MAGNOLIA IN SPRING

TREES AS GOOD CITIZENS

BY

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"MEMORIAL TREES," "THE FOREST POETIC," ETC. ETC.

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DEDICATED TO EVERY MAN, WOMAN AND CHILD WHO PLANTS A TREE

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CHAPTER I.

TREES AS GOOD CITIZENS

The groves were God's first temples. Ere man learned
To hew the shaft, and lay the architrave,
And spread the roof above them—ere he framed
The lofty vault to gather and roll back
The sound of anthems; in the darkling wood,
Amidst the cool and silence, he knelt down,
And offered to the Mightiest solemn thanks
And supplication.

—WILLIAM CULLEN BRYANT.

MAN owes it to himself to see that the street and roadside shade tree is given its well-earned place in the sun.

This place has been won through a service of centuries. Since time began, the shade tree has been the changeless and unfailing friend of the human race. It has graced earth with its beauty, and to every generation has given freely of its protective shelter. Beneath its friendly boughs man has found refuge from the blazing sun and the angry storm. To every human being the shade tree is a benefactor; to every community a blessing and a benediction.

Shade-giving is the one thing in which the tree's relations with man have stood unchanged. All other relationships of tree and man have varied with the ages, for the uses of wood have gone through a steady development with the progress of the race. Shade trees alone, among the children of the forest, have been ever constant.

There has, it is true, been no change in the influence of trees on literature. To-day, as for countless centuries, man seeks the shade of a friendly tree to write or to enjoy what others have written. The poets of by-gone ages found ease and inspiration in shaded nooks, and the writer of to-day turns likewise to the shelter of his favorite tree.

One of the beauty spots of the world is the site of the tomb of Virgil, overlooking the Gulf of Naples. This tomb marks the great poet's favorite retreat during his last years of life, and it was there, according to tradition, that he wrote his undying epics. The visitor to Posilippo finds it easy to understand why these wooded slopes, overlooking the blue Mediterranean, held such charm for the poet and made him choose this spot for his final resting place. In the same way, a visit to Cambridge shows why our own Longfellow sought the soothing shade of his beloved Elms for the writing of poems no less enduring than those of Virgil. For each of them, as for all mankind, the shade trees held irresistible charm.

Trees have had their part in history no less than in literature. In modern warfare the great generals pitched their tents and held their councils under the trees, as did the captains of Carthage, Greece and Rome. The Cedars of Lebanon and the trees of Gethsemane have deathless place in man's memory. It was under an Oak that Abraham received the angel, and it was in the shade of a tree that Socrates and Plato held discussion. Turn where one may, in the pages of history or in the life of to-day, the shade tree makes constant appeal to the imagination and to the sense of romance because of its unchanging rôle as man's faithful friend. Through all the ages the sheltering tree has had no rivals. "The Groves were God's first temples," and man's appreciation of their use and beauty gives them everlasting place in his affections.

This permanent kinship entitles the shade tree to a foremost place on the bookshelf. Shade trees merit the

ELMS AND MAPLES IN SUMMER

best attention that can be given them. The more we know of their proper treatment, the greater will be our opportunities for enjoying them. The more we study methods for their growth and nurture, the more of them we will have; and the more we have, the greater will be the beauty of our communities and our roads.

The purpose of this book is to simplify to some extent the problems of those who would grow shade trees. These problems can be made easy by study and the application of simple rules of safety and caution. The problems cover such subjects as the choice of the tree best suited for planting in a particular soil and location, its planting, its growth, its care and its protection. To disregard the information presented is to invite disappointment. To observe it is to bring true shade tree satisfaction which will repay the effort a thousand fold.

It must be borne in mind that for its friendly offices the shade tree is entitled to man's best care and protection. In its demands it asks nothing in selfishness. Its one aim is to thrive for man's benefit. Its sole purpose is to bless the world with its kindly gifts. In giving the shade tree its well-earned place in the sun, man is but creating, for himself and his heirs, a place in the welcome shade.

The city with fine shade trees is the City Beautiful. Travel where one may, in this country or abroad, it is soon learned that the final test of a city's beauty is its shade trees. Fine buildings and broad avenues are not enough. The best works of artist and architect must have trees to set off and enhance their splendor. A city without an abundance of shade trees on streets, on lawns and in parks is incomplete.

When the traveler gives thought to the world's most beautiful cities, he thinks instinctively of Washington and Paris; and in thinking of them he delights in the memory of their wealth of trees. To the fame of these two capitals shade trees have given generously of their charm. In each of these cities great architects and gifted artists have created buildings of rare splendor and stately grace, such as the White House, the Capitol, the Pan-American Building and the perfect façade of the Treasury Building, in our own National Capital; and the Louvre, the Elysée Palace and the marvellous creations of Versailles, in Paris and its environs. One lingers in admiration and reverence on these wonders, but the chief charm of both cities is found in the magnificent shade trees which line their streets and beautify their lawns, parks and public grounds.

Who can picture Sixteenth Street, or Massachusetts Avenue, or any of the streets of Washington deprived of shade tree beauty? How much pride could Americans take in the beautiful park around their Capitol if the grounds lacked the trees which now cover its sweeping slopes? How would Paris look without its Champs Elysées, its Bois de Boulogne or its Champ de Mars? Think of New York covered with brick and stone throughout the area now occupied by Central Park, a Chicago without Lincoln Park, a Boston without its splendid Common, or a San Francisco lacking its Golden Gate Park. Visualize without their trees, the city streets, parks or lawns with which you are familiar, and see what becomes of the City Beautiful.

Throughout America there are cities famous for their shade trees. The magnificent Elms of New Haven and Oberlin, the tree-lined thoroughfares of Brooklyn, East Orange, Springfield, Mass., Detroit, Indianapolis and Los Angeles—compare them with city streets which lack the glory of the trees. The contrast should give each of us increased spirit to see that our own streets and our own lawns shall not suffer by any similar comparison.

WHITE OAK IN AUTUMN

The worth of trees to a city is by no means confined to beauty. The city of fine shade trees is the City Healthful as well as the City Beautiful. In comfort, in health and in sanitation the shade tree is an important factor in civic welfare. Only a part of the benefit gained by man from shade trees is reckoned as by pleasure to the eye, and relief from the direct rays of the sun. Added to the welcome shelter is the cooling influence produced by the trees through their leaves; for trees transpire through their leaves in a way that has a pronounced influence on temperature. By absorbing moisture from the earth through their roots and releasing much of it into the air through their leaf-pores, the trees cool the air and freshen it. Enter the woods on a hot summer day, note that the temperature among the trees is several degrees lower than in the open. Wherever a shade tree spreads its leafy branches, this influence is constantly at work.

By this process of evaporating and exhaling moisture, the trees not only reduce the temperature, but serve a further useful purpose in giving off oxygen required by man in the air he breathes; and, by drinking in the carbonic acid gas, perform a double function in purifying the air.

Medical authorities recognize the value of trees in their influence on the health of a community. In the study of human illness, and particularly of the ailments of children in the crowded cities, doctors have found that trees do much toward reducing the death rate. Research has shown that one of the chief causes of sickness and death among the children of the congested districts is the stifling heat of midsummer days, intensified by reflection from heated pavements and sunbaked walls. On streets where shade trees are lacking, this reflected heat is given off night and day, to the severe discomfort and serious harm of people so unfortunate as to be denied the grateful shade of tree-lined thoroughfares.

In addition there is a different stimulus produced on the nervous system by the various colors. The effect of green is soothing, so that foliage masses tend to counteract the irritating effect of many of the colors common in city streets, especially that of red brick buildings.

What has been said for trees in the city holds equally well for the open country, although, to those familiar with country conditions in the eastern United States a country lacking in trees can hardly be realized. In naturally treeless regions, tree masses are also valuable in protecting small areas from the sweep of the drying winds and making possible the growing of plants, not otherwise practicable, as well as making living conditions more comfortable.

From every point of view, shade trees are of vast importance to the dweller in city, town or country. In beauty, in comfort and in public health the shade tree is the indispensable and never failing friend of man.

CHAPTER II.

TREES CROWN THE HOME

What does he plant who plants a tree?
He plants, in sap and leaf and wood,
In love of home and loyalty,
And far-cast thought of civic good
His blessing on the neighborhood.

ALL of the arguments in favor of trees for the community at large, and for the town or city street or the country road, bear with concentrated force on trees for the individual home. However small the lot, if there is a place for a tree there should be a tree in that place. If there is no room for a tree, shrubs, at least, should be planted. Trees and shrubs give the final touch that marks the difference between the home and the mere house. Shaded lawns complete the picture of shaded thoroughfares. They provide the poetry of the home setting; they give expression to the bit of sentiment with which every true home-lover is blessed; they color the home with the tinge of romance that meets universal human need.

No other feature does as much to give the home a well-dressed appearance as the presence of trees. Whether it be the stately mansion, with its broad sweep of spacious lawn, or the modest residence on the forty-foot lot, the graceful foliage of trees or shrubs is necessary to produce the homelike charm. If there is room for many trees, this room should be used; but the space for the single tree must not be neglected.

It is only necessary to note the appearance of homes in general to realize the emphasis of beauty produced by trees and shrubs. The best kept lawn, whether the impressive slope of the pretentious establishment or the tiny strip of grass on the small city lot, is robbed of its best chance for attractiveness by a lack of shade and foliage. The transformation brought about by the planting of trees and shrubbery is sometimes beyond belief until the demonstration has been actually made. By careful planting, the comparatively small place can be given the dignity of acres; the modest home may assume the appearance of the small-scale estate. The house glimpsed through foliage has a charm not possible to the more costly house in treeless setting.

In lawn plantings, as in street plantings, the relation of cost to results is an important consideration. The increased value, accruing to all of the property on a tree-lined thoroughfare, is again made greater in the case of the individual home which adds trees of its own to those of the street. Any one of us, in buying a home or a site on which to build, would be influenced in favor of the lot with shade and foliage. Trees and shrubs give the contact with Nature which man instinctively craves, and for which he is willing to pay.

Let it be remembered, then, that in beautifying the home with trees the outlay is to be regarded as an investment, pure and simple; an investment in beauty, in health, in comfort, and, finally, in cash value. Any one of these would make the investment worth while.

The tree, therefore, should be recognized as blending beauty, poetry, sentiment and romance with the practical and important elements of profit and health.

The planting of shade trees, too, must be looked upon as an investment, not as an expense. Trees increase the dollar and cent value of property. Those familiar with the values of residence real estate recognize the greater worth of homes on streets lined with shade trees. Of two houses alike in design and structure, the place on the shaded street will always command the higher price.

BEECH IN WINTER

This principle applies to communities as well as to individual homes. The visitor to town or city gains his first and most lasting impression from the presence or absence of shade trees. The community with streets bare and bleak and shadeless is dismissed as an undesirable place in which to live. Shaded streets and tree-clad lawns have a charm which often proves the deciding factor in influencing the home seeker in his choice of a place of residence.

Definite evidence of this is found in the efforts of real estate men to give new property added beauty and attractiveness by the planting of trees. That their choice of species is ofttimes ill-advised, because of demand for quick growth, does not change the major truth that they recognize the value of the shade tree. Experience has shown them that in the sale of homes in a new residence district, trees are as essential as sidewalks and paving, and second only to sewer, water, gas and electric connections.

Whether along the street or on the individual lawn, the cost of planting trees is insignificant, and no man who can afford to own a home can afford to deny himself and his family the added beauty, health and comfort to be derived from trees. It is not a question of one's ability to afford the outlay. It is a simple truth that none of us can afford not to do it; tree planting is good business as well as good taste.

Unlike paving and other improvements, including the house itself, the tree, properly cared for, is not subject to depreciation in value. On the contrary, its worth becomes greater with the passing years. In the towns of New England to-day there are massive Elms which are known to have spread their overhanging beauty before the eyes of the Pilgrim, and which now give to the old homes a value that can be measured in dollars just as surely as in beauty, in the same way that the massive Oaks of the South Atlantic and Gulf States have added beauty and value to plantation and town. What could be a more grievous mental picture than that of Northampton, Greenfield, or historic Williamstown, in Massachusetts; picturesque old Charlestown, in New Hampshire, or Savannah, Georgia, or Mobile, or Tuscaloosa, Ala., or Pass Christian, Miss., or any one of scores of other communities, shorn of the crowning beauty of these stately veterans of shade?

The community in which any one of us may live is entitled to this asset. That our forefathers failed to provide shade for the coming generations is no excuse for similar failure on our part. The longer we delay the planting the more remote will be the time of gaining the benefits of the trees we plant. We can never start any younger. This applies to communities and individuals alike. The time, therefore, for a beginning is the immediate present.

CHAPTER III.

HOW TO IDENTIFY SHADE TREES

HOW many trees do you know well enough to call by name at sight? Can you tell an Oak from a Beech, a Red Oak from a White Oak or a Norway Maple from a Sugar Maple? Do you know the difference between the Buckeye and the Horse Chestnut?

The man who loves trees should be able to identify them at a glance. This does not mean that he should turn botanist and spend his life in the pursuit of such terms as "staminal differentiation" or "pinnately compound," or that he must study the trees of Borneo or Madagascar. It does not call for scholarly research into the many-syllabled Latin names employed by the scientists. *Platanus Occidentalis* is all right for the expert, but for the plain citizen the simple name of Sycamore meets every demand. The one thing that is suggested is that he should make himself familiar with the trees most commonly found in his own section of the country and that he learn to know them by the names in everyday use.

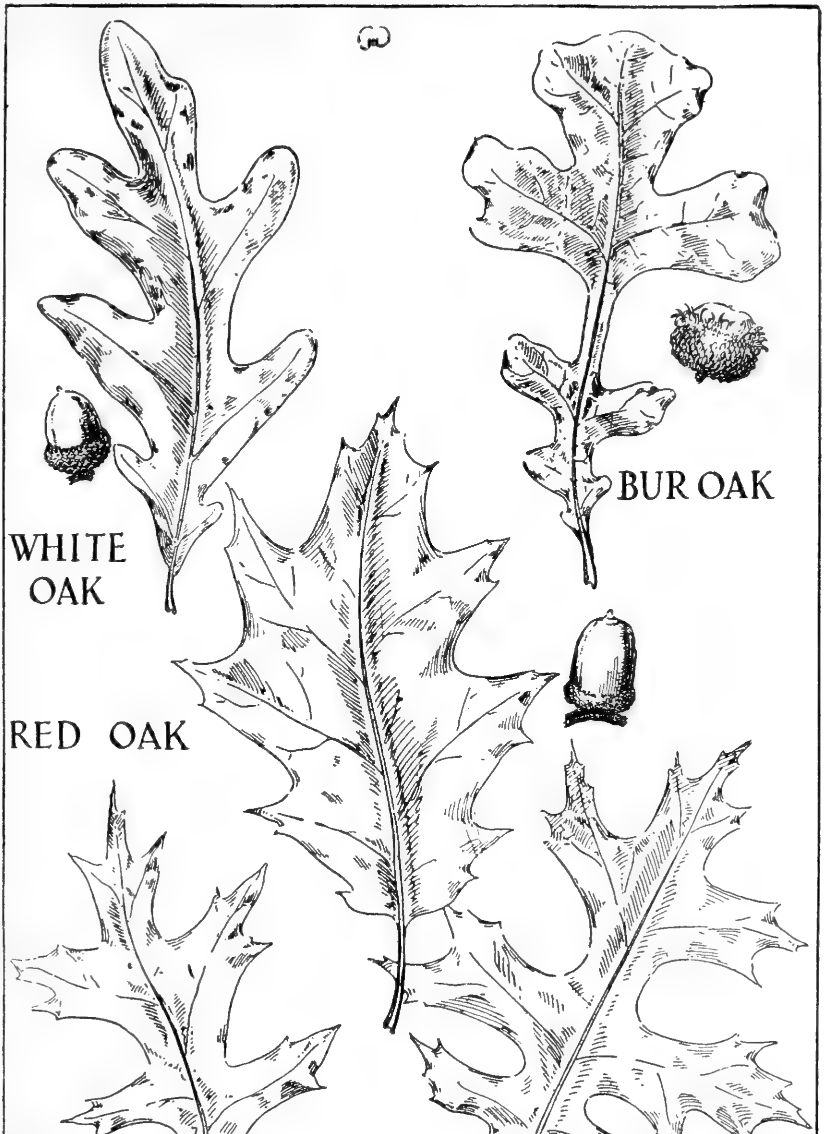
A little study along this line may save one from embarrassing moments when somebody asks the name of a particular tree in city park or by country roadside.

Take the Oaks, for instance. The average man is not concerned with the distinction between *Quercus palustris* and *Quercus velutina.* What he wants to know is how to tell the Pin Oak from the Black Oak. He would like to be able to distinguish an Oak from the other trees and the different species of Oaks from one another.

As a group the Oaks carry general marks of distinction from other trees. One of these marks is the bearing of acorns, in which the Oak has no competition. Within the group itself, however, there is more or less kinship of appearance which is confusing to the person who has given no thought to identifying trees.

All of the Oaks may be grouped as either white or black. To the former group belong the White Oak proper and the Bur Oak, Swamp White Oak, Chestnut Oak, Overcup Oak, the Post Oak and Live Oak, which may be recognized by the rounded lobes of their leaves, with the exception of the Post Oak and Live Oak, which have no lobes; and by their light grey or light buffish-brown bark, which breaks off into loose, flaky scales. The Bur Oak is distinguished from its close kinsmen by its cork-like branches. The trees of this group mature their acorns in a single year, and for this reason acorns of old and new crops are never found on a tree at the same time.

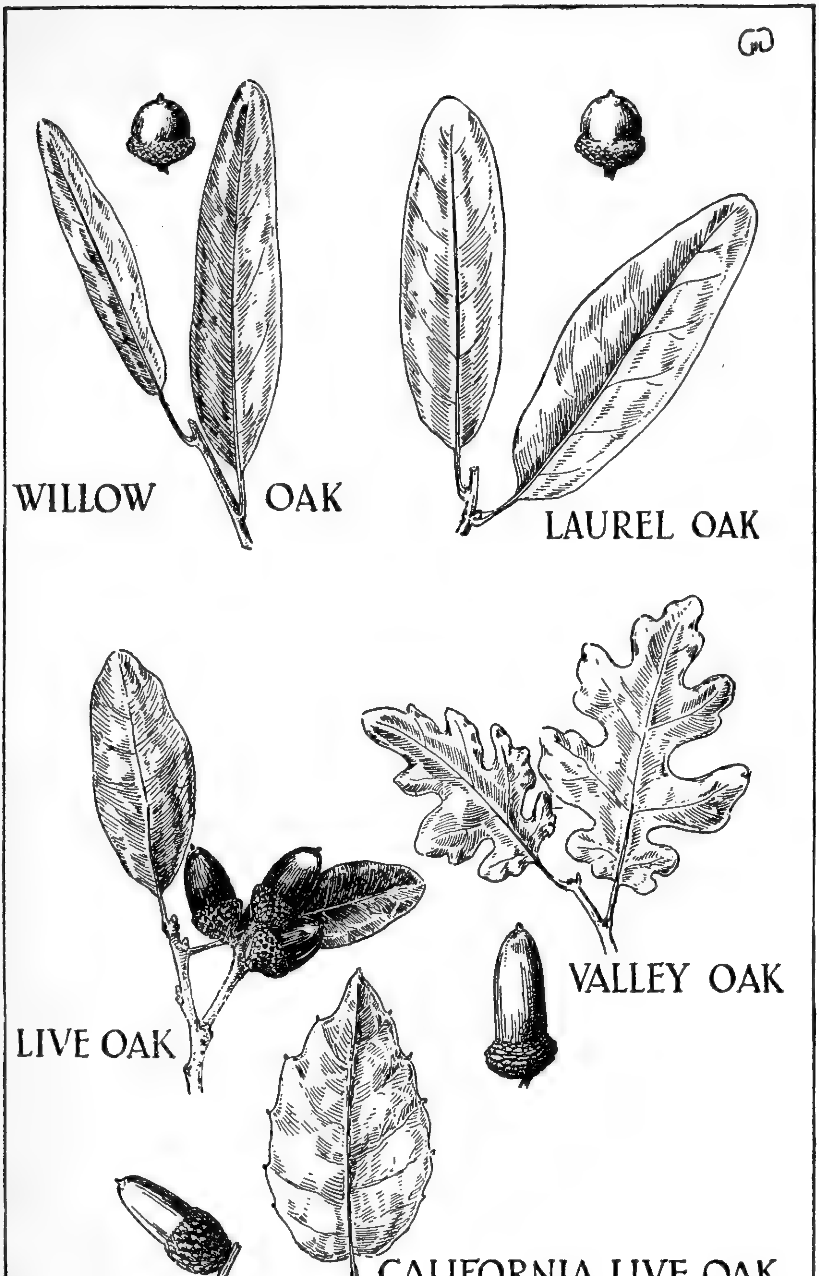
To the Black Oak group belong the Black, Red, Pin and Scarlet Oaks, Spanish, Water, Willow and Laurel Oaks. Instead of the rounded lobes of the leaves of the other group, all of these have leaves with lobes that are sharply pointed, or the leaves are tipped with bristles. The Pin Oak may be recognized by its horizontal and drooping zigzag lower branches, the deeply cut leaves, the tiny branchlets set into its limbs suggesting wooden pins, and the small acorns and cups. The Black Oak has rough, dark bark, growing in ridges; its leaves are a deep lustrous green above and dull light olive green beneath; its buds are pointed and have a dense, hairy covering. The inner bark is yellow and has a very bitter taste, in sharp distinction to that of the closely related trees such as Scarlet Oak. The Scarlet and Red Oak have nearly smooth bark. The Red Oak when young has bark that is almost smooth, greyish or greenish cast brown, becoming darker later. Its new twigs are terra-cotta colored and the


WHITE OAK
BUR OAK
RED OAK
PIN OAK
SCARLET OAK

older ones sepia-brown or grey. Its buds are pointed and practically free from hairs; the leaves are not as deeply lobed as the Black and Scarlet Oak and are of a dull, dark green or yellowish green on the upper side, somewhat paler underneath and with lighter veins. In the autumn the leaves turn a deep maroon red. It has a large acorn set in a broad shallow cup. The Scarlet Oak has thick dark brown bark, with irregular, shallow furrows. Its leaves are thin, a shiny olive green above, somewhat paler beneath. The autumn coloring of the leaves is deep, cardinal red. The buds are blunt and smooth with a slight hairy covering at the base. The oaks of the Black Oak group require two years to mature their acorns, and for this reason the same tree will, at the same time, show young acorns of the new crop and fully grown acorns of the previous year. The kernel of the acorn in the White Oak group is mostly lacking in the bitter principle, some of them being quite edible, while those of the Black Oak group are bitter.

Ash leaves are composed of several leaflets along a single leaf stalk. These leaflets are in pairs, opposite to each other on the stem, together with a terminal leaflet. The number of leaflets on each ranges from five to nine, most frequently seven. The leaves are also arranged opposite one another on the twigs and branches. There is a wide difference between the characteristics of the Green Ash and those of the White Ash. The leaves of the White Ash are whitish beneath and smooth, often with a few suggestions of coarse teeth; those of the Green Ash are green on both surfaces and have teeth like saws.

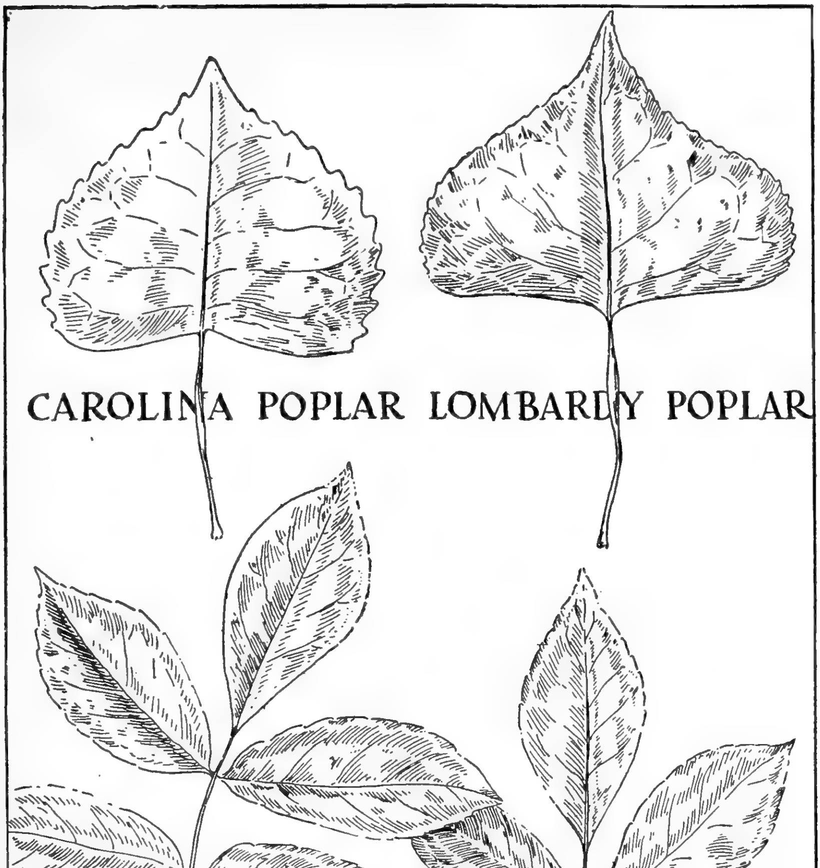
While the Horse Chestnut belongs to the same genus as the Buckeye, the two are quite different. The leaves of the Horse Chestnut are seven-fingered, while those of the Ohio, Sweet and Red Buckeyes are usually five-fingered; the flowers of the former are five-petaled, of the Buckeyes


WILLOW OAK
LAUREL OAK
VALLEY OAK
LIVE OAK
CALIFORNIA LIVE OAK

four-petaled. The fruit of the Horse Chestnut is a globular husk containing a single nut; that of the Buckeye usually contains two. The Horse Chestnut has the advantage of the Buckeye in profusion and beauty of blooms. The buds of the former are sticky, shiny and resinous, which is not true of the Buckeye.

The Maples have opposite leaves, with deeply recessed edges and always bear keys, or seeds with a long winglike appendage, in pairs. These are as characteristic as acorns are of the Oaks. The leaves are borne in pairs, one opposite the other, along the stems. On the Norway Maple, the leaves are broader than long, five-lobed and easily identified for the reason that the leaf stalks and veins give forth a milky juice when cut or broken. Its bark is dark grey, fairly smooth and compact, with shallow, close and narrow furrows. Its twigs are comparatively stout. The Sugar Maple has leaves very much like those of the Norway Maple, but are longer than broad and the exuded sap is clear. Its bark is a light brownish-grey, deeply furrowed perpendicularly into coarse flakes. Its twigs are about half as thick as in the Norway Maple. The bark of the Red Maple is smooth in youth, furrowed and shaggy and with long ridges on older trees, and changing in color from light to dark greyish-brown as the tree matures. The leaves are quite variable but are three-lobed, sharp pointed and, quite unlike the Norway and Sugar Maple, have definite saw-tooth edges. Leaf and flower buds as well as twigs and fruits are red, the summer foliage a light green on red stems and the autumn leaves a brilliant scarlet. There is a variety with yellowish instead of red twigs, flowers and fruits.

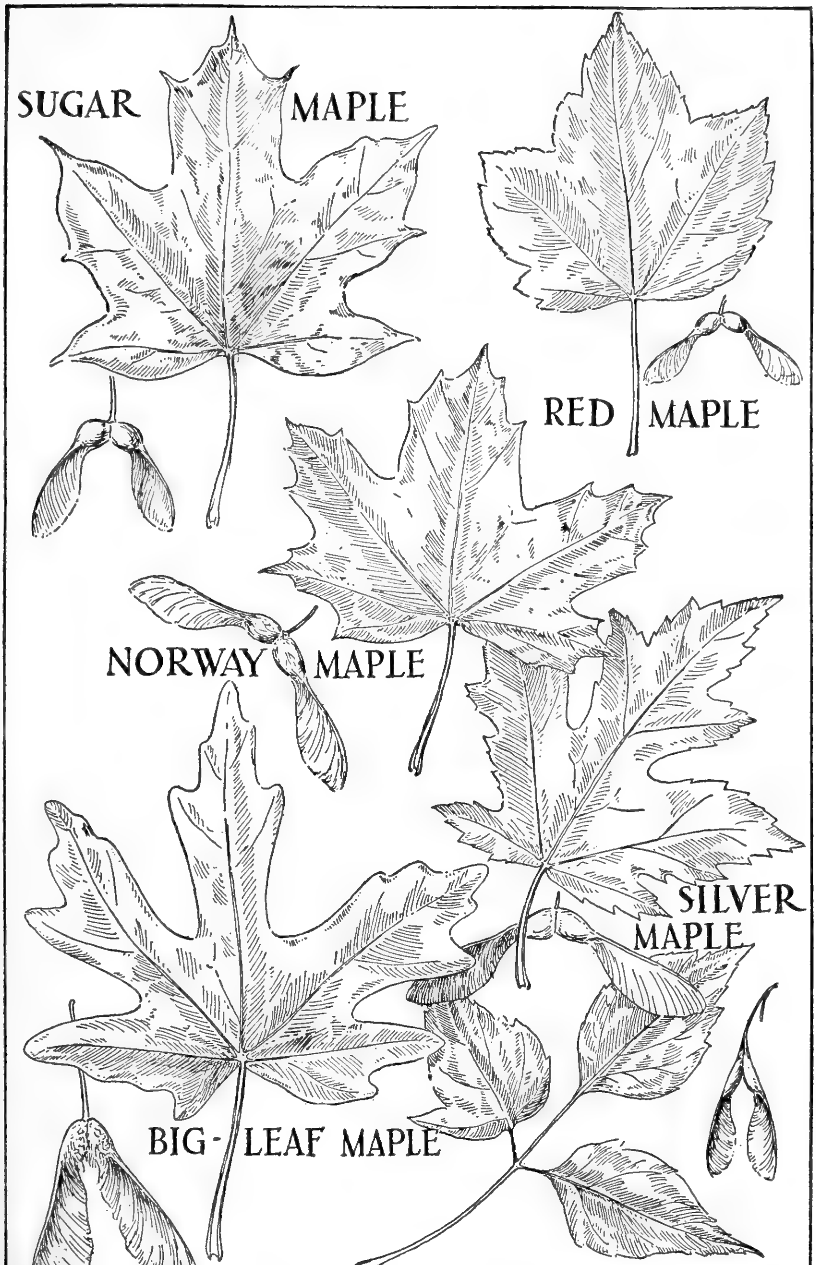
The Box Elder, or Ash-leaved Maple, is to be distinguished by its ash-like leaves of three to five leaflets on a single stalk, coarsely toothed and usually deep green.


CAROLINA POPLAR
LOMBARDY POPLAR
WHITE ASH
GREEN ASH

The bark on the trunk resembles that of the Ash, and is light brownish-grey, with narrow, shallow furrows. The young twigs are a light olive green.

The Sycamore is a large, handsome American tree. Its European relatives are called plane trees. The name Sycamore is used in Europe for the Sycamore Maple or False Plane Tree, while in the Orient and among the ancients it was a kind of Fig. The Sycamore is also called Buttonwood, Buttonball or Button Ball tree, Plane tree and American Plane. It has large maple-shaped leaves but has balls instead of keys as the seed vessel; the leaves of the Sycamore are not borne opposite one another, being thus in contrast to the habit of the Maple. Furthermore its bark peels off in thin, brittle layers, a characteristic lacking in the Maples except to a very small extent in the Sycamore Maple. The peeling process leaves almost white patches on the dull, ruddy brown bark, giving a characteristic mottled effect which can be recognized at a long distance. This appearance is not even suggested in the Sycamore Maple. Another characteristic peculiar to this tree is that the base of the leafstalk makes a cap-like covering over the young buds and the bud is not seen in the axil of the leaf as in nearly all other trees. The leaves are light green, five-lobed, and with a few coarse teeth. The fruit is in the form of a single ball, rarely two, known as the buttonball, which changes from green to light brown in the autumn and hangs throughout the winter. The London Plane, often cultivated as the Oriental Plane—a sister tree to the Sycamore—sheds its bark as does the Sycamore but leaves pale greenish patches beneath, instead of almost white ones. Instead of the single ball the fruit of this tree is generally borne in clusters of from two to four.

