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1926 - [n.d.]

The Ailanthus Tree

TO A LITTLE AILANTHUS TREE

*You small ailanthus tree,
You gamin of the streets,
In barren ways,
Through scorching days,
From a six-inch square of earth
You wave green plumes in glee.*

*You child of cement streets
Of clamor, smoke and grime,
All plumed in green,
A forest queen,
To city folk you bring
The thought of far retreats.*

*They call you "Tree of Heaven,"
You gamin of the streets,
Who toss green smiles
Down arid miles,
A balm for dusty hearts,
The balm of God's own leaven.*

FLORENCE FINCH KELLY

THE AILANTHUS TREE
IN PENNSYLVANIA

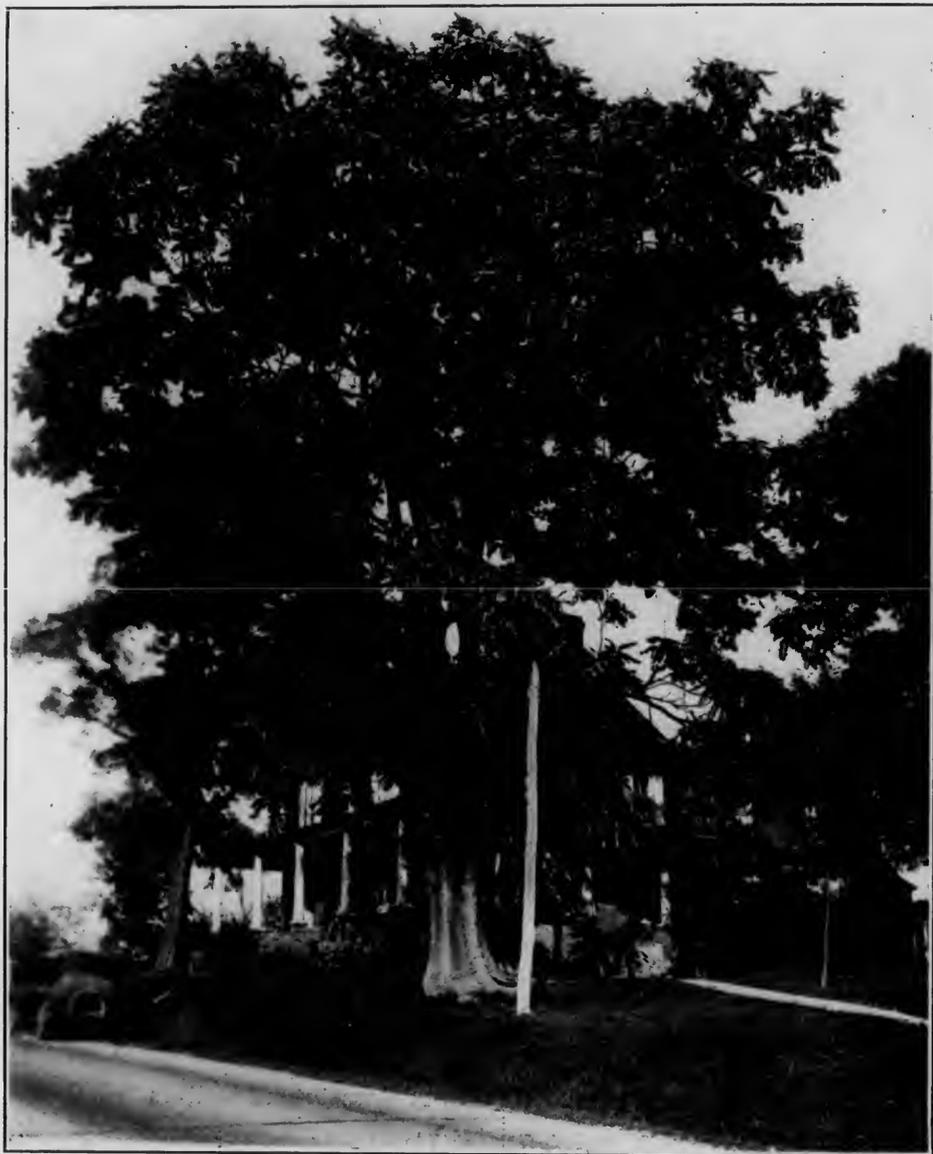
By
Joseph S. Illick
and
E. F. Brouse



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Pennsylvania Department of Forests and Waters
R. Y. Stuart, Secretary
Harrisburg, Pa.

January, 1926



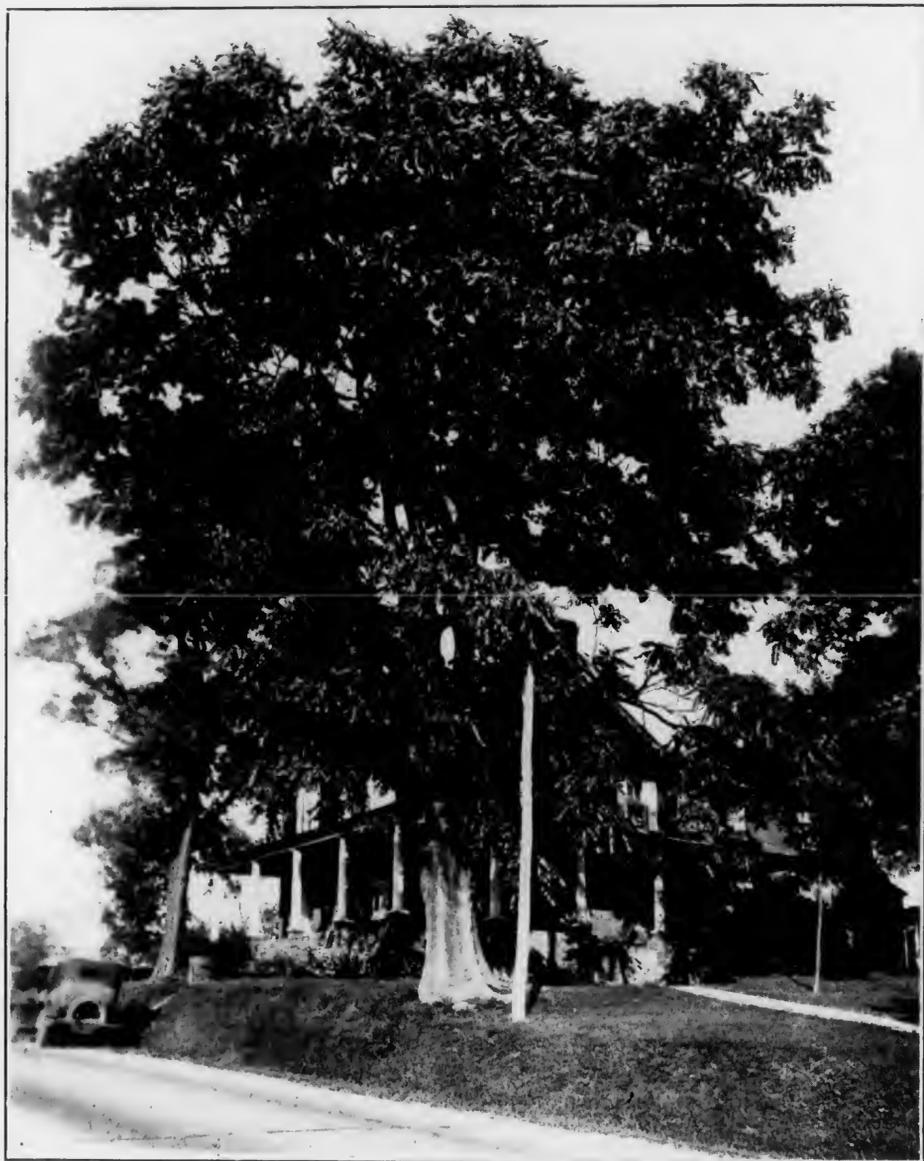
A Big Ailanthus at York Springs, Pennsylvania.

FOREWORD

Almost 150 years ago the ailanthus tree was brought to America. The first tree was planted in 1784 by William Hamilton in his garden called "The Woodlands," now known as "The Woodland Cemetery" bordering the campus of the University of Pennsylvania in Philadelphia. At first this interesting tree immigrant was planted exclusively as an ornamental tree. From the day of its first introduction the climate, the soil, and other growth factors, favored it. It was not long until specimen trees were growing in most of the southeastern counties of Pennsylvania. Later it was planted in western Pennsylvania, and now it is found in practically all parts of the State, but is not common in the highlands.

While man was a big factor in distributing the ailanthus throughout Pennsylvania, the tree itself has contributed much to the extension of its range. As soon as the trees planted in the early days reached maturity, they began to broadcast seeds far and wide. As a result of this wide seed distribution, trees began to spring up on a wide range of situations.

The ailanthus situation in Pennsylvania is serious. It is the only introduced tree that is competing vigorously with our native tree growth, and in this competition it appears to have a marked advantage. Unless a use is found for its wood, this tree will develop into a worthless forest weed and become a forest nuisance of the first magnitude. To check its growth is a difficult problem. It is far more practical to find a use for its wood than to attempt to control this ultra-aggressive tree. A general study of its wood characteristics suggested that it might be used in the manufacture of woodpulp. To determine the merits of this suggestion, a cooperative experiment was undertaken several years ago by the Pennsylvania Department of Forests and Waters and the Forest Products Laboratory, Madison, Wisconsin. The laboratory tests show that the wood is well adapted for the manufacture of pulp. In a number of ways it is superior to woods now used extensively in the manufacture of woodpulp.



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With the probability that ailanthus wood will be used in the manufacture of pulp, a study of the tree's growth and other silvical characteristics was undertaken. The conclusions are set forth in this bulletin. It is hoped that the results of this study will be of considerable value to forest land owners in Pennsylvania, and open a gateway to the profitable handling of this interesting tree immigrant.

JOSEPH S. ILLICK

THE AILANTHUS TREE IN PENNSYLVANIA

GENERAL DESCRIPTION

The ailanthus is an interesting tree immigrant. It was first planted in this country near Philadelphia in 1784. Later it was introduced in Rhode Island (1820) and at Flushing, New York. As early as 1841 this tree was common in the nurseries of the eastern United States.

The ailanthus is also called "Tree of Heaven" and "Chinese Sumach." Its Chinese name is "Chow Chun," meaning "The Stinking Chun." The common name "Tree of Heaven" has a curious history. It is said that this name was given to it as if the tree was accused of lacerating the heavens because of its great height. While in modern Chinese it is known as "The Stinking Chun," Chinese poets of older times spoke of it as "God's Tree."

Investigations show that this tree is a native of the Molucca Islands, about four degrees south of the equator and not far from Borneo. Although of tropical origin, its long cultivation in far northern localities in Asia, Europe, and America, has adapted it to temperate regions. It now has a wide distribution in China. In Pekin it is a favorite shade and ornamental tree.

Professor W. C. Lowdermilk of the College of Agriculture and Forestry, University of Nanking, Nanking, China, under date of October 13, 1924, writes: "Ailanthus is common in central China and very common about Nanking. It grows on a variety of soils, including heavy clay to loose rocky upland soils. The annual rainfall varies from 20 to 60 inches. It is a very persistent sprouter. In the nursery it makes remarkable growth the first year as well as later. Our beds of one year seedlings average 30 inches in height. The tree is used chiefly for shade; only occasionally it occurs in plantations. The wood is inferior, being brittle, non-durable, and splits easily."

Records show that the seed of ailanthus was first sent from China to the Royal Society of London in 1751 by the Jesuit missionary D'Incarville. These seeds were turned over to Philip Miller at Chelsea Garden and to Philip C. Webb at Busbridge near London, who planted them, and from them raised many trees. As early as September, 1782, the ailanthus tree grew on the outskirts of Utrecht, Holland. Articles published in 1783 and 1788 referred to it as growing in the

Dutch gardens. A description of it was published in Paris in 1788, where travellers now find it common in parks and along boulevards.

Ailanthus was recommended for planting almost without qualification in the early days of Kansas, but experience has shown that it is too tender for northern Nebraska and the Dakotas. It does not thrive in very dry situations and prolonged droughts are fatal to it. For fully fifty years ailanthus has been widely planted in California. In the Great Valley and the bordering foothills, it is a common tree about dwellings and in gardens. It is the only foreign tree that competes aggressively with the native tree growth of California.

Soon after its introduction into America, the ailanthus sprang into popularity as a street tree. Its rapid and luxuriant growth impressed the early nurserymen and its ability to thrive in very unfavorable situations, particularly in industrial centers, is responsible for its wide use. It was planted extensively in New York City, Brooklyn, and Philadelphia. In the center of Baltimore is a small park with driveways bordered with recently planted ailanthus trees. Today one finds it planted along streets of many eastern cities, and each year it is becoming more common in the rural sections of many eastern and mid-western states.

DISTRIBUTION IN PENNSYLVANIA

The earliest planting of ailanthus in Pennsylvania was in and around the city of Philadelphia. In 1784 the first tree brought to America was planted in an arboretum near the site now occupied by the University of Pennsylvania. Now the ailanthus occurs in all parts of the city and in Fairmount Park are small patches occupied exclusively by this aggressive tree. From Philadelphia the ailanthus extended its range into the interior of the State.

Each year the ailanthus is becoming more common in Pennsylvania. It is gradually extending its range and it is also becoming more common in places where it has been established for some time. Its occurrence coincides rather closely with the distribution of human habitation. In the populous regions and agricultural sections of the State this tree is common, while in the sparsely populated and mountainous regions it is very rare to absent. It is generally distributed throughout the southern, central, and southeastern parts of the State, excepting at higher altitudes and in colder situations. In a few places it has become very abundant.

Near Reading in Berks county, occur dense thickets and extensive patches. In the vicinity of Mont Alto, Franklin county, are growing a large number of trees under a wide range of conditions. Entire fence rows have been occupied by it to the exclusion of all other trees.

It has completely preempted vacant places on farm lands and in some places it is gradually pushing its way into the forest. It is common about many of the abandoned furnace properties of southern and central Pennsylvania. About Harrisburg in Dauphin county occur a large number of trees. On both the east and west shores of the Susquehanna River it is common. In the vicinity of Speecheville, Dauphin county, a short distance north of Harrisburg, and along the Susquehanna above the Clarks Ferry Bridge occur thousands of trees. Here are found some of the most thrifty young stands in the State.

Almost all of the larger trees occur in the southeastern, southern, and central part of the State. Here it is now making its best growth. Some middle-sized trees are growing in the western part, where it is now extending its range very rapidly. Locally about Pittsburgh it is becoming rather common. Only a few isolated specimens have been found in the higher mountains of the north-central part of the State, and it is generally absent in the higher elevations of the Alleghenies. Recently a small clump was found growing near the New York State line about one-half of a mile north of Sugar Grove, in Warren county, at an elevation of about 1,250 feet. Records show that Mr. Frank Miller, a local nurseryman and tree lover, planted a specimen ailanthus tree here about 35 years ago. From this single tree has developed a small clump that appears to thrive fairly well in this cold part of Pennsylvania. But extensive field studies show that it thrives best at lower elevations and in the milder part of the State.

INTERESTING STANDS OF AILANTHUS

Some interesting stands of ailanthus occur in Pennsylvania. One occurs on the Dauphin County Farm about two miles east of Harrisburg. It is almost a pure stand, for mixed with the ailanthus occur only a few cherry, ash, and several other kinds of trees. The stand covers about one-half of an acre. The trees range in age from 19 to 25 years with an average age of 22 years. Measurements of all the trees on this half of an acre give the following results:

<i>Breast-high Diameter (inches)</i>	<i>Number of Trees</i>	<i>Average Height (feet)</i>
1	2	10.0
2	5	11.6
3	11	16.0
4	14	22.7
5	13	32.8
6	22	36.3

Breast-high Diameter (inches)	Number of Trees	Average Height (feet)
7	25	46.1
8	19	45.7
9	18	50.5
10	22	50.5
11	7	44.8
12	7	48.0
13	2	47.0
14	3	47.3
15	3	54.0
16	3	47.3
17	1	65.0
Total	177	

The total breast-high basal area of the trees on this half acre is 65.3 square feet, which is the equivalent of 130.6 feet per acre. This compares favorably with other stands of young trees. Where the trees stand close to one another they are straight and their trunks are clear of branches for a considerable distance from the ground, but where they stand far apart their stems are limby and tend toward crookedness.



A Young and Thrifty Stand of Ailanthus, Dauphin County, Pennsylvania.

A small pure stand of ailanthus is growing along the Susquehanna Trail about one mile north of New Buffalo in Perry county. The trees border the highway on the east, and are mixed with black locust. Ten years ago both the ailanthus and black locust were cut. The

present trees are the result of stem sprouts and root suckers. They average eight years in age, have an average breast-high diameter of 3.4 inches, and average 32 feet in height. The dominant trees stand at the rate of 1,400 per acre. In addition there are 1,760 trees 1 to 3 feet high per acre.



In Summer the Ailanthus is Clothed with Foliage of Tropical Luxuriance.

On a farm about one mile southeast of Mont Alto, Franklin county, occurs what is probably the best young stand of ailanthus in Pennsylvania. The trees are growing near a sink hole in a fertile clay loam agricultural soil with a fair amount of soil moisture. When 6 years old these trees—all of sprout origin—had attained an average breast-high diameter of 2.6 inches, and an average height of 28.6 feet. A careful count showed the equivalent of 3,680 trees per acre with a basal area of 132.7 square feet per acre. In size these six year old trees compare very favorably with stands of other trees 15 to 25 years old. A permanent sample plot will be established in this stand for the purpose of making available accurate figures on the growth and yield of ailanthus in southern Pennsylvania.

LARGE AILANTHUS TREES

The ailanthus does not become so large as do the oaks, elms, and sycamores. It is a short-lived tree. When the trees become 3 feet in diameter, heart rot usually starts. Decay, as a rule, progresses

Breast-high Diameter (inches)	Number of Trees	Average Height (feet)
7	25	46.1
8	19	45.7
9	18	50.5
10	22	50.5
11	7	44.8
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rapidly. Practically all the larger trees are hollow, with only a shallow shell left on the outside. The older trees often fall before a wind storm and then their hollow interior is revealed. Ten of the largest ailanthus trees growing in Pennsylvania are listed in the following table:

Tree Number	Breast-High Diameter (feet)	Height (feet)	Height to First Branch (feet)	Location
1	3.5	65	10	Mooredale, Cumberland County
2	3.4	..	18	Five Forks, Franklin County
3	3.2	67	9	Mooredale, Cumberland County
4	3.2	65	18	Mooredale, Cumberland County
5	3.2	..	15	Waynesboro, Franklin County
6	3.0	90	20	Pine Grove Furnace, Cumberland County
7	3.0	68	8	York Springs, Adams County
8	2.8	52	10	Mooredale, Cumberland County
9	2.7	55	10	Mooredale, Cumberland County
10	2.5	63	16	Carlisle, Cumberland County



A Group of Middle-Size Ailanthus in the Humphrey Marshall Arboretum at Marshallton, Chester County, Pennsylvania. These Trees Range from Two to Two and One-Half Feet in Diameter.

What is probably the most interesting group of middle-size ailanthus trees in Pennsylvania stands in the historic Humphrey Marshall Arboretum in the village of Marshallton, Chester county. This is one of the oldest tree places in America, having been established

in 1773. A careful study of this ailanthus group shows that they are of sprout origin. They may be second or third generation sprouts that have developed from the specimen ailanthus tree that the famed botanist planted in his arboretum more than 125 years ago. There are seven middle-size trees in the group ranging from 2 to 2½ feet in diameter at breast-high.

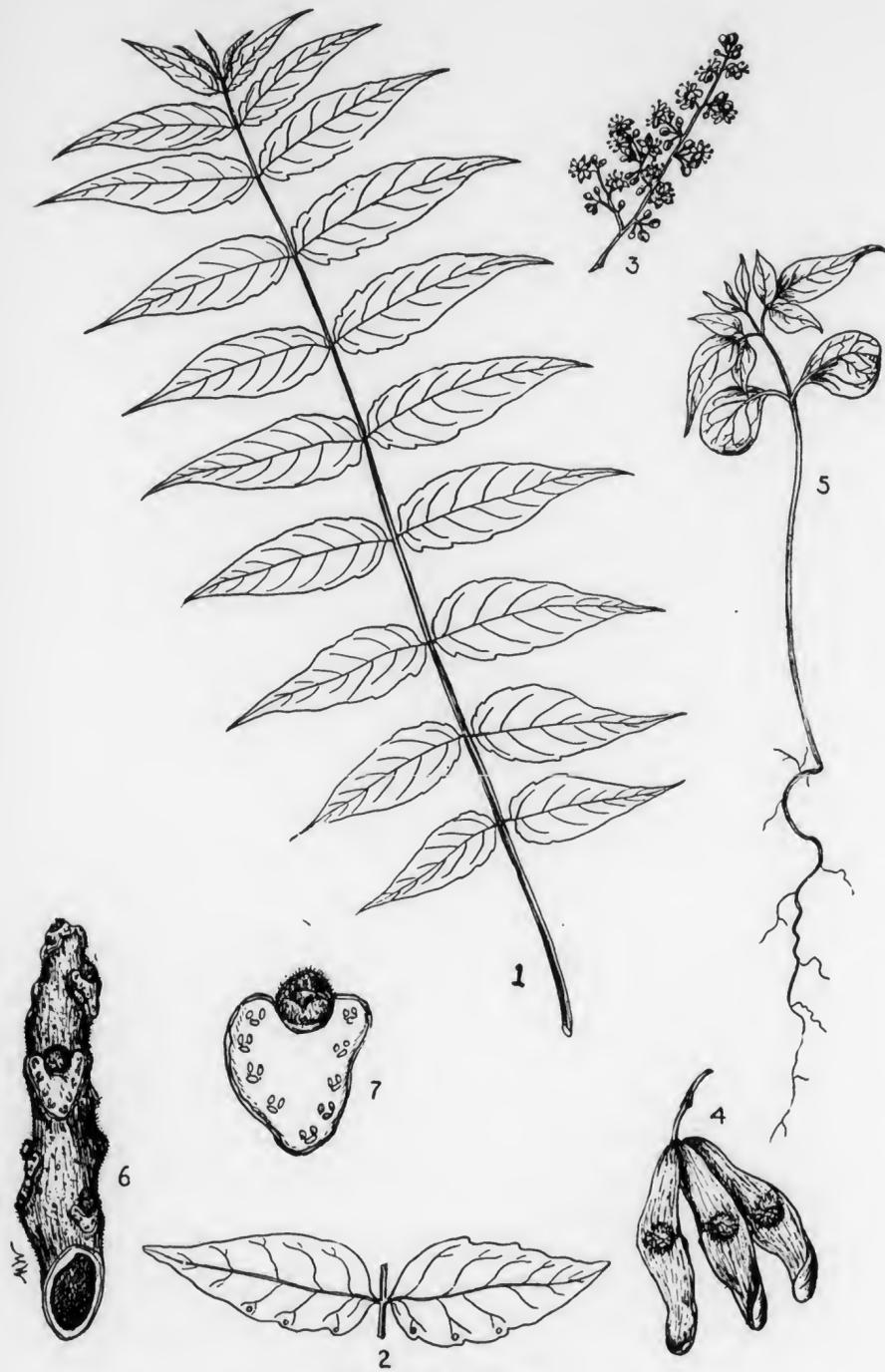
Practically all of the large ailanthus trees found in Pennsylvania occur in the southern half of the State. A group of large trees stands at Mooredale, Cumberland county, about 7 miles southwest of Carlisle. Five of these trees show a circumference at one foot above the ground of 14.9, 13.2, 12.5, 12.1, and 11.3 feet. There may be larger trees in the State, but no records of them are now available.

HOW TO RECOGNIZE THE AILANTHUS

The ailanthus is a strange looking tree. Just a glance at its luxuriant tropical appearance tells us that it is not native to Pennsylvania. In general appearance it resembles the walnuts and sumachs more closely than any other native tree. Its unusual appearance makes it rather easy to identify at all seasons of the year.

Its large tropical leaves, arranged alternately along the twigs and persisting until late in autumn, are unfailing distinguishing characteristics. They are usually 1 to 2 feet long, occasionally three feet. The writer measured a leaf on a vigorous shoot that was exactly 4 feet long. No other tree common in Pennsylvania has such large leaves. Each of the big leaves are made up of 11 to 41 egg-shaped leaflets. The leaflets are smooth along the margin except for a few tooth-like projections near the base. On the lower surface of these projections are usually found a few tiny dots. A close examination of these dots shows that they are glands. When crushed, the leaves give off an offensive smell.

In winter the ailanthus can be distinguished by its stout twigs which are covered with a fine down and dotted with small ochre-colored breathing pores. The twigs are stiff and practically all of them look upward toward the sky. This gives the tree a very bold appearance through the winter months when it is without foliage. The twigs are roughened by large heart-shaped leaf-sears and in the center of the twig occurs a wide light brown pith. In the notches in the upper part of the leaf-sears occur downy small buds. They are so tiny that it is often hard to see them. One wonders how such large leaves can come forth from such small buds. The bark on young trees is smooth, thin, and light gray. As the trees become larger, the bark becomes rougher and darker. The fissures are usually light in color and stand in strong contrast with the darker ridges. On middle-sized



THE AILANTHUS

1. A mature leaf, x 1/4.
2. Lower side of two leaflets showing dot-like glands, x 1/2.
3. Part of panicle of flowers, x 1/2.
4. Three winged seeds, x 1/2.
5. A seedling shortly after sprouting, x 1/2.
6. Section of a winter twig showing wide pith, large leaf-scars, and small roundish buds.
7. Winter bud and leaf-scar with small clusters of bundle-scars, natural size.

trees the bark is often marked by diamond-shaped fissures. On old trunks it is dark gray and sometimes black.

In the fall of the year seed-bearing ailanthus trees can be distinguished by their large seed clusters, produced in great numbers. Each seed cluster, usually from 5 to 7 inches long, carries from 500 to 1,000 seeds. Each seed consists of a little flattened nutlet surrounded by a flat, spirally twisted, paper-like wing about 1 1/2 inches long and one-half of an inch wide. The ailanthus has striking distinguishing characteristics at all seasons of the year, for it has few features in common with other trees. Meeting it just once means an acquaintance for life.

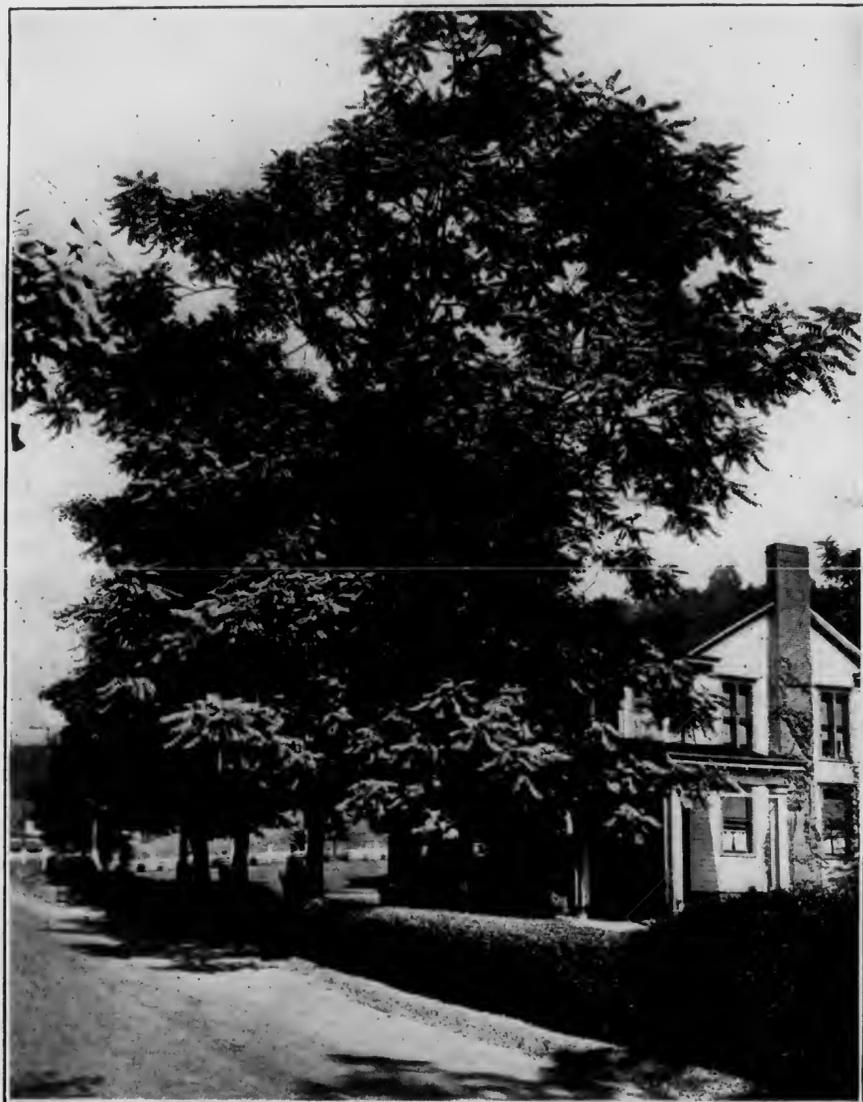
AN ATTRACTIVE ORNAMENTAL TREE

When young, the ailanthus is an attractive and distinctive ornamental tree. In summer it is clothed with foliage of tropical luxuriance. In the fall of the year the seed bearing trees bear seed clusters of blushing pink against the fern-like leaf masses. This tree bears two distinct kinds of flowers, namely, staminate (male), and pistillate (female). The two kinds of flowers never occur on the same tree. Trees bearing staminate flowers should not be used for ornamental purposes, as the odor of the flowers is unpleasant. The pistillate flowers have no objectionable odor. For ornamental planting pistillate specimens should always be selected. Single specimens of pistillate trees, especially when young or middle aged, make an attractive appearance. As soon as the trees reach middle size they should be replaced, since they deteriorate rapidly. The branches of the crown are very brittle and break freely. As a result of strong winds and snow pressure many trees develop an unshapely crown early in life. A popular use of this tree is to start a few specimens and cut them back each year. Under this treatment they send up vigorous shoots bearing leaves of great size and rare beauty. This is an excellent means of producing quickly a screen effect in many respects similar to a fern bed. When planted for ornamental purposes great care should be taken so as not to permit the trees to sucker freely. Only when the ailanthus is grown under controlled conditions does it add to the attractiveness of the home grounds.

HOW AILANTHUS REPRODUCES

Ailanthus possesses three important methods of reproduction. It sprouts vigorously, seeds freely, and produces suckers in great numbers. There are two kinds of ailanthus trees, namely, staminate and pistillate trees. The latter only bear seed. The seeds begin to develop in early summer and mature in September and October. They are

borne in large, dense, usually 5-panicked clusters. One thousand and one fruit clusters were counted on a tree 35 feet high and 12 inches in diameter at breast-high. An eight inch tree carried 884 clusters. A branch 15 feet long and one and one-half inches in diameter at the



When Young the Ailanthus is an Attractive Tree. Trees Bearing Staminate Flowers Should not be Planted for Ornamental Purposes. Their Flowers Have a Very Unpleasant Odor.

butt had 36 clusters. Four seed clusters of average size had 703, 831, 932, and 1,364 seeds. This gives a total of 3,830 seeds—an average of 959 per cluster. When fresh, 4,000 seeds weigh six and one-half ounces. After 4 days of air drying they weigh six ounces. It follows

that a tree 12 inches in diameter may produce a million seeds in a season. During the summer months and early autumn these fruit clusters are very attractive, bearing touches of yellow, red and brown. In fall at about the time when the leaves drop, the color of the fruit clusters is reduced to a dull pale brown. The clusters often persist far into the winter and some hang on the trees until spring. The seeds are surrounded by a thin membranous wing which is a great aid in scattering the light seed far and wide. The seed germinates freely. During the first year seedlings reach a height of 10 to 15 inches. Reports from China show that seedlings have reached a height of 30 inches during the first year. The trees of seedling origin usually become older and remain sounder than trees of sprout and root sucker origin.

Sprouting from the stump is this tree's commonest method of reproduction. The sprouts show a remarkable growth during the first three years. Successive cuttings appear to stimulate growth. Each time the trees are cut they appear to be re-invigorated. In a fence row near Mont Alto in Franklin county, that was clear cut in the winter of 1922-23, there were found in July, 1924, 17,860 2-year old and 10,019 1-year old sprouts per acre. The 2-year old sprouts averaged 9 feet in height and the 1-year old sprouts 2 feet in height. The sprout growth is often so abundant that competition sets in soon. Too many trees try to grow on the same place and the weaker must give way to the stronger. At the end of three years it is often possible to find more dead trees than living trees in an ailanthus thicket. The following table shows the condition of the sprouts in a dense young stand of ailanthus:

Age (years)	Number of Trees Per Acre	Height (feet)
1	800	6.3
2	1,360	10.5
3	3,000	14.2
Total	5,160	Average Height 12.0

On this area there were 5,160 living sprouts per acre that averaged 12 feet in height. The 3,000 three-year old trees averaged 14.2 feet in height. On the same area were 6,920 dead trees per acre. This shows that in a dense ailanthus thicket only three years old, there may be more dead than living trees. The competition is keen and the mortality is high. The strong and favored trees survive while the weaklings must give up their places. With the stem sprouts one

often finds many root suckers. These two methods of reproduction often operate side by side, and with them one frequently finds trees that grew from seed.

THE GROWTH OF AILANTHUS

Ailanthus is one of the most rapid growing trees found in Pennsylvania. The growth, however, varies considerably with the origin of the tree. Trees that start as seedlings, sprouts, or root suckers show a wide range in height and diameter growth. The following table, based upon measurements of more than 1,000 trees growing under a wide range of conditions in southern and central Pennsylvania, gives the height and diameter growth of trees of seedling, root sucker, and sprout origin:

Age (Years)	Height (Feet)			Breast-High Diameter (Inches)		
	Seedlings	Root Suckers	Sprouts	Seedlings	Root Suckers	Stem Sprouts
1	1.3	2.7	6.0			
2	3.9	5.6	9.2			
3	5.8	8.3	13.6			
4	7.9	11.6	17.2	1.3	1.5	1.8
5	10.0	14.5	19.9	1.8	2.0	2.4
6	12.0	17.4	23.7	2.3	2.5	2.9
7	13.9	20.2	32.9	2.8	2.9	3.4
8	15.9	22.9	34.6	3.3	3.5	3.9
9	18.0	25.4	38.0	3.7	4.1	4.3
10	20.0	27.8	41.0	4.1	4.7	4.8
15	30.0	38.9	51.2	6.1	6.9	7.2
20	39.5	46.1	57.3	7.7	8.8	9.1
25	45.9	50.3	59.5	9.1	10.1	10.3
30	51.4	53.0	60.3	10.2	10.3	11.1

Field studies show that ailanthus grows well when it develops in mixture with other trees. In Pennsylvania, black locust is its most frequent forest associate. These two trees are able to adapt themselves to similar sites and possess other growth habits that enable them to grow side by side. In a forest stand made up of 95 black locust, 20 ailanthus, and 20 other trees, the ailanthus at the age of 22 years showed a height of 60 feet and a breast-high diameter of 7.5 inches. In this stand the ailanthus grew tall, straight, and was free from limbs. A tree growing in a stand of black locust on a rather sterile gravelly loam hillside near Speecheville in Dauphin county, made the largest growth of any single specimen measured in the State. At the age of 18 years this tree was 60 feet high and 12.5 inches in diameter at breast-high.

Growth studies show that ailanthus grows very rapidly in youth and that height growth is practically completed in 25 to 30 years.



When 20 Years Old, Ailanthus Has an Average Breast-High Diameter of 9 Inches and Yields 37 Cords of Wood per Acre.



The Ailanthus is a Very Aggressive Tree. Fence Rows are Often Occupied by It to the Exclusion of All Other Trees. These Seven Year Old Sprouts Average More Than Four Inches in Diameter.

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3	5.8	8.3	13.6			
4	7.9	11.6	17.2	1.3	1.5	1.8
5	10.0	14.5	19.9	1.8	2.0	2.4
6	12.0	17.4	28.7	2.3	2.5	2.9
7	13.9	20.2	32.9	2.8	2.9	3.4
8	15.9	22.9	34.6	3.3	3.5	3.9
9	18.0	25.4	38.0	3.7	4.1	4.3
10	20.0	27.8	41.0	4.1	4.7	4.8
15	30.0	38.9	51.2	6.1	6.9	7.2
20	39.5	46.1	57.3	7.7	8.8	9.1
25	45.9	50.3	59.5	9.1	10.1	10.3
30	51.4	53.0	60.3	10.2	10.3	11.1

Field studies show that ailanthus grows well when it develops in mixture with other trees. In Pennsylvania, black locust is its most frequent forest associate. These two trees are able to adapt themselves to similar sites and possess other growth habits that enable them to grow side by side. In a forest stand made up of 95 black locust, 20 ailanthus, and 20 other trees, the ailanthus at the age of 22 years showed a height of 60 feet and a breast-high diameter of 7.5 inches. In this stand the ailanthus grew tall, straight, and was free from limbs. A tree growing in a stand of black locust on a rather sterile gravelly loam hillside near Speecheville in Dauphin county, made the largest growth of any single specimen measured in the State. At the age of 18 years this tree was 60 feet high and 12.5 inches in diameter at breast-high.

