APPLICATION OF GENETICAL METHODS TO LONG-TERM FOREST MANAGEMENT IN THE NORTHEAST

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A PULPWOOD OPERATIONAL ROUTINE DESIGNED FOR TREE IMPROVEMENT

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As many of you know, my adventures in forestry over the past 40 years. have centered largely in northwestern Pennsylvania in my work for the Armstrong Forest Company.

Specifically, I'd like to tell you about an experimental type of pulpwood cutting in second growth, even-aged northern hardwoods which we initiated in 1940. This cutting covered 10 acres and is known as our Crop

Tree Plot. Our previous studies of these even-aged stands had shown that the highest rate of current increment occurs during the 3rd and hth decade of their development following clear cut Ling. Our basic plan, therefore, from a purely pulpwood management standpoint, has been to make a substantial cut "from the top" at about the 40-year age class. A minimum cut of 12 to 15 cords per acre is required if the initial operation is to stand on its own feet and give the area a proper degree of accessibility for continuing cycle yields. A cut of this type relieves the stand competition sufficiently that many of the tall, slim, naturally pruned stems continue to live and grow into higher quality trees, instead of being lost by suppression mortality. A cut of this character removes about 66 percent of the merchantable sized pulpwood, but only 15 percent of the stems. Thus the growing stock left is generally comparable to a normal stand just beginning its period of maximum current increment, but with the exception that much of the competitive pressure has been removed. Thus at least four additional cycle cuts for pulpwood, at intervals of 12 to 15 years, are indicated before a newly regenerated stand is required for a new rotation. Such management, we feel, gives the maximum cubic footage of usable material throughout a rotation.

Even in forest management for pulpwood, however, one has to provide against both shortage and excess of forest yield. Greater forest acreage provides the hedge against shortage. If that increased acreage returns a surplus, then it is desirable to have that surplus in high grade timber for special products returning the greatest value. Such thinking led to the question: why not pick out certain trees, prior to the first cut for pulpwood, with the thought of carrying them through succeeding cycles, so that they would have the quality and size desired in the event they proved to be surplus over pulpwood needs?

As a result, we set up our so-called "Crop Tree Plot", consisting of 10 acres in an even-aged 42-year-old stand of northern hardwood on Site I, in which black cherry and hard maple predominated. Twenty trees per acre were selected as crop trees, the requisites being (1) even distribution (2) desirable species and (3) clear, straight bole with compact crown. Of the selected trees, 53 percent were hard maple, 43 percent black cherry, and the balance of 4 percent included soft maple, ash, and beech. The in tention was to retain the occasional tree of so-called inferior species so that no species of the climax forest would be eliminated. The area was then cut for pulpwood, all trees 8 inches in diameter or more, leaving the marked crop trees together with all other trees below 8 inches.

Most of the crop trees had been intermediate trees in the original stand, so the cut was heavy, yielding almost 22 standard cords of peeled wood per acre. An initial cut of this weight makes it possible to provide suitable accessibility to the fullest extent, thereby making possible much lighter future cuts. It can here be mentioned, that on the better operating sites when complete accessibility is provided by the initial operation, and with other favorable factors, a volume cut of as low as five or six cords per acre for succeeding cycle cuts may be economical. Nevertheless sufficient growing stock was left to close the forest canopy quickly enough that it was evident seedling reproduction of cherry on the ground at time of cutting would not survive.

In 1950, ten years after the initiation of this experiment, a 2-acre plot within the 10-acre plot was set up for special treatment to determine whether small cherry seedlings on the ground would survive and develop a new stand if everything excepting the marked crop trees were removed. Incidentally this cutting yielded 14 standard cords of peeled pulpwood per acre, making a total of 36 cords yield for the 57 year period, with the 20 crop trees remaining for continued growth while a newly regenerated stand is becoming established. It should he understood that the 1950 cutting was made to give a "preview" on reproduction problems which would ordinarily not be met until the stand had gone through several more cycle cuts, for pulpwood, and until it had reached an are of 80 to 100 years. The balance of 8 acres in the original 10 was chemically girdled in 1951 for a 1 year cycle pulpwood cutting, which is yielding nine cords per acre; and which retains ample growing stock, in addition to crop trees, for further pulpwood removals.