In the American Elm, the trunk divides gradually a short distance from the ground into two or more stout


SUGAR MAPLE
RED MAPLE
NORWAY MAPLE
SILVER MAPLE
BIG-LEAF MAPLE
ASH-LEAVED MAPLE

branches, which curve gracefully upward and outward to form a symmetrical, rounded, wide-spreading or vase-like top. This tree's brownish grey bark is furrowed into perpendicular flat-topped ridges, very rough and solid, with whitish inner layers. The tree is marked by drooping twigs, and by pointed leaves which are usually quite rough above, sharply double-toothed, with straight, pale veins clearly marked and extending to the teeth on the margins. The English Elm has an oblong top, often divided into two sections, one above the other and the lower smaller than the upper. The trunk does not separate into branches as in the American Elm, but is more or less continuous well into the top of the tree. Its branches are crooked and heavy, and its twigs do not droop as do those of the American Elm. The leaves are similar to those of the American Elm, but are apt to be smaller. The two trees are similar as to bark, except that the bark of the English Elm is the harder and coarser.

The Hackberry resembles the Elm in some respects, but its trunk does not divide so gradually. Its light bark is irregularly ridged and after a few years is covered with prominent wart-like projections of the outer bark, which are a distinguishing characteristic. The leaves, like those of the Elm, are unevenly developed and lopsided to a much greater extent than in the Elm. They are a light olive green, sharp pointed and coarsely toothed, and each leaf has its two lowest side veins prominent and extending well up from the base. The berry resembles a yellow cherry, turning to purple-black and is sweet and edible.

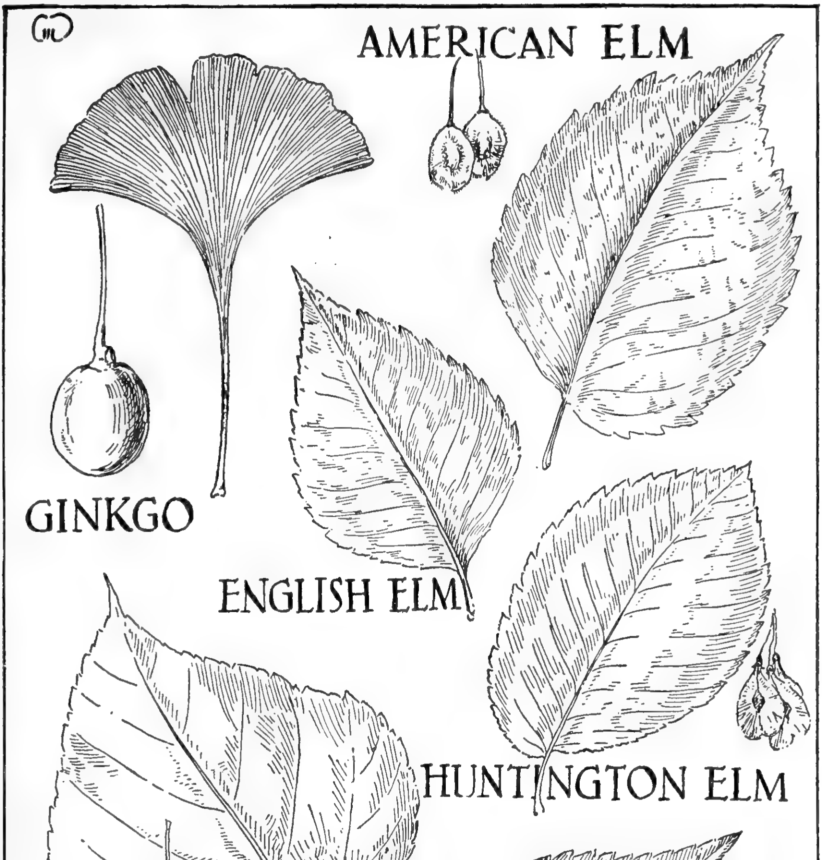
While the various Poplars have numerous points in common, they are marked by distinctive characteristics. The Lombardy Poplar is tall and slender, shaped like the spire of a church, and its erect branches normally start at


GW
ORIENTAL PLANE
LONDON PLANE
CALIFORNIA SYCAMORE
SYCAMORE

a point not far above the ground; its bark is brown and rough, the leaves a dull olive green, blunt toothed and triangular, often broader than long, and tapering to a sharp point. The Carolina Poplar, or Cottonwood, has a wider crown and more open branching than the Lombardy Poplar, and is marked by its large twigs at the ends of branches; its bark is dark grey, almost smooth, and its leaves are larger than those of the Lombardy and have coarse teeth. The Quaking or American Aspen, another member of the Poplar group, is easily recognized by its finely toothed, small, trembling leaves, its reddish brown twigs and its sharply pointed narrow buds; its trunk, gradually tapering to the top and its slender branches. In the Large-toothed Aspen the buds are thicker and broader and the leaves have much coarser and more remote teeth. The unfolding leaves are white and woolly.

The Ginkgo is a tree of unusual appearance, with slender branches, extending upward and outward from the trunk at an angle of approximately 45 degrees. The trunk and branches are straight and tapering, the bark dark brown or greyish, smooth in youth and becoming rough and seamed. The leaves are a bright green, fan-shaped, and have several short clefts in the edge, and grow from alternating short button-like branches in clusters of from three to six. Because the leaves resemble those of the maidenhair fern in shape, though much larger, this tree is frequently called the Maidenhair Tree.

The American Beech is marked by its smooth, close grey bark, hugging the trunk and branches even in old trees, which permanently show every cut or bruise. In its close bark it resembles the Red Maple, but in the Beech the branches and twigs are alternate, while in the Red Maple they grow opposite each other. The leaves


AMERICAN ELM
GINKGO
ENGLISH ELM
HUNTINGTON ELM
BASSWOOD
EUROPEAN LINDEN

of the Beech are thin, finely and straightly veined, sharp pointed and sharply toothed. The nuts grow two in a bur and form a sharply three-sided pyramid of a shiny brown color. The European Beech has similar though often darker bark, and its leaves are proportionately broader, though smaller, with less pronounced teeth and with 5 to 9 pairs of side veins, instead of 9 to 14 pairs, as in the American Beech.

The trunk of the Grey Birch, when young, has a shiny bark of reddish brown, and as the tree matures, the bark becomes a dull chalky white with triangular dark patches underneath the bases of the branches. The bark is close-fitting, does not peel rapidly, and has thick short horizontal lines. The branches are slender and the lowest droop, while those near the top are ascending or erect. The leaves are triangular, sharply long pointed, and have fine teeth. The White, or Canoe Birch, has buff-white bark which peels off in paper-like layers. It lacks the triangular patches seen on the Grey Birch. The leaves are egg-shaped instead of triangular and double-toothed. The Paper Birch resembles the Grey Birch in that it has the same chalky-white bark, but it is different in that the bark of the Paper Birch peels off readily in thin layers, and that the dark, triangular patches are missing.

The Basswood, or American Linden, has brownish grey bark with long, vertical fissures. The leaves are broadly heart-shaped and one-sided at base. The leaves of the European Linden are more evenly heart-shaped and are smaller than those of the Basswood. The flowers of the Basswood have five creamy white petals opposite petal-like scales; in the flowers of the European tree these scales are lacking.

WHITE ELM RED SPRUCE BEECH WHITE ASH

RED MAPLE TAMARACK WHITE PINE

TULIP POPLAR SWEET-GUM SCARLET OAK

BASSWOOD WHITE CEDAR FLOWERING DOGWOOD SHAGBARK HICKORY


ASPEN
WHITE OAK
YELLOW BIRCH
BALSAM FIR
WHITE WILLOW

HARD MAPLE

WHITE MAPLE

RED OAK

CHESTNUT

CHAPTER IV.

SELECTION OF TREES FOR PLANTING

IT is of basic importance in the planning of shade tree planting that due care and attention be given to the selection of the species best suited for the particular location. Choosing the right variety is the starting point of shade tree success. A tree unsuited to the climate, soil, or other local conditions of growth can not be expected to produce the desired results. All other rules may be carefully observed and the most painstaking and intelligent attention may be given to planting, pruning and general care, but if an unsuitable variety is selected, the results will be disappointing.

Choice of proper varieties is not difficult. The factors that determine the selection are adaptability to the climate and to the soil of the locality, suitability of the size, form and denseness of shade to the streets upon which they are to be planted, and ability to withstand gases, smoke and other untoward city conditions.

To secure hardiness, trees should be used that are known to thrive locally or under similar conditions. They should also be selected with regard to the soil where they are to be grown. The soil of streets is often far from ideal and as it is impossible to modify more than a small part of the future feeding ground, trees must be selected to suit the soil. Another requirement is hardiness, ability to overcome handicaps, combined with adaptability to particular environment. In cold climates this factor includes strength to withstand snow, ice and freezing, and in all climates it involves power of resistance to wind, mechanical injuries, insects and diseases. Rapidity of growth is another point for consideration and in this it is as necessary to know what to avoid as what to seek. The lure of rapid growth has been responsible for the planting of numbers of Silver Maples, Carolina Poplars, Water Oaks and other species undesirable for the region where they were planted. It must be remembered that these trees grow rapidly but that they are short lived. A Carolina Poplar or Silver Maple will have to be replaced at about the time a Red Oak, a Sycamore or a Norway Maple has reached its best development. It must be remembered also that careful cultivation is a factor in tree growth, and that some of the slower growing varieties will show more rapid increase, under proper care, than the desirable ones would if left to shift for themselves.

Shade-giving qualities are also an important factor, particularly for street trees. Too much shade may be as undesirable as too little, and selection should be based on the character and width of the street. For narrow streets it is best to have trees of slender growth or small size, with light foliage, or those in which development can be controlled by pruning, in order that the sunlight may not be entirely shut off from the houses and the grass. On thoroughfares of unusual width, the utmost in dignity and effectiveness may be obtained by using the largest trees and allowing full development of the crown.

A point to be borne in mind is that beauty is not the sole result desired in successful shade tree development. If it were, it would be hard to resist the temptation to use exclusively trees of the broad spreading type, for the sake of the overhanging arch of foliage which would result from the meeting of the branches from the two sides of the street. Experience has shown that, despite the beauty of an archway shade, the dense foliage of the arch may prevent the free circulation of air, shut off sunlight from

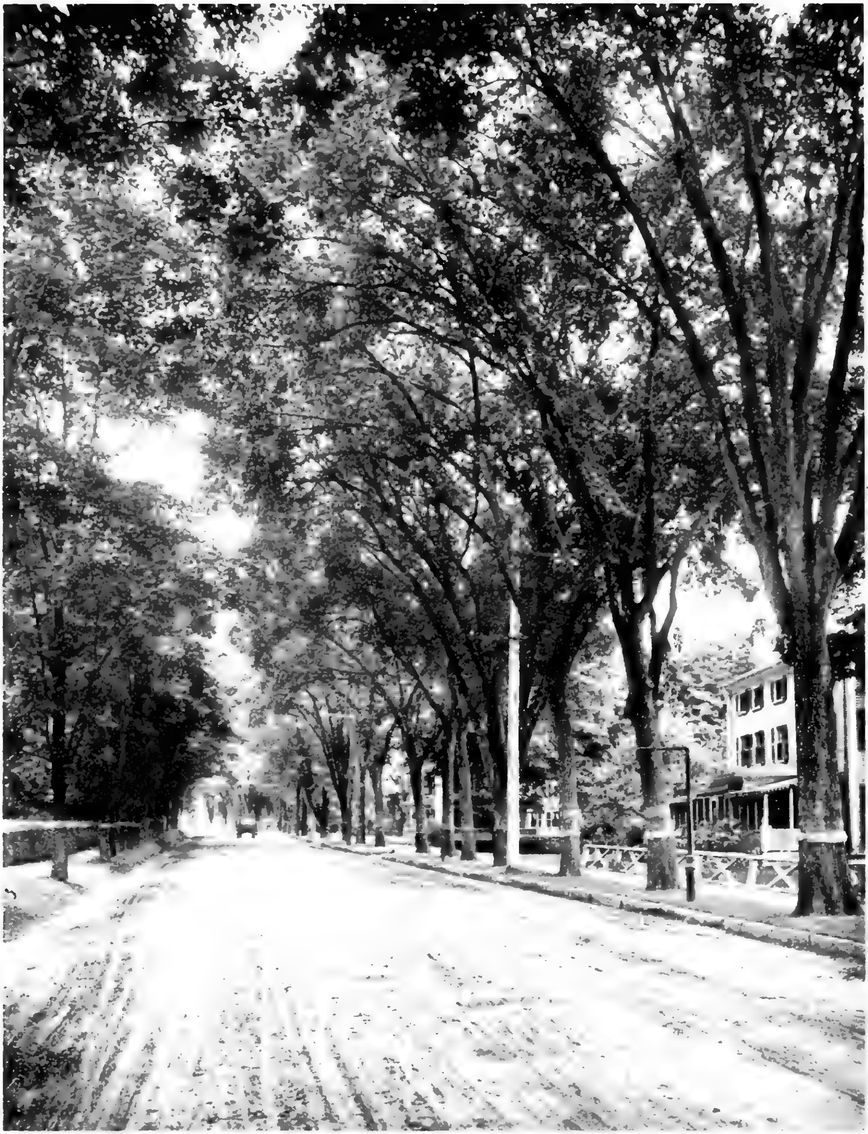
PIN OAK.

the grass, and produce undesirable dampness by interfering with speedy drying-out after rainfall. It may often be much better to have trees of more upright growth. If the upright trees lack the over-arching beauty of the others, they offer compensation in their individual stateliness, and by serving as a beautiful frame for setting off their environment. A thoroughfare lined with trees of this type offers a vista not possible with the trees which arch the roadway from curb to curb. A variation is the use of trees of a type to be kept closely pruned into small size and formal shape. For exclusive business streets and those where narrow sidewalks and poor growing conditions are a handicap, this is particularly desirable. It is much used in European cities, where careful attention has been given to tree planting. With proper attention and care, trees of small size will thrive in small patches of soil where larger trees, with their spreading root systems, might languish. The effect of these formally pruned trees is dignified and decorative, and gives a fine touch of green to a street lined with high-class shops or handsome houses in solid rows. An important advantage of this type of planting is that, in the event of the death of one of the trees, replacement is easy when nursery stock is kept for the purpose. European cities provide for replacements by keeping a supply of fair-sized trees in municipal nurseries for emergency use. Since all the trees are kept pruned to small size, little time is required before a transplanted tree has developed a crown uniform with that of the older tree.

Clean habits are as important in trees as in human beings. Some trees are entirely lacking in observance of the proprieties as to causing litter through blooms or fruit or through the breaking and falling of fragile twigs and branches. These trees are to be avoided for the sake of neighborhood pride in good housekeeping. The Carolina Poplar is one of the worst offenders. Its brittle quality causes limbs to break, while its bulging roots and trunk mar the evenness of curb and sidewalk and cause cracking of concrete or flagstones; and the dropping of spring blossoms is so extensive as to become a nuisance.

Silver Maples break sidewalks through the action of their roots, and have disadvantages similar to those of the Carolina Poplar. The staminate (male) Ailanthus is objectionable to many because of the unpleasant odor of its flowers, and care should be taken to use only pistillate (female) trees, the flowers of which lack this odor. Only the staminate or non-fruit-bearing form of the Ginkgo should be used as the falling fleshy fruits not only make the pavement slippery, but are somewhat poisonous to the skin of some people. The Cottonwood spreads its seeds in the form of a fine cotton or down which is quite objectionable because it is often irritating to the respiratory organs and is most untidy. It can be avoided by using staminate trees only. As Poplars are grown from cuttings, trees of the desired sex may be obtained by making cuttings from trees of that sex. Root cuttings from an ungrafted tree of the proper sex could be used for propagating the Ailanthus, but the Ginkgoes would have to be grafted.

A final consideration, but by no means the least important, is the element of beauty. This involves form, vigor and suitability to location and environment. Factors of beauty also include the coloring of the leaves and the nature and appearance of flowers or fruit. Fine examples of coloring are to be found in the brilliant autumn foliage of the Red Oak, following its summer dress of heavy dark-green leaves. The gorgeousness of the Maples in autumn coloring makes these trees general favorites for street planting. Of the Horse Chestnut, the



MAPLE AND ELM.

chief charm is its beautiful flowers in spring, but this is counteracted by its bareness when it sheds its leaves in early autumn.

For the country as a whole, no trees can be named as entirely good and none as entirely bad. Even for any particular city or county the same holds, as width of street, character of soil or other consideration may render a tree that in general is excellent for the locality, of little value for the particular purpose. Further, trees that are most undesirable over a large range of country are, many of them, of much value under more severe conditions, such as the Poplars and the Hackberry, which are valuable trees in many parts of the West.

Here is presented a list of good trees for many sections of the United States and also a list of those that are often mistakenly used.

Red Oak.—The Red Oak comes nearest of any to being the best shade tree for the eastern half of the United States. It is a strong competitor of the Elm in the regions of the latter's best development, as well as of the Sugar Maple where it thrives best, and of the Willow Oak and Live Oak in their special region, but has a much wider range of prime development than any of these. It grows more rapidly than other Oaks and adapts itself to a wide diversity of soil conditions. This species is at home in almost any soil, including locations close to the ocean. Its trunk is straight and strong, its top symmetrically oval or round, and foliage luxurious and turning a bright red with the approach of cold weather, remaining on the tree till late in the fall. It largely escaped injury in New England in the severe sleet storm of November 1921 that was so destructive to the Elms, Maples and other ornamental trees. The city of Washington has used the Red Oak on stretches of street, with results that are not excelled on any thoroughfare in the city, as has also Atlanta, Georgia.

Pin Oak.—Among the Oaks, first choice for street planting is usually, though undeservedly, given the Pin Oak, so named in allusion to the dead twigs, which resemble pins driven into the trunk. With fair soil this tree grows well in small area, and it yields to pruning in a way that makes it possible for the tree to be kept of relatively small size or be allowed to attain considerable development. Where the root area is restricted, pruning will check expansion of the top and hold crown and root system in the harmonious relationship needed for best results. The Broadway roof of the New York subway, far uptown, shows these trees, growing in shallow soil and pruned into formal shape with excellent effect. The Pin Oak has upright trunk and its crown is a natural pyramid, with young slender horizontal branches, normally of formal outline and fine foliage. Either pruned, or permitted to follow its full development, the tree is highly desirable for street purposes. It has few enemies and these are easily controlled. The autumn foliage is a deep scarlet and extremely attractive, but the dead leaves hang on most of the winter.

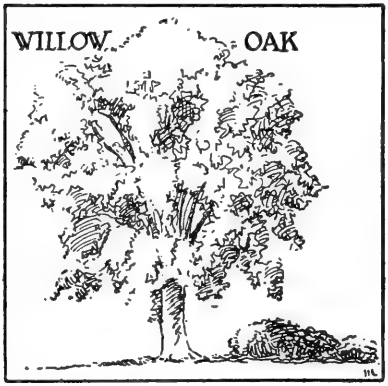
Scarlet Oak.—This tree is even less exacting as to soil than the Red Oak. It will grow almost anywhere and the brilliant coloring of its autumn foliage fully justifies its name. A row of these Oaks brightens the landscape with the striking beauty of a forest of flame. It is to gravelly soil what the Pin Oak is to wet clay.

White Oak.—While better suited for lawn planting than for street purposes the White Oak holds high place. Short and sturdy, but capable of being pruned to a high head, with spreading top, the tree is pleasing to the eye and productive of excellent shade. Its slow growth may be materially hastened by proper location and good soil, while its long life—comparable with that of the Live Oak and the Valley Oak—gives it lasting beauty and value.

Live Oak.—For planting in the Southern states, where mild climate and general conditions are favorable, the

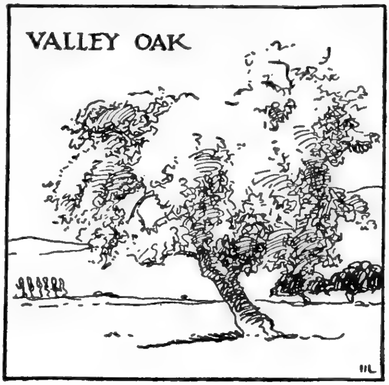
Live Oak is an ideal street tree. Its broad, spreading top and evergreen leaves make it excellent as a shade tree, and it is much used in the towns and cities of the South. The tree is comparatively slow in growth and thrives in well drained soil. Most used in cities near the coast.

Willow Oak.—This tree, sometimes erroneously called the Water Oak, is one of the best of the quick-growing oaks for use in the Southern states. It is frequently used with the Water Oak for street planting and is usually confused with it. It is, however, a distinct tree, which can be distinguished readily from the Water Oak. It is longer lived and is its equal in every other respect. Trees of this variety, which apparently have been planted about 80 years, are found in excellent condition, while Water Oaks planted at the same time, have either entirely disappeared or are showing marked evidences of decline. In the South the Willow Oak is readily transplanted, as trees 12 feet high are dug from the woods and planted on the street with success. In the extreme South this tree is nearly half evergreen. Its foliage does not assume the bright colors of the Red, Pin and Scarlet Oaks.



Laurel Oak.—The Laurel Oak is a large oval headed tree that is not as rugged and irregular as the Live

Oak, but is suitable for street planting in the Southern states. It has large, thick, glossy leaves, and in the warmer regions it is almost evergreen. It is readily transplanted, but as it is not so common in the woods as the Willow Oak and the Water Oak it has not been so much used as a street tree. Near the Gulf of Mexico it is called the Water Oak.

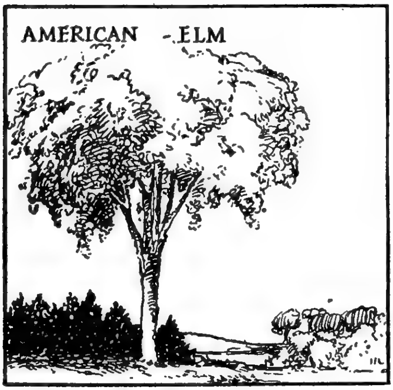


Valley Oak.—The Valley Oak is a beautiful tree for regions like California. When transplanted young, especially if taken from a pot, it is easily established where there is opportunity to water it for a few years.

California Live Oak.—This is an evergreen suitable for use in California near the ocean. It is also useful in region 3 and in the western part of region 5. It is easily transplanted when young, especially when planted from pots.

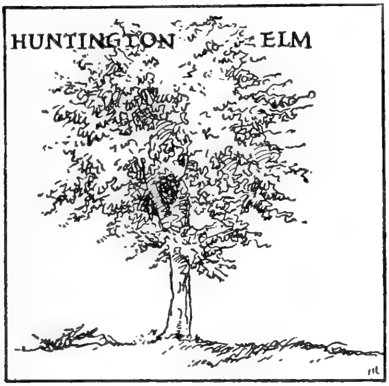
Bur Oak.—The Bur Oak or Mossy Cup Oak is one of the large native Oaks and in many sections of the country is much used as a shade tree. It is especially useful on the black soil just east of the dry farming sections of the country, where the rainfall is too meager for the Red Oak and Pin Oak to be at their best. In the autumn, the leaves turn a dull red or maroon. The tree thrives in deep, rich soil.

American (or White) Elm.—This tree stands forth as the dean of shade bearers and city beautifiers for New England, New York and the Great Lakes region.



To have seen the stately dignity and towering grace of the Elms of New Haven, Cambridge, Oberlin or Evanston is to have seen American shade trees at their best. For wide streets and broad avenues it has no superior. With its high-arching crown, its gracefully drooping foliage of brilliant green, the American Elm affords a summer picture not offered by any other variety of tree; while the leafless crown is silhouetted against the background of winter sky with an artistry by which poet and painter are at once inspired and baffled. Whether alone or in company, the Elm is of commanding beauty. The solitary tree of this species carries the perfect message of the reigning monarch, while the broad avenue, enclosed in a double row of the trees offers an arching vista finely expressive of the thought that "The groves were God's first temples." Where its serious enemies can be controlled, it can be used to advantage. It is particularly susceptible to the elm leaf beetle and the tussock moth. If it can be watered when young, it does well in many parts of the dry Western country.

English Elm.—The English Elm is a tall, oval-headed, compact, handsome tree with leaves which are smaller than those of the American Elm, and which stay on much later in the fall. It is at its best in the Puget Sound region, equalling the American Elm there and on the coast of California ex-

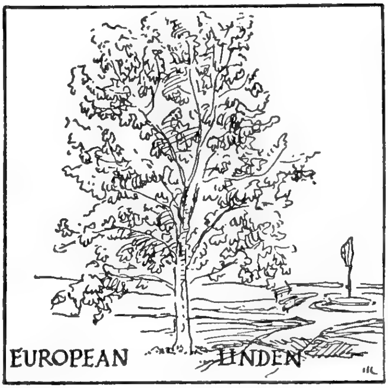


celling it. It also thrives in the Sacramento and San Joaquin Valleys and in the Atlantic States from Washington to Georgia.

Huntington Elm.—The Huntington Elm is a comparatively round-headed European variety. It is a large, handsome tree with good foliage and is more compact than the American Elm. It succeeds well in the Pacific Coast states.

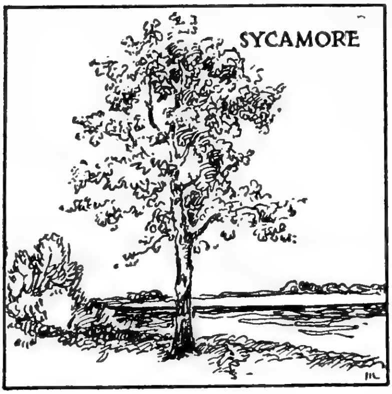
Ginkgo.—The Ginkgo or Maidenhair Tree, which was imported from China and Japan, has taken foremost rank among the desirable trees for shade purposes in the cities of eastern America. Because of its hardiness and its freedom from insects and diseases, its use has been given special attention by the United States Department of Agriculture. One of the most effective bits of group planting in the city of Washington is the collection of Ginkgoes in the grounds of this department. The tree thrives on poor soil, and is not injured by the reflected heat from pavements, which causes serious harm to many trees. If unpruned, its shape is conical, with occasional stray branches at almost any angle, but becomes a broad, flat-topped tree with age, having obliquely-spreading straight branches. By trimming, it may be developed into rounded form at an early age. There is a pyramidal form that is comparable in its outline to a Lombardy Poplar that maintains its typical outline. Its vigorous persistence of growth against obstacles and its response to control of form by pruning make it a valuable tree for narrow city streets. The name Maidenhair Tree comes from the leaves being shaped like the leaflets of the Maidenhair fern. These are dark green and turn a brilliant yellow. The pistillate trees bear yellowish soft-fleshed fruits in abundance. These are objectionable because, in dropping, they make the sidewalks slimy and slippery; they have a very disagreeable odor, and the flesh is poisonous to some skins. By using only the staminate form, grafted from mature trees, there need be no trouble from the fruits. Its use is growing in favor and should be encouraged.

Basswood or American Linden.—Advocates of the Basswood for street purposes will find a living and forceful argument for this species in the beauty of Massachusetts Avenue in the city of Washington. On a stretch of several miles along this famed residential thoroughfare, the entire planting, consisting of two rows on each side of the street, is in Basswoods. The well rounded crowns and generous leafage of these trees give the street an attractiveness which is emphatic even in a city so well shaded as Washington, and with the coming of the fragrant June blossoms the effect is all the more pleasing. The tree is subject to insect enemies and sensitive to their attacks, but its beauty repays the effort required for overcoming these handicaps. It demands a deep, rich soil.



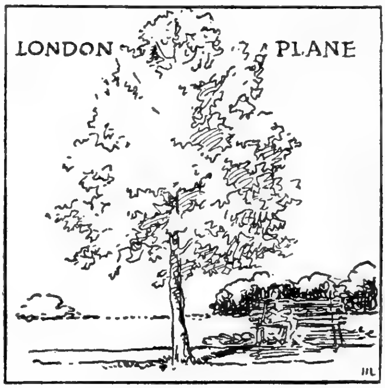
European Linden.—Of attractiveness akin to that of the Basswood is the European member of this family. The European Linden is erect and symmetrical, with attractive foliage which renders it an ideal street tree. In European cities it is one of the trees generally used. Its hardiness, adaptability, relatively rapid growth, response to pruning and ability to overcome obstacles, make it suitable for most conditions of soil and environmont. It is well adapted to narrow streets. In selecting specimens for planting, care should be taken to obtain the tree in its true type, *Tilia vulgaris*. The large-leaved European Linden, *Tilia platyphylla*, is less desirable and invites serious damage from the red spider. *Tilia Argentea* is also good.

Sycamore.—One of the best of native trees is the Sycamore or Buttonball. This tree is tall and stately, with broad, open top, growing to large size and adapted to wide streets. Although frequently severely pruned, its appearance is not permanently injured thereby. The soil



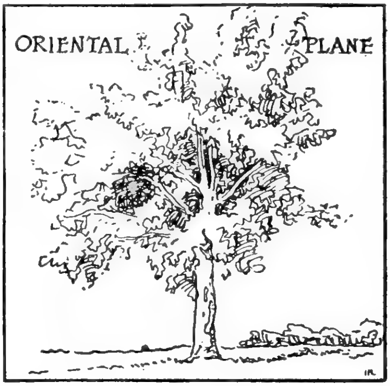
for the Sycamore should be rich and moist. Properly placed it grows very rapidly and is well adapted to the conditions imposed by city environment. It suffers much from a disfiguring leaf and twig blight, especially in early spring, and in New York and New England it is especially subject to sunburn, frost crack and winter killing.

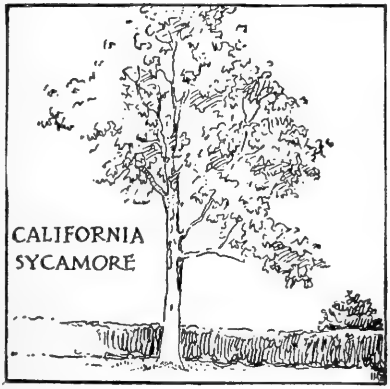
London Plane.—A relative of the American Sycamore is the London Plane—usually listed by nurserymen as Oriental Plane. It is supposed to be a natural hybrid between our Sycamore and the true Oriental Plane. This is more symmetrical and compact than the Sycamore, and in many cities it is more used than any other tree, because of its beauty and the readiness with which it adapts itself to the conditions of city environment. The tree has the stateliness characteristic of the American Sycamore and a finely formed top of much grace and dignity, with perfect symmetry as one of its most striking and pleasing points of attractiveness. In common with the Sycamore, it



may be pruned vigorously with a minimum of damage, and this is a factor in its selection for narrow thoroughfares. It is one of the most rapid growers among the desirable trees, and, unlike other trees which develop rapidly, it has the advantage of long life. Freedom from serious disease and insect attacks are strong points in its favor. It is more regular in form than the Sycamore, but it is also subject to blight and in New York and New England to sun-scald, frost crack and winter killing.