Growth studies show that ailanthus grows very rapidly in youth and that height growth is practically completed in 25 to 30 years.



When 20 Years Old, Ailanthus Has an Average Breast-High Diameter of 9 Inches and Yields 37 Cords of Wood per Acre.



The Ailanthus is a Very Aggressive Tree. Fence Rows are Often Occupied by It to the Exclusion of All Other Trees. These Seven Year Old Sprouts Average More Than Four Inches in Diameter.

Diameter growth continues for a decade or two thereafter, but it slows down rapidly. As soon as a retardation of growth manifests itself, heart rot begins to develop. To get optimum growth the ailanthus should be handled on a rotation not to exceed 40 years, and on some sites 30 years would be a better rotation age.

RAPID GROWTH OF SPROUTS

The sprouts of ailanthus grow very rapidly during the first few years. The following table gives the annual height growth of 6 sprouts during the first four years of their development:

Year	Height Growth (feet)						Average Height Growth (feet)
	Tree No. 1	Tree No. 2	Tree No. 3	Tree No. 4	Tree No. 5	Tree No. 6	
First	4.5	6.5	9.4	10.3	10.7	12.6	9.0
Second	5.0	6.0	5.7	4.2	4.4	4.9	5.0
Third	5.0	4.0	4.2	2.7	1.8	3.8	3.6
Fourth	4.2	3.0	2.6	2.8	3.0	3.3	3.1
Total Height (feet)	18.7	19.5	21.9	20.0	19.9	24.6	20.7

The foregoing table shows an average height growth of 9 feet during the first year, 5 feet the second year, and 3.6 and 3.1 feet respec-



One-Year Old Ailanthus Sprouts Ranging in Height from Three to Eleven Feet. About 20 Per Cent of These Yearling Sprouts are Over Six Feet High.

tively during the third and fourth years. The maximum annual height growth was made by tree No. 6 during the first year, when it grew 12.6 feet in a single season. This is the largest annual height growth recorded for any sprout measured in Pennsylvania. The six trees whose measurements are given above grew in a dense clump in a moist clay loam alluvial soil near Speecheville, Dauphin county. Their



A Seven-Year Old Sprout Stand of Ailanthus Averaging 30 Feet in Height and Over Three Inches in Diameter.

growth was considerably above the average. It represents the best height growth that may be expected of ailanthus. The stumps from which the sprouts grew averaged approximately 2 inches in diameter at 6 inches above the ground. In most cases only one sprout developed from a stump. The small vigorous stumps were a big factor in stimulating such an exceptionally large height growth. Careful measurements show that ailanthus sprouts often grow a full inch in height in a single day during the optimum growth period of late spring and early summer.

YOUNG TREES SPROUT BEST

Field studies show that young trees send forth the most vigorous sprouts. Trees up to 5 inches in diameter usually send forth two or three strong sprouts, while larger trees as a rule produce a larger number of relatively weak sprouts. Two trees standing side by side were cut at the same time. The one was 5.5 inches in diameter at 19

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Young Ailanthus Trees Grow Rapidly and Sprout Freely. Vigorous Sprouts Produce Big Leaves of Rare Beauty.

inches above the ground, the other was 1.5 inches in diameter at 11 inches above the ground. The former produced 4 sprouts that averaged 5.5 feet in height at the end of the first growing season and the latter supported 2 sprouts that averaged 6.2 feet in height after one season's growth. The sprouts that originated from the larger trees

were relatively weak and spindly, while those that developed from the smaller trees were strong and vigorous. Another stump 5.5 inches in diameter at 16 inches above the ground produced 9 sprouts that averaged only 4.3 feet in height at the end of the first growing season. An examination of sprouts that make a height growth of 6, 8, to 10 feet during the first season, usually shows that they grow singly or in pairs, and, as a rule, originate from small thrifty stumps.

The ailanthus also sprouts readily from the roots, especially when the parent trees have been cut. Old trees that are on the decline also send forth root suckers rather freely. Observations show that where a large number of root suckers develop they often grow at the expense of sprouting from the stump. An area 16.5 feet square was laid off about an ailanthus stump 9 inches in diameter and cut 8 inches above the ground. On this area were counted 212 1-year old root suckers that averaged 4.4 feet in height. This is the equivalent of 33,920 per acre. The stump of this tree carried very few sprouts and all of them were relatively weak. A large number of root suckers generally implies a weak sprouting from the stump.

Growth studies show that root suckers, as a rule, do not grow as rapidly as stump sprouts. This is due to a concentration of growth in the single stump in contrast with a diffusion of it over the widely scattered roots. Growth studies also show that the average rate of growth over a long period of time between root sprouts and stump sprouts is relatively less than in the early stages of development.

Field studies show that root suckers often spring up at great distances from the parent tree. In a field bordering a row of mature ailanthus trees near Carlisle in Cumberland county, root suckers were found at 87 feet from the base of the tree. No difference in height growth of suckers was noted at varying distances from the parent tree. Irrespective of the distance from the base of the trunk, the root suckers appeared to be growing at approximately the same rate.

DISTINCTIVE GROWTH HABITS

The ailanthus is a tree with distinctive growth habits. It adapts itself to many soils and a wide range of climatic conditions. It is very aggressive, it grows very rapidly, sprouts very freely, and suckers very profusely. It cannot stand shade. It is always at its best in full sunlight. It will grow on dry situations, but is at its best when nourished with an ample supply of water. It shows preference to limestone soil, for it occurs in great numbers and thrives about the workings of limestone quarries and upon limestone outcrops.

With apparent grace it accepts the hard fate of growing in crevices of brick walls, in back alleys, among paving stones, on slag piles, about



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An Open Grown Ailanthus with a Little Army of Root Sprouts.

refuse dumps, among rocks, on barren wastes and other unfavorable situations. There is no soil so thin, no site so sterile, no spot so scorched, no space so limited that the ailanthus will not attempt to grow thereon, and often to our amazement, it grows freely where other trees falter and fail.

HAS FEW ENEMIES

The ailanthus has few enemies in Pennsylvania. Insects seldom attack this tree and fungous diseases are rarely found upon it. It is one of only a few trees not injured by the periodic cicadas (17 year locusts) when depositing their eggs. Other nearby trees often suffer heavy damage during "the 17 year locust" years, while the ailanthus remains unharmed. Heart rot and frost damage are its major foes. As soon as trees reach middle-size they usually give evidence of heart rot, and when 2½ to 3 feet in diameter they are often hollow. Mayr reports that "in the Fagetum (the region of the beech, birch and maple forest type) the twigs of ailanthus freeze back every winter. During the cold winter of 1879-1880 with a temperature of -30°C, practically all ailanthus of middle Europe were killed." Where milder climates prevail, this tree makes its best growth. In northern Pennsylvania and particularly at higher altitudes it is usually damaged by frost and extreme low temperatures. As a general rule, the ailanthus can be grown as far north as the native chestnut is found. North of the range of the native chestnut its chances for making satisfactory growth are not very promising.

WOOD YIELD OF AILANTHUS

The wood yield of ailanthus ranks high among Pennsylvania trees. The following table gives the yield per acre that may be expected of ailanthus stands of sprout origin, if handled properly:

<i>Age</i> (years)	<i>Height</i> (feet)	<i>Breast-high</i>	
		<i>Diameter</i> (inches)	<i>Yield</i> (cords)
10	41.0	4.8	15.0
15	51.2	7.2	26.5
20	57.3	9.1	36.8
25	59.5	10.3	43.2
30	60.3	11.1	50.0

At thirty years the yield of ailanthus trees of root sucker and seedling origin is almost as high as that of trees of sprout origin, but it is considerably less at the age of 10, 15, and 20 years. After



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30 years. It progresses rapidly and is also a big factor in reducing shortly thereafter the stands begin to open up, for ailanthus is a very intolerant tree. When the tree crowns reach full-size they begin to break down, for the branches are very brittle. Strong winds and snow pressure are responsible for many deformed crowns. The effect of incomplete and broken crowns shows up immediately in a slowing down of volume growth. Heart rot sets in soon after the tree reaches 30 years. It progresses rapidly and is also a big factor in reducing volume growth. To get the best yield, ailanthus of sprout origin should not be handled in rotation of more than 30 years, and trees of seedling origin are at their best before 50 years.

THE WOOD OF AILANTHUS

In general appearance, the wood of ailanthus is similar to ash and chestnut. It is moderately heavy, rather durable, medium in hardness, somewhat difficult to split, and of a beautiful satin-like lustre. Oven-dried ailanthus wood weighs 33.5 pounds per cubic foot.



Cutting Up a Big Ailanthus Tree for Fuel Wood.

The sapwood is wide and white to yellowish. The heartwood is grayish orange. The annual growth rings are wide and distinct. The springwood is very broad with numerous large vessels toward its inner margin and few small ones scattered or grouped toward the outer part. The medullary rays are distinctly visible to the naked eye and have a satiny lustre. The pith is large and brownish. Ailanthus wood does not shrink nor warp much in seasoning, has a beautiful grain, and takes a fine polish. A panel veneered with ailanthus was exhibited at the St. Louis Fair. It attracted considerable attention, and, upon request, was sent to Europe. Ailanthus wood is used for fuel, occasionally in cabinet work, and in a few instances in the manufacture of musical

instruments. In Europe it is used in the manufacture of wooden ware and also for charcoal. In southern Pennsylvania ailanthus poles are used rather extensively as bean arbors.

AILANTHUS AS A PULPWOOD

The rapid growth of ailanthus and the structure and physical properties of its wood suggested that it might be used for pulpwood. In order to determine its merits as a pulpwood, one-half of a cord was sent from Mont Alto, Pennsylvania, to the Forest Products Laboratory at Madison, Wisconsin. The material averaged 6 inches in diameter and was taken from trees that ranged from 10 to 15 years in age. The results of the experiment fully confirmed the belief that it was a good pulpwood. This study showed that oven-dried wood weighs 33.5 pounds per cubic foot. The corresponding density of aspen is 23 pounds and spruce 24 pounds. A study of the wood fibre of ailanthus showed a length of 1.2 millimeters, while that of aspen is 1 millimeter, which means that ailanthus pulp should be stronger than aspen, other things being equal.

Rawlin and Staidl* write that "The yield of pulp, over 1,600 pounds per cord of 100 solid cubic feet of wood, is quite high and is due to the comparatively high density of the wood. Compared with aspen, which yields from a similar cord only 1,080 pounds of pulp, ailanthus showed a considerable superiority. It also compares favorably with aspen in the amount of chemical consumed in the digestion of unit weight of wood and in the bleachability of the resulting pulp. * * * * The bleached soda pulp may be used in paper making as a substitute for the corresponding pulp from aspen, and on account of its longer fibre length, somewhat stronger paper may be expected. Both the bleached and unbleached pulps absorb water very rapidly and may find additional use in the manufacture of blotting paper. In view of the increasing shortage of aspen, the production of pulp from rapidly growing species is desirable. Ailanthus appears to be admirably suited to cultivation as pulpwood and is capable of being grown throughout a wide climatic range."

Ailanthus pulpwood will probably be used to the greatest advantage in the soda process, by which bleached pulps can be obtained suitable for book, lithograph, and other papers in which softness and opacity are requisites. There is a growing shortage of pulpwood and probably ailanthus will help satisfy the rapidly increasing demands. More detailed technical information on the pulping value of ailanthus can be had from the Forest Products Laboratory, Madison, Wisconsin.

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SEEDING AND PLANTING EXPERIMENTS

To know more about the propagation and growth of ailanthus a number of seeding and planting experiments have been established in Pennsylvania. On April 28, 1924, a small quantity of seed was collected near Mont Alto. During the first week of June this seed was planted in the forest tree nursery at the State Forest School, Mont Alto. In spite of the late seed collection, the late seed sowing, no artificial watering, and keen root competition with black locust trees of pole size, the seedlings grew to an average height of 7 inches during the first year. Nursery experiments show that the ailanthus is easy to grow. If planted early and watered well, one year old seedlings should reach an average height of 18 to 24 inches. Reports from China show that at the end of one year's growth seedlings averaged 30 inches in height. Because of its rapid growth and its extreme intolerance, not more than 2,000 seedlings can be produced per bed of 100 square feet.

In the spring of 1925, 1,000 1-year old ailanthus seedlings, raised in the Mont Alto nursery, were shipped to the Bayless Corporation of Austin, Pennsylvania. They were planted the latter part of April in rich loam soil on the northern border of the borough of Austin, Potter county. The site had a southeastern exposure and was covered with a heavy growth of bracken fern. The trees were spaced 4 x 4 feet. An examination of this plantation in October, 1925, showed an establishment of 90% of the trees, which averaged 2 feet in height at the end of their first year in the plantation.

A recent survey of the forest lands of the State shows extensive stretches of barren forest land in the coal and coke fields of western Pennsylvania. For a number of years these vast reaches of idle land have given much concern to foresters. Field studies have shown that few of our native trees can endure the unfavorable climatic conditions of this industrial region. Ailanthus has also demonstrated that it will grow in many places in spite of smoke, noxious gases, sterile soil, and other unfavorable growth conditions.

To ascertain if ailanthus will reclothe the bare hills of western Pennsylvania, a number of experiments were established by the Pennsylvania Department of Forests and Waters in the vicinity of Johnstown, Cambria county, in the fall of 1925. Ten thousand ailanthus seeds of the 1924 crop and 70,000 seeds of the 1925 crop were used in this experiment. Three experimental plots were located on a bare mountain top at an altitude of 1700 feet. In one plot, 1924 seed was broadcasted and in the other two plots, 1925 seed was used. In one of the latter plots the seed was broadcasted, in the other it was placed in seed spots. Three similar plots were located at about the middle of the mountain at an elevation of 1500 feet, and three

additional plots were located at the base of the mountain at an elevation of 1300 feet. These three series of plots, located at different elevations and under a wide range of soil moisture conditions, should give some very conclusive results in a few years.

In order to ascertain the resistance of ailanthus to smoke and gases emitted so generally and so freely from coke ovens, three more plots were established at distances of 300, 500, and 1,000 feet respectively from a series of ovens. In a few years this experiment should show how ailanthus will grow about the coke ovens of the bituminous region.

For years trees have been trying to establish themselves on the hillsides and hilltops of the coke and coal fields of western Pennsylvania. It is difficult to find more unfavorable climatic conditions for tree growth than here. It remains to be seen if ailanthus will thrive under these unfavorable conditions. If it will, then it will be able to do that at which other trees have failed. If it will reclothe these barren hills of Pennsylvania and produce a wood suitable for the manufacture of pulp and for other important industrial uses, these experiments will have been worth while. If the conclusions will not be favorable to the ailanthus, then we will at least know that we must look elsewhere for a tree that can thrive under these unfavorable growth conditions.

THE FUTURE OF AILANTHUS

What the future of ailanthus in Pennsylvania will be is difficult to predict. It is known, however, that this tree has been extending its range rapidly. Each year it occupies more ground, and within its established range it is becoming more common. Extensive field studies show that no other tree competes so aggressively with the native tree growth. In many places it has developed an obvious advantage over the native trees. Unless some major use is found for its wood, it will become a serious forest weed. If such a use is found it will be possible to take advantage of its rapid growth and vigorous reproduction. Preliminary investigations show that it has merit as a pulpwood. Further studies will determine how extensively it can be used in the manufacture of pulp and paper, and where good wood yields can be expected. The results of these studies will determine its future rating as a forest tree in Pennsylvania.



SECRETARY CHARLES E. DORWORTH

FORESTERS' CONFERENCE

Senate Caucus Room, Capitol
HARRISBURG, PA.

February 5 and 6, 1929

Bulletin 39

COMMONWEALTH OF PENNSYLVANIA
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INTENTIONAL SECOND EXPOSURE

STATE FOREST COMMISSION

CHARLES E. DORWORTH, *Chairman*

EDWARD BAILEY

HENRY W. SHOEMAKER

MARY FLINN LAWRENCE

N. P. WHEELER, JR.

FOREWORD

I know of no group of men in any branch of service who have been afforded opportunity for greater inspiration along practical, helpful lines than this Foresters' Conference. The many constructive ideas advanced, with deserved praise for accomplishments of the last two years, place upon you Foresters an obligation to achieve still greater progress for forestry during the coming biennium. The pride of the Commonwealth, the hopes of the people who comprise the Commonwealth, for the greater advancement of forestry, constitute a command to you to meet this tremendous obligation. With a true understanding of what you have done, and what you can do, I face the future with you, willingly and confidently, knowing that you may be depended upon to attain the goal charted for you. Strenuous as have been the last two years, there will be no let-down, for a program of still greater progressive activity is ahead of us. Upon you as a group, and upon each of you, individually, rests the success of this program which will mark the greatest advancement in forestry in all the proud history of Pennsylvania.

CHARLES E. DORWORTH

PROGRAM

TUESDAY, FEBRUARY FIFTH

Morning Session—9:30 O'clock

Opening AddressSecretary Charles E. Dorworth
AddressGovernor John S. Fisher
GreetingsMembers Pennsylvania State Forest Commission
Pennsylvania's Forestry ProgramState Forester Joseph S. Illick
Greetings:—

Representatives of Pennsylvania Forestry Association, American Forestry Association, American Tree Association, and Society American Foresters.

Afternoon Session—1:30 O'clock

Construction and Maintenance of Serviceable Forest RoadsR. H. Vought
State Forest Roads and TrailsT. Roy Morton
Recreational Opportunities in the State ForestsJohn R. Williams
The Development of a State Forest Camp Site ProgramR. W. Stadden
State Forest SignsCharles E. Baer

WEDNESDAY, FEBRUARY SIXTH

Morning Session—9:30 O'clock

Special Forest StudiesDr. E. A. Ziegler
Major Forest Protection ProblemsGeorge H. Wirt
Pennsylvania's Forest Observation Tower SystemH. E. Clepper
Aerial Forest SurveysC. P. Wilber, State Forester of New Jersey

Afternoon Session—1:30 O'clock

A Practical Reforestation ProgramH. E. Elliott
Forest Demonstration AreasPaul H. Mulford
Marking State Forest Boundary LinesT. C. Harbeson
Auditing and Accounting ProcedureW. E. Montgomery

ROUND TABLE DISCUSSION

OPENING ADDRESS

Secretary Charles E. Dorworth

THIS is a conference unique in the history of the Department of Forests and Waters. It is a step onward in the efforts and aims of our Department to further improve and expand the efficiency and opportunities of our field personnel. The field force, without even the slightest reflection upon our Department officers, for whom I have the highest regard and very deep affection, does come very close to my heart. And that may be due to the fact that I grew up with men who did things in the woods. I think I acquired a deep understanding of their makeup and of their needs, and perhaps, putting it on the broadest human plane possible, I think I acquired a real understanding of how much the man in the field not only needs but depends upon those in the Department to think of him, help him when he may lack the courage or perhaps is too modest to ask for things that he knows he needs.

Our group conferences of Forest Rangers during the past year were framed with the thought of improving or expanding their efficiency by bringing them together for an interchange of ideas, that one might learn from another what each happened to be doing and how he was doing it, and see for themselves what is being done in the other districts as well as their own.

This conference is based upon our hope that it will lead to a greater inspiration, and a greater desire for service that will contribute in a substantial way to the success of a most substantial program of activity for the coming two years. The program that we are mapping out is dependent to a great extent upon what support we receive from the Governor and the Legislature now in session. It has been demonstrated to us by Governor Fisher that he is whole-heartedly back of the Forestry Department and the forestry program of our State. The last Legislature demonstrated the same deep interest and confidence. I feel justified in making the statement to you field men here today that I am entirely confident that the present Legislature has seen sufficient of what our Department has done with the funds made available two years ago, that it will be entirely willing to continue cooperation with us on the very broadest scale that available funds will permit. I know that we will have the same sincere, enthusiastic

support of Governor Fisher, and it is a great pleasure to me, as I know it is to you, that Governor Fisher is going to break into his busy program this morning to afford us a few minutes as a tribute. And I want you men to get fixed indelibly in your minds that he is coming here as a tribute to you for what you have done in the last two years, and as an inspiration to you to continue that splendid, progressive activity during the coming two years.

I am particularly delighted that we have here today some of the members of the Legislature who are destined to play a vital part in the program that means so much to our Department. I want to express to Senator Gelder and to Mr. Williams, the Chairmen of the Senate and House Committees on Forestry respectively, my personal appreciation, and the appreciation of our field personnel; and to other members of the Senate and House who are here I want to convey that same thought, that same note of appreciation. Your presence here means a great deal to our men. To them it means first that you are not only interested, but in an official capacity you are placing the finger of responsibility upon our men who are spending in their work the money that you are aiding to make possible.

I want to express also my very deep appreciation to the members of the State Forest Commission.

This concludes my word of welcome to you. I am looking forward, with the same anticipation that each one of you is looking forward, to the good that our sessions will do. There isn't a man here but what can profit from the sessions, and I am afraid that if there is one here too wise to learn, he is in the wrong department.

CHAIRMAN DORWORTH: Gentlemen of the Conference: We are entitled to a blue ribbon. The Governor, who has been with us one hundred per cent, demonstrated that again a moment or two ago when he broke away from a roomful of people waiting to see him, to keep his promise to come here today and by his appearance and a word of greeting testify, as I said this morning he would do, his appreciation of your activities in the past two years, and to give you still greater inspiration for your activities in the coming two years.

It is a privilege and an honor to all of us that we have this opportunity, and may I present His Excellency, the Governor of the Commonwealth, Governor Fisher! (Applause).

ADDRESS

By Governor John S. Fisher

MR. SECRETARY AND GENTLEMEN OF THE CONFERENCE: I am not sure that I had any advance information and certainly no premonition that I was expected to appear before you this morning, until this diligent Secretary of Forests and Waters came and dragged me out from the midst of the waiting throng that usually is found outside the Governor's door. I tried to plead off, and offered in extenuation a physical infirmity which has been attacking me in that point of my anatomy that is underneath my vest, but even a humanitarian plea of that kind didn't touch his heart. He said I had to come down here and meet the members of this Conference!

Under the circumstances, of course, I haven't any particular message to deliver to you. I want to express my satisfaction that you have gathered here in this way, that you have come from all the various fields of your activities to compare notes, to gather inspiration, and to take back to your work the benefits of this interchange of ideas and to carry with you no doubt a fuller appreciation of the great work of reforestation that is going on in Pennsylvania.

Not so long ago we had, among other visits from our neighboring states, a call from a delegation of officials and members of the Legislature of Minnesota. Well within my memory the Northwest was associated with forestry and wild life. I can well recall when many of the people from the headwaters of the Susquehanna seeking new fields, and seeing the exhaustion of their forests, left for the Northwest. Michigan, Minnesota and Wisconsin was then the great field of endeavor to which they looked forward. So it was rather strange to me that we should have from that very region a committee, coming to Pennsylvania to find how we were remaking the forests that had been denuded in the years gone by. They went around and visited, I suppose, some of your fields of activity. I know they were here with the Secretary. I know they called on me after they had made some examination of the work in Pennsylvania, and expressed their surprise and gratification at the remarkable progress that was being made here.

That kind of testimony, coming from our neighboring states who are interested in this subject, is very pleasing to us. You are the working force entrusted with the duty of carrying forward

this important work. I suppose you, like myself, lose yourself in amazement when you wonder why the fathers and the grandfathers and the great-grandfathers, who slaughtered the forests of Pennsylvania, hadn't some forethought about the restitution of these trees, but they hadn't. And I can remember up in Clearfield county, reaching into Indiana and Cambria and over into Jefferson, where they had those remarkable forests a generation or two ago, that when they cut over a tract they boasted that they "didn't leave a fishing pole." That was a favorite expression to show the thoroughness of the job. If they had just left a few of those magnificent monarchs of the forest, one of which Col. Shoemaker has named for me and thereby done me a great honor—I want to see that great tree up there—if they had just left a few of those scattered over the mountain sides there would have been much less of a problem than that with which we have to deal today.

I happened to be a member of the Senate in 1901 when the question of organizing a Department of the Government for forestry purposes came before the Legislature. Those who had part in that contest will never forget it—it was hot. Somehow our city friends particularly could not catch the vision of the work that was proposed to be done, and particularly was that true of those who followed the banner of reform. They said that the purpose of setting up a Forestry Department was to provide shelter for a lot of bum politicians who were out of a job. (Laughter). You remember that, some of you, and the bitterness of the fight. And yet it went forward, and it wasn't long until those who had been loudest in denunciation were strongest in support of the work. It has not been a "refuge for bum politicians." After all our job is not a political job; it is an industrial job, and we must go at it as we go at any real task, with our coats off and our sleeves up.

The acquisition of this great forestry domain we have in Pennsylvania was a splendid and noble thing. I shan't consume your time talking about the men who were responsible for the furtherance of that work. You recall who they were, the men who stood at the head of the Department, those who stood with them here, those who studied this great problem and then took practical means to recover for the State acreage that was available for reforestation. But it has been a great achievement, and those who did it, while they may be forgotten, have left behind them a monument, if such a thing can be so called, that will stand to their credit in generations to come.

And we want now to pick up the things that they have so well advanced; we want to go forward in this great work. Perhaps the War was responsible, perhaps other influences were at work, that caused an intermission in the purchase of forest lands, and in the reproduction of forestry growths, but we have been enabled to renew that work in the two years that have just closed, and you have had part and parcel in the job.

When we started in I didn't know what a half million dollars would do, but I did meet the challenge of the sportsmen of the State who said to me, "If you give a half million for new purchases, we will contribute a dollar more for each hunter's license and turn that over for the purchase of game preserves." Well, we went to work, and the results are familiar to you all. I think between the two departments we have acquired something like 260,000 acres, nearly all within a single year. A half million dollars is a lot of money when we think of it in an individual way, but when we spread it over 160,000 acres which were purchased largely under the guidance and inspiration of our friend who sits over there, "Irv" Gleason from Williamsport, and who has a personal, speaking acquaintance, I think, with every worth while tree in the Allegheny Mountains, we did a big thing with that money and we found that it amounted to a great deal more than we had really anticipated.

Now there are two factors that enter into this thing of forestry development, the first is the available money, and the second is the intelligence, industry and force that you men put back of the work. It is a business man's job.

I want to compliment you on the good record you have made in renewing this work. For the coming two years I have recommended to the Legislature another million dollars to be expended—that is just twice what we have had in the past biennium—for forest land purchase. And with the same ability demonstrated by those in charge, we ought to acquire more than 300,000 acres of land, and this exclusive of what will be done by the fees arising from the hunters' licenses. I am looking for a combined record of a half million acres to be added to the forest reserves and to the hunters' game refuges in this biennium. I should be disappointed if we failed to achieve that aim.

Now you see I have talked a lot more than I had expected. It is always pleasing to me to meet with those in the employ of the State upon whom we must rely for results. I wish it were possible for me to form more intimate personal contacts with the

great army of State employes, but we are subject to physical limitations. I want to assure you that it is really a privilege for me to look into your faces this morning, to welcome you here, to compliment you on your good work, and to express to you the hope that you will continue in the same diligent course that you have followed in the past, so that the accomplishments of the Forestry Department will be an achievement of which the State and the people of the State will feel proud. (The members arose and applauded.)

ADDRESS

By Mr. Edward Bailey

Member, Pennsylvania State Forest Commission

IT IS A very great pleasure to me that I am able to be here this morning. It is also a pleasure to stand here and look you all in the faces.

The one thought that I want to suggest to you today is a vision, and then cooperation. As far as I have seen the work of the forest commission during the years that I have been connected with it, everybody has had a vision. They have pictured what Pennsylvania could do in its forestry work, for the inhabitants of Pennsylvania and for those who are coming after us. That can't be done, as I say, without vision, without cooperation—and I congratulate the Legislature on the spirit they showed two years ago and on what is apparently going to be given to the Forest Commission and the Department this year. I feel sure that the money will be well spent. I am sure it will do the present generation good and that the generations to come will feel grateful for the work which is being done. (Applause.)

ADDRESS

By Col. Henry W. Shoemaker

Member, Pennsylvania State Forest Commission

I THANK you for your very kind welcome. I was joked at considerably when I came in because, having come back from nearly a three months' incapacitation, they said I looked better than before I went away. So I said I would have to have an annual illness, and Mr. Dorworth's words quite overwhelmed me.

During the past week I had a little outing in the mountains to get freshened up for this two-day conference. To my mind the great slogan for this coming year should be to go after the forest fires even stronger than ever before. They are being kept down, but the trouble is that we trust too much to the god of rains and we want to be prepared for the fact that every season may be a dry season, and every season we are going to make the acreage and the volume less, with fewer fires. That is the only way to conquer this forestry problem. That, as Mr. Bailey said, is the vision, the day when forestry will be carried on and prac-

ticed like any other business, subject only to minimum fire risks like in any other industrial enterprise, and not handled in a way so that if it rains we will have a good reason, and if it doesn't we may have a bad season.

But we know that all you valiant young men, with your shoulders to the wheel and the fine inspiration of leadership, with the Governor's backing and the Legislature's cooperation, and Secretary Dorworth, Mr. Bailey and Dr. Illick, and all the good people who are cheering you on, will follow up in 1929 and 1930 and make these four years the greatest four years in Pennsylvania forestry. I thank you. (Applause.)

PENNSYLVANIA'S FORESTRY PROGRAM

By State Forester Joseph S. Illick

PENNSYLVANIA forestry is the result of a half century of earnest endeavor and unselfish service. It became an active force in 1877, when the late Doctor Joseph T. Rothrock—Father of Forestry in Pennsylvania—began his historic Michaux lectures in forestry. From a small and struggling beginning it has developed into one of the Commonwealth's major enterprises. As Pennsylvania forestry moves forward today, it displays a background of constructive achievements and a foreground of promising possibilities. Much could be truly said about achievements in Pennsylvania forestry, but at this conference, I purpose to talk of the future rather than of the past, and to discuss a number of major projects essential to a broad and purposeful forestry program for Pennsylvania.

THREE PERIODS OF FOREST LAND PURCHASE WORK

The most active project in Pennsylvania forestry today is the purchase of additional forest land for State forest purposes. Thirty-one years ago (June 13, 1898), Pennsylvania purchased her first forest land. A review of Pennsylvania's forest land purchase work during the past 31 years reveals three important development periods:

- Period I (1898-1921) Continuous acquisition of forest land for State forest purposes.
- Period II (1921-1927) Complete suspension of State forest land purchase work.
- Period III (1927-) Active revival of State forest land purchase program.

During the 24 years of Period I (1898-1921), funds were available regularly for the purchase of State forest lands. As a result of this uninterrupted purchase program, Pennsylvania acquired 1,133,050 acres at a total cost of \$2,561,224.31, or at an average price of \$2.26 an acre.

During Period II (1921-1927), there was a complete suspension of forest land purchase work, excepting the completion of a few purchases covered by contracts made under the appropriation of 1919. It is noteworthy, however, that the legislature of 1921

appropriated \$500,000 for the purchase of additional State forest land, but this item was vetoed by the Governor upon the recommendation of the Commissioner of Forestry.

An appropriation of \$500,000, made by the Legislature of 1927, and approved in full by Governor John S. Fisher, made possible an active and substantial revival of the forest land purchase program. When this appropriation became available, written sale offers of 650,000 acres of forest land were on file with the Department of Forests and Waters. The purchase work had not progressed far before it became evident that available funds would purchase less than one-fourth of the area offered.

Acting in accordance with the sound forest land purchase policy formulated by the State Forest Commission, 65 tracts aggregating almost 160,000 acres have been purchased at an average price of \$2.81 an acre. In my opinion, the purchase of these 65 tracts of carefully selected forest land, at a cost considerably below the lowest estimates available, at the beginning of the purchase work, is the most outstanding achievement in Pennsylvania forestry in recent years.

The complete discontinuance of purchase work for a period of six years following 1921, made it necessary to build up anew a forest land purchase organization, when the \$500,000 appropriation in 1927, became available. A thoroughly-trained and efficient forest land purchase organization has now been developed, and is ready to function to whatever extent funds will be made available. I am confident that during the next two years, there will be in operation the most extensive forest land purchase program ever undertaken in Pennsylvania. To help realize this hope, I want to give my personal assurance, as State Forester, that whatever funds become available will be expended in a business-like way for the purchase of carefully selected tracts of forest land suitable for State forest purposes. In considering this important forest land purchase program, it is important that we understand that the funds used for this purpose must not be classed as an operating expense, but rather should be considered as a sound investment for the people of Pennsylvania.

FOREST PROTECTION—A VITAL PROBLEM

No forestry program is complete without a consideration of the most serious enemies of the forest. Forest protection continues to be the most vital problem in Pennsylvania. The complete control of forest fires is a pre-requisite to successful forest management. In recent years substantial progress has been

made in formulating and putting into operation plans for practical forest protection. Thirty years ago no organized attempt was made to control forest fires in Pennsylvania. As late as 1913 less than one-half of the forest fires were reported. Now, with a State-wide system of forest protection in effect, more than 98 percent of all forest fires are reported promptly, and fire-fighting crews are dispatched immediately to extinguish them.

The reduction in the average size of forest fires in Pennsylvania shows how effective the work of this State-wide fire-fighting organization really is. In 1913, the average size of forest fires in Pennsylvania was 412 acres. Five years later (1918), the average size had been reduced to 140 acres. By 1923, the average size of fires had shrunk still farther to 105 acres. Last year (1928), it was reduced to 45.1 acres.

Notwithstanding this gratifying achievement, forest fires are still the most serious problem in Pennsylvania forestry. The latest available figures show that 2,456 forest fires occurred in Pennsylvania during 1928. They burned over 110,872 acres, and their estimated damage is placed at \$360,000. The Commonwealth's share of the cost of extinguishing these fires was \$103,305.60. A general analysis of these figures shows an average daily damage of almost \$1,000, and the Commonwealth's share of the cost of extinguishing them averaged almost \$300 for each day of the year. No system of forest management can flourish in Pennsylvania so long as forest fire damage and the cost of extinguishing forest fires remain at the present high level.

No consideration of Pennsylvania forestry is complete that does not stress the need of a more complete control of forest fires. But in placing greater stress on forest fire problems and practices, we must not overlook the urgent need of developing a better understanding of other forest foes, and of devising more effective means of controlling them, particularly in the case of insects and fungi. The listing of a few of the many destructive tree diseases and insects, such as chestnut blight, maple wilt, larch canker, woodgate rust, white pine blister rust, damping-off disease, white pine weevil, locust borer, golden oak scale and hickory girdler, is sufficient to illustrate the importance of promoting studies that will bring about a better understanding of their life histories and result in a practical control measure. We cannot hope to move forward with successful forest practices until better and more practical fungous and insect control measures are worked out.

URGENT NEED FOR MORE FOREST ROADS

Another major project in Pennsylvania's forestry program is the development of a carefully-constructed and well-coordinated system of forest roads. The more I think about Pennsylvania forestry, the stronger becomes my conviction that the key to the successful handling of the State forests is an adequate and well-coordinated system of serviceable forest roads.

During each of the last two years \$100,000 was expended from the general appropriation to the Department for road and trail work within the State forests. This was about \$80,000 a year more than was used for this purpose during each of the two preceding years, when only \$22,600 was spent on more than 2,000 miles of roads and almost 3,000 miles of trails. During each of the last two years, an additional \$100,000 was expended by the State Highway Department on the construction and improvement of important roads within the State forests.

The advantages of this enlarged forest road building program are already being enjoyed by the thousands of people who annually use the State forests. Year after year we shall see better-protected and better cared-for forests because of these new and better forest roads.

Despite this increase in road building the present mileage of roads within the State forests of Pennsylvania is entirely inadequate. There are vast blocks of land within the State forests upon which there is not a single mile of serviceable road. On the 160,000 acres purchased during the present biennium, and on practically all forest land now available for purchase, only poor and widely-scattered roads can be found.

Not less than 5,000 miles of serviceable roads are required to bring the present State forests (1,290,000 acres) under efficient management. This does not provide for the road requirements of additional forest land purchases. At first thought this mileage may seem large, but the merits of this figure become obvious when we consider that several hundred years of European forestry practice, under conditions similar to those that exist in Pennsylvania, have shown that good forestry practice requires not less than one mile of road for every 250 acres of forest land; and under intensive management one mile of road is needed for every 100 acres.

During the past year an exhaustive survey and an intensive study of State forest roads was undertaken. This work has now progressed far enough to enable us to list the most urgent pro-

jects, and to formulate sound practices for road construction and maintenance. The Department's forest road building personnel, in charge of a competent engineer, stands ready to go forward with as comprehensive a program as appropriated funds will permit. The immediate and far-reaching advantages of forest roads, and the competent organization now available to build them, truly justify a liberal appropriation. Without forest roads and trails, only the crudest kind of forest management is possible. The urgent need is not for short stretches of detached road, but for a carefully coordinated system of properly-located, well-graded, adequately-drained and carefully-constructed forest roads. With such road systems available in the State forests of Pennsylvania, the foundation would be laid for an efficient handling of the Commonwealth's forest investment.

