. Accordingly, a study was conducted in the Piedmont of South Carolina to determine plant cover and seed production of legumes before and after a single spring or summer burn.

METHODS

The study site selected was an area dominated by loblolly pine (Pinus taeda L.) more than 20 years old on the Sumter National Forest near Greenwood, South Carolina. No wildfires or attempts at timber stand improvement had been recorded in the existing stands on the study area. Nine locations, ranging in size from 2% to 107 acres, were randomly chosen for the study, and 294 plots, each comprising one-tenth of an acre, were marked out on the nine locations during the summer of 1964. In each location, the plots were selected by using nine combinations of site index and pine basal area as guides (table 1).

Because it was not possible to obtain all combinations or replications of variables at each location, the number of plots per location varied from 18 to 53. On the selected plots, pine basal area averaged 91.4 square feet per acre, the trees averaged 41.8 years of age, and the average site index was 68.3.

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Table 1. --Number of plots for each combination of site index and pine basal area on the nine locations

Site index	Basal area	Number of plots on location--									
		1	2	3	4	5	6	7	8	9	Total
	sq. ft.										
40-59	60-79	8	3	5	3	0	3	3	4	3	32
60-79	60-79	7	3	6	3	3	3	3	6	3	37
80-	60-79	2	3	2	3	3	3	3	1	3	23
40-59	80-99	4	3	9	3	0	3	3	6	3	34
60-79	80-99	9	3	7	3	3	3	3	5	3	39
80+	80-99	2	3	2	3	3	2	3	2	3	23
40-59	100+	6	3	9	3	0	3	3	8	3	38
60-79	100+	9	3	6	3	3	3	3	4	3	37
80+	1 oo+	6	3	5	3	3	2	3	3	3	31
Total		53	27	51	27	18	25	27	39	27	294

All legumes on each plot were counted during the summer of 1964. During the winter of 1964-65, 12 soil-seed samples were randomly collected from each plot; the sampling technique used was that of Ripley and Perkins (1965).

Three of the nine locations were burned during the spring of 1965 (on April 6 and 9, and May 5), three were burned during the summer of that year (on July 26 and August 17 and 18), and the remaining three served as controls and were not burned. All of the burns consisted of "cool" fires--i. e., about half of the ground fuel was consumed in each case.

The leguminous plants on each plot were counted again during the summer of 1966. During August of that year, 12 uncovered aluminum pans, each 8- by 11- by 55/64-inches, were randomly placed in each plot. Seeds were collected from these pans in December 1966.

RESULTS

Legumes were present on 291 of the 294 plots before the burns, but the number of plants varied considerably from plot to plot. After the burns, legumes occurred on the same number of plots as before, indicating no major change in frequency of occurrence (table 2).

Table 2. --Percentage of the total number of plots on which each species of leguminous plant occurred before and after the 1965 burns

Common and scientific names		Spring burn (131 plots)		Summer burn (70 plots)		Control (93 plots)	
		1964	1966	1964	1966	1964	1966
		Percent					
False indigo	Baptisia tinctoria (L.)	2	2	0	0	0	2
Sensitive plant	Cassia nictitans L.	37	48	43	53	54	55
Partridge-pea	Caesia fasciculata Michx.	2	0	4	0	0	0
Spurred butterfly-pea	Centrosema virginianum (L.) Benth	11	14	6	9	23	17
Butterfly-pea	Clitoria mariana L.	30	5	40	21	15	9
Beggarweed	Desmodium						
	canescens (L.) DC.	2	0	0	0	0	0
	ciliare (Muhl. ex Willd.) DC.	64	58	69	74	71	74
	laevigatum (Nutt.) DC.	40	30	64	61	40	42
	line atum DC.	2	0	0	0	0	0
	marilandicum (L.) DC.	63	65	76	76	78	76
	nudiflorum (L.) DC.	1	1	9	9	0	1
	obtusum (Muhl. ex Willd.) DC.	18	4	20	1	20	14
	paniculatum (L.) DC.	62	56	71	67	57	65
	rigidum (Ell.) DC.	24	50	56	57	29	56
	rotundifolium (DC.)	11	14	26	29	33	24
	strictum (Pursh) DC.	2	2	3	0	2	0
	tortuosum (SW.) DC.	0	1	0	0	0	0
	viridiflorum (L.) DC.	2	1	0	13	0	0
Milkpea	Galactia						
	regularis (L.) BSP.	51	44	63	61	67	81
	volubilis (L.) Britt.	5	1	4	0	3	0
Lespedeza	Lespedeza						
	bicolor (Turcz.)	0	5	0	0	11	15
	procumbens Michx.	68	72	80	77	81	91
	repens (L.) Bart.	66	63	76	87	87	74
	sericea (Thunb.)	2	2	0	17	2	0
	striata (Thunb.) H. & A.	0	3	0	4	0	0
	virginica (L.) Britt.	57	53	57	30	58	41
Dollar pea	Rhynchosia tomentosa (L.) H. & A.	4	2	6	3	19	16
Hoary pea	Tephrosia virginiana (L.) Pers.	2	2	13	11	22	13