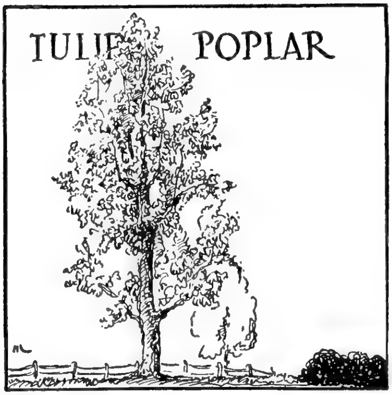
Oriental Plane.—This is also a large, handsome tree much used abroad. Paris holds the Plane as one of its favorites and not less than thirty per cent. of the trees of the French capital are of this variety. It is scarce in this country, although it is listed by nurserymen. The tree almost universally planted under this name in this country is the London Plane. It would add variety to our planting if available.





California Sycamore.—The California Sycamore is a native of the Pacific Coast and is well adapted to culture under those conditions. It is better than the American Sycamore for the West.

Tulip Tree.—The great size of the Tulip tree, sometimes called the Tulip Poplar and the Yellow Poplar, makes it especially suited for planting on wide thoroughfares where the space calls for trees of generous proportions. The splendor of its tulip-like blossoms gives it wide popularity. These flowers are a blend of green and yellow, touched with orange, and their brilliance is ample reward for the painstaking care required in successful transplanting. The tree is of symmetrical form with comparatively narrow top, and though its wood is rather brittle, its foliage is graceful and extremely pleasing to the eye. It requires deep, rich soil and plenty of moisture. It should be transplanted only in early spring.



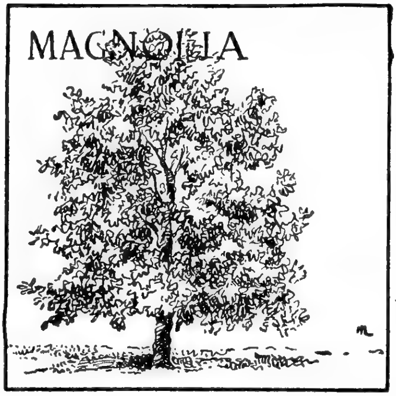
Sweet Gum.—The Sweet Gum has many points to recommend it for street planting where it is hardy, and it may well be regarded as one of the most desirable trees for this purpose east of the Appalachian Mountains from New Jersey southward. Its narrow and well-shaped top, symmetrical growth and graceful, star-shaped leaves, give it an especial beauty during the season of green foliage. With autumn the green changes with kaleidoscopic effect into red and yellow, with touches of brown and purple, lending unusual splendor to the street lined with these trees. In its winter dress of spiked balls, the Sweet Gum lacks the bareness of other trees and thus carries its ornamental effect throughout the changing seasons of the year. The soil for this tree should be rich and moist,

although its vigor enables it to adapt itself to less favorable conditions. It is difficult to transplant near the limits of its successful cultivation. In regions where the ground freezes in the winter it would best be moved only in very early spring. Its roots are particularly tender and susceptible to drying out, like Magnolias and the Tulip tree. Where practicable, it may be moved with a ball of earth; but as it does especially well on light soils near the coast, this is frequently impracticable and unnecessary.

White Ash.—Though not so much used as some other trees, the White Ash has fine possibilities as a street shade tree. Its comparatively light foliage makes it especially desirable for streets, as the open crown permits the passage of sunlight and free circulation of air. The tree develops a round, graceful top and it grows fairly rapidly. Rich soil and moisture are required, but under favorable conditions it is thrifty and hardy. It is rather subject to attacks of oyster shell scale and leopard moth. The chief drawback is its short season of foliage, being similar to the American Elm in this respect.

Green Ash.—Though of smaller growth than the White Ash, the Green Ash is much used in western cities and has a distinct place in the tree planting program of any community. It is even more hardy than the White Ash and makes a good species for narrow streets where dense shade is not wanted.

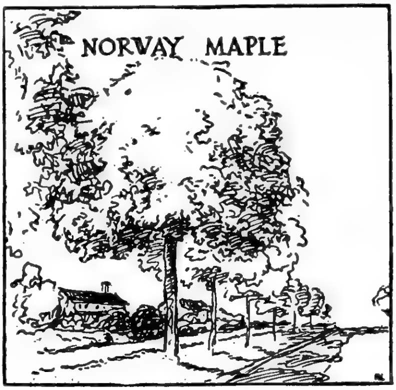
Magnolia.—A favorite tree in the South is the Great Flowered or Evergreen Magnolia. Its broad, elliptical leaves are evergreen, and to the deep green lustrous beauty of these is added the splendor of the creamy white blossoms, which grow in tropical profusion. The tree is one of the most superb growths to be found in America and is adapted for street planting where an evergreen is suitable. It is hardy from Washington to Saint Louis southward and in California and the western parts of Oregon and Washington. The soil should be rich.

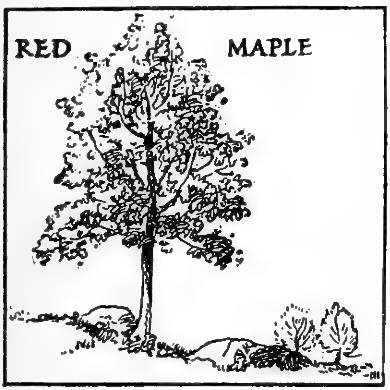


Palmetto.—The Palmetto is one of the palms native from South Carolina southward, where it can be used as a street tree, as also in southern Texas and southern California. Its massive, spreading leaves give it a richness comparable only with Palms.

Camphor Tree.—The Camphor tree thrives through most of Florida and southern California, succeeding where the orange will grow. It is much used for its shade in these regions. The tree is an evergreen with shiny leaves and does not demand rich soil.

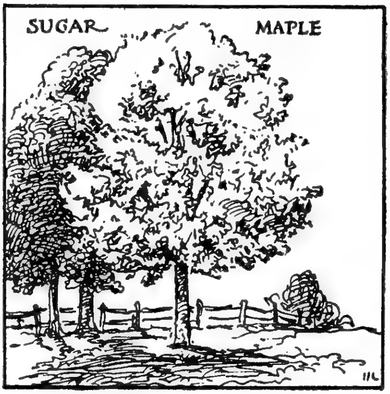
Norway Maple.—Although it has many good qualities to commend it, the Norway Maple is too dense in foliage to be desirable for street planting. Also it is naturally a low-headed tree and when the attempt is made to get the branches high, much of the beauty of the tree is destroyed. It is one of the handsomest for open lawns, and especially when grown with the lower limbs resting on the ground. It is hardy and bears transplanting admirably. It has a long season of foliage, extending from early spring to late autumn, giving beauty to a street when other Maples are bare. It is round-headed and symmetrical and readily controlled by pruning, so that if thoroughly and consistently thinned it can be maintained as an attractive tree for street purposes. Its natural outline is usually good. Its growth is fairly rapid and it adapts itself to almost any soil and environment, is not subject to serious diseases and suffers less than most species from insect attack. Its worst enemies are the tussock moth and the leopard moth, but these usually do not cause great damage. Plant lice attack it at times but it is seldom that the tree requires spraying for these. It is more resistant than the other Maples to illuminating gas in the soil.





Red Maple.—One of the recommendations for the Red Maple is its all-the-year-round beauty. Even winter does not rob it of its attractiveness, for when bare of leaves, its red twigs and branches weave a delicate tracery against sky and building, which contributes a grace and charm much to be desired.

The tree starts to blossom at the first hint of early spring and its small red flowers, followed soon by red fruits, are a delight to the eye after the winter's cold. Throughout the summer there is pleasing contrast of bright green leaves with the red stems on which they grow, while autumn brings a brilliant scarlet tinge which may well be considered the crowning glory of the year. It is sturdy and is proof against storms. Its oval head and medium size make it an excellent tree for narrow streets. It is of slow growth in its early stages, but when it is firmly rooted, its development becomes much more rapid. It thrives best in moist soil. Like the Norway Maple it is subject to few diseases and insects. It drops its foliage very early in the autumn and does not thrive under city conditions; but is excellent in the suburbs and near the ocean.



Sugar Maple.—In general appearance this tree is much like the Norway Maple, though oval-headed instead of round-headed and less dense. In streets of considerable width, with ample parking, the tree is well worth planting, but in spite of a certain hardiness it lacks the power of the Norway Maple to overcome the handicap of paved streets and congested surroundings. This tree lacks adaptability to soil conditions and requires much moisture, therefore is best used only under suburban conditions. Where the proper conditions exist, however, it is extremely attractive, because of its erect growth and symmetrical form. The autumn coloring of the foliage is particularly fine, with its riot of red, yellow and orange, though it drops its leaves early in the autumn. During the winter the tree has a beauty and grace similar to that of the Red Maple. It may be pruned into a low, spreading crown. It is more susceptible to insect attacks than the Norway and Red Maples and suffers from borers, scale and leopard moths.

Big Leaf Maple.—The Big Leaf Maple is a strikingly handsome native of Oregon, Washington and California, with normal height ranging from thirty to sixty feet, and under the best conditions reaching ninety feet. It is much used as a shade tree in the Pacific Coast states. This species requires deep, rich soil, but thrives from the Sierra Nevada Mountains to the Coast, and is one of the best for that country.

Silver Maple.—As in the case of the Carolina Poplar, the Silver Maple has been much planted because of its rapid growth. This tree is also proof against many of the hardships of city life, but it is undesirable in most of the country because of its early loss of strength and resultant decay and the damage to pavements caused by its bulging surface roots. The tree litters the street through the breaking and dropping of its brittle branches, and heavy storms often break off large limbs. When sleet storms occur, this tree is usually the first to be damaged. Damage

from insects is another fruitful source of dissatisfaction with this species. Its use should not be recommended in regions more favorable for tree growth, but from the Missouri River westward there are many places where its use is warranted.

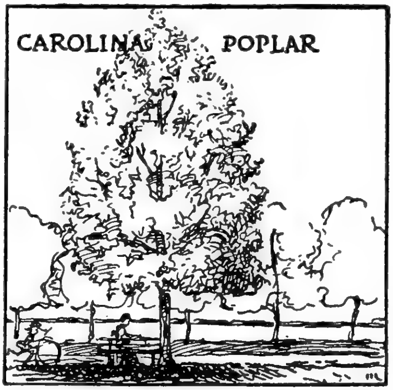
Ash-Leaved Maple (Box Elder).—Of rapid growth and thriving even against adverse conditions, this tree

is used where other trees will fail. While short-lived, with a tendency to heave and crack sidewalks and pavements, and scraggly on top, it is most desirable for planting under conditions unfavorable to other trees, and it has its distinct place in city shade tree development in the Western states. It should not be planted where other trees will thrive.

Lombardy Poplar.—The stateliness of tall growth is the distinguishing characteristic of the Lombardy

Poplar, the only member of the Poplar family which is eligible for street planting except west of the 100th meridian. Its erect trunk and narrow form, suggesting the spire of a lofty cathedral, lend themselves well to the dignified beautification of a narrow street, although little shade is produced. It is frequently disfigured by Poplar canker disease. The tree grows rapidly and its life is comparatively short.

Carolina Poplar.—Choice of the Carolina Poplar in the eastern states is chiefly influenced by its rapid growth, and this very rapidity of development carries with it one of the factors which make the choice unwise. Its rank growth involves short life, and it is necessary to remove this tree at about the time more slowly growing species would be coming into their full usefulness and beauty. The Carolina Poplar, like certain other trees, litters the street with falling flowers, seeds and leaves. After a few years of growth under humid conditions, its wood becomes brittle to



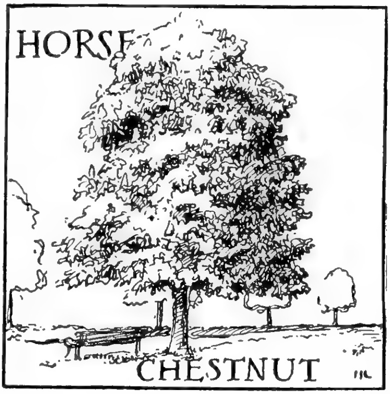
such an extent as to cause the breaking of limbs and branches, adding another source of litter. The persistent and widespreading roots of the trees penetrate sewers and drain pipes and are a frequent nuisance in this respect; while the main roots are so near the surface as to cause cracking of sidewalks and derangement of curbing. The only excusable location for the Carolina Poplar is the congested business street, where it is to be kept severely pruned into formal shape and small size, or the western half of the country. In congested streets the Ginkgo is better. Real estate operators have been liberal users of the Carolina Poplar in suburban residential allotments because of their cheapness and ease of culture, but the planting of the tree for this purpose is shortsighted and adds no permanent value to property. In the drier regions of the west, where but few trees thrive, it can be used to advantage, and under these conditions its most serious defects in regions more favorable to plant growth are overcome by the adverse conditions.

Beech.—In spite of its beauty and vigor, the Beech is not a good tree for street planting because of the difficulty of transplanting, its failure to thrive under the trying conditions to which street trees are subject both below and above ground, and the density of its foliage, which produces too heavy shade for street planting. It is, however, quite desirable for lawn and park planting. (See Chapter VIII.)

Pecan.—A tree adapted for use in the South is the Pecan, which adds shade value to its production of nuts. The tree is tall and slender, with narrow leaves of graceful type. It requires considerable room and rich soil, and is better adapted to suburban streets and country roads than to city streets. (See Chapter VIII.)

Mountain Ash.—The Mountain Ash is a beautiful and ornamental small tree, with an extreme height of thirty feet and with spread of top ranging from eight to fifteen feet. It has slender branches which grow upward, and thin foliage which produces moderate shade. In May or June it is covered with white flowers, followed by large clusters of orange red berries in autumn. This tree thrives best in cool locations and so is adapted only to the most northern states. It is not adapted to general use.

Horse Chestnut.—The Horse Chestnut is a tree with arguments for and against its use in street planting. Its springtime beauty is one of the finest things any shade tree has to offer, by virtue of the magnificent display of white flowers surmounting the large dark compound

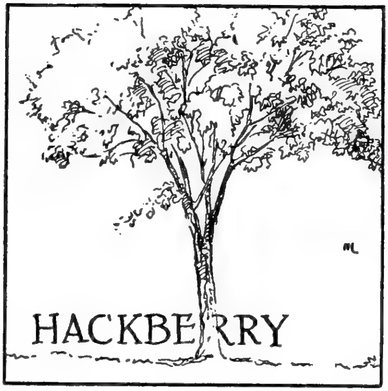


leaves over the whole of the oval top. This floral richness has caused the tree to be widely used in the streets of Paris, where the Horse Chestnut eloquently expresses the French love of beauty. The tree does not require very rich soil and is of fairly rapid growth. On the other hand its leaves drop off during the summer, due largely to a fungus trouble, leaving the tree bare during the autumn months, while the dropping of buds, flowers and nuts in the varying seasons results in much street litter. The disease that causes this dropping of the leaves can be largely controlled by spraying. The tree suffers much from insect and fungus attacks, as well as from boys trying to secure the non-edible nuts; and while its attractiveness is beyond question, this charm is fleeting, and the tree does not commend itself to general use in street planting. It is more at home on lawns and in parks or other open spaces.

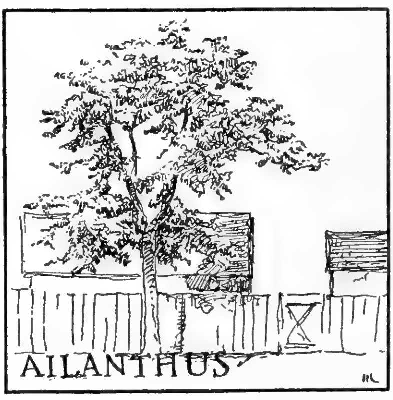
Black Locust.—The Black Locust has many fine qualities for narrow streets, but it is so subject to attacks and serious injury from boring insects that its use is not to be advised in the east. It is one of the best in the western half of the country.

The Conifers.—While highly ornamental for lawns and parks, or other open places, the Pines and kindred trees, classified as Conifers, have no place in street planting. The mere fact that they are evergreens is enough to bar them from this usage. Their winter shade is undesirable and in addition to this, they do not yield readily to pruning. Besides which, the normal shape of many of them is with branches resting on the ground, and the removal of these destroys the beauty of the tree. Moreover, they will not withstand the soot and dust and sulphur fumes prevalent in a city.

Hackberry.—Because of its ability to thrive in poor soil and in varying climates, the Hackberry has staunch friends among the planters of street shade trees, especially in the south. It is valuable in the western half of the country, but in the east it is rather ragged. In appearance, it is much like the Elm, although smaller and more erect. The tree is affected in some places by a disease called Witches' Broom.

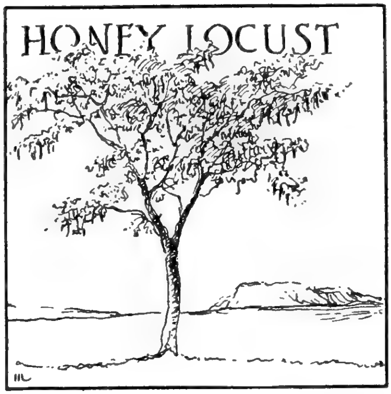


Ailanthus or Tree of Heaven.—The chief recommendation for this tree for street planting is that it will thrive where others would die. The poorest soil and the most forbidding environment seem to offer no discouragement to it. Its growth is very rapid and, in its younger years, it has attractive form, which it maintains with advancing age if not mutilated by accident or severe pruning. It is useful where other trees would not grow, especially in the heart of cities, and for this reason should have its place among trees to be considered for congested areas. The foliage is rich and heavy and produces good shade. Because



of a heavy and disagreeable odor emitted by the staminate trees, only the pistillate form should be used. These may be readily secured by grafting from proper trees or by growing them from cuttings. The city of Paris uses the Ailanthus freely in street planting.

Honey Locust.—The soft, delicate foliage of the Honey Locust gives this tree an attractiveness which entitles it to a claim on the interest of tree planters. The foliage is light and open and produces the moderate shade desirable for narrow streets. Its flowers are fragrant and rich in honey, and the thorns on the branches add to its picturesque effect. The tree is of hardy and fairly rapid growth, and not exacting as to conditions of soil and environment, standing pruning well. It is particularly useful because it thrives in the dry regions of the west. In some sections the thorns are considered an objection, and a thornless form is sometimes obtainable.



Pepper Tree.—The California Pepper tree is much used in southern California. It is a moderate-sized, broad-headed tree with fine foliage, which gives it a light, airy appearance. During the fall and winter it is covered with scarlet berries which in contrast with the persistent foliage produce a pleasing effect.

CHAPTER V.

THE PLACING OF SHADE TREES

STREET planting of shade trees must adapt itself to conditions. Appearance and the opportunity for proper growth are the determining factors in successful planting, and the community which pays closest attention to these points will find itself the town or city beautiful in the full meaning of the phrase. To ignore them will cause coming generations to wonder why so little heed was paid to the simplest rules of tree planting. Proper location with regard to the general appearance of the street or road is as important as good conditions for growth. On formal roads and city streets uniformity in species, size and shape and regularity of arrangement are essential. On country roads naturalistic planting is usually best. Haphazard selection and placing should be avoided, for with it comes a mixture that is usually undesirable and sometimes fantastic—a hodgepodge of trees which defeats the efforts at beauty and attractiveness.

Tree location covers a wide range of possibilities. The most restricted and least frequent way is growing them in large tubs or boxes. Between this and the informality of country roads or the formal planting of wide parkways or boulevards are many possibilities, and careful study of these will do much to aid in making an appropriate selection for any location.

Plans for the arrangement of trees along a street or roadway may be divided into six general classes, suited to various conditions.

(1) **The Two-row Type of Sidewalk Planting.**—A row of trees along each side of the street is so natural and

GINKGO.

so prevalent that it may be described as the normal type of street planting. It gives the ideal effect for which street shade trees have been utilized—a thoroughfare lined with welcome shade and graceful foliage. In most streets this arrangement affords the acme of decorative effect and comfort. The usual place for these is between curb and side-walk, although on narrow streets the sidewalk is sometimes next to the curb and the trees are back of it. A parking strip, separating walk from curb with a ribbon of grass, adds materially to the beauty of the street, serves to help protect pedestrians from the dust and mud of street traffic, and affords the necessary area for trees and their root development. It is a narrow street that cannot spare at least 4 feet on each side for a parking strip of this character, with its tree-planting possibilities. The best practice adopts 4 feet as a minimum width for the strip; under no circumstances should a tree be planted nearer the curb than 2 feet and, where space permits, this should be increased. A residence street width of 50 feet between the building lines suggests a roadway of not over 24 feet, sidewalks

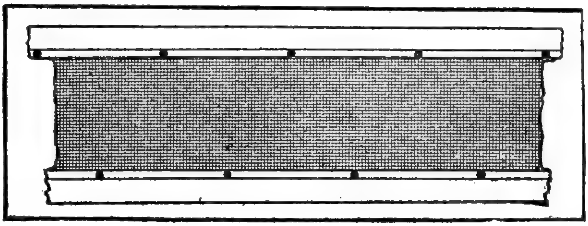
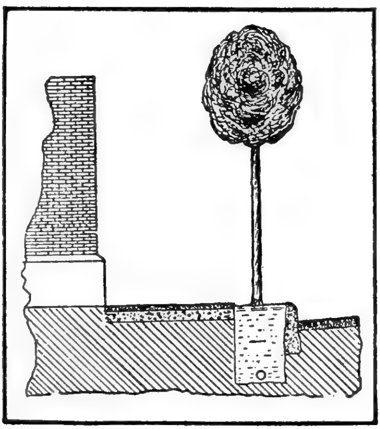


Diagram for tree planting on narrow avenue. Trees 45 feet apart and planted alternately.



Growing trees on busy thoroughfares. Types which tolerate severe pruning are planted between sidewalk and curb or in rich earth 3 to 4 feet deep.

of 4 feet each, strips of 5 feet between sidewalk and curb, and an inner strip of 4 feet between sidewalk and building line. On a 60 foot street with 26 foot roadway, there is room for 5 foot sidewalks, 6 foot outer strips and 6 foot inner strips. The 30 foot roadway of an 80 foot street may be flanked on either side by a parking strip of 10 feet, sidewalk of 7 feet width and inner strip of 8 feet; while a width of 100 feet affords room for a row of trees along either curb, with generous inner and outer parking strips, and a central parkway of 20 feet.

Where through traffic has developed on narrow streets or there are car tracks, then a larger proportion must be devoted to the traffic way than indicated above, a street 50 feet wide having a roadway possibly 30 feet wide, parking strips of 4 feet, sidewalks of 6 feet; or if the traffic would warrant, then a sidewalk of 4 feet and an inner parking strip of 2 feet. On a 60 foot street with 30 foot roadway, there is room for 5 foot sidewalks, 6 foot outer strips and 4 foot inner strips. The 40 foot roadway of an 80 foot main traffic street may be flanked on either side by parking strip of 8 feet, sidewalk of similar width and inner strip of 4 feet; while a width of 100 feet affords room for two 20 foot roadways, a row of trees along either curb, with 8 foot inner and 6 foot outer parking strips, a sidewalk 6 feet and a central parkway of 20 feet.

(2) **Two rows on each side of the street.**—This is an extension of Plan 1, for use on streets in which additional space is available. By placing a line of trees along the curb, and a second line between the sidewalk and the property line, the volume of shade and the decorative effect are increased; but the plan has its disadvantages in that overcrowding is apt to be the result unless the street is wide, the buildings are set well back and the trees are

BASSWOOD OR AMERICAN LINDEN.

planted at liberal distances apart. Because of better soil and light conditions, one row usually develops more rapidly and more vigorously than the other, producing a ragged and uneven effect. The plan is not recommended unless there is the ideal condition of abundant space. By alternating the trees, that is, putting them first on the outside of the sidewalk and then on the inside, the effect of a double row may be produced in a narrower space than where all 4 trees are placed in a straight row across the street. See diagram.

	Turf	* Tree		Tree *
		Sidewalk		
* Tree			Tree * Turf	
	Roadway			
	Turf	* Tree		Tree *
		Sidewalk		
* Tree	Turf		* Tree	

(3) **With Center and Side Planting.**—This also is an extension of Plan 1. It calls for one or two rows of trees down the center of the street, in addition to a row on each side. This type of planting is used on streets of considerable width which have no interfering car tracks. The plan involves a grass-grown or gravel covered parking strip in the center of the street, and the effect is extremely attractive. The trees in this parking strip may be in single or double line. On Pennsylvania Avenue southeast, and New York Avenue northwest, of the United States Capital, as well as streets in Jacksonville, Florida, New Orleans, Louisiana, Augusta, Georgia, and many other cities, the trees are in double line, separated by double street car tracks. This particular arrangement naturally calls for a great deal of space. Because of their width of 150 feet or more, these streets can accommodate the double

center row most satisfactorily. Including tree strips the sidewalks on Pennsylvania Avenue are 20 feet wide, and each of the two roadways 38 feet, leaving 44 feet for the parking strip.

With streets less than 150 feet wide, it is desirable to use small trees, shrubs or evergreen bushes, instead of trees, for the center planting. Fine park effects may be obtained with these.

(4) **The Center Strip.**—For narrow streets without car tracks, where the buildings restrict the admission of light, and traffic needs suggest a double roadway, a single row of trees in the center of the driveway may be advisable. An abundant supply of light and sunshine is essential to the best development of trees. To place trees along the curb of a street where sunshine is in scant supply robs the trees of their chance for proper growth. In general terms, trees cannot be at their best unless their distance from the building line is at least equal to half the height of the buildings. In some streets this cannot be achieved with trees along the side of the roadway, and the center strip offers the solution.

It may sound contradictory, but the single strip of trees in the center is used for broad thoroughfares as well as for those which are too narrow for sidewalk plantings. A street may be 100 feet in width and yet have sidewalks too narrow for trees; so narrow that to place trees along the curb would result in shutting off light and air from the buildings. By placing the trees in a central row, the decorative and shade-giving qualities are obtained, and the trees have the chance for vigorous growth which would be lacking if they were placed on the narrow sidewalks. Two central rows, of course, are better than one and should be planted where space and traffic conditions permit.

RED OAK.

(5) **The Potted Type.**—This is for streets where brick or stone paving monopolizes the space and makes natural tree growth and development impossible. It is extremely formal, and can be used for narrow streets lined with handsome buildings, or for a paved plaza or thoroughfare largely devoted to vehicular traffic, as in the case of the Park Avenue approach to the Grand Central Terminal in New York; sidewalks and street pavements cover all surface, leaving no place in which the usual street trees would have a chance to live. By planting small trees in tubs or boxes and placing these containers on the sidewalk or in the center of the driveway, these man-made obstacles may be overcome. They are similarly used in some of the streets of Paris, notably the Rue de Rivoli. The effect may be strikingly pleasing and highly desirable when ordinary tree planting is not possible, due to neglect to provide proper conditions in the original development, or to the necessity of meeting exceptional features in design. It is possible by this means to use different trees for succeeding seasons; but, on the other hand, much greater care is required to maintain them than to maintain trees planted in openings in the paving, and thus the expense is very greatly increased.

(6) **The Informal Type.**—On country roads, especially in a rolling or a hilly country, or on secondary highways, the formality of trees in straight lines, at regular distances apart, and of uniform size and appearance is inappropriate, as well as being tiresome to those who may find it necessary to travel along such roads. In contrast to such arrangement, trees of many species may be scattered at irregular intervals along the roadside, but selected and arranged in such manner as to accentuate the natural beauties of the country through which the road passes. Such informal planting needs equally as much thought

and planning as to species and location as does the more formal planting of city streets.

The placing of the rows of trees on a street is dependent on the width of street and the character of its use. The spacing of the trees in the rows, however, is dependent primarily on the species to be used, as well as on the distance between rows and the closeness with which buildings have approached or are likely to approach the trees. Large growing trees should be placed from 60 to 80 feet apart, although the practice in many places is to plant them as close together as 30 to 35 feet. Smaller trees should be planted more closely. When the distance between the rows of trees is greater than three-fourths of the proper distance between specimens, then the trees may properly be planted opposite one another; but when rows are closer together than that, then the trees had better be staggered, that is, the trees on one side of the street should be planted opposite the middle of the space between the trees on the other side. On narrow residence streets, with liberal lawns in front of the houses, large trees may sometimes be used by increasing the distance between the trees in the row, so that the distance to the nearest tree on the other side of the street is as great as that to the nearest tree on the same side of the street would be, if the trees were planted a normal distance apart.

To be successful, tree spacing must ignore lot lines and lot ownership, the trees being placed at the proper distances apart for the effect of the street as a whole, irrespective of whether or not a tree comes in front of every lot. This sometimes causes dissatisfaction, but it is essential to success. If the idea that tree planting is a community function for community benefit, in the same way as street paving or sewers, can be impressed on the owners in contrast to the idea of individual ownership

HORSE CHESTNUT.

in the nearby trees, dissatisfaction is less likely to appear.

The distance between trees often has to be slightly modified, in order that they may be properly placed with respect to intersecting streets. It is desirable to avoid placing trees directly on a corner though they may often come within ten feet of a corner without being objectionable. By slightly crowding or stretching the distance between the trees in the middle of the block, adjustments may often be made that will produce more pleasing results at the corners, without materially modifying the effect between.

CHAPTER VI.

SHADE TREE PLANTING

PREPARATIONS for planting shade trees begin with choosing the actual specimen from nursery stock and continue until the digging of the hole into which the tree is to be set. Each part of this program calls for the exercise of care, but there is no mystery about any feature of it. The one thing to be borne in mind is that each step is important. Nothing should be neglected and nothing left to chance or even to guesswork. Correct planting is half the battle.

In the sense of establishing shade trees in city streets, planting necessarily means transplanting. To undertake to raise a tree from its beginning is a needless expenditure of time and effort. Trees of suitable size may be had of nurserymen at slight cost and with a saving of several years in the time required for development. It is possible, when technical knowledge is at hand, to satisfactorily transplant trees taken from the woods, but these are less likely to withstand the shock of moving than those which have been raised in nurseries, as the nursery trees, if well grown, have been replanted or root pruned every year or two, and have by this means been forced to form a compact root system that is not too large for the limited area of street environment. Forest trees, with their longer roots and fewer fibrous roots near the trunk, are more difficult to transplant and have less certainty of living than well selected nursery stock. The pruning of the top, undergone by the nursery tree, is also an important factor, as this frees the tree from branches for a height of several feet and likewise helps to bring about the devel-

EUROPEAN LINDEN.

opment of the crown in the way best suited for shade and ornament.

In choosing nursery stock, when the city does not have its own nursery, the first consideration is the selection of the nursery itself. Strict care must be given to confining purchases to one of known reliability and responsibility. Trees from other sources are apt to be defective and improperly developed and trained. The cost of the specimen is of such small significance, that an attempt to economize by seeking trees commended by nothing but lowness of price, is mistaken thrift, and almost certain to prove expensive in the long run.

The importance of dealing with a nurseryman of high repute is obvious. This dealer regards every tree with jealous eye because of its value in contributing to his prestige as a nurseryman. He is no more willing than the customer to have his trees prove defective and unsatisfactory. In addition, he will give valuable advice in the selection of individual specimens and in their planting and care. It is to his interest to do all this, and to aid the tree planter in every possible way, for every tree successfully planted does its share toward stimulating the industry of which his nursery is a part.

Choose a tree that is in healthy condition and as nearly as possible perfect in shape. The nurseryman who tries to sell a deformed or misshapen tree is a good man to avoid in making purchases, for his effort in this direction may be taken as fairly good evidence that other things are wrong with his stock. Be sure to insist on a properly trained root system. The trees best suited for transplanting into street environment are those in which the roots have been pruned into compact form, to fit them for life in a ground area restricted by paving, sidewalks, curbs and underground pipe and conduit construction. This requires root systems that are compact and vigorous, and as large as can be accommodated by the particular site. The greater and more vigorous the root system, within small area, the more rapid will be the growth and development of the tree in its new home.