RAPID GROWTH OF FOREST TREE PLANTING

Making and keeping forest land productive is the major requirement of good forestry. As a result of destructive lumbering and repeated forest fires, enormous areas of unproductive forest land formerly covered the hills and dotted the valleys of Pennsylvania. During recent years, however, forest protection supplemented by tree planting has restored the forest on a considerable acreage of both State-owned and privately-owned land. Forest tree planting began in the State forests in 1898. In 1910 the Commonwealth began the distribution of forest tree planting stock to private planters, on the most liberal terms offered by any Commonwealth. To date 36,257,000 trees have been planted in the State forests, and more than 75,000,000 have been distributed to private planters.

Probably no project in Pennsylvania forestry has moved forward with greater approval than forest tree planting. There are now scattered throughout the State many successful forest tree plantations. They serve as helpful object lessons in practical forestry.

It appears, however, that we have concentrated too much on pushing the tree planting movement forward, and have not given enough attention to the correction of weaknesses and improper practices. During 1928 a State-wide survey of private plantations, started in a small way about five years ago, was pushed forward on a substantial basis. It covered 961 selected plantations in 29 different counties, and showed an appalling percentage of poor plantations. Among the principal causes responsible for these poor plantations are: poor planting stock, poor selection

of trees for planting sites, careless planting, improper planting methods, grazing on planted areas, and lack of adequate and competent supervision.

It is imperative that these unfavorable factors be corrected, even if the net result may be the planting of fewer trees. The goal of Pennsylvania's reforestation program is no longer to plant a large number of trees, but to establish and maintain successful plantations of quality trees. To achieve this end, quality planting stock must be produced, trees adapted to specific sites must be planted thereon, proper planting methods must be used, and last but by no means least, adequate and competent supervision must be provided at all times.

This supervision is required, not only for the trees planted in the State forests, but also for those distributed to private planters. The annual planting of 12,000,000 trees by private forest tree planters of Pennsylvania means an annual investment in cost of planting stock and planting expenses of about \$200,000. When a tree-planting investment implies an expenditure of \$200,000, it justifies close and competent supervision. Under no circumstances is it good business to permit planted trees to become orphan trees.

Pennsylvania's reforestation program likewise calls for the planting of more trees in the State forests, than have been set out in recent years. From 1910 to 1919, the number of trees planted annually in the State forests ranged from 1,000,000 to more than 6,000,000 (1918). From 1920 to 1926, the number planted ranged from 133,221 to 560,525. In 1927, and 1928, there were set out 559,635 and 925,649 respectively. Present plans call for the planting of not less than 1,000,000 trees annually in the State-owned forest land. This increase in planting is brought about in part by the open and unproductive areas in some of the land recently purchased. Before going forward with the several large-size planting operations in areas upon which planting is an absolute need, it will be necessary first to solve the deer-damage problem.

IMPROVING THE COMPOSITION OF FORESTS

Another reforestation problem that requires serious consideration is the improvement of the composition of the existing forest growth. For every acre in the State forests of Pennsylvania that requires planting—a recent survey shows the number to be 33,357 acres—there are almost 40 acres that do not require general planting; but in practically all of the areas that do not require general planting there occurs a superabundance of inferior trees.

We have reached the place in Pennsylvania forestry where we

must give more consideration to the improvement of the composition of the forest. In the early stages of the development of forest stands, this can be accomplished by weeding operations or by weeding supplemented by planting. If worthless and inferior stands are permitted to develop, they will result in an early and worthless maturity. The toleration of such conditions is not good forestry. Without subtracting anything from the planting program, we should now begin to undertake forest improvement work in natural growth, with the object of developing mixed stands of quality trees. In some cases this will require supplementary planting. Irrespective of specific requirements, such a program will result in producing full crops of quality trees, and this is the main objective of good forestry.

RECREATIONAL OPPORTUNITIES ON THE STATE FORESTS

Three years before the first acre of State forest land was purchased, and six years before the Department of Forestry, now the Department of Forests and Waters was created, the use of forest land for recreational purposes was advocated by those favoring the creation of State forests.

Thirty years of practical experience in handling the State forests of Pennsylvania, and the study of recreational developments in other states and countries, have shown us that it is best to develop the recreational facilities of our own forests along varied lines. Accordingly the recreational projects in the State forests of Pennsylvania have been classified as State Forest Monuments, Special Scenic Drives and Views, State Forest Parks, State Forest Camps, and State Forest Camp Sites.

During 1928, the 1,945 leased camp sites in the State forests brought in an income of \$17,717.42. The estimated total cost of the buildings erected on these 1,945 leased camp sites is approximately \$2,000,000. This substantial investment is positive proof of the confidence the lessees have in the stability of Pennsylvania's State forest camp site policy.

The outdoor play places and life-saving stations maintained in the State forests are a great asset, not only to the people of our Commonwealth, but also to thousands of tourists who come to Penn's Wood. Pennsylvania's forestry program calls for the enlargement and improvement of these public recreational opportunities. We cannot afford to delay this development, for the need is urgent and the benefits derived therefrom are inestimable.

EDUCATION IN FORESTRY MUST CONTINUE

Education in forestry is a continuous requirement. No forestry program is complete that does not have a place for educational

efforts. However, with each forward step in forestry a change in emphasis becomes necessary. To facilitate a better consideration of this subject, I will divide it into the three major classifications, namely, Popular Education, Practical Education, and Special Studies or Technical Education.

In the early days of forestry, popular education or the instruction of the public, is the prime requirement. After forestry is well-established, it is no longer necessary to stress the appeal program. In Pennsylvania the time is at hand to shift emphasis from general acceptance appeals to practical demonstrations to forest land owners. To point out the need for forestry is no longer enough. What is wanted now are illustrative examples of good forest practices.

DEMONSTRATING FOREST PRACTICES

The important thing to do is to get forestry into the ground. To achieve this goal we must get more and more of our forestry lessons into the woods. The time is at hand to develop special plots in all parts of Pennsylvania, demonstrating forest practices and showing how forests can be handled successfully. The primary purpose of these plots is to show, in a small way, how forest operations can be handled in a large way. Our program calls for the establishment and development of demonstration plots in parts of the State for the purpose of showing a wide range of forest conditions and the results of many different forest operations. Whenever possible these demonstration plots should be located along or near highways or good forest roads. Too often, in the past, only a few persons knew the facts about forest plots. To overcome this unfortunate situation each demonstration plot will be posted with the most important information pertaining to it. This work will go forward until the saturation point is reached. We cannot afford to stop short of this goal in our program of practical education in forestry.

MORE FOREST RESEARCH NEEDED

Purposeful action in forestry must be based on facts. To practice better forestry we must have more and better forestry knowledge. One of the greatest handicaps in Pennsylvania forestry today is the lack of reliable knowledge based on special studies and tested trials. Present plans call for the development of a force of five to eight trained research workers, who will devote their main efforts to special studies, giving preference to those that tie into immediate administrative problems. Supplementing the work of these research specialists there will be developed a greater opportunity for individual foresters to conduct special studies and prepare reports thereon.

AN IMPROVED FOREST RANGER SERVICE

The introduction and promotion of this program will require a number of adjustments in our present personnel organization. There is now too wide a gap between our forest rangers, with no special training, and our foresters, with a minimum of four years of college training. Much thought has already been given to this situation. A plan is now being developed to improve this condition. It aims to raise our forest ranger service to a higher level. To accomplish this we must develop an intermediate personnel, that will function between our present rangers and foresters. For want of a better term, we may call them senior forest rangers. They will be trained to do many things that are now being done by district foresters and assistant foresters. The solution of this problem will provide a better-balance personnel organization and insure a more efficient handling of the field work in forestry.

In conclusion, let me say, that in my opinion, that forestry program is best that is guided by practical experience and painstaking research, encouraged by enlightened public interest, and promoted by the united effort of a strong, well-balanced and thoroughly-schooled operative organization. On this basis Pennsylvania's forestry program is sure to go forward, for we have a united organization, in which I have strong faith. And I am confident that the funds required to promote our work in a purposeful and business-like way will be forthcoming.

CONSTRUCTION AND MAINTENANCE OF SERVICEABLE FOREST ROADS

By R. H. Vought

SERVICEABLE forest roads are an essential to good forest management. The serviceability of a forest road depends entirely on the standard used in construction. By the standard of a road is meant the combination of elements that determine its ability to carry traffic, such as location, grade, alignment, width, and the condition of its surface and structure. In the present stage of forest road development, a forest road project is necessarily an earth road project. The service that is expected of it will determine the standard of construction.

LOCATING FOREST ROADS

The results obtained in forest road construction depend primarily upon the careful preliminary study given to the selection of the best location for them. In most regions forest areas include only the mountainous sections of the State, where the topography is very rugged. Generally the main forest roads follow the larger mountain streams from lower elevations to the tops of divides. In this way it is possible to obtain satisfactory grades. Where the streams will not give the desired grades between objectives, or where the cost of construction in following streams is excessive, locations must be selected along the side of a mountain, following the best grade and employing the switchback to reach the desired objective.

In choosing a location preference should be given to a southern or western exposure and so receive the benefit of the sun, which helps to keep the surface in serviceable condition. Wet, swampy ground should be avoided whenever possible. Frequently land which appears suitable in summer is found to be not at all fitted for a roadbed during the wet season. This fact must always be kept in mind when one is working along creek-beds and in low land. A side-hill location, slightly above the toe of the slope gives a much better roadbed, and helps solve the drainage problem. The side-hill location often eliminates the necessity of stoning the road surface to make it serviceable. When selecting a location one should avoid very steep slopes and hard rock, if possible. Roads cut into earth slopes that exceed 35 degrees are subject to slides, while large quantities of hard rock make road construction expensive.

Even though the first cost of construction is slightly increased, one should choose the location that will necessitate the fewest bridges, providing the road obtained is equally stable. Bridges are expensive to build and to maintain. They are also liable to destruction during floods.

When a location parallels a stream, care must be taken to keep the roadbed well above high water and away from the scour of the stream. After the general location and standard of a road have been determined, the importance of making a survey and of carefully planning the construction of the project cannot be too strongly emphasized. The methods to use are the simplest ones that will give the desired information. For general forest work, the Abney level, the compass, and the tape will give the ground location and the information necessary for construction.

SERVICEABLE GRADES

The maximum grade used will depend upon the service required of the road. By grade we mean the per cent of rise or fall for each 100 feet in a horizontal plane. A road has a 10 per cent grade when the elevation is 10 feet higher or lower in each 100 feet of distance. For a primary or base road, the maximum grade used will determine the load that can be hauled. A maximum grade of less than 8 per cent should not be adopted as this is the grade allowable on the main highways in the mountainous sections of the State. Nothing would be gained by using a grade less than the grade that must be used after leaving the State forest roads. On our secondary roads, where travel is light, a grade of 12 per cent is allowable. For unimportant secondary roads even 15 per cent is justified for short distances, especially where this will save heavy cuts and fills and thus greatly reduce the cost of construction.

FOREST ROAD ALIGNMENT

In flat country where the topography is not rugged, long tangents and light curves can be obtained in road construction at a reasonable cost. To adhere rigidly to a definite standard of alignment in forest road work would increase the cost of construction to an extent not justified by the service rendered. It is better judgment to sacrifice alignment where the cost would be excessive, providing the road obtained is safe to travel and will serve its purpose adequately. Every curve, with less than a 500-foot radius, must be properly banked or elevated on the outside to aid traffic. If the road to be constructed is not a two-way traffic road, a width of at least 16 to 20 feet should be provided on curves for

safety in passing. For ordinary speeds of travel a road alignment which allows 200 to 250 feet of clear sight will meet practical safety requirements.

WIDTH OF FOREST ROADS

Forest roads that are used extensively for the public, require sufficient width for two-way traffic, or a 16-foot clear roadway. The amount of public use will generally be the determining factor in deciding the width. For forest development and protection, a 12-foot surface with intervisible turnouts for passing, built on proper location and within the allowable limits of grade, can be widened when public use demands, with no loss in the original investment. In this way we may delay making the investment required for the additional width necessary for two-way traffic, until the traffic demands and justifies such an expenditure. Whether a 12-foot or a 16-foot road is constructed, it is necessary to vary the width according to local conditions. Through swamps, where parallel drainage ditches are required, the width of the shoulders must be increased for safety. Extra width should be provided on curves. Where particularly interesting views are found, extra width should be provided for parking. On steep hillside locations where extra width greatly increases the cost of construction, if sufficient funds are not available to build a wider road and the need is imperative for development, a 9-foot road, with an inslope toward the bank, for safety, is justifiable, and may satisfy all immediate needs.

CONSTRUCTION OF FOREST ROADS

To give the best return for money invested, road construction work should be done at the right season of the year. Every road program should be planned at least a year ahead of actual construction. If the program is planned ahead, clearing may be done in the fall and winter with the few men necessary to carry through the winter, to keep an organization together. The stumps can be pulled in the early spring when the ground is wet and loosened by the frost. Actual grading may be started as soon as the ground is settled. The construction work should be completed well ahead of fall rains. If this procedure is followed, there can be saved not only the waste occasioned by doing the work out of season, but it will also be possible to keep together a well-balanced organization of trained men. The foreman directly in charge of construction must have some knowledge of grades, alignment, and curves, and must know how to use the information supplied by the location survey.

CLEARING FOR FOREST ROADS

The point of view of the local forester as well as that of the road builder should govern the clearing of timber for proposed roads. Forest roads are built for reasonable rates of travel in the interests of fire control and for administrative purposes and also to allow the public to enjoy what the forests offer. With this thought in mind, the road can be made to fit its surroundings. Wherever possible, in clearing the roadway, big trees should be avoided by shifting the center line of the road to one side or the other, thus bending the road in gentle curves and not holding rigidly to a fixed center line. Shifting the center four or five feet to right or left in a distance of 200 feet in order to miss some particularly large or attractive tree, is good judgment and does not lessen the serviceability or appearance of a road.

When low, wet ground or bad drainage conditions are encountered it is necessary to make wider clearing to allow sunlight and air to reach the surface of the road. Where clearing is done for this purpose, the side of the road should be favored that will allow the most sun to reach the road surface.

At curves it is necessary for safety to get visibility for 100 to 150 feet. This can often be accomplished by selective thinning, by the trimming of the lower branches and the cutting of the underbrush, rather than by actually clearing away all the trees from the insides of the curves to gain the desired visibility. The results obtained by selective thinning are generally satisfactory, and are in keeping with sound forestry practices. All brush and stumps must be disposed of properly by burning or by scattering them back into the woods far enough away from the roadway so that they will neither present an unsightly appearance nor become a fire hazard.

GRADING A FOREST ROAD

The actual grading of the road should not be started until the clearing is done or has advanced far enough so that they will not interfere with each other. The foreman in charge should go over the entire line and decide how to handle the work to the best advantage. In an easy rolling country road grading is comparatively simple and is known as turnpiking. The earth is thrown up from either side and used to form both roadbed and surface. This type of construction is the cheapest form of road building, providing the material handled is suitable for a satisfactory surface.

The work can be accomplished entirely by the use of a road grader and tractor. For this work a five-ton caterpillar tractor,

with a good grader weighing at least one-half and not exceeding two-thirds of the weight of the tractor, is the most effective combination. A suitable roadplow, a scraper, and road-drags should also be available. Where light cuts and fills are necessary the plow and the scraper should be used to construct proper vertical curves on the grade line. Such cuts and fills eliminate short breaks or changes from an ascending to a descending grade. A road drag should be used to keep the surface properly shaped after the grading has been completed, and until the newly constructed surface is solid enough to carry traffic. This is much cheaper than the use of tractor and grader for this particular purpose.

On hillside locations with slopes up to 30 degrees, the construction of a road is nearly as easy as the construction of a simple turnpike road, and the drainage and surface obtained are generally far more satisfactory than is the case with the turnpike road. When a road on a hillside location is graded, it is of the utmost importance that the first cut should be made at the top of the slope and that stakes should first be placed with reference to the center line grade, so that this can be accomplished. If care is taken to make the first cut properly with grader or plow, the road builder eliminates the necessity for a large amount of expensive hand sloping. On sidehill slopes that exceed 30 per cent, road building is more expensive. Before it is possible to work in such situations with tractor and grader, it is generally necessary to construct a bench. Where this is necessary, all possible hand labor must be avoided in order to keep the cost within proper limits. Generally a team of horses and a light reversible sidehill plow are effective in making the first cuts, and a light horse-drawn grader can be used to advantage in moving the earth loosened by the plow. Where the slopes are too steep for a team, a single horse and a light plow can be used until sufficient level space has been obtained for a team to work.

On roads cut in steep slopes, when the requirement is for at least 16 feet of road width, it is cheaper and far more satisfactory to use the modern gas shovel, providing there is a considerable amount of this kind of work to be done. It is not necessary to remove the stumps and stones before grading as it is when tractors and graders are used. The finished grade and side slope left by the shovel are generally more satisfactory than the grade and slope left where the work is done with the grader. After the shovel has completed the heavy grading, the tractor and grader can quickly and cheaply shape the surface for travel.

When a road is built by the usual methods, that is, with the tractor and the road grader, the results obtained, and, to a large extent, the cost of construction, depend on the ability and interest of the tractor and grader operators. Comparatively few men understand how to operate a road grader so as to accomplish the most possible and the best work. An efficient operator, with a few laborers to remove large stones and roots, can produce gratifying results at a very reasonable cost. Only trained operators should be used, and they should be held responsible for the results obtained.

In a number of projects the roads have to be constructed through a section of one-man size rock and even large boulders. In these cases a large amount of hand labor is unavoidable. But after the rocks have been removed, machinery can generally be used to advantage in shaping the road. On other locations, it is necessary to shape the roadbed out of the local stone and haul in suitable material for the surface. Such roads, although more expensive to construct, give general satisfaction when built, for their roadbed is perfectly drained, and the road as a whole is in shape for travel at all times.

PROPER AND ADEQUATE ROAD DRAINAGE

We cannot have well constructed and serviceable forest roads without proper drainage. The matter of drainage requires far more attention than it generally receives. In road building there are three types of drainage to consider, namely, surface drainage, sub-surface drainage, and natural cross-drainage.

In order to protect our road from surface drainage, it is necessary to give the surface a crown of from three-fourths of an inch to a full inch, to every foot of width. Such a slope will carry the water quickly to the side ditches. In the case of nine-to-twelve foot sidehill roads, the roadway should slope toward the bank, for safety in travel. Enough cross-drains must be used to carry off the surface water which collects in the side ditches. This water must be led under and away from the road, before it has obtained enough volume to cause damage to ditches and roadway by washing. On grade, these cross-drains should not be placed at right angles to the center line of the road, but should be given sufficient slant from right angle, and a fall of four to eight per cent, in order that the heavy wash will pass through the pipes and not clog them. When pipe cross-drains are used they should not be less than one foot under the surface of the finished road. Such setting will protect the pipe and also insure better drainage.

Sub-surface drainage presents quite a different problem and is more difficult to handle properly. The road builder has to contend with seepage, marshes, bog holes and springs that arise under the roadbed. To overcome these difficult conditions, it is necessary to widen the roadway and allow the sun and air to help dry the surface. Through swamp land, deep open ditches dug parallel with the road will often lower the sub-soil drainage. Hence, by ditching it is often possible to obtain satisfactory road surfaces through marsh lands. Springs beneath the surface of the road can be drained by ordinary stone drains; in other cases it is necessary to resort to rock fills to get a satisfactory surface.

By the term natural cross-drains is meant the live streams that must be conducted across the road by means of bridges or pipe culverts. Where it is necessary to build a bridge for this purpose, care must be taken that the bridge is large enough to carry all the water in the flood season; also that the best location is selected; and that the bridge, when constructed, shall be well above high water and floating driftwood. Wherever possible suitable local material should be utilized. In most places in the State forests suitable stone is available for abutments and piers. When these are well constructed of stone they are cheaper and as permanent as concrete.

A well constructed bridge superstructure that is made of sound wooden stringers and three-inch oak plank floors is good for ten years of service under average forest conditions. No permanent bridges should be built, except on the main, fully-developed, and permanently-located forest roads. For the construction of permanent bridges special plans will be furnished.

SURFACE TREATMENT OF FOREST ROADS

A well-drained road, constructed through sections where earth, shale, or other suitable road building materials are found, is serviceable for travel at all seasons of the year. Such roads are easy to maintain and can be driven over in comfort. This favorable natural condition occurs only on approximately fifty per cent of the roads in the State forests of Pennsylvania. To make other roads serviceable at all seasons, it is necessary to haul in proper surface materials. By careful search it is often possible to find suitable shale or gravel within reasonable hauling distance, or even along the roadway itself. In other sections are found unlimited quantities of stone that can be used to build up the bed sections. If the road justifies the expense, small crushers can be used to crush this local stone material. With this prepared material a serviceable road surface can be constructed at a relatively low cost.

MAINTENANCE OF FOREST ROADS

The importance of proper maintenance of forest roads cannot be over-estimated. If the construction of a road is justified then the road itself must be maintained in order to protect the investment and render the service that justified its building. Occasionally several miles of earth road with an initial investment of \$1,000 to \$5,000 a mile for construction are found in a fair condition, with the exception of two or three short sections. Often such a situation is caused by poor drainage. In many cases, the amount of money and time required to make satisfactory repairs would be a small item, but for the lack of these needed repairs the entire road is practically useless. Such a condition is never justified. Maintenance consists in keeping a road up to the standard established in construction and in making minor improvements. Maintenance consists in giving constant attention to surface and drainage, to mowing weeds, cutting brush that overhangs the roads or obscures the view on curves, and to keeping the roadway free from fallen trees and rubbish, so that it presents a neat appearance. Maintenance is also concerned with erecting and keeping in repair proper signs as guides or warnings to the public.

It is generally necessary to reshape the surface of a road with a light grader in the spring as soon as the frost has left the ground. In some cases, even a good road drag will give satisfactory results in reshaping if the dragging is done before the ground has settled. The importance of the road drag for maintenance must be emphasized. Dragging when necessary is the best and cheapest kind of surface maintenance. Immediately after a rain, as soon as the soil has dried sufficiently so that it will not stick to a drag, but will pack under traffic, is the time when dragging gives the best results for earth roads. Shale roads should be dragged while they are wet. Dragging a road in the late fall, just before a road freezes, will close the ruts. The surface will freeze smooth and the road will be in good condition in the spring. By varying the load of a drag and by lengthening or shortening the hitch, it is possible to produce satisfactory results. Surface holes must be kept filled with suitable material. If possible, this material should be the same as that of the present surface, so that the wear may be uniform. Wet places in the road must be stoned so that they can carry the necessary traffic.

Drainage maintenance consists of cleaning the outlets and inlets of all culverts and cross-drains, and in keeping open all drainage ditches, placing additional cross-drains where necessary, removing and replacing improperly placed and poorly located cross-

drains, examining all bridges and retaining walls, and making the necessary repairs.

Adequate and cheap maintenance requires adequate and proper equipment. For the conditions on the State forests of Pennsylvania light tractors and graders, road drags, and medium weight dump trucks are best, as teams are seldom available. If the best results are to be obtained the right equipment must be available at the right time.

COMPREHENSIVE FOREST ROAD SYSTEM IS NEEDED

Though the total sum spent for the building and maintenance of forest roads may appear large, the expenditure is more than justified if the money is properly used. Every road constructed should be a part of a comprehensive system for forest protection, forest development and public use. For every road that measures up to standard requirements, the Commonwealth is justified in spending the money necessary to build it and to keep it in proper repair.

Roads are but means to an end. The ultimate end is human betterment. Social improvement has been, and will continue to be dependent very largely upon transportation.

STATE FOREST ROADS AND TRAILS

Committee

T. ROY MORTON

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Presented by T. Roy Morton

WHEN the first forest areas were purchased by the Commonwealth, practically no good roads or trails were found upon them, but as funds permitted much was done in the way of utilizing the more or less temporary roads that had been used in logging operations. On these forest areas were a great many old lumber roads and tramways overgrown with brush and trees. Early in the administration of the State forests it became apparent that if forest fires were to be controlled with any degree of success and other forest operations carried on successfully, particularly the reforestation of barren areas, the State forests would have to be made accessible. It was only natural to use that which seemed to offer the quickest and cheapest solution, namely, the repairing of these old roads. For years many miles of them were kept clear, and they were of great value in fire suppression. They made areas accessible and served as fire trails from which fire fighting crews could work. These old lumber roads and tramways could be traveled on horseback or with wagon, which were the only means of travel available at that time.

The days of the old wagon road with its bad alignment, steep grades, and rough surfaces are now a thing of the past. As a result of the change in our transportation, it was found that the development of roads without a definite plan would prove costly and many of them would need to be relocated or abandoned. Road crews twenty years ago consisted of teams of horses and men with picks and shovels, but as the need for a higher standard of construction increased, road machinery such as steam shovels, trucks, tractors and graders have of necessity followed, and now the State forests are becoming more accessible by the development of an extensive system of roads and trails.

ROADS ESSENTIAL TO GOOD FOREST MANAGEMENT

Forestry in Pennsylvania is no longer a theory. The best forest practices dictate that if the forests are to be administered so as to bring the greatest possible benefit to all the citizens of

the Commonwealth, a system of well planned and well built roads is essential. Such a system must be developed to make all parts of the forest accessible. These roads are essential from the standpoint of (1) forest protection, (2) forest administration and development, and (3) forest recreation and other public uses.

GOOD ROADS MEAN BETTER FOREST PROTECTION

Good roads in the forest offer the best means of controlling forest fires. Pennsylvania has had many destructive forest fires which might have been prevented had there been an adequate system of roads and trails. Forest fires cannot be entirely prevented, but by being attacked quickly they can be prevented from becoming large and from doing great damage. Many places exist today in the State forests where it is necessary to walk from five to seven miles in order to reach a forest fire. This results in a great loss of time and permits of the fires becoming serious and destructive. Forest fire fighters, even though physically able, are loath to walk great distances to extinguish fires. Even those willing to walk several miles, upon reaching the fire are unable to render their best service. Every portion of the State forest should be readily accessible for quick transportation of fire fighters. Delay in reaching a single fire may cost the Commonwealth many times the cost of construction of necessary roads and trails.

A well planned and well built system of roads prepares the way for sound forestry practice. Roads make it possible to utilize forest products to good advantage and may double the stumpage value of all trees in the forest. In fact, the success of forest management depends to a large degree upon the existence of a well developed transportation system.

One of the major uses of the State forests is to provide healthful recreation for the people of the Commonwealth. Full use of the forest for recreation is encouraged, and increasing numbers are taking advantage of this opportunity by hunting, fishing, camping and hiking through the forests over roads and trails. People are only beginning to appreciate what the forest offers in the way of recreation. Records show that in 1928 one and one-half million people visited the State forests of Pennsylvania. This means that about one-sixth of the population of the Commonwealth is using the State forests, which clearly demonstrates the urgent need for making them readily accessible. A forest road system which can be traveled by automobile will add to the wealth of the State and to the health of its people by the wholesome use of leisure time spent in recreation.

KINDS OF ROADS

The administration of the State forests, comprising as it does such varied activities as fire prevention and suppression, reforestation, recreational development, including parks, temporary and permanent camps, utilization and lumbering, has demonstrated the need for three classes of roads, namely, (1) primary roads, (2) secondary roads, and (3) trails.

These are roads which will be permanent and serve as base roads for continual general use. Care should be taken to select the proper location and alignment with a grade not over eight per cent. The surface of these roads should be the best obtainable from local material, and this will be determined largely by the amount of traffic. Usually a 16-foot surface can be constructed with the necessary extra width required for proper drainage.

The secondary forest road system serves as great a use as the primary road system for forest development and protection purposes. These roads tie together the primary systems and open up otherwise inaccessible areas. Traffic on these types of roads is generally much lighter than on a primary system, and a standard of construction is applied which will develop roads at a lower expense and serve the purpose for which they are intended. Secondary roads rarely need to be wider than is necessary for one-way traffic, with proper turnouts for passing, and a 12 per cent grade is not considered excessive.

Trails are carefully laid out paths through the forest. They are seldom more than six feet in width, with rocks, logs, and other debris removed. Their function is to provide a means of access to blocks of timberland between roads where it is not economically feasible or desirable to construct roads. They are of particular value in forest fire control, and while used chiefly as avenues of approach, may in cases of large fires be used as bases for back fire and attack. In some instances they follow potential road routes and their construction thus represents a stage of development of ultimate forest roads.

PRESENT MILEAGE OF FOREST ROADS

On the State forests of Pennsylvania there are now 2,230 miles of roads. Only a small percentage have been constructed and maintained in condition to meet present needs. Most of these roads are of a temporary type. They were constructed at small cost to serve the immediate need for forest protection and administration. To date 761 miles of these roads have been so constructed or rebuilt that they are maintained in condition for automobile traffic. Of the 761 miles which comprise the present

developed road system, 378 miles are classed as primary roads. They range in width from 10 to 16 feet and were built at an average cost of \$1,500 per mile. The remaining 383 miles of the roads in condition for automobile traffic, comprise our present developed secondary road system. These roads have been constructed for light traffic and range in width from 9 to 10 feet. They were built at an average cost of approximately \$1,000 per mile.

The Department of Forests and Waters has also constructed and is maintaining 2,952 miles of trails. The construction of trails has been relatively simple, and the cost thereof comparatively light, averaging approximately \$25 per mile.

Road and trail work has been a part of State forest operations since a time shortly after the first land was purchased in 1898. At times substantial progress was made, while at other times it moved slowly because of inadequate funds. During the past two years the largest road and trail program ever undertaken in the history of the Department was placed in operation. On the Logan State forest, located in Huntingdon County, of which I have had charge for more than twenty years, the allotment for road and trail work during the last four fiscal years was as follows:

<i>Year</i>	<i>Amount</i>
1925-1926	\$1,350.00
1926-1927	1,675.00
1927-1928	7,107.12
1928-1929	7,000.00
Total	\$17,132.12

As a result of the increased allotments during the last two years, it was possible to place the roads in better shape than at any time since I have had charge of this interesting forest. For example I will cite the Harry's Valley Road, which was rebuilt in 1927-1928 at an average cost of \$1,360 per mile, and the Diamond Valley Road, also built in 1927-1928, at an average cost of \$1,190 per mile. Both of these roads belong to our primary road system.

Before these roads were rebuilt they were not in condition for automobile traffic except a few months during mid-summer. At present they permit automobile travel any month during the year. They are a safeguard to the forest and a joy to the people seeking recreation. They have opened up both valleys for quick transportation of fire fighters.

NEED FOR MORE FOREST ROADS

If the State's investment in forest roads is to be protected properly, consideration must be given to their maintenance. If maintenance is neglected, the original investment is soon lost. The cost of maintenance depends upon the traffic the road carries, how well the road is drained, and the soil or material which makes the wearing surface, as well as to what extent the forest districts are equipped and organized to take care of maintenance at the proper time. Very few of our roads have heavy enough traffic to justify the expense of constant maintenance. In most instances periodic maintenance will be satisfactory.

The annual cost of maintaining the average primary State forest road amounts to approximately \$125 per mile. The maintenance of the secondary road system, on account of light traffic, should not exceed \$50 a mile. The maintenance of trails consists chiefly of mowing the brush and removing fallen trees and other obstructions. The annual average cost of this work will not exceed \$5.00 per mile.

There remain 1,469 miles of unimproved forest roads in our present road system. Of this amount, 135 miles belong to the primary system and 200 miles to the secondary system. There is a demand for immediate construction or rebuilding of these roads if the forests are to be properly protected and developed and the public given access to the vast stretches of unbroken forest land now owned by the Commonwealth. The construction or rebuilding of the present unimproved primary roads will cost approximately \$2,500 a mile. Many of them must be re-located or have proper grade and drainage. For the present unimproved secondary roads, for which a lower standard of construction will serve, the cost should be approximately \$1,200 a mile.

There is urgent need for the immediate construction of 225 miles of new trails for forest protection on the forest lands purchased during 1928. This trail construction will represent an expenditure of not less than \$10,000 to protect the growing timber on the new purchases. This amount can easily be lost to the Commonwealth by one uncontrolled fire within a forest upon which adequate trails are not available.

CONCLUSION

Good roads through our State forest areas, built at a reasonable cost, are necessary for the protection, development and public use of the State forests by Pennsylvania's citizens, who are the stockholders. By having good roads every one will reap the benefits of this ownership.

With the recent expansion of our State forest areas, the need of developing a system of roads and trails upon the newly acquired lands is apparent. Nothing will do more toward giving these new areas the best kind of protection against fire, and nothing will help more to open up the resources thereon for everybody's use, than the construction of an adequate system of serviceable forest roads and trails.

Good forestry, assuring adequate protection and development of our State forests, requires that ultimately there should be ten miles of roads and trails per 1,000 acres of timberland. At the present stage we are far from this mark. To construct a complete system of roads and trails will require a number of years, but the improvement and rebuilding of the roads comprising our present system, and the construction of new roads and trails to protect our new purchases, is a direct obligation which should be met at the earliest possible opportunity.

RECREATIONAL OPPORTUNITIES IN THE STATE FORESTS

Committee

JOHN R. WILLIAMS PROF. HAROLD HORNING
V. M. BEARER LAWRENCE E. FISHER
W. F. DAGUE

Presented by John R. Williams

THIRTY years ago the need of out-door recreation was foreseen by the pioneers in the forestry movement of Pennsylvania. Our first Commissioner of Forestry, the late Dr. Joseph T. Rothrock, speaking for his colleagues on the Commission, advocated the use of forest lands for health and recreation at the very beginning of the State forest program. When the recommendations were made to the General Assembly for the purchase of State forest land one of the major reasons given for their acquisition was that:

The State forests should combine in themselves not only charm of scenery which would attract our population to them but that they should also possess such altitude, purity of atmosphere, and general health-giving conditions as would make them sanitariums for those of our population who did not desire or could not go to remoter points for renewal of strength.

From a modest beginning in 1898 with the purchase of 17,010 acres, the State forest lands have been increased until now they contain almost 1,300,000 acres, and in their development the needs of the people for wholesome out-door recreation have not been overlooked. The public forests of Pennsylvania have been freely used by her people since their creation. Governor Stone, in his Arbor Day proclamation in 1901 stated: "These Forest Reserves will be the people's parks, free to all who comply with the laws for their preservation." Nowhere on these forests may one see a "No Trespassing" sign, but on every main thoroughfare at the entrance to a State forest is erected a sign welcoming the people to their own forest domain. The increase in the number of visitors to our State forests has been truly phenomenal. In 1920 it is recorded that 60,000 people visited them; in 1921, 80,000 people; in 1922, 202,000 and in 1928, one and one-half million. These figures show beyond a doubt, that there is a real need for outing grounds and that our State forests are being used to an extent perhaps undreamed-of a generation ago.

Let us review what has been done to meet the recreational needs of our people on the State forests of Pennsylvania. To begin this line of work the State Forest Commission in 1903 adopted the following resolution:

Whereas, the Forest Reservations of the Commonwealth of Pennsylvania are comprised of tracts of land at present distributed throughout 23 counties, which tracts differ in extent, topographic features, commercial value, and historic interest, and which contain as a whole all the marked character of the scenery of the State, such as broad summit plateaus overlooking the surrounding country, sharp ridges separating deep mountain valleys, noble bluffs at the confluence of streams, mountain brooks of great beauty, and natural riverside parks, and,

Whereas, the Forestry Commission is in receipt of numerous requests for permits to locate camps, or for erecting cottages upon State forest lands at various points; therefore, upon consideration, it is hereby

Resolved, That concessions for camps, or erection of cottages cannot be granted where the site designated in the request or application is one of exceptional beauty, or of great historic value. All such sites are held as a trust for the benefit of the general public forever.

STATE FOREST MONUMENTS

Since 1903 a great advance was made, for in 1921 several noteworthy and historical groves were designated as State Recreational Parks, and in September of that year the State Forest Commission resolved to call these areas State forest monuments to conform with national practice. In following out this commendable recreational activity nine State forest monuments and three special scenic areas were set aside.

The Bear Meadow State Forest Monument in the Logan State Forest in Center County, is perhaps the most unique of these monuments. In this forest meadow of 350 acres is found growing balsam fir, tamarack, spruce and mountain ash, all tree species rare in Pennsylvania. Some of the largest specimens of the tree huckleberry known in the World are also growing in this forest meadow, as well as the ordinary mountain laurel. Some specimens of the latter have a diameter of five inches at breast-height. Within this area are also growing thickets of rhododendron of unusual size, and rare sundew and pitcher plant. In the same State forest there is also set aside a 50-acre plot comprising a tangle of giant forest trees, mostly white pine and hemlock, overtopping dense thickets of rhododendron. This plot

is called the Detweiler Run State Forest Monument. In this forest is also one of two State forest monuments named for two young poets who gave their lives on the battlefields of France, namely, Alan Seeger and Joyce Kilmer. Within the Alan Seeger State Forest Monument are hemlock trees of great size and age and some of the finest oaks in the State. The rare table mountain pine is found there and the rhododendron often reaches a height of 40 feet.

