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TRENTON, N. J.
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1912.

REPORTS OF
THE FOREST PARK RESERVATION COMMISSION
OF NEW JERSEY

AN EXAMPLE OF
WOODLOT FORESTRY

BY
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Assistant Forester

TRENTON, N. J.
MACCRELLISH & QUIGLEY, STATE PRINTERS.
1912.

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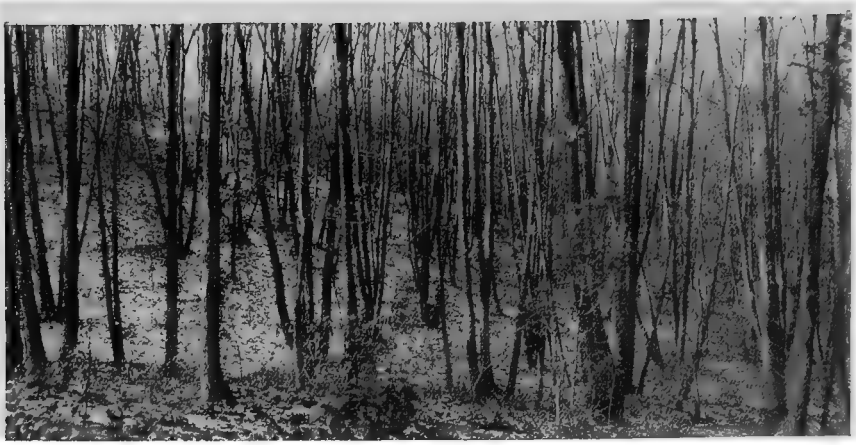

Fig. 1. *Dense Sprout Stand* (Chiefly Chestnut Oak) *Before Thinning.* Note Fine Litter of Leaves, etc.

Fig. 2. *The Same Stand After Thinning.* Note that the Tallest, Straightest, Most Thrifty Trees in Each Group are left to Grow Larger. Also the Low, Clean-cut Stumps.

Fig. 3. *The Same in the Summer After Thinning.* The Crown-cover on the Right-hand Portion is Already Dense Enough; On the Left It is too Thin.

A Part of the Forest on Mount Laurel Before and After Treatment.

An Example of Woodlot Forestry.

During the winter of 1911–12 an improvement thinning was made in the forest on the State Reserve at Mount Laurel near Moorestown, Burlington county. This forest came into the possession of the State in the usual neglected condition; that is, it had been simply allowed to grow. Fortunately, fire had been kept out. The presence of considerable blight-killed chestnut on a part of the area, and a general crowding of the trees, made necessary a felling much heavier than would be proper except under extraordinary conditions. Forty-five per cent. of the cubic contents of the stand was removed, and some large vacancies resulted because of irregularities of growth, but the greater part of the area was so treated that a fairly even stand of trees was left (see Figs. 3, 11, 13). Fifteen dollars per acre was netted on the operation. More could have been realized by a private owner who would adapt time and convenience to the work.

As the forest on this reserve is typical of that on many areas in New Jersey, it is the purpose of this bulletin to describe its treatment as a practical example of how similar forests should be managed. The questions which entered into the treatment of this forest, and which will have to be considered in most woodlot forestry, with the faults that were revealed, are discussed under the following headings:

1. History of the Forest.
2. The Neglected Woodlot.
3. Markets.
4. Marking the Trees.
5. Felling the Trees.
6. Clearing Up.
7. Products.
8. The Thinned Forest.
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HISTORY OF THE FOREST.

The forest is about forty years old. A cut was made forty-four years ago which removed the entire stand. In the restocking which followed, a part of the hardwood stand was made up of sprout growth and a rather larger part of seedling growth. Shortly after the cutting, pine was introduced by carting from a forest some distance away branches laden with cones and scattering them about. From these cones the seeds fell which have produced the present pine stand. The pine trees on Mt. Laurel are thus somewhat younger than the hardwoods. The growth has not been interfered with by fire or grazing.

THE NEGLECTED WOODLOT.

The forest occupies twenty acres, and was composed of a mixture of pine and hardwoods, decidedly overcrowded. The soil is clayey or loamy sand, rather better than true forest soil, though it is properly rated as such because the ground is too steep to be cultivated as are the adjoining lands (see Fig. 2). A thin layer of humus is being increased year by year, thus gradually improving the soil.

Many trees were dead or dying, even the dominating trees suffered for want of space. Only a small percentage of the trees were large enough for the saw mill, or for other material than cordwood, yet it was apparent that if the small, stunted and interfering trees were removed, the others would be able to make a more rapid growth. Clearly the forest needed a heavy thinning, by which all superfluous trees would be removed and only the better ones left (see Figs. 1, 2, 3).