A well developed top is also desirable in the tree to be transplanted, but it should not be too large for the roots, as this inequality will result in weak growth, and may even cause the tree to die soon after removal.

The stem should be straight and the branches should be from 7 to 9 feet from the ground. In size the stem should be from 2 to 3 inches in diameter. Trees of this size bear transplanting better than those which are larger. Successful removal may be given trees even 12 inches in diameter, but the expense increases very materially with the greater size. This increased cost is primarily due to the long period of nursery care required in bringing it to the larger development, and even more to the expense of removal and subsequent care. For general street purposes a maximum of 3 inches has been found by far the most satisfactory.

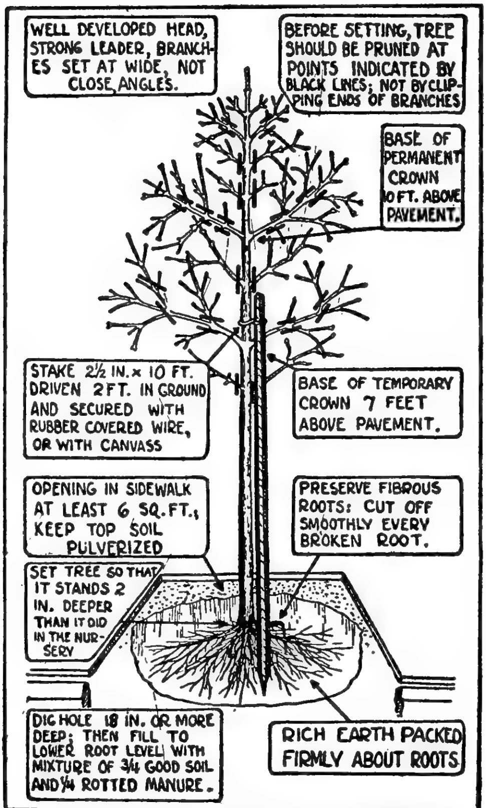
Whenever possible, tree purchases should be made at a nursery near the place at which the tree is to be planted, as this involves no change of climate, and further, a short shipping distance is desirable. The more brief the time in transit, the less danger there is of injury to the tree by exposure of the roots. It is important to replant a tree as promptly as possible after it has been removed from its original location. If necessary, however, to make long shipment the tree may be fully protected against damage by careful handling at the source. This is another argument in support of dealing with nurserymen of the highest standing, for this type of dealer will be unwilling to risk his reputation by careless and inefficient packing and shipping.

SWEET GUM.

In digging a tree for transplanting the entire root system should be taken up, with particular attention to the small roots, for it is through these fine rootlets that the tree secures its nourishment from the soil. The one thing most essential is to keep the roots moist during the journey. A root that is allowed to dry out loses its vitality and becomes worthless.

Sometimes it is necessary to transplant trees of larger diameter than three inches, as in the case of replacing a tree where its companions are of considerable size. This can be done by digging the specimen with a large ball of earth about the roots. This earth serves to hold the moisture and also protects the roots from injury in handling, but of even more importance it keeps the roots in close contact with the soil so that growth can be continued without the tree having to reestablish its growing connection by sending out new rootlets. In many cities municipal nurseries are maintained and trees of various size are available for replacing those which die. This is one of the important functions of a nursery maintained by the city, as it is desirable, of course, that the new tree should be, as nearly as possible, of uniform size with the other trees on the street. A municipal nursery prepares these trees for transplanting by a process of checking the spread of roots as the trees grow. To accomplish this the trees are root pruned at least every two years. In the case of the larger trees, a trench is dug around, which results in forcing the roots to develop compactly, so that the specimen may be planted in the restricted area of street surroundings without trimming the roots at the time of moving.

The tree planter's responsibility begins with the arrival of the tree from the nursery, and he should use care to see that the precautions taken by the shipper are not nullified by careless methods of handling in the process of planting. His chief duty is to see that the roots continue well protected against injury and against loss of moisture through exposure to sun or wind, that the soil is properly prepared and that the simple rules of correct planting are followed. The first of these rules is to have the hole ready for the tree upon arrival. Sometimes this can not be done, and in such case the tree should be "heeled in" as soon as it is received. The "heeling in" process consists of merely placing a tree or trees in a temporary hole or ditch from 1½ to 2 feet in depth and with sufficient width to accommodate the roots without doubling them up. Trees thus placed and with the roots thoroughly and closely covered with soil, will retain their vigor for a month or more, and be ready for planting when needed.



OBSERVE THESE INSTRUCTIONS IN PLANTING

The planting hole should be a trifle larger than the root area of the tree. This makes it possible to give the roots full space without bending them. The hole should be about a foot deeper than the roots themselves, and since

WILLOW.

the depth of planting should be as nearly as possible the same as the depth to which the tree grew in the nursery, a layer of soil, rich in plant food, should be placed at the bottom of the hole. This regulates the depth of planting and gives a fine, mellow soil condition which is important to growth. The depth of planting may be easily determined by noting the mark of the soil around the trunk or stem, indicating the surface line before moving.

In planting along city streets it is often necessary to provide richer soil than that which is at hand. Earth with good growing qualities may be procured in the vicinity of any city or town and the slight additional trouble involved in this step will be more than repaid by the results. City soil is seldom of a character that encourages vegetation. The ideal soil is a light sandy loam, smooth in texture and so porous as to encourage the passage of air and moisture for feeding the roots. Clay soil packs tightly and prevents this free circulation, while too much sand is undesirable in that it does not hold moisture. The most satisfactory soil carries about seven-tenths sand, two-tenths clay and one-tenth decayed vegetable matter or thoroughly rotted manure. Fresh manure should never be used. A compost heap furnishes good material in the form of decayed manure mixed with fine soil. This heap should be prepared a year in advance, and the alternate layers of earth and manure spaded and turned occasionally to effect thorough mixing. In providing new soil the amount required will be from 2 to 3 cubic yards, to give the roots ample nourishment.

Careful attention should be given to pruning before planting. This applies to roots which may have suffered injury in the process of digging or in moving, and it also applies, in a very important measure, to the removal of a considerable portion of the tree's top. (See Chap. xv)

Cloudy days are best for planting. Strong sunlight or wind is harmful in that it causes rapid drying out of the roots. The tree should be placed without delay in the waiting hole prepared with its own earth or with the earth and compost brought from elsewhere.

The tree should be set into the hole with roots spreading naturally, and not crossed nor folded. If any roots are broken or seriously damaged, they should be cut off with a clean cut to provide a good surface from which new roots may start. In filling the hole, finely pulverized earth should be worked in by hand or a small ramming stick, so that it completely occupies all the space around the roots and under them. Enough pressure should be applied in this process to cause the earth to surround the roots firmly and compactly. To this end it is essential to use only moderately moist earth. Wet earth is injurious, as it will pack and become brick-like on drying and so impenetrable to the young rootlets, unless it is extremely sandy. Firmly embedded roots are necessary to enable the tree to hold its position and not work loose. The filling and compacting should be continued to a point 2 or 3 inches below the level of the ground. If watering is done, it should be at this point, and it should be done so thoroughly that the moisture will reach the entire root system. In humid regions it is not usual to water at transplanting, if deciduous trees not over 4 or 5 inches in diameter are transplanted while dormant. In time of drouth in dry countries, for large or evergreen trees, or for trees that have started to push their foliage, watering is frequently necessary. Tamping or compacting of the soil after wetting will be injurious. As a final step in planting, a layer of pulverized earth should be placed over the compacted or wet soil and left loose, to facilitate air and water circulation. When trees

CATALPA.

are received in bad condition or for other special reason, they are sometimes planted by puddling, that is, the tree is placed in the hole, some loose earth is thrown in about the roots, the hole is partially filled with water and more earth is thrown in the water. The tree is planted by moving it up and down in this mud until there is no question but the roots are all surrounded by it, and then more soil is shoveled in, until the mud is crowded over the rim of the hole. In this method there must be absolutely no compacting of the soil by tamping of any sort or the result will be a brick in which the tree cannot grow. This does not apply to real sandy soil. It is important, of course, that the tree should be in an upright position. It is desirable that a stake be driven into the earth alongside the tree, and tied to it to hold the tree from swaying, until its roots have taken firm hold.

It must be borne in mind that the mere digging of a hole is not all that is involved in preparing the tree's new home. The location of this hole is as important as the selection of the tree itself. If the planting is in a grass strip, the problem of location is simplified, as it then becomes merely a matter of dividing the space between sidewalk and curb in such way as to best accommodate roots. If traffic conditions and limitations of space require that the sidewalk extend all the way to the curb, it becomes necessary to provide a free area for the tree. Twelve square feet should be taken as a minimum for the unpaved area. In some cities the smallest area permissible is prescribed by ordinance or regulation. The city of Washington recognizes the importance of this free space by providing that the openings shall be 3 by 8 feet in size, thus establishing 24 square feet as the official requirement. Without adequate opening, the tree will be choked to death by the solid sidewalk, which permits the entry of neither air nor moisture.

In some streets the entire sidewalk surface is needed for traffic, and this makes it impossible to sacrifice the space that is required. In a case of this kind, a sidewalk grating may be employed, permitting pedestrians to use the sidewalk up to the very base of the tree and still providing breathing room for the tree itself. This grating is level with the surface of the sidewalk, and the ground underneath slopes away from the tree, forming a pit or basin, which collects water, and is therefore useful in supplying moisture to the roots. The grating is so set as to be easily removed for cleaning the space underneath. In dense traffic the grating is essential, but where it is possible to provide a space free from paving, without the use of the grating, this should be done in the interest of the tree's best development.

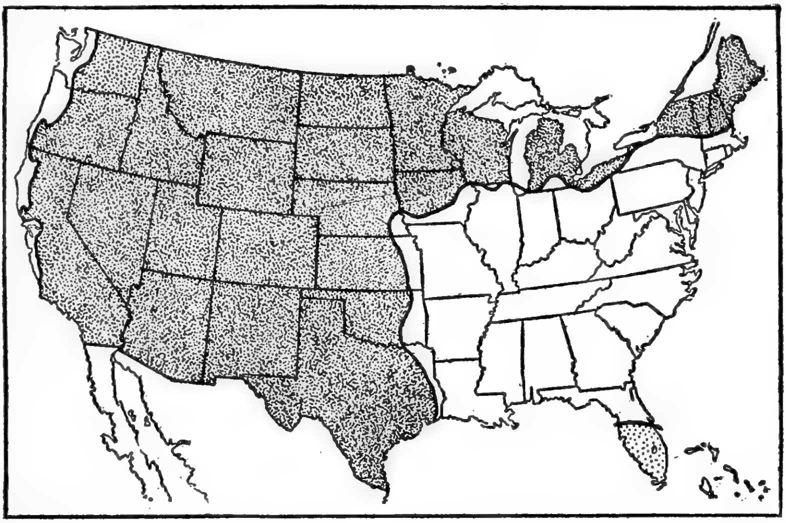
Irrigation and drainage are essential to the life of the tree. The ideal means of providing water is by having the tree so placed that the soil surrounding the roots may be loosened from time to time, in order that surface watering may penetrate the earth and reach the roots in abundant supply. This is possible where trees are planted in space free from paving, such as a strip of gravel or grass between sidewalk and curb. If a grating is used, it should be taken up occasionally and the soil underneath made loose by cultivating. One of the most important features of the grating is that it allows this cultivation, in addition to preventing the traffic from packing the surface, as would occur if foot-traffic were allowed to use the space immediately surrounding a tree without the protection afforded by the grating.

If the natural drainage fails to prevent water from collecting at the roots, artificial drainage may be supplied by using tile drains, 3 or 4 feet below the surface, to carry surplus water to the nearest sewer. This is

SYCAMORE.

necessary only in the case of solid soil, which holds water and keeps the roots in constant state of excess moisture. Roots kept too moist are deprived of air, and this is a serious handicap which is apt to result in the death of the tree.

Deciduous trees may be planted at any time after the leaves begin to drop in the fall, and before growth has



In the white areas trees may be planted in the spring or fall. In the dark areas spring planting is best. In southern Florida plant whenever moisture conditions are favorable.

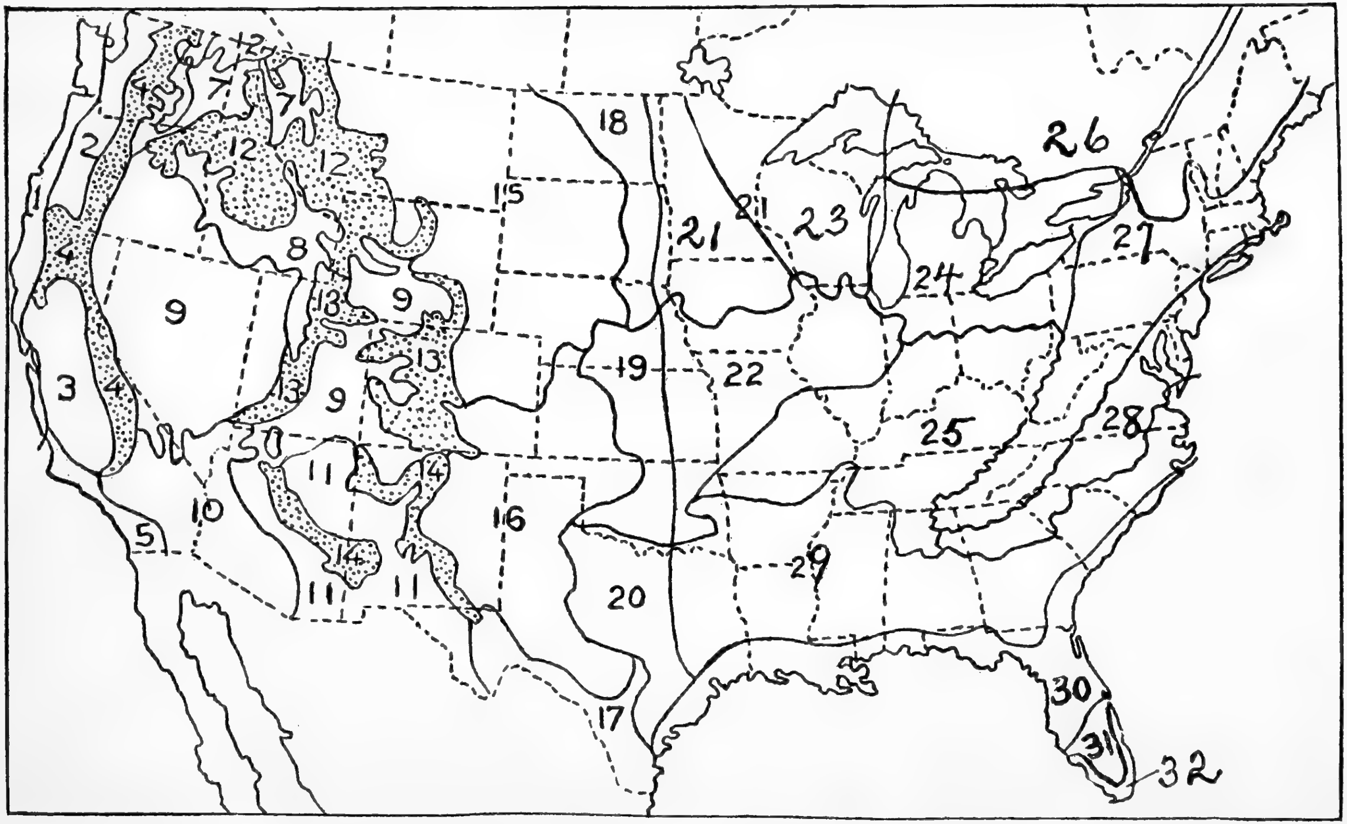
developed very far in the spring, even when the ground is frozen, if the bottom and sides of the hole are not frozen and there is available an abundance of unfrozen, sufficiently dry earth to place about the roots and nearly fill the hole. For best results, however, many experienced planters prefer the spring season, as being the time when all vegetation starts growing, although in the eastern third of the United States, except the coldest parts, a fall planted tree will be a half year ahead of a tree planted at a corresponding time in the spring planting season. Careful observation has shown that trees planted in the autumn, under trying conditions, make slower progress than trees of the same character planted early the following spring. In mild climates, this is not a factor, and fall planting is followed by good results. Except in climates where the ground does not freeze in winter, a few kinds of trees like Magnolias, Tulip and Sweet Gum should be transplanted only in spring. Evergreens should be planted when the ground is warm. It is usually done in late spring or early autumn.

THE FOLLOWING MAP AND TABLES SHOW TREES SUITABLE FOR PLANTING IN DIFFERENT AREAS

The map and tables should be consulted in selecting trees, and determining their suitability for different regions. The numbers on the map show regions indicated by similar numbers in the tables.

KEY TO CHARACTERS IN TABLES

Numbers 1 to 32 in tables indicate the regions marked by number on the map.
S—Trees most desirable for street and roadside planting in regions numbered.
s—Trees less desirable but will grow.
R—Trees suited for country roads but not for city streets.
a—Trees suited only for southern parts of regions numbered.
b—Trees which require watering for a few years.
c—Trees worth trying although their adaptability is uncertain.
d—Trees suited only to northern part of region numbered.
n—Trees that are undesirable.


1
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	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Acacia, Australian blackwood	a		S		S																											
Black wattle	a		S		S																											
Green wattle	a		S		S																											
Silver wattle	a		S		S																											
Ailanthus	S	S	S	S	S	S	S	S	S			S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S		
Ash, White	S	S	S	S	S																S	S	S	S	S	S	S	S	S	S		
Green						S	S	S	S	S	S	S	S	S	S	S	S	S	S	S												
European	S	S	S	S		S																										
Camphor			S		S					S																				a	S	S
China berry	S		S		S					S	S						S			S									S	S	S	
Texas umbrella	S		S		S					S	S						S			S									S	S	S	
Elm, American	S	S	b	S	b	S	S	b	b			S	S	S	b	b	b	S	S	S	S	S	S	S	S	S	S	S	S	S	S	
English	S	S	S		S																			S	S		S	S	S			
Huntington	S	S	S	S																												
Wahoo or winged																													S	S	S	
Eucalyptus, Blue gum	a		R		R																											
Desert gum			R		R					R																						
Manna gum	a		R		R																											
Red gum	a		R		R					R																						
Sugar gum					R					R																						
Ginkgo	S																	S	S	S	S	S	S	S	S		S	S	S	S	S	
Hackberry, Common	s	s				s	S	S	S			S	S	S	S	S		S	S	S	S	S	S	s	s		s	s	s	s		
Mississippi											S						S			S									s	S	S	
Pecan																				R					R			R	R	R		
Honey locust	S	S	S		S				S	c	S	S	S	S	S	S		S	S	S	S	S	S	S	S		S	S	S			
Horse chestnut	S	S	S																					S	S		S					
Buckeye	s	s	s																			s		s	s		s					
Linden, Basswood	S	S	S	S		S	S					c	c	c	c	S		S	S	S	S	S	S	S	S		S	S	S			
European	S	S	S	S														S	S	S	S	S	S	S			S	S	S			
Locust, black	S	S				S	S	S	S	c	S	S	S	S	S	S	S	S	S	S	s	s	s	s	s		s	s	s			
Magnolia	S	S	S			S																						S	S	S	S	S
Maple, Ash leaved	n	n	n	n	s	n	s	s	s	s	s	s	s	s	s	s	s	n	n	n	n	n	n	n	n	n	n	n	n			
English	S	S	S	S		S																										
Norway	S	S	S	S														S	S	S	S	S	S	S	S	S	S	S	S			
Broad leaved	S	S	S			S																										

Red															S	S		S	S	S	S	S	S	S	S	S	S	S	S	S		
Silver	s	s	s	s		s	s	S	S		S	s	s	s	S	S		S	S	S	s	s	s	s	s	s	s	s	s	s		
Sugar	S	S	d																c		S	S	S	S	S	S	S	S				
Sycamore	S	S	S	S																				s	s		s	s				
Oaks, California live	a		S		S																											
Chestnut												c	c	c				S			S	S	S	S	S	S	S	S				
Darlington																													S	S	S	
Laurel																									a			a	S	S	S	
Live																													a	S	S	S
Bur or mossycup												c	c	c	c	c	c	S	S	S	c	c	c	c	c	c	c	c	c			
Pin	S	S	S	S														S	S	S	S	S	S	S	S	S	S	S	S			
Red	S	S	s	S		S	S	c	c			c	c	c	c	c		S	S	S	S	S	S	S	S	S	S	S	S			
Scarlet	S	S																			S	S	S	S	S		S	S				
Swamp Spanish																									S			S	S			
Valley			S		S																											
Water																												n	n			
Willow																												a	S	S	S	
Palms, Palmetto-Carolina			S		S					c							c													S	S	S
Palmetto-Texas			S		S					S							S													S	S	S
Palmetto-Victoria			S		S					S							S													S	S	S
Washington	a		S		S																									S	S	S
Windmill	a				S																									S		
Guadeloupe Island					S																											
California blue palm			S		S					S							S			a												
Canary Island date			S		S					S																				S	S	S
Fine date			s		s					s																						
Cocoa-nut																																S
Cocos plumosa					S																											
Royal palms																																S
Pepper	a		S		S																											
Poplars, Cottonwood	s	S	S	s	S	S	S	S	S	S	S	S	S	S	S	S	S	s	s	s	s	s	s	s	s	s	s	s	s	s	s	
Carolina	s	S	S	s	S	S	S	S	S	S	S	S	S	S	S	S	S	s	s	s	s	s	s	s	s	s	s	s	s	s	s	
Lombardy	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	
Rubber			S		S																										S	S
Silk Oak			S		S					S																					S	S
Sweet Gum	S	S			c																							S	S	S	S	
Sycamore, California	S	S	S	S	S																											
Common	S	S	S	S	S	S	S	c	c	c	c	c	c	c	c	c	c	S	S	S	S	S	c	S	S		S	S	S	S		
London plane	S	S	S	S	S				c	c	c					c	c					S		S	S		S	S	S	S		
Tulip	S	S				S																			S		S	S	S			
Walnut, Black																					R	R	R	R	R		R	R				
California	R	R	R	R	R																											
English	R	R	R		R																				R			R	R			

CHAPTER VII.

ROADSIDE PLANTING OF TREES

DWELLERS in towns and cities have no monopoly of the duty to plant shade trees. Rural communities also have a responsibility in this respect—a responsibility no less urgent than that of people living in centers of population. Shade is necessary on country roads as well as on city streets. Man's gifts from the trees in beauty and in health are as valuable to the owner of farming property as to him whose residence is on a city thoroughfare.

Trees are at home in the country. In regions uncrowded by the habitations of man they have room to attain their fullest growth and development, thereby lending picturesqueness and charm to the countryside. The rural district which is lacking in trees is as desolate as the town or city likewise unblessed. It should be a matter of pride for the dweller in rural regions to do all he can to prove that the city man has none the better of him in appreciation of shade trees and in growing them successfully.

The success of the American farmer in raising the crops that feed the nation and a large part of the outer world shows where he stands in ability to produce; and, as for appreciation of beauty, we have every reason to know that this is confined to no class nor environment.

If the rural dwellers of America have failed to make the most of their opportunities in the planting of shade trees, it must be granted that the reason is the same that exists as to the people in our towns and cities—a lack of stimulus. The interest now current in roadside tree planting is giving the stimulus that was needed, and there is good ground for confidence that the result will be a

A ROADSIDE LINED WITH LOMBARDY POPLARS.

countryside revealing itself in a new glory of shade tree riches.

Roadside planting is one of the most important phases of shade tree development. The highways of America are the great arteries of the nation. With the universal use of the automobile, this is true in a sense previously undreamed. The value of the tree-lined country thoroughfare to the adjacent property is as direct as that of the shaded street in town or city. The charm of the trees will attract where the barren roadside would repel. There are roads in New Jersey, New York, Connecticut and elsewhere, for the enjoyment of which tourists will go many miles out of their way, to the increased prosperity of the surrounding neighborhoods. Thousands of permanent residents have been attracted to Pasadena, San Mateo, and other places in California, to some of the famous resorts of Florida and the Carolinas, and to summer places in New England, Michigan and Wisconsin, by the lure of shade tree splendor. Costly homes and extensive improvements have been established along the inviting highways in and near these communities, with the inevitable result that all property values have been increased to an amazing extent; and largely because the charm of the trees proved irresistible to visitors from other places.

Every community may not be suited for a resort, but none can afford to overlook the value of shade trees. The highway without trees is merely a means to an end. It is used simply because it leads somewhere. The road which has its lines of stately trees carries a charm peculiarly its own, and is sought because of its beauty and attractiveness. Many communities have already awakened to this truth, and have shown a determination to let no other community outdo them in offering the shade tree invitation to the world-at-large to come and enjoy the beauties and the restfulness of their highways. Such development cannot fail to be attended by an increase in property values, and it has an additional value through the greater comfort and enjoyment afforded the residents of a neighborhood by the conversion of plain and unlovely country roads into driveways of impressive charm and loveliness.

The range of varieties for country roads is greater than for city streets, as many trees that do not flourish under city conditions will attain magnificent growth in the better conditions of the country. Points to be considered in selecting trees for the country thoroughfare are beauty, shade and hardiness. Lack of facilities for artificial watering makes it desirable to select trees which thrive under the local conditions.

The Oaks and the Red Maple are good examples of desirable roadside trees, combining abundant shade with graceful dignity and beauty. They have the qualities of strength and hardiness which are sought for in trees for this purpose. The Sycamore is another species which meets the requirements. In the Oak family fine representatives for the country roadside are the Red, Pin, Scarlet and White Oaks for the North—Live, Willow and Laurel Oaks for the South, the Mossy Cup Oak for the prairies, the Valley Oak for California and the Red, Pin and English Oaks for the western parts of Oregon and Washington. In more than half the United States the stately American Elm lends a picturesque magnificence to the landscape and transforms a road into a splendid avenue which cannot fail to command the admiration of the traveler. In the northeast the Lindens and White Ash are well suited for roadside shade trees, and the Ginkgo, Tulip, Aspen, Yellow Birch and Beech will

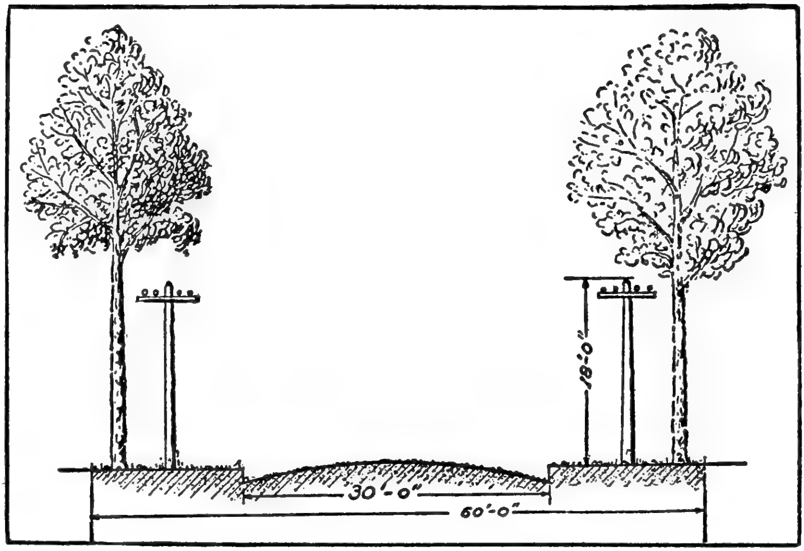
SUGAR MAPLE FOREST FORM.

likewise be found extremely satisfactory. For the South, additional desirable trees are the Sweet Gum, Umbrella or Cucumber tree, Tulip, Ginkgo and Evergreen Magnolia, and in California the Eucalyptus, the California Walnuts and large leaved Maple on all the Pacific Slope, and the Camphor, Silk Oak and Pepper trees for southern California.

On stretches of road where trees are meant to provide shelter from wind and storm as well as to furnish shade, it is well to use types of trees which adapt themselves to what is known as a windbreak. This purpose is effectively served in the East by such evergreens as the Spruce, Balsam, Cedar and Arbor Vitæ, and in less degree by deciduous trees, while in the West only deciduous trees are available except in California, where the Eucalyptus is the most important for this purpose.

In roadside planting, trees should be in rows, following the alignment of the boundary fences or property lines on some straight roads, but irregularly placed on winding roads. When in straight lines, uniform spacing is important, and there should also be uniformity as to species, size and shape in order to secure the most satisfactory landscape effect. As to spacing, a distance of at least 80 feet between trees should be allowed, to give room for proper development and to prevent such density of shade as will hamper the growth of crops near at hand, and interfere with the view from the roadway. In providing windbreaks, it is desirable, of course, to have the trees much closer, and often more than one row on each side is desirable.

Shrubs, too, have their place in roadside ornamentation, and their use should be encouraged. Whether in groups of their own or used with trees, they greatly enrich the landscape. In some spots, where trees cannot be



How to plant roadside trees where there are telephone and telegraph poles.

placed to advantage, shrubs will produce highly ornamental effects. Species native to the neighborhood are desirable, because of demonstrated suitability to climatic and soil conditions. A dwarf-growing tree of shrub-like characteristics which is much used for ornamental driveways is the Hawthorn or Thornapple. The boulevard in Genesee Valley Park, at Rochester, has been planted with this variety for a stretch of two and one-half miles. When in bloom the Hawthorn is a plant of rare beauty and later in the season, it has the charm of a profusion of large, red fruit and dense dark green foliage.

The location of the rows of trees along a roadway must necessarily be determined by local conditions. Regard must be had for telephone or telegraph lines and the trees should be located in a way that will result in the smallest possible interference from wires and poles. A 60 foot roadway may be advantageously subdivided into a 30 foot drive, with 15 feet on either side for the accommodation of trees and pole construction. This makes it possible to place the poles near the roadway and the trees along the property line, a plan which has been found effective in Kansas and other states which have given close attention to roadside planting.

CHAPTER VIII.

NUT TREES FOR ROADSIDE PLANTING

FOR roadside planting many of the best authorities urge the use of nut trees, as combining the elements of shade tree beauty with those of crop-producing utility. They argue that for size, attractiveness and purely ornamental effect some members of the nut group are among the most desirable of American trees, and that they excel most other trees of hardwood timber value in rapid growth, length of life and resistance to insects and diseases.

With this blend of the artistic and the practical, the advocates of this type of planting are constantly gaining new followers, and the growing of nut trees along the highways is steadily becoming more frequent.

