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REPORTS OF
THE FOREST PARK RESERVATION COMMISSION
OF NEW JERSEY

FOREST PLANTING
IN NEW JERSEY

BY
ALFRED GASKILL
State Forester



UNION HILL, N. J.
DISPATCH PRINTING COMPANY.

1913.

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The Forest Park Reservation Commission.

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 - HENRY B. KÜMMEL, Trenton, *Executive Officer.*
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CONTENTS.

	PAGE
The Need of Planting,	7
Where Planting is Proper,	7
Shade Trees not Considered,	7
No Quick Riches,	8
Climate and Soils,	8
What to Plant,	8
Pure or Mixed Forest?	8
Evergreens or Deciduous Trees?	9
Quick Growers,	9
Nut Trees,	9
Choice of Species,	10
Specific Descriptions,	10-13
Trees not Recommended,	13
How to Establish a Forest,	15
Sowing Seed,	15
Best to Plant Small Trees,	15
Preparing the Ground,	15
Size of Trees,	15
How to Order Trees,	15
How to Handle Trees Before They Are Planted,	15
Heeling-in,	16
Spacing,	17
Planting (Outplanting)	18
Puddling,	18
Clefts,	18
Crew,	18
Lining out,	18
Planting,	19
Intervals,	20
Speed in Planting,	20
Subsequent Care,	20
Cutting Back,	20
Time to Plant,	21
A Forest Nursery,	21
Location, Soil,	21
The Kind of Plants to Buy,	21
Planting (Transplanting)	21
Cultivation,	22
The Second Year,	22
Purpose of a Nursery,	23
The Cost of a Plantation,	23
Where to Get Material for Forest Planting,	24
The Profit in Planted Forests,	26-28

ILLUSTRATIONS.

Fig. 1.—The Kind of Land that Should Be Restored to Forest,	7
Fig. 2.—Trees for Forest Planting,	9
Fig. 3.—A Forest Nursery,	9
Fig. 4.—Diagram, Heeling-in,	16
Fig. 5.—Diagram, Square Planting,	17
Fig. 6.—Diagram, Triangular Planting,	17
Fig. 7.—Diagram, Cleft Planting,	18
Fig. 8.—Diagram, Area to be Planted,	19
Fig. 9.—Diagram, Furrow Planting, and Slit Planting,	22
Fig. 10.—Eight Examples of Planted Forests,	23



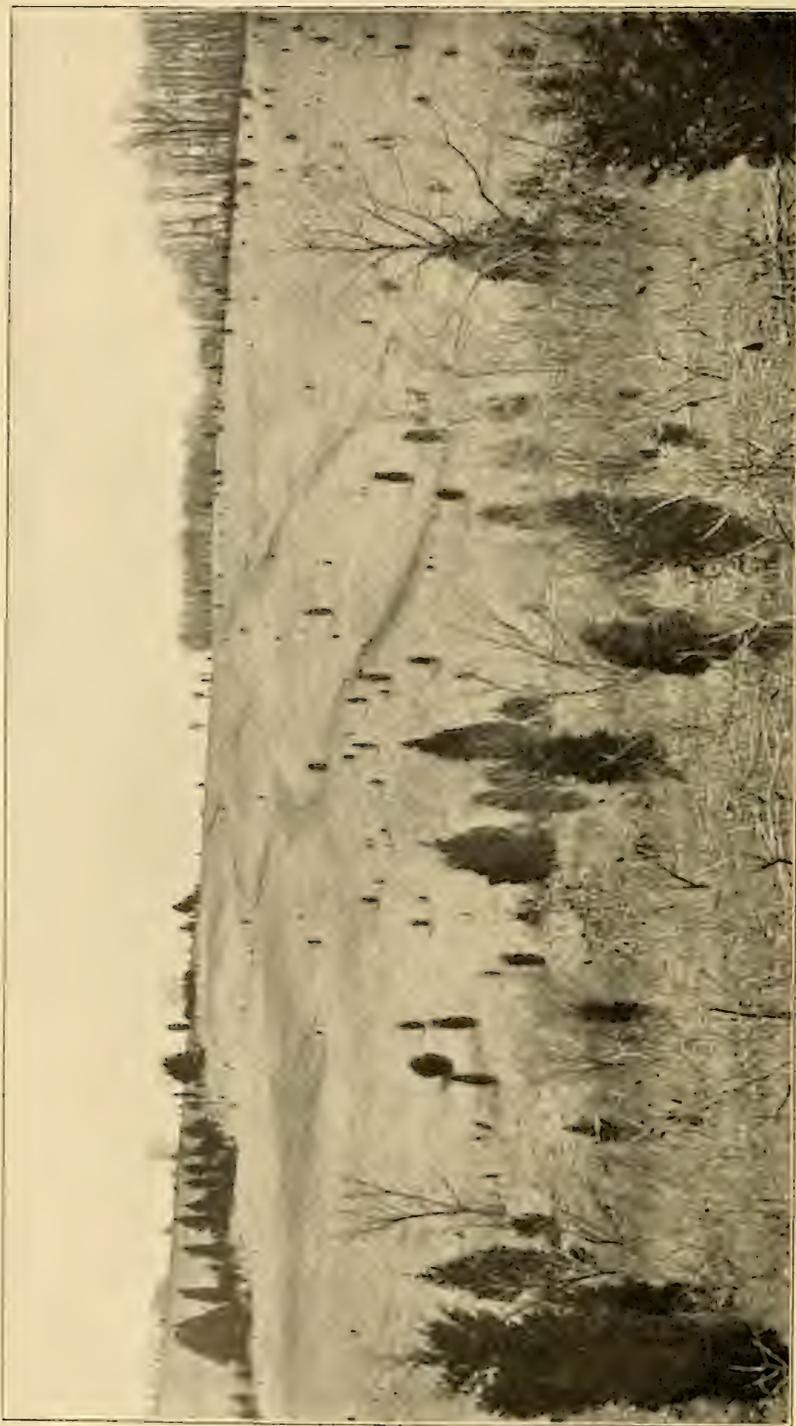


FIG. 1. The kind of land that should be restored to forest. It can be farmed but washes badly and will do better in trees. The scattered evergreens are volunteer red cedars.

STATE AID IN FORESTRY.

The Forest Commission wants to assist farmers, and all woodland owners, to practice forestry. See offer on page 28.

Forest Planting in New Jersey.

THE NEED OF PLANTING.

The Forest Commission lays little stress upon forest planting because the State's woodland area is now as great as it should be, and because it is easier, cheaper, and, for the present, better to make good forests out of the abused and neglected natural forests. To do this requires, in most cases, no outlay; simply protection against fire and proper thinnings at the proper time are enough. The result will rarely be as good, silviculturally, as from a planted forest, but the crop will come quicker and it will cost less.