On the areas burned in the spring, there was an average increase of 460 legumes per acre (table 3). There were average decreases of 273 legumes per acre on the areas burned in the summer and of 363 per acre on the control areas. An analysis of variance showed that these changes in plant numbers were not statistically significant.

Table 3. --Average number of leguminous plants per acre on the nine locations before and after the 1965 burns

Season of burn	Location number	1964		1966		Change
		Mean	Deviation	Mean	Deviation	
		Number per acre				
Spring	1	980	1,120	920	1,380	-60
	2	340	250	590	600	+250
	3	1,040	1,240	2,230	7,670	+1,190
	Average	787		1,247		+460
Summer	4	2,850	8,670	1,380	1,660	-1,470
	5	1,140	830	1,420	1,460	+280
	6	1,660	1,300	2,030	1,170	+370
	Average	1,883		1,610		-273
Control	7	1,810	1,900	1,160	960	-650
	8	1,950	1,620	1,480	910	-470
	9	520	490	550	570	+30
	Average	1,426		1,063		-363

Before the burns, legume seed averaged 0.97 pound per acre in the litter and upper soil layers on the nine locations. Of this, 81 percent was seed from Lespedeza spp. and Cassia spp. Seed from Galactia spp., Desmodium spp., Rhynchosia tomentosa (L.) H. & A., and Tephrosia virginiana (L.) Pers. were also found on the plots before the burns. It should be emphasized that this total of 0.97 pound of legume seed per acre on the unburned locations represents several years' accumulation. Hard seed or seed which were not eaten, decomposed, or blown or washed away remained in the litter and upper soil layer for several years. Therefore, these data should not be confused or compared with annual production of legume seed.

Samples taken after the burns indicate that annual production of legume seed averaged 0.41 pound per acre on the locations burned during the summer, 0.31 pound per acre on those burned during the spring, and

0.06 pound per acre on the unburned control locations. These values were significantly different at the 95-percent level of probability. The species with the most abundant seeds after the burns were Cassia, Lespedeza, Desmodium, Galactia, and Centrosema, in that order.

SUMMARY AND DISCUSSION

Single prescribed burns of low intensity during the spring or summer had little effect on the species composition of leguminous plants in loblolly pine stands of the South Carolina Piedmont. This result corroborates previous findings (Oosting 1944; Carren 1943; and Lemon[1]) that infrequent burns of low intensity cannot be expected to alter the species composition of the southern pine stands. It is not clear why the production of legume seed was higher after the summer burn.

Results from previous studies (Cushwa and Redd 1966; Cushwa et al. 1969) indicate that leguminous plants and seed respond best to "hot" fires--i. e., those in which a high proportion of the ground fuel is consumed. Laboratory tests (Martin and Cushwa 1966; Cushwa et al. 1968) have also shown that seed from several leguminous species germinate best after scarification with moist heat at temperatures near 80° C., a situation requiring a hot fire. The response of the leguminous plants and seed in this study, therefore, would probably have been greater if the pine stands had been burned with more intense fires. Nevertheless, further work will be necessary before we can make final conclusions about the value of prescribed burning to quail and other wildlife in the 2.5 million acres of pine in the South Carolina Piedmont.

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