Without going into much detail here on specific results of this experimental work, I may say that we feel well satisfied that carting crop trees is a practice we feel justified in extending into standard routine of our management. Many of you have seen or heard of our practice of chemical girdling for bark removal, and its general adoption into our management plans has resulted in the necessity of marking each tree to be girdled. As of August 1, 1955, nearing the end of the girdling, season, we have treated about 1/4 million trees, so you can judge the magnitude of the marking job, and the variation that could occur in attempting to follow marking rules. We have found that having crop trees uniformly distributed and designated on any area is a tremendous help in marking practice. The sample plot information gained at the same time that the crop trees are designated, enables the foreman of the marking crews to say, for any particular compartment, what size trees, and how many for each crop tree, are to be marked for girdling in order to follow the cutting plan as to cords per acre. This is a tremendous help in giving material justification for another forward step in silvical practice.

There are many additional details of our work that time does not permit my telling of here. I only hope the preceding sketch gives enough background so that you may understand the theme of what I'm trying to tell you. To me, that theme means that tree improvement need not be far removed from practical silviculture, and in spots at least, the two may proceed hand in hand. As I see it, our practice of crop tree marking, though in its infancy as to standard use, may well be a long step towards tree impr ovement--or perhaps we could call it forest improvement. What we are doing boils down to this--we are selecting 20 trees to the acre (out of a stand numbering about 600) to be carried through several cutting cycles to maturity. These trees might be termed "the pick of the crop" of many thousand seedlings that got off to an even start (following clear cutting) from seed produced from a mature climax forest. Certainly they may represent the better phenotypes. Quite probably, too, especially because of the large acreage involved in the plan, they include a variety of desirable genotypes which may come to be recognized, as we follow through at each cutting cycle, on their development towards maturity.

As our planned scheme of operation moves through succeeding cutting cycles, we should be able to observe the behavior of these crop trees to see which ones, if any, deserve special mention or nomination into the "elite" classification. Normally, there may still be ample time to prove them before a regeneration cut, Is made, so that full advantage can be taken of such trees as the seed source for the next generation. Conversely if some ones of the crop trees are found undesirable as a source for regeneration, it is not impractical to remove theirs before a regeneration cut is made.

Such a plan as I have outlined may be sound basically, and while it provides a present procedure to be followed, the time period involved in waiting until the 21st Century for regeneration lets me out of the picture. Consequently, I'm looking for short cuts, even in a matter like tree improvement. Frequently in my past experience where seeking an answer to a silvical question that involves a long experimental period, I have found that nature already has conducted the experiment and given an answer--if we can find it. So here again, with a genetical problem to face, we have looked for a possible short cut. For what it may be worth I shall set forth a possible procedure of approach to one of our local genetical problems having to do with black cherry.

Some half dozen counties in northwestern Pennsylvania seem to include the optimum region for black cherry. The original climax forest in this area contained roughly two percent cherry. The prevalent practice of clear cutting increased this proportion tremendously--in some of our second growth stands today cherry may make up over 50 percent of the merchantable volume. Today the even-aged second growth stands over 50 years of age are producing, sufficient volume of cherry sawtimber to attract the veneer log buyer as well as the sawmill operator. Perhaps only a small percentage of cherry large enough for veneer meets the quality requirements. In the first place many of the trees large enough to qualify developed as wolf trees with heavy branching low on the bole. But even the trees which show surface indication of giving a clear butt log have to be felled and examined before they will be accepted for veneer. The most frequent cause of disqualification of otherwise suitable requirements is gum spots. There is superficial evidence to indicate the possibility that very local areas produce cherry with minimum of gum as compared to other areas where gum may disqualify all trees. Another common defect is the "brush knot"", Quite possibly both these defects may be traced to genetical influences, direct or indirect.

The point in question, however, referred to as a possible short cut in procedure, has to do with the fact that cherry is generally a prolific sprouter. Under today's condition of the uncontrolled deer herd, the sprouts do not have a chance to survive without protection, but this sprouting quality makes it possible, (1) to produce a tree, at an accelerated pace, which is genetically identical with the tree that has proven its veneer qualities, and which is also in the same local environment, (2) to obtain within a year or two an abundance of material for vegetative propagation. It is true that only few of the veneer logs today come from sprout origin, but at the time of cutting the original forest there were very few stumps to sprout, some of the stumps did not sprout, and the sprouts had to survive their environmental influences. Actually, however, we have produced veneer logs from trees of sprout origin in the second growth forest; occasionally multiple sprouts have permitted taking one stem for veneer and permitting an additional stem or two to continue its development as part of the same individual.

Recently, we arranged with one of the veneer manufacturers so that they will report to us the quality of veneer from individual logs which we have identified by number with the stumps of the trees from which they were cut. This will permit a definite proving of individual trees, which though cut, are still capable of vegetative propagation.

There are a number of other short term experiments we are conducting, and which relate to sprouting as a means of propagating cherry individually as they become of proven quality. We hope that some worthwhile information will be available in the not too distant future.