Where planting is proper. There are places and conditions, however, that justify planting; they are where land cleared for cultivation or pasture is found unfit, or is no longer wanted, and where forest is desired for pleasure or to simplify the administration of an estate (Fig. 1). In the first case the land, being fit for nothing but forest—true forest soil, would naturally have a low value; a plantation therefore should be expected to yield a profit. In the latter cases satisfaction rather than profit would be the object.

Underplanting, or filling gaps, in woodlots is often advisable. The procedure is the same as in open plantations but greater care in the choice of species is required on account of the deficient light afforded—see tolerance, p. 9.

Shade trees not considered. The present discussion deals solely with the production of timber. Beauty and shade are entirely apart.

NO QUICK RICHES.

Intending forest planters are reminded that an investment in forestry will yield returns in proportion to the skill and wisdom that underlie it; that the income from a plantation may equal from four to eight per cent., compound interest, yet can rarely be more because there is a limit to the rate at which trees grow. **Sure, steady, moderate returns**, rather than quick riches are always the foresters aim. See p. 25.

CLIMATE AND SOILS.

The climate of New Jersey is everywhere suitable for many kinds of trees, and highly favorable to some. No part is too hot, too cold, or too dry to produce vigorous trees.

Its soils, on the contrary, are very diverse, and make necessary a careful adaptation of species to local conditions. No part of the upland, except the beaches and about 25,000 acres on "The Plains," is incapable of supporting a forest of some kind. Even the sandy soils of the pine section are less sterile than is commonly supposed. Solely for the guidance of tree planters the soils of the State may be divided into six classes. See p. 14.

WHAT TO PLANT.

When a forest is founded by Nature one wisely uses what he finds; when a forest is to be planted the aim should be to **choose the best** for given conditions.

Pure or mixed forests? Many foresters advocate mixed plantings (two or more species) upon the ground that that is Nature's way, that one species helps another, that insects and disease do less harm than in pure (one species) forests. All these arguments have weight, yet most authorities now favor comparatively small groups of a single species, each group representing the fittest tree when climate, soil, markets and all other factors are considered. Under this rule pure forests of several hundred acres may be established. For these reasons, and because it is hard to determine the character and proportions of a mixed forest without a careful study of local conditions, **only pure forest plantations are here considered.**



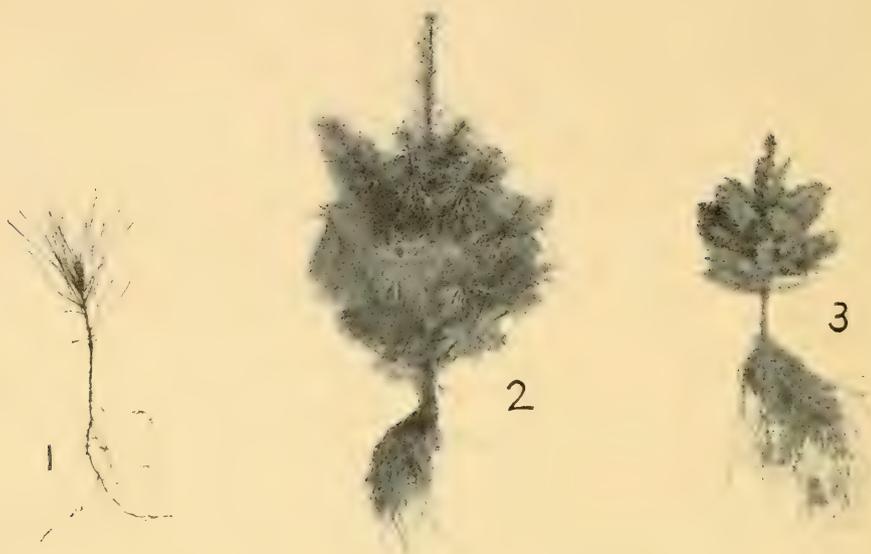


Fig. 2. TREES FOR FOREST PLANTING.

1.—Two-year-old Pine Seedling: It is healthy but not sturdy and has long slender roots. 2.—Four-year-old Pine Transplant: Vigorous, sturdy, well-compacted roots. 3.—Four-year-old Spruce Transplant: Not so large as the pine but capable of making a good growth.



Fig. 3. A FOREST NURSERY.

Scotch Pine at right, Norway Spruce, left. All two years old.

Evergreens or deciduous trees? An impression prevails that black walnut, white oak, black cherry, hickory, etc., are the most profitable trees to grow because their woods bring high prices. If the available land is suited to these trees it may be so used, yet such trees grow well only on strong agricultural soil of which there is, or soon will be in this State, none to spare. If we deal with true forest soils the conifers or **evergreens will yield more** per acre and year **than any others**. Pine of some sort is the world's most valuable wood, and always will be, because it satisfies most needs. Pine is best for planting in South Jersey because it is suited to the sandy soils, and it is best for planting in North Jersey because it produces more wood in less time than any deciduous tree. Spruce and fir are almost as valuable, and may be used as variants.

Tolerance. In forest planting, as in every branch of silviculture, the innate qualities of each tree species with respect to sunlight must be considered. Some; pines, ash, cottonwood, will endure little shade from other trees; they are called light-requiring or intolerant: others; spruce, fir, beech, are less particular and are called shade-enduring or tolerant (of shade). Tolerant trees when well grown always have more branches than intolerant trees, but more of them can thrive on a given area. An intolerant species must never be planted where it will lack light.

Quick growers. By all means use the species that will give quickest returns, but bear in mind that rapid growth is usually a response to stimulation through fertile soil, abundant moisture, excess of warmth, etc. Cottonwood grows rapidly in moist soil; it will fail where it is dry. Catalpa requires warmth, fertility and moisture for its full development. White pine thrives on a medium soil, yet on poor soil may fall behind pitch pine.

Nut Trees. Nut culture is not forestry, but a branch of horticulture. A tree developed for fruit has too much crown to produce good lumber; one grown tall and straight for lumber has too little crown to yield much fruit. Dismiss, therefore, all thought of combining the two crops. Let fruit (including nuts) be grown where that is likely to be profitable and the trees can be given the care that they need. Trees for lumber are satisfied with poorer soil and much less care. Of course, fair crops

of nuts may be, and often are, produced by forest trees.

Choice of Species. For most situations in New Jersey let the choice be limited to the following species. Their qualities and values are known; others may be as good, but are less sure.

White Pine. (*Pinus strobus.*) This is unquestionably the most promising tree for forest planting. Its silvical qualities adapt it to any but the poorest soils, its growth rate is high and tolerance considerable. All this results in a large timber production at a comparatively early age. A yield of 30 M board feet per acre at 50 years is not excessive. The one drawback is that a dangerous disease threatens the species. For the present it is recommended that white pine be planted in moderate quantity only.