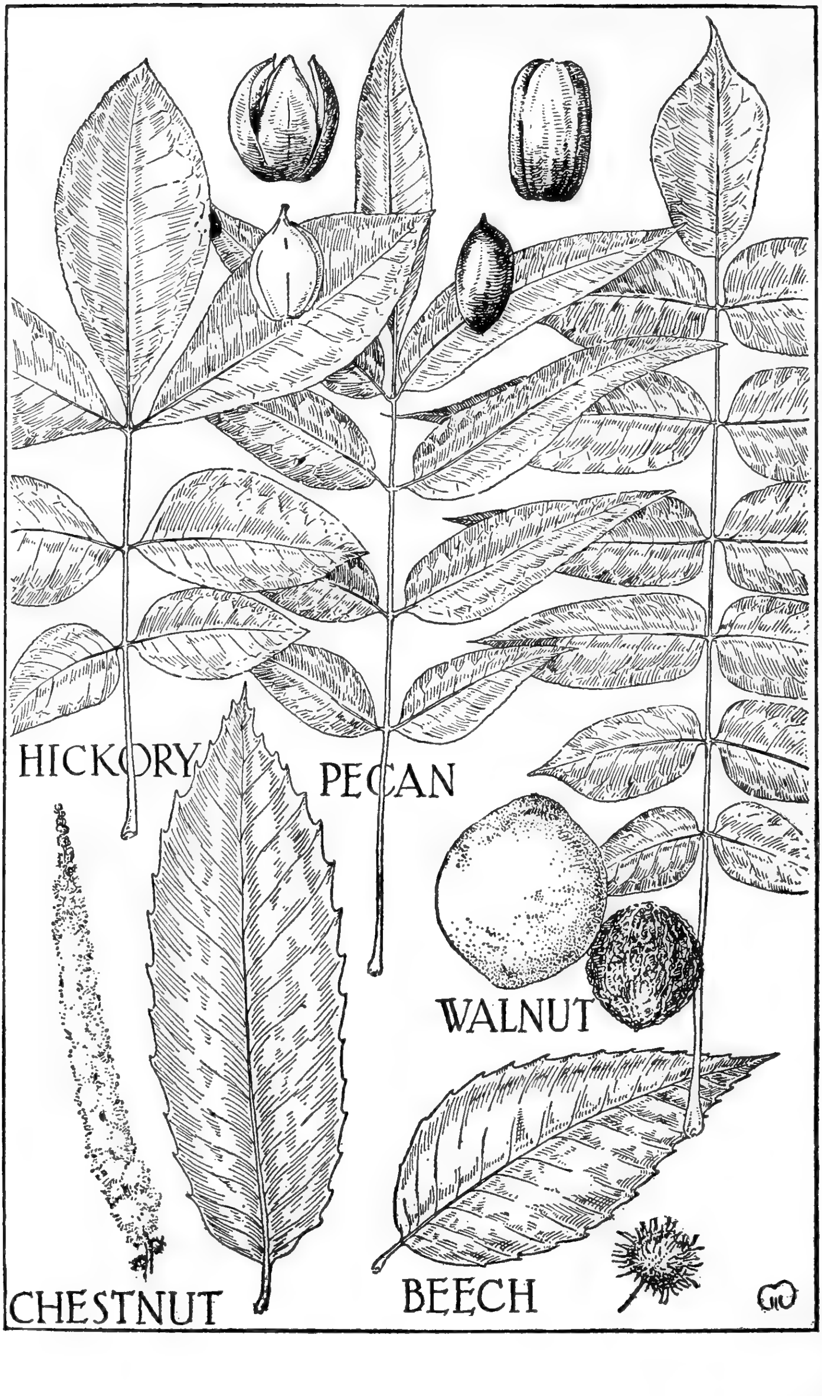
Perhaps the first objection offered when this type is suggested is the likelihood of raids on the nut crop by people passing along the highway. The simplest reply is, even in the event of complete loss of the crop, the property owner is as well off as he would have been with non-producing species. His highway has had the benefit of the shade, the landscape has had the added beauty and picturesqueness provided by magnificent trees, and his farm has the increased value that comes from these advantages. To carry the reply still farther, it may be pointed out that complete loss is neither necessary nor probable. In support of this the experience of nut and fruit growers in various parts of the country may be cited.

In California, the Pacific Northwest, Michigan, and many other sections we find orange groves, or almond and walnut groves, apple or peach orchards, and extensive vineyards coming close to the highways, and more than

SHAG BARK HICKORY.

half the time with no fence or other protection against raiders from the outside. For all practical purposes, this amounts to roadside planting. It is true that in some parts of California the stealing from groves and orchards near the highway has become so serious that stringent protective laws have had to be enacted. It is equally true, however, that with or without the protection of fences, wherever this sort of thieving occurs it is fairly certain to extend into the orchards as well as along the immediate borders of the highways. It must be conceded, of course, that fruit or nuts grown outside a fence are more tempting than those inside, and that a certain amount of stealing from highway trees in excess of that which occurs on private land must be expected and taken into consideration. Experience in New York has shown that roadside fruit trees have invited pilfering that extended well into the orchards and upon the removal of the roadside trees there was no further trouble, even though there was no change in the fence. Fruit and nut trees are also liable to mutilation by the would-be gatherers especially as the tendency is to attempt to get the crop before it is mature. On the other hand, it must be remembered that experience shows that the harvest of nuts from roadside trees is clear gain, as compared with the non-producers, and that the yield makes it worth while to undertake the growing and protection of trees of the nut group if the owner can be indifferent to the mutilation of the trees.

In some European countries nut and fruit trees along the roads are sources of material profit. These trees are owned by the public, and the sentiment of the community has been sufficient to protect the crops against marauders. Even though we may assume the lack of any well developed protective sentiment in this country, the civil authorities can easily provide regulations which will


HICKORY
PECAN
WALNUT
CHESTNUT
BEECH

inflict penalties for raids on the product of roadside nut trees. If the trees are planted and owned by the tax-payers, such regulations will be the more readily enforced; but, even in the case of private ownership, it should not be difficult to afford protection which will assure the property owner at least a reasonable proportion of the harvest.

The planting of nut trees is of itself comparatively new in this country. Until within the last ten years, except in the regions where commercial nut raising had become established, the individual's proposal to plant trees for the raising of nuts was usually met by scornful comment. One nut tree planter, in planting an orchard of nut trees on his farm near Washington some years ago, found himself the object of critical remarks and good-natured jests from friends and acquaintances. The most frequent criticism had to do with the length of time involved in waiting for the young trees to reach the age of production. To one critic who had thus questioned the wisdom of the undertaking, the planter replied: "I don't know just how long it will be before these trees bear, but I do know that they will be bearing nuts a long time before the trees you are not planting." That this planter had the right idea is borne out by the experience of more than one man who has found that his roadside nut trees have proved themselves equal to the important task of caring for taxes and insurance on an entire farm—an experience not yet reported by those who confined their activities to criticism.

As illustrating the not isolated experience of those who have planted nut trees along roadways, instead of the usual shade trees, an illuminating incident has recently come into notice from a Southern plantation. In this case a tenant farmer in Georgia was having difficulty in raising the funds for the annual payment of $600 in rent money and supporting a family of considerable size at the same time. Prices for cotton, corn and other staples were low and the demand light. During this period of depression, the tenant-farmer found financial salvation in the harvest from 73 Pecan trees clustered about the residential buildings of the farm and extending in lines on both sides of his private entrance and along the public highway in front of the plantation. These trees had just come into bearing, and from their crop the tenant netted nearly eight hundred dollars, practically a third more than the amount of his rent.

In Portland, Oregon, in 1907, a resident planted eight seedling Persian (English) Walnut trees along the street in front of his residence. From these trees each year, in addition to having all the nuts needed for home consumption and dividing with the boys of the neighborhood on their own terms, he now obtains from nuts which he sells enough revenue to go a long way toward covering his taxes.

A pioneer Pecan planter and one of the best known growers in Florida, had an experience which is typical of that of many who are brave enough to weather the jests of the neighborhood. In the fall of 1893, he ordered 100 Pecan trees from nurseries in Georgia and Louisiana. His place was then largely planted to Orange trees but he planned to set the Pecan trees along the driveway and about the buildings. The trees arrived at the railroad station, and were still in the freight house when the famous freeze of 1894 arrived with its temperature of 15°F., killing the citrus trees and financially ruining many hundreds of people. Most of his neighbors left the community, but the planter removed the dead Orange trees and put the Pecans in their places. In later years he ordered more trees and put them out, too.

The few straggling neighbors who hung on turned to cotton, corn, cattle, etc., the "etc." referring largely to

CHESTNUT

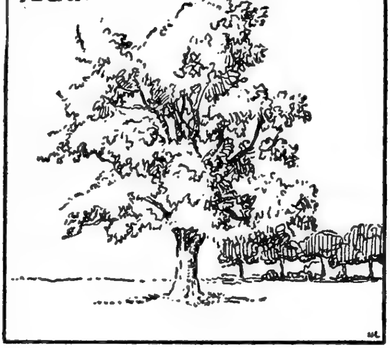
caustic witticisms aimed at the planter. They entertained themselves by commenting on what "that d—— Yankee" (from Maine) was doing. Their jokes were varied, as usual in such cases, but the general opinion of the planter would have been expressed in the terms of Blackstone by "*non compos mentis*." Years went by, and in time these very neighbors came to ask employment from the planter in his nut orchards. They then frankly admitted that "It always did seem like the man had more sense than most people."

The importance of the nut-raising industry along commercial lines is evidenced by a total investment of more than $110,000,000 in the growing of Persian (English) walnuts in California, with an annual crop value of from $10,000,000 to $12,000,000; and the growing of almonds in the same state, with a yearly yield of $2,000,000.

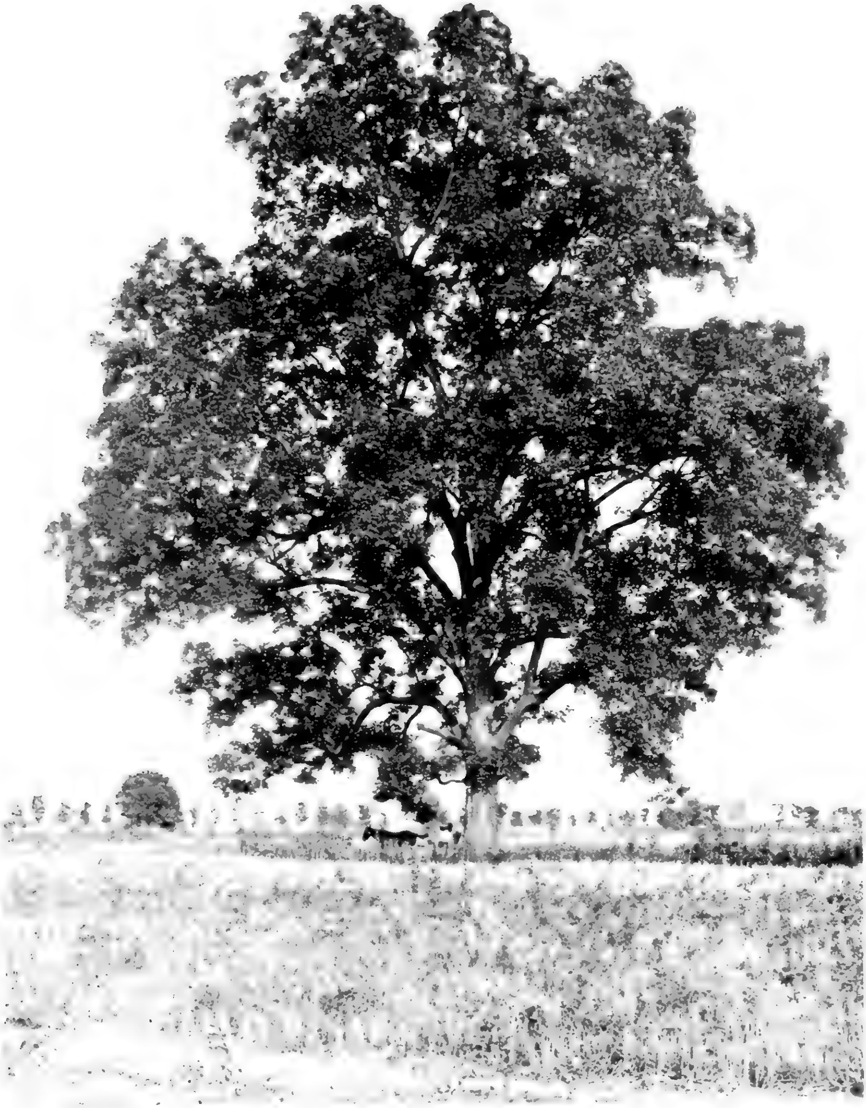
Pecans are grown, wild or cultivated, in every Atlantic seaboard and Gulf coast state from Maryland to Texas, and up the Mississippi to southern Indiana and eastern Iowa and in parts of Oklahoma and Kansas. Pecan production is bound to increase for the one sufficient reason that this crop thrives best mainly where no other cultivated tree product of importance is being raised. The range of the Pecan is for the most part north of the citrus fruit section, and either south of, or below the altitude level of, the successful raising of apples and other deciduous fruits.

The Pecan is, perhaps, the finest of all American nut trees for roadside planting wherever conditions of soil and climate will warrant. It is strictly native to this continent and is found wild nowhere but in the United States. Beautiful specimens 3 or 4 feet through at the base and from 100 to 150 feet in height are found in the alluvial soils of the Mississippi and its tributaries. For both shade and ornament it is a splendid tree, which thrives in rich and moist soil.

According to the census of 1920, the total production of pecans in 1919 was 31,898,548 pounds. Estimating on a value of twenty cents a pound for the "run of the drop," this indicates an addition of more than $6,000,000 to the wealth of the pecan-growing states. Texas produced more than half of the total yield.


PECAN

When well chosen and properly cared for, the eastern Black Walnut is one of the handsomest of all our native trees. Many nature lovers class it next to the American Elm in stateliness and decorative effect. In congenial soils it is one of the most rapid growers among the hardwoods, and it is by no means unusual for a seedling to develop a height of 20 inches or more during the first year. The size of the matured tree is nothing short of magnificent. During a recent contest for the discovery of the handsomest tree in the state of New York, a Black Walnut was one of the four largest trees found. In point of permanence it is also conspicuous, while one of its greatest advantages is the readiness with which it adapts itself to changed environment. Since its introduction into northwestern Oregon, for instance, it has been found to make as satisfactory an ornamental tree in that climate as in the eastern states to which it is native. The city of Salem, Oregon takes great pride in possessing one of the finest specimens in America for size and beauty in relation



PECAN.

to age. At the age of 51 years, it had a breast-high circumference of 10 feet 11 inches. As showing the utility value of the species, it may be mentioned that this tree not infrequently produces several bushels of nuts in one season.

The length of time required to bring a Black Walnut into production is variable. In a Pennsylvania nursery a tree has been photographed which was grafted when three years of age and which, in its fourth year, produced 7 nuts. This early fruitfulness is not wholly desirable, as it is better for a tree to grow for 6 or 7 years before it is allowed to bear. Nevertheless, this instance is important in showing that the time of production is largely in the hands of the grower.

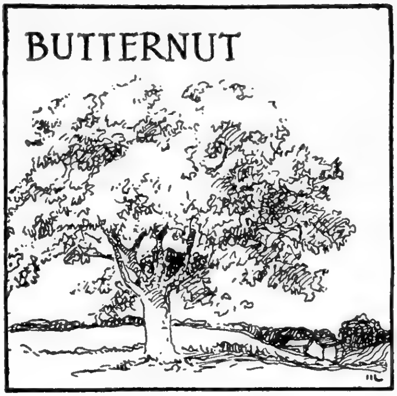
Some specimens run for 15 or 20 years before producing, but this time may be reduced by grafting. Different varieties may vary also in the matter of leafing-out in the spring and shedding leaves in the autumn, and in resistance or susceptibility to the attacks of insect pests and fungus diseases. To realize best results, these differences must be taken into consideration when seed or young trees are being selected for planting. A good rule to follow is to be sure that the seed came from a tree which had as nearly as possible the qualities wanted, and latitude and soil conditions as nearly similar as possible to those of the new planting.

In California, the highway authorities are planting many miles of roadway with Black Walnut trees. Stretches of roads lined with magnificent trees of this species may be found in many places in this state. One of the finest of these borders the Lincoln Highway fifteen miles west of Sacramento.

In Livingston County, Michigan, there are numerous splendid rows of Black Walnut trees from 50 to 60 years of age which are among the beauty spots of the state's highway system. One of Michigan's planters in the fall of 1920, procured thirty bushels of selected walnuts from Mt. Vernon, the George Washington homestead in Virginia, to be planted by school children on school grounds and at their homes and along the state highways. Something like 2000 were planted by him in a nursery, for subsequent use in the city parks of Saginaw. An early example of this planter's high valuation of the Black Walnut is afforded by a handsome and thrifty specimen now standing in front of the Saginaw postoffice, where it was planted by him 15 years ago.

The Black Walnut develops a well-rounded crown of symmetrical growth, and in its native state it is found in rich woodlands over a wide range of country. Its natural territory extends from Massachusetts south to Florida, and west and southwest to Minnesota, Nebraska, Kansas and Texas. Adaptability to strange regions broadens this range to include almost the entire country for purposes of transplanting or introduction.

The Butternut, a close kinsman of the Black Walnut, has distinct claims to consideration as a roadside tree, especially for cold climates. Although less durable for timber purposes than the Black Walnut, smaller in growth, and not so attractive in appearance, it has the advantage of growing in climates too severe for either the Walnut or the Hickories. In fact, the Butternut thrives further north than any other tree of the nut-producing group. Its resistance to frost makes it well worth while as an addi-



tion to the varieties available for northern regions. The range of this tree is from Nova Scotia south into Pennsylvania and Maryland, and southwest to Arkansas. Its most common native regions are the mountains, from Maryland north to and including New England. The nut of this tree has a very rich flavor. Crop production is irregular, but sometimes exceedingly generous.

Among the Hickories the Shagbark has a beauty and individuality all its own, while the best specimens rival the Maple for sturdy strength and attractiveness. The use of this species as a roadside tree has many advocates, and

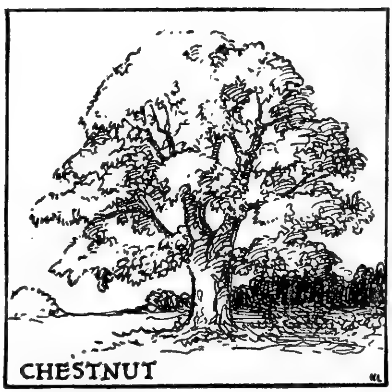
the fine specimens to be found along the highways of Michigan and other states forcefully confirm the arguments in its favor. The tree grows in practically the same territory as does the Black Walnut, but it is of slower growth and less able to adapt itself to the conditions of changed environment. Many other Hickories have much the same qualities of beauty that characterize the Shagbark, and together they cover a wide range of soil and climate.

In comparatively mild climates the Japanese Walnut makes a satisfactory roadside tree. It is dwarfish in habit, and somewhat less hardy than the Black Walnut. Successful planting has been practiced over a considerable part of the country.

The Beech has many qualities which commend it for highway planting. It is a tree of rugged growth, with dense foliage of surpassing beauty, and lends genuine charm to the roadside landscape. Its one drawback, a minor one, is that its smooth white bark is a perennial invitation to the carving of initials. The beech is wide-spreading as to limbs, round-topped and symmetrical. Its native field is for the most part in the north, but it also grows to large size alongside the Magnolias of southwest Georgia and other Southern states.

The same graceful dignity which makes this tree so highly prized in parks and on private estates makes it a favorite for roadside purposes as well. It stands a good deal of shade, but requires rich, cool and fairly moist soil; it should never be planted in soil which is dry or gravelly. It will thrive in soil somewhat too wet for the Black Walnut, Shagbark Hickory, or Pecan, but must not be planted in soil where the moisture is excessive, as in swamp lands.

The Chestnut has many points of value, but the ravages of the deadly blight render its use hazardous in



many parts of the country. This tree can not be recommended for general planting. There are certain sections, however, outside of its native range, where the Chestnut does well and where its planting is being encouraged. This condition is to be found in western Washington and Oregon, northern California, and in eastern California in the foothills of the Sierras.

CHAPTER IX.

MEMORIAL TREES

TREE planting to honor the heroic dead of the Great War, or others, has given the world a new form of monument—the memorial that lives.

The memorial tree is clothed in the finest of human sentiment. In its ever renewing growth it stands forth as a thing alive, a simple symbol to keep forever green the memory of those in whose honor it is planted. For to-day and for generations yet unborn, the message of the memorial tree is the message of life.

That the memorial tree should altogether supplant other forms of monument is neither to be expected nor desired. Memorials of stone or bronze will always have their place. The massive beauty of the Washington Monument, the impressive dignity of the Grant Tomb and the graceful outline of the Arc de Triomphe are enough to prove the enduring worth of memorials of this character. Even with such memorials, however, the memorial tree plays an important part. For bringing out the artistic symmetry of such structures in their full value, an environment of trees is indispensable. By enhancing the beauty of the surroundings they give an added worth and meaning to the stateliest edifice reared by human hands.

One of the most appealing features of the tree as a memorial is that this form of expression is possible to everyone. The memorial tree is suited to the requirements of the city as a whole or to the needs of the one person. It may express the reverence of a community, of a group or an individual. In either form it is ideal.

It has been gratifying to see the world's response to the claims of the tree as the most fitting memorial to those who

MRS. HARDING PLANTING AN ELM ON INTERNATIONAL AVE. FACING THE LINCOLN MEMORIAL, WASHINGTON, D. C.

went to the defence of civilization. Throughout America and in foreign countries the response has spread on a growing wave of human approval. Among the Allied Nations, as in the United States, the people have been quick to recognize the appropriateness of the living monument, and to join with America in the planting of memorial trees.

The movement had its birth with the signing of the Armistice, when the people of the United States adopted the tree as their token of tribute. The idea was taken up promptly by officials, by organizations, by the nation's editors and by the people. Memorial tree planting had become an established custom before our troops were withdrawn from the camps of France. When General Pershing reached this country after his brilliant leadership of the American Expeditionary Forces, among his first acts was the planting of memorial trees in Central Park, New York, and in Independence Square, Philadelphia. Dedicated to the soldier dead by their commander, these trees will stand forth to future generations as noble sentinels of a noble chapter in American history. Two years later he carried the message of the memorial tree overseas, and on French soil planted an Oak in the Trocadero gardens, to symbolize America's homage to the soldier dead of France.

The American Legion responded with the same spirit which moved the great general. The organization is taking a leading part in cooperating with the American Tree Association in spreading the claims of the memorial tree and in active planting of these living monuments. In orders to posts throughout the world the Legion early threw its influence to the movement, and from everywhere come reports of tree planting by the Legionnaires in tribute to their comrades-at-arms. A pioneer in this work was Colonel F. W. Galbraith, Jr., one of the first commanders of the American Legion. Colonel Galbraith entered into the undertaking with the vigor and enthusiasm which marked his entire life, and his last official act, a few days before his tragic death, was to plant memorial trees at the intersection of the National and Dixie Highways in Vandalia, Ohio. The Legion will extend the tree planting along both of these important roadways, in tribute to Colonel Galbraith as well as to the men who died in France.

The President and Mrs. Harding have planted a number of these living memorials. Perhaps the most notable instance of tree planting by occupants of the White House was at the formal opening of Armistice Week, on November 7, 1921. That week will always hold conspicuous place in American history, as a period made memorable by the burial of America's Unknown Soldier and by the opening of the epoch-making Conference on the Limitation of Armament. The first event on the week's program was the planting by Mrs. Harding, on the grounds of the Lincoln Memorial, of two trees to the memory of the Allied Armies and the Allied Navies. These trees stand at the head of International Avenue.

It was with a fine sense of fitness that the first memorial tree to be planted in the National Capital was dedicated to the memory of the men of the United States Forest Service who had given their lives in the war.

The soldier dead from the Congressional Library were given the tribute of the memorial tree.

Another tree planted in the National Capital was in memory of Quentin Roosevelt and was set out by the pupils of the Force School.

There was pretty symbolism in the plan adopted by the Daughters of the American Revolution at Arkadelphia,

PLANTING AT GRANT'S TOMB, NEW YORK, IN MEMORY OF GEN. U. S. GRANT ON THE CENTENNIAL OF HIS BIRTH.

Arkansas, in planting a Maple as the organization's memorial to the soldiers and sailors of that city. About the roots of the tree the planters placed soil from each state in the Union and from each of the Allied countries. The linking of all sections of the Union is also achieved in the memorial grove established in Exposition Park by the Los Angeles Chamber of Commerce. To be known as the Grove of States, this planting will contain a tree from each state. The city of Fort Wayne, Indiana, provided a memorial park, one corner of which is devoted to a five acre grove of memorial oaks. In this grove each tree is a tribute to a fallen soldier. In Philadelphia extensive planting has been done, including 500 trees in Logan Square.

Baltimore has its Grove of Remembrance in the world famous Druid Hill Park. The trees in this group were dedicated to the fallen heroes by the War Mothers of America, now a part of the Service Star Legion.

Gold Star Mothers planted 150 trees in the forest preserve of Cook County, Ill. In Chattanooga, Tennessee, more than 188 trees have been planted to the memory of the soldiers of Hamilton County. New Jersey has been active in memorial tree planting, with an example set by Governor Edwards in planting an Arbor Day tree, at Trenton, to perpetuate the memory of the soldiers of the state who gave their lives at the call of their country.

The town of Charlotte, Michigan, has given splendid illustration of the meaning which may be given the planting of memorial trees—a meaning which embraces community improvement as well as honor for soldier dead. Charlotte's memorial took the form of converting an unsightly piece of ground into a handsome park in which coming generations could take enduring pride. In this park the community has planted 7000 White Pines, 1000 Maples and Elms, 100 Black Walnuts, 100 Butternuts and a grove of Red Oaks. In the center of the park stands a boulder, with the hero list setting forth that the grove is a memorial to the men of Eaton County who gave their lives in the war.

An ambitious project in army circles was the planting of 6000 trees at the balloon school of the United States Army, at Fort Omaha, Colorado. Nearly 1000 of the trees were in memory of individuals who died in the service after having passed through the camps at Fort Omaha and Fort Crook.

That the tongues in trees may preach their sermons to man was emphasized in the call for the planting of memorial trees which went forth to the Christian Endeavor Societies of the world. In this call, Rev. Francis E. Clark, founder and life-long leader of the Christian Endeavor organization, urged upon the members that through the planting of memorial trees they will come "closer to the Great Tree Maker." In this phrase Dr. Clark summed up the appeal of the tree to human hearts, and gave mighty impetus to a movement in which he sensed impressive possibilities for the tribute of homage which would make the world a better place in which to live.

From the village school to the great universities the educational institutions of the land have utilized the memorial tree for voicing their reverence for the memory of students and to classes. On the drill field of the University of Illinois, 173 trees were planted in honor of 173 graduates who gave their lives. Georgetown University, at Washington, dedicated 54 trees for the same purpose at its 120th commencement, and on the grounds of many institutions throughout the United States trees and groves of remembrance have been planted as tributes

TREE PLANTED IN MEMORY OF JOHN MUIR AT THE MUSEUM OF NATURAL HISTORY, NEW YORK CITY.

of honor. The University of Washington, at Seattle, worked out plans for an arboretum to take the form of a memorial park, traversed by memorial avenues. In this elaborate undertaking the authorities are planning for a century ahead, and there is vivid appeal to the imagination in the future beauty of this living memorial in the great Northwest.

On the grounds of the State Masonic Home at Elizabethtown, the Masons of Pennsylvania have established a memorial grove containing 264 trees. Each tree is registered in the name of a Mason who died in the service of the flag, and the roster is an impressive showing of the patriotism of the splendid organization.

When the Children of the American Revolution met in Washington, they planted a memorial tree in front of the D. A. R. building to mark the date. In the shape of a five pointed star of trees, the State Normal School at Bloomsburg, Pa., honored its graduates. To mark the centennial of the birth of Clara Barton and of Gen. U. S. Grant memorial trees were planted. In the latter case the tree was placed at Grant's Tomb in New York City, having been sent from the Grant Farm near St. Louis, Mo.

The fiftieth anniversary of the first Arbor Day in Nebraska, in 1872, called out thousands of new tree planters. Many of these trees were placed in honor of J. Sterling Morton, the father of Arbor Day. In front of the American Tree Association's headquarters are three trees planted for Morton by the Nebraska Society. Another was placed by the District of Columbia Federation of Women's Clubs on the Lincoln Memorial Grounds.

To mark the conference of the Pan-American Women an International tree was planted on the grounds of the Pan-American Building, Washington, D. C.

Another interesting group of trees on the Lincoln Memorial grounds at Washington are the trees planted by the John Burroughs Clubs of the public schools. This group for Burroughs, Thoreau, Whitman, Emerson and Muir is called the Hall of Fame. In Pasadena there is another Hall of Fame for famous men. At Atlanta there is an Authors' Grove that is nationally famous. At St. Louis, Mo., there is a Gold Star Tree Court of Honor, and there is another at Trenton, Mo. This is part of a plan for state wide Gold Star Highways. Memorial tree planting has directed the thought to bigger things. At Herkimer, N. Y., the American Legion has a memorial forest well under way in which more than thirty thousand trees have been put in place.

Everywhere memorial tree planting can be made a community affair, for the people can be brought together by tree planting. Whether it be one tree or a memory mile, there are community possibilities in the day's program.

The people of the whole country are turning to tree planting. Prominent visitors from other countries officiate at plantings. In the list we find Joffre, Foch, the Prince of Wales, the King and Queen of the Belgians and many other nationally known people. The tree lends itself to all times and all occasions.

MARSHALL JOFFRE OF FRANCE PLANTING A MEMORIAL TREE AT MT. VERNON, N. Y.

CHAPTER X.

ROADS OF REMEMBRANCE.

A NATURAL extension of Memorial Tree planting has been the development of Roads of Remembrance.

From coast to coast these highways have been planted with shade trees in grateful tribute to a nation's soldiers.

The Road of Remembrance has no limitations. Whether on the modest and secluded lane, on the great transcontinental highway, or on the city boulevard, the roadside tree is the enduring token of reverence and appreciation; and in its far-flung gift of shade and beauty it will bear to coming generations the truth that in these highways the planters wrought blessings for the future no less than tribute to the past.

The immediate favor with which the Road of Remembrance idea was greeted resulted in definite and active response to the appealing sentiment of the highway of tribute. The entire country is now dotted with sections of highway planting. The spirit of the movement goes forward in a way that leads to the belief that in coming years the roadside without shade tree beauty will be the conspicuous exception to a general rule.

Roadside planting has two-fold appeal. It is a definite contribution to highway betterment as well as the finest form of memorial tribute. To clothe the roads of the land with trees is an important example of community improvement, and one which will carry its blessings into the distant future. Just now the movement has especial timeliness. The country is face to face with opportunity. In cooperation with the Federal government, the states are now planning the most extensive program of road building yet undertaken in the United States. The work of construction will embrace every state in the Union. Aroused by the unusual blend of practical benefit and sentimental appeal, organizations throughout the country have become active participants in the creation of Roads of Remembrance. Women's clubs, automobile clubs, and highway associations have entered into the spirit of the movement, with a determination that the newly built roadways shall be Roads of Tribute in the ideal form. In the schools, also, the project has gained momentum, and throughout the land Tree Planting Associations have been organized to plant particular sections.

The White House has given encouragement and stimulus to the movement through the spoken word, the written message and active participation. In a letter the President said:

"I find myself altogether responsive to your request for an appeal to the people to plant memorial trees along the important public highways as memorials to the men who were sacrificed in the World War, and, indeed also to those who gave their service without the ultimate sacrifice. I can hardly think of a more fitting testimonial of our gratitude and affection than this. It would be not only the testimony of our sentiments, but a means to beautify the country which these heroes have so well served.

"A general adoption of this plan would, in coming years, be noted as one of the useful and beautiful ideas which our soldiers brought back from France. The splendid avenues of France have been among the great delights and attractions to travellers there, and a similar development would equally add to the beauty and attraction of our country. I am pleased to know that the idea has already been taken up quite extensively and that considerable progress has been made. If the cooperation of state, municipal and county administrations may be secured, as well as of the forestry services of the nation and the states, it ought to be possible to make a rapid advance in a comparatively short time. I hope that you and your coadjutors may be successful in securing a most substantial beginning in this direction during the present season.

(Signed) WARREN G. HARDING."

THEODORE ROOSEVELT POST, AMERICAN LEGION PLANTING THE FIRST OF 200 MEMORY TREES TO COL. ROOSEVELT.

Mrs. Harding's approval and support were expressed in a letter to the Women's Club at York, Pa. Mrs. Harding wrote:

> "Please allow me to congratulate you on the wonderful work you have brought to conclusion in the dedication on Memorial Day of the road of remembrance along the Lincoln Highway. In the planting of twenty-five miles of that famous highway, you have erected a memorial that the entire country can enjoy in the years to come. May long life attend the trees you have placed in the care of the Lincoln Highway Memorial and Tribute Tree Association."