The Joyce Kilmer State Forest Monument contains 21 acres of old hemlock and white pine and is located in the Bald Eagle State Forest in Union county. At the entrance to this monument is hung a sign bearing the legend "Gypsies Are Welcome to Camp Here," this in fulfillment of a wish of the poet that some day he should own a bit of wild woodland upon which gypsies would be welcome to camp.

Should one travel up Kettle Creek in Potter county, the flags of the United States and Norway could be seen flying from the top of a high cliff. These flags mark the site of the castle which was built by Ole Bull, famous violinist, who in 1852 came with 800 colonists from Norway, to establish a community of his countrymen in the heart of the Black Forest of northern Pennsylvania. This historic spot, of pathetic memory, is preserved in the Ole Bull State Forest Monument in the Susquehannock State Forest.

Beautiful rock scenery, together with stands of splendid original hemlock and white pine, is found within the McConnell Narrows State Forest Monument in the Bald Eagle State Forest in Union county. It is said the last herd of wild bison in Pennsylvania was destroyed near this monument, in the famous "Sink," in 1799.

On Martin's Hill in Bedford county, which rises to a height of 3,075 feet above sea level, in the Buchanan State Forest, are nine acres of large original hemlock that has been set aside as the Martin's Hill State Forest Monument.

Mount Logan State Forest Monument in the Bald Eagle State Forest, comprises 47 acres of superb primeval white pine and hemlock. It was named in honor of Chief James Logan, greatest of the Indian orators, whose happy hunting ground it was.

The Mount Riansares State Forest Monument, covering 13 acres in the Bald Eagle Forest, has perhaps the most romantic history of any of our State Forest Monuments. This area is part of the timberland which was purchased for Maria Cristina, former Queen Regent of Spain, with money obtained by her for the sale to the United States of the land that is now the State of Florida. She directed that the highest point on her Pennsylvania posses-

sions should be named after her husband, the Duke of Rianares.

In addition to these monuments, three special areas of rare scenic charm and beauty have been set aside for perpetual preservation. They are the Cherry Springs Drive, Coxe's Valley View and the Site of Valhalla. No cutting is permitted on these scenic areas excepting for improvement purposes.

SEEING PENNSYLVANIA FROM OBSERVATION TOWERS

Pennsylvania's unparalleled beauty, as viewed from her splendid system of highways, has received most favorable comment. Each year, with the increase of road building on the State forests, the motoring public is brought in closer contact with practical forestry work. No feature of Pennsylvania's forest management program has attracted more attention than her State-wide system of forest observation towers. There are now 117 of these observation stations, ranging in height from 40 to 80 feet, on the highest points in the Commonwealth, affording magnificent views over vast areas of forest land. From some of the most commanding sites as many as 250,000 acres of forest can be seen. While built primarily for fire detection, these towers are open for the use of the general public.

STATE FOREST PARKS

To meet the ever increasing demand for general recreation, six State forest parks have been set aside within the State forests of Pennsylvania. These State forest parks are equipped with shelters, cooking places, sanitary toilet facilities, and in many instances running water which is piped from nearby springs. Tables and benches are also supplied. Bathing and wading places for children are provided at some of the parks. Usually a refreshment stand or restaurant is operated as a private concession. By a special arrangement with the concessionaire he is responsible for keeping the grounds clean and for the general maintenance of the surrounding area. These parks are not allowed to develop into so-called amusement parks with noisy merry-go-rounds and other mechanical contrivances. The children's needs are provided for by sand boxes, slides and swings, and for the young people, athletically inclined, tennis courts and ball grounds have been built. For those less strenuously inclined, quoit courts are provided. In one or two State Forest Parks public dance floors are managed under concessions and are proving popular.

These State forest parks of Pennsylvania are provided primarily for the use of picnic parties, for family gatherings, as meeting places for social clubs, nature study clubs and similar uses. Over-night camping is not allowed. Each of the State forest

parks is located on the site of some historic event or has some natural features which makes it unique, and all are situated on main highways which make them reasonably accessible from large centers of population.

The Caledonia State Forest Park is located along the Lincoln Highway in the Michaux State Forest in Franklin county. It is the site of one of the early charcoal iron furnaces erected by the Great Commoner, Thaddeus Stevens, the Father of the Public School System of Pennsylvania, and was named by him after his native home in Caledonia county, Vermont. This historic furnace was destroyed by the Confederate Army in July, 1863. It is noteworthy that the only public golf course on State forest land in Pennsylvania adjoins this park.

The James Buchanan State Forest Park at Stony Batter, in the Buchanan State Forest in Franklin county, marks the site of the birthplace of the fifteenth President of the United States. A stone pyramid monument marks the site of President Buchanan's birthplace. In 1913, 3,000 Norway Spruce trees—now 25 feet high were planted about the monument.

The George W. Childs State Forest Park in the Delaware State Forest in Pike county was deeded to the Commonwealth by George W. Childs, for many years editor and publisher of the Philadelphia Public Ledger. This most picturesque park contains three beautiful waterfalls and a great variety of forest trees. It is one of the outstanding beauty spots within the State forests of Pennsylvania.

The Voneida State Forest Park in the Bald Eagle State Forest, near the eastern border of Center county, was named for a most interesting character, John Voneida, a hermit and philosopher, who spent his last fourteen years on this beautiful mountain spot. In this same Forest District, but located about five miles west of Troxelville, in Snyder county, is the Snyder-Middleswarth State Forest Park. It covers 425 acres of virgin timber, mostly white pine and hemlock.

The Leonard Harrison State Forest Park, located in Tioga county, contains 121 acres and lies a short distance east of the former Black Forest, the most extensive stretch of forest land in the State. It commands a notable view of the Pine Creek Gorge, one of the wildest and most picturesque sections of Pennsylvania. It was the generous gift of the late Leonard Harrison of Wellsboro.

PUBLIC CAMPS IN STATE FORESTS

The public camps located within the State forests of Pennsylvania are provided primarily for the use of campers, tourists and local vacationists who desire to pitch a tent and remain in

the forest. Those desiring to remain longer than one night are obliged to secure a camping permit from a forest officer. These permits are good for a period of three weeks and may be renewed at the end of that time.

These public camps are generally smaller in area than the State forest parks and are usually located in sequestered spots along secondary roads, although some of the most widely used ones are on main highways. They are equipped with needed conveniences such as cooking places, fuelwood, a pure supply of drinking water, sanitary toilet facilities, tables and benches and rustic shelters. Bathing places are provided in many instances. Quoit courts and ball grounds are also available.

STATE FOREST CAMP SITES

In order to provide places for those who desire to remain in our forests for relatively long periods, such as a stay during the summer or during the hunting and fishing season, legislation was enacted giving the Department of Forests and Waters authority to grant leases on special small sites within the State Forests. This legislation was passed in 1913. These leases are for a term of ten years, and the privilege thereof is open only to citizens of Pennsylvania. A nominal annual rental of from seven to fifteen dollars is charged. Many of these camp sites are leased to hunting clubs and fishermen, and no group of citizens is more enthusiastic about recreation on State forest lands than the sportsmen of Pennsylvania. Each year sees more farm and private wild lands posted with "No Trespassing" signs and it is becoming an accepted fact that future recreation of this sort may be had only on State lands. There are now 1,945 such leases in the State forests of Pennsylvania.

GOOD HUNTING AND FISHING IN STATE FORESTS

During 1927, 505,600 hunting and 293,000 fishing licenses were issued in Pennsylvania and it is safe to say that a large percentage of these pursued their sport in the State forests. While only ten per cent of the forest area of the State is contained within our State forests, 45 per cent of the deer killed, 38 per cent of the bear, and 31 per cent of the elk, were shot during 1927 on the State-owned forest lands. Within the borders of State lands are located 20 game refuges, aggregating 45,612 acres. In addition to these game propagating areas are the State forest parks and public camps, within which no hunting is allowed.

It is interesting to note the attraction Pennsylvania's recreational opportunities have had for the non-resident of Pennsylvania. Non-resident hunting licenses to the number of 4,880 were issued in Pennsylvania during 1927, having a value of \$73,200, and

4,500 non-resident fishing licenses. That more than 100,000 non-resident hunters, fishermen, and tourists visited the woodlands of Pennsylvania during 1927 is a conservative estimate. It would be interesting to calculate what a commercial asset these visits meant to the communities in and adjacent to our State forests. If these visitors spent an average of \$10.00 each in our forest communities, there was a total expenditure of \$1,000,000 distributed throughout these forest regions by people from outside of Pennsylvania. If \$1.00 was spent by each of the 1,500,000 Pennsylvanians who have visited our State forests during 1928, we find that this army of visitors distributed \$1,500,000 in the forest communities.

RECREATION AND TIMBER PRODUCTION

It would seem that on some special areas recreation has come to rival timber production. In places this development is liable to bring serious conflict between the recreational interests on one hand and the timber growing interests on the other. This danger can be avoided through proper classification of our forest areas as to proper uses. It will be necessary to distinguish between the areas where timber production should be the primary use and others that are potentially recreation areas.

When an attempt is made to make such a classification the question at once comes up as to what shall be the standard in measuring the relative value of land for the different uses. The returns from outdoor recreation in the form of health, happiness, and wholesome living, are admittedly great, but it is difficult to express this in monetary value. In order to have a basis from which to calculate the value of recreation, let us assume that it is affected by the law of supply and demand like any other commodity. Then it will be fair to assume that recreation is worth at least as much as the public pays for it. Using this as a measure of value let us take the case of the Michaux State Forest, located in the South Mountains in Adams, Cumberland and Franklin counties. In this forest, conditions are such that it has been possible to collect fairly accurate data as to the extent of recreational uses. For the year 1927 the classes of recreational use and the number of persons reported under each class are as follows:

<i>Kind of Forest Users</i>	<i>Number</i>
Permanent Campers	3,300
Temporary Campers	465
Public Camp Users	2,500
Park Users	90,000
Hunters	3,000
Fishermen	450
Transients	8,000

The largest class is made up of users of the park areas. This includes chiefly picnic parties varying in size from the family group to single gatherings of as many as twenty-five hundred persons. These were people who used the forest for one day or less. Under transients are included those who were reported at the various inns, along with users of the public golf course. Known groups who made automobile tours over the State forest are also included in this class. This last class is admitted to be incomplete because of the impossibility of getting full record of all the smaller parties who made drives over the forest on holidays without stopping at the recreational centers. Many of the people listed as campers spent weeks and even months in the forest. It may therefore seem a conservative estimate to say that the public spent at least 100,000 days of recreation in this forest of 40,000 acres.

Taking our former estimate of one dollar per person in actual expenditure for transportation food and lodging while in the forest, including fees for dancing and golfing, and rentals for permanent camps, it figures out that the public spends at least \$100,000 per year for recreation in this one State forest. This calculation assumes that the entire acreage is uniform in recreational value. As a matter of fact fully 90 per cent of the recreational use is confined to 10 per cent of the area. The public is spending therefore \$90,000 for recreation enjoyed on only about 4,000 acres.

Aviation is still in its infancy but already we can say that people are flying to our State forests. We are living in the aftermath of a great war and are now confronted by unusual conditions which are the result of that war. In the past 75 years, which covers the period of our intensive timber exploitation, we have changed from a nation of a largely rural population to one of an urban population. Less than 26 per cent of our population is now actually living on farms, more than half of our people are now living in towns of 2,500 or more and the tendency is toward concentration in villages and towns and away from isolated sections. These facts are mentioned to show that with the increased leisure of our modern civilization, our people, following an instinct inherited from their pioneer ancestors, are taking more and more to the great out-of-doors, there to breathe pure air, drink from cold mountain springs, and revel in the freedom from their daily tasks. For this worthy cause the State forests of Pennsylvania are open at all seasons of the year.

THE DEVELOPMENT OF A STATE FOREST CAMP SITE PROGRAM

Committee

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Presented by R. W. Stadden

PENNSYLVANIA'S State forests now comprise approximately 1,290,000 acres purchased at various times during the last thirty-one years. From the very beginning of the administration of these forest lands there were numerous requests for camp site privileges. For the most part these were desired in connection with the erection of tents during the deer season, but with the passing of years the need of providing small recreational sites for extended periods became apparent. This was a need which the Department was very glad to fill since the providing of hunting and recreational grounds for the citizens of the Commonwealth has always been one of the principle objectives in the whole State forest program. To make this possible the Forestry Commission sponsored the act of March 27, 1913 which permitted the Department "to lease, for a period not exceeding ten years, on such terms and conditions as it may consider reasonable, to any citizen, church, organization or school board of Pennsylvania such portion of any State forest as the Department may deem suitable as a site for a temporary building to be used by such citizen, church, organization or school board for health and recreation or as a site for a church or school purposes".

The first camp site was leased under the provisions of this law on October 21, 1913. For some time the demand for permanent camp sites was rather limited, but it gathered momentum as it progressed and is now growing by leaps and bounds. This is indicated by the fact that on January 1, 1919 there were less than 400 camp site leases in effect; on January 1, 1924 the number was approximately 1,000; four years later it had increased to 1,840 while at the present time (January 1, 1929) there are 1,945 leases in effect.

CAMP SITE REVENUE AND VALUE

In addition to the personal benefits accruing to those who use these camp sites, and the increased favor which the Department receives as a result of them, there are certain monetary advantages which are sometimes overlooked. This is of great importance from a local standpoint since, in accordance with present court decisions, it is possible for townships and counties to levy taxes upon buildings erected upon permanent camp sites. Hence, the local revenue is increased in proportion to the number and value of these camps. This necessarily applies to districts which are usually poor and greatly in need of such revenue as they can possibly obtain, while the amount levied on each camp is quite nominal. The State School Fund has also been a beneficiary of the Department's camp site program to the extent of more than \$100,000.00 since 1913. From a Departmental standpoint, the Delaware Forest District, which has 486 permanent camps—the greatest number of any district in the State—might be cited as an example. In this district there are 64,597 acres of State forests which originally cost the Commonwealth \$99,756.64 or an average of only \$1.54 per acre. The revenue from camp sites in this district in 1928 amounted to \$5,168.60 which is a return of slightly more than five per cent upon the original land investment. In the Delaware Forest District as is the case in all others, the maximum return has not yet been reached as there are still available a great number of desirable camp site locations.

NEED FOR FORWARD-LOOKING PROGRAM

The importance of the permanent camp site problem in its relation to proper forest management has been fully recognized by the Department of Forests and Waters. In 1927 a committee of five foresters, of which I had the privilege of being a member, was appointed to study conditions and to formulate a definite camp site program, and many of the suggestions which will be made hereinafter are the result of the efforts of this committee. The purposes of the camp site program in the State forests of Pennsylvania cited in the committee report are (1) to correlate present practices and methods; (2) to consider their adaptability for future administration; (3) to assure a proper classification of land use in the State forests in order to provide for public and private recreational needs; (4) to raise the standard of recreational use in the State forests; (5) to anticipate future needs; (6) to eliminate unnecessary details of administration and to effect the fullest cooperation between the Department and its permittees. The present intention of the Department is to endeavor to foresee the future recreational needs in the State forests and then to fill these requirements in an orderly and efficient manner.

This can be done only by substituting a well balanced and properly conceived program in place of the somewhat haphazard methods that are usually followed at the inception of most newly organized activities.

FOREST LAND CLASSIFICATION

In view of the ever increasing demand for camp sites, it seems imperative that a survey be made of each forest which will designate in general the forest areas that are not available for permanent camp sites and will, in addition, specifically indicate areas on which permanent sites will be granted. It is quite apparent that in the former classification will be included such areas as will be needed for future administrative uses; areas desirable for general recreational use, such as the State forest parks, State forest monuments and scenic areas; lakes, dams and streams of such a nature that they should be devoted to public rather than private use; and also such areas as may be needed for special purposes, and those such as water sheds whose unrestricted use would be contrary to public policy.

SURVEY OF AVAILABLE CAMP SITES

After all such areas have been excluded, attention may then be directed to those remaining areas where the semi-private use by individuals or groups will not conflict with administrative use by the Department nor with public interest. Upon these areas each district forester should designate certain locations as available for permanent camp sites. Emphasis should be placed upon the necessity of the forester's taking the initiative in the selection of camp sites. He should suggest and direct rather than merely acquiesce in the desires of those seeking camping privileges. Too often in the past and even in the present, this latter condition has existed when better results both from the standpoint of the Department and also of the lessees would have resulted had the forester played a more active part in the selection of the sites.

CAMP SITES AND WATER SUPPLY

When the present leasing system was begun in accordance with the act of 1913, those applying for sites usually selected locations in close proximity to good springs and frequently were granted a lease which included the spring itself. This was soon recognized as being highly objectionable, and definite instructions were issued that no springs be included within leased ground. In the case of leases which already contained springs, the boundary lines were modified as soon as the site was re-leased. With the rapid expansion of the camp site movement, cognizance must be taken of

the fact that the location of camps can no longer be restricted to areas in close proximity to springs and streams but that in many cases other means of providing pure drinking water will have to be used.

HEALTH REGULATIONS

Nothing in connection with the camp site program is of greater importance than sanitation, and the Department should make a special effort to see to it that the camp sites under its jurisdiction are models in this respect. In the first place, attention should be given to the location of toilets and garbage pits and an active effort must be made to enforce rigidly the recommendations and rules of the State Department of Health with regard to their care. Incidentally, these matters should be made clear to the lessee prior to the execution of the lease, so that there can be no misunderstanding on his part as to his responsibilities.

BUILDING REQUIREMENTS

As indicated in the provisions of the lease, plans for any buildings erected thereon must have the prior approval of the District Forester both as to the location and the actual specifications of the proposed structure. It should not be the aim of the Department to make the buildings erected on the permanent camp sites distinctive in character but the lessee should be required to comply with certain definite standards. This standard may vary in different locations and under varying conditions, but the final test would be that the buildings themselves are presentable in appearance.

REGULAR INSPECTION OF SITES

Probably no activity is more vital to the success of the camp site program than supervision. By supervision is not meant police inspection, but it should have for its purpose friendly cooperation between the Department and the permittee to the end that improvements may result. At present the district forester's office has to give to this whole program more attention than should be necessary. This is partly due to the fact that those making application for leases usually come to the district forester's office and then are inclined to resent being passed on to one of the rangers. The district forester, on the other hand, doubtlessly enjoys the many personal contacts which he makes and, on his part, is reluctant to lose that type of work which he finds so pleasant. His time is so valuable, however, and so necessary for other purposes that it becomes incumbent upon him to put aside his personal preferences and to so train his rangers as to make them available for this kind of work.

The importance of the camp site program varies somewhat in the different districts but in all districts it is now and will continue to be one of the big jobs in our State forestry work. It is, therefore, necessary that the problems of each district be carefully and conscientiously studied and that definite plans be made to meet the conditions which are constantly arising. If this is done, there can be no question but that the result will be an ever-increasing benefit to all concerned, to the individual, to the forester, to the Department and to the Commonwealth itself.

STATE FOREST SIGNS

Committee

CHAS. E. BAER RALPH C. WIBLE
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Presented by Chas. E. Baer

SIGNS are used on State forest land to designate the names of roads and trails and to point out the direction from a road intersection to the nearest camp or settlement, or from a trail intersection to the next trail. Such signs are known as "direction" signs. Other signs are used to designate the names of places and things, such as rangers' headquarters, springs and streams. Signs so used are known as "place" signs. State forest signs enable people who frequent the woods, such as hunters, fishermen and tourists, to travel through large forest areas without becoming lost. These signs are also intended to have an educational value in acquainting the public with forestry practices.

STANDARD SIZES

The size of the signs used at the present time varies from that of a small tree-label sign to that of a large sign bearing the slogan, "Prevent Forest Fires—It Pays." This sign is five feet high by ten feet long, and is made of a wooden frame faced with galvanized sheet metal. The tree-label sign is three inches wide in lengths of 12, 14, 16 or 18 inches, in proportion to the length of the tree name. This tree-label sign is made out of No. 18 gauge sheet metal, with the top and bottom edges turned inward and rearward, about one-half inch, at about an angle of 45 degrees. A sign of similar construction but shaped like an arrow, with a pointed arrow-head of three inches and the "feathered" end notched with a one-and-a-half inch indentation, is used at public camps to indicate the direction to springs, streams, garbage pits, and latrines. The road and trail sign is of similar construction and is an arrow sign with a six inch point and a three inch rear indentation.

The flange sign is made of No. 14 gauge sheet metal. One flange sign used is 12 inches wide by 20 inches long, with one long edge turned over one and one-half inches at an angle of 90 degrees.

The sign is erected by driving supporting nails in this turned-over edge. Wooden signs are made of one-inch boards, surfaced on four sides, with strips one inch thick and two inches wide placed around the four edges. The strips are then finished with one-half inch quarter-round. When a wooden sign is made of more than one board, the sign has a similar frame but is faced with No. 14 gauge galvanized sheet metal, after which the quarter-round is put over the top of the metal. The metal is used to cover up the cracks between the boards that are caused when the boards shrink after being put out in the weather. Paint also sticks to metal better than to wood.

The size of the signs used on State forest land corresponds to that of signs used in other lines of business, although there is a tendency to lean to the smaller type of signs rather than to the larger type. It is to be borne in mind that the small sign can carry the message and serve the purpose intended without marring the beauty of the immediate landscape.

One of the largest signs, five feet high by eight feet long, is now used to mark plantations, and gives figures showing the kinds of trees planted, the number planted and the year in which the trees were planted. Signs made for this purpose in the future will be made four feet high by six feet long. All other State forest signs will be of this size or smaller. There will be no definite rules in regard to standardization in sizes of signs; but signs used for similar purposes should be as near alike in size as possible.

Most of the signs are rectangular in shape. However, there are two arrow signs, the one used at public camps is three inches wide and 12, 14, 16 or 18 inches long; the other, used for roads and trails, is six inches wide by 36 inches long.

WOODEN VERSUS METAL SIGNS

There is a marked tendency on the part of business concerns either to use signs made entirely of metal, or to use galvanized sheet metal on the faces of signs. One reason why wood is gaining disfavor is because paint does not stick uniformly to spring and summer wood. Wood usually has holes and depressions in it, and paint catches in them. If the paint can find plenty of good-sized pores or depressions in the wood into which it can enter, the paint will stick. Otherwise it will drop off in flakes. There is no inherent "stick-to-itiveness" about paint. That is the conclusion of the Forest Products' Laboratory of the U. S. Forest Service, after making careful tests to find out why paints fail. These tests show that paint adheres readily to spring growth of wood, and poorly to summer growth, because the former is porous and the latter dense and comparatively poreless.

If in the weather, a wooden sign will last only two or three years. Then the paint will either crack off or show a streaked or "alligator" effect. On the other hand, a metal sign can be painted so that it will still look good at the end of three years; or if lacquered it will look good for six years, except for the fact that the colored paint fades. This fading we escape by using black and white paint.

Metal signs, for example arrow direction signs, are likely to bend, and for some time were objected to for this reason. They are bent by wind, ice, snow, animals, and man. This is now largely prevented by putting turned edges at the tops and the bottoms of such signs. As was previously indicated, sheet iron of about No. 18 gauge is used, and the two edges are each turned at an angle of about 45 degrees.

Wooden signs are more bulky than metal signs. Our standard road and trail sign is six inches wide and 36 inches long. If these signs are made of wood, a forest ranger can carry perhaps ten when erecting them, but if they are made of metal, he can carry fifteen. In no case should these signs be carried loosely. Instead, they should be securely fastened together before they are taken into the woods, to prevent rubbing. This can be done by using two straps made of webbing or leather, with adjustable buckles. One of these straps should be fastened around each end of a bundle of signs. Such a bundle can be carried by a sling over one's shoulder. A No. 18 gauge sheet metal road and trail sign six inches wide by three feet long weighs about three pounds. The average wooden sign of the same size weighs a little more.

In most cases repairs can be made to damaged metal signs, but usually wooden signs cannot be repaired satisfactorily. Sheet metal signs with holes shot through them can be repaired by welding or soldering. Dents made in metal signs can be pounded out. Bent metal signs can be straightened. A blow that would bend these turned-edge arrow signs (six inches wide by three feet long) would split or break a wooden sign of the same size and practically destroy it.

COLOR OF SIGNS

At the meeting of the Committee on Signs on April 27, 1928, of which I had the privilege of being a member, it was unanimously agreed that the color of the State forest signs, excepting possibly fire prevention signs, should be a white background with black letters and a black border. This color combination seems to look best for the longest period, as other colors invariably fade. Experiments conducted by the U. S. Forest Service Laboratories, and by Pennsylvania and other states, to determine the most

permanent color combinations for signs, show that black and white are the most legible and durable combination for use in forest areas.

Heretofore, most of our signs have been made with a green background with white letters. But green is too nearly the color of the forest, and therefore does not present sufficient contrast. Green is one of the most difficult pigments to mix so as to produce a shade that is uniform in color. In mixing, too much turpentine (synthetic or pure), linseed oil (raw or boiled), and too many other factors enter into the problem, making it difficult to produce a uniform shade. It has been shown that a gallon of green paint of a certain shade, purchased in 1926, and a gallon of the same kind and grade purchased in 1927 from the same company, produced different colors. One was a much lighter shade than the other. This fact was shown when signs painted at different times for use in the same forest were found to be of different shades of green.

STYLE OF LETTERING

The standard color for State forest signs, as has already been mentioned, will be white with black letters. Some other State departments as well as the Department of Forests and Waters are using the same combination of colors. The signs of the State Game Commission are in black and white. But the type of lettering and border will give State forest signs an individuality which will make them distinct from any other signs. One advantage of having signs of all forest districts uniform will be that the tourist or forest visitor upon seeing one of these signs will know that he is within a State forest area.

A sign survey of the 25 State forest districts of Pennsylvania reveals plainly that in no single instance are the road and trail signs uniform. Even in a single district it has been noticed that as many as three different styles of signs and lettering have been used for roads and trails. The lettering in many instances was done imperfectly, and in a few instances both spelling and abbreviations were incorrect. It is therefore quite apparent that a definite sign policy and program was necessary in the Department of Forests and Waters, especially for forest road and trail signs.

Since each forest district had a distinct style of lettering, it is apparent that the lettering should be standardized and be uniform for all districts. In order to facilitate standardization it was deemed necessary that the sign painting be centered at one or two places in the State. In accordance with this plan, one sign painter is now working in a central sign painting place in St. Marys, in the Elk Forest District. The various foresters submit their

needs to him and the signs are painted and shipped to them. In this way the work is done more economically and satisfactorily than if each forester had his signs done locally.

The style of lettering which has been made standard is the plain block letter. This style was chosen because it is the plainest and most legible letter. Therefore, all forms of fancy lettering are barred from use in State forest signs.

The size of letters will differ according to the size of the signs, but the block letter type will remain the same on all signs. So far as possible, the lettering of certain kinds of signs will be made uniform. For example, road and trail signs will have the main titles in letters two inches high, made with one-half-inch stroke and being on an average one and one-half inches wide. For convenience this is called the "heavy face" letter. Main titles in long names will be made with "heavy face condensed" letters that have a stroke of three-eighths of an inch, and are on an average one inch wide. The subtitles will be in letters one inch high, made with a quarter-inch stroke, and with an average width of three-fourths of an inch. Where the names of several places and the distances thereto are to be given from a certain point along a road, then the name of the road itself is placed on the standard arrow road sign, while the names of the several places are each placed on separate arrow signs three inches wide and of lengths depending upon the names to be placed thereon. The names on these small arrow signs are made in letters one inch high.

LENGTH OF SERVICE

State forest signs will be painted if they are large in size, and lacquered if small. Large signs will be made with a background of wood or a wooden frame and faced with No. 14 gauge galvanized iron. The first coat will be a galvanized iron primer, then will follow two coats of flat white paint, after which the letters will be put on and the signs given a coat of spar varnish. Such a treatment will keep a sign in good shape for several years. Small signs will be made out of un-galvanized sheet iron and will be lacquered. The first coat will be a priming lacquer for use with white lacquer, then two coats of white lacquer will follow, after which the letters will be put on with a black striping lacquer, and the sign given a coat of clear lacquer. This treatment will keep a sign in good shape for about six years.

Since lacquer dries quickly, it must be put on with a spraying machine. One reason why lacquer looks better for a longer time than paint is because lacquer dries from the inside out while paint dries from the outside in. Lacquer makes a smooth, neat-

looking sign, and is to be preferred to paint where it can be used. As automobiles have been improved in appearance and made to look good for a longer time through the use of lacquer, so can metal signs be made to look better and to give longer service.

HOW TO PLACE SIGNS

The tendency has been to place too many, rather than too few signs in our State forest areas. A limited number of signs, judiciously placed, is far superior to a large number of signs, placed promiscuously. Road and trail signs should not only contain the name of the road or trail, but should include the distance to the next road or trail. On long roads or trails, two or more signs may be used advantageously in naming the particular road or trail, but they should be placed for direction only. This helps forest visitors to find their way through the State forests. Many instances have been noted where hunters and recreationists have easily found their way through some of the State forests that were adequately posted with signs. Where these signs are made to conform with the Department's Public Use Maps, people can go into great stretches of forest land without fear of being lost.

Forest road and trail signs, therefore, should serve two purposes: first, to show immediate location; second, to indicate direction and distance to the next road or trail. No district forester can sit in his office and prepare a list of signs to be used in a State forest area unless he has previously gone over the area and knows where those signs are to be placed, and the distance from those locations to the connecting roads or trails. Therefore, great care should be exercised in submitting the information to be placed on each sign, so that the distance to the intersection is stated as nearly accurately as possible. It should be borne in mind that place and direction signs in the State forests are the guide to forest visitors, and are just as essential as road signs are to the tourist.

Road and trail signs may be placed on trees where it is possible, but if no convenient tree is at hand a post should be erected and the sign placed thereon. These posts should extend six feet above the ground and be painted black. They will be made out of channel iron three inches wide, one and one-half inches deep, and of No. 11 gauge iron, and should have three-eighth inch holes every inch (centre to centre) for a length of four feet from the tops of the posts. The posts will be made nine feet long, so that they can be put in the ground three feet. To prevent these posts from bending from their perpendicular position, a triangular piece of flat sheet iron, six inches on each side, will be fastened on each

post at a point 3 feet from the bottom of the post. Sheet iron of No. 11 gauge is about one-eighth of an inch thick and weighs about 5 pounds per square foot. One of these iron posts weighs 18 pounds, while a four by four inch chestnut post nine feet long weighs more than 24 pounds. The price of these iron posts will be from 60 to 80 cents each, while a four by four inch wooden post nine feet long contains 12 board feet of wood, which, at \$50.00 per thousand, costs 60 cents. Channel iron posts are easier to carry to remote forest sections. They are cheaper to erect as they can be driven into the ground, whereas a hole must be dug for a wooden post. Also, they are not affected by heaving from frost as are wooden posts, and therefore they remain straighter and neater looking.

When signs are nailed on trees it is recommended that 16 penny galvanized nails be used. When iron nails are used they will rust, and the rust will run down over face of sign and discolor it. These nails should be driven into the tree so as to allow one-half of an inch of each nail to extend out in front of the sign, in order to allow for the normal growth of the tree. Otherwise, in less than a year, the growth of the tree will draw the nail heads into the face of the sign and start to damage it.

In erecting large signs, two wooden posts, four by four inches, should be put up with at least two cross-bars between them on which the sign is fastened. These cross-bars not only serve as braces, but also make it easier to erect and take down the sign. In order to hold the side posts perpendicular, and therefore neat and orderly, cement should be poured around each post to a point about two inches above the level of the ground. This will also prolong the life of the posts by preventing them from rotting off where they would otherwise come into contact with the ground.

COST OF SIGNS

The materials used for painting 153 road and trail signs (six inches wide by three feet long) consisted of one gallon of galvanized iron primer, two gallons of flat white paint, one-half pint of black paint, three quarts of varnish, and one-half gallon of turpentine, making the average cost for material per sign six and one-half cents. The No. 18 gauge sheet metal signs cost 29 cents each. The cost of labor for painting, at \$4.00 a day, averaged 40 cents a sign, as eight to twelve signs can be painted in a day. This makes a total cost of seventy-five and one-half cents a sign. In using lacquer to make a sign of this size, the cost is somewhat reduced by the saving in time on account of the lacquer drying quicker than paint and varnish as the various coats are

applied. The average number of letters for these 153 signs was twenty-nine. It requires as much time to make the one-inch letters as it does to make the two-inch letters, because more care must be taken in making the small letters. In making signs with white backgrounds and black letters, it costs twice as much to make the letters as it does in using, for example, a green background with white letters, because of the different method that must be employed. In painting black letters on a white background more time is required in making the sharp corners on the A's, E's M's, etc. To make a sign with a green background and white letters, the sign is first painted white and the letters are outlined with a pencil, after which the green is easily and quickly applied around the outline of each letter.

As the State forest sign program progresses, it is expected that the best features now in vogue in the use of out-of-door signs will be adopted. With one or two sign painters specializing in this work, they will be able so to systematize their work that the best signs will be produced at a minimum of cost. It will be their aim to develop a series of signs for State forest use of which the Department can justly be proud. Some of the signs which we now use we are proud of, and among these is one bearing the words "You are welcome on the State Forests." May we, before a great while, be able to discard this sign, and when that time comes we may have many different signs, each so well adapted to its particular forest use, that in every one the forest visitor will intuitively see the word—Welcome!

SPECIAL FOREST STUDIES IN PENNSYLVANIA

Committee

DR. E. A. ZIEGLER	LEROY FRONTZ
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Presented by Dr. Ziegler

THE first stage looking toward forest restoration in any country is necessarily employed in arousing the public conscience to the evils attendant upon forest destruction. In such a new public movement it is only far-seeing statesmen that are able to judge large human processes and their results. These men for a time work alone. If they spent their time on detailed research the movement would die "aborning," no matter how exact and scientific such research might be. One of the greatest examples of such statesmanship in Pennsylvania is seen in the life of the late Dr. Joseph T. Rothrock. His argument for an "about face" by the Commonwealth in its handling of its forest resource needed at first no special studies nor detailed research. His thesis was written by the giant hand of the demon fire from one border of the State to the other.

However, along with the truly Herculean task of organizing the sentiment of the Commonwealth in support of the rebuilding of the forest resource and thus preventing the "Pennsylvania Desert" from securing a death grip on about one third of our entire land area, Dr. Rothrock saw the host of problems that required solution before forestry practice could be established on a firm foundation. Along with his forest protection policy, his State forest land purchase policy, his forest law problems, and the problem of a trained forest personnel, he gave some attention to special studies. Although there were then (1895) no trained foresters in Pennsylvania to take up detailed work, excellent descriptive reports were made on such subjects as maple sugar and charcoal. In 1897 he had some investigations made of forest insects attacking pitch pine and spruce, and a report on fungous diseases of trees. These latter papers, valuable as they were, were frankly stated to have been largely drawn from research elsewhere. Other excellent papers were written on the water

influence of the forest, the use of timber by the mining industry, and lumbering on the West Branch of the Susquehanna, as well as compilations of statistics on the lumber cut and fire loss—all subjects cognate to and of value in forestry but taking no field study and showing the need of forestry rather than affecting the methods of forestry. Their writers, such as Dr. Byron D. Halsted, Prof. Charles W. Johnston and Mr. John Birkinbine, were leaders in their fields. The first forester employed appears to have been Mr. William G. Kohout in 1897, who made and recorded some limited observational notes on forest composition and carried out a few elementary growth studies. But again the most profitable part of his work was the demonstration of timber and money yields of the managed forests of Europe. All this was most excellent and creditable and in keeping with that very early development stage of the forestry movement—the time when minds were being made up to accomplish something.

It was only after the Commonwealth began acquiring forest land in 1898 and employed permanently its first trained forester, Mr. George H. Wirt, in 1901, that forestry practice can really be said to have been seriously approached in Pennsylvania. Forestry was at once transferred from the region of observational general discussion to efforts in the woods, and, it may be added, has been there ever since in Pennsylvania and to an increasing extent.

At once practical problems presented themselves and real forest experiment was begun. In 1901, 1902, 1903 and 1904, thinnings, prunings, plantings, nursery work and experimental forest fire organization were begun by Mr. Wirt in the Mont Alto Forest with the double object of training foresters and making the Mont Alto Forest an experimental forest laboratory. It has been the location of a considerable number of the forest studies since then, though these studies, experimental work and forest research have spread all over the state as foresters became available and assumed responsibility for actual forest practice on other State lands.