Red Pine or Norway Pine. (*Pinus resinosa.*) A tree that in many ways promises to be quite as valuable as white pine. Its wood is a little heavier, but is also stronger. The tree is not so rapid a grower, and in maturity the forest is less dense, but the individual trees are apt to be taller and their stems clearer. A yield of 30 M board feet per acre at 60 years may be expected. The tree has no dangerous enemies.

Scotch Pine. (*Pinus sylvestris.*) This is the common pine of Europe. It thrives on good soil, and makes a fair growth on the poorest. It is especially vigorous when young. The wood is practically like that of red pine, consequently sure of a market in any form. A yield of 25 M board feet per acre at 50 years should be obtained from a plantation established under fair conditions.

Austrian Pine. (*Pinus laricio.*) A much heavier-set tree than any of the others, and generally appreciated for its good looks. The species is adaptable to poor soils, especially limestone rocks. The stem cleans about as well as white pine. The yield is somewhat less.

Pitch Pine. (*Pinus rigida.*) The common pine of South Jersey and of the mountain ridges in North Jersey. It is by no means the valueless tree that many imagine. The wood is resinous, but strong and fairly durable, and is in demand always for construction lumber and box boards. The rate of growth depends largely upon the soil. On poor sand it is naturally relatively slow, but its great value is that it is highly fire resist-

ant. The tree should be fostered wherever found and may be planted on land too poor for other species, or where the fire risk continues.

Loblolly Pine. (*Pinus taeda.*) A tree native of the Southern states, where it grows with marvelous rapidity. Recent experiments indicate that it can be grown successfully in South Jersey and in sheltered situations, but for the present it is recommended only for experimental planting.

Shortleaf Pine. (*Pinus echinata.*) The species found in Central and South Jersey, usually mixed with oaks, on the better soils. It is comparable in most respects with red pine, and in South Jersey may be planted as an alternative.

Norway Spruce. (*Picea excelsa.*) The common spruce of Europe. A tree of great economic value because its wood is sought for paper pulp as well as for lumber, and because, by reason of its tolerance, it is able to grow in close stands. It requires fairly strong soil, and thrives on ground much moister than is acceptable to any of the pines. (It will not grow where the ground is constantly wet.) This species is preferable to any of the native spruces. The average yield on suitable soil is about 30 M board feet at 60 years.

Douglas Fir. (*Pseudotsuga taxifolia.*) Stock from Rocky Mountain seed only should be used. That from Pacific Coast seed is apt to be frosted. The tree grows at about the same rate as the Norway spruce, though the stands are not quite so dense. The wood is tough and strong, comparing favorably with red pine or shortleaf pine. From the best information available, a yield of 25 M board feet at 60 years should be obtained on fair soil.

European Larch. (*Larix europaea.*) A tree especially valuable on account of the durability of its wood. Unlike the Eastern American species, it requires well drained as well as fairly strong soil. It is advised for planting where the extinction of chestnut is likely to create a demand for posts, poles, etc. A yield of 20 M board feet at 60 years may be expected.

Balsam, Fir. (*Abies balsamea* or *Abies pectinata.*) The first is the native species; the second the European. They are valuable on account of their adaptability to moist land, high degree of tolerance, and production of a wood that is about as useful

as spruce. In many situations the plantations may be made with a view to marketing Christmas trees, for which either species is preferred. A mixture of balsam and spruce with a view to removing the former at 10 or 15 years, leaving the latter to grow to timber size, would often prove advisable.

Cottonwood. (*Populus deltoides.*) The so-called Carolina poplar, a tree of very rapid growth on moist soil—of little value where it is dry. It should be planted not less than 10 feet apart, either pure or mixed with a more tolerant species suited to the same conditions. A yield of 25 M board feet in 30 years may be expected.

Red Oak. (*Quercus rubra.*) Probably the most promising deciduous tree for soils of moderate fertility. Its wood has a recognized value for many purposes, and apparently is the most available for railroad ties. A yield of 20 M board feet, or 700 railroad ties, per acre in 40 years is possible.

Tulip Poplar. (*Liriodendron tulipifera.*) The most valuable soft wood deciduous tree. It requires strong, well-drained soils, but when planted in such situations grows vigorously. As the wood is used generally for cabinet work and fine box boards, trees less than 16" diameter, breast-high, have comparatively little value. Properly made plantations should yield 30 M board feet per acre at 50 years.

White Ash. (*Fraxinus Americana.*) This tree grows vigorously on ground too wet for cultivation. Its wood is in constant demand on account of its toughness and elasticity. As sapwood is even more valuable than heartwood, the trees can be marketed when comparatively young. Ten M board feet, or 20 cords, at 25 years are easily possible.

Hickory. (*Hicoria laciniosa*, [shellbark,] *H. alba*, [bullnut,] *H. glabra*, [pig nut.]) The first grows on moist land, the two latter on drier ground, but all require considerable fertility for a satisfactory development. The wood is highly valuable for vehicles and tool handles, and is preferred when young rather than when old. Where conditions are favorable, no crop is likely to be more valuable than one of hickory. It will usually be marketed in the form of billets and measured by the cord. A yield of 15 cords in 25 years may be expected.

Basswood. (*Tilia americana.*) A tree in many respects sim-

ilar to tulip poplar, though rather less rapid in growth. It may be planted as an alternative or variant.

Locust (*Robinia pseudacacia*) is in demand everywhere for posts and railroad ties. The trees grow with marvelous rapidity for a few years on any but the poorest soils, but soon slack up. They are, moreover, almost invariably attacked by a boring insect. Plantations should be made with a view to harvesting the crop at about 15 years of age. Two thousand posts per acre is a fair yield.

Trees not recommended. A few trees entirely unfit for economic planting in New Jersey are so persistently boomed that their real qualities should be known.

Catalpa. Grows very rapidly on rich, moist soil and in a mild climate. In North Jersey its late growth is apt to be frozen; in South Jersey only the best soils are fit. Its wood is valuable only for posts and poles, being very durable, but weak.

Black Walnut. The wood is valuable only when cut from the heart of large, old trees. A tree 40 years old might be 12 inches in diameter yet contain only a 4-inch cylinder of brown wood. The sapwood of young black walnut is very wide, light in color and unmarketable.

Silver (White) Maple. The tree requires good soil, while its wood is weak, perishable and of little value. In fact, no maple is worth planting for lumber in New Jersey.

Eucalyptus. No species is adapted to conditions in this State. The quick growing kinds are as sensitive to frost as orange trees.

FOREST PLANTING.