The spirit which prompted these letters is the spirit which has resulted in roadside planting in all parts of the country. The planting takes many forms. In Bibb County, Georgia there is a Cross of Trees with Macon as the point of crossing. Along the Lincoln Highway there have been many plantings. At York, Pa., the Women's Clubs have planted twenty-five miles along both sides of that highway. The dedication was made a wonderful event for Memorial Day. The trees have been turned over to the Lincoln Highway Memorial and Tribute Tree Association. At Canton, Ohio, where the same highway passes, the Lincoln Highway Memorial Association of Stark County is planting memorial trees. Along the road leading from the highway to the tomb of William McKinley there has been planted an Avenue of the Presidents to lead into the major road. The St. Joseph County Memorial Tree Forestry Association, at South Bend, Ind., has completed its share of the tree planting along the Lincoln Highway in that state. Under the direction of the Ottawa Permanent Memorial Association and Ottawa Tree Club, trees have been planted along the Lincoln Highway in Iowa. Out of Clinton has been made a "Memory Mile" and planted with trees by the Kiwanis Club. Thus the work goes on. At Seattle, the Garden Club has planted 1200 memorial trees and the work has been but started to the Pierce County line.

One of the first Roads of Remembrance to be completed was fifteen miles of the West Coast road out of Tampa, Fla., where the Rotary Club has charge of the work. In Kentucky, there is a twelve mile Road of Remembrance between Lexington and Georgetown.

The main highway from New York City to Buffalo is to be a Road of Remembrance and the first trees have been planted. Victory Oaks have been planted in Louisiana along the Jefferson Highway that leads from New Orleans to Winnipeg, Canada, and towns all along the route are making plans for memorial tree planting. Beautification of the great highways goes hand in hand with the memorial tree planting. Particular attention is being paid to this by the Woman's Commission of the Bankhead National Highway Association. Trees, shrubs and flowers will be planted along this highway and plans for a great bird preserve are being pushed. In many places in California the Road of Remembrance idea has made great progress. In many of the states the tree planters are working in close cooperation with the state highway officials and reports show that hundreds of towns are providing parks and beauty spots as a result of the campaign.

On Armistice Day, 1921, the day of the burial of the Unknown Soldier at Arlington, the American Legion planted many miles of Roads of Remembrance in Chicago and on other thoroughfares in various sections of the country. At Santa Rosa, California, the Legion has cooperated with the Chamber of Commerce in planting four and one-half miles of shade trees along a section of the state highway.

Under the leadership of their Chambers of Commerce, Joliet, Aurora and Ottawa municipalities have planted Memorial Trees to the number of 10,000 on the Lincoln Highway in Illinois.

DEDICATION OF ROADSIDE TREE PLANTING ON THE LINCOLN HIGHWAY NEAR YORK, PA

In Indiana the Women's Clubs plan to set out Memorial Trees along every mile of the Lincoln Highway in its course across the state. Richard Bennett of Wisconsin has planted 70 trees along the 70 rods of highway which touch his property. This is the unique individual effort thus far recorded with the Association.

Brooklyn, New York, has undertaken a memorial highway as an important part of a great civic improvement, which means making over a large part of the municipality. One thousand trees have been planted at Middletown, Ohio. Chattanooga is lining the road with trees as it approaches the city from each direction. Ware County, Georgia, has given the highway an eight mile planting. The Jefferson and Dixie highways will become Roads of Remembrance to an extent in keeping with the development of the Lincoln Highway.

At Paducah, Kentucky, 2000 memorial trees, lining a Victory Road, have been set out by the McCracken County Historical Society, which undertook to provide a tree for each man and woman of the county who answered the call of the flag. Mobile has a memorial highway five miles long. In Lake County, Florida, the Park Commission's planting of Roads of Remembrance covers the entire county. Minneapolis has connected two parks by a memorial boulevard lined with trees for its full length of seven miles.

In Great Britain the Road of Remembrance Association is urging that all memorials be given the proper setting on Roads of Remembrance or on memorial avenues leading to such highways.

Beautification of the great highways goes hand in hand with the memorial tree planting.

CHAPTER XI.

THE HALL OF FAME FOR TREES

IT is fitting that trees should have their own Hall of Fame to give permanent record to their participation in history.

Through all the ages the trees have had important share in human progress. Under all conditions and in all climes they have proved themselves the best of good citizens. Their story is closely interwoven with the fabric of time. They have been a part of statecraft, war, art and literature, and they have stood as silent witnesses to man's achievements and solemn participants in his councils of destiny. To carry their message of the past to the generations of the future is an enterprise of vivid appeal to the imagination.

Since the creation of the idea of a Hall of Fame for Trees the spirit of recognition has spread to all parts of the United States. The study of the trees presented as candidates for admission to the Hall of Fame has been a study of American development. Trees now living and offered as nominees have been sentries of history written and unwritten. Research into the individual records of the candidates has been an intimate education in the progress of the New World of Columbus, Washington and Lincoln.

To cover the life span of the nominees the imagination must go back 4000 years and more. In the Redwood forests of California stands a tree whose claims rest on the simple statement of age. The General Sherman Sequoia is declared to be the oldest thing now living. It was of giant growth at the time of the birth of Christ, almost 2000 years ago. To-day, at an age of

THE NEW GARDEN OAK NEAR THE SCENE OF BATTLE OF GUILFORD COURT HOUSE, N. C., NOMINATED FOR THE HALL OF FAME BY THE DAUGHTERS OF THE AMERICAN REVOLUTION. BENEATH THIS TREE THE QUAKERS CARED FOR THE INJURED IN THE BATTLE THAT ENDED THE REVOLUTIONARY WAR. FROM HERE CORNWALLIS RETREATED TO YORKTOWN.

more than 4000 years, it has a diameter of 36½ feet and a height of 280 feet. This tree is located in Sequoia National Park, where it stands as a memorial to General William Tecumseh Sherman, as well as the undisputed monarch of the ages.

In sharp contrast to this woodland patriarch is the Naturalization Tree in Kentucky, a symbol of the American Spirit of to-day. For this tree no certificate of age is necessary. Both name and fame rest on its service in connection with Americanizing recruits at Camp Zachary Taylor during the recent war. Under its branches thousands of aliens took the oath of allegiance upon being mustered into the ranks of the United States Army. On a single day this tree witnessed the naturalization of 925 of these new Americans and saw their salute to the flag of their new citizenship.

In the grounds of the White House, at Washington, stands a tree which links the past and present in an unusual manner. This tree is the outgrowth of an acorn brought from Russia, and because of this and its unique lineage it is known as the Russo-American Oak. The tree from which the acorn was obtained stands in Petrograd. It grew from an acorn produced by a tree at the tomb of Washington, at Mt. Vernon. The Mt. Vernon acorn was sent to the Czar of Russia by Senator Charles Sumner, of Massachusetts, and planted in the grounds of the Imperial Palace by the Czar as a symbol of Russo-American friendship. In 1898, the tree which had grown from Senator Sumner's acorn was located by Ethan Allen Hitchcock, then American Ambassador to St. Petersburg. Gathering and planting some of the acorns from this tree, the Ambassador sent a sapling of the new generation to President Roosevelt for planting in the White House grounds. The planting took place on April

6, 1904, exactly thirteen years before the day on which the United States joined hands with Russia and other European countries in the greatest conflict the world has ever known—a conflict which led to the destruction of the old Russia and the assassination of the royal family. The young tree was planted by President Roosevelt himself, with the cooperation of Secretary Wilson of the Department of Agriculture, and Mr. Hitchcock, at that time Secretary of the Interior. With its registration in the Hall of Fame, this tree takes conspicuous place in the list of trees with a history.

In various spots in the District of Columbia may be found trees of individual celebrity. In the shadow of the Capitol, within the splendid park surrounding the seat of government, is a tree planted by George Washington and now treasured as a priceless memento of the first President's interest in the beautifying of the city named in his honor. On Connecticut Avenue hill stands a stately tree of majestic spread, known as the Treaty Oak, for the reason that under its branches an important treaty with the Indians was signed 150 years ago.

George Washington's interest in trees was of far-reaching influence. In many places trees are now growing which owe their existence to the Father of the Country. One of these is reported from the vicinity of Bath, Pennsylvania. It came from Mt. Vernon as a gift from President Washington to General Brown, a notable figure of the Revolution. General Brown planted this tree in front of his old home, and it is known today as the Washington Horse Chestnut. In the nomination of this tree for the Hall of Fame its present base circumference is given as 27 feet, 7 inches, with a girth of 17 feet at a point 6 feet from the ground. In the Friends' Graveyard at Salem, New Jersey, is an Oak under

KENTUCKY COFFEE TREE—FISHKILL-ON-HUDSON, N. Y.
PLANTED IN 1804 IN FRONT OF THE HISTORICAL VERPLANCK MANSION, THE SCENE OF THE FIRST MEETING OF THE SOCIETY OF THE CINCINNATI. IT IS 75 FEET HIGH—10 FEET IN DIAMETER. SPREAD OF BRANCHES, 181 FEET.

which soldiers of Washington's army drilled in the days of the Revolution. This tree is known to be more than 300 years old. Its branches cover almost a quarter of an acre. Of even greater spread than this is the Sir Joseph Hooker Oak, nominated from Chico, California, which has a single limb 102 feet in length, and of which General W. T. Sherman declared that at noon it would shade an army of 7000 men. Six feet from the ground this Oak has a circumference of 28 feet, 4 inches.

In various parts of America are trees famous through association with the Marquis de Lafayette. One Lafayette tree on the battlefield of Brandywine derives its prestige from the circumstance that when the celebrated French general was wounded at Brandywine his injuries were given first aid under this tree. At Annapolis is a tree under which a reception to Lafayette was held, with a distinguished company in attendance. In the form of trees planted by his own hand, General Lafayette left many mementoes of his travels in America. One of these is now standing at Concord, New Hampshire. Another is at Yorktown, near a house in which are still to be seen cannon balls imbedded in the timbers during the notable battle of Yorktown.

There are many Lincoln trees which were planted in memory of the martyred president. These are reported from various sections of the United States. One of these is a Hackberry, planted by John Finn on April 27, 1865, at Decorah, Iowa. This tree now holds place as one of the finest growths in the state and it has won more than local reputation for its symmetrical beauty. Another tree of similar significance stands before the home of Mrs. Allen Partridge, in Augusta, Maine. With other Lincoln Trees these specimens have found their merited place in the Hall of Fame for trees with a history.

General Ulysses S. Grant had a keen appreciation of the worth of trees, and showed his interest by planting them on many occasions. During the famous journey around the world which followed his term in the White House, this celebrated American planted a tree in each large city in the Orient visited in his travels. Throughout his tour he was received with ceremony befitting his widespread renown, and in every city the crowning event of the day's program was the planting of a tree. As a result there are many "General Grant" trees in various parts of the world. Chicago takes deep pride in one of these, an Elm planted by the soldier-statesman in Washington Park in 1879, during his first visit to the city after his tour of the world.

Indiana treasures with reverence the Constitutional Elm, with its spread of 124 feet. Under this tree, in 1816, was held the Constitutional Convention of Corydon, and as a result of this association with the making of the state, the tree holds firm place in the affections of the people of Indiana. In North Carolina stands the Battleground Oak, also known as the Cornwallis Oak and the Liberty Oak, because of its association with momentous events in the war of the Revolution. This tree witnessed the celebrated battle of Guilford Court House, in 1781. In the opinion of its sponsors it is entitled to a place in the Hall of Fame for its shade tree beauty as well as for its historical interest. The spread of its branches is more than 100 feet and its base circumference 21 feet.

The Wesley Oak has been nominated from St. Simon's Island, off the coast of Georgia. This tree brings its message of the early days of Georgia's settlement, when British troops were quartered on the Island. One notable chapter in its history is linked with the American visit of John and Charles Wesley, whose memory is sacred to the followers of Methodism throughout the world. Both Wesleys are known to have preached under the Wesley Oak, with British soldiers as their congregations.

In addition to the General Sherman Sequoia, with its life span of forty centuries, California offers many other trees of historical and romantic interest. One of these is a tree of to-day, which tells a story of modern development in the Golden West—a story of the uncovering of agricultural riches surpassing the gold mines in their permanent value to the state. This tree, the Hilgard Chestnut, stands in front of Agricultural Hall, on the campus of the University of California, where it rears its stately crown as a living memorial to Professor Hilgard, first dean of the College of Agriculture. Professor Hilgard's work for the development of California's amazing agricultural resources had much to do with the creation of the State's almost fabulous wealth in farming; this tree is a grateful tribute to this distinguished man. The Chestnut was planted in 1885, and in the fall of 1922 its branches covered an area more than 50 feet in diameter.

America has many trees prized for their association with literature, as the Cambridge Elms, immortalized in story and poem, the Elms of New Haven and Princeton, made famous by intimate relationship with many of the nation's most gifted men of letters, and the trees of Boston Common which have sheltered generations of literary celebrities. A worthy addition to the list, serving to link the genius of the old world with the spirit of the new, is the Shakespeare Memorial Oak, occupying a place of honor on the campus of the University of Rochester in the state of New York. This Oak was brought from Shakespeare's home in Stratford-on-Avon, and was planted at Rochester April 23, 1864, in connection with the celebration of the tercentennial of Shakespeare's birth.

Visiting royalty has made its contribution to the famous trees of America. In Central Park, New York, is an American Elm which was planted by the late King Edward VII, of Great Britain, during his visit to this country as the Prince of Wales. Not more than 100 feet away is an English Elm, planted in 1919, by the present Prince of Wales, the widely beloved grandson of the earlier visitor. The present prince also planted trees at Annapolis and at Mt. Vernon, and took part in the ceremonies at which Bishop Harding planted a tree, at St. Albans Cathedral in Washington. When the King and Queen of the Belgians visited this country, in 1919, the Queen planted a European Green Beech in Central Park, as a token of Belgium's enduring affection for the people of America. These trees serve as fitting reminders of the royal visits, and in the years to come they will stand forth as living symbols of the bonds by which the civilization of the Old World is linked with the New Democracy of America.

Trees of history abound in all parts of the United States. Their Hall of Fame was conceived as an open book of memory for their life stories. In its pages will be found a record of events generously epitomizing the development of American civilization. Because of the existence of this permanent record, generations yet unborn will have all the more intimate glimpse into the past and all the clearer conception of the events of history. In its own particular field of service, the Hall of Fame for Trees is as necessary and important as the Hall of Fame in which is perpetuated the memory of the achievements of man.

CHAPTER XII.

LABELLING SHADE TREES

THE close observer often wonders why so little attention has been paid to labelling the shade trees of our towns and cities.

Somebody has said that the effect of reading a label on a tree previously unidentified is like an introduction to a stranger, in that it creates an interest otherwise lacking.

Where the trees are labelled, the observer will find visitors stopping to study the markings and showing genuine interest in the information. Where there are no labels he will note people vainly trying to establish the identity of the trees.

The newly developed interest in shade trees, throughout the country, carries with it an aroused demand for definite information as to species. For a community to make liberal expenditures for tree planting and then stop short of labels is a mistake in policy. The cost of planting is expressed in dollars; the added expense for labels is a matter of cents. Since the success of the movement for shade tree development is largely a question of education, it is obvious that the more we do to make trees popular the greater will be the public interest in their planting and protection. Labels will play an important and necessary part in this educational work, and may therefore be counted as having a vital influence for the beautification of the community.

Until quite recently practically none of the cities of America have undertaken to label the trees in adequate fashion. In some communities one finds an occasional label, but too often even this has become illegible and useless through the action of the elements. In other instances, one will find labels which confine themselves to scientific names, quite out of reach of the everyday citizen. It is hard to picture the school child or the casual park visitor growing enthusiastic upon reading a label which solemnly proclaims a tree to be "*Ulmus Americana*." On the other hand, there is something definite and satisfying in a label showing the tree to be a good, old-fashioned American Elm, of the type made immortal by the poets and holding deathless place in the pages of American history through association with men and events of distinguished memory. *Liquidambar styraciflua hamamelidaceæ* would leave the average person unmoved and unimpressed, but Sweet Gum is a name known to all of us and well calculated to cause a feeling as of a handshake with an old friend.

To give labels their true educational worth their use should be systematic and uniform. They should include all the trees of the community, whether in parks, on squares or on the streets. They should be in simple form, easily read and durable. The information given on each label should be suited to both student and layman. To cover these various points involves:

1. Centralized action by municipal authorities or by joint undertaking on the part of individual property owners.
2. Labels of such material and design as will insure permanent legibility.
3. Information covering the common name of each tree, its scientific name, and the part of the world to which it is native, as for example: "Norway Maple, (*Acer platanoides*), Europe."

The National Capital has undertaken to set an example of effective shade tree labelling. In line with suggestions that the park trees of the District of Columbia should be marked for the benefit of park visitors, a plan to achieve this end has been made operative by the Division of Public Buildings and Grounds. The details of the Washington system will be of suggestive help to the authorities of other cities. Lieutenant Colonel C. O. Sherrill, U. S. A., describes the plan as follows:

"The label consists of a base so designed as to be bent approximately to fit the particular tree on which it is used. On the face of this base is riveted a plate upon which will have been previously stamped the botanical and the common names of the tree. The plate is then fastened with screws to the trunk of the tree, sufficiently high up to prevent it from being damaged by children, and yet not too high to be clearly seen by persons interested in tree nomenclature.

Tree marker used in Washington, D. C.

"A number of different methods have been tried in the District for labelling trees, but none have ever proven entirely successful, for the reason that some became detached and carried away by souvenir seekers. It is believed that the size and weight of this label, and the printing on its face, which clearly indicates the fact that it belongs to the Government, will deter souvenir hunters from carrying these labels away. If the plate containing the name alone should be pried loose it can be readily replaced at very small expense. The screws used to attach the label to the tree are placed one above the other so that the growth of the tree will not pull them out, and it is believed that they will not do any damage to the tree."

Let us hope that tne example of the District of Columbia will have its helpful influence on other cities throughout the United States.

If the trees could speak it is a safe guess that they would hail their labels as good advertising. The sight of a fine specimen of shade tree is apt to inspire people with the desire to possess trees of similar beauty. This is where the advertising value of the label becomes manifest. Its definite information as to species and variety brings within public reach the added possibility of gracing the community with trees of the type most wanted. Tree labels are desirable from every point of view.

CHAPTER XIII.

CARING FOR SHADE TREES

THE tree planter's responsibility continues from the time of planting until the tree dies. The young tree must be cared for and protected with willing hand and guided to full development. The neglected tree has little chance. The one way in which planting may be made successful is by meeting the tree's needs as they arise or anticipating them. No other method can be depended upon to produce satisfactory results.

Some of the fundamental requirements of successful shade tree growth are moisture, nourishment, cultivation and protection. These involve the tree's very existence. It is a waste of time and money to undertake planting without a determination to give close attention to these essentials.

Watering begins at the time of planting. After this first supply of moisture is given, the young tree should be watered with unfailing regularity in dry climates and occasionally in humid climates, if drouth occurs soon after planting. This is especially important during the first season's growth, when the tree is adjusting itself to its new environment and is fighting to gain permanent foothold in its strange surroundings. Water not only supplies moisture, but also conveys into the tree, through root absorption, the mineral elements and plant food necessary to growth. In watering, it must be borne in mind that the roots of a tree are more extensive, and deeper in the ground, than those of other plants. For this reason, more water is required to reach the entire root system. The quantity of water needed varies with species. Trees which have roots near the surface require more water than those with roots which penetrate more deeply, and the trees of rapid growth demand more than those which grow slowly. As a general rule, watering should be done every week or ten days when copious rains are lacking. Too frequent application of water is as bad as not watering enough, since excessive supply causes the earth at the roots to become soggy and sour. During the first year from ten to fifteen gallons of water should be applied each time.

The water should be applied gradually and so thoroughly that it will soak into the ground for at least one and one-half feet. A gradual application is best for the reason that it resembles Nature's methods. Heavier application will wash the soil away from the roots near the surface and cause the formation of a hard top crust of earth. The water should be encouraged to filter through the soil. This may be done by using moderately light soil and keeping the top soil pulverized. A simple method of applying water to a small number of trees is to allow it to run slowly through a small opening near the bottom of a barrel placed near the base of each tree. Another method, which will be found simpler in watering a large number of trees, is to make a basin of earth, surrounding the base of each tree, and fill this with water. In following either plan, it is desirable to smooth the surface after the water has penetrated to prevent the formation of a crust; and to cover the wet soil with dry, fine soil or a mulch of leaves and straw, to conserve the moisture by preventing evaporation.

In some cities underground irrigation is provided by means of tile drains, supplied with water from the city mains. This is effectual and especially useful in streets where the paving takes up the entire surface area.

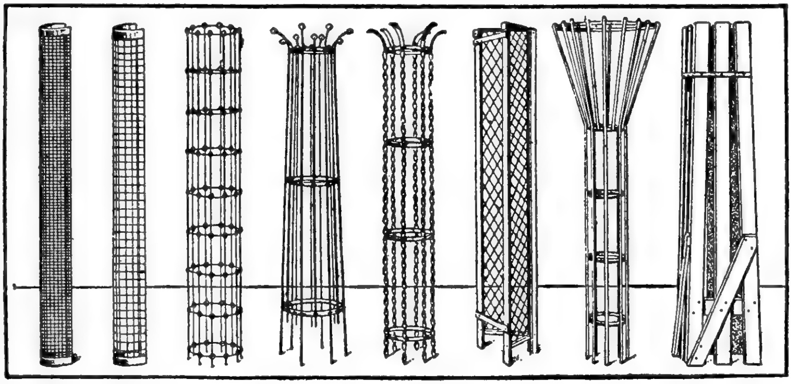
Akin to watering, and closely related to it in importance, is cultivation of the soil at the base of the tree. The ground must be kept free from weeds and sufficiently loose to permit air to reach the roots. Loose soil holds moisture much better than soil which is allowed to pack and form a solid surface. Closely packed soil causes the moisture to rise to the surface and evaporate, while loose soil gives the roots the full benefit of it. Lack of cultivation of the soil may be set down as one of the most frequent causes of failure in the growing of trees. On the other hand, careful and oft-repeated cultivation will often insure success where the handicaps of environment are most serious. Constant cultivation is needed during the first summer of the young tree in its new location. To accomplish this, the soil should be kept well crumbled to a depth of three or four inches, in an area extending from the base of the tree as far as the roots reach.

The nourishment taken from the soil by root absorption may be augmented to good advantage by covering the surface around the base of the tree in the autumn with mulch containing well-rotted manure. In the spring this should be turned into the soil, where it serves the double purpose of furnishing added nourishment and of rendering the soil more porous. Instead of the manure, chemical fertilizer may be used, but it lacks the organic matter contained in manure. A good mixture for most trees in light soil is made up of equal proportions of nitrate of soda, acid phosphate, muriate of potash and ground bone. This should be applied in the spring with the exception of nitrate of soda which should be applied only when roots are active. The amount required for the individual tree will be from 1¼ to 2 ounces of the mixture for a tree occupying a space of 8 square feet. If the nitrate of soda is applied separately ¼ to ½ ounce per tree may be used. Nitrate of soda is a strong plant stimulant so needs to be used in small quantities at any one time but can be used more frequently. A year's supply of the other ingredients may be applied at one time, using 4 to 12 ounces of the mixture per tree. For heavier soil the same ingredients are used but in different proportions, the formula calling for two parts of nitrate of soda, three parts of acid phosphate, one part muriate of potash and two parts of bone meal. The quantity to be used for each tree is the same as in the case of the lighter soil. This fertilizer should be evenly distributed and mixed into the soil in a thorough manner. Too liberal use of the chemical mixture will injure the roots.

Protection from injury is essential to the young tree on the city thoroughfare. All of us have seen boys swinging on the slender stems as if the trees had been planted as a part of a public gymnasium. We have seen trees bent down till their tops touched the ground, by those who find pleasure in watching the flexible stem fly back to an upright position. We have seen trees die as a result of these and similar abuses, because of the loosening of the roots just at the time when it is most important that they should be allowed to gain firm foothold. We have seen men tie horses to the slender trees and have found the horses nibbling at the bark, to the serious injury of the tree. The horses are not to blame, of course, but this is no comfort to the man whose tree is ruined in the process.

It was to prevent injuries from these and similar causes that the tree guard was invented. The loss of bark caused by horse bites frequently causes a wound which affects the tree's whole future. With the growth of the trunk the old wound accumulates thick edges, invites decay and permits the entry of borers and the growth of fungus diseases. The death of the tree is apt to follow, and all because one horse was hitched to the unprotected stem. A tree guard would have made the damage impossible.

Guards are of various styles. Each type has its advocates, but any guard which prevents injury from outside sources serves its purpose. One of the most familiar varieties is a four cornered box made of upright



Types of tree guards

strips of board, anchored to four stakes driven firmly into the earth. This is a combined guard and support. For the purpose of keeping the young tree in an upright position, the stem is fastened to the top of the guard at each corner. Galvanized wire netting is much used for guards, and in some cities this is reinforced with sheet iron for a couple of feet at the base, to provide protection from dogs. Guards of iron or other metal are made in many styles and designs. The type is relatively unimportant, as long as it furnishes complete protection and is not distinctly unsightly.

Contradictory though it may sound, the tree must also be protected against the guard itself. If the flexible young stem is permitted to sway in the wind and rub against the edges of the guard, abrasions of the bark will occur, which may prove as serious as the injury which might have been suffered if the tree had been left unprotected. This swaying must be prevented by fastening the stem to the guard itself, or to an upright stake firmly implanted in the ground alongside the tree. If the guard is sufficiently strong and is well anchored in the soil, attachment to the guard is best. If not, then attachment to a strong stake is the best anchor. This stake should be about nine feet in length and sunk into the ground to a depth of at least three feet, to give it the solid footing necessary for stout support. For fastening the tree to this stake or to the guard, nothing better can be found than loops of old rubber hose, which are excellently suited for the purpose by reason of softness and flexibility. Soft leather or rope may be used but care must be taken to keep from binding the tree too tightly. A length of rope or wire slipped through a rubber hose also serves the purpose well, but wire should not be used unless so protected. The stake may be either inside or outside the tree guard. This will depend on the size of the guard, as the stake is to be placed about ten inches from the tree. To prevent decay the stake should be tarred or creosoted at the lower end, with the coating covering the part which is to be underground and extending for a few inches above the surface as well. Creosote is probably better than tar because it penetrates the wood while tar merely covers the surface. The stems of young saplings make the best stakes as they are likely to be stronger than sawed lumber but they are difficult to obtain. In attaching a tree to a single stake, the hose or other attachment should be put on in the form of a figure 8, so that two bands of the tying material intervene between the stake and tree and thus help to prevent chafing. When a guard is used permitting two attachments, each one should be put on in the form of a letter U so as to hold the tree from possible contact with the opposite side of the guard. The guard should be kept around the tree for several years, until the trunk has reached a diameter of six inches at the very least, and in some locations it should be permanent. With the growth of the trunk careful watch must be kept to see that the tree does not become cramped or choked by the guard. Neglecting to remove a guard when it has been outgrown is certain to cause injury. In many cases, the expansion of a trunk within an unyielding guard has resulted in girdling the tree with a wound causing death.

It is important to keep a guard painted and repaired. The need of repairs to this protective device is so frequent as to emphasize the danger to which the tree itself would have been exposed if there had been no such buffer to parry the blows.

CHAPTER XIV.

PRUNING SHADE TREES

PROPER pruning is essential to success in shade tree development. A tree may be well planted, duly cared for and abundantly nourished, but the result may be most unsatisfactory without judicious pruning. For insuring development of root and branch, for producing attractiveness of appearance, for adapting size to environment, and at times even for enabling the tree to live at all, pruning is necessary. There is sometimes a distinction made between pruning and trimming. When this is done, pruning refers to that minimum of cutting that may be necessary to encourage the thrifty growth of the tree and encourage its development along natural lines while trimming has reference to changing or restraining the form to conform to architectural features or conditions.

The underlying principle of pruning is the establishing of a correct relation, as to size, between top and root system. In nature a definite balance of this relationship is maintained. In the growing of the shade tree the planter must assist nature in order that both upper growth and root system shall be adapted to the area available. The pruning of branches and leaf-buds throws all the vigor of the tree into the remaining parts and results in more vigorous growth for both top and roots. In addition to this it is necessary that the tree should be trimmed for the purpose of creating a symmetrical crown, graceful outline and a height of branch which will not interfere, in street trees, with sidewalk traffic or with wires.

The first pruning is at the time of planting. Before the young tree is set out, both top and roots should be given attention. If the roots have been broken or otherwise injured in digging or handling, the injured portions should be removed by clean cutting with a sharp knife. Healing and the natural growth of the root will progress from a surface which has been cleanly cut, while decay and death are likely to follow the ragged break or abrasion. For the top pruning there should be removal of all branches that can be spared. The amount to be pruned varies with species. Oaks, for instance, require much more cutting than do Norway Maples and Elms, but in many cases it may be said that three-fourths of the leaf-buds should be removed. This may seem drastic, but it is necessary for satisfactory growth. The purpose of the seemingly severe pruning is to reduce the amount of leaf surface the tree must support the first year. This decreases the amount of moisture that must be supplied to the top by the roots, and the lessened drain enables the root system to use this strength in becoming firmly established in the soil. In this pruning it is not always necessary to interfere with the shape of the crown, but even when it does involve such sacrifice the pruning should be done. Form can be regained after the tree has become established, but proper growth cannot be achieved without the preliminary pruning. New growth, to replace the branches which have been cut off will start close to the stem, and this serves a useful purpose through establishing a compact top. Without this pruning the tree may not live, and even if it does survive, its crown will be ragged and its foliage lacking in density.

In pruning at planting time, where only the end of a branch is to be removed, the cutting should be done immediately above a strong bud, and care should be taken to see that the bud which remains is one which points in the direction toward which growth of the limb is wanted. For the removal of an entire branch, the cut should be right at the remaining limb—so close that not even a slight stub remains. The cut should be cleanly made and should leave no ragged edge to delay healing. Any sharp knife may be used but a pruning knife is desirable and may be obtained at a hardware store. Pruning shears are clumsy for this delicate work and are apt to cause bruises on the young and tender tree. The pruning is more easily done before the tree is placed in its planting hole.

Sometimes it will be found that with very warm weather immediately after planting the leaves which develop will wither and droop. This usually indicates that the growth of the top has been more rapid than can be supported by the transplanted roots, and additional pruning is needed to prevent the death of the tree. In this secondary pruning up to three fourths of the top may be removed, even though this reduces the tree to the semblance of a bean-pole. It is better to take this step than to have the tree die. After the roots have become established, the formation of the top will take care of itself.

After planting, the tree should have annual pruning. Symmetrical formation of the top cannot be otherwise secured. As the tree grows it will be found that for graceful appearance certain branches must be held in check, while others must be coaxed into full development. The amount of light reaching a tree is an important factor in developing the crown. The strongest growth of branches is in the direction of the strongest light, and this must have consideration in pruning for development. It is well to remember, in planting as well as in pruning, that such part of a tree as may be shut off from the light can not have vigorous growth.