The most plentiful trees were chestnut oak, white oak, red oak, black oak, pitch pine and scrub pine, maple, red gum, tulip poplar, while other species occurred in small numbers. The soil is naturally adapted to the oaks; the presence of the pines being due to the artificial seedling. The pines have made a very satisfactory growth, however, for while they are naturally found in

the lighter, poorer, soils, they generally thrive on better ground if they are not overcrowded by the hardwoods. These pines when once fully established in full light are able by their rapid growth to overtop most of the hardwoods, but if the hardwoods are established first, there is little chance for the pines to make place for themselves.

Chestnut has grown more rapidly in this forest than any other tree. In the past it probably has been the most valuable tree in the practice of woodlot forestry because of its sprouting capacity, its rapid growth and the ready market which always awaited it in the form of lumber, poles or ties. The prevalent bark disease, however, necessitates removing it from this woodlot. Anyone owning chestnut in New Jersey will be wise to find an early market for it, as the disease is very likely to destroy it.

Red cedar was plentiful before the larger growing species became dominant. The species demands practically open sunlight to live, and as this has been shut out for some years by the overtopping trees, the cedar ceased to grow and much of it died (see Fig. 10). It should have been removed from the forest several years ago.

MARKETS.

Because of the limited amount of material to be cut, an investigation of local markets only was made. It was found that cordwood, telephone poles, saw logs, fence posts, etc., could be sold at a profit. These products represented what a proper thinning of the forest would produce. An important feature of successful forestry is the putting of each tree into the product in which it will yield the most.

MARKING THE TREES.

Before the choppers were allowed to begin cutting, every tree to be removed was marked by a blaze in the bark, which could be easily seen by the workmen (see Figs. 4, 10). The following rules were fixed and followed:

1. Mark all chestnut trees.

2. Mark all cedar trees.

3. Mark all dead trees.

4. Mark all suppressed trees; that is, all trees which are shut out from the sunlight by larger ones.

5. Mark all but two, and in most cases all but one, of the trees in groups which have started from one stump.

6. Mark the poorer specimens of groups of trees where their crowns have not sufficient space, choosing to be left the stronger, freer-growing trees.

7. Mark enough trees so that the crown of each one left will be free from its neighbor by a few feet.

8. Favor to be left pitch pine rather than scrub pine when it is a question which of two equally healthy, but interfering, individuals to save.

9. Favor to be left oak rather than pine where it is a question as to which of these two species should be removed. (On a poorer soil this rule would be reversed.)

FELLING THE TREES.

After all the trees had been marked, a crew of four men, under a competent foreman, were given the following instructions for the felling:

1. Cut all marked trees, but only those marked.

2. Cut all stumps as low as possible. No stump free from mechanical hindrance should be left higher above the ground than the diameter of the cut (see Figs. 2, 5, 7, 11, 13).

3. Cut all reasonably straight oak and pine into saw logs down to a 6-inch top diameter and an 8-foot length.

4. Cut all straight chestnut trees into telephone poles. Peel the poles.

5. Cut all other chestnut into fence posts.

6. Cut cedar into posts, vineyard stakes and bean poles.

7. Cut locust into posts.

8. Cut all other trees and all branches to a two-inch diameter limit into cordwood, and then rank in piles of not less than half a cord.

Fig. 4. *One of the Older Pine Stands. A Heavy Felling was Required Here as Many of the Trees were Dying From Overcrowding.*

Fig. 5. *The Same Stand After Thinning; Small Pine Trees Have Since Been Planted in the Gaps.*

A Pine Stand Before and After Treatment.

9. Fell all trees over eight inches in diameter at the butt with saws, in order that the felling direction may be better controlled and the stumps left smoother. Trees less than eight inches in diameter may be chopped.

10. Protect the unmarked trees from injury when felling the marked trees by carefully choosing the felling direction.

11. Pile all brush in openings or on chestnut stumps, where it can be burned without damage to the remaining trees (see Fig. 7).

12. Cut suppressed and dying undergrowth and pile it with the other refuse, but spare the laurel and all live young trees.

These rules will apply to almost any New Jersey woodlot. It is not necessary, however, that the underbrush be cut or the tops piled and burned in an ordinary operation. Underbrush forms a natural part of a forest, and the tops of felled trees, if lopped and scattered, will soon decay and form humus. A further reason for leaving the tops to decay is that the standing trees may be injured when the brush piles are burned. There is no real need of burning brush in a hardwood forest; when it is carefully done, however, it somewhat lessens the risk of forest fires. The brush was burned at Mount Laurel because it was desirable to make a neat and sightly natural park for the use of the local citizens, as well as to furnish an object lesson in forestry.

CLEANING UP.

