Good Seed Trees Pay Off

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Foresters familiar with the management of the Francis Marion National Forest in Coastal South Carolina know that the silvicultural system for loblolly pine requires leaving four or more good seed trees per acre for regeneration purposes (Figure 1). Where needed a preparatory cut is made to develop seed trees. Four to twelve seed trees per acre are left at regeneration cut. A removal cut is made after reproduction is safely established. Large trees, 16 inches or more in diameter at breast height, are generally selected for seed production. Those showing evidence of past good production by the presence of many old cones in the tops are preferred, providing they are of good vigor and form. Results obtained from the first timber tract handled under this system clearly show that good seed trees can bring about rapid restocking. In spite of some adverse weather and a period of only poor to fair cone production in general, satisfactory regeneration was obtained in three growing seasons.

The Area

The area under discussion is known as the Able Chance. It encompasses about 200 acres lying along the north side of Threemile Head Road about five miles west of Witherbee, Berkeley County, S. C. Before logging, this typical upland site was occupied by a moderately well-stocked stand of mature loblolly pine and a scattering of longleaf pine. Like most stands of loblolly pine in Coastal Carolina, it was predominately even-aged and, in this particular case, about 75 years old. There was no evidence of logging prior to the harvest cut, which yielded about 8,000 board feet (Scribner log rule) per acre.

The Seed-bed

The charred bases of standing trees gave evidence of past wildfires. However, since the establishment of organized protection in 1934, no wildfires had passed through the area. This resulted in a rather heavy rough, consisting mainly of pine needles and grass. As a further consequence of fire exclusion, fairly dense groups of advance pine reproduction of sapling size occupied some of the natural openings. Elsewhere a hardwood under-story, mostly gum, oak, and myrtle, had become established. This varied in density but was heaviest in the wetter locations, such as in natural depressions scattered over the area and along the course of a small stream. Together with the 15-year accumulation of pine litter, the under-story hardwoods presented a formidable obstacle to the establishment of pine reproduction.

Primarily as a hardwood-control and rough-reduction measure, all of Able Chance was prescribed burned in mid-winter of 1948-49. Best results were obtained on the highest ground, but very little hardwood reduction was accomplished in the more poorly drained sections where control was needed most. Because of a patchy burn and generally light fire, total seed-bed improvement was small. Fortunately most of the logging was with crawler tractors which in the course of the cutting operation beat down most of the residual hardwoods. Some logging was done in May and June 1949, but the main effort was during the interval from December 1949 to May 1950.

The seed-bed was further improved on about half the area as a result of a wildfire which occurred in April 1950, just before the end of logging. This was a very clean burn and was hot enough to consume all except the heaviest limbs in the slash piles which had covered about 25 per cent of the ground surface. Hardwoods up to saw-timber size were killed by the fire, as were a small number of the seed trees—later salvaged. A pulpwood operation, following the removal of the saw-timber, helped to improve the seed-bed in the unburned area by utilizing some topwood and thus slightly reducing the area of slash.

To summarize the foregoing, it can be said that Able Chance presented a unique opportunity to measure on a large area (200 acres) the capacity of good loblolly pine seed trees to establish regeneration. Two quite typical seed-beds were involved. Each had in common a relatively ineffective burn in advance of logging and partial scarification by tractor during logging. Each had the following individual characteristics

Area No. 1 (80 acres)—Unburned after logging. Resultant seed-bed consisted of areas of mineral soil (7%), disturbed by logging (49%), no disturbance (20%), and slash (24%). Patches of advance reproduction were present.

Area No. 2 (120 acres)—Burned after logging. Rough-reduction complete except for scattered remnants of slash piles. Most advance reproduction destroyed.

Because of advance reproduction, Area No. 1 was only partially dependent on the seed trees to complete its restocking. A survey made in December 1950, showed that 27 per cent of the milacres tallied contained one or more stems of this established reproduction, numbering 435 per acre, with dominants averaging 11 feet in height. Although other similar seed-beds may vary as to the amount of advance reproduction, this serves to demonstrate that it should not be overlooked in planning for regeneration.

In contrast, Area No. 2 contained only 77 stems of advance reproduction per acre for an estimated stocking of 5 per cent.[1] Obviously this area would have to depend almost entirely upon the seed trees.