SPECIES RECOMMENDED FOR VARIOUS LOCATIONS.

Poor Soil

Dry sand with little humus. (Natural Pitch Pine land.)

Very stony ground with little soil of any kind.

Pitch Pine
Austrian Pine
Scotch Pine

Medium Soil

Sandy or gravelly loam, dry with little humus. (Natural Chestnut Oak land in South Jersey.)

Ground of any kind naturally fresh, but exhausted by cropping or by fire. (Stones need not be considered.)

White Pine
Red Pine
Shortleaf Pine
Austrian Pine
Scotch Pine
Pitch Pine

Norway Spruce
(Avoid South slopes)
Douglas Fir
European Larch
Silver Fir
Balsam

Tulip Poplar
Red Oak
Black Locust

Cottonwood
White Ash
Hickory
Basswood

Good Soil

Loam with some humus. (Good arable land.)

Rich ground with standing water at times.

Stones need not be considered.

Any tree on the list

Norway Spruce
Balsam
Cottonwood
White Ash
Shellbark Hickory
Basswood

HOW TO ESTABLISH A FOREST.

As every item of cost in growing a forest must be carried as an investment at compound interest until the timber is mature, it is important to save every possible expense.

Sowing Seed. The lowest initial cost is found when seeds are sown on the ground, yet neither that method nor planting the seeds in prepared spots gives good results. Birds, mice, dry weather and many adverse influences make it advisable to start with sturdy young trees.

Best to Plant Small Trees. These may be grown in a home nursery or bought. Unless the quantity wanted is great, the latter is the better plan and as cheap in the long run. Evergreens, in particular, require much skill to grow successfully.

Preparing the Ground. Though trees undoubtedly grow better when planted in worked and fertilized soil, the practice is to omit everything of the kind on account of its cost. If the ground is very weedy or covered with brush, it may be mowed and burned over; that is all.

Size of trees. There is no economy in large trees; the only advantage they possess is that the plantation shows sooner. On the other hand, very small trees are handicapped by the weeds. A safe rule is to use plants about a foot high. Deciduous species may be larger, evergreens smaller. Of the latter those that have been transplanted are stronger and better rooted than seedlings and are to be preferred unless the cost is too great. See Fig. 2.

How to Order Trees. If the number needed is not over five thousand, buy trees of the size required for planting and have them delivered at the time they are to be set. If the quantity is large, it may pay to get small seedlings and cultivate them for a year or two in a nursery (see p. 21). The latter plan has the further advantages that it produces strong, sturdy trees, and insures their being on the ground exactly when they are wanted.

How to Handle Trees Before They Are Planted. When a tree is out of the ground its roots must **never become dry**. It is especially important to guard evergreens since the foliage is active at all times and the draft upon the root moisture therefore con-

stant. Deciduous trees without leaves are less sensitive. In foliage they should never be moved. Nurserymen now make it a rule to leave a quantity of earth about the roots of all evergreens over 18 inches high and keep it in place by a piece of sacking (ball plants), but this is not necessary with smaller plants if the roots are kept moist. When the box or package arrives, open it at once and thoroughly wet the contents. If planting is to be delayed more than forty-eight hours, take out the plants and heel them in in a convenient place to stay until wanted.

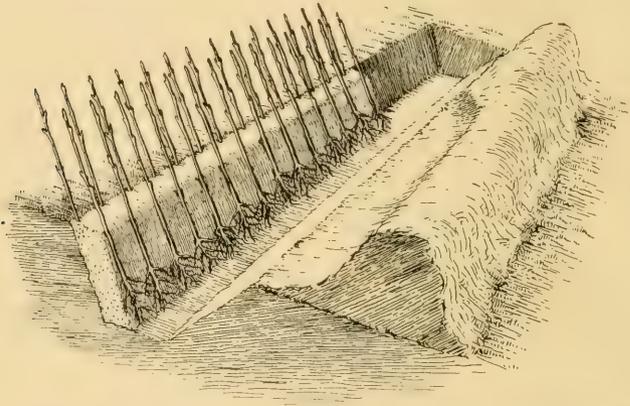


Fig. 4. Heeling in Young Trees. A trench properly made and two layers of deciduous trees in place; the first is covered in; the second ready to be covered. Evergreen trees should have none of the foliage covered.

Heeling In. This simply means putting a tree in the ground temporarily so that its roots shall not become dry before it can be regularly planted. With a number of trees to heel in, dig a trench in moist soil. Let the front of the trench be on a 45° slope and somewhat deeper than the length of the tree roots. Then loosen the tree bundles and spread the trees along the sloping wall in a single row and an inch or two apart. Cover the roots and lower stems with earth taken from the trench and tamp it down firmly so that every root is embedded. Successive layers of trees may be put one on another, with two or three inches of earth between, if the quantity is too great for a single row. If dry weather comes, wet the earth freely. Trees of any kind can be kept in this way several weeks without injury.

Spacing. The proper interval between planted trees depends upon the habit of the species, the strength of the soil, the expected life of the plantation, etc. In this part of the country it is most usual to space 6 ft. by 6 ft. in squares. Cottonwood should have a little more room, locust a little less. The aim is to give each tree room to develop a good-sized crown, yet not so much that it will have big lower branches, or the plantation need thinning before the stems are large enough to be salable. Straight rows equally spaced, thus,



Fig. 5. Diagram Illustrating Tree Planting in Squares.

are better than "staggered" rows or triangular spacing, thus,

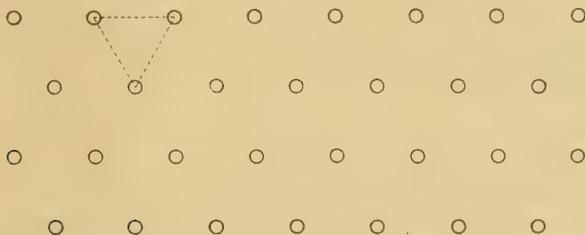


Fig. 6. Diagram Illustrating Tree Planting on Triangular Plan.

because removals can be made more uniformly when the time for thinning comes. Wider intervals between the rows than within the rows are justified only when one element in a mixed plantation is intended to be removed early.

TREES PER ACRE AT VARIOUS SPACINGS.

3	feet	x	3	feet.	.....	4840	trees
4	"	x	4	"	.....	2722	"
5	"	x	5	"	.....	1742	"
6	"	x	6	"	.....	1210	"
8	"	x	8	"	.....	680	"
10	"	x	10	"	.....	435	"

Planting (Outplanting). It is well to work systematically though no more than a couple of thousand trees are to be set. As soon as the trees are brought on the ground mix a "puddle" and put the roots in it, leaving the tops in the air. "Puddle" is simply thin mud, preferably made of clay and water. It can be mixed in a tub or in a shallow pit. Provide baskets lined with wet moss or burlap, or pails, to carry the trees, and a heavy mattock or grub hoe for each planter—that is all. Baskets are lighter. If mattocks are not available, spades may be used, but not to dig holes; that costs too much, a cleft in the ground is enough. If the turf is close, or weeds very dense, "scalp" a square foot of ground where each tree is to stand.