After the cutting was completed the cleaning up of the refuse became the immediate problem. Men with forks, rakes, sprinkling pots and water were ordered to burn the brush piles. If a pile was so located that the flames would not overheat the surrounding trees, a fire line four to six feet wide was raked around the heap down to mineral earth and a match applied. Each pile had to be watched until all danger of its jumping across the fire line was passed. Whenever a fire got started away from the brush piles it was promptly extinguished by means of the sprinkling pots. All piles which were too large or not properly located with reference to remaining trees were divided or moved before

being burned. The cost of cleaning up and burning the brush was at the rate of 16 cents per cord for the volume of marketable wood removed. As explained above, this expense is unnecessary in ordinary woodlot operations.

THE PRODUCT.

The products into which the material was cut were adapted to the local market. The total amount of material removed was 20,475 cubic feet of solid wood. If figured at 80 cubic feet per cord; this equals 256 cords.* Only 208 cords, however, were cut into fuel, the balance being represented by 80 chestnut telephone poles, 67 cedar fence posts, 109 sawed chestnut posts, 800 bean poles, 400 vineyard stakes and 12,475 board feet of saw material (see Fig. 7). The market value of the 48 cords represented by these products was more than double their value as fuel. The net return from the whole operation was approximately $300.

THE THINNED FOREST.

As it now stands, the forest contains 24,712 cubic feet of wood. Each tree that remains has been saved because it was the best fitted individual in its group for future growth and gave the greatest promise of future value. The forest as a whole is thrifty, and has a prosperous look as if all the trees were doing their best to produce wood, in striking contrast to the appearance which it had before the removal of the unthrifty specimens which served to make the whole seem unkempt (Compare Figs. 1 and 3, 12 and 13).

PLANTING.

In several parts of the forest, gaps or openings, too large to be soon occupied by natural growth, existed. One of these had been made by the removal of gravel (Fig. 6), another by road

* A cord of 128 cubic feet contains on the average 80 feet of wood and 48 feet of air space.

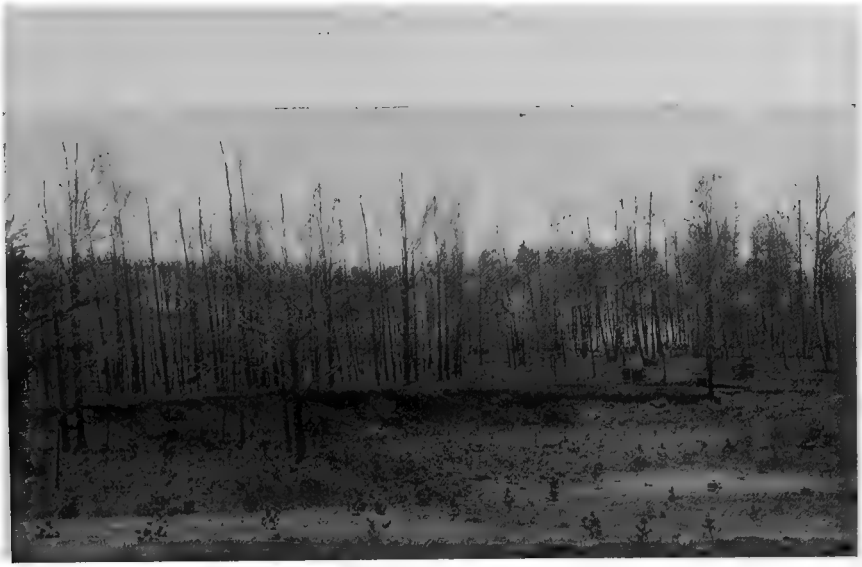

Fig. 6. *The Forest After Treatment, with An Old Gravel Pit in Foreground Planted to Scotch Pine.*

Fig. 7. *Product of the Improvement Thinning. A, A, A, Low, Clean-cut Stumps; B, B, Electric Poles; C, C, C, Cord Wood; D, Fence Posts; E, E, E, Brush Piled for Burning.*

grading, others by the enforced felling of chestnuts or of groups of large pines. The total area was about two acres. To redeem this land from idleness, and at the same time to get some knowledge of the values of various trees in such situations, it was planted in May to scotch pine, white pine, austrian pine, norway spruce and douglas fir. The little trees, none of them over a foot high, many less than four inches, with not a few seedlings of pitch pine and scrub pine, which the increased sunlight has caused to germinate, now promise to thrive and add to the diversity, interest and value of the reserve.

Planting in gaps, or planting anywhere when protection is assured and natural forest is lacking, is good policy. The cost in this case, counting trees, freight and labor, was at the rate of $9 an acre. That is, trees of the same kinds and size could have been planted solid 6 x 6 feet, or 1,210 per acre, for that amount. The spacing here was necessarily very irregular.

A STUDY OF THE GROWTH.