The prescribed fire on the whole Chance in mid-winter of 1948-49, coming after the main seedfall, destroyed most of the 1948 seed crop. Consequently, complete restocking of Able Chance was dependent upon the seed crops of 1949 (before cutting) and those after cutting. Even so, the 1949 seed crop affected only Area No. 1, inasmuch as the post-logging fire destroyed the seed in Area No. 2.

Seed Production

Permanent seed traps maintained at the Santee Experimental Forest five miles away showed only fair seed years for 1949, 1951, and 1952 and that 1950 was a very poor year. Seed trapping on the Able Chance dates from 1950. Figure 2 shows the fall of viable seeds per acre for the years of record, ranging from 7½ thousand sound seeds in 1950 to almost 90 thousand in 1952. In other words, the output per tree jumped from a low of 1900 seeds to a high of 22,000 three years later. This checks with Trousdell's *(1)* findings of greatly increased seed production three years after cutting. This stimulation of seed production probably arises from an increase in flower-

[1]The amount of reproduction required for full stocking has not been exactly determined. The stocked quadrat method of estimating stocking provides a basis. Here full stocking indicates one or more seedlings established per sample milacre. Partial stocking can thus be expressed as a percentage thereof.

Figure 1.--General view of Able Chance. Francis Marion National Forest in mid-summer of 1950 showing residual stand of four seed trees per acre. Foreground and on right burned by post-logging fire of previous April. Unburned area on left marked by older slash. Fresh slash is from recent pulpwood operation.

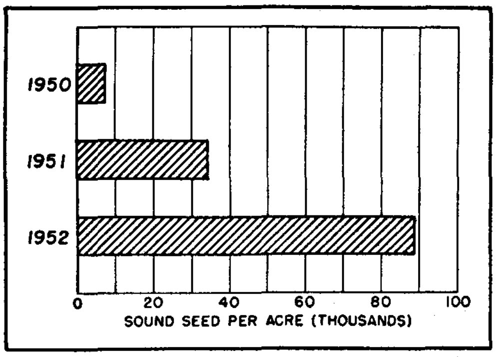

FIGURE 2.—*Average number of sound seed produced annually by four seed trees per acre on Able Chance, Francis Marion National Forest, for 3 years following logging.*

bud formation as a consequence of cutting. Production at a high level can be expected for at least several years.

Regeneration

As previously stated, Area No. 1 had an unmeasured, but not large quantity of 1949 seed on the ground after logging. In addition about one-fourth was restocked with advance reproduction.

Area No. 2 had for all practical purposes no seed or reproduction available for the first growing season. Consequently, one area had a decided advantage over the other at the beginning of the regeneration period. The first year results bear this out. By the end of the growing season, restocking in Area No. 1 was about one-half completed (Table 1). In contrast Area No. 2 fell far short of this. Obviously much depend on the ability of the seed trees to produce enough seed to complete restocking in the second and subsequent growing seasons. The seed trees met this test. At the end of the second growing season, restocking was three-fourths completed in Area No. 1 and about two-thirds in Area No. 2. In the following year both areas attained a desirable level of stocking both in numbers of trees per acre and distribution.

TABLE 1.—*Regeneration of loblolly pine during 3 years after logging, Able Chance, Francis Marion National Forest, S. C.*

	1950		1951		1952			
Area	Stocking[1]	Stems per acre	Stocking[1]	Stems per acre	Stocking[1]	Stems per acre	1, 2, & 3 year seedlings	Advance reproduction
	%	Number	%	Number	%	Number	%	%
1	59	1600	74	2640	84	3600	88	12
2	14	170	66	1320	92	3100	98	2

[1]Per cent of sample milacres with one or more stems.

Seed-bed Deterioration

There is no doubt that the condition of the seed-bed was an important factor influencing the rate of restocking in both areas. On certain areas a larger and more aggressive hardwood population could have dominated the site after the first year. Apparently seed-bed deterioration on the Able Chance was not that rapid. Even so, evidence of deterioration is present, at least in the third growing season after logging. In 1952, Area No. 1 required 4½ times more seed than the previous year to produce the same number of seedlings, while Area No. 2 required two times more seed. The superiority of the seed-bed in Area No. 2 is further apparent in the number of seedlings established. Excluding the first growing season, 2900 seedlings per acre were established in Area No. 2 (14 seeds per seedling), while No. 1 produced 1600 seedlings per acre (26 seeds per seedling).

