

SOME NOTES ON THE YELLOW PINE FORESTS OF CENTRAL ALABAMA

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Contributed

In 1907 the spring term of the Senior Class of the Yale Forest School was spent in Clay and Coosa Counties, Alabama, a region located in the central part of the State, in the rolling foothills of the Appalachian Mountains.

In connection with the regular course of instruction in field methods and lumbering, considerable attention was devoted to a study of the reproductive capacity of longleaf pine, to determine if possible whether forest management could be successfully applied to these lands and if so under what conditions. The results secured cannot be regarded as final, but a number of facts were brought out by the study that are of distinct importance. The region was well adapted to the investigation, because lumbering had been carried on in the vicinity for twenty-one years. During the last seven years of this period the timber was cut to a diameter * limit of fourteen inches, and during the previous fourteen years to a sixteen-inch diameter limit, because these sizes represented the smallest trees which the company believed they could cut at a profit.

The Forest Service in 1905 prepared a working plan † for these holdings, the object of which was to provide for a second crop. The main features of the scheme recommended were cutting to a diameter limit of eighteen inches

* Diameter breast high is referred to in all cases unless otherwise specified.

† Bulletin 68, Bureau of Forestry. A Working Plan for Forest Lands in Central Alabama.

and the protection of the cut-over lands from fire. The provisions did not prove acceptable and were abandoned after a short half-hearted trial.

The pine forests in Central Alabama consist of moderately open pure stands, extending over large areas and containing from five to eight thousand board feet of merchantable timber per acre. Although a wide range of diameter classes does not appear, there often are found a varying number of thrifty or suppressed poles among the mature trees. The regularity of the virgin forest is broken by occasional patches or groups of young growth which are generally too small for saw-logs.

The effect of attempting to apply a method of cutting to a diameter limit in a forest of this kind can have but one of two results, namely, the removal of the entire stand of vigorous trees over large areas, if the limit is set at fourteen inches, or if the diameter is set at eighteen inches, the amount of merchantable material left standing is so great that logging proves too costly for consideration.

Cutting to a fourteen inch limit usually leaves standing a varying number of poles, but these are nearly always of an age approximating that of the felled trees, and are badly suppressed. The rate of growth of these remaining trees determines the time in which a second crop can be secured, and on their reproductive ability depend succeeding crops. It is, therefore, very important that these two factors be thoroughly understood before second or future yields are predicted.

Measurements taken on cut-over lands showed a current annual growth of one-twentieth of an inch. This statement is based on measurements taken on 343 trees growing on lands logged between 1887 and 1908. Plots one acre in extent were selected on all sites represented in the region, and from each tree a section was cut at breast height, and the current annual growth since logging measured. The

trees on the plots were characteristic of the growth over the entire logged area and the data secured from them form a safe basis for the prediction of future yields for cut-over pine lands in this section.

The following table exhibits, as a whole, a fairly uniform rate of growth for most diameters. Those showing the most marked variation from the average are based on a small number of trees, which probably accounts for their irregularity.

TABLE I
RATE OF GROWTH OF YELLOW PINE ON CUT-OVER LANDS
(Central Alabama)

Diameter breast high. (Inches.)	Current annual growth since logging. (Inches.)	No. of years required to grow 1" diam.	No. trees measured.
5	0.0331	30	9
6	0.0400	25	39
7	0.0433	23	33
8	0.0397	25	44
9	0.0517	19	55
10	0.0658	15	45
11	0.0523	19	30
12	0.0423	23	33
13	0.0417	23	22
14	0.0790	12	16
15	0.0508	20	11
16	0.0480	21	6

Extensive valuation surveys made by the Bureau of Forestry in 1905 (on the tract on which these figures were taken) show that the average number of trees per acre of nine, ten, and eleven inches in diameter is eight and three-tenths. If we assume that a twelve-inch diameter limit is the minimum at which the future crop can be cut at a profit (this is two inches lower than the present minimum limit of lumbermen), we find that in twenty years only the present eleven-inch diameter-class can be harvested; in forty years the present ten- and eleven-inch classes; and in sixty years the present nine-, ten- and eleven-inch classes; the

total yield* at the latter time being only six hundred and eighty feet B.M. per acre.