The forest having been put in good shape, a study of the yearly growth, as indicated by the rings on the stumps of the felled trees, revealed some interesting facts in the lives of the various individuals. Most of the larger trees made a fairly uniform and rapid growth up to twenty years of age, from which time on it began to drop off, more or less rapidly according as the stand in which the tree grew was more or less crowded. In fact trees of all sizes maintained or diminished their rate of growth according as they were the stronger or the weaker individuals in their particular groups.

Figure 8 shows plainly the variation which is found in trees of the same age, in the same stand, and grown under practically the same conditions except that of spacing; thus *A* is from a black oak, 41 years old; *B* from a chestnut oak, 45 years old; *C* from a chestnut, 44 years old; *D* from a post oak, 43 years old; *E* from a white oak, 40 years old; *F* from a maple, 40 years old and *G* from a sassafras, 40 years old. The black lines are

drawn to show the growth in ten-year periods. From their sections it is easy to read the history of the trees, as follows:

Specimen A came from a tree grown from seed. Up to the fourth year this tree was practically free from hindrance and grew rapidly; in the fourth year it is probable that a drought was responsible for the very small increase in diameter that is shown. A study of the United States rainfall record, kept at Moorestown, shows that in 1874, the year of small growth on this tree, only 59 per cent. of the normal amount of rain fell in the growing months of May, June, July and August. In the eighth and ninth years this tree had a hard struggle with its neighbors for nourishment. It apparently overcame this opposition, and from that time until its thirty-fourth year continued little influenced by its rivals. After the latter period, especially in the thirty-ninth, fortieth and forty-first years, it shows the effects of crowding by its neighbors. This tree was cut because it had reached a size which made it economical to market it, and it was occupying too much space.

Specimen B is from a tree of sprout origin. Until it was twenty years of age, this tree made a very creditable growth on the side away from the center of the stump from which it sprouted. At that time the other sprouts from the same stump became so powerful that the necessary food and light was denied this one, and gradually its rate of growth decreased until in the last few years it became quite insignificant. The side of the section with the shortest radius illustrates the effect of overcrowding in the forest. Light and food were lacking here, and, consequently, little growth was made after the sixth year. Compare this growth with that on the longest radius. Two and two-tenths inches were made on the short radius in forty-four years, while on the longest radius the same was made in eleven years, or one-quarter the time. After the sixth year a growth of 1.7 inches was made in thirty-eight years on the shortest radius, as against 5.2 inches on the longest radius during the same period. Had this tree had sufficient room it could have maintained a complete growth, as indicated on the long radius, and would then have been 12.4 inches in diameter instead of 8.5