Clefts. A satisfactory cleft is most easily made by driving a hoe or mattock, having a blade nine or ten inches long and five inches wide, deeply into the ground, raising the end of the handle and slightly twisting it to loosen the earth below, then lifting the loosened clod an inch or two as the mattock is withdrawn.

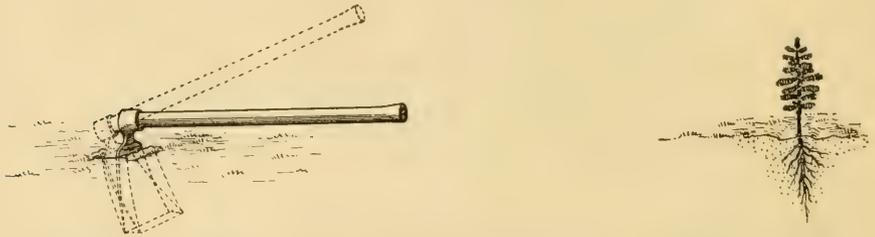


Fig. 7. Cleft Planting. The mattock should be driven in as shown by solid lines, then raised, as shown by broken lines, before it is withdrawn. The tree at right shows how the roots are embedded when cleft is closed.

A spade driven straight down and then worked back and forth from the handle serves the same purpose, though less speedily.

Crew. Crews of two planters and one boy to hand trees to them, with a man to set the line stakes for several such crews and to puddle the trees, are most effective.

Lining-out. Let the line man set two stakes in each line, one at the edge of the plantation, the other 50 feet or more inside it. The planters then take their places at the opposite side of the plot and in line with the pairs of stakes.

Planting. Each planter sights over his two line stakes and drives his mattock into the ground at the proper point. After raising the handle, he slips one hand along to the head and with the other receives a tree from the basket boy. Then as the mattock is lifted with one hand the tree is put into the cleft with the other, the mattock is removed and the cleft closed with a stamp of the planter's heel. To spread the roots as much as possible, and not bunch them, it is well to put the tree deep into the cleft and before stamping withdraw it until the collar (the junction of stem and root) is about one inch below the ground surface. **Two things must be observed:** have each tree stand a little lower than it did in the nursery—never higher; be sure the earth is set close about the roots and that the tree stands fairly upright.

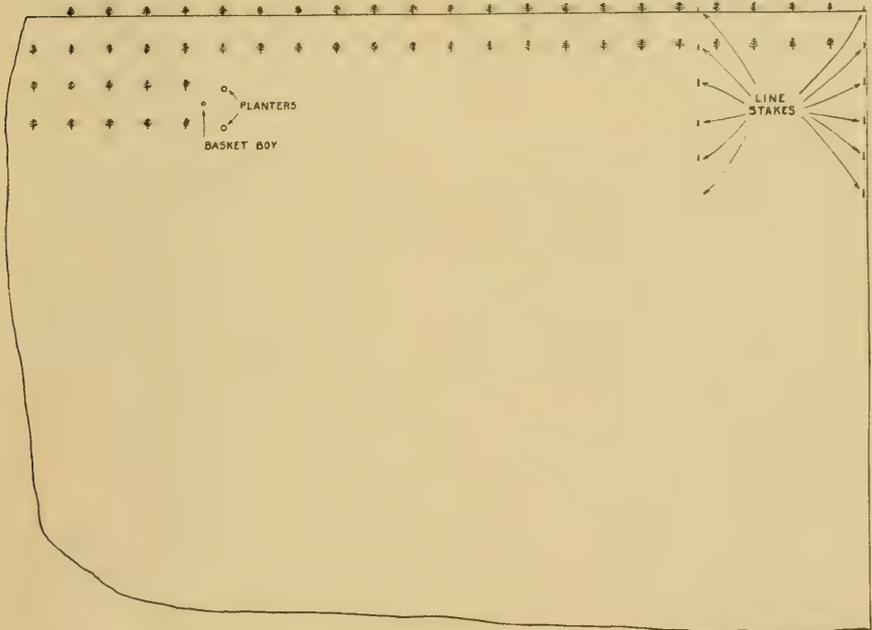


Fig. 8. Diagram of area to be planted. Two rows are finished, the planters are at work on two more. Line stakes have been set for six rows.

Intervals. After the first tree is set let the planter move forward the required distance and again sighting for his line, make his second cleft, and so on. It is always possible to approximate the required distance by pacing, by adding the length of the tool or of the tool and arm, to one, two or three steps. A six-foot interval can be fixed by taking one step forward and, with both feet set, making a mattock stroke at arm's length. It is not necessary to attain precision in line or interval; slight irregularities will be lost as the trees grow.

Speed in Planting. With the help of a line man and basket boy, two planters should set 200 trees per hour unless the ground is very stony or heavily turfed. One man doing all the work himself should average 600 trees a day. But do not acquire speed at the expense of good work. Watch the planters that they do not get careless and leave the trees bent or half embedded. Better not plant at all than invite failure through carelessness.

SUBSEQUENT CARE.

A forest plantation ordinarily needs no cultivation or special care. Fires must be kept out, of course, and stock also, but no expense for culture is warranted unless more than the economic production of lumber is involved.

Cutting Back. An exception to this rule is made when the growth of deciduous trees is slow. If each tree is cut off just above the ground the succeeding shoot is stronger and ultimately taller than the original would have been.

Replacement. If as many as 30 per cent. of the trees die the gaps should be filled within two years. If the loss is less, and is fairly well distributed, filling is ordinarily not done.

Cleaning. When a plantation is five or ten years old, sometimes earlier, it may be necessary to go through it and cut out brush, tree weeds and other undesirables. This should be done always, and only, when such growth interferes with the free development *upwards* of the planted trees. Keep the crowns of the young trees free to the sunlight; let low-growing brush and weeds alone. They stimulate height growth and shade the ground.

Thinning. No plantation made as here directed will need thinning before it is twenty years old. When the time for that comes further advice should be sought.

TIME TO PLANT.

In this climate early spring, as soon as the frost is out of the ground, is best. Be ready so that no time need be lost. Deciduous trees should never be taken from the ground while their leaves are on. Evergreens can be, and often are, planted successfully in late summer and early fall, but there is always danger that the winds of winter, often very dry, will put too great a strain upon the weakened root system of any tree that is moved in the fall. Cloudy or wet weather is always better than bright sunshine.