Further seed-bed deterioration can be expected during 1953. Not to be overlooked in this connection is the 1952 seed crop, which amounted to almost 90,000 sound seeds per acre. According to Trousdell *(1)* this is enough seed to restock a completely undisturbed seed-bed during the first year after logging. What differences arise as a consequence of the fourth growing season and present stocking remain to be seen. As a minimum, further improvement over the present satisfactory stocking can be expected.

In this, as in all loblolly pine areas undergoing regeneration, consideration must be given to the hardwood problem. The understory hardwoods were well under control during the first growing season. Although the winter prescribed fire before logging was of small consequence, tractor logging gave good control in Area No. 1 and the post-logging fire made the job of control complete in Area No. 2.

Though a tally of hardwoods was not made during the first growing season, counts made during the following two years showed that the hardwoods were definitely becoming re-established (Table 2). So far, these hardwoods were not affording any real competition to the pine except in the vicinity of the small stream. Here, some low release by cutting or chemical treatment seems desirable if a dominant stand of pine is to be established. Elsewhere, pine is present in sufficient number or large enough to overcome most hardwood competition. Substantially fewer and shorter hardwoods in Area No. 2 compared with Area No. 1 indicate that the post-logging fire of April 1950 completely killed many hardwoods and reduced the vigor of surviving root systems.

TABLE 2.—*Hardwood development second and third year after logging. Able Chance, Francis Marion National Forest, S. C.*

	1951		1952		
Area	Stocking[1]	Stems per acre[2]	Stocking[1]	Stems per acre[2]	Height of average dominant
	%	Number	%	Number	Feet
1	62	1430	71	1730	6.9
2	32	990	51	1060	4.9

[1]Per cent of sample milacres with one or more stems.
[2]Sprout clumps counted as one stem.

Cost of Seed Trees

Most forest managers working in the loblolly pine type should be well satisfied with obtaining a degree of regeneration comparable to the foregoing. Regeneration by planting requires initially about 1200 seedlings per acre. In three years, four seed trees per acre established about three times that many. Furthermore, these were about as uniformly distributed as in a plantation. Artificial reforestation in the locality ranges in cost from $10 to about $15 per acre, depending upon the difficulty of planting. Because of the logging debris, the cost of planting the Able Chance would approach or exceed the higher figure.

On the other hand, the cost of regenerating Able Chance by seed trees is little or nothing. Interest accruing on the capital value of the stumpage left, unless offset by growth, can be charged as a cost of the seed tree method. The seed trees on Able Chance averaged about 18 inches d.b.h. and 3½ logs each. Average volume per acre was about 1300 board feet, Scribner log rule. As insurance against loss by fire these seed trees will probably be held for a number of years beyond the time needed for regeneration. The total should be about 10 years. During that time it is conservatively estimated that growth rate, including mortality, would amount to about 4 per cent compounded annually or 63 board feet per acre per year. If four per cent can be considered a satisfactory rate of return, there are no costs chargeable to the seed tree area except those for protection and general administration, and such costs are incurred on all areas. During the 10-year period stumpage values may decline, but as in any permanent business that is a chance that must be taken.

Selection of Good Seed Trees

Seed trees may not all be as fruitful as those on the Able Chance. But the forest manager can increase the possibilities of a more abundant seedfall in most stands by a careful selection of trees to be left. Large trees, particularly those with many old cones, are generally the most productive *(2)*. Production can also be greatly increased by release of selected seed trees three years in advance of the main harvest cut *(2, 3, 4)*. This is important in dense stands, particularly in younger age groups, where trees have not had the opportunity to establish their capacity to produce seed. Consideration should also be given to advantages of cutting during years of high seed production, at least in those areas most difficult to regenerate. This is made possible through cone-crop estimates, which are reliable up to 12 months in advance of seedfall *(4)*. Better progeny should also be an objective of all seed-tree cuttings and trees of best form, vigor, and quality given preference over all others.

References

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