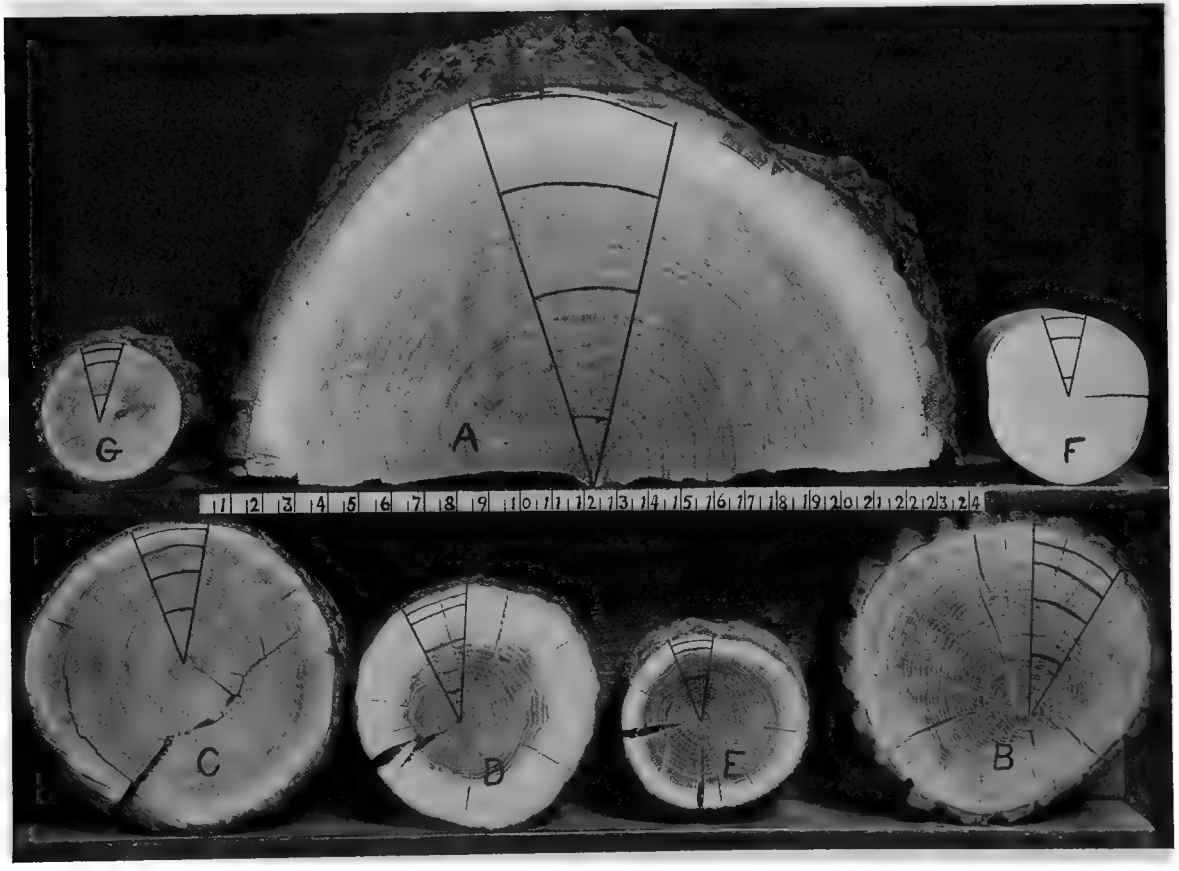

Fig. 8. *The Effect of Light Upon the Growth of Trees Illustrated by Cross-sections From Seven Trees of Nearly the Same Age.*

inches, as it was at the time it was cut. This tree was felled because it was the weakest of a crowded group.

Specimen C is from one of the smallest chestnut trees cut on this woodlot. Its growth was slow throughout, but especially so since its thirtieth year. It was also crowded by other trees. It would have been at least twice this size if it had grown free from competition. Some trees of this species grew to a 26-inch diameter, while this tree was growing to 9.2 inches. All trees of this species were cut because of the chestnut bark disease.

Specimen D is from a post oak. This tree was crowded by others on the side of the short radius. On the side of the long radius it grew fairly rapidly until it was about 24 years of age when the crowding became too severe and its growth was seriously checked. Practically all the trees of this species were removed by the thinning, because any of the other oaks are better as regards the rate of growth and market value.

Specimen E is from a white oak grown from seed. It made a moderate growth for twenty years, but was always crowded. After it was twenty years old the surrounding trees gained supremacy, and if the cutting had been deferred a few years more, they would probably have killed this tree entirely. The growth rings for the past ten years are so close together that they can only be distinguished under a strong magnifying glass. Of this species only weak individuals, like the one shown here, were cut, as white oak is one of our most valuable forest trees.

Specimen F is from a red maple. This tree was out of its element from the start. The ground here is much drier than its natural habitat, consequently its growth has been very slow throughout. Up to twenty years of age, the growth was better than from that time on, as is the case with practically all other trees in this stand. In addition to being in an unfortunate location, this tree, being rather tolerant of shade, persisted in its growth in spite of an amount of crowding which probably would have killed an oak. This is a tree of low value, and, except under very favorable circumstances, is not suited for timber growing.

Specimen G is from a sassafras, and a good sample of the class of inferior trees which are allowed to remain in the forest. Specimen *A* was 12 inches in diameter when this tree was not quite 4 inches. During the last ten years this tree was scarcely able to maintain life. It is a weed tree, and has no place in a timber forest.

This discussion and the illustrations show some of the possibilities of tree growth. They give an insight into tree history, and indicate the effects which trees have upon one another as they grow together in a forest. Anyone can take Fig. 8 into a forest which is being cut, and there read life histories comparable at every point with those shown here. Of course, any complete study of tree growth would include an analysis of heights as well as of diameters, but that may be ignored here, for the sake of simplicity, as well as because the relation between height and diameter is fairly constant in any given stand or forest unit.

A COMPARISON OF ACTUAL AND POSSIBLE YIELD.

The diagrams on the opposite page, Fig. 9, show at a glance the value of proper thinnings. The relative size of these diagrams was determined by a study of the average volume growth of the unthinned stand, and the maximum volume growth of the theoretical thinned stand, as shown on individual trees which grew under conditions which would normally be found in thinned stands. The unthinned stand at forty years of age showed a total product of 2,240 cubic feet per acre, in comparison with a possible 3,296 cubic feet per acre in a properly thinned stand. While these figures represent the difference in volume, they do not represent the difference in value. It is quite probable that the 1,808 cubic feet left after the forty-year cut in the properly thinned stand would have double the value, foot for foot, of that which now remains in the forest which was not thinned until it was forty years old. This fact becomes more evident when it is realized that the volume of the improved stand thus represented would be largely saw timber instead of fuel.