A FOREST NURSERY.

Small trees can now be bought at prices so low that it rarely is advisable to grow them from seed. But one can save much money, and have the trees when they are wanted, by establishing a transplant nursery.

Location, Soil. Choose a spot as for a garden; rich, warm, gently sloped and, if possible, with water for irrigation so that drouth shall not cause loss. In the spring, work the ground and fertilize it as for corn.

The Kind of Plants to Buy. Deciduous trees should be one year old rather than more. They are then from 4 to 16 inches tall. As evergreen trees of the same age are rarely over 5 inches tall, often not more than 2 inches, it usually pays to get two-year-olds.

Planting (Transplanting). When the young trees are received, care for them as directed on p. 16. When ready to plant, make furrows 18 inches apart with a hand-plow, going over each line twice if necessary to get the required depth. Or, if the soil is moist and compact, make a long cleft with a spade along each line. This method is often better than furrowing because the opening is deeper and the roots are more easily covered.

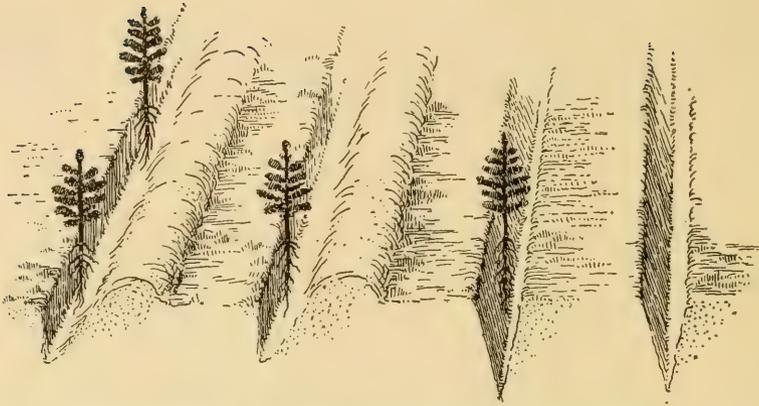


Fig. 9. Furrow Planting and Slit Planting. At left the earth is shown as opened by a plow with trees set against the vertical sides but not covered in. At right slits have been made with spades to receive the trees.

Let each planter then take a pail partly filled with trees whose roofs have been puddled as directed on p. 18. Beginning at one end of a row, he then sets the trees by hand about 6 inches apart. If furrows have been made, each tree is set against the vertical side and the earth scraped over and packed about its roots. If clefts, the tree is pushed down as far as it will go, then withdrawn until the collar is level with the ground surface and the cleft closed. As always, it is important to spread the roots as much as possible, not buch them, and to embed them firmly. See p. 19. After the planting is done, run a wheel hoe over the rows to close all gaps and level the ground.

Cultivation. Treat a tree nursery exactly like a garden. The planting method indicated implies the use of a wheel hoe. Keep the surface soil pulverized and destroy all weeds. Cease cultivating about August 20 so that growth may be checked and the shoots have a chance to lignify before frost comes. The weeds that grow after that time will help to shield the little trees over winter. If some of the trees are lifted by frost, as often happens when they are very small, they must be set back at once.

The Second Year. After the trees have been in the nursery a year one of three things is to be done. 1. Leave all to grow another season. In this case remove all weeds and trees that have died and continue the cultivation. This will be the rule where small evergreens are concerned. It is good practice if the





Scotch pine 7 years old, 5 feet high.



Locust 6 years old, 14 feet high.



White Ash and Red Oak 7 years old,
4 feet high.



Beech 7 years old, 2 feet high.



Scotch pine 6 years old on a water
shed.



Pitch pine 2 years old newly planted.



Jack pine filling a gap in a forest.



White pine 30 years old recently
thinned.

FIG. 10. EXAMPLES OF PLANTED FORESTS.

land to be planted is weedy and strong plants are needed. Deciduous trees can often be induced to grow more vigorously by cutting off the main stem just above the ground. A sturdy sprout soon replaces the first growth. 2. Take everything for out-planting. This will be the rule with most deciduous trees as they should be large enough. Evergreens may have to stay. 3. Remove the well grown trees for out-planting and leave the smaller ones. This is always good practice if growth has not been uniform, as the weaklings then have a better chance.

Purpose of a Nursery. It is well to remember that the object of nursery treatment is to produce trees that are healthy and vigorous, that can be transplanted safely and that will give quick results in their permanent places. This is attained in commercial nurseries by constant care and thorough cultivation. Trees in a private nursery require no less.

THE COST OF A PLANTATION.

It is self-evident that a plantation can be made to cost more than it is worth—by using big trees, by spending more time than is necessary. It is quite as easy to do the work so hastily that there will be no permanent result. The necessary outlay includes only the cost of trees, delivery, labor in planting, and sometimes a charge for removing brush and putting the land in shape. Fair average costs may be estimated as follows:

COST OF PLANTED FOREST—PER ACRE.

Trees set 6 ft. x 6 ft.—1210 per acre.	Ordinary Conifers.		Deciduous
	4-year transplants 8"-12" tall	3-year seedlings 5"-8" tall	Trees. 1-year seedlings 4"-8" tall
	(at \$10 per M.)	(at \$4 per M.)	(at \$3 per M.)
Trees	\$12.10	\$4.84	\$3.63
Freight & hauling	1.00	.75	.75
Planting time at 20c per hr.	4.00	3.50	3.00
Total	\$17.10	\$9.09	\$7.38

These costs can be materially reduced if the plants are bought small—2-year seedling conifers can be had for \$3.00 per M and cultivated one or two years in a nursery. See p. 21. Some

saving may also be made in planting cost, though too great speed always means poor work and ultimate loss. Of course, if home labor is employed, the entire planting cost may be ignored. On the other hand the cost may be considerably increased if many trees die and replacements become necessary. German forest plantations rarely cost less than \$10 an acre even with the low wages that prevail.

WHERE TO GET MATERIAL FOR FOREST PLANTING.

The State of New Jersey Furnishes No Trees to Forest Planters.

Young trees can be obtained from many nurserymen, although as a rule those who handle ornamental stock do not have the large quantities of small trees that often are wanted, or are not prepared to make the price low enough.

Buyers are recommended to satisfy their needs from nurseries within the State, and, other things being equal, from that which is nearest the planting site, or which will deliver the stock with least delay. In all cases it is advisable to stipulate that stock shall be taken from the ground of the vendor—not assembled from other nurseries.