TABLE II
FUTURE YIELD OF YELLOW PINE ON CUT-OVER LANDS

Present diameter. Inches.	9	10	11	
Diameter in 60 years. Inches.	12	13	14	
Contents. Feet B.M., in 60 years.	57	83	112	
Average number of trees per acre.	2.9	2.9	2.5	
Total contents of diameter class. Feet B.M., in 60 years.	164.9	238.8	284.4	688.1

The present owner of the land is not interested in a third crop, but feels that if he "can count on having a second crop averaging three thousand feet to the acre ready for the axe by the time he has finished marketing the present crop (twenty-five years), the company is willing to modify its present logging methods to the extent of cutting to a diameter limit and avoiding injury to young growth. It is unwilling to incur expense in protecting its lands against fire, however, either for the purpose of improving the second crop or for that of hastening the production of a third."

The requirements are for a cut of three thousand feet per acre in twenty-five years, and it is evident from the figures given that any scheme of cutting to a reasonable diameter limit cannot produce the results desired.

The reproductive ability of trees left on cut-over lands has not been thoroughly understood and too much reliance has been placed on them as a source of future crops. The

* In calculating this yield, use was made of the table of volume of longleaf pine and the tables of present stand given in Bulletin 68, Bureau of Forestry, p. 16 and pp. 20-28 respectively.

trees are of four classes; namely, saplings, thrifty poles, suppressed poles, and an occasional large diseased tree that is too defective to cut.

Productive saplings were not found in the region, although the season of 1907 was a favorable one for seed production. However, Dr. Charles Mohr states* that a longleaf pine sapling may begin to bear flowers and fruit when the tree reaches its second decade, and it is probable that occasional specimens can be found in this region that are seed-bearers. However, they are so few in number as to be a negligible quantity.

Small poles (35 to 50 years old) bore very few seed and so far as could be learned those produced were sterile, for no reproduction resulted. Small crops of seed are borne by thrifty poles ten to twelve inches in diameter (60 to 85 years old) but not in sufficient quantity to insure ample reproduction.

The suppressed poles are usually long and spindling and often have a short tufted or a scraggly one-sided crown, which is so thin and scanty that it cannot furnish nourishment necessary for both the sustenance of the tree and seed production. Only a very small percentage of suppressed trees bear cones, and these seldom contain fertile seed. All thrifty trees in the vicinity were productive during 1907, and suppressed poles would have been so, had they possessed fecundity.

Large defective trees with a good crown development are fairly productive. These trees are often too poor for profitable utilization, but if left standing will be of value as seed trees. However, they are not sufficiently abundant to restock more than a small percentage of the total area.

The observations proved conclusively that in Central Alabama satisfactory reproduction of longleaf pine cannot

* Bulletin 13, Bureau of Forestry. "Timber Pines of the Southern United States."

be secured from the usual stand remaining on cut-over lands where the mature timber has been cut to a diameter limit of fourteen inches, for trees of this diameter or less do not bear seed in sufficient abundance to insure a future crop of timber. The investigation showed that the most prolific trees range in size between sixteen and twenty-four inches (100 to 175 years old), and the diameter limit method is not the one to secure their presence on cut-over lands for reproductive purposes.

There are several means by which reproduction may be secured in yellow pine forests. The "stand" method where successive cuttings are made throughout the mature forests, the "strip," and the "group" methods would secure a well-stocked forest under proper management. However, the modern logging railroad with its expensive construction, maintenance, and equipment forces the lumberman to remove, at one felling, all the merchantable timber that is to be cut for many years, and therefore these systems are not acceptable to them.

Reforestation of yellow pine lands by planting would not be practical, for the tree possesses a very long tap-root, and the production and planting of the stock would be too expensive for consideration.

The use of seed spots might meet with some success, for the seed germinates readily with little preparation of the soil, but this method also would be costly, because of the labor involved in seed collection and distribution. It may prove feasible for restocking large areas of denuded lands on which artificial means must be employed because of the absence of large thrifty trees.

The dense reproduction that springs up in the virgin forest indicates that a "clear cutting" system could be applied during the spring of the year, subsequent to the fall of seed, when the conditions are favorable for germination previous to logging.