Next to the experimental work on fire organization and its progressive development, the widely burned forest areas suggested first of all forest planting, which required the immediate establishment of forest nurseries. Nursery development brought a host of problems for solution—some local, others general. Unfavorable soil conditions for coniferous seedlings were made the subject of numerous experiments. Brilliant success crowned many of these experiments. As an example might be cited the charcoal soil-modifier developed in the Mont Alto nursery, which, for conifers,

decreases winter heaving, spring damping-off and summer baking on an otherwise difficult clay soil. In this nursery it has changed failure with conifers to abundant success. In 1924 the last and most elaborate work on chemical treatment of nursery soil to prevent damping-off was carried out in cooperation with the U. S. Bureau of Plant Industry. In every case the standard Pennsylvania soil treatment on the check plots showed results superior to the chemically treated plots. The nurserymen of our Department were the first to show that proper soil drainage and soil acidity were able to generally control the most destructive damping-off disease. Other nursery studies showed successful methods of seed collection and extraction, normal seed fertility, best time for sowing, proper shading, proper mulching, modified broadcast-sowing as producing cheaper seedlings than rill-sowing (with debatable maintenance of quality of seedlings), the proper periods for holding young trees of various species in the nursery, methods for control of weeds and fungous and insect enemies, that soil fertility can be well maintained without chemical fertilizer, though perhaps the use of raw bonemeal and phosphate rock may lessen weed troubles emphasized with barnyard manure as well rotted compost. Hardwood seedlings of heavy seeded species were found easy to produce but difficult to transplant with the same success as conifers on account of their long tap roots. Some studies have been made to find in nursery practice methods to reduce this tap root development—such as root pruning and removing the tip of the seed radicle as in acorns.

While all the nurseries—Mont Alto, Asaph, Greenwood and Clearfield—contributed to this long series of nursery experiment and study, the Clearfield Nursery deserves special mention in the experiments and studies leading to the introduction of power machinery in nursery practice and the consequent lowering of costs. Though there are many problems still to solve, and new ones developing, it can be said that forest nursery practice in Pennsylvania has progressed to the point where by experiment and special study it has attained a standard of success comparable with the best in this country, and in other countries in which forestry practice is more than a century-old.

Among the notable lessons in our nursery experience several have shown negative results. Two of these, namely, (1) the failure of the small forest ranger nurseries, and (2) the institutional nurseries without trained nursery superintendents, should not be passed by. The first was partly due to the conflict of duties at critical nursery periods, and the second to no trained supervision at all, or to "garden" superintendence primarily inter-

ested in other lines of endeavor. But both failures were also in part due to the lack of constant experiment and special studies necessary to successful nursery work.

Forest planting began on the state lands in 1899 with the planting of 1,000 Carolina Poplar cuttings in Pike County. This plantation was a complete failure. The oldest plantation now growing it two acres of white pine on the old "Monaghan Field" in the Mont Alto Forest. Other plantings followed on a considerable scale, first attention being given to old abandoned fields in the State forests. These plantings were frequently used for experiments on

- (a) Planting methods and costs
- (b) Spacing and size of trees
- (c) Adaptability of species to soil and site
- (d) Mixture of species
- (e) Relative rate of growth and wood production of different species of trees

As a result of these experimental plantings, methods have become successful and more or less standardized. "Permanent Sample Plots" are now laid off in the older plantations and the actual wood production is ascertained each five years. The development of the forest stand is accurately recorded in diameter and height, and after some little time there will develop a sufficient body of data to inform a prospective planter what a given species will produce at a given age, and the cost of any reforestation work he may desire to do. A striking result of these plantation sample plots and studies, which largely concern conifers, is that they will produce much more wood per acre and year than natural hardwoods, probably one and one-half to two times as much. This means that we can increase the productivity of our forest land by increasing the stand of conifers at every opportunity. This will lead our new forests toward their original position with the conifers predominating.

Special experiments have been begun, looking toward converting poor hardwood and scrub oak areas to conifers. This has been a more difficult problem and one not thus far attended by the same success as old field planting. The harder and rougher soils and competition for moisture and sunlight require a more careful selection of species as well as stronger plants. Although much work remains to be done on this problem results already secured show that:

- (a) Many burned hardwood areas that seem hopeless for perhaps five years will again develop a good stand of sprout timber without planting.

- (b) Where sufficient hardwood sprouts fail to materialize and fully occupy the ground, and to take control from dense scrub oak thickets, only the most tolerant species are successful, such as Norway spruce. Hemlock and other tolerant species are expected to qualify in later experiments.
- (c) Where light conditions permit, the hard pines—particularly red pine, pitch pine and Scotch pine—are showing much promise in early life.

The Department early began the study of forest increment by permanent sample plots established in natural forest stands and planted stands on both state and private lands. There are about 80 permanent sample plots recorded in the Department files. Special species studies (like that of the Pitch Pine Study with 50 plots and the Beech-Birch-Maple Study with 50 plots—mostly permanent) require many additional plots. It is impossible to study the growth of single tree stems and assume a certain number to the acre and thus secure reliable acre yields. Sample plots of one-tenth to one acre are laid off to secure wood increment data,

- (a) For comparing the production of different species in pure stands and in varying mixtures.
- (b) For studying the effect of different kinds of silvicultural treatment, such as the proper degree of thinning at different ages to stimulate growth, as compared to check plots unthinned.
- (c) For determining forest and working-circle yields so as to determine how much timber may be cut yearly and still increase the standing timber capital.
- (d) For studying the best methods of securing young trees by natural seeding as well as for the study of seed production and the collection of seed.

These few illustrations suffice to show the function of sample plots. Many others could be listed. Special studies on the total amount of growing stock of various sizes or age classes, on administrative forest units of the state lands, are going on with the intention of fixing a total cut per year, first as thinnings and then as final cut for timber. Such a study is now complete for the Mont Alto Forest. This must now be followed up by a marketing campaign to build up a permanent market for the particular wood products that must come out of the forest so as to permit normal development. On the Mont Alto Forest the annual cut is set now at 3,000 cords, practically all of which is made up of thinnings.

Economic studies of costs of cutting, hauling, manufacture and freight rates are necessary, and are being made. As an example, a study made by the senior class of the Pennsylvania State Forest

School in August 1928, showed that on a large Pennsylvania mill it took 15 minutes to saw 1,000 board feet of lumber from logs ranging from 6 to 9 inches in diameter; 11 minutes for 10 to 13 inch logs, and 7 minutes for 14 to 28 inch logs. That lumberman was undoubtedly losing hard cash in cutting 6 to 10 inch logs as they had twice the cost of sawing, and probably twice the cost of logging, of the more mature timber.

A study of freight rates shows intra-state rates in Pennsylvania on extract wood, pulp wood and mine timber to be 50 to 300 percent higher than southern railroad rates, and inter-state pulpwood rates into West Virginia, prescribed as fair by the Interstate Commerce Commission. This condition must be remedied in the next few years, as the removal of \$200,000 worth of thinnings and salvage cuttings from the \$80,000 Mont Alto Forest (22,000 acres) alone in the past eight years, indicates the volume of such low grade products that must come out of our 1,300,000 acres of State forests while we are bringing the main stands to saw size. A special freight rate on blighted chestnut was a large factor in the above thinning and salvage cutting. Economic studies are probably in need of special attention more than any other at the present moment.

A little experiment of scattering some bushels of soil from successful forest nursery seed beds over beds afflicted apparently with some obscure soil trouble in the Milton Nursery last year showed some unexpected effects in improving the seedling-growth and the stand. This reminds us that the world knows little as yet about that basic forest element—the forest soil. In connection with the soils course at the State Forest School, a study is now being conducted on Mont Alto Forest soils, that will be of great assistance in interpreting the results in reproduction, growth, increment, and forest type investigations. The trail leads not only through the chemical properties necessary to tree growth but into soil bacterial life and activities. The agricultural soils experts had struck this trail earlier in the case of the species of nitrogen fixing bacteria on clover and alfalfa roots.

This paper could not cover, in the time allotted, the main lines of research carried out by the Department in its first quarter century of existence, nor sufficiently emphasize the tremendous importance to Pennsylvania of the results thus far achieved.

In closing, several facts stand out. In agriculture there is spent in special studies, research, experiment and education in Pennsylvania, by the Department of Agriculture; the State College of Agriculture; the Agricultural Experiment Station, Farm Agents, and related agencies, well over one and one half millions of dollars of public funds. In addition, large amounts are spent

by private individuals and agencies. And the government is now being implored to help get rid of the surplus agricultural crops. The forest resources, embracing an area equal to that of agriculture in our state and in the nation, and now growing only one sixth of our consumption, receive about one thirty-third as much, with little help from private forest owners. Assuming it takes as much as 10 acres of forest to produce the same value as one acre of farm, mere equality of state effort for the two resources would demand an increase in forestry from \$50,000 to \$160,000 for the closely allied functions of research and technical education. But forestry requires at present much the greater relative effort. Where there are now 80 sample plots on the State forests of Pennsylvania there should be 800; where there are now two full time research men, there should be six or eight.

The Federal government is at the moment making much larger provision for forest research. The National Lumber Manufacturers Association and the Pulp and Paper Associations, the National Chamber of Commerce and many other industrial organizations are increasing research on the consuming end, but the timber growing research is left largely to the National and State Governments.

The second important fact that deserves comment is that in the marked progress in forestry technique worked out by our Department, through the very limited research and special study we have had time and money to carry on, our foresters have too often been satisfied to use the conclusions of the experiment in carrying out our own work only. There should be much more writing up of such results for the use of the profession at large and the public. For this public use of our findings the studies must have recorded in greater detail and system the facts and conditions that bear on the problems. Mere unrecorded personal observation of this contributory data may enable the investigator to reach reliable conclusions for the prosecuting of his own work, but the public needs more for their use of it. It is only in this way that these results can be solidly built into the growing forestry art. Without this recording and publication, we lose too much with the personal passing of the forester. It also makes for friendly help and cooperation, and will prevent much independent duplication of effort. The lack of this writing up of our work has secured outside recognition for our progress only by those who have visited our forests. These visitors always seem to find much more than their reading had indicated. The leadership in this basic research and special study development in Pennsylvania lies largely in the technical personnel of the Department of Forests and Waters.

MAJOR FOREST PROTECTION PROBLEMS

By George H. Wirt

WHEN some one mentions the subject of forest protection, ordinarily the first thing thought of is forest fire. Likewise, it is common these days to think of forest fire as the only force against which the forest must be protected. Thus far little has been done in Pennsylvania in regard to insect damage in forests. Somewhat more has been done in regard to fungous troubles. Foresters, however, as a rule have barely touched the facts as to insect and fungous damage in forests past, present or future, notwithstanding the several conspicuous examples of what both insects and fungi may do. A few of the current troubles of foresters and forest land owners are the chestnut blight, white pine blister rust, Woodgate rust, sap and heart rots, weevils, sawflies, scales and beetles. Insect troubles seem to be on the increase both as to number and as to extent of damage done. In my opinion, a major protection problem is presented to us by reason of the lack of appreciation of and concern as to insect and fungous damage. The problem now is, how a consideration of the subject of the protection of forests from insects and fungi may be brought about so that such protection activities can be given their proper position in a well balanced forestry program. Unquestionably, this Department needs technical men qualified for research work in forest entomology and forest pathology.

The forester in Pennsylvania is facing also, the problem of damage by deer, beaver and other animals. Some work has been done in the study of deer and beaver but much more must be done. Foresters need facts. The experience of the last hunting season is an indication of what may be expected in attempting to solve such problems. This phase of forest protection is to my mind a major problem, because of the misconceptions abroad as to the proper relations between forests and wild animals and between forestry and forest animal regulations.

There are other protection problems such as those of trespass, ice damage in young plantations, and soil influences, which are forcing themselves upon our attention but, right or wrong, we do not now consider them as of major importance.

FIRE—THE MAJOR PROTECTION PROBLEM

There remains for consideration the forest fire problem. It is the one major forest protection problem which is receiving some consideration. Briefly stated the problem is: How may we eliminate forest fires? Some one very properly may inquire as to whether the problem can be solved, that is whether forest fires can be eliminated. We are convinced that they can be. The problem has been solved elsewhere, and it can and will be solved in Pennsylvania. Its solution depends upon a number of major factors and it is these factors that will be considered herewith more or less in detail.

EDUCATION—A PRIMARY FACTOR

The primary factor in the whole proposition is that of education—education of landowners, of forest land users or frequenters, of local, county and State officials, of those who operate equipment likely to set fire to the forest, of those who by their own acts are likely to cause forest fires, of those who of their own volition or by compulsion assist in forest fire extinction, of timber users, of school children, and so as not to miss anybody, of the general public, and not the least in importance, of ourselves as foresters. This factor in the problem of forest fire elimination is not a simple proposition nor one to be met by a mere wave of the hand. The subject matter must be considered. Shall we present to our people facts or suppositions, guesses or hypotheses? I believe that it should be our determined purpose to present nothing but facts. The big problem, however, is to get facts. Until everyone concerned in gathering the facts needed or likely to be needed realizes the importance of the work and is actuated by the strictest personal integrity, the subject matter handled in educational work against forest fires will be at fault and may lead to wrong policies and expenditures.

NEED FOR EXTENSIVE RESEARCH

There is need for much more extensive research into number, cause, damage and location of forest fires as well as more detailed study of every phase of forest fire prevention and control. The forester who is not alive to this urgent need will soon find himself in the background.

EFFECTIVE PRESENTATION OF FACTS

The forms and methods to be used in presenting forest fire facts demand important consideration. The whole subject of educational methods and of psychology stares the forester in the face and usually he is not on speaking terms with the situation. It

is a real problem or set of problems to know what facts should be presented to various groups and in what form so as to produce results. Therefore, it is for foresters to do more studying along these lines or for them to follow the directions of those who are qualified as to such methods.

Briefly it may be stated that the more effectively the educational factor is handled, the less difficulty there will be in handling correctly the other factors of this major problem.

PROPER DISTRIBUTION OF RESPONSIBILITY

Another factor which faces those interested in the protection of forests from fire is that of the proper distribution and acceptance of responsibility for that protection. Fundamentally there is the responsibility of ownership of land. Ownership implies protection and with most forms of property there is no hesitancy upon the part of the owner in using all of his resources to establish and retain his ownership and to maintain his rights against encroachments by others. How far the owner goes in maintaining his property against the forces of nature, depends of course upon his character and resources. Ordinarily good sense or business pressure brings it about that when property cannot be protected, ownership changes to some one who is in a position to afford protection and maintenance. For a number of reasons these usual economic principles have not been held applicable to forest property. The problem of the forester is to find the reasons for this situation and how to change them.

COMMUNITY INTERESTS

It is now a generally but vaguely accepted fact that the community has some interest in forest property even when owned by an individual. There are said to be certain benefits, some definite and others rather hazy, which the community obtains from the individual's property, therefore the community should protect the forest, and some people even go so far as to say that the owner should not cut his trees when he wants to do so. Granted that the community has an interest in productive forest property, no matter who holds title to the land, it has then some obligation and responsibility to protect its interests. These community benefits are said to flow to the local community, to the Commonwealth and to the Nation. It would appear, therefore, that each of these governmental agencies has a share in the proposition. The question is "What is each one's share?" Taxes are paid for protection and even without any special community benefits each governmental agency which receives taxes is under obligation to afford to each particular kind of property reasonable

protection from the forces that are endangering its existence or profitable management. Likewise, it is productive property which furnishes taxes, therefore governmental agencies receiving taxes from specific kinds of property would naturally take an interest in seeing to it that such property be kept productive so as to continue as a source of taxes and, if possible, in increasing amounts.

DISTRIBUTION OF PROTECTION COSTS

There is an economic principle that each party concerned should pay in accordance with the benefits received. But who can figure out the value of forest influences? Another principle of American law is that a community does for its welfare that which cannot be done individually by its constituents. The State steps in when the local community is unable to do for the common good the thing that is necessary and so the National Government takes up that which cannot be done by the Commonwealth. Some times under this proposition "will not" or merely "does not" may be substituted for "cannot." Ultimately of course the whole tax paying populace bears the burden but with an unjust distribution.

COOPERATIVE RESPONSIBILITY

It has been demonstrated numerous times that for an individual owner of forest land to completely protect his property against fire he would be obliged to expend much more than can ever be obtained from it. On the other hand it has been demonstrated that through the cooperation of adjoining owners complete protection from fire can be obtained for a moderate and reasonable expenditure. But there are always a certain number of obstructionists who are willing to benefit by the other fellow's activities, as long as possible, without incurring any expense. These people block cooperation. How may they be handled in order to bring about individual and community welfare?

LEGISLATION AND FINANCES

It is evident that any solution of this difficult proposition must be found, in part at least, in legislation. Then it is apropos to ask, who, how and when, with respect to getting proper legislation, and its enforcement after the best possible compromise is obtained. Another major factor in the problem is that of finances. How much money is needed to protect the forests of Pennsylvania from fire? From what source should the money be obtained? Who is responsible for obtaining it? How shall it be spent when made available? Other questions just as perplexing may be asked. The first question can be answered only with an approximation after a very careful and detailed study of the situation with respect to

fires has been made. Generalities are sufficient in order to get started but for efficient results details must be known. For example, we have worried along to this time with only a hazy idea as to the extent of forest area needing protection.

No forest map of Pennsylvania is as yet in existence, and every year that goes by without a forest map of the State means that much delay in a business-like determination of facts necessary for a reasonable forest protection budget. In my opinion, an airplane map is the only type of map which will show what is needed for forest work. Without reliable maps no rational forest policy can be completed.

SOURCE OF NECESSARY FUNDS

The source of the money needed depends upon many things, but whether it is coming from the right places it tied up with the question of responsibility heretofore discussed. As for example, in view of the facts that the majority of forest owners are doing nothing to protect their forest property from fire, that local governments as townships and counties are not assuming their responsibilities, and that even in the absence of this help the Commonwealth is able to and should protect the forests within its borders, is it good policy for this State to accept money from the Federal Government for this purpose, on the very general pretext that forest protection in this State is a benefit to navigable streams? Should the representatives of the Commonwealth solicit and accept contributions from certain individuals for specific protection activities carried on in the region in which such individuals own forest land without soliciting every land owner benefitted? Is it not better to get funds from any source rather than not be able to afford protection to a certain region, provided, of course, the money is obtained honestly and expended efficiently?

HOW TO ALLOT PROTECTION FUNDS

How shall the money available be allotted? We are face to face with the fact that there are forest fires to be extinguished. This means men and equipment. There are plenty of men available for all kinds of labor in Pennsylvania if there is ready money to pay for their services. There is plenty of equipment available for purchase just as rapidly as funds are available to pay for it. But the men available may not be efficient and much of the equipment on the market now does not meet our needs. Men can be trained and new equipment can be developed, but how much money should be set aside for such work? When it comes to men and equipment, fundamentally there must be a detailed study of the needs of each local community. In some places men

are plentiful and in others scarce. If a satisfactory forest fire fighting tool will make one man more efficient than four or five men without equipment, then there must be a decision as to whether man power is to be bought or whether tools are to be obtained. The towers must be manned, but is it necessary for them to be manned from the beginning to the end of the fire season? An organization built up for extinction can also do educational and other preventive work. How far should the funds available be spent for prevention and detection in order to reduce to a minimum the amount needed for extinction?

It is certain that extinction expenses are an unpredictable item. No one knows where, when or how forest fires will start, nor what it will cost to extinguish those that do start. It is a big step in advance, therefore, when all parties concerned consider such expenses as an emergency proposition and funds are provided in such a way that flexibility is permissible.

COORDINATION OF FORCES

There is also the factor of coordinating all the protective forces of the local communities in order that they may work together to the advantage of the forest. Time will, however, not permit its discussion at this time.

These four factors in the protection problem, namely, education, division of responsibility, finances and cooperation, react upon each other, but nevertheless must be dealt with specifically by each forester no matter how large or how small his protection unit. That progress has been made in Pennsylvania along the lines of protecting the forests from fire is well known to all of you. That it is still an unsolved problem worthy of the best thought not only of every forester but also of every good citizen is not so generally acknowledged. Just now protection from fire must be stressed, but always with the idea that, with the development of constructive work in the woods, the forest fire organization as such will disappear.

There seems to be no such hope for the elimination of insect and fungous problems, and others arising from disturbed natural conditions. It is the part of wisdom therefore to "be prepared."

PENNSYLVANIA'S FOREST OBSERVATION TOWER SYSTEM

Committee

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Presented by H. E. Clepper

WHAT were probably the first observation stations in Pennsylvania for the protection of State forest land were constructed on the South Mountains in Franklin county in 1903. Tall trees on the higher points of ridges were selected, pieces of wood were nailed on them to form ladders, the tops were cut out, and in some cases temporary platforms were built in the tree tops.

In 1905 a forty-foot wooden tower with an open platform was erected on a mountain near Mont Alto. During the following nine years a few more temporary wooden structures were erected in various parts of the State, but for the most part the early foresters took advantage of whatever they found available that could be used for observation stations, and the tree top look-outs continued to be their principal reliance for forest fire detection.

In 1914 this Department erected its first steel towers. These were fifty feet high, with open platforms on top, but only four were erected. Three years later the State built two steel towers equipped with enclosed tops and ladders. These and all subsequent towers were equipped with telephone instruments connected with the forester's office and some forest fire wardens. The open top tower was not satisfactory, in that the observer was exposed to high winds and cold and could not possibly stay on the platform for very long periods. It became necessary to adopt some type of tower with an enclosed top, which would provide greater comfort for the observer.

The passage of a State compensation law led to a consideration of the possibility of State employees falling from the ladders of these towers, and the fact that the public began to use these towers suggested a change in the type of construction to insure greater safety. Instead of using a ladder to mount the tower, it was found desirable to erect only towers equipped with stairs and guard rails. Towers purchased in 1919 and 1921 were of

this type; many of these towers were sixty feet in height, of galvanized steel with enclosed cabins on top. Incidentally, by experience, it was found that to build wooden towers of the same height was fully as expensive, and the wooden ones had the added drawback of needing paint more frequently.

EQUIPMENT OF OBSERVATION STATIONS

Each top tower cabin is furnished with a telephone, permitting communication with the forester, forest rangers, or forest fire wardens. Most of the towers now have installed in the top cabin an iron table with a movable top, upon which is mounted a circular map showing the territory under observation by the towerman. This map is covered with plate glass, and centered in the map is a movable instrument called an alidade, which indicates on a circular scale on the map the azimuth bearing of the observed fire.

Each towerman is supplied with a pair of field glasses and various blank forms upon which he keeps a complete record of reported forest fires, and such other records as humidity and temperature.

Near the foot of the towers are small cabins, in which the towermen stay when not on observation duty. These cabins are usually equipped with stoves, cots, mattresses, tables, chairs, cooking utensils and dishes. Fire tools are stored therein. In the cabins on the ground there are no telephones, but instead a call bell is installed. If the telephone in the top tower cabin rings when he is on the ground, he will hear the call but will have to mount the tower in order to answer the telephone. This arrangement acts as a precaution against the possibility of the towerman failing to be on the top of the tower when he should be there, and guards against his making reports from the ground instead of from the point where fires should be observed.

The average cost of Pennsylvania's forest tower observation stations, fully equipped, is approximately \$1,500 each. The State's total investment in tower stations is approximately \$141,000. Approximately 1,000 miles of telephone line connect the towers with commercial telephone companies, of which the Department of Forests and Waters maintains approximately 800 miles.

THE PRESENT OBSERVATION SYSTEM

Of the 117 State manned observation stations in Pennsylvania, 111 are State-owned steel towers, four are manned in cooperation with other organizations, and two stations are bare knobs. These primary observation stations form the backbone of the forest fire

detection and location system in Pennsylvania. In addition to the State's system, the U. S. Forest Service maintains an observation station on the Allegheny National Forest in northwestern Pennsylvania.

Supplementing the State observation stations, private interests have gone to the expense to construct seven towers, which are designed primarily for giving protection to woodlands privately owned. These towers have been erected by water companies for protection of their watersheds, and by coal companies. Probably in no other way can the increasing interest in the need for forest protection throughout Pennsylvania be shown more effectively, than by the fact that seven private business organizations have committed themselves to a definite policy of forest observation, and have been willing to expend funds to erect these towers and to keep them properly manned during the forest fire seasons.

NEED FOR ADDITIONAL TOWERS

The forest fire observation tower system of the State is now practically complete. There are a few gaps to be filled, however, in that there remain sections throughout the State which would be better protected if they had the advantage of closer detection. Fifteen additional primary towers (eighty feet high) and two secondary towers could be used. The need for these seventeen additional stations is not an immediate matter, as they can be gradually added during the next five years, at the end of which time the forests of Pennsylvania will be adequately covered by a network of observation stations, practically insuring that no large areas of woodland within the State would be without the range of efficient fire detection.

HEIGHT OF TOWERS

During the early growth of Pennsylvania's observation tower system it was believed that towers fifty feet in height were satisfactory, if placed upon a high knob. Later it was found that a tower sixty feet in height permitted more satisfactory observation, and accordingly the majority of the towers constructed in recent years are of the sixty foot type. Experiments conducted by agencies in other states and within our own state show that sixty foot towers have advantages over fifty foot towers, and that eighty foot towers are greatly superior to the sixty foot type. Accordingly, several eighty foot structures were erected during the past two years, and these almost immediately proved their worth over the lower types. Recent reports show that the efficiency of eleven towers could be greatly increased if they were increased in height to eighty feet.

IMPROVEMENTS NEEDED TO INCREASE EFFICIENCY

In addition to the foregoing suggestions there are certain other improvements within the detection system itself on particular towers which need to be completed as rapidly as circumstances will permit. Six towers are without proper or complete maps for the territories covered by them, and six are not equipped to locate fires by the triangulation system, which is standard for the Department, and without which no tower can function at its greatest efficiency.

Perhaps the greatest weakness in the operation of individual towers is the fact that there are often certain areas within a fifteen mile radius of them which the observer cannot see directly, and in which the smoke of fires might not be visible for a half hour or more. These areas where detection is not possible at the moment a fire starts are called blind spots, or spots of indirect vision. It frequently happens that a towerman has such blind areas within a fifteen mile radius of his tower. Accordingly, it is suggested that the next step designed to increase the efficiency of the present observation system is that each blind spot within a fifteen mile radius of each tower be marked on the tower map with red ink or by cross-hatching. Each State-manned tower should have such a visibility map as soon as possible.

The aim of a tower observer should not be to report smokes from unusually long distances. Too much area should not be assigned to one observer. A serviceable visibility range should be established for each tower. An observer who is encouraged to report smokes from long distances out of his useful range has a tendency to concentrate on finding out how far he can see fires, and thereby overlook and fail to report immediately fires springing up within a few miles of the tower.

SPECIAL TRAINING FOR OBSERVERS

The initial training that an observer receives is the basis upon which his value as an observer will depend. A man who, when first employed, receives thorough, patient, and helpful instruction from the forester, will invariably make a better fire observer than the one who receives slovenly instruction, or receives no instruction at all and is expected to pick up the necessary information. Perhaps no other feature of the tower personnel is so important as this of giving the observer adequate and early training. All towermen receive general instructions concerning their duties and the preparation of their reports, but in many respects even more important than these general instructions, is the necessity for specific written instructions for the guidance of each individual towerman.

There are 117 State observation stations throughout Pennsylvania, and there are, therefore, 117 distinct problems, each peculiar to an individual tower. Unless a forester has absolute dependability in his tower observers, the forest protection activities of his district cannot function at their greatest efficiency. An observer who is entirely dependable can be taught the necessity for accuracy, promptness, and persistence in the detection and location of fires, and in reporting them. Too much stress cannot be laid upon these qualities in observers. Granting that an observer is reliable, his subsequent training is dependent upon the efforts of the forester. Various plans for providing the observer with this training have been suggested and attempted, but perhaps the best method by which this training can be given is for it to be given him on the tower, preferably when fires are burning, by the forester or some other experienced member of the district personnel.

The training of observers should not cease with informing them how to detect and locate fires. It should go much further. A good observer will know what to do during damp and rainy weather to keep himself occupied, and will be employed at road building or repairs, telephone line maintenance, or cutting brush. A good observer will look after and follow up these duties, if the forester brings them to his attention and constantly checks his activities.

MOBILE DETECTION

Supplementary to the main tower observation system some form of the old lookout system is still used in seven forest districts. A patrolman or watchman is stationed on a high place on extremely dry days and watches for fires in a limited territory, usually not covered directly or clearly by a tower. The average number of such lookouts operated annually in Pennsylvania is thirty-one, but they are needed for an average of only ten days each during each year. These lookouts usually have telephone service accessible near the point where they are stationed. They form a valuable supplementary service to the towers, since it frequently happens that when a lookout man discovers a fire he will usually attack it with a crew of men and extinguish it at once. Such dual service is very necessary in some districts and perhaps will need to be continued for a number of years.

Carrying this idea further, the forester may, and often does, use smoke chasers, who may be inspectors or forest fire wardens, stationed at the towers. As soon as smoke is detected they proceed at once to the location and find out whether or not it is a forest fire. If it is, they procure men and extinguish it. The smoke-chaser fills a great need in extending the efficiency of the fire

towers, and his position is that of a mobile secondary observer. The tower observer is stationary, but the smoke-chaser, upon the report of a fire, can proceed anywhere within the territory covered by the tower, and determine whether the smoke reported is actually a forest fire or a false alarm.

PERIOD OF SERVICE AND SALARIES

The average period of service per year for a State forest fire observer is fifteen weeks, approximately eight weeks in the spring and seven weeks in the fall. In actual practice, the yearly period of service varies in the 25 forest districts from eight to twenty weeks. While it is possible, for the sake of saving allotted funds, to defer putting towermen on duty until the very last moment before the start of a fire season, this practice should be discouraged, for in attempting to save money the forester often endangers timberlands many times the value of the attempted saving. Since the Commonwealth has gone to great expense in erecting its system of observation stations and equipping towers with tools, cabins and telephone lines, and since this system has been brought into existence for the express purpose of protecting forest properties and insuring them against destruction by fire, it is not consistent with the aims of this system to keep the towers unmanned during any part of the year when there is a probable chance for fires to occur.

In a few forest districts observers are paid on a daily basis for the days that they are actually engaged in observation work, although in the majority of districts observers are paid on the basis of a regular monthly income, which varies between \$75 and \$110 a month, the average being \$85. Because a forest fire tower observer in Pennsylvania must be a person of intelligence considerably above that of the ordinary laborer, and also because an observer must know his territory intimately, be able to read maps, use the alidade, take bearings on the direction of forest fires, know how to use a telephone for long distance calls, make minor telephone line repairs, and be able to use the thermometer and hygrometer supplied him for taking temperature and humidity readings, it is apparent that the scale of wage now paid them is not excessive.

MEN VERSUS WOMEN OBSERVERS

It is of interest to know that of the 117 observers, 109 are men and eight are women. The experience of foresters who have employed women as forest fire observers shows that they are ordinarily very satisfactory at this work. A woman is quick to detect fires, and is usually careful in locating them properly. In addition,

she is careful in taking humidity and temperature readings, and can be depended upon to be thorough in the preparation of her reports. A woman is, however, not always satisfactory, because she is physically unable to do some of the heavier duties expected of an observer, such as repairing telephone lines, building roads leading to towers, and cutting brush.

HOLDING OBSERVERS FROM YEAR TO YEAR

The wage scale of observers has risen slightly during the past five years, so that it is no longer the serious problem it was formerly. District Foresters report little trouble in keeping the same observer season after season. It is probable that by a gradual increase in the number of women observers, who take this position owing to its limited duration, and by attempting to get observers from farming districts or from industries where the fall and spring seasons for this work coincide with depression in their usual occupations, the problem of keeping the same observer, season after season, will largely be solved.

Some foresters, especially those having State forests in their districts, report that by using observers from their regular force of employes they can, by giving certain men regular work for nearly the entire year, have observers on hand whenever they need them. The forester who can give the observers additional work during those seasons of the year when they are not engaged at the tower, has less trouble holding his men than the forester who must take the observer off the payroll just as soon as the fire danger is past.

SPECIAL STUDY OF EFFECTIVENESS OF TOWER DETECTION

While Pennsylvania's tower system is practically complete, studies of its efficiency have not kept pace with the growth of the system itself. We do not know definitely how much effective fire detection we get from the towers and how much comes from other sources. By effective detection is meant that which is the immediate cause of putting into action the extinction forces. A tower does not give effective detection that simply observes a fire some time during its progress. The usefulness and effectiveness of a tower is indicated by the number of fires for which it gives the first effective alarm. Many forest fires in Pennsylvania are effectively reported not by the towers, but by outside sources. Just what this percentage is, of the total number of forest fires in Pennsylvania for any one year, has not yet been determined.

Since the majority of forest fires burn during the spring and fall seasons, when the towers are manned, it is not too much to expect that practically all fires occurring then should be effectively reported by the towers. There is urgent need for information

concerning the effectiveness of Pennsylvania's observation towers in reporting first alarms as compared with first alarms from other sources, and there is also need for similar information for individual towers.

BEAUTIFYING TOWER SITES

Pennsylvania's observation system has proved its value in bringing to the attention of the public the needs for, and the progress made in forest protection. Thousands of people visit the observation stations yearly. The more accessible ones are often thronged with visitors during suitable weather. There has already been considerable work done leading to the beautification of tower sites by planting ornamental and shade trees, by keeping the grounds clear of underbrush, by painting and making more attractive the tower buildings, and by painting the wood-work on the towers. Notwithstanding the progress made, this work needs to be continued on a larger scale, especially at the observation stations which are easily available to the public. It has been suggested that appropriate State-owned tower sites be developed to the point where they would be comparable to the smaller public camps on State forests, now equipped with tables, benches, fire places, latrines and other improvements.

MAINTENANCE OF OBSERVATION STATIONS

The majority of the top tower cabins have been lined with wood, and painted. This procedure should be made a part of the program for tower improvement for all towers in the State. The lining of the cabin not only is of comfort to the observer, thereby increasing his efficiency, but reduces noises in the cabin to a minimum, thereby making telephone conversations easier.

The painting of the exterior wood work should be done every second year, and the painting of the interior wood work every third year. Towers made of galvanized steel may not require painting for as long as twenty years, but some steel towers, where the galvanizing had not been of the best, should have the steel work painted every five years. A definite painting schedule should be worked out for all towers throughout the State, whereby every individual station would get the benefit of periodic painting to avoid excessive weathering and to decrease depreciation.

Pennsylvania pioneered in the creation of a forest observation tower system and has achieved a position worthy of note. We are justly proud of the high standard of service made possible by our State-wide system of towers.

Aside from the part that the 117 towers play in protecting Penn's Woods, they are also pillars of inspiration to the forester, beacons of service to the public, and from them can be seen some of the most expansive and beautiful views in the State.

AERIAL FOREST SURVEYS

By C. P. Wilber

State Forester of New Jersey

I AM always glad to have an opportunity to rub elbows with a group of foresters, and I am always more glad when there seems to be a chance, perhaps, to give them something of interest and help. And whatever I can add to this meeting in that way is very gladly brought to you. I want to say first, as I told Mr. Illick when he asked me to come over here, that I don't stand before you as an expert on the making of aerial maps. As a matter of fact, not as an expert in any way on aerial maps. I know nothing of how to make a map from the air.

About three years ago we first came in contact, through some work we were considering in connection with fire protection work in New Jersey, with a first class salesman who represented an aerial engineering firm. He finally sold us in the office the idea of mapping from the air. He brought samples and he brought a line of talk that was irresistible. We had even more difficulty than he had had in selling us, in persuading the fiscal officers of the State to permit us to make what they considered a rather expensive experiment in making a map from the air. We had an opportunity to get three maps for \$2700. They finally pared that down to one map, as an experiment, for which we paid \$1100. What we wanted to do was to have maps made of the various State forest areas in New Jersey, supplementing some of the best topographic maps there are in the country, if not in the world, which cover every inch of New Jersey and cover it very accurately and thoroughly, but supplementing them in data that, so far as we could see, no topographic map made through the ordinary procedure of engineering could supply.

We went down into South Jersey—and I want to say before I say anything more, that what I have to say is predicated purely on our observations and experience in the use of these maps in the coastal plain. I think from study and the consideration of those maps and of sample areas that we have had before us for the hilly country in North Jersey, that what I say as to the advantages of this sort of a picture of the country for the coastal plain will hold, if the same kind of maps and material are available, in a hilly country. I can't say this from actual working

with maps in such territory. We hope in another year or so that we will be able to, because we are so thoroughly sold on the air map as an adjunct to the forestry work that just as fast as we can collect the money for it, we are going to cover other areas.

This map, as I say, cost us \$1100. It covers 20,000 acres. It is made on a scale, the original photographs which we get from the camera direct, of 500 feet to the inch. We have an enlargement of that map in atlas form showing the country on the scale of a thousand feet to the inch. Those are the scales that we specified should be provided because they are the scales on which our State forest maps and working plans and all our data are worked up and have been worked up previously. There was some question in my mind whether these men would be able to give us a map that would read 500 feet to the inch or 1,000 feet to the inch. However, we can scale off distances on those prints as accurately as we can on the state topographic maps that were made by the most careful engineering practice. They read perfectly. So I am satisfied that for accuracy there is nothing to be feared.

What can be read from air maps in the way of elevation, as I say I am not able to tell you from actual experience, but I believe from samples we have read and gone over in the office of the hilly country, that elevations can be read with almost equal accuracy, by means of available instruments and machinery for bringing up the elevations.

The thing I spoke about to Mr. Illick, and that he asked me to talk about today, was not to attempt to describe the mapping, but to give you some idea of what we had found as the result of the use of this particular map that we have. And I want to point out four different ways in which it has a value from our standpoint.