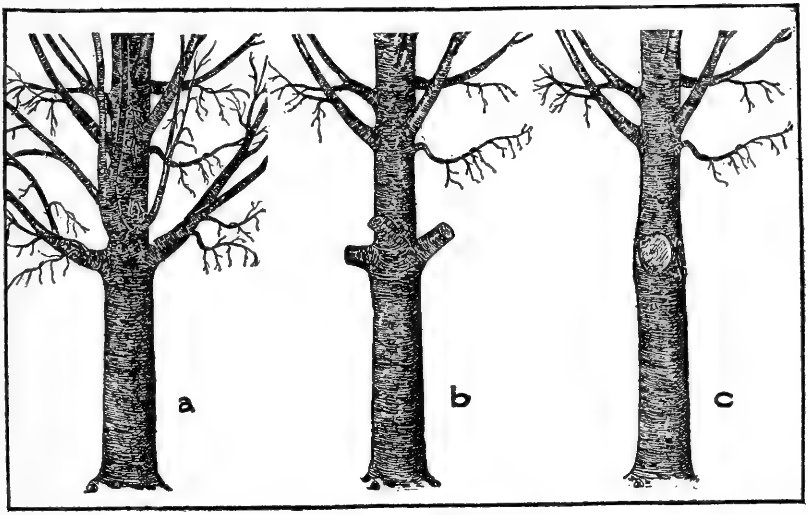
The yearly pruning calls for the removal of all crossing branches and all branches not so located as to aid in the formation of a well-shaped crown. If the tree has a tendency to form too dense a top, some of the inner branches should be removed. As a guide to this removal it must be borne in mind that too much shade is as bad as not enough. The top should not be allowed to grow to a density that will shut off light from nearby houses, nor prevent some sunshine from reaching the ground underneath the tree, nor should it interfere with the free circulation of air. It is important that this pruning be done early in the life of the tree, so that it may be accomplished with a knife. To wait until later, when a saw must be used, involves larger wounds and slower process of healing.

The total of such pruning on a normal healthy tree will be very slight, not averaging more than a cut or two per tree per year, most trees going for several years without needing a cut, but nevertheless they should have an annual inspection with sharp pruning tools in hand. Where two branches form a sharp fork, that is, if they almost parallel each other, one of them should be removed. If both are allowed to grow there will be danger of splitting. No two branches or twigs should touch each other. Where there is such contact one should be cut off. If there is a tendency toward the formation of more than one main stem, or trunk, the pruning should remove or shorten all but the central stem in order to concentrate the growth in this main leader. If the upper part of the stem tends to bend downward, a short length of bamboo or small pole of other light, strong material, tied to the stem, will hold it in upright position. All shoots which develop along the trunk and the lower portions of the branches should be removed.

Since the object of pruning is to promote vigorous and symmetrical growth, it is well to be guided by the principle that the aim is to produce a primary frame toward the center, with a surrounding framework. The primary frame will consist of one or more main branches from the stem, while about this will be several smaller branches grouped in a way to form a symmetrical outer framework. The primary frame should be in harmony with the habits of growth belonging to the particular species. Branches which do not conform to the characteristic shape of the species, and cannot be made to conform, should be removed. Branches which develop too rapidly to harmonize with the general framework may be held in check by removal of their ends. These steps develop the tree along lines in keeping with the natural growth of the species. This is always desirable, since pruning is not intended to alter the normal form of the tree. The best pruning is that which leaves the tree most natural in appearance, and in the long run makes it look as if it had not been pruned at all. An exception to this general rule is to be made, of course, in trees trimmed into formal shape and small size for narrow, crowded streets. Trimming for this type of trees should always be done by an expert.

It is important that the trees should have a proper height of branching above ground and that the trees should be uniform in this respect. To achieve this it is necessary to pursue a policy of gradual removal of the lower branches. The removal of the lower branches should proceed with the growth of the tree from year to year, so that within a few years there will be 10 or 12 feet of the trunk free from branches. This height is necessary in street trees for the freedom of traffic, and it is also important in the matter of appearance. Trees with low-hanging branches are far less effective than those which show clean trunks to the proper height. The real beauty of a tree-lined thoroughfare is lost if the branches are so low as to shut off the vista of stately trunks and graceful foliage.

All wood which is either dead or dying should be removed promptly. A tree that carries a heavy burden

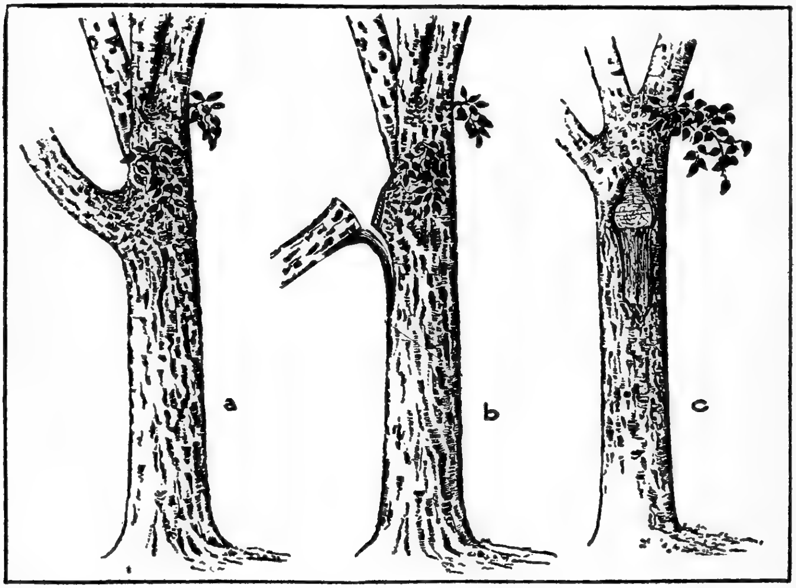


Proper method of pruning trees.

a.—Tree before pruning.
b.—Distance from trunk for first cutting.
c.—Second cutting of limbs close to trunk and scars finished with mallet and chisel.

of dead limbs loses vigor of growth, and has a ragged and irregular development. Imperfect limbs, also, should be removed.

If a tree has not had the early advantages of pruning during its years of development, even belated pruning may be made to play an important part in giving it new vigor and added beauty. Such trees are apt to have branches which cross or interfere with one another. In cases of this kind, removal of the branches that can best be spared will strengthen and improve the others. On a mature tree the cutting should be done at a crotch, and the wound should be parallel with the stem from which the limb has grown. The cut should be as close as possible to the remaining branch to promote rapid healing and a good appearance afterward. A perceptible collar or shoul-



Improper method of pruning tree.

a.—Tree before pruning.
b.—Limb cut too close resulting in bark peeling.
c.—Unsightly wound caused by this kind of pruning.

der will usually be found around the base of a limb, and the wound will heal most readily if the cut is made through this collar. The fact that the close cut involves a larger wound is less important than the lessened danger of decay and the better appearance which come with the absence of an unsightly stub. All cuts should be left with smooth regular edges and surfaces, as jagged, rough outlines or surfaces retard healing. When there has been a clean cut, properly made, a small wound requires no treatment other than waterproofing by painting the surface with a coat of shellac. This should be applied with a brush to the edges of the wound, covering the bark and at least half an inch of the wood. This should be done as soon as the cut is dry enough to hold the shellac, and within three or four minutes at the most after the cutting. The shellac serves to prevent loss of moisture, and since the cambium, or inner bark, will die if it is allowed to dry out, the coating is an essential step. Wounds more than half an inch in diameter require artificial protection during the process of healing. This protection is given by painting with shellac and following this by coating the center of the wound with coal tar, creosote or lead paint. The shellac forms one of the best protecting covers for the sensitive tissue between the bark and the wood where growth takes place, and which is called cambium layer or cambium. It is the least injurious to this vital but sensitive part of the tree of all of the substances now known. As it is not permanent when exposed to weather, especially moisture, it needs to be coated with one of the other substances mentioned. The shellac need not be applied to the whole wound if the cambium is thoroughly covered, including an inch of the adjacent wood.

If the wound is large, it should be sterilized by applying antiseptic after the application of the shellac. There are several preparations of this nature, and among these one of the best is creosote, which has a particular value in destroying the germs of decay and preventing destruction. The creosote is applied with a brush and should cover all of the exposed wood not covered by the shellac. On top of the shellac and creosote the surface should then be covered with a thick coating of coal tar to keep out water. This waterproof coating should be renewed from year to year, whenever there is a tendency to crack or peel. Even when no crack is apparent, recoating will do no harm, and it may prevent trouble from causes not visible. If shellac is not used the protective coatings must not reach the outer edges of the wound, where they will come into contact with the cambium as the latter is so sensitive to the chemical action of the material used for protection it may be killed by contact with it. It is a good rule not to allow the weatherproof applications to come within half an inch of the outer edges of the wound, except to cover shellac. The protective coating is applied with a brush, and if coal tar is used it is usually necessary to thin it by heating. Two coats should be applied, and these should be repeated from year to year until the wound is healed.

In pruning it is well to start at the top of the tree and work downward, as this not only simplifies the shaping of the crown but also makes it easy to remove any limbs or branches that may lodge in falling. In addition to cutting close to the trunk or remaining limb, it is important to make a clean wound, free from projections or raggedness, as a rough surface will impede healing. Care must be taken also to prevent injury to the surrounding bark. Pruning saws are made especially for this work, but a rather fine-toothed handsaw may be used. One with seven teeth to the inch is good for most purposes. Pruning saws come with teeth on one or both edges. The two-edged ones should be avoided, as the back is liable to do damage in close work. Pruning saws supported on a frame like a meat saw but with the blade on a swivel are especially desirable.

Great care must be exercised to keep a limb or branch from splitting and breaking the surrounding bark. In removing limbs of moderate size this is best accomplished by sawing underneath first and finishing from above. In cutting off larger limbs, the first sawing should be from the under side, at a distance of 10 or 12 inches from the base of the limb. This cut should extend about half-way through or until the saw pinches too badly. This should be followed by a cut from the upper side, a few inches farther out. The under cut prevents the split, which is bound to occur when the limb falls, from running back to the base of the limb and tearing the bark at the juncture with the parent stem. After the limb has been removed in this way, the stub may be sawed off at the trunk or parent stem without danger of splitting. In the case of a very large limb, the part to be removed should be supported from above by the use of ropes to prevent it from falling and doing damage to branches beneath.

Pruning may be done at almost any season, except when the sap is running in the spring. To prune in the spring will result in "bleeding," or loss of sap. This is never fatal and it is questionable if it is often seriously injurious, except to the nerves of sympathetic observers. The most rapid healing will probably take place following late spring or early summer pruning, when the tree is in full growth. The slowest healing probably takes place following August cuts. Fall or winter are favorable seasons because of the absence of foliage, which gives a perfect view of the inner branches of the tree's framework, and because, being a relatively leisure time, the work might be more thoroughly and carefully done.

The tools required for pruning increase in number with the growth of the tree. For the first pruning a sharp knife is the one tool necessary, and is best whenever it can be used. In subsequent work a pair of pruning shears will be found useful. Many of these shears have a single blade which works against a shoulder applied to the branch. The pressure of the shoulder to the branch should always be upon that part of the branch which is to be removed; if applied to the part which is to remain, bruising and injury will result. Some shears cut with a sliding motion of the blade, resembling the motion of a knife, instead of with the crushing movement of ordinary shears. The purpose of this arrangement is to prevent injury to bark or surface.

A pole pruner is useful as the tree gains height. This is mounted at the end of a pole 10 or 12 feet in length, or longer as needed. The cutting is done by operating the knife by means of a rope, while the workman stands on the ground. A spring serves to bring the blade back into position after a cut has been made, so that the blade is ready for another cut. This implement is useful for removing small branches and shoots. Of a similar nature is the useful pruning hook, mounted near the end of a pole. The curved cutting edge is on the under side of the hook, and the implement is used by pulling this blade downward over the branch or twig to be severed. At the end of the pole is a chisel, to be used with upward stroke and pressure. This chisel is convex, to prevent slipping. A pruning saw on the edge of a pole is also useful. Great care must be exercised in the use of the pole instruments to avoid letting them strike limbs or trunk, as serious wounds may result from such blows.

For the removal of large limbs a pruning saw must be used. Saws for this purpose have spreading teeth, to make a wide cut. The ordinary saw makes a narrow groove, and lets the green wood bind the blade to an extent which makes sawing difficult. An ax should not be used for pruning.

CHAPTER XV.

INJURIES TO SHADE TREES

THOUGH a shade tree may have a thousand enemies and but one friend, its chance of life is good if that friend holds a determination to give proper care to injuries which the tree may sustain.

The sources of injury to the street tree are many and persistent. City traffic aims countless blows at the trunk; overhead wires, snow, hail, sleet and windstorms are a constant menace to the branches and foliage; underground construction of pipes and conduits constantly threatens the roots; and, as if these were not enough, carelessness endangers growth in many ways that can not be enumerated. Wounds and injuries come from these various sources. These may be overcome only by careful attention.

Even a slight injury may develop into serious results unless properly treated. For this reason, no wound should be neglected. Every injury which extends beyond the outer bark makes a place where insects, parasitic diseases, or wood decay or all may enter. Every broken limb or branch offers opportunity for attack. To prevent trouble prompt action is demanded. Here, if anywhere, is the need to apply the remedy before the trouble spreads, as it is not only the cheapest but also the only safe way. The neglected wound invites decay, which may easily prove to be fatal.

Traffic injuries take many forms. When a street tree has outgrown the guard of its youth and this protection has been removed, damage is possible. Horse bites are frequent sources of trouble, while other traffic dangers come from runaway horses or unruly automobiles colliding with unprotected trees, from draymen backing their trucks against them sharply, while porters or laborers scrape branches or trunk with merchandise in loading or unloading. Such carelessness will largely be curbed if it is known that an alert official is watching the trees, and that punishment will be meted out for damage done.

The top of a tree may sustain either direct or indirect injury from overhead wires. Linemen should not be allowed to cut limbs for the stringing of wires, nor should they be permitted to attach wires to any part of a tree. In most cases it will be found that the apparent necessity for either of these things can be averted by careful consideration of other ways and means for the placing of the wires. Even when this is done, it is sometimes necessary that wires pass through a tree-top, and in such cases, close watchfulness is required, and if trimming is essential, it should be done by the city employees, not by the linemen. A swaying wire may cause serious abrasion, with possible death for the part affected, especially after insulation is worn from electric light or power wires. Linemen should never be permitted to wear spurs in climbing trees, as the sharp points make serious wounds in bark and wood through which disease and decay could enter. Broken limbs and split or torn bark are sequels to severe storms or heavy snowfall, and many trees have been lost as a result of neglect to care for the wounds. In most cases the loss was needless. Even when badly mutilated, trees may be saved for long careers of usefulness and beauty if given prompt and intelligent attention.

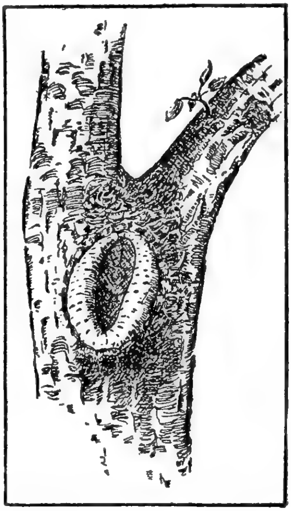
Injury to the roots occurs in the installation of sewers and conduits, the laying of gas and water pipes, the placing of paving in street or on sidewalk, the changing of grade, and similar types of construction. Work on these improvements is almost certain to cause the cutting or mutilation of roots. Such injuries require immediate attention. The injured parts must be removed or freed from ragged edges to facilitate the process of healing, and in extreme cases by a corresponding trimming of the top, to reduce the foliage demands to correspond with the lessened power of the root system. In planning construction work which threatens damage to the roots of trees, the harm may frequently be averted by suiting the plan of work to the existence of trees. Contractors should not be allowed to excavate near a tree, for any purpose, without the approval of the civic authorities. If the community has a shade tree department, the entire work should be under the supervision and control of that branch of the local government. Through consultation and cooperation—and through compulsion, if need be—much damage can be prevented. In underground construction, and even in widening a street or changing a grade, it is often possible to modify plans in a way to save trees which would have been sacrificed if there had been no municipal control.

Underground damage does not always start below the surface, but it may come from above, as in the case of salt water from ice-cream freezers emptied near the base of the tree or calcium chloride or sodium chloride (common salt) applied to the surface of roads and walks to keep down dust. These substances are very injurious to the roots of trees and other plants, as is also water in which much of either is dissolved. Road oils also have to be handled carefully in the neighborhood of trees to prevent injury to the roots. Salt should never be used for melting ice or snow on a sidewalk near trees, as the brine thus formed will injure any roots that it reaches. Precaution is necessary in connection with drainage from mortar beds placed near trees. Water saturated with lime must not be permitted to reach nearby root systems, as the lime will cause serious injury.

Gas leaks are a frequent source of underground damage. Prevention of trouble from this source and treatment for the overcoming of injuries are detailed in Chapter XVII.

Much of the damage to shade trees is purely man-made, ranging from the wounds caused by careless use of the pruning-hook to those incidental to building construction. In the erection of a new building a tree is liable to various forms of mistreatment—all of them injurious and preventable, as using a tree as part of a scaffold or allowing guy wires or ropes to be fastened to its trunk, piling of stone, bricks or other building material against it or striking with the hubs, double-trees or fenders of delivery vehicles. If, under the stress of extreme and unusual conditions, it should be necessary to permit the use of a tree as a substitute for the support of a guy wire, ample protection should be provided in the form of substantial strips of wood, placed vertically and in such way as to keep the cutting force from reaching the bark. To use a padding of burlap or other textile fabric, as is sometimes done, fails to furnish adequate protection, as the strain penetrates this soft material and often causes serious damage. If the piling of stone, bricks, sand, lumber or other building material is a necessity due to limited space or other unavoidable causes, the tree must be protected by strong wooden guards to prevent cutting or bruising the trunk.

All of these injuries can be avoided. When the damage has been done the important step is at once to repair the injury and apply the means of healing. Prompt action simplifies the healing process and improves the tree's chance for complete recovery. When bark is torn or broken, all ragged or loose bark should be trimmed with a sharp knife or a gouge, and the wound should be given protective treatment at once by painting the exposed wood with coal tar, creosote or lead paint as directed under pruning. (See page 145) Ragged edges of the bark should be pared cleanly with a sharp knife, before treatment, as smooth edges heal much better than those which are uneven. If the wood has been injured, the damaged part should be cleaned out with a knife or gouge before the treatment is applied. Bark which is merely bruised, but not torn or broken, requires no treatment.


Proper healing of wound in a tree.

In paring the bark around the edges of a wound, special care must be taken with the lower edge, as it is particularly important that this part should be smooth in outline and should have no tongues projecting upwards. The bottom of the opening should be rounded downward, or better, pointed, and its center should be its lowest part. This is necessary in order that it may more easily receive nourishment from the down-flowing sap. The flow of sap is in two directions. Moisture taken from the soil by the roots carries its contribution of mineral salts upward, mainly through the sapwood to the leaves, and returns towards the earth, mainly through the inner bark, after having been changed in the leaves by the addition of carbon products, taken from the air under the influence of sunlight. On its downward journey, this altered sap conveys and distributes materials essential to growth that were prepared in the leaves. The sap travels most readily in straight lines, and because of this tendency the sides and upper edge of a wound fare best in the matter of receiving nourishment, while the lower edge is out of the direct channel and is less generously supplied. Thus it is obvious that a tongue of bark, projecting above the lower edge of a wound or bark below a broad wound, cannot receive its share of sap, and must therefore languish and die. Even on the upper edge a projection is undesirable, but it has better chance than a similar tongue on the lower edge. From this it is clear that the wound should have its edges so trimmed as to make as little top and bottom as possible. In other words, the wound which has its longest dimension parallel with the limb and the shortest dimension across it, is the one which will heal most rapidly. These factors should be borne in mind in trimming the edges.

In connection with injuries to the bark it must be remembered that bark which has been seriously damaged, or which has been torn loose from the trunk, can never be made to resume its growth. Efforts are sometimes made to induce growth by fastening the bark to the tree with nails or otherwise. This not only does no good, but works still further damage by making an attractive rendezvous for insects and decay. The only thing to do in a case of this kind is to cut away the loose and injured bark and apply protective coverings.

Freezing sometimes does more or less serious harm to trees which have been transplanted from warm climates into regions of severe cold. Cracks or splits in the bark and wood, caused by alternate freezing and thawing, invite disease and decay. The wounds should be treated as soon as they become apparent, which is usually during the summer, when the bark splits away from the wood. Injured parts should be cut away and the surface given a protective coating. Wrapping the trunk of a tree with burlap or straw, before cold weather, will prevent frost damage, not by keeping the tree warm as many suppose, but by protecting it from the sun's rays during the day, thus preventing so much variation in temperature between day and night. This is especially helpful when the day temperature in the sun is well above freezing and the night temperature several degrees below. Shading the south side of a trunk is often sufficient to protect against frost cracks or sun scald.

In old trees it frequently happens that the bark near the base comes loose from the trunk, preventing a proper flow of sap downward and forming a hiding place for insects which endanger the life of the tree. Loosened bark may be detected by tapping with a metal object. If the taps produce a hollow sound, easily recognizable when contrasted with the sound of taps on a healthy tree, the loosened bark must be removed and the wound treated with some protective material as already discussed.

For the repair of all injuries, and even for the chance to live, the street shade tree needs and merits a friend. In a town or city where there is a shade tree department, the friendly offices of healing and repair are best exercised by the constituted authorities. Where there is no such department, the tree must look to its next of human kin—the property owner or nature lover who transplanted it into its strange environment and who profits most by its existence and development. For him to withhold the needed help is to nullify the effort of planting. Such neglect is short-sighted and inexcusable.

CHAPTER XVI.

REPAIR OF SHADE TREES

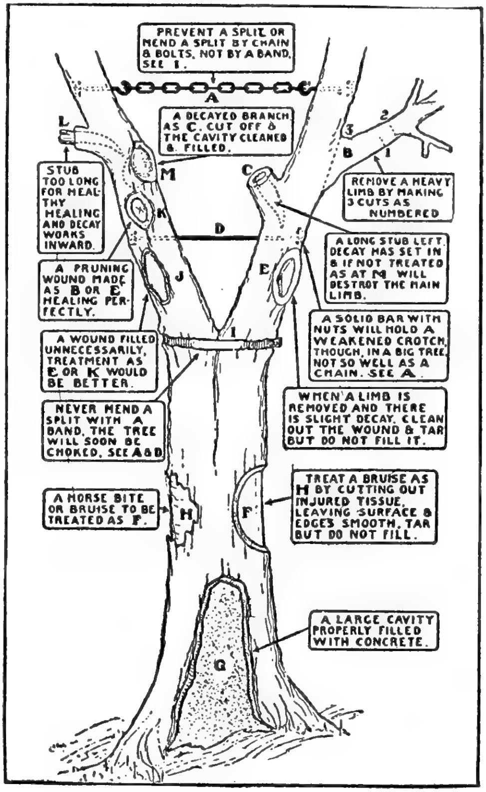
TREE repair is comparable with both surgery and dentistry. For the amputation of limbs the use of the surgical knife is required; for mending splits in trunks or frame, the treatment is akin to the application of the surgeon's brace; and for the prevention of further damage, due to decay, the human parallel is found in the filling of a tooth.

In minor operations no particular technical skill or experience is necessary, but in the more elaborate repairs the work should be done whenever possible by one who has high technical skill, knowledge and experience.

Just here let emphasis be placed on the importance of selecting the right man for intricate operations. None of us would entrust our families to the care of the casual stranger, who might happen along and represent himself as combined surgeon, dentist and mender of clocks and shoes. For the curing of human ills and the repair of broken bones we seek the best skill obtainable. Similar care should be exercised in the matter of helping badly damaged trees.

This warning is founded on the widespread disaster resulting from the work of irresponsible, unscrupulous, or unreliable persons calling themselves tree surgeons. These are so numerous and their methods so damaging, that every tree owner or custodian should be on the alert to prevent his trees from falling into the hands of such "tree butchers." The employment of a man who cannot show proper credentials or references, or whose skill is not known is equivalent to paying out money for the destruction of a tree. Felling the tree with an ax would be cheaper and no less certain.

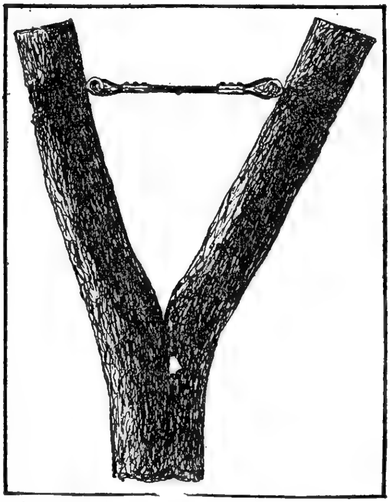
The menace of the incompetent tree surgeon has been recognized by Connecticut and other states in the passage of laws designed to protect the public against his destructive methods. One such law requires that no person may practice tree surgery or repair without a license, and that this license shall not be granted until the applicant has proved himself qualified for the work. If trees are worth having, they are worth protecting from the ravages of the quack, and experience shows that this requires strict legal regulation, with severe penalties for the violator. This sort of legislation seems as necessary for safeguarding the welfare of trees as for the protection of human life and limb.



Proper and improper tree surgery.

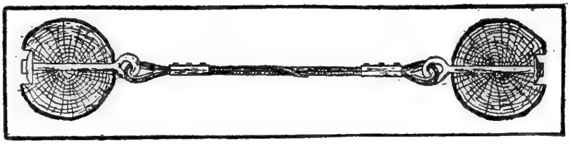
The simplest surgical operation is the removal of dead or dying branches or decaying stubs, followed by antiseptic treatment and the application of a water-proof covering as protection against moisture and decay.

In removing a decayed or diseased branch, all the affected portion should be taken. The cut should be through sound wood, at a point back of the trouble, unless the decay extends into the trunk, when it will be necessary to dig out all the decay and treat it as a cavity. Care must be taken to make the removal of a branch in such way as will cause no injury to the surrounding parts, as discussed under pruning, and then treat the wound as advised for the treatment of large wounds in the same chapter. The treatments of other mechanical injuries that may be helped by pruning are discussed in the chapter on injuries.


How to attach eyebolt and stranded wire.

The splitting of crotches must be braced to prevent additional splitting and to permit healing. If the split is an old one, the first step is to remove all decayed or diseased wood from the wound, apply an antiseptic wash and water-proof the surface by means of an application of coal tar. Where there is neither decay nor disease, the antiseptic washing will be all that is necessary in this preliminary treatment. The next step is to brace the split part. In the case of a divided trunk, a single bolt, just above the crotch, will suffice if the split is small; while for a larger one, it will be found necessary to use one bolt at the height of the crotch itself, and a second a foot or more higher, regulating the location of the upper bolt by the size of the two stems, and their position in relation to each other.

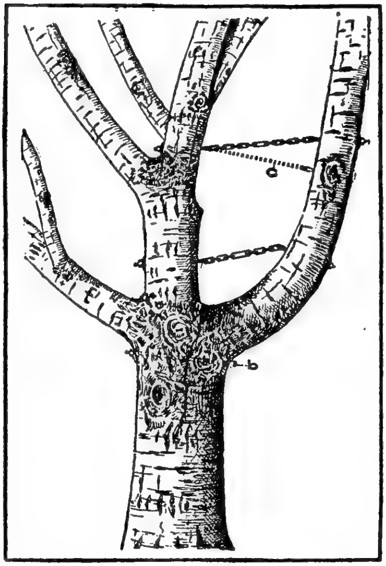
For applying the bolt, bore a hole through the center of the trunk, using a bit a half inch or larger in size. The larger the tree the larger the bolt required. At each end of the hole affix an iron washer about three times the diameter of the hole. These washers are affixed by cutting away some of the outer bark and wood and sinking them into the depressions thus made at right angles to the bolt. Into the hole insert a bolt which fits snugly, and of a length which will cause it to project from a quarter to half an inch at each side. When the bolt is in place, a nut should be placed on each end and these should be screwed up until they are tightly against the washers. Before the bolt is inserted, tar or creosote, preceded by shellac on cambium layer, should be applied to all exposed places, including those cut for the accommodation of the washers. The hole itself should also be tarred or creosoted. To complete the work, the exposed parts of the bolt and nuts should be water-proofed.



Method of attaching eyebolt and stranded wire.

Two limbs sometimes split apart where they divide, as a result of the force of wind-pressure. To check a split of this nature as soon as possible is important. The process is called guying. In this work the split is bolted in a manner similar to that used for bracing split trunks.

For guying close to a crotch—within 18 to 24 inches—a single bolt extending through both limbs may be used. In applying a brace further from a crotch, flexibility for the swaying of the limbs in the wind may be obtained by using a chain or cable attached to bolts instead of a single bolt. In this method a bolt is put through each limb with a ring or hook on its inner end, and to these there is attached a wire chain or cable of proper length to connect the two bolts firmly and to hold the limbs tightly in their relation to each other. By screwing up the nuts the connection may be tightened slightly, either at the time of insertion or in case of future need. Instead of the wire chain or cable connection, a turnbuckle center may be used, as giving more freedom in tightening or loosening the strain on the bolts, but this is practicable only when the limbs are quite close together.



Improper method of chaining a tree. Dotted line shows more effective method. b. bolt. c. chain.

In guying limbs, as in bracing trunks, it must be remembered that a coating of tar or creosote should be given the hole and edges of the bark where cut.

If more than two limbs are involved in a split, they may be guyed in combination.

It is of the utmost importance that guying should never be done by means of an encircling wire or other girdle about tree or limbs. With growth of the tree the girdle will cut into the bark, interfere with the proper flow of sap and in time shut it off entirely and thus cause the death of the part above the girdle. To wrap a wire around a tree for any purpose is almost certain to cause death.

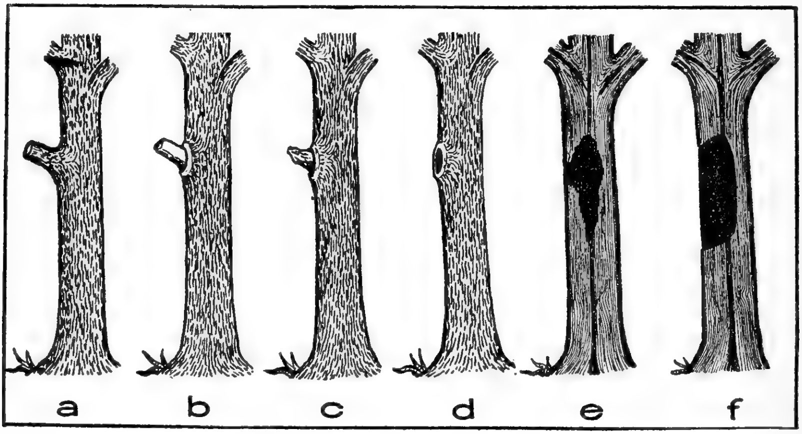
When the loss of bark almost or entirely encircles a tree, a process known as bridge grafting may reunite the upper and lower edges of the remaining bark, and thus sometimes reestablish the flow of sap. The grafting is done in spring, by the use of dormant shoots or twigs of the previous year's growth somewhat longer than the bare place, affixed perpendicularly under the freshly trimmed edges of the bark to bridge the wound. The ends of the twigs are trimmed wedge shape, and these sharp ends are inserted between bark and wood, beneath slits in the bark above and below the wound. When properly placed, they form a bridge through which the sap may flow. To hold the bridge in place, a cloth bandage should be tied around each edge of the bark. To prevent drying, the ends of the bridging twigs should be coated with melted grafting wax. This wax may be made of four parts of resin, two parts of beeswax and one part of tallow, melted together and worked with greased hands, in cold water, until it becomes grainy. Success with bridge grafting depends upon close contact of fresh cambium layers of scion and stock at both ends, with immediate protection from further evaporation by thorough and careful waxing.

Cavities offer serious problems in the life of a tree and require careful treatment. Minor cavities may be cared for by the layman, without previous experience, if simple rules are closely followed, but in the case of a large one it is unwise for the work to be undertaken by any but the technically trained expert.

One of the commonest causes of decayed cavities is the protruding stub left from careless pruning. Unless the limb has been cut without leaving a stub, rot will start which, sooner or later, will spread its decay into the trunk. Similar results come from neglected surface wounds. In the course of time troubles thus started imperil the life of the tree.