The removal of the timber by animal logging, which is customary in the region, does not disturb more than twenty-five per cent. of the forest floor in stands where the timber runs six to eight thousand feet B.M., per acre. The accumulations of brush that are too dense for seedlings to thrive under them do not cover more than five per cent. of the area, so that seventy per cent. of the ground remains undisturbed. The reproduction on this area is sufficient to insure a fully stocked stand if the crop is protected from fire.

This method may be used only during the first part of the growing season, because during the latter part the seedlings in the mature forest suffer from lack of moisture and sunlight and die in large numbers. The method is applicable only for periods coincident with seed years and can be used solely as a means of supplementing the regular management practiced.

In heavy stands the "scattered seed" method offers the best opportunity for the removal of a major part of the crop at one operation. The success of this method demands that vigorous, healthy, middle-aged trees, sixteen to twenty-four inches in diameter, be left standing. The number of trees required is governed by their height and the slope of the land. Longleaf pine seed is distributed on level land for a maximum distance of one and one-half times the height of the tree. The distance of effective seeding is not greater than the height of the tree. Trees sixteen to twenty-four inches in diameter have shafts ranging in length from eighty to one hundred feet and four to five of these trees distributed with regularity must be left to effectually seed one acre. These contain from two to six hundred feet board measure each. Therefore, from six hundred to three thousand feet of the best merchantable timber must be left on the ground for a future harvest. Stands averaging two to three thousand feet per acre can-

not be handled in this manner, because all merchantable material must be cut at one felling to make the operation profitable. Here natural reproduction must be secured previous to logging. These forests usually grow on inferior soils, but the open character of the stand would encourage reproduction, and favorable conditions would result with effective fire protection.

Longleaf pine seed years occur in Alabama approximately quadrennially. The problem of securing a crop of seedlings on the areas cut over between seed years is not easy, for a heavy growth of grass and ferns springs up after logging and in two to three years this becomes so dense that the herbage must be burned off previous to the fall of seed, so that they can reach the mineral soil. Where there is some young growth on the ground this would destroy a considerable portion of it, but the choice lies between the protection of a poor stand, or the destruction of a portion of all of it, in order to secure a better stocked stand. There is an element of risk in this, for conditions may be unfavorable for seed development and germination, and it may not be possible to secure a stand until one or more seed years have passed.

The quantity and quality of the seed crop may be foretold for at least a short period in advance of its fall, but it is not possible to reckon with climatic conditions that may destroy the crop. Damp, warm weather during the late fall or early spring may cause the seed to germinate on the leaf litter, or even in the cones, and in either case, the succeeding frosts kill the succulent plants and germinated seeds, and destroy all hope for reproduction until another period of four years. This may mean that the restocking of the area will be delayed for seven years. During this time grass secures a strong hold on the land, and where a heavy sod forms, a serious obstacle is offered to reforesting the areas, because seedlings are choked out before

they have sufficient root development to cope with the herbage.

The treatment to which cut-over lands should be subjected, where reproduction is lacking, will depend somewhat on the relation of the cutting season to the seed year. Burning off the ground cover is essential and during seed years this would take place late in the year previous to the fall of seed and before logging, so that the only refuse on the ground after logging would consist of unmerchantable logs and crowns. This refuse is seldom responsible for the great damage that is done to young growth, because the herbage growing on cut-over lands is the chief fuel of fires. The crowns are composed of coarse, brittle limbs that are not readily inflammable. Three-fourths of them are badly smashed in falling and lie close to the ground in a position for most rapid decay, and they offer a minimum of fire danger. The most inflammable portion of this slash is the foliage which falls after two years, and thereafter is not a serious menace.

If felling occurs between seed years and the land remains unseeded for more than a year subsequent to logging, it is again necessary to burn off the ground cover of the logged lands before the seed falls. The logging débris complicates the work because the brush must be lopped, and, if dense, removed from the vicinity of seed trees and thrifty young growth. Further handling of the slash is unnecessary.

Brush burning is not essential, for fire can be kept out of the slash as easily as it can be kept out of areas where the débris has been burned.

Although fire is often an essential tool of the forester in securing reproduction in longleaf forests, it is a scourge as soon as the crop is started. It is fatal to seedlings until they begin to grow rapidly in height, which is usually at the age of four years. During the six or seven succeeding years the foliage may be injured several times by sur-

face fires before the plant succumbs. At the age of twelve years stands are usually immune to light fires, although growth may be retarded by the loss of the ground cover.