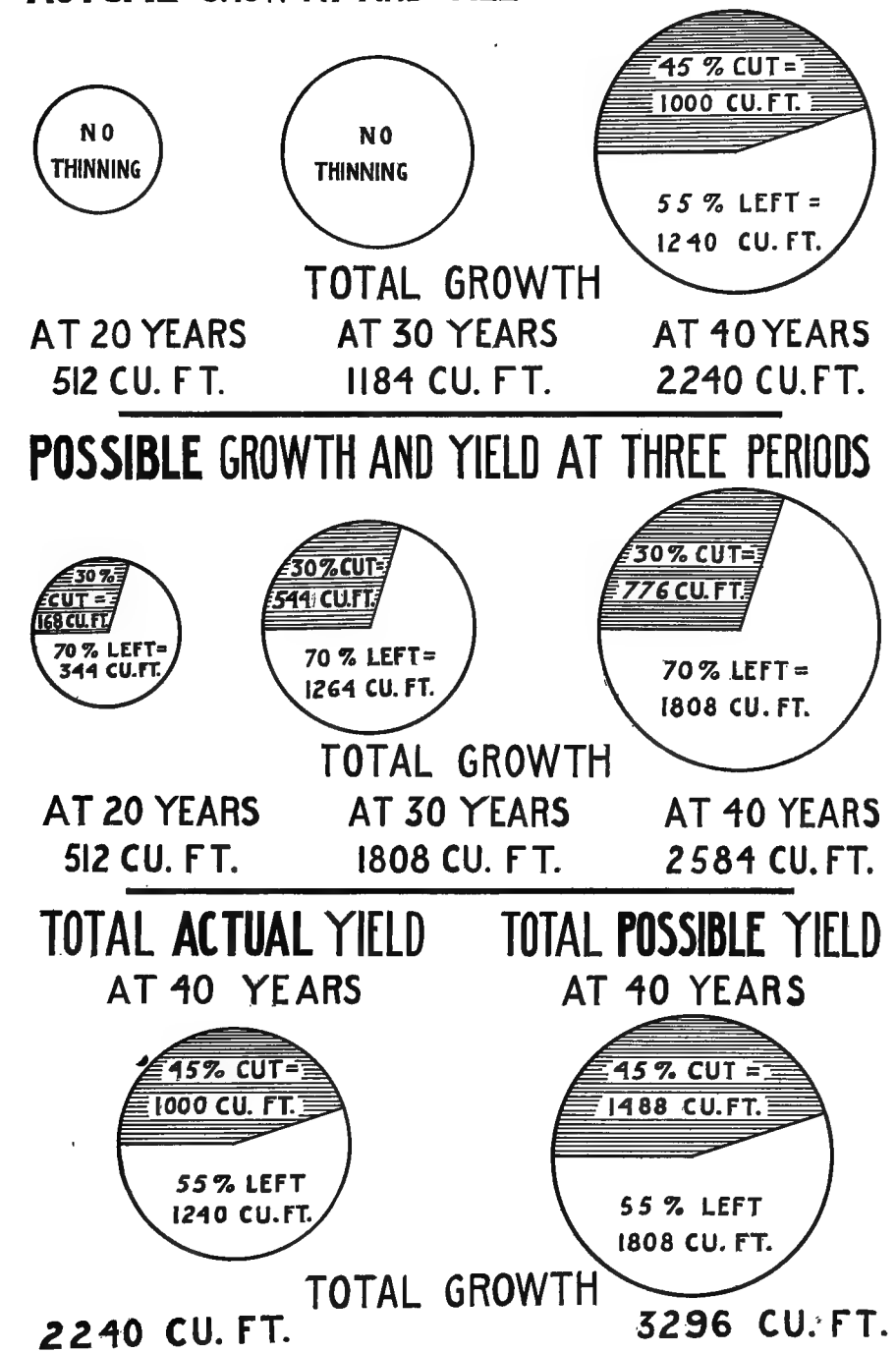

Fig. 9. *Diagrams Comparing Yield per Acre of Uncared-for Forest with the Possible Yield of the Same.*

ECONOMICS OF THE NEW JERSEY FORESTS.

To apply the lesson of Mount Laurel, it may be observed that the forests of New Jersey at the present time are composed of what is commonly known as "second growth." In reality, most of them have been cut over three or four times. They have also been repeatedly burned and otherwise greatly abused. Thus while 45 per cent. of the State's land area is forest, the greater part is of little actual value. And the stripping the forests of so much of their valuable saw timber has forced many manufacturing concerns to cease entirely to depend upon the local sources and to import their log material from other States. That the home market for saw material is satisfactory is evidenced by the absence of any considerable areas of standing timber. The small saw mills, cutting only from 5,000 to 7,000 board feet per day, have long been able to keep pace with the growth of the forest. Whenever an oak or a chestnut tree becomes large enough to make ties, piles or poles, it finds a ready market.