The first is in typing and estimating; in other words, dealing with the timber. We find on those maps that by using the ordinary sample plot method which is used for any estimating and any determination of types, we can locate an area of a certain appearance on the map, go into the field at a cross-roads or where a certain bridge crosses a stream, find out what the timber or cover is, and then apply that classification to the same sort of appearance on the map anywhere as being the same sort of timber, the same sort of stand. We find we can tell from the map reasonably closely, as closely as you would from the ordinary field survey unless you were making a very careful research study, the age and character of the stand from study of the map, after we have been in the field and established our primary data from

sample plots. We find we can tell the species, separate hardwoods from coniferous growth, separate cedars from pine growth. I doubt very much if we could tell oak from hickory or separate the hardwoods in that way, but that ordinarily is not necessary.

We find, therefore, that we can go over on the map this area of about 8,000 acres which the State owns; can mark out a certain area; use the planimeter and say that we have so many acres of merchantable pine or pine of certain sizes; we have so many acres of cedar swamp that is of usable size; we have so many acres of open land, brush land, scrub land, or something of that kind that needs a certain regenerative treatment perhaps.

This means, so far as we are able to judge it—and we have only had the maps for use since last April—that for \$1100 on this State forest area we have the equivalent of from three to five years of surveying work for a crew of three men all done when the map is put on our desk, except a very limited amount of work in the way of sample plots that has to be done to establish our basic data for interpretation of the map. Therefore, it means a tremendous saving in time, in getting the data that is necessary for any effective use or study of the area, and it saves money, so far as we are able to find out.

Second, there is the question of the topographic data, and by that I mean not only the streams and the ridges and the high and low places, but the culture—the roads, the railroads, the trails, bare spots and all that sort of thing. We find that traverses, which would have taken us years for a crew of two men to make in mapping out these secondary roads, that are never necessary for intensive development but which we have got to know and be able to use for protection and development of the area, are unnecessary. We find that these roads are shown as accurately on the air map, probably more accurately, than they would have been by a very tedious and a very expensive physical survey of the land on the ground in the way of traverses and the subsequent map.

Therefore, I think we have at least added half as much again to the value of the air maps, from the topographic data that we derive from them. We feel that the \$1100 cost of the air map is cut down just that much more. We are not able to state the exact amount of saving, but I don't doubt that there would have been a two or three years' job for a crew of from one to two men in putting that material on paper, if we did not have this map.

Third, another element in the value of it is the work in land acquisition, in adding to the State Forests. It has put us in a position so that when we want to know where we had best go

first in making additions (and may I here say that our purchase program perhaps is slightly different from yours in that we have no limit whatsoever to the price we can pay and we are able to go anywhere we want to buy land if we can justify the purchase) we are able from this map to tell whether what appears on an ordinary map as a jog in the way of an exception, is a piece of land that we can forget for five or ten years without any serious handicap, or whether it is the type of timber, the type of location, or in some other way has a value that ought to be assimilated into the area immediately. We can tell whether we are getting merchantable timber or just scrub growth without going on the ground, as we have had to do in the past on this area, and as we still have to do on other areas to determine those factors. We can't make the land survey, of course, from this map. The metes and bounds must necessarily be worked out and the corners established on the ground. But in determining in a general way the acquisition program for a given area, certainly this map has proven its value in that country and under those conditions it has eliminated a great deal of the preliminary reconnaissance necessary for acquisition work.

Fourth, and one of the most interesting and perhaps valuable features of the map, is its influence on the protection work. As I say, we have found roads—if you don't know the Southern Jersey pines you don't know how easy it is to lose a road—but we have found roads on that map that the men on the ground didn't know of or had forgotten, old tote roads that went into cedar swamps and hadn't been used for 20 or 30 years, the end of which had been obliterated or lost, but the balance of which lay on the ground, a valuable element when we have occasion to work out a protection plan.

In working out our protection plan, dividing the area into various blocks and units of one sort or another for protection, for isolation of plantations, and for any general work of that sort, we are able to say "There is a swamp lying along here," or "There is a ridge"—and of course in South Jersey there are ridges, although the difference in elevation is not so great as you find in the ordinary hilly country—"There is a road" and "there is a railroad," or this, that and the other thing—a picture on that map that reads so plainly that it doesn't take an engineer to read it. It is far more easy to interpret and memorize than the same data, put with the ordinary amount of detail on the ordinary map, would be.

These, therefore, are the four elements of value as we see them in this map from one year's experience in the field with it. They are of tremendous help and a tremendous saving of time and

money, and the saving in time means a saving in getting work started, of course, in typing and estimating. They are of real help in building up a topographic and feature map; they are of tremendous help and a tremendous saving in time and money in doing our acquisition work, in locating areas for purchase and deciding on areas for purchase. And they are going to prove more and more of tremendous value from a protection standpoint, and have already more than paid for themselves, to my mind, in the readiness with which we have been able to make a complete fire map, a complete working plan of that area which we haven't been able to do and won't be able to do for several years to come, on the other large areas in the same kind of territory through the ordinary means of traverse and ground survey study.

There is this added feature to the maps that perhaps ought to be mentioned. A new man coming into a territory, given a few hours of opportunity to study such a map with a man who knows how to interpret them, knows what the different types of color and density in the map mean, can go into his area as if he had been over it on foot, a very large part of it. Now there are very few of you—and most of you have had a certain amount of engineering—who can take a map, lay it out on the table and from an hour or two of study tell what your territory looks like, be familiar with it if you had to go in there, know that you would find good-sized timber along this road and scrub oak along this stream and that sort of thing. The fellow who has an ordinary memory can take these map sheets and as I say travel through the country in the office before ever going into the field. And although we haven't had occasion to put a new man on in this area to try it out, I am confident that someone starting work would move far faster and be efficient far sooner with this map as an aid in starting him in his work on the area.

I would like to say, if I haven't talked too long already, just a word that Mr. Illick didn't ask me to say in connection with the use of airplanes for fire control. For three years now the State Fire Warden in our State had available during the fire seasons an airplane at his call at any time. This was very frankly an experiment when we began it.

We didn't try it out in any way at all even from the beginning as a patrol proposition, as we felt that it would be too costly, and our experience has proven that a dozen fire towers would be more effective than one airplane operated probably at greater cost. From towers you get a continuity of observation that you can't possibly get from the airplane, and you get an assurance of observation under all weather conditions that you can't possibly get

because the airplane can't always operate and isn't always in condition to operate. And then the cost favors towers, for if you have to hire a plane, as we have been doing, or purchase a plane and maintain a high priced mechanic and the helpers that go with it, that makes it very excessive. But we have found this, that it is a paying proposition to use an airplane when you have a big fire. Colonel Coyle has been out over areas in both North and South Jersey, so we know that both kinds of territory are subject to the same kind of treatment. He has gone out and made preliminary reconnaissances when a fire has gotten to a large size, that probably would have taken three or four days for a man in charge of the fire to make either in an automobile or on foot, and within 20 or 25 minutes has been able to drop to that man on the ground a complete map showing him exactly the boundaries of the fire at that time, showing him the kind of burning he can expect to the north or northeast or in any other direction about which he wants to know, showing him what barriers the fire is approaching in a certain direction so that he can feel less concerned in that direction than in some others.

We are sold on this and are using the plane and shall continue to use it, year after year, unless, perhaps the State, through the National Guard, or even through the Department, makes it possible to own one of our own.

We have saved money in actual fire fighting costs and we have saved a tremendous area from burning, and that is perhaps even more important, by this prompt and certain knowledge of the complete condition of a fire, when it gets big enough to mean a real reconnaissance to get around the outside boundaries, to know what you are doing.

Then, on those trips, the Colonel has also mapped previous fires. Now we have always done this. I don't know how carefully your men in the field, and your men that do have that sort of work to do, measure areas of your fires. We are trying to get them just as accurately as we can, but with the best intentions in the world the men who are capable of estimating fires both in the field and from maps, make considerable errors at times. We made a correction of 3,000 acres in the area burned by a fire last spring, by a five minute flight coming around from another fire over the area that had been burned previously. That fire was air mapped from the burned area on the ground just as accurately as it could have been done if they had run a traverse line around the boundary of the fire.

And then one peculiar thing about the use of the plane is fire fighting and control, that perhaps does have some value and

perhaps doesn't have a great deal, is the influence it has upon the morale of the men on the ground. The men on the ground have always known when the State Fire Warden was on the way up in a plane. They have always watched for him. They have always known when the plane was overhead, and although they are down there and in many cases under a heavy cover of foliage and not at all visible from the air, the men on the ground say it is positively ludicrous to see the way a fire crew digs in when that fire plane comes overhead because the boss is looking at them from on top. (Laughter) And it has just that rather insignificant, perhaps, but rather pointed effect upon the morale of the men who are in the field.

I might just sum up in this way. I am confident, in an area where you have large contiguous areas of woods to deal with, whether it be a state forest or largely private land, that the money cost of making an air map at present rates, by the average companies that do it, is more than repaid by the savings made in time and in money for the various types of work that would have to be done on the ground if it was not done that way from the air. (Applause)

I said at the beginning that we don't have at the present time a map—a complete map—on a hilly section. The only map we have worked with is one on the coastal plain. I am confident, from inspection and study of samples that have been submitted by these various concerns which do air mapping, that they will be equally valuable and probably make the same savings in the hilly country. I might say to you that the Regional Tri-State Planning Commission of Philadelphia has just completed a sixty or seventy thousand dollar map which will give you a test area around the Philadelphia District, which will permit you to make a study personally that way. And I think that is now available at small cost.

A PRACTICAL REFORESTATION PLAN

Committee

H. E. ELLIOTT

R. R. HOUPY

E. F. BROUSE

H. M. NICHOLAS

Presented by H. E. Elliott

IMMEDIATELY after the first State forest land was purchased in Pennsylvania, it was recognized that upon certain areas there could be no hope of reforestation within a reasonable length of time except through artificial seeding or planting. This fact led to the planting of 1,000 trees upon State land in 1899, the beginning of a program which has resulted in the reforestation of 24,977 acres with a total of 36,257,000 trees planted. According to estimates made by district foresters there are still about 30,000 acres on the State forests that should be partly or wholly planted. Upon privately owned land that is suitable only for growing trees there is unquestionably a huge area which must be planted if it is to be brought back to a state of productivity. In view of these facts, the need for a practical reforestation plan is self-evident.

For a number of years after its establishment, the efforts of the Department of Forestry were devoted almost entirely to the State forests, and the entire output of the forest nurseries was planted upon State land. With the increased interest in forestry, came the demand for trees for use in reforestation projects upon privately-owned lands. It was in 1909 that the Department was authorized to provide trees to private individuals and corporations for planting upon their own lands. At first the trees were sold at cost. Then distribution was made free of charge, with the recipient bearing merely the cost of packing and transportation. More recently, the law has been changed again to enable the Department to sell seedlings at a sum not greater than the cost of production. Under these policies, the demand has increased to such an extent that during the last nineteen years more than 75,000,000 trees have been distributed to private planters. From this it will be readily appreciated that tree planting can be expected to take a very important place in the forestry program of Pennsylvania. It is fitting, therefore, to review the past, ascertain the results of plantings made heretofore, and then formulate a program which may be expected adequately to care for the future.

RESULTS OF PLANTING

Periodical examinations have sufficed to keep the Department well informed with regard to the status and progress of the plantations that have been made upon our State forests. The planting records are complete and in detail. It has, therefore, been possible to follow the various plantations from the very beginning, observe the influences both favorable and adverse which have affected them, and note any mistakes that may have been made, in order that in the future these same errors may be avoided. Such complete and accurate information is, however, not available in the case of plantations made by individuals and corporations, and until recently there has been considerable doubt as to the results being obtained from private plantings. Consequently, in 1928 a systematized effort was made to examine representative plantations in seven forest districts embracing twenty counties of the State. Locations were selected which would include almost every condition under which forest tree seedlings are planted in Pennsylvania, and during the course of the survey 961 plantations were examined, embracing 6,792,000 forest trees of 47 species. It was found that 281 plantations had an establishment of 50 to 75 per cent or better and could be termed successful; 21 had an establishment of 50 to 75 per cent, while the remaining 659 were placed in the class having less than 50 per cent establishment. In making these calculations, plantings for ornamental purposes were classed as failures due to the fact that they were not plantations for reforestation purposes.

CAUSES OF FAILURES

Reviewing more closely the 680 plantations below 75 per cent establishment, it was found that 108 of these were ornamental plantings. Of the remainder the causes of failure, in the opinion of the examiners, were as follows:

<i>Cause of Failure</i>	<i>Number of Plantations</i>
Dense Shade	118
Poor planting	107
Grazing	81
Weeds and grass	67
Fire	44
Trees discarded	30
Poor planting stock	38
Heaving	22
Theft	12
Smoke and gas	7
Rodents	5
White pine weevil	5
Miscellaneous	46

From these statistics it is quite apparent that the results being obtained from private planting fall far below those on the State forests. The problem immediately arises as to practical remedies.

EXAMINATIONS BEFORE, DURING AND AFTER PLANTING

The first step that naturally comes to mind in preventing the recurrence of existing conditions is the necessity of closer contact between the planter and the Department. This can be effected through examinations made before, during and after planting. In the past, where the planting operation has been of any considerable size, the planter has usually conferred with the district forester and has been given the benefit of his advice and experience. This policy should be extended to include every private planting. Too often trees have been planted where they have been foredoomed to failure. An examination of a proposed planting site by a competent expert prior to the planting will not always spell the difference between success and failure, but it will unquestionably result in planting operations not being attempted except where there seems to be a fair chance of success. Neither will the presence of a forester during the planting operation insure 100 per cent establishment, but it will afford the opportunity for instruction in proper methods. Likewise, periodic inspections after planting will frequently result in the correction of damaging influences before much harm is done, in addition to keeping alive the active interest of the owner, and assuring him of the Department's desire to cooperate with him in his efforts. It is important that proper and adequate supervision is given. A distribution program of 12,000,000 trees annually means an investment of \$200,000 on the part of the tree planters for planting stock and planting costs. It is a better program to plant a smaller number of trees well than to plant a larger number without reasonable assurance of success.

CHANGES IN DISTRIBUTION POLICY

In seeking a remedy for such unsatisfactory conditions as exist with regard to our planting program, a number of changes in departmental policy have been suggested. Many of the foresters feel that all applications for trees should pass through the district office before being approved at Harrisburg. By giving the forester this advance information concerning the proposed plans of private planters in his district, he would be in a much better

position to supervise and direct their efforts along sound and proper lines. Thus many possible mistakes in selection of species and sites may be avoided, since the forester is afforded an opportunity of making an investigation where the conditions seem to warrant it.

The present minimum limit of 1,000 trees to each planter has been criticized as being too low and 2,000 suggested as a better figure. It is, however, much better than the 100 tree minimum that prevailed several years ago. A change to a 2,000-tree minimum might work a hardship upon a few small planters, who can conveniently handle only 1,000 trees per year and yet who by means of consistent small plantings year after year are obtaining real worthwhile results. The opinion prevails, however, that the area required and the effort necessary in planting 2,000 trees is so small that this might well be made the minimum limit except where only reinforcement is to be done. In the past, trees obtained from the Department have been put to uses other than those for which they were intended, while some have been planted contrary to the Department's advice and instructions. To correct this condition, probably some form of blacklist could be devised which would make it impossible or at least much more difficult for such persons to obtain trees from the Department in the future.

In connection with complaints relative to the size of trees being shipped from the nurseries, a special reforestation committee of five foresters who served during 1928, made an examination of trees at the Clearfield, Greenwood and Mont Alto nurseries. After careful consideration certain seedlings of each of seven principal species were selected as standards for those particular varieties. If nurserymen are informed as to the number and species of trees to be raised annually, and given a standard specimen seedling to produce for shipment, then from his experience and his knowledge of conditions in his nursery each nurseryman should be able to so modify his nursery practice as to produce, under average conditions, a seedling conforming to the established standard. No trees should be shipped from the nursery that do not meet the required specifications. After reviewing the nursery production plan approved during the latter part of 1927 a number of changes were suggested by the committee as to the percentage of the various species to be raised in our Departmental nurseries. These recommended changes follow:

<i>Species</i>	<i>Percentage in Present Plan</i>	<i>Percentage Recommended</i>
White pine	27.50	22.00
Red pine	27.50	30.00
Scotch pine	10.00	7.00
Pitch pine	8.00	10.00
Norway spruce	11.33	15.00
Japanese larch	7.00	7.00
Other conifers	2.00	2.00
Red oak	1.33	2.00
White ash	2.00	1.00
Black locust	2.00	2.00
Black walnut66	.66
Tulip poplar33	1.00
Other hardwoods ..	.33	.33
	100.00	100.00

RECOMMENDED PROCEDURE

Although in the past, planting in Pennsylvania has been largely confined to the spring season, there is a desire on the part of some private planters to obtain trees in the autumn. Experience in this State indicates fall planting should be discouraged and that applicants should always be informed that greater chances of success prevail in spring planting.

Many of the large plantations on State land contain only one species, white pine. Subsequent events show that better results would probably have been obtained by using a mixture of several varieties rather than attempting to raise a pure stand of white pine. Present knowledge relative to the various kinds of trees that should be planted together is not extensive, but it is a known fact that the greatest insect damage occurs in pure stands. Hence, it seems reasonable to assume that any mixture of desirable trees adapted to a certain site will in the long run prove more satisfactory than a pure plantation. The selection of species adapted to local conditions is a most important factor in the success of any planting, and if the proper species are not available, it is far better to delay reforestation for a year or more than to attempt it with trees unsuited for the site.

Too much emphasis cannot be placed upon the importance of the planting operation itself, and it should be the first care of the forester to give instructions with regard to the proper methods of procedure. The mattock and planting mallet can well be recommended as the best combination of tools. The examination of private plantings indicated that over-emphasis had frequently been placed upon the Department's instructions to the effect that the trees be planted slightly deeper than they had been in the

nursery. Steps should be taken to correct the erroneous impression which evidently exists with regard to this phase of the planting operation.

Many promising plantations are now complete failures due to lack of protection. Proper protection consists both of preventive and remedial measures. On our State forests, fire, of course, is the greatest danger, but in private plantations grazing doubtlessly ranks first. The private planter should be instructed in the best methods of eliminating damage from these and other destructive agencies. He should also be encouraged to familiarize himself with the appearance and habits of various insect and fungus pests, and to obtain information concerning such other conditions that may arise from time to time to militate against the success of his planting. This again brings up the subject of inspection and supervision, and it is only by frequent visits to the plantation itself that its condition and progress can be determined.

DEMONSTRATION FORESTS IN PENNSYLVANIA

Committee

PAUL H. MULFORD

E. C. PYLE

W. M. NACE

H. B. PHILLIPS

Presented by Paul H. Mulford

THE demonstration forest area is probably the most effective means by which we can "sell" the idea of scientific forestry to the forest land owner and the general public. It is effective because it is many things in one. In the first place, it is an advertisement, just as much so as a huge announcement on a billboard or on the pages of a magazine or a newspaper. Secondly, it is an exhibit, just as much so as a bushel of prize apples on a stand before a fruit shop, or a window display in a store. It is a complete sample of the thing we are trying to create. What the ordinary commercial advertiser accomplishes by purchasing a back-page display advertisement in a big magazine, by proclaiming the virtue of his wares from the roadside billboard, and by displaying those wares in his show window, we foresters can accomplish through the creation and maintenance of well-located demonstration forest areas.

No matter how ardently we may wish to convert people to the idea of scientific and practical forestry, it is wholly impossible for us to visit or correspond with all woodlot and timberland owners of the Commonwealth. We cannot even attempt to instruct or convert them individually. We are defeated before we begin if we attempt to go to the many thousands of forest land owners in Pennsylvania and explain each forward step taken in our forestry practice. Yet it is both important and imperative that somehow we "get our message across" to them. There is no more effective way to do this now than through the creation of demonstration forests that will show the passerby just what it is we are aiming to do. Then, he who runs may read, and after he has read, he will spread the gospel himself.

Publishers will tell you that advertising alone never made a great sale for a book. Theatre managers will tell you that advertising never yet was responsible for a successful run of a play. Publishers and theatre managers agree that the thing that sells books and theatre tickets is the personal recommendations of the people who have read the books and seen the plays. They tell

their friends about what they have seen or read. The thing that will make forestry "go" with the people is an attractive and successful example. Hence, the demonstration forest area is one of forestry's best advertisements.

A demonstration area is a portion of a forest that through scientific methods and practical application has been made into a model area. It is a section of a woodland, set apart and rendered distinct, whereon the forester endeavors to portray practical forest practices and good forest conditions. Such a section of the forest is as different from the woodland about it as a well cultivated corn field is different from a neglected planting in which the corn is choked by weeds. A weedless, finely tilled corn field, where the thrifty corn-stalks rise in perfect alignment, and the heavy ears of grain give promise of vast stores of food, is a sight that at once pleases the passing farmer and arouses in him the desire to possess a similar field of corn. In like manner a well-cared-for piece of forest pleases everybody that sees it, and creates in the mind of woodland owners a desire to have their own bit of forest look as well. Like the little leaven that leaveneth the whole lump, the demonstration forest helps to raise the standard of forest practice in great stretches of our woodland.

A demonstration forest area may be a forest plantation or a section of natural forest that has been set aside and improved by artificial means. In such tracts the dead and dying timber is first removed. Then "wolf" trees and crooked trunks that will never make timber are cut away. Next the dead and dying lower limbs are pruned. These trimmings are either dragged away to other sections of the forest, or are piled and carefully burned. A piece of woodland that has been altered in this manner is like a run-down house that has been repaired and painted and had its yard raked clean and re-seeded with lawn grass, its fence rebuilt and painted, and its hedge freshly trimmed. No longer is the forest floor of the demonstration area littered with down timber. No more do crooked trees here deform and choke young growth, or spreading crowns shut out the light. Neither do underbrush, fallen timber, nor the dead and dying lower branches obstruct the vision. Through the aisles of the forest the observer's eye can see afar. The straight and slightly tree trunks are pleasing to behold. The forest floor, now clean and smooth, stretches pleasingly before the eye, here dark with shade, there splashed with sunlight. The forest has been changed from a jungle into a woodland garden. It cannot fail to please and delight the beholder. Quite naturally the observer tells somebody about the beautiful bit of forest he saw. And if that beholder

happens himself to own a woodlot, inevitably he feels a desire to have his bit of forest look as attractive as the area he has just examined. And this is particularly true when we take a piece of woodland that has been standing untended for years, meantime growing rough and unkempt, and alter it into a pleasing, thrifty, orderly stand of timber. The very contrast heightens the effect.

To accomplish its purpose, however, the demonstration forest area must be properly located. Indeed, proper location is the essential measure of success. The finest demonstration forest in the world would be practically worthless if it were so located that nobody could see it. Lock an advertisement up in your safety deposit box, and it will never sell a cent's worth of anything. But publish it abroad, in the proper advertising medium, and see how it draws the dollars from the people's pocket-books. Likewise, if we create a demonstration area deep in the heart of an inaccessible forest, it accomplishes nothing. To be effective, a demonstration area must be where it can be seen. And to be most effective, it must be where it can be seen by the greatest number of people. In this respect, the demonstration plots at Caledonia Forest Park are particularly well located. They border the Lincoln Highway, the main artery of motor travel across this continent, where they are seen by uncounted thousands of people.

The line of demarcation, which separates the demonstration area from the remainder of the forest, must be plain and distinct, so that the demonstration area will stand out sharply. Thus we not only avoid any possibility of having observers mistake the unimproved forest for a part of the demonstration area, but through the contrast between the two types of forest development we heighten the favorable effect of the improved demonstration area. For this reason we should select, for demonstration areas, suitable portions of forests that lie along well-traveled highways. Demonstration forests accomplish far more than advertising good forestry practice, for they actually assist in the development of scientific forestry.

Many different kinds of forest demonstration areas are needed. Among them should be areas showing:

1. The results of forest protection.
2. The effect of improving natural forest stands.
3. Different methods of thinning and pruning plantations, and their effect.
4. How to plant forest trees, proper spacing distances, and desirable tree mixtures.
5. Special study plots, visualizing the rate of growth of different trees and different tree combinations, and the yield of different systems of forest culture.

6. Proper timber cutting and harvesting methods. In my opinion, this is one of the most important present day problems in Pennsylvania forestry.
7. Model forest areas serving as an inspiration for sound forest practices.

Scientific forestry has been practiced in Pennsylvania for more than twenty-five years. If only demonstration plots had been placed in all our State Forests where there were natural stands far enough developed for the purpose, what a vast amount of interest would have been created in the minds of the people by this time. Again and again tourists have remarked: "We saw that fine planting at Caledonia which the Forestry Department has improved, and we feel that if timber lands like that can be developed, we want to start planting!" The "show window" at Caledonia has certainly "sold" forestry to vast numbers of people.

Fortunately the Department of Forests and Waters has taken a very decided step forward within the past few years by establishing in both the State Forests and on private lands, study plots for demonstrating special phases or problems of forestry. These plots consist of areas that vary in size from a quarter of an acre to several acres each. The lines of demarcation between these plots and the surrounding forests are sharply emphasized, and proper signs give the most important facts that are worth knowing about demonstration areas.

The Chinese have a saying that one picture is worth a page of type. Similarly we might say that one demonstration forest area is worth a wagon load of bulletins on forestry. Professor Joshua A. Cope of Cornell University, told the Society of American Foresters:

The most effective tool to bring about the adoption of improved forest practices is to take the farmer to the forest, and when you get him there, don't say it with words, but say it with thinnings, with improvement cuttings already made, with the felled wood already cut in lengths and stacked, or with stately rows of hand-planted trees growing into a thrifty forest.

Some of our foremost educators say that ninety per cent of all human knowledge is acquired through ocular avenues. Others put the figure at seventy-five per cent. The exact percentage is unimportant. The important fact is that most of what we learn, we learn through seeing. Hence it follows that in the development of a broader plan for educating the public about forestry, visual methods merit full consideration.

During the three years 1926-1928, demonstration forest areas were made in Tioga county in both planted and natural stands.

The work in progress brought forth much comment and many questions by both the men engaged in it and by the passing public. When the work was completed, and before a sign of any sort had been erected to explain the situation, woodlot owners from all over the county had grasped the meaning of what was done and were talking about it. Merely to see this improved bit of woodland was enough to make woodlot owners desire to have their timber stands like it. When calling upon a farmer at the extreme end of the county upon some other matter, he straightway began to question as to how he could improve his woodlot "like the one he had seen at Ansonia."

Within a month after the completion of this same improvement demonstration in a natural stand, two farmers, who lived not five miles distant from the plot, started like improvements in their own woodlots, altogether on their own volition and initiative. Not one word was said to them by any one connected with this Department. When they were asked why they were improving their woodlots, they said that they had seen the Department's demonstration area and were so impressed by it that they wanted to improve their own woodlots in the same way.

In Morris township, Tioga county, lives a man who is nearing the age of retirement from active work. For the past twenty years he has been busy at odd times in improving his small woodlot. The planting demonstration in the nearby State forest attracted his attention. Straightway he began to secure trees from nearby stands, carefully lifting and transplanting them in his own woodlot. Each spring saw an addition to his planted area. Not satisfied with this one phase of forestry, he began to prune his trees. Each winter he goes over his woods and removes dead trees and carefully trims the living ones. Today his little private woods is a home demonstration area that is worth while. Wherever any one is led to create in his own woods a similar improvement, he likewise helps to spread the gospel of scientific forestry.

That there is need for the demonstration area in forest work is easily seen. Such an area provides a valuable field for study. It furnishes a guide or standard for both the forester and the private woodlot owner. It is a guide that anyone who sees can understand. Persons interested in making a forest planting, or in conducting a chemical-wood, mine timber, pulp, or lumber operation, can take the demonstration area as an example and so learn the proper method for his operation from these demonstration plots.

Particular attention should be paid to preparing proper signs for demonstration areas. Unless a plot is properly marked, the observer may not realize what the plot is intended to show.

There is a very good sign that marks the Caledonia plantation demonstration. It is a large sign, six feet by ten, that stands directly in front of the plantation, close to the Lincoln Highway. The sign bears this legend:

WHITE PINE PLANTATION

Planted1906
 Pruned1923-1926
 When 50 years old, will yield 35,000 board feet of timber

This simple sign has been very effective in telling the high points of this forest tree planting of 1906. Motorists from every state in the Union and from some foreign lands have admired and many of them have stopped and studied, this orderly army of young white pine trees. While this sign has done a lot of good, it does not go far enough in telling the story of this interesting tree planting. There should be supplementary signs, similar to those in use in the demonstration plots of the Finnish Forest Service. These supplementary signs should be small signs about 18 by 24 inches in size, fastened to posts at a height of five to six feet. They should be placed within the plot, and should give general or specific information about it, so that the story of the plot may be told in full to the searcher for information.

Inasmuch as the Department of Forests and Waters is responsible, not only for the forests in the State forests, but also for the forests that must be produced on the non-agricultural lands of the State, it is highly desirable that we should "sell" the idea of the increased values that come through proper care of the forest. This idea can be promoted best through the development of demonstration forest areas. These should be so developed that people of all stations of life and from every part of the Commonwealth will grasp the idea and help to spread the gospel of better forests for Pennsylvania.

We must look upon our work in creating demonstration areas in the forest as far more than improvement work in the woods. It is missionary work and advertising work and propaganda work accomplished by forestry methods in the furtherance of a great movement for human welfare. When the forester works in this way he combines statesmanship with forestry. But he does not deliver his message in the usual way. He says it with trees, by establishing demonstration forest areas at as many strategic points as circumstances permit. For just as the proper study of mankind is man, so the proper study of the forest is the woodland itself.

MARKING STATE FOREST BOUNDARY LINES

Committee

T. C. HARBESON R. P. FATZINGER
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Presented by T. C. Harbeson

THE WORD bound or boundary is taken from the old French "bonde," meaning a frontier line or that which serves to indicate the limit or extent of land. A boundary is usually defined by certain marks, or it may be ascertained by reference to a plan or measurement. Pennsylvania State forest boundary lines are ascertained by reference to deeds and drafts conveying title, leading back to the earliest history of the Commonwealth. On March 3, 1792, the last of thirty-three treaties and purchases was consummated with the Indians, whereby full ownership and control of all lands in Pennsylvania was given to the Commonwealth.

The conveyance of title to land from the Commonwealth is by patent. Patent is obtained upon application to the Land Office in the Department of Internal Affairs. From the description furnished in the application, the Surveyor General, after satisfying himself that the area applied for has not been patented, grants a warrant to survey. Upon the return of the survey, accompanied by the purchase price, a patent from the Commonwealth is granted to the purchaser for the area surveyed.

ORIGINAL SURVEYS

References in the deed conveying title to the Commonwealth, for State forest lands, lead back to the original survey returned on the warrant issued. During the period of great land sales (1790-1795), surveyors of all grades were deputed and sent out to establish the boundary lines of land purchased. Each deputy surveyor was given a district, the east and west lines of which were run and marked from the Susquehanna river due north and south to the State line. The interior lines of each district were then supposed to be run and marked. In many instances these interior lines were not run or marked at the time, but were plotted on paper and are frequently referred to as "parlor surveys." Removal of timber, and subsequent forest fires, destroyed nearly all

marks and corners made at the time of the original surveys, so that when the Commonwealth regained title by purchase of such areas for State forest purposes, it meant that approximately 3,400 miles of these lines had to be re-surveyed and the original lines and corners accurately re-located. This was an immense and difficult task.

RELOCATION SURVEYS

The problems which faced the early State forest surveyors may be summed up as follows:

1. Inaccuracies of the original survey.
2. Destroyed line blazes and corners.
3. Large devastated areas devoid of ample tree growth to carry markings of the relocated lines.
4. Rugged topography and inaccessible areas.
5. Long distances from habitation.
6. Lack of means of transportation.
7. Antagonism of adjoining land owners, and illiterate people holding adverse possession.
8. Meager appropriations.

These relocation surveys were nevertheless carefully planned and made. Many of the lines were at first disputed, but disputes resulted in only four lawsuits, all of which were decided in favor of the Department. Considering the immensity of the task and the difficulties encountered, this survey work marks one of the Department's outstanding achievements. It is imperative that this standard of work be maintained because it is more incumbent upon the State to be sure of the location of its many miles of State forest boundary lines than could be expected of the private land owner.

Where foresters or rangers were assigned to the areas previous to the time the surveys were made, they were instructed to assist the survey crews as much as possible, in order to become well acquainted with their boundaries. In some cases the surveyors were instructed to hasten the line work in order to keep costs to a minimum. Consequently, they made few marks and set up meager stake and stone corners. Funds were later provided to thoroughly remark and rebuild all the lines and corners already established. This was to include full establishment of all State forest boundary lines, with new markings on additional trees, better corners, and ample use of white paint, which was approved as a standard color to indicate State forest boundaries.

When one realizes the many additional miles of trial lines and intersecting lines which had to be run to prove the accuracy of the survey when no trace of any original marks and corners could

be found, one begins to comprehend the difficulty of the task. The cost of these surveys varied from \$16.15 per mile in 1906 to an average of \$30.40 per mile in 1927. This relatively high cost of a relocation survey is one big argument in favor of marking State forest boundary lines in a permanent manner and in maintaining them properly so that the work need not be repeated in the future.

Forest boundaries accurately established form a legal protective barrier against encroachment by man. Therefore, boundaries must be protected by continuous and open possession of all land within their limits. This presupposes an accurate survey, properly demarcated, because in law the exact boundary of land is always a matter of evidence; where no evidence is available, the court acts on presumption. For instance, the boundary of land on opposite sides of a road, whether public or private, is presumed to be the middle line of the road.

MARKING STATE FOREST BOUNDARIES

In the marking of State forest boundaries, questions arise, the correct answers to which should seemingly govern this work. These questions are as follows:

1. Are the lines which are to be marked temporary or permanent?
2. Should the method used be temporary or permanent?
3. Is that method of marking, which gives the highest degree of permanence with the least cost, the best method?
4. Should the method used be practical?
5. Should the method used be systematic?
6. Should the method used be standardized?

When the first surveys for the relocation of State forest boundary lines were made by the Department, serious thought was given to these questions. They are answered in part by the markings now placed on a big majority of lines which have been accurately re-surveyed. The complete answer was not thus fully recorded, but was necessarily postponed until sufficient men and money became available to inscribe it in the forest. A recent compilation reveals that approximately 3,200 miles of State forest boundary lines have been surveyed, 104 miles which had been lost were re-surveyed, and 371 miles of additional lost line are in need of re-surveying. A study of the causes entering into this neglect reveals the following in the order of their degree of responsibility:

1. Lack of tree growth at the time of survey to carry line markings and blazes.
2. Frequencies of transfer or change of personnel in districts.
3. Lack of sufficient men and money.
4. Lack of full appreciation of the significance and importance of well marked lines.

It appears that the four above named causes can and should be remedied. The solution to the problem presented by lack of ample tree growth can probably be overcome by devising and providing some standardized form of permanent marker. Planting of some suitable tree species on the line would take care of the future. Red pine (*Pinus resinosa*) suggests itself for this purpose.

State forest boundary lines naturally fall into two classes: (1) Permanent, (2) Temporary. Permanent lines, where there seems to be little or no possibility of the State acquiring the adjoining land; temporary lines, where there is no reasonable doubt but that the land adjoining can and will be purchased under a contemplated program of acquisition. Prudence and jurisprudence both demand that all permanent lines be marked in a durable, practical, systematic and standardized manner. Economy requires that temporary lines be maintained and patrolled so long as they are State forest boundaries.

The present system of blazing and notching trees and preserving them from cutting appears to provide the most practical line marker. It has a high degree of permanence and the cost is low. Many such marks would have probably stood the test since the first surveys in 1776 had the original forest areas not been devastated. Where a sufficient number of trees of proper size and quality are not so situated as to serve for line marks and corners, some durable form of marker must be provided. The following plan is suggested:

1. For all well known and undisputed original corners from which accurate surveys should start, provide a reinforced concrete post six inches square at the base and four inches square at the top, and having a total length of four feet. An inscribed metal plate marked with a keystone should be counter-sunk in one side of the post, near the top end. This plate should carry an inscription stating that this is a State forest boundary corner and that there is a penalty for destroying it. It should be stamped with the consecutive corner number, the adjoining warrant numbers, and the date of its erection. This post should be planted firmly in a vertical position.

2. All other corners should be provided with a five foot section of two-inch galvanized pipe to be firmly driven into the ground, around which stones should be piled. Into the open end of the pipe should be driven a durable wooden plug, upon which should be stamped a keystone and the consecutive corner number.

3. All corners should be carefully witnessed. Where there are no line trees nearer than fifty feet, the direction in which the lines extend from the corner should be indicated on the ground

by an open ditch 10 by 10 inches by five feet, or pipe guiders should be set approximately thirty feet away from the corner.

4. On all boundary lines of considerable length, sections of pipe such as used for corners should be driven on the line at various points. However, they should always be located in a methodical manner. For example, where a line crosses a ridge or considerable elevation of land, a pipe should always be driven on the line at the highest elevation. Where a line crosses a road, trail or stream, a pipe should always be located on the line either on the north or the east side, depending upon the general trend of the road, trail or stream. A wooden plug should likewise be driven into the open end of each pipe located on the line. The plug should be stamped with a keystone and also support any metal markers which might be in use.