An effective system of fire protection is one of the absolute essentials for the management of yellow pine in the South.

The protection of the young growth against animals is of little importance in central Alabama, for stock laws forbid the natives to pasture any form of animal on the open range. The extensive damage inflicted by hogs on seedlings in other sections does not occur here. There is no incentive to burn forests because the settlers do not benefit from the range. This assists materially in keeping down surface fires.

Turpentine orcharding is conducted on an extensive scale and because of the ignorance and carelessness of the labor employed, and the crude methods of extraction, it has a marked effect on the forest. The box system of extracting crude turpentine from the tree is widely practiced and although an improved scheme, the "cup and gutter" system, has been introduced, its use is not general. The boxes weaken the bole, kill five to ten per cent. of the bled timber during the four years of operation and are a serious fire menace because the resin they contain is inflammable and a few fires are sufficient to seriously injure the tree. The "cup and gutter" system reduces the number of trees killed to about one per cent. and lessens damage from fire because it cannot gain headway on the pitchy bole, and scarification does not appear to seriously impair the vitality of the tree unless it is nearly girdled. It is not, however, popular with many workmen and some difficulty is experienced in its use. Turpentine orcharding necessitates the selection of seed trees several years in advance of logging. Scarified trees, especially those that are "boxed," are not suitable for seed purposes, because of the added

danger from fire and disease to which they are subjected, but during turpentine operations the selected seed trees may be damaged and recourse to bled trees would then be necessary.

The extraction of crude turpentine has led to numerous practices that are detrimental to the forest, such as the boxing of thrifty poles that at best yield only a small amount of resin. The deep gash made at the base of the tree greatly weakens the bole, and it is usually blown down during the first severe wind storm. Even if it stands, it is too small to cut when the area is logged and it is left behind to encumber the ground—not only a total loss to the landowner, but a menace to the remaining stand.

Fires also play havoc in the turpentine woods, and in order to keep them under control it is customary each fall to burn the scanty growth of grass and the thin carpet of needles. This burning is often done by careless laborers and the fires get beyond control and spread over large areas, doing great damage to young growth and bled trees. This practice has not proved so destructive in Central Alabama as in some sections, but its evil effects were observed.

The greatest damage to the cut-over lands arose from the use of coal- and wood-burning locomotives on the logging railroad. No efforts were made to provide spark arresters or in any way to prevent the spread of fire from areas ignited by the locomotives. As a consequence, the carelessness of train crews was responsible for the greater number of fires on cut-over lands.

In the virgin forest where turpentine operations were not in progress, the fires were started by the log-cutters, who burned the undergrowth and litter for the ostensible purpose of driving out rattlesnakes and to make walking easier. The area of virgin forest and cut-over land burned annually could be reduced to a small per cent. of the

present total if a patrol were maintained along the logging railroads during the dry periods and the wanton firing of the forest by employees stopped.

Tables of age on a diameter-breast-high basis, which were prepared for this tract by the Forest Service,* show that it requires eighty-five years from seed for a tree under favorable circumstances to reach twelve inches in diameter, and one hundred and eight years to reach a fifteen-inch diameter, so that the present generation of owners and perhaps the next, will be unable to harvest another crop from the land. This is discouraging, for the expense of reforestation and protection, coupled with the annual payment of taxes, makes so large an investment, when compounded for eighty-five years or more, that a timberland owner has cause to doubt his ability to practice profitable forestry on his holdings; and southern lumbermen will not invest money in the improvement of their forest lands until the profit secured from the manufacture of lumber is greater than it is to-day.

The existing knowledge concerning the silvics of longleaf pine is so meager that extensive research and experimental work must be conducted before the problem of management can be solved. This study should cover a wide range of conditions because the soil and climate are so varied throughout the longleaf belt. Private citizens cannot be expected to undertake such work, and it is not probable that the Government will take active steps to carry on studies except on its forest in Marion County, Florida. This investigation is of vital importance to the States within whose boundaries the longleaf forests lie, and they should take some action soon to determine the means by which these forests may be successfully managed and perpetuated.

* Bulletin 68. Bureau of Forestry.