By properly thinning and caring for his forest, the farmer or woodlot owner can in forty years secure logs which it formerly required from sixty to eighty years to produce. At the same time he can get from the thinning material sold, or used, more than enough to pay the expenses of the attention that the woodland requires. Timber raising which is not economical is not recommended. Timber culture on a sound financial basis is the only forestry which should be practiced.

In many localties it has been customary in the past to cut the forests clean every twenty or thirty years to supply the cordwood market. The practice is wasteful. Forestry demands that the material to be made into fuel shall be drawn from the branches of timber trees and from the defective trees which it is necessary to remove in order to allow the better trees to grow into valuable timber. There will always be enough poor trees to supply the demand for fuel; there is now an excess of them in all parts of the State. Under these circumstances, it is folly to cut trees which have the possibility of producing more value

if allowed to grow. Any woodland owner who permits clear cutting for fuel purposes in any of the ordinary New Jersey woodlands does it to his own detriment.

The market for cordwood is good only where the woodlands are so located that a short haul is possible. If woodland owners would merely thin their forests of poor material, holding the better trees for more valuable products, they would take a great deal of wood out of the fuel market, and thus extend the area within which cordwood can be cut at a profit. Every woodland owner whose forest is so located that there is a market for firewood has an immediate forestry problem which he should consider. By a little study and careful management, such a property may be made to yield a continuous revenue. Simple protection will accomplish something, of course, for, when nature is made forester, the fittest will surely survive. But her process is slow and her ax dull. The case of Mount Laurel proves this.

The composition of the New Jersey forests in the future will be mainly of oak and pine. Chestnut, which up to the present time has composed from 30 to 60 per cent. of the northern forests, is rapidly being exterminated by the bark disease. Black oak, red oak, white oak, chestnut oak, tulip and ash are the species naturally adapted to the higher elevations. To them, pines and other conifers may be added by planting. On the level sands of South Jersey the native pitch pine is of greatest value and deserves a higher esteem than is commonly accorded it. The oaks found in association are comparatively slow growing and of less commercial value.

FIRE AND GRAZING.

Fire, uncontrolled, has no place in any forest Controlled, it is often a helpful agent in cleaning up waste. The pine lands of South Jersey have been brought to their present low estate by repeated burnings, not by the use of the ax. Any tree up to ten years of age is likely to be killed by even a very moderate fire, and older trees, even the fire-resistent pitch pine, are often seriously damaged.

It is of value to a forest owner to bring his trees to saw-log size in the shortest possible time. Frequently it has taken fifteen years to re-establish a growth equal in value to a ten-year-old stand which was destroyed. *Fire, therefore, must not be tolerated!*

Grazing must be prohibited in all forest plantings, and in reproduction cuttings, at least until the trees are of such size that their crowns are out of reach of the animals. The young, tender shoots are relished by stock, and an entire year's growth may be lost in a few minutes; moreover, trees thus injured may carry the results through life in the form of crooked stems.

SILVICULTURE.

A tree, or a forest, grows and develops well or ill, in response to certain stimuli. In the case of a single tree these influences are reduced to their simplest terms—food, water, light. In the forest they are multiplied and complicated by the struggle of trees, shrubs and herbs each to find the means of life. One who practices forestry takes a hand in this contest, and wisely as he may, checks useless interference, conserves the elements of growth, and stimulates the most valuable trees. After the forest is started his only tools are the ax and saw. It is, therefore, right, not wrong, to use them constantly—and *intelligently*.

But the basis of all silviculture is a knowledge of what helps and what hinders the growth of trees. Leaving many factors untouched, the most important may be considered under the following heads and then applied to the "Theory of Thinnings." (Page 21.)

Light.—Without light the leaves of trees are unable to perform their functions in the elaboration of sap. Some kinds of trees require more light than others. Those whose leaves will function in a weak light are known as tolerant, or shade-enduring, while those that require practically full sunlight are called intolerant, or light-requiring. There are many grades between the extremes. Coniferous or evergreen forests are comparatively

easily managed because they contain but one, or, at the most, a few, species. In any hardwood forest, however, trees of widely varying light requirement are found. Pitch pine, red cedar, grey birch and tulip poplar are some of our most intolerant trees; black oak, red oak, white oak and basswood are more or less tolerant, while beech and sugar maple are very tolerant.

One intending to cultivate a forest should study the light requirements of each species represented, and by proper and timely thinnings give each tree the light it needs—not too much, for it is easily possible to develop oversized crowns and to waste the humus and foster weeds on the forest floor. Most trees need some shade protection in early life, as direct sunlight frequently causes the tender plants to dry out. Once fully established, however, any tree will make a more rapid growth in full sunlight than elsewhere.