5. At the time of survey the location for all concrete and pipe markers should be determined and located on the finished draft. Corners should be identified on the draft by consecutive numbers. The draft should serve as an index to all permanent markings, in order to facilitate all manner of forest surveys and in keeping an office record of maintenance work done on boundaries.

6. All tree blazes made during the year of survey should be stamped with a keystone. The hatchets now in use for marking timber for cutting could be used for this purpose.

7. On areas devoid of desirable tree growth, a standard tree species should be planted along the boundary line. The tree selected should possess qualities of fire resistance and be fairly free from insect and fungous attack, an abundant seeder, wind firm, and desirable from an economic standpoint. Many of these trees, if favored, should live to serve at least a two-fold purpose. First, as living symbols of the State forest boundaries; second, as mother trees for natural seeding of new forests. Red pine is suggested for this purpose.

8. Metal markers serve well to supplement tree markings and identify the State forest boundary lines for forest visitors. Their further use appears to be justified, but tree blazing should not be dispensed with because of their use. The first metal markers for State forest boundary lines were used in Tioga county in 1909. They were instituted at the initiative and personal expense of Forest Ranger Henry Cox, now deceased. These crude original markers were nothing more than round tin can tops painted white. After a period of nineteen years they still mark lines which would be difficult to follow if it were not for these metal tags.

9. The younger forest rangers in the district where the survey is being made should form part of the surveying crew in order that they may become familiar with the lines.

10. There should be a definite understanding in running and marking lines in order to place responsibility for negligence. The surveyor should know just where his work ends and the district forester should know where his work begins. Probably the best solution would be to employ a marking crew to pick up work where the surveying crew leaves off and carry it to completion.

11. Actual forest practice on our State forests should in itself be such as to help distinguish between State and private land. Our forest improvement cuttings should start at our boundaries, particularly where they cross roads, trails and streams.

MAINTENANCE OF STATE FOREST BOUNDARY LINES

There are certain permanent State forest boundary lines in remote regions which are little used. The idea has been advanced that it would probably be cheaper and better to eliminate the cost of frequent markings on such lines and make a relocation re-survey when future conditions demand it. Probably the best argument against such procedure is that every additional survey introduces a chance for error. Such errors might culminate in litigation in case the land became highly valuable, and this thought suggests that the exactness of a re-survey should not be based upon present acre value but rather on its highest expectation value. When once a line has been satisfactorily relocated, it should be held and maintained. The evidence of the line is that it must count back to the original or previous survey. This is a fact that should be kept in mind when making new blazes on trees in later years. No blazes made at this time of the survey should be freshened or chopped open, for this destroys their identity. New tree growth must be marked from time to time to replace the original markings which become indistinct or are lost because of death and destruction of marked trees. The loss of all chestnut because of the blight presents a problem and suggests the urgency of new marks.

If a boundary line is to be opened and used as a trail or fire break, the cost cannot be justly charged to maintenance of boundaries. Boundary lines used strictly as such require no great expenditure for maintenance. Brushing of boundary lines can be done quickly in conjunction with the erection of metal markers. The brush removed should be cut high so that the projecting snags will help demarcate the line even when the ground is covered with snow. Where no real destructive fires have swept across previously brushed boundary lines, it is possible to follow the line five or more years after brushing, with the snags serving as the only guide.

The placing and nailing up of metal tags or markers can be done cheaply. Fifty tags can be placed per mile at an approximate cost of \$1.50. A two-inch galvanized roofing nail is probably the best to use. The nail should be allowed to project one-quarter to one-half of an inch, in order that the growth of the tree does not strip the tag off the nail before it serves its full usefulness.

In painting lines no paint should be applied to fresh blazes. The blazes must season before they will take oil and cause the paint to stick. Three years after the original painting, repainting should take place. Thereafter, re-painting at five year intervals appears to maintain the visibility of all marks sufficiently well. Painting can be done to good advantage by two men working together, each assisting the other in helping to line in and locate the blazed trees. Under average conditions two men can repaint five miles of line a day. This would require at least one gallon of good paint or its equivalent in white lead and oil. While white paint has been selected as standard on all state forest boundary lines, it is, however, commonly believed and supported by observations that red paint is more permanent for this purpose.

An old custom observed in many English parishes is called "Beating the Bounds." In former days when maps were rare, it was usual to make a formal perambulation of the parish boundaries on Ascension Day or during Rogation Week. In the north of England the latter is still called "Gang Week" or "Ganging Days" from this "ganging" or procession. The priest of the parish, with the church wardens and the parochial officials, were headed by a crowd of boys, who, armed with green boughs, beat with them the parish boundary stones. Sometimes the boys were whipped or even bumped on the boundary stones to make them remember. The object of taking boys was obviously to insure that witnesses to the boundaries should survive as long as possible. This custom is thought to have been derived from the Roman Terminalia, a festival celebrated on the 22nd day of February, in honor of Terminus, the god of land marks, to whom cakes and wine were offered, with sports and dancing taking place at the boundaries.

It is possible to learn a lesson from this old established custom which could well be revived in the maintenance of our present day State forest boundary lines. We, too, might set apart a "Gang Week" or "Ganging Days," during spring or autumn, when our forest personnel might perambulate their boundary lines and offer white paint and shiny medals to the god of land marks.

ACCOUNTING AND AUDITING PROCEDURE

By W. E. Montgomery

THE PRINCIPAL fiscal functions of the Pennsylvania Department of Forests and Waters are naturally divided into:

1. Operation of departmental cost accounting system.
2. Control of departmental allotments.
3. Examination and auditing of district accounts and records.
4. Supervision of expenditures in connection with the State budget system.

The last-named although of great importance, does not hold the same interest for the field personnel of the Department as do the first three of the functions enumerated. Consequently, in this brief paper, we shall omit all other reference to the State Budget, and confine our attention entirely to those activities which more closely concern the district foresters and their assistants.

For a number of years after the establishment of the Department of Forestry, bookkeeping in the Harrisburg Office consisted to a very large degree, in a mere journal entry of expenditures from the various appropriations together with such memoranda and records as were necessary to properly explain and substantiate the disbursements in question. In the field the bookkeeping practice varied from that used by one forester in the northern part of the State who kept most of his accounts in his head and the remainder in a loose-leaf note-book, the pages of which were usually either loose or lost, to a rather elaborate system evolved by Forester Robert G. Conklin when in charge of the Caledonia Division of the South Mountain State Forest. This system was described in a paper read by Mr. Conklin at the First Convention of Pennsylvania Foresters held at Harrisburg in March 1908. In answer to a statement that the Department had never informed the foresters as to the manner in which the accounts were to be kept, the then Commissioner of Forestry replied that as soon as work on the new reserves had been reduced to a system, uniform accounts would be required, but in the meantime each forester would have to determine his own needs. In general, there was an attempt on the part of each forester to account for his own time and that of his rangers together with the limited funds placed at his disposal, on a project cost basis, by charging certain amounts to administrative expenses and to

the various buildings, plantations, roads and trails upon which work was done. To a large extent, the bookkeeping was single entry and although similar in form, yet there were almost always such variations in the procedure used in the various forest reserves (now State forests) that seldom were the accounts themselves really comparable.

FIRST ATTEMPT AT COST ACCOUNTING

The first attempt to establish a cost accounting system in the Department and to co-ordinate the various methods used in the districts was made in 1919, when a card of accounts was devised and instructions issued relative to its operation. How well this preliminary work was done is evidenced by the fact that the accounting system now in use is based entirely in its fundamental and more important phases upon the system started ten years ago. This system recognized the differences that characterize capital as against administrative, maintenance and operating expenditures. I might digress for a moment to say that greater care should be exercised by the district offices in preparing their distribution sheets, for frequently expenditures are charged to maintenance, which, from their nature, are unquestionably capital charges. There are doubtlessly numerous other items not recognized because the character of the services rendered or the materials purchased is such that it could be either an operating or an asset charge.

This card of accounts formulated in 1919, used the numerical system of identification and was subdivided in such a way that it covered every phase of activity in which the Department was then engaged. In addition it made provision for such other operations as might be conducted in the future. The bills forwarded to the Harrisburg office were accompanied by distribution sheets similar in purpose, if not in form, to those now in use. The system provided however, that only the main or controlling accounts should be kept in the Harrisburg office and that only the various sub-accounts be recorded in the district ledgers. No vouchers were used, but loose-leaf sheets were prepared in the Harrisburg office and forwarded to each district for insertion in the district ledger. No inventory was taken at the outstart. The system consisted of merely a running account of classified expenditures from the date of beginning. As of January 1, 1921, however, physical inventories of all land, stumpage, buildings, equipment and improvements were taken and set up as capital charges upon the records. At this time the voucher system now in use was started and certain elaborations were installed. Considerable trouble was experienced however, in reconciling the individual

district accounts with the control accounts kept in the central office, with the result that in June, 1922, it was decided to keep district ledgers in the Harrisburg office as well as in the field. This necessitates a certain duplication of work, but experience has shown that the additional expense entailed is justified in the results obtained.

REVISION OF ACCOUNTING SYSTEM

During several years' use, frequent suggestions were made as to revisions and elaborations, with the result that in 1924 a number of changes were put into effect. For the most part, these consisted in breaking down numerous accounts into their component parts and in the establishment of sub-accounts covering the activities involved. Later it was found that this action for the most part was ill-advised, since the information thus made available was seldom needed, while the addition of the numerous sub-accounts had resulted in creating a more complicated and cumbersome system. Consequently, on June 1, 1927 the system as now used was put into effect. This eliminated most of the sub-divisions made three years previously and in addition it combined quite a number of kindred accounts previously kept separate and distinct.

The basic principles and most of the main accounts of the original system of 1919 are still retained at the present time. The main changes have been due principally to an effort to ascertain just what is needed in the way of statistical accounting data and then to adjust the card of accounts in such a way that the desired information can be obtained with the least amount of work. To cite a few general instances, this has resulted in (1) bringing together the maintenance charges of a number of roads into one road system account instead of ten, fifteen or twenty separate accounts; (2) combining of a group of buildings into one account instead of six, eight or ten; (3) reducing nursery operating charges from thirteen to five accounts and (4) consolidating numerous protection and public assistance charges. It should be emphasized that these combinations and consolidations were not made arbitrarily nor for the sole purpose of decreasing the work involved, but were made only when experience had shown clearly that an extra-fine subdivision, as then existed, had created a superfluity of accounts. The present system offers an excellent example of a card of accounts which gives all the essential information with a minimum outlay of time and effort.

WHEN ALLOTMENT SYSTEM STARTED

Until 1921, the Department had no system of allotments. Prior to then appropriations were so small and the number of forests

so numerous, and consequently the funds at the disposal of each forester were so meager, that a system of allotments would have been little short of an absurdity. With the sub-division of the state into twenty-four districts, and with the increased funds available for maintenance and improvement work upon the state forests and for general protection purposes throughout the State, the absolute necessity of a departmental budget became apparent.

INTRODUCTION OF BUDGET SYSTEM

The present budget system, like the accounting system, is the result of evolution (Arkansas and Tennessee to the contrary notwithstanding). The first intra-departmental budget was put into effect June 1, 1921, at which time certain amounts were allotted to each of the districts, although no attempt was made to keep a control record of expenditures in the Harrisburg office. This procedure provided no check upon the districts and, beginning June 1, 1923, funds were allotted in accordance with the classification of accounts although no separate record was yet kept of expenditures, the plan being to ascertain the status of the allotments through the accounting system. In this procedure, however, numerous difficulties arose. By June 1924, it was evident that a separate and distinct record of allotments was absolutely essential.

SIMPLIFICATION OF ALLOTMENTS

The Department administration policy at that time was to exercise a very close check upon all district expenditures. For this reason, in the system of allotments that was established, there was a much greater number of allotment captions than would otherwise have been deemed necessary. As a result of this system, it was possible to make only very small allotments in the great majority of cases. This, in turn, made necessary the constant transfer of funds, frequently only a dollar or so in amount, so that in the end there were many more transfer entries than those covering actual expenditures. The faults of this system were quite evident, and early in 1927 an effort was made to correct them so that the necessary bookkeeping would cease to be a hardship, and also that the district foresters might have greater latitude in expending moneys allotted to them. To attain this end a new budget system was put into effect which reduced the field allotments from seventy to twenty-two, with only thirteen additional allotments for the Harrisburg office in place of thirty-nine. Rules were also put into effect which permitted foresters to make transfers within certain limits without the necessity of first obtaining authorization from the Harrisburg office. Through the present system those in charge of fiscal affairs have what

they consider an adequate control over all expenditures, and the work now necessary, both in the Harrisburg office and district offices, to keep the allotment record up-to-date, is not burdensome.

AUDITING DISTRICT ACCOUNTS

The auditing of the district accounts began in November 1921. The original plan called for the covering of the twenty-four forest districts in a period of two years, thus making a biennial audit of each district. The work was to be done by the regular personnel at such times as they could be spared from their customary duties. On this basis in the eighteen month period ending May 1923, sixteen audits were completed. The following month, by reason of a decrease in appropriations, it was necessary to reduce the accounting personnel with the result that it was impracticable to make any audits with the diminished force during the remainder of 1923. Only one district audit was completed during the entire year of 1924. In 1925 five district audits were made. During the first eight months of 1926 only one audit was completed, and during the next eight months the records of fifteen districts were examined. From this record it can be seen that during the several periods of audit activity the biennial standard was maintained, but the difficulty was in the impracticability and lack of sustained effort, due in some instances to insufficient help and in others to pressure of current and special work. This condition was unsatisfactory from two standpoints: First, the audits were not sufficiently frequent; and second, the work had to be done chiefly at odd times when routine work would permit the auditors being absent from headquarters. Both of these difficulties were overcome at one and the same time by the employment of a traveling auditor in October, 1927.

PRESENT AUDIT SCHEDULE

When the traveling auditor began to function it was decided that the records of each Forest District should be audited once within every six months. Now, after approximately a year of auditing on this basis, all back audits have been made, and at the present the work is proceeding on a basis of semi-annual audits or better. In addition, District Foresters were instructed to reconcile their accounts at the end of each month, a procedure dictated by good business. Most of the foresters had, however, already been following this practice. Special forms were prepared for making periodic district reports upon their reconciliations. In this way practically all of the difficulties encountered under the old system have been obviated. Due to the comparatively short intervals between audits, the trouble in finding such

mistakes as may occur, has been reduced to a large extent, and through the system of reconciliations and reports, the possibility of errors occurring and being carried through many months, has been much reduced. Thus, where formerly the audit of a district may have covered the accounts of several years, and required an enormous amount of work, it is now reduced to a routine procedure usually not taking more than a day or so to complete.

This short statement summarizes briefly the origin, development and present status of the methods used by the Pennsylvania Department of Forests and Waters in regulating its fiscal affairs. There are no claims to perfection in the accounting and auditing procedure of the Department. As the years pass by, alterations will doubtlessly be found advisable, but just now no changes suggest themselves. Such information as is deemed necessary and desirable is provided at a reasonable expenditure of money and effort by the present system—a system in which we take a pardonable and justifiable pride.

ADDRESSES AND GREETINGS

ADDRESS

By Col. Henry W. Shoemaker

Member, State Forest Commission

LIKE Lough Neagh in Ireland, where you go out in a boat on a clear day and are supposed to see the spires of a buried city of long ago, the lost lumber towns of Pennsylvania are buried under the debris of industrial waste. I have always been very fond of old maps and old lists of post offices, and I have speculated upon what has become of those towns shown on those old maps, and those lists of post offices—where they have gone to, these vanished cities of central and northern Pennsylvania.

Here today we have heard much talk about making the lumber business continuous, making forestry perpetual. And that is emphasized by these cities which rose and fell and disappeared completely. Out of the "Fifty Years Ago" columns appearing in one of the Potter county papers, I have compiled now and then lists of towns which were mentioned in that column. Some were in Potter County, others in McKean County, in Tioga and Clinton Counties, and surrounding counties. I wonder how many of you can tell where every one of these is. I can tell where a few of them are. Dr. Illick can probably tell where more of them are. Mr. Emerick and Mr. Elliott and others could probably tell where still more of them are. I will give them to you: Mina, Clara, Alexandra, Electra, Sweden Valley, Lymansville, Costello, Cross Forks, Gardeau, Cammal, Leetonia, Liberty, Cherry Mills, Turrell, Trexler, Hillsgrove, Norwich, Colegrove, Conrad, Cameron, Granere, Barclay, Morris, Slate Run, Cedar Run, Betula, Jamison City, Nora and Cartee Camp.

Some of them have small remnants of their former glory, a battered old hotel or railroad station, but others are wiped completely off the map. I can't find any trace at the present time of Granere or Barclay or Alexandria or Electra or even Lymansville. And I have two very interesting pictures of Gardeau, both taken by that great old mortal of the Pennsylvania lumber woods, Major William T. Clarke, who traveled from 1880 to about 1918 through the forests, photographing these passing lumbering scenes. He took pictures of every phase of life, camp life, groups of families, interiors of homes, their kitchens and implements,

and horses and oxen, and the great virgin forests as they looked. The first picture of Gardeau was taken in 1897 when that lumber town was in its prime. There were several big hotels and stores in evidence, wagons and people crowding the street, and in the foreground the ornate tomb of Col. Parker, the pioneer of the town, with the masonic emblem on the top of the mausoleum.

The last picture was taken in 1921 and shows that all that was left of the town was the tumbling down home of Col. Parker and the tomb with the masonic emblem all awry, with trees and bushes grown up all around it. The lumber town had completely disappeared. The distant sawmills and their stacks, and the stores and hotels were gone, one by one.

It will be interesting, I think, for Dr. Illick to reconstruct and resurrect these old lumber towns, and I suggested to him that he ask each district forester to compile a list of lumber towns that had been in his forest, and also try to locate a number that we have found the names of but don't seem to have any existence on maps. I have searched the maps for several of these towns and they apparently came and went so quickly that they didn't get on the maps. But according to the Potter County Journal there was a good deal of activity in them at certain times, because it tells of the number of people living there and the amount of lumber that was sawed up.

But to bring back the lumber towns with their human interests, what happened there, the great lumber operators that had charge of them, I think will make a very fascinating booklet, and the cooperation of every one of you good friends here will make it probably as fascinating a booklet as the Department has brought out. I congratulate the Department on these frequent bulletins appearing from the pens of different members of the Department. They are getting better looking. The State Printer is using better judgment and better taste, and I always take a supply of these books with me on my travels. I travel about 800 miles every ten days in the trains, and I carry a supply of these forestry bulletins with me, and if I make even the slightest contact with anybody in the train, I shove a few forestry books on them.

I believe in the publicity idea, that people must think forestry, talk forestry and live it, in order to back up to the fullest extent.

This is a wonderful gathering today. One can feel the thrill and inspiration of meeting the men here today that we find in remote spots, now all together, working for a common purpose in the great cause. And they will all do greater work as a result of conferences of this kind. (Applause).

REMARKS

By Irvin W. Gleason

*Chief, Bureau of Lands**Pennsylvania Department of Forests and Waters*

SECRETARY Dorworth in his remarks has given me a lot of credit for buying forest land. As "Al" Smith says—I am going to give you the "low down" on this land-buying proposition. When Secretary Dorworth came to Williamsport and wanted me to be purchasing agent for the Department, I frankly told him I didn't care about serving. The main reason why I didn't care about the job was because of my experience with a political job I had one time up the river, when I was elected school director in a little town for a period of three years. The next year a fellow member on the board ran for re-election and they beat him on account of claiming the school board had done some grafting in buying chalk. Ever since then I have had a horror of political jobs.

I want to say frankly that I did not want to serve, because I had an idea, like most laymen, that politics would enter into it, and for that reason I did not want to get mixed up with it, but I will say now, that I have the honor of serving on a number of important industrial boards, and I have never been on the board of any private industry that is run on principles that are any better than those of our Department of Forests and Waters. It has been a pleasure to me to be associated with Secretary Dorworth and the rest of his organization. Just take the State Foresters who are here today, they are the boys that are leaders in their field. I often think that these conscientious young men would make cracker-jacks for any private concern in purchasing timber or any other similar work. The whole Department is run on a sound business basis. I want to say frankly that I do not consider myself as a purchasing agent, but rather as a buffer between the State Forest Commission and the land owner. When the State Forest Commission has a meeting and act upon some of the land offered they say: "Irvé you go out and buy this land and do not pay over \$1.75 an acre for it. It might be worth more, but do not pay it." So you see it is up to me to see these people and do the best that I can. So often the landowners say: "We have carried this stuff for twenty years and paid the taxes on it during all this time," and then they come down to Secretary Dorworth and State Forester Illick and tell them that, and these fellows say: "We know it is worth more, but you can't do much with that man Gleason." So what I am is a buffer to decoy a lot of my friends, fellows who are old, honest, but poor lumbermen, into selling their lands to the Commonwealth at a low figure. I feel

I am like the old steer out in the stockyards who leads the cattle up to be slaughtered. (Laughter)

In concluding, I want to say very frankly that I am delighted for the privilege of serving in this capacity, because it is entirely a different job than I had anticipated. I find the whole thing is run on business principles and every dollar spent could not have been spent more economically if the men who did the buying had bought it for their own personal use. (Applause)

ADDRESS

By Hon. Frederick T. Gelder

*Chairman of Senate Committee on Forestry
Forest City, Pa.*

I COME from a section of Pennsylvania that they call the rural section, and so just naturally I am interested in problems like forestry. We have miles upon miles of territory that probably should go back to the forests. There is a great stretch along the railroad that has been denuded from trees and no effect made to replant. I was very much interested in hearing the report of State Forester Illick as to the number of fires, because it has been my experience that about every second year fire does come in and retard the growth. If you could keep the fire out, without any planting, we would soon have forests again.

I notice that your Forester is interested in roads. We feel that the prosperity of the country districts—and that is where all of you foresters come from—must come first from a better system of roads.

But I feel that the forestry development of Pennsylvania is one development in which we are simply "plowing-in" the money of the State, and that it is going to come back in dividends. I think that every session of the Legislature should appropriate generously for State forests. I wasn't so keen on a bond issue for State forestry as I was for some other things, because I felt that perhaps it wouldn't be a good thing to dangle too much money before the people who had the land to sell, although I did vote for the bond issue and advocated the bond issue. But I feel that the Legislature ought to be able to appropriate the money that is necessary so that you can purchase land, each two years, and still continue to make the Commonwealth of Pennsylvania one of the outstanding forest reservation states of the Union.

Now I had no idea that I was coming here to talk, and I was sitting here feeling peacefully secure in the idea that I wouldn't, but I want to assure you that I am interested in your problem, as I know that the Chairman of the House Committee on Forestry is, and we will try to work out as far as possible adequate finances for the Forestry Department. I thank you. (Applause)

ADDRESS

By Hon. George Williams

*Chairman of House Committee on Forestry
Wellsboro, Pa.*

I CAME here to listen and to learn something of the needs of the Forestry Department, and to pledge anew my cooperation to the fullest extent in bringing about the things that are needed to further the splendid work that has been done for a number of years by the Department.

I have been particularly interested in State Forester Illick's report of the work that has been accomplished, particularly in the last two years. I feel that the \$500,000 appropriated by the Legislature two years ago for the purchase of lands has been wisely expended. And I hope and have no doubt but what the liberal appropriation that may come from the Legislature this session for use during the coming biennium, will be as carefully invested as was that \$500,000 of the present biennium.

Two points developed by Dr. Illick appeal to me, and I want to say just a word on them.

One pertains to the extent to which the State lands have been used and are being used for recreational purposes. Having had something to do with the introduction of the original bill that authorized the Forestry Department to open up the lands for such purposes, it has been very gratifying to me to see the extent to which they have been used, and I firmly believe that the health of the people of the Commonwealth, because of the use of these lands, has been greatly benefitted.

Also I would bring to your attention a point that District Forester Mulford, State Forester Illick and Col. Shoemaker are familiar with. That is the Leonard Harrison State Forest Park which was a gift of my fellow townsman and public benefactor, Mr. Leonard Harrison, who recently passed away in the Johns Hopkins University Hospital. In 1927, 14,000 people visited this picturesque park. The drawback to its proper development is the matter of roads, as Col. Shoemaker can testify, and I do feel that as a memorial to Mr. Harrison, who was so generous in his gift to the Forestry Department, that some way should be worked out to improve the road leading from Wellsboro into that park. The Forestry Department has done a splendid work in equipping that park for the convenience and comfort of tourists. I earnestly ask for the cooperation of Secretary Dorworth and Colonel Shoemaker and the other members of the Forestry Commission, in working out some scheme by which that park may be more easily reached by the thousands and thousands of people who desire to visit it. (Applause)

ADDRESS

By Hon. Frank J. Baldwin

*Member, Pennsylvania State Senate
Austin, Pa.*

IT IS not necessary for me to say that I am glad to be here. I know that conferences of this kind must be of great benefit to you foresters and to all others, because after all, I don't know of any occupation that young men can take up where there ought to be so much inspiration and so much vision as that which should come to the forester. And I want to say of those foresters with which I have been acquainted, which have been quite a number, that I have been glad to number them as my friends, and we have been glad to count them among our most aggressive citizens, public spirited fellows, fellows that were a help to every county and every community. And I would say that after these men have their education and are engaged in this wonderful work they are doing, that I think it is the duty of the State and of your Department to make it so that it is worth while for them to follow up through their life the occupation they are engaged in. And that means that they can't live on love of their work entirely, but from time to time they should be encouraged in the way of competent salaries to get along on and to interest them.

Now Mr. Chairman, you know that I have been interested in forestry from its very beginning. I knew your good friend, the Father of Forestry, Dr. Joseph T. Rothrock, and there was no man that I admired more. After looking over some of the forests, not only in our own State, but in our neighboring states, and after seeing some forests in some of the European countries, I want to say to the Forest Commission of Pennsylvania that I believe that our State is further advanced than any other State in this Union, and I believe that we are going at this forestry problem in just as practical a way as any other country in the world.

There are a good many things that would be of interest, that I am interested in, and that you boys are interested in, and that your Commission is interested in or considers of a great deal of importance. I want to congratulate the State of Pennsylvania and your Commissioners upon the position that I consider your Department is in today, and that the State is in in establishing forest lands that are really going to be worth while, and in acquiring these lands in a manner so that it is an investment for our State. And it cannot be said that we have paid prices larger than we should in acquiring them, but the purchases have been advantageously made. It has seemed to me that the purchasing

of waste lands in Pennsylvania should be through one Department, and that through your Department.

There are so many things that we are interested in. You people are making Pennsylvania, and our county of Potter has more State forest lands at the present time than any other. My district has its full share of acreage, which we are glad to have. But where we have these lands where growth is coming in so nicely we want to make them attractive. In doing that you have got to be able to get around in those forests. We want Pennsylvania to be so attractive that our people will realize that they cannot see more in the Adirondacks or in any other State outside of good old Pennsylvania.

There are sections in Pennsylvania where you have forest lands which should be renewed by the planting of forest tree seedlings. Probably I am converted to that position by the fact that I have seen those trees that have been planted. I have watched them grow. On a great many tracts of land you are getting a growth of hardwood, and it is a protection. You are getting a forest as well as protection to our waters and streams and attractiveness. But in other sections to some extent we should renew the planting by the Commonwealth. Why should we as a State say to the individual and the corporation, you are planting eleven or twelve million trees a year and on our part not doing anything at all? I at least think that the State of Pennsylvania should do enough planting to let the individual and the corporation and others understand that we as a State, and the Forestry Department, do believe in reforestation to the extent of doing some planting where it is needed. And you foresters who are familiar with your sections know where those sections are.

But, Mr. Chairman, I didn't come down here with any particular thought in mind, except one, and that is that where you have these beautiful lands and the valleys, the streams and the roads that go with them, that we ought to be able, and the people of our State and other States should be able, to get where these growths are. And I would like to see your Department have enough money so you could make these roads wherever you have any large quantities of forest lands so that people can get to them with cars, that they should be accessible at all times of the year.

And I only want to pledge, gentlemen of the Commission and others, my support to anything that is in the interest of the Forestry Department. I do think that today your Department is in a wonderfully fortunate position because I think that over the State of Pennsylvania today the people are educated to the fact that the Forestry Department is worth while and they are going to support it. You are going to have other means of

support that is coming in anyway, and you must have a program, as I say, so that you can acquire a reasonable acreage of waste lands year and then make the most of them.

And to these forestry boys here, and to you, I can say that from what little that I have been able to see, Pennsylvania has opportunities, as far as forests are concerned, that are not exceeded any place throughout the world.

If I can be of help any time, call upon me. (Applause)

ADDRESS

By Hon. Harvey G. Bowers

*Member, Pennsylvania State Senate
Punxsutawney, Pa.*

I AM glad that I took the time and the opportunity to drop in at this conference, and further acquaint myself, through listening to your papers and talks, with the steady progress being made by the State in this important problem of forest conservation. You are not satisfied with the fine progress that you have already made, but you are constantly looking ahead and planning for the future. That is the secret of success in any venture. I am very glad, indeed, to be here with you.

I am mightily interested in forestry. I was born and raised in the woods. As a matter of fact, I followed the lumber business and destroyed a good many trees in my time—perhaps I made more stumps than I should have. Today, we have greater opportunities than ever, for helpful assistance from you foresters as to the proper and accepted methods of handling our forests. I am glad that this is so, for I know that it promises a better future for them. Old methods have been discarded for new ones, and that, as we know now, is absolutely necessary. You are to be congratulated.

The grand forests that were formerly found on every hand in Pennsylvania, have been greatly reduced. Timber of all kinds was, of course, necessary. It was put there to be of service to us, to satisfy our wants and meet our legitimate needs. Our mistake, it seems, was that we did not cut our forests in a legitimate way and, more than that, care for them afterwards, to protect and assist the second growth. After lumbering followed fires, repeated fires that destroyed everything. As a result we have vast areas of old waste land that ought to be taken up by the State and reforested.

I can speak from experience, for I have worked somewhat myself along these lines. The Punxsutawney Hunting Club bought 4,700 acres from Charlie Steele of Sunbury, and there were

a lot of barren places on it and we started to replant them, and a fire broke out four years ago and burned over about 3,000 acres and destroyed these young seedlings we had planted. Many trees, oaks and maples a foot through on the stump, were also damaged and destroyed. This fire came from an unknown cause, but no matter what the cause, the result is just as serious. Today, there is some new growth coming along, and we are very anxious to protect it. We know that the State is doing everything possible to prevent forest fires, and to put them out, but that does not excuse the private owner from doing his share, and all he can do to stop fires on his own land. I have fought fire a good many times myself, and stayed out all night and many a time it has broken over and we had to fight it again. Fire is the most serious enemy of the forest that we have to contend with. It is a very creditable thing that this great Commonwealth of ours, through your Department and you men, take such great precautions to control fire in the woods. You have fire fighting equipment and forest fire wardens all over the State, and I know this, that they gladly and immediately respond to every call.

Then there is the need for roads, good roads that reach into the forest and make it accessible for the fire fighters and for those who wish to enjoy our forests, I am glad that the State is beginning to give more attention to this very matter of roads, on a scale that justifies the use of our forests. These forests mean more than we realize to our people. And that will be more true as time goes on. I am a lover of the forests. I think all of us here are, and I think that more than we may realize, most of the men, women and children who compose our great Commonwealth are really lovers of the forest. Going back into the deep woods of a forest, and hearing the trees singing beautiful songs through their branches, the lure of the woods is very inspiring. We need good roads, and more of them, to protect our forests, to open up their beauties for the enjoyment of our people, as well as in the business of growing trees, from the planting of the seedlings to the days of logging operations.

I believe in tree planting, and I think it behooves each one of us to help to boost the reforestation of the waste lands in Pennsylvania. It pays. You can go out and buy a lot of waste land selling around from a dollar-and-a-half to three dollars an acre. You can reforest in the next 50 years, land that cost two-and-a-half an acre at the present time, and in the next 35 to 50 years there will be a ten per cent investment, provided you can keep fires out.

I sincerely hope that you keep up the good interest which the people of this Commonwealth have at the present time in trying

to preserve and take care of our forests. In the meantime you always want to speak to your neighbor and fellow sportsman as you go around through the forest, relative to protecting the forests from fire.

I want to thank you that I have met you here, and to reassure you that in anything I can do to promote the preservation of our forests in Pennsylvania, I am at your service. Thank you. (Applause)

ADDRESS

By Hon. C. J. Goodnough

*Member, Pennsylvania House of Representatives
Emporium, Pa.*

LIKE some men of old, I came here not to talk but to listen, and I always find it profitable to listen in on the discussions of a body of men such as have gathered here today for the discussion of the problems incident to their profession.

To my mind, forestry service is one of the greatest institutions of the Commonwealth of Pennsylvania. We are apt to think of this Department as engaged solely in the growing of trees, which at some time may be converted into lumber for building purposes and supply wood for many uses. To my mind, forestry is a much bigger and broaded business, for the general welfare of the Commonwealth depends, in a large measure, upon its forests. Well-cared for forests are of great value to agriculture and have a favorable influence on the flow of water in the streams. If we restore and maintain forests on our hillsides, we will avoid the damage that comes from floods and extremely low water. Therefore, I say that the work in which you men are engaged is very important, and it is a great pleasure to me to come here and spend a few minutes with you to ascertain as far as I can what you are doing and how you are doing it.

If I recall correctly, at the last session of the Legislature an appropriation of \$500,000 was made for the purchase of additional lands. This appropriation had my hearty approval, and I am glad that there now appears in the general appropriation bill an item, which of course is subject to amendment, of one million dollars for the purchase of additional land. It is important that additions be made to the State forests as rapidly as possible, but it is perhaps of greater importance to protect those forests from the great danger that comes from fire, and I am glad that the forest protection work of the State is achieving such commendable results, and it is a pleasure to know that the money appropriated to this Department is used so well and spent in a large measure for the protection of the forests.

The paper on "State Forest Roads and Trails" to which I have just listened is just along the line in which I think our forests need development. These roads and trails will be a great help in forest protection. How true it is that the best time to control a fire is right after it has started; then it is a comparatively small matter to extinguish it, but in a few hours it may gain such headway as to be practically impossible of control. Unless we can have these roads and trails, we cannot come immediately upon the scene of the fire, and there is so much precious time lost.

Permit me to thank you sincerely for the privilege of saying these few words to you and particularly for the privilege of listening to the practical and worth while things that I have heard here about this important work.

REMARKS

By Hon. North Shellenberger

*Member, Pennsylvania House of Representatives
McAllisterville, Pa.*

I REALLY am not very familiar with forestry work, but did especially try to get on this Committee. I am interested in it. Juniata County is bounded on the north by Shade Mountain and on the south by the Tuscarora Mountains, about 60 miles long and perhaps 8 miles wide—a real forest region that means much to our people. There is considerable State Forest land, too.

I wanted to appear yesterday, but had some appointments and couldn't get around and the same was true this forenoon. I want to say as a member of the House that anything I can do to advance forestry will give me great pleasure and am very glad to have had the honor to say just these few words. I thank you very much. (Applause)

ADDRESS

By Dr. Ralph D. Hetzel

President, Pennsylvania State College

MR. CHAIRMAN, Ladies and Gentlemen: I had thought to make my contribution this morning merely by silent and humble testimony of interest by my presence here. I am sure I need not say to you that I know that I am totally unworthy of the introduction your generous Chairman has given me. I can explain it only in this way, that I think no one on earth more needs education than an educator. And so a wise educator seeks always to find those who are capable of contributing to his proper education.

As I came on into this great Commonwealth two years ago from a very much smaller state, I felt greatly in need of finding

those who might lead me somewhat into the light. And I selected as one of my guides the Honorable Secretary of this great Department. He has insisted that my education will not be complete except that I should sit in here with this group to make appraisal of the great and constructive service that is being done. And he has understood, I know, that I have accepted in large measure because I felt that it afforded me opportunity to testify to my deep appreciation of the splendid service which is being rendered by those who have chosen to make forestry their profession, and chosen to make forestry their profession in the spirit in which Mr. Wirt described it, and there is nothing more glorious than that type of spirit of devotion; and also, if I could, to some of those splendid generous souls who have been devoted for many, many years to forestry, and who have given of their wisdom and their counsel out of no consideration except that they deemed it a large and valuable contribution to the general welfare.

I find here a very congenial group. I find this atmosphere a congenial one. When I get a sniff of the woods or of newly cut lumber, then I presume I am emotionally more stirred than at any other time in my life, because I am a product of one of those lumbering towns, not of Pennsylvania but of Wisconsin. I recall days of glorious adventure, rough days, rugged days, days when I lived in an atmosphere of magnificent virility, a time when we were engaged in that process of wasting, that denuding, that profligacy which was criminal but which we thought only natural and proper. I recall a lumbering town, the buildings, what there were, all of lumber of course, raw looking—most of them without paint; the sidewalks, where there were sidewalks, were all of planking; the store fronts were projected upward to delude us into believing that we had something more than one story establishments—great bald things whose countenances reminded you of a contemporary highbrow. The sidewalks and the floors of these buildings were all chewed up from the calks of the river hogs and the lumber jacks. In a community in which every other building was a saloon, and if it proved inconvenient to go next door you could be accommodated in the building in between without any trouble. (Laughter.) A time when bawdy houses and their occupants were accepted as possibly evil—although I am not sure that they were considered evil—but if evil, a perfectly necessary evil. When the rivers were full all the time of great logs.