The following carry a good variety in moderate quantities :

Bound Brook Nurseries,	Bound Brook.
The Shrewsbury Nurseries,	Eatontown.
The Elizabeth Nursery Co.,	Elizabeth.
Hiram T. Jones,	Elizabeth.
Joseph H. Black, Son & Co.,	Hightstown.
North Jersey Nurseries,	Millburn.
Arthur J. Collins,	Moorestown
Bobbink and Atkins,	Rutherford
Steele's Pomona Nurseries.	Palmyra
F. and F. Nurseries.	Springfield

As there are no nurseries in the State especially devoted to forestry stock, it is sometimes advantageous to buy large quantities outside—specifying always that the trees shall be grown by the seller, and that prices shall be based upon size, not upon age alone.

The following are trustworthy :

North-Eastern Forestry Co.,	New Haven, Conn.
D. Hill Nursery Co.,	Dundee, Ill.
Isaac Hicks and Son,	Westbury, L. I.
Biltmore Nurseries,	Biltmore, N. C.
American Forestry Co.	South Framingham, Mass.

THE PROFIT IN PLANTED FORESTS.

No planted forest can be a bonanza. Tree growth rarely averages more than six per cent. a year (wood volume), consequently the profit is determined by what the land will produce plus the increase in land and lumber values, minus the cost of care, taxes and compound interest on the investment. As land values and lumber values are steadily increasing, while planting costs are as low as they ever will be, almost any plantation made now on land of low value is practically sure to yield a fair profit. As forestry has no place on land that is valuable for something else, moderate returns are many times better than nothing at all. The following will show what may reasonably be expected, though it is emphasized that no one really knows what lumber will be worth forty or fifty years hence or what expense in the way of taxes, etc., may be involved. We can only make estimates, using the best knowledge that we have of rates of growth and the tendencies of lumber and land values, and of tax levies. The latter in particular are so uncertain that each owner must make his own estimate of the probable burden. For the sake of simplicity only initial costs and final yield are considered. In fact, there will be some intermediate costs and some income from thinnings. The latter, however, should more than balance the former. Immunity from fire and other dangers is assumed. Forestry is utterly impracticable where there are forest fires!

EXAMPLE 1.

EXPECTED PROFIT FROM A PLANTATION OF WHITE PINE OR AUSTRIAN
PINE ON ROCKY GROUND IN NORTH JERSEY—PER ACRE.

INVESTMENT.

Land	\$6.00	
Planting Cost	9.00	
		\$15.00 with compound interest at 5 per cent. for 40 years....=
		\$105.60
Taxes—1 per cent. on land value=6 cents paid annually for 20 years; then 1 per cent. on \$30 (average value land and forest)=30 cents for 20 years; all with compound interest at 5 per cent.....=		15.16
Protection=10 cents paid annually for 40 years with 5 per cent. com- pound interest		12.08
		<hr/>
Total investment		\$132.84

YIELD.

Sale Value after 40 years:		
20 M ft. lumber at \$10 per M stumpage		\$200.00
Land at original price		6.00
		<hr/>
Total		\$206.00
Less cost		132.84
		<hr/>
Net profit		\$73.16

Or, figured another way:

INVESTMENT.

Land	\$6.00
Planting Cost	9.00
Capital at 5 per cent. required to produce cost of Taxes and Protection as above	5.00
	<hr/>
Total	\$20.00

YIELD.

Sale Value after 40 years:	
20 M ft. lumber at \$10 per M stumpage	\$200.00
Land at original price	6.00
Capital for expenses	5.00
	<hr/>
Total	\$211.00

This \$211. equals 6 per cent. compound interest on the original investment
of \$20.

EXAMPLE 2.

EXPECTED PROFIT FROM A PLANTATION OF RED PINE ON SANDY SOIL
IN SOUTH JERSEY—PER ACRE.

INVESTMENT.

Land	\$5.00	
Planting Cost	8.00	
		\$13.00 with compound interest at 5 per cent, for 60 years....=
		\$242.84
Taxes—1 per cent. on land value=5 cents paid annually for 20 years; then 1 per cent. on \$20 (average value land and forest)=20 cents for 40 years; all with compound interest at 5 per cent.....=		35.80
Protection.—10 cents paid annually for 60 years with compound interest at 5 per cent.=		35.36
		Total investment \$314.00

YIELD.

Sale value after 60 years:		
30 M ft. lumber at \$12 per M stumpage.....	\$360.00	
Land at original price	5.00	
		Total \$365.00
		Less cost 314.00
		Net profit \$51.00

Or figured to show the rate of profit as in the first example:

INVESTMENT.

Land	\$5.00
Planting Cost	8.00
Capital at 5 per cent. required to produce cost of Taxes and Protection as above	4.13
	Total investment \$17.13

YIELD.

Sale Value after 60 years:	
30 M ft. lumber at \$12 per M stumpage.....	\$360.00
Land at original price	5.00
Capital at 5 per cent. required to produce cost of Taxes and Pro- tection as above	4.13
	Total \$369.13

This \$369.13 equals 5.25 per cent. compound interest on the original invest-
ment of \$17.13.

EXAMPLE 3.

EXPECTED PROFIT FROM A PLANTATION OF COTTONWOOD ON DISUSED
BUT SUFFICIENTLY STRONG LAND IN NORTH OR SOUTH JERSEY
—PER ACRE.

INVESTMENT.

Land	\$10	
Planting Cost	10	
		\$20 with compound interest at 5 per cent. for 30 years....=
		\$86.40
Taxes—1 per cent. on land value=10 cents paid annually for 10 years; then 1 per cent. on \$25 (average value land and forest)=25 cents for 20 years; all with compound interest at 5 per cent.=		11.60
Protection—10 cents paid annually for 30 years with compound interest at 5 per cent.=		6.64
		<hr/>
Total investment		\$104.64

YIELD.

Sale Value after 30 years:		
25 M ft. lumber at \$10 per M stumpage.....		\$250.00
Land at original price		10.00
		<hr/>
Total		\$260.00
Less cost		104.64
		<hr/>
Net profit		\$155.36

This may be calculated, in the same way as the two former illustrations, as equivalent to 8 per cent. compound interest on the original investment.

STATE AID IN FORESTRY.

To encourage the practice of forestry on private lands, 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 making recommendations for their management. Where cutting is necessary, a part of the trees to be felled will be marked to guide the owner in the removal of the rest. Advice in regard to markets will be given, but in **no case** will the forester have **part** or interest in a sale. Those who wish to undertake **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.

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 Commission 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. Public institutions, Shade Tree Commissions, etc., will be aided without charge. Inquiries by mail on any forest or shade tree matter will be carefully answered.