Soil.—Each tree species grows best in some particular kind of soil, yet, other things being equal, most trees will live in any soil except the most impoverished. Trees even in the forest often become established in places entirely unsuited for them. Some species, like the hickories and oaks, have deep root systems, and consequently require a deep soil; others, like the hemlock and spruce, have shallow root systems, and often will grow in a few inches of soil on the face of a solid rock. In improving a forest the trees should be studied with reference to their soil requirements, and an attempt made to bring about an adjustment by encouraging those which seem well satisfied. In planting new forests the most suitable trees for a given locality can always be found, but in the case of old forests, it is necessary to make the best of the trees which are already on the ground.

Humus.—The humus which forms on the forest floor from the decay of leaves and other litter is of value to the trees as fertilizer, as a mulch to prevent the evaporation of moisture from the soil, and as a medium through which the air may reach the roots. The forest soil improves year by year as the humus enters into it; it is, therefore, important to preserve it. This can be done by keeping a moderate amount of shade. Too

Fig. 10. *A Typical Mixed Stand Before Thinning.* Trees X, X, X, marked for Removal. Note ,also, Cedar Tree at Left Which Died from Lack of Light.

Fig. 11. *The Same Stand After Thinning.* Note the Clean Appearance of the Forest and the Low Stumps.

MIXED FOREST BEFORE AND AFTER TREATMENT.

much sunlight causes a rapid disintegration of the litter and often fosters a weed growth that makes a heavy draft upon the soil moisture. Fire destroys the litter, which by decay passes into humus, and impoverishes the soil.

Moisture.—The amount of moisture required by the different forest trees varies greatly, and, though most trees will live in any except the extremes of dryness and wet, a knowledge of the preferences or requirements of each will aid one in determining whether or not a given tree is in a congenial situation. Black spruce and larch are at home in wet swamps; rock oak on stony hills; white oak, black oak and walnut on well drained lower slopes and lowlands. In nature, if a tree germinates out of its range, it dies and no one is concerned about it. In forestry, however, it is important to know how much moisture a given tree needs in order that mistakes may be avoided.

Litter and Undergrowth.—The litter and undergrowth protect the humus and gradually add to it. They form a light covering for the soil and help to maintain a condition of moisture conducing to the decomposition of dead vegetation. They also form a shelter for game. The litter and undergrowth are as much parts of the forest as the trees themselves, and as such should never be destroyed either by fire or by cutting.

THEORY OF THINNINGS.

The object of thinning a forest is to reduce the wasteful competition by which nature brings the trees to maturity. While they are small, many trees can find sustenance on a given area; as they grow older, and each requires more room, the number must be diminished. From the standpoint of the forest, a thinning should be made whenever the individual trees begin to crowd one another. From the standpoint of the owner, thinning must be deferred until the trees are large enough at least to return the cost of their removal. As a matter of fact, very few of our forests seriously need thinning before they are twenty years of age, a time at which, if advantageously located, they will usually

yield enough material to cover the cost. To thin a forest properly, then, begin when it is about twenty years old, and thin it regularly at intervals of from five to ten years until the final crop is ready for harvest.

Points to observe in thinning:

1. Choose the trees to leave, rather than the ones to take out.
2. Try to develop an even spacing between the trees.
3. In the early thinnings, let the value of the species in its final product be important in determining the trees which are to be left.
4. Have in mind that trees with long straight boles are of greatest value for lumber.
5. Save the best grown trees of the most valuable species.
6. Try to maintain a nearly complete crown canopy as a means of preserving soil fertilty. Do not take out too much, rarely should more than 20 per cent. of the volume come out at a time (see Fig. 3).
7. Mark the trees to be removed, not those that are to stay, as every wound lessens the vitality and the value of a tree.

STATE AID IN FORESTRY.

Since forest owners know little about the methods employed in forestry, the Forest Commission offers the services of its foresters, so far as their time will permit, to all who ask for them. The assistance given includes the examination of woodlands and the making of recommendations for their management. Where cutting is necessary, a part of the trees to be felled will be marked to guide the owners in the removal of the rest. Advice in regard to markets will be given, but in no case will the forester have part in a sale. Those interested in forest planting will be advised regarding the most suitable species for their situations, how to obtain the trees and how to plant them. The State supplies no planting material. Fire protective plans will also be formulated.

Fig. 12. *A Younger Pine Stand Before Thinning.* Note the Great Number of Small, Weak Trees.

Fig. 13. *The Same Location After Thinning.* Note Absence of Conspicuous Stumps.
YOUNG PINE STAND BEFORE AND AFTER TREATMENT.

In all cases the assistance given is advisory. There is no obligation to follow the recommendations made, though where they are acted upon the Forest Commisson claims the right to inspect the property from time to time and to publish facts concerning the work for the benefit of the public. The cost to the owner is the forester's actual expenses while away from Trenton. His salary is paid by the State. Inquiries by mail on any forest subject will be carefully answered. For this there is no charge.

Write to the State Forester, Trenton, about anything relating to forests or shade trees—not fruit trees.