And so I had a most wonderful apprenticeship in the days of that great adventure. And I recall, too, that I paid a little for it. I can remember days in the summer when the thermometer

registered 90 outside of a freight car and 120 inside, and I was just a youngster, and outside was one of these Norwegian lumbermen who had shot boards for years and years, and I was trying to keep from being buried by the stream that came on and on and looked not like a series of boards but like a perfect ribbon, uninterrupted by any break. In fact they came sometimes in such manner that it seemed to me that the ribbon had buckled back. And then I spent some time in the lumber woods; I learned how to pull a cross-cut saw. I have seen that great process of waste go forward, and I have seen the regret that has followed upon it, and I have sensed the petitions for help, such as the Governor called attention to this morning when a delegation from Minnesota came back here to Pennsylvania to ask in what manner they might heal their wounds.

Then I went from Wisconsin out into the real Northwest. The Governor referred to Minnesota, Michigan and Wisconsin—that isn't the real Northwest—but out in Oregon and Washington. And there again I got into this atmosphere of a harvest, a cropping, where the only thought of scientific forestry, perfected forestry, was that of efficient forest engineering, except this, that out there I sensed for the first time the positive and constructive ministry of our great National Government, running somewhat parallel with this process of deforestation and waste. And it was rather an odd thing to see them coming together. This new ministry didn't find a very congenial atmosphere, but within a few years it became evident that the process was making an impression, even on those whose greatest interest was to cut with no thought of the future.

Then I had the interesting experience of going back, into New Hampshire, where we found timber lands, forests, cut over even before, I presume, the forests of Pennsylvania. I found them there struggling with this question of what they were going to do with these lands. And I had the satisfaction of offering the suggestion to them some ten years ago that I thought they would be entirely justified in many sections of the State in having either the town or the county or possibly the state make large purchases of this land, much of it which was still being made the homes of settlers who were trying to live on what they called farms, farms which couldn't possibly give any considerable measure of support to a family but which required that the community should maintain roads and schools—that these sections should be purchased and these roads and schools closed, the land reforested in a very much larger measure than ever before, and that the settlers should be taken to those sections where land

gave greater agricultural promise. And I find now that New England is acting on that proposal.

It is for these reasons that I am interested in this meeting. And also, and I presume this is the more significant, because I happen to be charged with a measure of responsibility for the administration of one of the State's great public institutions, the State College, and I find here in Pennsylvania that its true character hasn't always been understood, that that type of institution had its birth in the West, and so here we haven't actually sensed it in true character. So I am anxious to take this occasion to testify to you that this institution of higher learning, a public institution, finds its true function in service, in public service. It is an institution designed to do public service through educational processes. And so it is a part of this service which you render, entirely sympathetic, exceedingly anxious that it shall give what it has to contribute in the way of educational processes, in the way of scientific research, without the desire of wasteful duplication but with the desire of rendering true and generous service to the great cause of forestry, as well as to all of the various functions of the State which finally contribute to the well being and happiness and prosperity of our people. It is to that thing that our institution is pledged, above everything else. Its objectives, its purposes, its procedures are those that are defined by the State need and the well being of our people. I come to offer that to you knowing that we have as much to learn from you men who are rendering service in the field, as we have to contribute and possibly more. I hope you will accept my sincere petition that we may be one of you in spirit and in fact. That is my compliment to you gentlemen.

Thank you. (Applause)

REMARKS

By Russell Edwards

American Tree Association, Washington, D. C.

IT IS like a burst of sunshine to come in contact with members of a legislative body who seem to have some regard for the dear old public back home. You know down in Washington we sometimes think that the guardians of the public welfare down there come a long way from their well known constituents and sort of lose sight of them. And when forestry appropriations come up down there it is rather hard to get the law makers to pay any attention to them because of their distance from their public. Public opinion is the most powerful agent, if it can be applied to forestry, that forestry has. The function of the American Tree

Association is to turn the thought of the American people to forestry and trees. Now I am going to take just about three minutes to talk about forestry. My job is to keep the word "forestry" and the word "tree" in the newspapers and the magazines of the United States, and make people think about them. Consequently, I want to give one or two illustrations of the power of public opinion and show how valuable it is to you men who are in the field if you can talk forestry as well as work at it.

As one example of the power of public opinion and turning public thought, I will recite a personal experience. Every afternoon at five o'clock I call up my wife and tell her I am coming home, so she can put on the pork and beans. Once, perhaps twice a year, she will say, "Stop and bring home some soap, I forgot it." I will stop at the corner grocery store and thinking about what I going to do tomorrow, and without any mental stress, I will say to the groceryman, "Give me two bars of Ivory soap." Procter & Gable have spent millions on billboards and magazines and newspapers of the United States just to make me say "Ivory" when the time comes. That is publicity, working on public opinion, selling a man an idea, making him think about it.

Public opinion does strange things. It gave women the vote, put vestibules on the front and back of street cars, makes the doors of public buildings swing outward, following that terrible school fire in Cleveland. It has almost brought prohibition, and I presume it is going to do a lot of other strange things.

So I merely want to get over this one idea to the forester in the field. Your State Forester touched upon it when he talked about the educational value of selling this idea to the public, the fellow who sooner or later has got to pay the freight. But I want to impress on you that you have taken a remarkable step forward when you give a little time to talking forestry to this group of women or that school or this Rotary Club, and still further spread the message of the trees.

REMARKS

By Prof. John A. Ferguson

*Head, Department of Forestry, Pennsylvania State College,
State College, Pa.*

I ATTEND a great many meetings on forestry, but none just like this one. I have attended meetings of forestry educators and forestry administrators, but I believe that this is the first time that I have ever attended a meeting of what somebody has called "dirt foresters," that is, a meeting of men who are actually handling forests.

Some of you have been in the State forests to my knowledge for more than twenty years and it is a great pleasure to me to listen to your papers, to hear the discussions, because after twenty years' experience in handling forests a man should be able to speak with authority on the subject. It must be an interesting thing to you young men to be associated with a Forestry Department that is considered the best in any State of the Union, and to be associated with a State that has a real forestry policy.

It is a great privilege to be here today and to enjoy the program. (Applause)

ADDRESS

By Prof. Nelson Courtland Brown

Syracuse University

I HAD come here to look and listen and learn and not to talk, and just this morning Mr. Illick very kindly suggested that I might tell you something of the things we are trying to do in New York.

Before I do, I would like very much to congratulate you, particularly Mr. Dorworth, Mr. Illick and the administration, on the splendid progress that you have made and are making in this great State of Pennsylvania. I am not trying to flatter you nor to feed your vanity when I say that foresters generally look upon Pennsylvania—and I say this as a neighbor to the North—as probably having the most effective state organization and putting into effect the best all around forestry program of any state in the nation. And I say that as a loyal son of the Empire State.

As you know, we have about 2,000,000 acres of forest preserve in New York, but it is all locked up. You can't go in and even cut a stick of timber. You can't build any of these roads and trails we have been hearing about, because the law states that it shall remain as wild forest land forever.

We have just come in from dinner and I am reminded of a little story of the great wide open spaces where men are men and women are sometimes governors.

A wild-eyed man with disheveled hair rushed into the sheriff's office in the country court house with a smoking revolver in his hand, which he laid on the desk. The sheriff took his feet down from the top of the table and said, "Well, what is the big idea?"

"Why," this fellow said, "I just shot a man."

"Did you? Who did you shoot?"

"Why," he said, "I shot an after dinner speaker."

"Oh," said the sheriff, "That is all right, but you are in the wrong office. They pay the bounties down in the Treasurer's Office at the end of the hall." (Laughter)

So I come here with more or less fear and trepidation, because you men know such a great deal more about this forest business than I do. I have listened with great pleasure to your Governor and the many other distinguished officials of your State, on the progress you are making. And I want to congratulate you sincerely on the really magnificent progress that Pennsylvania has made and is making.

If you are interested, I would like to take a few moments of your time to tell you of some of the things we are trying to do in your neighbor State to the North.

Two years ago this month, Senator Hewitt, Chairman of the Finance Committee of the State Senate, introduced a resolution to bond the State for \$100,000,000 for twenty years, to spend \$5,000,000 a year during that time for the purchase and planting of abandoned farm land. As you know, that is a lot of money, and there was more or less comment upon it in the papers. The next year Senator Hewitt introduced it in the Senate again, and he told me a little later, "I wanted to see what the reaction would be, what people would say about it, and I had no dreams myself even that it was going through." They held a hearing on it, and there were about 250 people, representing every possible interest in the great out of doors, including the Izaak Walton League, State Forest, Fish and Game Leagues, Women's Clubs, the Association for the Protection of the Adirondacks and many others. Every interested organization in the State was invited to come in and have their say. There wasn't a voice raised against it. It had an excellent chance of going through, but they did decide to appoint a State Reforestation Commission, as it is known, to investigate the whole problem and to report back this year and advise the Legislature as to what to do.

Let me rehearse to you briefly the three fundamental reasons why this idea of planting up the idle lands of New York State has been brought forth in this form.

In the first place, there has been considerable sentiment in favor of reforestation in New York, as you know, just as in Pennsylvania and throughout the eastern part of the country. Mr. J. S. Whipple, Commissioner of Forestry in 1900, was a great crusader for the cause. He talked to the legislature and to everybody who would listen to him, and told them of the needs of reforestation. And since that time we have expanded our nurseries and have something like 107,000,000 trees in three large State nurseries, with an annual capacity of 30,000,000 trees. Last year we planted 25,000,000 trees and private corporations from their own nurseries planted about 4,000,000 in addition. So that

sentiment has been gradually increasing and supporting the reforestation movement.

The second fundamental reason, as I see it, is that two years ago a State Industrial Survey Commission was appointed by the Legislature to inquire into the reasons why New York had lost so many industries. As you know, the textile industries of New England have disappeared, and in New York we have lost a great many industries, including textile, steel and many lumber and pulp and paper industries that have gone to Canada and other states. It was worthy of note that this Industrial Survey Commission, which had nothing to do with forestry, should come to the conclusion that one of the finest ways to rehabilitate the industries was to plant a lot of trees so they would bring back the lumber and the pulp and paper and wood-working and many other industries associated with the forest.

In 1850 we were the leading lumber producing State in the Union, turning out about 20 per cent of the total lumber supply of the country. I believe Pennsylvania was the leader in 1860, and then the leadership went out to Michigan. The pulp and paper industry was a very important one in New York from ten to thirty years ago, but we have been losing ground. But I cite that as an important contribution to the sentiment in favor of planting trees.

The third reason is our idle land problem. I won't go into that exhaustively, but briefly we have been abandoning farm land in New York State since 1880, at the rate of 100,000 acres a year up to 1920, and from then to the present, at the rate of 161,000 acres per annum. If that goes on you can easily see that it is going to become a very serious liability in our county administration. Idle lands will constitute a liability instead of an asset.

The agricultural economists tell us that the peak of this rate of abandonment has not been reached.

The first job our Commission decided to do was to make a survey of that reputed 4,000,000 acres of land to find out how many acres we could buy in blocks of 500 acres or more, and at a price of ten dollars or less per acre.

That was a very rough survey and it was a difficult thing to do, but we found that there are at least a million acres in New York State that can be purchased at ten dollars or less per acre in units of 500 acres or more. And on the basis of that survey, completed this fall, our Commission has held a good many hearings and sessions and we have decided to recommend two bills to the Legislature. One is to actually start a plan of State purchase of these lands and the planting of them. We are also recommending an

increase in the number of nurseries. We have four now, and this year our Commission made it possible for the Conservation Department to have a fifth. So within four or five years, or as soon as those two additional nurseries can be put into producing capacity, we will have an annual output of probably fifty to sixty million trees. Our Commission feels that eventually it is within the realm of possibility that we may have an annual output from our nurseries of 150 to 200 million trees a year. If you say that is a lot of trees, it is, but at that rate it will take us 20 to 30 years to plant up the idle and cut-over lands that ought to be planted in the State. At the present rate of planting it is going to take us 200 years to plant up the idle lands in New York. So we feel it is something to get busy about.

The second piece of legislation that we are recommending this year is to aid the counties in a system of county forests. It seems to be a brand new idea in this country, although an old one abroad. Sixty-seven per cent of all the forests in Switzerland are communal forests and they are a pretty well forested nation, as you probably know.

Ten counties of New York State have already made appropriations for planting forests. We have two county foresters in New York and Erie County has appropriated \$50,000 for a period of three years, Otsego \$30,000 for period of three years and so on.

As the result of that initial movement in that direction we have decided to build up a system of county forests. So we will introduce in a week or two a resolution appropriating \$5,000 from the State Treasury to any county which will match it with a like amount, up to \$5,000 for the purchase of any land and the planting thereof. There are about 60 counties in New York State that may take advantage of this law, so it means the institution of a progressive form of county forests. The title to the land is to remain in the county and the timber is to belong in the county. The State will have no strings to it except that the plan of purchase, planting and of subsequent management, must meet the approval of the officials of the Conservation Department at Albany. In other words we are not disposed to hand out State money to a county and then perhaps not have them spend it efficiently, or manage the forests according to accepted forestry principles.

Incidentally, we are working on two additional laws, to make it mandatory upon succeeding legislatures to continue to appropriate money for the State purchase and planting of these lands. Our Commission feels that New York, bonded as it is already for around four or five hundred million dollars, is pretty well loaded with this form of indebtedness. And we feel the State is well

enough off financially to take care of this expenditure out of current revenues. So it is our plan to meet those expenditures out of the annual appropriation, but this mandatory legislation will require future legislatures to continue this policy.

The other proposed law is to open up the constitutional prohibition regarding the Catskills and the Adirondacks. We have got some of the important people previously bitterly opposed to doing anything of that sort, to tentatively agree. The idea is to permit the planting and cutting of lands outside of the Adirondack and Catskill Parks, but within the sixteen Forest Preserve counties as established by the Constitution.

So I think we are making progress and I think in the right direction.

I have come down here to learn something of what you people are doing and have done, and I hope to take back, after conferences with Mr. Illick and others, some very helpful thoughts to New York. (Applause) I have enjoyed very much being here with you and want to thank Mr. Illick for his many courtesies and to congratulate you all on the splendid work you are doing.

REMARKS

By Hon. Lex Mitchell

Title Attorney, Pennsylvania Department of Forests and Waters

THERE is a part of the work in connection with the Forestry Department with which many of you are probably not acquainted. I refer to the abstracting of titles for forest lands. These lands were originally purchased for the purpose of taking off the timber. Little attention was given to titles; deeds were not recorded, and throughout these titles were more irregularities, more apparent defects and matters which if not given the most careful attention, would have foisted upon the Commonwealth a lot of bad titles.

We have had any number of difficulties in straightening out the abstracts. But when they came in finally they were approved by the abstractor in the field, reviewed and approved by the Title Attorney of the Department, also by the Attorney General's office, and the titles to them are absolutely good when taken over by the Commonwealth.

The great good you men and women are doing is beyond my expression. When you come in contact with somebody like Dr. Illick who is talking forestry, thinking forestry, continually doing forestry things, and who has done, I think, as much for the advancement of the conservation of forestry in Pennsylvania as any other in Pennsylvania today, you can't help but get that feeling.

There is one man that has done a great deal for the Forestry Department, and that is Mr. Irvin Gleason. He didn't make a long speech—not nearly as long as I am making—but I want to tell you he can buy forest land. He can go out and get it, and when he starts on the proposed program I haven't any doubt that there will be no trouble about purchasing all the lands for which money will be available.

I wish to thank the district foresters who are here today for the help they have rendered me. They know the facts; they can find things that I could not find, and that the title abstractor can't find. You will likely be called upon during the next two years a great deal more than you have in the past, because you know the land and know where to go to find information. You can be of great assistance to the abstractors in your particular country, by assisting them in getting the information they must get outside the records, because there is a lot of information we must have outside the records to straighten out these titles. (Applause)

REMARKS

By Charles R. Meek

*Chief, Bureau of Forest Extension,
Pennsylvania Department of Forests and Waters*

I AM glad to have this opportunity of expressing to the District Foresters and other members of the Department of Forests and Waters my appreciation for their very helpful cooperation in my work.

We have heard today something about the planting of forest trees and as there is another paper to come I must be careful and not encroach upon the paper that will be offered this afternoon.

As to the State Forest planting, I might state that from 1909 to 1919, considerable planting was done on the State Forests. For good reasons little planting was done between 1920 and 1927, on account of the War and the fact that most of the accessible State-owned lands had been planted up, besides the increased demand for tree planting stock for private individuals. During the last year, however, State forest planting has increased considerably and nearly a million trees were planted, and it is expected that over a million will be planted this year. Owing to the improvement of the road system more inaccessible areas are being opened up and further planting on fields made possible by the new land purchases.

In order that there might be a check-up on the reforestation work being done in Pennsylvania, nearly 1,000 private forest tree

plantations were examined and reported upon, and a reforestation committee was appointed to study the reforestation problem. The results of these studies I am sure are going to help materially in increasing the percentages of success secured by private forest tree planters.

REMARKS

By John W. Keller

Forester, Pennsylvania Department of Highways

I AM glad that I dropped in here just when Mr. Elliott was reading his paper on A Practical Reforestation Program. It is a subject that has always been dear to my heart, and since I have left the Department of Forests and Waters I haven't lost interest in it. I lost a little sleep in the last few years worrying over those points, and I suppose maybe some of the rest of you did.

I was particularly interested in the Committee that was appointed to look into the size of planting stock. If I had to name one thing that is more important than all the others put together in making a successful plantation, I would say it is the size of the planting stock. If that question is settled I believe it is going to do a whole lot towards solving the problem.

The stimulus that was given to reforestation by Dr. Illick in trying to find out a little more about why we are doing these things, than just the fact that we are doing them, is an excellent idea. We ought to plant for results, and when he made a study and found we were not getting results, then what is the answer to it? And if Mr. Illick doesn't do anything else in his whole administration more than solve that question, he will be doing a wonderful thing for advancing forestry in Pennsylvania.

I always have thought and still believe that reforestation will ever be a factor in Pennsylvania, and the people throughout the State are looking to you fellows for the answer. If they can't get it from you fellows where are they going to go for it? So from an outside standpoint I am delighted to think that you are going after it and trying to find the reasons for success or the reasons for failure. It isn't so much going out and finding all successes as it is going out and finding failures, but it is very important to find out what you are getting and then decide why those results have come about.

I am very glad to be with you this afternoon and I certainly hope I will have a chance to shake hands with you again. It makes me sort of homesick to get here and see your faces again. (Applause)

REMARKS

By S. T. Moore

*In Charge of Land Records,
Pennsylvania Department of Forests and Waters*

I JUST want to say a word to all of you here as to how pleased I am to again look into your faces. It doesn't seem so very long, and yet when you come to think back to 1900 when some of these boys first came up to my office and commenced to draft those wonderful drafts that they have made (laughter), I tell you it makes me feel a little old. But though I have passed my 73rd year, I feel as young as the rest of them, and I do like to get to these meetings. I think they are a wonderful help to the foresters as well as to us in the office. I am very glad indeed to meet you all.

I will tell you a little circumstance that happened years ago. We bought 176 acres of forest land in Mifflin County. I took the check of the Auditor General with me to pay for that land, and I handed it to the owner. He said, "What is that?" I replied, "That is your check for the land."

"Huh! I don't want that; I want the money. I want the solid cash. I ain't going to take no paper."

For a moment I didn't know what to do. I was ready to close the deal. The deed was ready to be executed, and he wouldn't take this check. So I went into the office to see my old friend George Russell, and said: "Look here, George, I am in trouble. I bought a piece of land out here for the State, only 176 acres, and that man refused to take the Auditor General's check, and I don't want to go back to Harrisburg to get it fixed up. What can I do?"

"Why, he said, 'I will give you the amount.'"

Then I said, "If you do I want it in silver dollars."

"All right" was Mr. Russell's reply.

Well, I had my little old buggy and horse—that is the way we traveled in those days, we didn't have automobiles then—and I got that amount of money. I went out and saw the fellow and said, "Here, I have your money. Come up to the squire's and we will execute that deed." So we went up and executed the deed and I went out and got this bag of money. "There's your money," I said, "I want the deed."

He looked at it. "My God," he said, "what am I going to do with all that stuff?"

"Well," I said, "that is up to you; that is what you wanted, that is what you've got and I want the deed."

So he signed the deed, his wife signed also, and I took it and stuck it in my pocket.

"Now what am I going to do with this money?" he said.

"To hell with you and your money," I said, "I don't give a damn what you do with it." (Laughter and applause)

REMARKS

By E. F. Brouse

*District Forester, Valley Forge District
Norristown, Pa.*

I HAVE prepared a short statement outlining the Department's obligations to private tree planters. Figures show that private individuals and corporations in Pennsylvania spend annually more than \$200,000 for forest tree planting. The cost of the trees, the planting and the interest in the investment, brings the total to the above sum. This is in excess of the amount made available to any other Bureau of the Department. We should be charged with the proper spending of this money just as surely as if it were appropriated to different districts. In reality it is an indirect allotment for the furtherance of work which if properly handled will be of mutual benefit to the planter and the Department. The importance of the Department help can be further stressed by the fact that in order for the private planters to break even on their investment it is necessary that 42 per cent of the planters produce in 50 years 35,000 board feet of lumber on every acre, which will sell for seventy-five dollars a thousand, excluding the cost of manufacture. It is unlikely that 42 per cent of the plantations will be so successful. Consequently, to produce an equal amount of lumber the number must increase if the private planter is to break even.

To break even today is not enough, but rather we must make him a profit, and besides show a margin of safety. When this is done the corporation and the business man will plant increasing numbers of trees. After all these are the ones that represent industry, and the ones who will plant trees when we come in and in an unqualified way show that it will pay. Successful plantations will return a profit. Consequently we must ever work toward the goal of a higher percentage of successful plantations.

According to the figures just used, if 75 per cent of the plantations were successful in that they produced 35,000 board feet per acre in 50 years, a good profit would be produced. This and more is attainable, but it will require constant supervision and it is worth it.

The Department is charged with the promotion of forestry in Pennsylvania. Tree planting is one phase of it. No matter whether planting stock is available free of charge, at cost, or

whether sold at commercial nursery prices, our obligation for the establishment of successful plantations does not change. We should guide the tree planter in such a fashion as to insure the success of the planted trees. It is largely within our power to do it. We owe it to the private tree planter in view of his large expenditure to put forth our best effort by furnishing first class planting stock of the kind best adapted to reforestation in Pennsylvania, by inspecting the area and offering our suggestions, based on practical tree planting methods supplemented by the proper follow-up work. (Applause)

REMARKS

By LeRoy Frontz

*Assistant, Bureau of Management
Pennsylvania Department of Forests and Waters*

AT THE request of the Chairman I will give a brief description of the exhibit which the Department had at the State Farm Products Show during the past month.

It has been our experience that most of the farmers inquire as to the best methods of handling their woodlots, not only with regard to planting but of improving existing stands.

With this in mind, an exhibit was planned which portrayed the proper handling of woodlots, planting and thinning operations. Seedlings were exhibited, showing the sizes and kinds furnished by the Department. Trees five to ten years of age were on display. A stacked cord of wood showed what each acre of a well managed forest in the State of Pennsylvania can produce, and in contrast to this was a stacked quarter-cord, which is the amount the average acre of forest land is producing in Pennsylvania at the present time.

Three panels depicting Penn's Woods in three epochs were shown, first, original stands of white pine and hemlock; second, extensive and destructive cutting and fire; third, processes of restoration. Two large maps showed the forest areas of the State, the State Forests, forest districts, District Forester headquarters and fire observation towers. A miniature fire observation tower and cabin, together with forest fire fighting tools, were also displayed.

It has been our practice in working up these exhibits to try and visualize the answers to questions most frequently asked by those who visit our exhibits, and to this end we feel that our recent exhibit was more successful than ever.

REMARKS

By W. A. August

*Assistant, Bureau of Management,
Pennsylvania Department of Forests and Waters*

DURING 1928, the Department inaugurated a definite permanent camp site program. In order that this program might move forward, there are, in my opinion, three things that need particular attention.

First. On the 2,000 camp sites now under lease, there are a great many buildings that do not present a creditable appearance. In order to correct this condition in the future, all applications for camp sites should be accompanied by a sketch of the proposed building plans.

Second. Inspections have revealed that many camps have been so located in the past that they offer a hindrance to proper forest management, particularly in reference to forest road improvement. This situation might be avoided if all building locations were to be designated by the forester.

Third. Our rules require that camp site code numbers be placed on all buildings, but inspections show that this is not always done and there is also a widely diversified system of numbering in use. I believe that the numbers should be uniform for all districts and that they should be provided and placed on the buildings by this Department. (Applause)

REMARKS

By L. L. Bishop

*Forest Supervisor, Allegheny National Forest
Warren, Pa.*

I AM very happy indeed to have the opportunity of bearing the greetings of the United States Forest Service, and for the opportunity of expressing my appreciation of the admirably conceived, adequately financed, and very effectively interpreted State forestry policy and program of Pennsylvania. It is one of the happiest parts of my work that I have the chance to work shoulder to shoulder, see eye to eye, with this State organization. It is a stimulus that is very desirable. It certainly is beneficial to me personally and I am sure it is reflected throughout our entire organization. The paper of State Forester Illick could with but a very slight change in caption, be adopted as our Allegheny National Forest program.

I was particularly interested in the clear enunciation of the fundamentals which now govern and will govern Pennsylvania's

forestry program. I have been especially interested in your land purchase program. It is a fine thing to know what someone else is doing, what someone else is able to do. I have the highest admiration for the effectiveness of that portion of your program in particular, and your whole organization and its work in general. (Applause)

RESOLUTIONS

Resolution presented by Mr. Harbeson

"RESOLVED, That the District Foresters of the Department of Forests and Waters express our grateful appreciation to His Excellency, Governor John S. Fisher, who by his splendid cooperation is advancing the cause of forestry in Pennsylvania; and be it further

"RESOLVED, That we extend to him our sincere thanks for his inspiring address upon the occasion of this conference."

"It was regularly moved and seconded that the resolution be adopted, was put to a vote and carried.

Resolution presented by Mr. Mulford

"WHEREAS, In His infinite wisdom, Almighty God has seen fit to summon from this life into the Life Eternal, that public benefactor, philanthropist and true friend of forestry, Leonard Harrison of Wellsboro, Pennsylvania; and

"WHEREAS, By his kindness of nature and uprightness of character he had endeared himself to all with whom he came in contact, and had become an outstanding and conspicuous figure in the forestry movement of his native State, through his staunch support as well as by reason of his numerous acts of generosity, most notable of which was the donation to the Commonwealth of the Park afterwards named in his honor, from which thousands of people each year are enabled to enjoy a view unrivalled in the East in scenic grandeur; therefore be it

"RESOLVED, That this conference of Pennsylvania Foresters in meeting assembled, hereby give expression to their appreciation of the high ideals and lofty principles that were so well exemplified in the life and service of the late Leonard Harrison; and be it further

"RESOLVED, That a copy of this resolution be spread upon the record of this conference and that copies be also forwarded to his family."

The motion was seconded, put to vote and carried.

Resolution presented by Mr. Winter

"RESOLVED, That the District Foresters of the Department of Forests and Waters convey to the Legislature now in session our grateful thanks for the use of the Senate Caucus Room for the several sessions of this conference; and

"RESOLVED, That we express our thanks to the Senators and Representatives for their helpful participation in our program of activities, assuring them that they have rendered valuable assistance in advancing forestry in Pennsylvania."

Upon motion regularly made and seconded, it was voted that the resolution be adopted.

Resolution presented by Mr. Williams

"Mr. Chairman, on behalf of the foresters, I wish to make a motion, that by a standing vote we show our appreciation to the State Forest Commission and to Secretary Dorworth and to State Forester Illick and the personnel of the Harrisburg office for the cordial reception they have given us and the thoughtful consideration of our efforts in making this, the first conference we have had as a body since Secretary Dorworth has been in charge of the Department, quite a memorable one and very pleasant in all its relations."

The motion was seconded and carried by a rising vote.

APPENDIX

STATE FOREST LAND PURCHASES BY THE
COMMONWEALTH OF PENNSYLVANIA

(Biennium 1927-1929)

<i>County</i>	<i>Area (Acres)*</i>
Bedford	2,802
Cambria	15
Cameron	5,273
Centre	14,240
Clearfield	3,924
Clinton	31,040
Cumberland	362
Elk	14,277
Franklin	1,292
Fulton	3,022
Huntingdon	460
Jefferson	3,199
Lycoming	3,333
Mifflin	1,095
Perry	1,720
Potter	50,253
Snyder	2,429
Somerset	4,697
Tioga	3,898
Union	204
Total	147,535

*Acquired or in process of acquisition as of February 1, 1929, with \$500,000 appropriation made by the Legislature of 1927.

STATE FORESTS OF PENNSYLVANIA
(By counties and areas)

<i>County</i>	<i>Area (Acres)*</i>
Adams	20,887
Bedford	13,558
Cambria	15
Cameron	88,329
Carbon	436
Centre	93,628
Clearfield	68,993
Clinton	175,381
Cumberland	22,082
Dauphin	3,808
Elk	37,044
Franklin	36,172
Fulton	9,418
Huntingdon	62,891
Jefferson	8,880
Juniata	3,534
Lackawanna	5,275
Lycoming	108,063
Luzerne	11
Mifflin	51,935
Monroe	6,400
Perry	31,187
Pike	58,370
Potter	209,038
Snyder	22,749
Somerset	10,847
Tioga	70,967
Union	54,397
Westmoreland	5,113
Wyoming	1,177
Total	1,280,585

February 1, 1929

**STATE FOREST LAND PURCHASED BY
THE COMMONWEALTH OF PENNSYLVANIA**

<i>Year</i>	<i>Area (Acres)</i>	<i>Total Cost</i>	<i>Average cost per acre</i>
1898	0	0	0
1900	77,018	\$130,944.20	\$1.700
1901	44,146	71,817.57	1.627
1902	174,321	406,768.79	2.333
1903	87,947	234,081.33	2.662
1904	142,243	363,138.94	2.553
1905	86,625	177,252.75	2.046
1906	67,848	169,459.97	2.498
1907	50,803	119,831.51	2.359
1908	75,231	182,222.97	2.422
1909	88,301	194,866.48	2.207
1910	17,074	44,492.81	2.606
1911	32,408	67,377.74	2.079
1912	15,971	49,782.36	3.117
1913	11,726	44,647.20	3.808
1914	8,933	19,632.16	2.198
1915	3,639	8,296.81	2.280
1916	8,136	22,891.70	2.814
1917	5,593	11,191.69	2.001
1918	14,351	28,118.67	1.959
1919	16,459	41,909.54	2.546
1920	59,728	122,728.13	2.055
1921	17,537	31,824.84	1.815
1922	2,912	12,832.02	4.407
1923	0	0	0
1924	329	859.08	2.611
1925	100	200.84	2.008
1926	203	1,014.59	5.000
1927	0	0	0
Total ...	1,109,587*	\$2,558,184.69	\$2.306

*In addition to the 1,109,587 acres acquired through regular purchases, 14,288 acres and 154 perches were acquired at tax sales, 4,275 acres and 54 perches at Commissioners' sales, 970 acres and 97 perches as vacant land, 2,288 acres and 124 perches as gifts, and 1,698 acres and 147 perches through exchanges and resurveys.

**RECEIPTS OF PENNSYLVANIA STATE FORESTS
1900-1928**

<i>Year</i>	<i>Amount</i>
1900	\$1,227.87
1901	1,951.57
1902	1,578.70
1903	9,758.02
1904	1,373.94
1905	2,247.67
1906	5,001.24
1907	3,955.89
1908	2,473.76
1909	5,267.11
1910	9,176.09
1911	6,460.08
1912	12,585.67
1913	13,076.07
1914	15,066.64
1915	13,483.84
1916	21,459.97
1917	21,569.69
1918	24,410.24
1919	34,517.15
1920	50,633.80
1921	48,261.63
1922	45,311.57
1923	80,275.90
1924	88,199.56
1925	68,607.28
1926	50,943.44
1927	62,263.66
1928	61,780.10
Total	\$762,918.15*

*Of this amount \$467,258.54 have been deposited in the State School Fund.

**REDUCTION IN AVERAGE SIZE OF FOREST FIRES
IN PENNSYLVANIA**

Year	Average Size of Forest Fires (Acres)
1913	412
1914	305
1915	316
1916	141
1917	150
1918	140
1919	133
1920	160
1921	78
1922	91
1923	105
1924	48
1925	49
1926	77
1927	30
1928	45

**CAUSES OF FOREST FIRES IN PENNSYLVANIA
(Five Year Record)**

						Five-Year Average	
	1923	1924	1925	1926	1927	Num- ber	Per Cent
Transients	1,062	650	737	805	505	752	30.6
Railroads	1,257	541	656	891	259	721	29.4
Brush Burning	212	92	283	266	103	191	7.8
Incendiary	178	124	218	189	68	155	6.3
Lumbering	65	7	31	47	6	31	1.3
Lightning	22	8	62	22	6	24	1.0
Miscellaneous	245	209	230	265	131	216	8.8
Unknown	498	366	345	432	168	362	14.8
Total	3,539	1,997	2,562	2,917	1,246	2,452	100.0

**STATE AND PRIVATE FOREST TREE PLANTING
IN PENNSYLVANIA**

Year	Number of Trees Planted	
	On State Forests	On Private Lands*
1899	1,000	
1900	1,500	
1901		
1902	5,000	
1903	1,600	
1904	7,700	
1905	40,000	
1906	99,550	
1907	36,930	
1908	100,628	
1909	738,461	
1910	1,092,213	66,374
1911	1,663,661	25,360
1912	1,890,404	66,854
1913	3,164,637	47,770
1914	3,393,571	108,685
1915	4,315,436	115,577
1916	5,492,020	1,471,875
1917	3,595,720	1,812,997
1918	6,033,760	2,186,899
1919	2,132,547	3,139,531
1920	238,298	2,543,374
1921	177,960	3,041,710
1922	133,221	3,670,621
1923	551,462	5,437,817
1924	424,380	8,577,464
1925	362,100	8,604,091
1926	560,525	9,768,879
1927	559,635	13,926,018
1928	926,649	9,882,310
Total	37,740,568	74,494,206

*Trees supplied from State forest tree nurseries.

FOREST TREE PLANTING ON THE STATE FORESTS OF PENNSYLVANIA
(By Years, Kinds and Numbers)

Year	White Pine	Norway Spruce	Scotch Pine	Pitch Pine	Red Pine	European Larch	Banks Pine	Red Oak	White Ash	Miscellaneous	Total
1899										1,000	1,000
1900										1,500	1,500
1902	5,000									5,000	5,000
1903	1,600									1,600	1,600
1904	3,000									3,000	3,000
1905	25,000									12,000	40,000
1906	85,700									7,350	99,550
1907	25,000									6,930	36,930
1908	70,800	11,900								9,942	100,628
1909	588,375	5,725	74,404			7,525				34,735	738,461
1910	777,289	12,000	70,925			8,852				112,661	1,092,213
1911	1,407,304	1,600	77,076	21,500		600	4,891			47,606	1,663,661
1912	1,335,247	120,499	152,900			13,025	199,136			50,696	1,890,404
1913	2,536,595	375,841	92,050			9,900				56,830	3,164,637
1914	2,494,252	169,969	133,154			22,650				171,501	3,333,571
1915	2,173,235	1,342,975	18,775			165,925				59,326	4,315,436
1916	3,343,400	744,570	714,950	9,600		68,640				94,610	5,492,020
1917	1,599,760	515,933	833,600	442,900		120,075				23,500	3,595,720
1918	2,935,250	1,269,460	803,475	473,640	387	287,000				8,950	6,033,760
1919	1,262,365	345,100	600	143,400	17,950	8,400				5,782	2,132,547
1920	196,770	8,580		3,850	175					3,469	238,298
1921	132,150	4,500		15,800	1,500					24,010	177,960
1922	54,655	6,561	63,225							8,780	133,221
1923	136,350	78,250	145,000	123,950						66,912	551,462
1924	88,530	52,250	21,520	32,700						89,640	424,380
1925	60,200	56,200	40,500	65,700	59,100	17,640				37,000	362,100
1926	79,600	35,975	233,850	39,500	68,500	31,500				14,000	560,525
1927	100,100	19,350	34,500	159,100	178,560	47,900				5,000	559,635
1928	152,426	60,450	233,516	20,175	240,476	3,200				211,406	926,649
Total	21,669,953	5,237,679	3,743,020	2,099,481	1,751,423	817,032	440,854	412,052	398,233	1,169,836	37,740,568

END OF NUMBER