LONGLEAF PINE CONE PRODUCTION IN RELATION TO SITE INDEX, STAND AGE, AND STAND DENSITY

Thomas C. Croker, Jr.

SOUTHERN FOREST EXPERIMENT STATION

Few cones were produced in stands less than 30 years old. In stands 30 to 70 years in age, production seemed best at timber densities of about 30 square feet of basal area per acre, and tended to increase with increasing site index.

Additional keywords: *Pinus palustris,* seed, natural regeneration.

Over the years, experience and research have given general evidence that production of cones on longleaf pine *(Pinus palustris* Mill.) varies with site quality and that release from competition stimulates cone bearing (Allen, 1953; Croker, 1952; Shoulders, 1968; Wahlenberg, 1946).

In the hope of providing specific information on these relationships, cone and seed production was studied in stands representing most of the range of longleaf. While the results are not definitive, they indicate some trends that merit further study and also contain implications for land managers.

METHODS

Cones maturing in the fall of 1971 were counted on 123 plots, each 0.05 acre in size, in even-aged stands of pure longleaf pine. Counts were made of open cones in the spring and included cones on the ground as well as those in the tree crowns. Stand densities ranged from 11 to 156 square feet of basal area per acre, ages from 18 through 82 years, and sites from 55 to 92 (50-year index). As no recent cutting had been done on the plots, the cones had matured under substantially the timber density existing when the primordia were initiated in 1969.

An effort was also made to relate number of seeds per cone to the same stand and site conditions. To this end, collections from 93 sample trees were made in 1967, 1968, and 1971. Where available, four cones were collected from each sample tree. Seeds were extracted, and means of sound seeds per cone were computed yearly. The collections sampled a good cone year (1971), a poor year (1968), and an average one (1967).

RESULTS

Cone production varied more widely than had been expected, and could not be analyzed by regression; the accompanying tables are arithmetic summaries. Tables 1 and 2 show

relations between stand age, site index, and stand density for all age classes sampled. Table 3 summarizes the combined effect of site and stand density for all stands in the age span between 30 and 69 years. Stands less than 30 and more than 69 years old were omitted from table 3 because a high proportion of the young stands were in the lightest density class, while stands above 69 years of age were too few to provide an adequate sample.

Table 1.—*Cone production per acre in relation to stand age and site index*

Age class (years)	Site index	Number of plots	Number of cones per acre	
			Mean	Standard deviation
	Feet			
<30	60	14	30	66
	70	11	84	10
	80	9	138	122
	90	6	654	974
30-49	60	6	256	609
	70	10	746	770
	80	13	822	768
	90	10	830	896
50-69	60	2	1,720	1,301
	70	18	1,251	940
	80	11	896	835
	90	0	. . .	. . .
70 +	60	4	420	337
	70	7	1,874	1,908
	80	2	270	382
	90	0	. . .	. . .

Table 2.—*Cone production per acre in relation to stand age and density*

Age class (years)	Basal area	Number of plots	Number of cones per acre	
			Mean	Standard deviation
	Sq. ft.			
<30	30	22	182	559
	60	11	146	115
	90	7	128	81
30-49	30	7	1,320	1,017
	60	10	972	840
	90	22	410	498
50-69	30	7	1,720	850
	60	8	997	1,028
	90	16	987	841
70 +	30	2	590	778
	60	3	3,093	2,570
	90	8	610	475

Table 3.—*Cone production per acre, by site class and stand density, for age classes 30 through 69 years*

Site index (feet)	Basal area	Number of plots	Number of cones per acre	
			Mean	Standard deviation
	Sq. ft.			
60	30	1	. . .	. . .
	60	3	766	750
	90	3	14	22
70	30	5	1,672	720
	60	7	1,468	900
	90	13	876	786
80	30	5	1,248	944
	60	6	1,174	828
	90	14	548	576
90	30	2	2,020	962
	60	3	434	388
	90	8	700	624

Cones were sparse on trees below 30 years of age. Those that did occur were mostly on the better sites at the lower stand densities. Some plots had no cones at all.

In stands 30 to 69 years old, production tended to rise with site index and to decline as stand density increased above 30 square feet of basal area per acre.

Numbers of seeds per cone ranged very widely and could not be related to stand or site conditions. The data did suggest that seeds number about 50 per cone in good years (i.e., in years when seedfall is above 50,000 seeds per acre), 35 in average years, and 15 in poor years (seedfall less than 20,000 per acre). These values agree roughly with those reported by Wakeley (1954).

The cone data, together with other observations by the author, indicate that the forester should plan a rotation of more than 30 years if he intends to regenerate longleaf naturally. Longer rotations are especially desirable on poor sites.

Further, it seems that cone production will be maximized if stands are thinned to about 30 square feet of basal area per acre. While not adequately tested here, still heavier thinnings would probably reduce the cone crop per acre.

2

LITERATURE CITED

Allen, R. M.
  1953. Release and fertilization stimulate longleaf pine cone crop. J. For. 51: 827.

Croker, T. C., Jr.
  1952. Early release stimulates cone production. USDA For. Serv. South. For. Exp. Stn., South. For. Notes 79.

Shoulders, E.
  1968. Fertilization increases longleaf and slash pine flower and cone crops in Louisiana. J. For. 66: 193-197.

Wahlenberg, W. G.
  1946. Longleaf pine. Chas. Lathrop Pack Found. and USDA For. Serv., 429 p. Washington, D. C.

Wakeley, P. C.
  1954. Planting the southern pines. USDA Agric. Monogr. 18, 233 p.