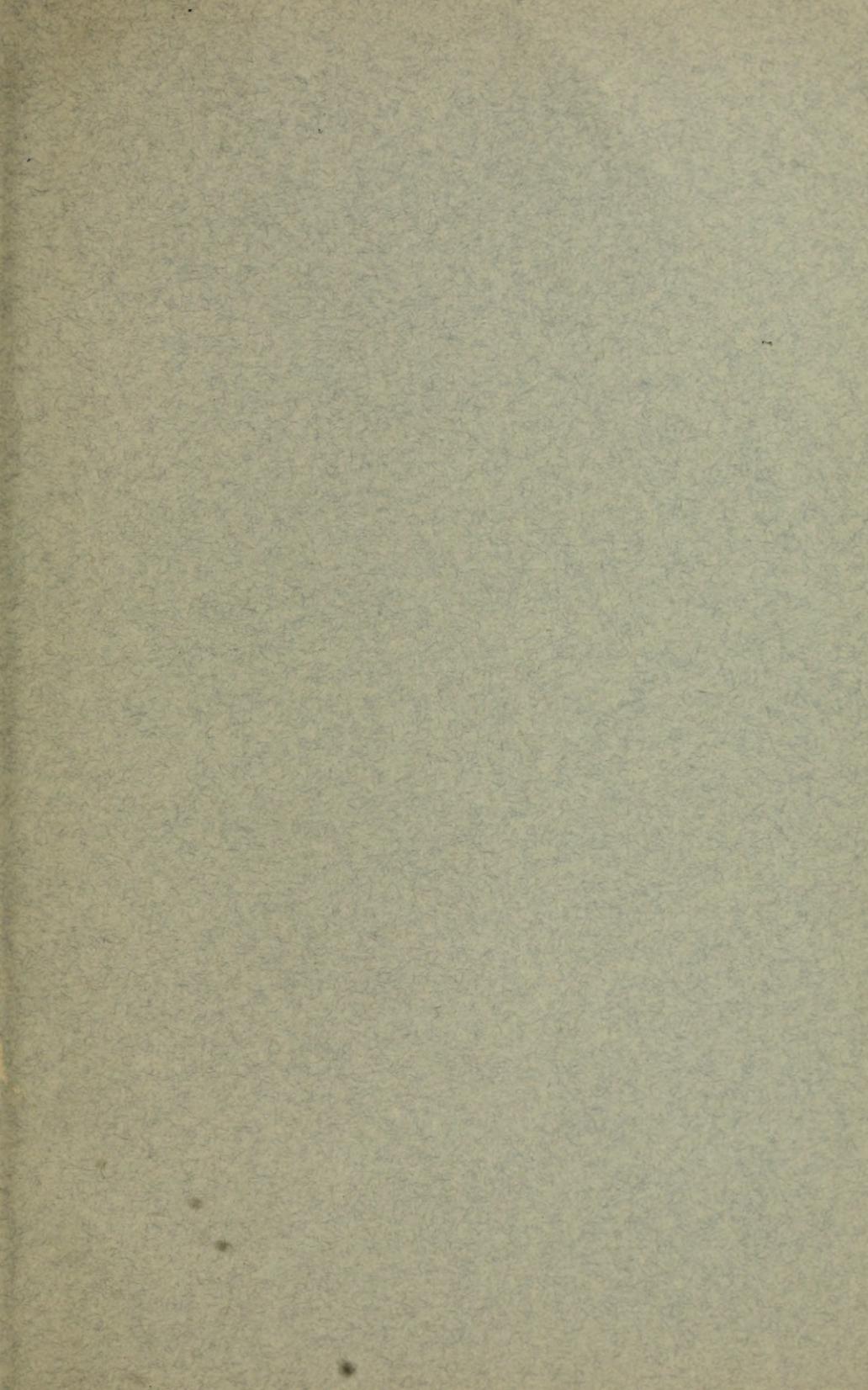
Write to the State Forester, Trenton, about anything relating to forests or shade trees—not fruit trees.

FOREST FIRES MUST NOT BE TOLERATED.

INDEX

	PAGE		PAGE
A			
Ash	9	Kind of plants to buy	15, 21
Ash, white	12, 14	L	
Assistance to forest planters	7, 28	Larch, European	11, 14
B			
Ball plants	15	Lining out	18
Balsam	11, 14	Locust	13, 14, 17
Basswood	12, 14	M	
Box boards	10, 12	Maple, silver	13
C			
Care of plantations	20	Mattocks	18
Catalpa	9, 13	Mixed forest	8
Cherry, black	9	N	
Choice of species	8, 10	Number of trees per acre ..	17
Christmas trees	12	Nursery, forest	21
Cleaning plantations	20	Nurserymen	24
Cleft planting	18, 21	Nursery, purpose of	23
Climate	8	Nut trees	9
Cost of plantations	23	O	
Cost of trees	23	Oak, red	12, 14
Cottonwood	9, 12, 14, 17	Oak, white	9
Cultivation	22	Ordering trees	15
Cutting back	20	Outplanting	18
D			
Deciduous trees	9, 15	P	
E			
Eucalyptus	13	Paper pulp	11
Evergreen trees	9, 15, 16	Pine	9, 10, 11, 14
F			
Fall planting	21	Pine, Austrian	10, 14
Fir	9, 11, 14	Pine, loblolly,	11
Fir, douglas	11, 14	Pine, Norway (See Pine, red)	
Fir, silver	14	Pine, pitch	9, 10, 14
Forest fires	25, 29	Pine, red	10, 14
Forest planting, need of	7	Pine, Scotch	10, 14
Forest planting, places for ..	7	Pine, shortleaf	11, 14
Forest planting, profit in ..	8	Pine, white	9, 10, 14
Forest soil	7, 9	Plantation, cost of	23
Frost	22	Planting	18, 19
Fruit trees	9	Planting crew	18
H			
Handling trees	15	Planting, forest (See Forest planting)	
Heeling in	16	Planting in triangles	17
Hickory	9, 12, 14	Planting, rate per day	20
I			
Intervals	17, 20	Planting speed	20
		Planting in squares	17
		Poplar (See Tulip and Cot- tonwood)	
		Posts	11, 12, 13
		Profit in planted forests	25-28
		Puddling	18
		Pure forest	8

	PAGE		PAGE
Q		T	
Quick growing species	9	Thinning	17, 21
R		Time to plant	21
Railroad ties	12, 13	Tolerance	9
Replacement	20	Transplanting	21
S		Tree growth	25
Seed sowing	15	Trees, cost of	23
Shade endurance (See Tol- erance)		Trees not recommended . . .	13
Shade trees	7	Trees, where to get	24
Size of trees	15	Tulip poplar	12, 14
Soil	8, 14	U	
Spacing	17	Underplanting	7
Spring planting	21	W	
Spruce	9	Walnut, black	9, 13
Spruce, Norway	11, 14	Where to get trees	24
State aid	7, 28	Y	
		Yield from plantations . . .	10, 11, 12



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