In the treatment of cavities it is most important that no trace of dead or diseased wood be allowed to remain. The basic principle is to make sure that all decay is removed. To leave decayed or diseased tissue will spoil the whole job.

Repair begins by digging out the diseased or decayed wood. For this purpose the operator should be equipped with a knife, gouge, chisels and mallet. He should not be alarmed at the growth of the cavity brought about by his



How a cavity is caused and how to treat it.

a.—Stub left after pruning.
b.—Decay starting in stub.
c.—Decay well advanced.
d.—Cavity formed in trunk.
e.—Section of trunk showing cavity.
f.—Cavity cleaned out and ready for closing.

digging, for it is necessary to remove the affected tissue, no matter how large the resulting hole may become. To make sure that the last trace of decay or disease is taken out, the digging should extend into healthy wood. On the outside, the rolls of bark which have grown up at the edges of the cavity should be pared off to a point even with the natural shape of the trunk.

When the cavity has been cleaned, exposing a smooth surface of sound wood at all points, the cambium and adjacent parts should be painted with shellac; then the walls should be sterilized with copper sulphate or creosote applied with a brush. This should be followed by at least two coats of coal tar over the shellac and creosote. If the cavity is shallow and so shaped that it will drain water, this treatment is all that will be necessary. It must be borne in mind that water is the great enemy of wood, and if the cavity is such as to permit the accumulation of moisture, an opening should be made at the bottom to allow any water to run out freely.

A small cavity may be filled with cement mixed with sand, in the proportion of two parts of sand to one part of cement, and with enough water to make it plastic, or with tar and sawdust. To hold this filling, the inner walls of the cavity should be shaped in a way that will serve to anchor the cement by giving it a foothold, just as a dentist cuts grooves and angles into the walls of a tooth to hold a filling. If the opening is smaller than the interior of the cavity, no particular anchorage is necessary, as the shape of the cavity will hold the filling in place, but with a cavity in which the opening is the largest part, a means of holding the filling must be provided. One useful form of anchor is made by cutting a deep groove in the wood immediately inside the opening and encircling the edges. This groove grips the cement and serves to hold it firmly after the hardening process has taken place. If more anchorage is necessary, it may be provided by means of flat-headed wire nails or staples, half-way driven into the walls, the projecting heads furnishing a grip for the cement.

In placing the cement use a trowel and a tamping stick. The stick should be an inch or two in thickness and two or three feet in length, or of such length as may be best used in the cavity. After a two or three inch layer of cement has been placed at the bottom of the cavity, the material should be spread with the trowel and then compacted by use of the tamping stick. This process should be repeated in two or three inch layers until the filling is complete, and the tamping should always be directed toward the back of the cavity rather than toward the bottom. The filling should stop at a point even with the surface of the wood. To allow the cement to project outside the wood, so that it is flush with the outer surface of the bark, will delay the purpose for which the operation was performed, as such projection will prevent new tissue from covering the opening without first lifting the edge of the old bark and growing up over the cement. If the filling is flush with the surface of the wood and the cambium has not been injured, a healing callous will promptly grow over the edges, and if the wound is small this new growth may eventually cover the entire surface. In overlapping the edges of the cement, this new tissue completely seals the cavity and usually keeps out moisture in small cavities.

After the cement has dried, its surface should be coated with coal tar, to prevent unnecessary absorption of water.

Often creosoted wood blocks, sawdust and tar are used instead of cement and have some advantages, especially less weight, without marked disadvantages.

If the cavity is long and deep, leaving little more than a shell of a trunk, the tree should be removed unless there is some very special reason for trying to prolong its life. If it is determined to fill the cavity, the tree should be braced and guyed and then the cavity should be reinforced by means of one or more bolts. A cavity less than two feet long usually requires no such reinforcement, but in those of greater length a bolt every two feet is desirable. The bolting is done in fashion similar to the process of bolting split crotches. The bolt should be half an inch thick, or even larger for trunks of considerable size, and must fit snugly into the hole bored for its reception. It should be placed where the nature of the cavity indicates the greatest need. The bolting should be done, of course, before the cavity is filled.

In considering cavities and their treatment, it is important to remember that large cavities offer serious problems and give chances for complications, and that for this reason it is generally best to leave them unfilled or open but if it seems best to have them filled, it will be wise to place the work in the hands of an expert rather than to try to repair them without the special knowledge and experience which are so essential.

CHAPTER XVII.

DAMAGE TO TREES BY GASES.

ILLUMINATING gas is a frequent menace to the street shade tree. Leaky gas-mains or service pipes are common in town and city streets. The leak may come from defective construction of the pipe-line or it may result from the jars and jolts of traffic. The one thing of real value is a policy of constant watchfulness to detect trouble at the start, followed by immediate steps to prevent its further progress and to overcome the damage already done.

This watchfulness must be exercised wherever a tree is neighbor to a gas pipe. That it should be an immediate neighbor in order for trouble to arise is not necessary, for the damage may spread for a hundred feet or more from the source of the leak. Frequently it is found that all trees and other vegetation within this distance are affected by the poisonous gas. The greatest injury is usually in the section nearest the leak, of course, but serious harm may be done at any point within the area through which the escaping gas penetrates.

The extent of the damage and the rapidity of the spread of the gas depends on the size of the leak and the character of the soil. When a pipe becomes broken and permits the sudden flow of a considerable volume of gas, a number of trees in the general neighborhood may be killed within forty-eight hours. If the leak is small, such as may be caused by the imperfect joining of pipes, or by the separation of a joint, the spread is much less extensive and the progress comparatively slow. Sandy soil permits the gas to travel more rapidly and to extend through a greater area than does clay.

The presence of a sudden leak of large volume, resulting from a break in a main, will usually show itself through changes in the appearance of all vegetation within a nearby circle. When the tree is in leaf, a flowing leak of this nature may generally be located by noting where the damage is greatest, for it will be found that the leak is near the center of the area affected, and nearest the particular tree which appears to suffer most seriously. The exact location may then be determined by the sense of smell.

When the trees are in foliage, gas poisoning which results from a sudden flow of gas makes itself immediately visible by the action of the gas on the leaves. As a result of the poison the leaves turn yellow, wilt, and finally fall. Later, the bark is apt to drop off in small patches, while dark blue stains may be found in the inner bark and in the roots. In the case of a smaller and more gradual leak the leaves turn yellow and droop, foliage is gradually thinned by the falling of some of the leaves, and a general appearance of unhealthiness and loss of vigor shows itself in the entire tree.

While the signs mentioned may result from other causes, and do not always indicate gas poisoning, their appearance makes it important that an immediate investigation should be made for the location of a possible leak. The surest proof of the presence of gas is its odor, which is so pervasive that it cannot be overlooked and is not likely to be confused with any other scent. When there is the slightest suggestion of this odor, steps should be taken at once to locate its origin. Even if the sense of smell does not detect gas when the symptoms of trouble appear, a careful search should quickly be made for the purpose of determining whether or not gas is to blame. In this search, one or more holes should be made in the ground with a crow-bar, to a depth of three feet or more. When the crow-bar is withdrawn, the gas, if present, may usually be detected by applying the nostrils close to the hole; or, even more effectively, by inserting a length of pipe into the hole and drawing up the gases from the subsoil by inhaling. *A lighted match should never be used in seeking a leak, because of the danger of causing an explosion.*

When gas is discovered, the possibility of saving the tree depends entirely upon the extent of the damage already done and the degree of promptness with which the remedy is applied. If the injury has not progressed very far, and immediate action is taken to remove the poison, complete restoration is possible.

One of the first steps, of course, is to see that the leak is repaired and further damage prevented. Prompt report to the gas company will usually result in immediate attention to the matter of repairs, for shade tree destruction by illuminating gas is recognized by the courts as constituting cause of action against a gas company. Many decisions may be found holding companies responsible for the death of trees and enforcing the payment of cash damages to the owners. The penalties thus exacted are useful in influencing a gas company to take every care to prevent leaks, but penalties do not restore trees and money cannot compensate for their loss. Frequently it will be found that the company, mindful of court decisions in awarding damages in similar cases, will cause its men to render first aid to the soil as well, with a view to preventing the death of trees in the immediate vicinity. This first aid is doing everything possible to free the soil of the gas which has accumulated.

The elimination of gas from the soil is not an easy matter and sometimes it is impossible to bring the soil back to a state of freedom from taint, but usually it will be found that a healthy condition may be restored. One of the best means of accomplishing this is to dig a trench 6 or 8 feet from the tree and as deep as the lowest part of the gas main from which the gas has escaped. If the gas has penetrated the soil on all sides, this trench should completely encircle the tree. Otherwise it will be necessary for it to be only on that side from which the flow of gas has come. This trench must be open sufficiently long to give the gas abundant time to escape. Ordinarily 30 days should be allowed for this.

When the gas has been given time to escape, the trench may be refilled with the soil if it has been thoroughly refreshed. It is safer, however, to provide entirely new earth, fortified by the addition of well-rotted compost in quantity equal to one-fifth of the bulk of the soil.

If these steps do not restore health, the tree should be removed. It is wise, however, to wait until an entire summer has passed before removal. In case removal proves necessary care should be taken to make sure that the gas is entirely eliminated from the soil, or fresh soil should be provided before planting a new tree.

Atmospheric influences are also a source of serious harm to shade trees. Gases and vapors in the air often seriously damage and sometimes cause the death of trees. This menace is especially prevalent in manufacturing communities, in which stacks and chimneys discharge their gas-laden fumes and smoke.

A very common offender is the smoke from soft coal, because of the large percentage of sulphur. The sulphuric acid resulting from combustion attacks vegetation. Smoke also causes trouble from soot, which is deposited on the leaves, obstructing light and clogging the breathing pores to an extent which sometimes results in asphyxiation. Heavy discharge of smoke also deposits soot particles on the ground, impregnating the soil with smoke acids and reducing fertility. Trees near factories and railroad roundhouses are particularly liable to damage from soft coal fumes. The evil effects of soft coal smoke are not severe in the neighborhood of small manufacturing concerns of the ordinary type, where the chimneys are carried well above the foliage. Also in humid regions the dust is washed from the foliage at rather frequent intervals. Nevertheless, coniferous evergreens and other especially susceptible trees do not thrive where soft coal is much used. The use of sulphur for bleaching purposes in an industrial plant releases gases harmful to vegetation. Injury is also sometimes caused by the fumes or other careless discharge of industrial wastes where naphtha, ammonia, carbolic acid, creosote oil and coal-tar or its products, or petroleum products are used.

When damaged by atmospheric gases, young leaves first show discoloration and then slowly droop and die. The twigs show reduced rates of growth, and gradually this reduction becomes apparent throughout the entire tree. These symptoms are followed by the death of the twigs and sooner or later by the death of branches and trunk as well.

Trees vary in their ability to resist injury from gases. It might be supposed that the slow-growing trees of sturdy nature would be less susceptible to this form of damage than those of rapid growth and short life. The reverse, however, has been found true. Among the trees which suffer most are the Oaks, the Elms, the hard Maples and the Lindens. At the other end of the scale, with the greatest powers of resistance, are such trees as the Poplars, the Box Elder, the Silver Maple and the Ailanthus, which will survive gas attacks where other trees would succumb. In England, the Elder has been found to be the tree which most successfully resists injury of this nature. It is obvious that where coal smoke and other harmful gases are present, tree planting should be confined to the varieties which are least damaged by the gases.

Trees in the vicinity of cement plants suffer from the deposit of cement dust on the foliage. Dampness may cause the dust to "set" or harden, which results in damage, although rain is apt to wash it off. The gases from open-air furnaces, used for melting tar and asphalt, and from steam rollers sometimes do serious harm.

There is no remedy for trees affected by atmospheric gases. Removal of the cause is the only way to put a stop to the trouble. The construction of tall smoke stacks helps to overcome the danger.

Trees weakened from the effect of gases, as from other causes, are more subject to insect and disease attacks than are healthy trees.

CHAPTER XVIII.

TREE DISEASES AND THEIR TREATMENT

IT is not possible that every tree planter should possess the technical knowledge required for the precise diagnosis of every tree ailment, for this is to be gained only by special technical training and practice. The individual, however, may at least familiarize himself with some of the fundamentals. An effort is here made to furnish help along this line.

Fungus growths on plants are of two kinds. One type —known as the parasite—lives upon wood bark, leaves or other live parts and takes its nourishment at the expense of the tree's vitality. In thus feeding it robs the tree of its strength and vigor and brings about serious damage. The other type—known as the saprophyte—lives upon dead plant material. With this distinction in mind it will be clear that, with respect to fungous diseases, the parasite is cause and the saprophyte effect.

Fungi attack all parts of the tree, from roots to foliage, flowers and fruit. The results are of varying character and manifest themselves in various ways. Frequently, the location of the chief damage is altogether remote from the point of attack, since a disease of the roots will often manifest itself through dying leaves and branches at the top of the tree. The most common form of damage, however, is localized and brings about the death of individual leaves or branches or causes decayed cavities which prove fatal if allowed to progress.

A fungus starts from spores, or tiny organic dust-like particles, corresponding to seeds in purpose, which are

APHIDS OR PLANT LICE

Painted maple aphid

Drepanosiphum acerifolii Thos.

1 Infested leaves of silver maple

2 Adult winged specimen enlarged

3 Nearly full grown nymph enlarged

4 Younger nymph enlarged

Chaitophorus ? aceris Linn.

5 Infested leaves of Norway maple

6 Wingless female enlarged

Two-spotted lady beetle

Adalia bipunctata Linn.

7 Larva

8 Pupæ

9 Adult

Woolly beech leaf aphid

Phyllaphis fagi Linn.

10 Infested beech leaf

11 Nymph enlarged

Elm leaf aphid

Callipterus ulmifolii Mon.

12 Infested elm leaf

13 Nymph enlarged

14 Winged female enlarged

Transverse poplar stem gall

Pemphigus populi-transversus Riley

15 Galls

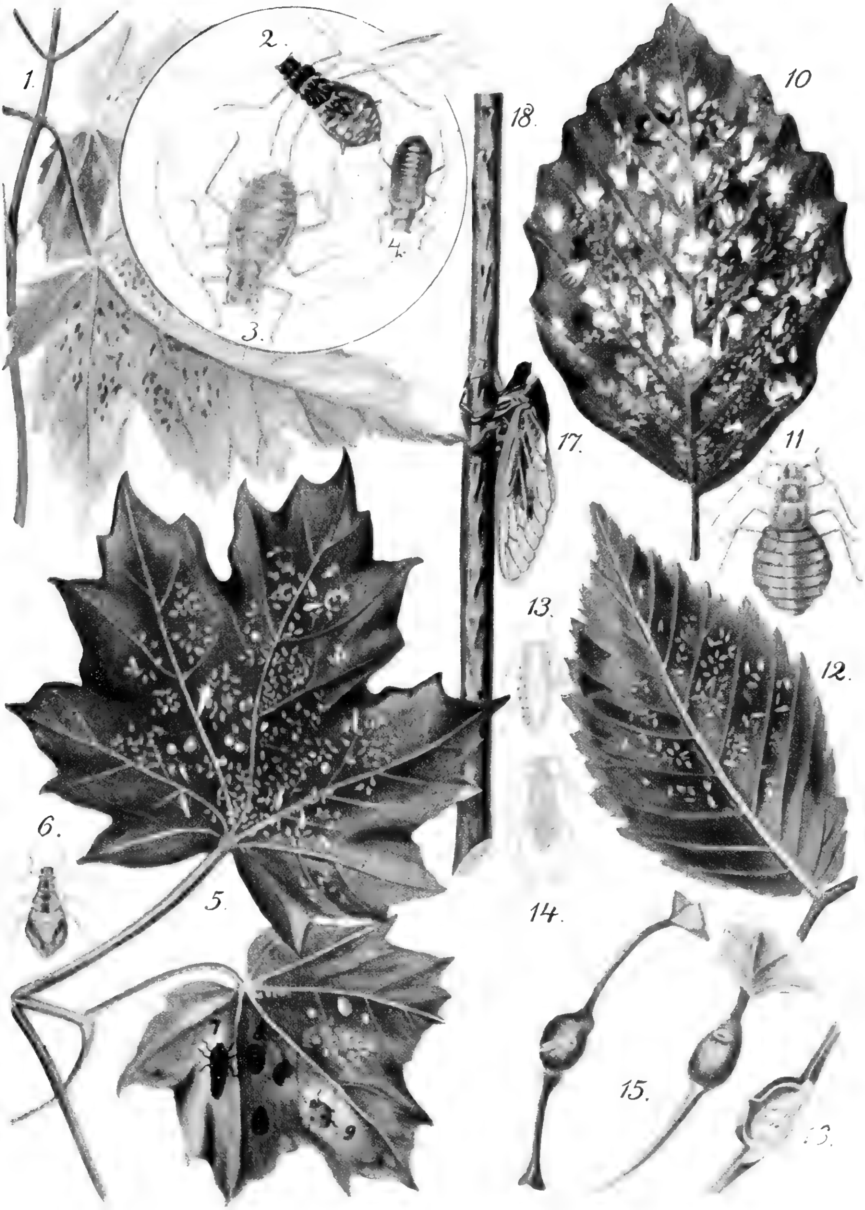
16 Section of one showing plant lice within

Periodical cicada

Tibicen septendecim Linn.

17 Side view of adult

18 Twig showing oviposition scars



L. H. Joutel. 1905

APHIDS OR PLANT LICE

widely scattered by the wind from a fungus already fully developed. These spores, lodging in wounds in bark, wood or twigs, or on leaves, send out rootlike threads and establish themselves in the tissue adjoining the wound, for their life work of feeding on the tissues and food manufactured by the green leaves of the plant. The roots, or threadlike filaments force their way into the bark, stem or leaf in all directions and form a mass of meshed fibres known to science as the mycelium. It is to this fibrous mass that the damage is due, as it absorbs the life-giving food which is needed by the tree itself. When the mycelium has become firmly imbedded in the tissue adapted to it, it extends to the outer surface, through the original or another wound in the bark, and shows itself in the form of the familiar bracket, or perhaps in the form of a toadstool, a puffball (powdery-looking coating of almost any color). These are the fruiting bodies, which often produce millions of spores for creating new generations of fungus growth, and when mature, they release these dust-like spores to be scattered on the breezes and begin again their work of destruction in wounds on other plants.

In the treatment of fungi it must be remembered that the fibrous mass within the plant is the cause, and the outside substance, or fruiting body, is the effect. Remedy calls for the removal or prevention of the cause. To remove the fruiting body does only temporary good, as another will quickly grow in its place. The only remedy is to cut out the entire mycelium. Where this is possible, and it is thoroughly done, the trouble will not come back. In applying this treatment, care must be taken to make the removal complete and to dress and protect the wound thoroughly, as outlined in the chapters on repairs and the treatment of injuries.

The fungous growths which are most conspicuous are those seen in the form of shelves or brackets on the trunks and limbs of trees. These outward signs of attack do not show themselves until the growths have taken deep root in the interior, and their appearance is a sign that the damage has already made serious progress.

Prevention of fungous growths is easier and more effective than subsequent treatment. In most cases the attacks have their starting points in wounds or scars. Without these wounds to furnish a place of lodgment, the spores could rarely gain foothold. Recognition of this emphasizes the importance of preventing injuries, as far as this may be possible, and the necessity for giving prompt healing and protective treatment to all wounds which may occur, in spite of precautionary measures which may have been taken. The development of injuries to bark or wood is akin to the progress of decay in a tooth. If immediate attention is given, decay is stopped. If treatment is neglected, a slight injury may develop into a serious and constantly growing cavity, with grave consequences.

Fungous growths on trunk and limbs are of many varieties, but they have the same general characteristics as to origin, and call for the same action as to treatment.

Some of the common fungous growths are known in a general way as heart-rots. These assume several forms and attack the heartwood of many trees such as the Beech, Aspen, Maple, Birch, Walnut, Oak, Hickory, Alder, Ash, Poplar and others. The Oak, Ash and Maple heart-rots so-called, are common on other kinds as well, so these names are not distinctive and are not generally recognized in connection with specific fungi. Likewise red heart-rot and white heart-rot are not used specifically for any fungus and are often misleading.

SCALE INSECTS

Maple phenacoccus

Phenacoccus acericola King

1 Clusters of male cocoons on sugar maple bark

2 Females and young on underside of leaf

Black-banded lecanium

Eulecanium nigrofasciatum Perg.

3 Badly infested soft maple twigs

4 Young along sides of leaf veins

10 Male, enlarged

11 Full grown female scales showing characteristic markings, enlarged

12 Young, enlarged

Golden oak scale

Asterolecanium variolosum Ratz.

5 Infested oak twig

Tulip tree scale

Eulecanium tulipiferae Cook

6 Badly infested tulip branch

8 Recently hatched young, enlarged

9 Young scales, enlarged

White flower cricket

Oecanthus sp.

7 Oviposition scars

L. H. Joutel, 1905

MAPLE AND OTHER SCALE INSECTS

Slime-flux is an ailment frequently found on the Elm, Maple, Yellow Birch and some other trees. This is in the nature of an ulcer and is usually associated with a wound. It is sometimes found in connection with a defective cement-filled cavity. The ailment usually appears in the spring and is characterized by a flow of slimy, discolored sap from the opening. This slime forms a fermenting substance which may be poisonous to vegetation, as shown by the killing of grass upon which it drops. It has destructive effect on the bark and on the wood immediately beneath, and if it is allowed to progress, serious damage and even the death of the tree may be caused. The best method of treatment for slime-flux is to make upright incisions in the bark, close to the wound, for the purpose of draining the liquid as quickly as possible and perhaps introducing an antiseptic wash. After the flow has stopped, the diseased parts should be cut away and the surface sterilized and painted as with other cavities.

Various trees are subject to trouble in the form of root-rot and other diseases of the root system. Root-rot is the result of a fungus, which usually enters through an underground wound. This fungus drains the vitality of the roots and eventually kills the tree or so weakens its base as to cause it to fall an easy victim to windstorms. Well-known symptoms of this disease are the hard, black, branching strands known as "shoestrings," which are found interlaced in the roots, and particularly between bark and wood, and penetrating the surrounding soil. These "shoestrings" ultimately form the fruiting body on the surface of the ground, which takes the form of a mushroom appearing to grow from the soil. The mushrooms are easily recognized when fresh and complete, appearing in groups or clusters the color of honey. On each of them a distinct ring appears on the stem, just below the umbrella-shaped top, and the stems are swollen at the base. These two characters often are unreliable as the ring is frequently evanescent and the swollen base usually is not very pronounced. Trees which are badly afflicted with this form of rot should be cut down, and it is not safe to replant in the infected soil.

Coral red spots about the size of a pin's head on the bark of trees and shrubs are symptoms of a disease commonly called Nectria Cinnabarina canker, a fungous growth closely related to the rusts of leaves, which finds entrance through small surface wounds. It produces bluish or blackish streaks in the wood. Once established, it has a tendency to spread to other trees or plants. This disease may be cured by cutting and burning all affected bark and wood and washing the wound with solution of copper sulphate, using 1 pound to 5 gallons of water. The exposed surface should then be coated with coal tar. As with other diseases, prevention is better than remedy, and if all wounds are promptly treated when created, the spores will find no means of entry.

Black knots sometimes appear on twigs and leaves of Cherries, Plums and allied trees but rarely on shade trees. While they are not serious, they are unsightly. They may be controlled by cutting and burning in the early fall and spraying with either copper sulphate or lime sulphur before the buds open in the spring.

"Witches' Broom" is a conspicuous growth which is frequently seen and which impairs a tree's appearance. It consists of masses of short twigs, so bunched as to cause them, in some instances, to be mistaken for mistletoe. This disease is caused by a fungus or an insect, often a mite. It may be controlled by cutting and burning the affected parts. Although mistletoe is a parasite plant it is not a fungus, but belongs to the group of flowering plants to

Sugar maple borer

Plagionotus specious Say

1 Place where egg was laid

1*a* Another more than normally discolored

2 Borer or grub in September from egg laid the same season

3 Nearly full grown borer

4 Adult or beetle

5 Hole through which the beetle escaped from the trunk

6 Sawdust or borings packed in burrow

Maple and oak twig pruner

Elaphidion villosum Fabr.

7 Grub or borer in its burrow, a portion of the twig being cut away to show its work.

7*a* Small twig with only a thin shell of bark, the wood being nearly all eaten

8 Pupa in burrow. The base of both twigs represented has been nearly eaten off by the larva

9 Adult or beetle

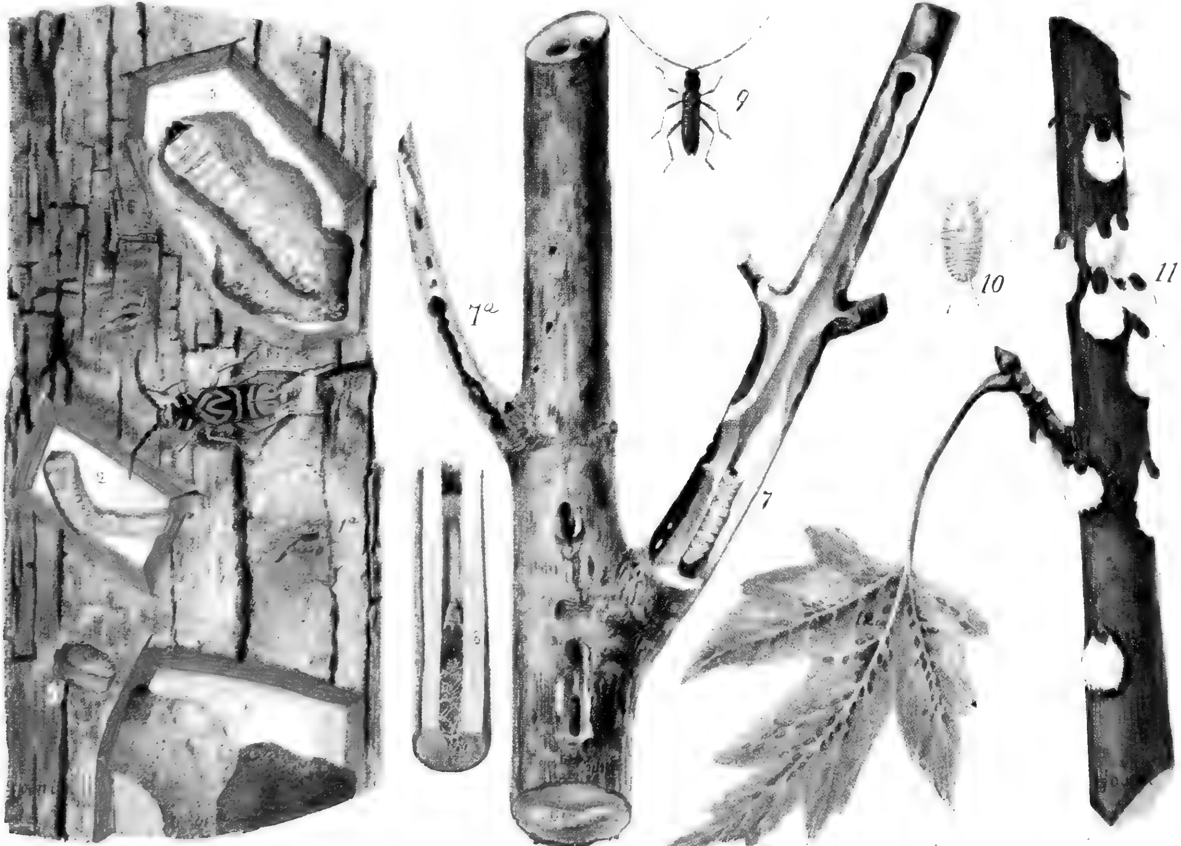
Cottony maple scale

Pulvinaria innumerabilis Rathv.

10 Active or recently hatched young

11 Adult females, many eggs can be found in the woolly masses

12 Leaf with many young scales on its underside



L. H. Joutel, 1900

MAPLE BORERS AND COTTONY MAPLE SCALE

which its possible hosts, the trees and shrubs, also belong. Its part in romance and sentiment does not begin until the twigs reach the drawing room. On its host the mistletoe is a parasite, sapping its strength and retarding its growth. The damage starts when the mistletoe dies, for in the process of decay it leaves a cavity which affords a means of entrance for other more harmful diseases. If allowed to flourish, mistletoe becomes a serious enemy. It may be controlled by cutting it away completely and treating the cavity as recommended in previous chapters.

Various fungous diseases attack the foliage of trees and these may be the cause of much damage, since it is through the agency of green leaves that a plant gets its real nourishment, and any reduction in the foliage decreases the tree's food supply. In addition to this definite damage the loss of leaves mars the tree's appearance. If the growth persists for a single season only, the damage is not important; but if it proceeds unchecked for several years, the tree becomes badly weakened and may die.

Protection against these diseases is largely by means of spraying. The effectual materials are spoken of as fungicides, the most useful of which are Bordeaux mixture and ammoniacal copper carbonate. The former is the least injurious to foliage, while likely to discolor buildings. The latter is safer near buildings, but needs to be very carefully made and applied in order not to injure the foliage.

Bordeaux Mixture.—Bordeaux mixture is composed of copper sulphate (bluestone) and quicklime, with a certain quantity of water. The amounts of copper sulphate and of lime to be used with a given quantity of water vary somewhat, according to the kind of trees to be sprayed and the disease to be treated. The following formula is quite satisfactory for general work:

Copper sulphate (bluestone)	pounds	3
Quicklime	pounds	4
Water to make	gallons	50

For severe diseases on trees with resistant foliage it is often advisable to use 4 pounds of bluestone and 6 pounds of lime to 50 gallons of water instead of the above formula.

Directions for Making.—To make a single barrel of Bordeaux mixture, dissolve the bluestone in 25 gallons of water and in a separate vessel slake the lime and dilute it to 25 gallons. Then pour the two solutions simultaneously through a strainer into the spray tank.

If large quantities are to be used, stock solutions of the bluestone and lime should always be prepared, thus saving the time necessary to dissolve the materials. A stock solution of the copper sulphate may be made by dissolving it at the rate of 1 pound to each gallon of water. Fill a 50-gallon barrel two-thirds or three-fourths full of water and place a sack (or box with perforations in the bottom and sides) containing 50 pounds of copper sulphate in the upper part of the barrel, suspending it by a string or copper wire. In from 12 to 24 hours the sulphate will have entirely dissolved, and the sack or box should be removed and enough water added to fill the barrel. After slight stirring, the solution is ready for use. The stock lime may be prepared by slaking 50 pounds in a barrel or other vessel, and finally adding water to make 50 gallons. In slaking the lime sufficient water should be used to prevent burning, but not enough to "drown" it, and the mass should be continually stirred with a shovel or spading fork until a thin paste is formed.

In making Bordeaux mixture, take the necessary quantities of the stock copper sulphate and the stock lime solutions to give the formula in the total amount of water to be used and place each in separate elevated dilution tanks, which should hold half as much as the total capacity of the spray tank. Thus, if the spray tank holds 200 gallons, each dilution tank should hold 100 gallons; and, according to the above formula, 20 pounds of copper sulphate (20 gallons of the stock solution) and 20 pounds of lime (20 gallons of stock solution) would be required. To each dilution tank add water (one-half the total amount of spray) and after stirring, allow the diluted ingredients to run, through separate hose or troughs attached to faucets near the bottom of the tank, into the strainer on the spray tank, where the two solutions come together, producing the Bordeaux mixture. Only the quantity which can be used during the day should be mixed, as the Bordeaux mixture deteriorates on standing.

In case the dilution tanks are not elevated to admit of filling the spray tank by gravity, the diluted solutions must be dipped and poured into the latter by hand, a bucketful of each simultaneously. This method is advisable in small operations, where a few barrels at most are needed.

It is important that Bordeaux mixture should be thoroughly strained in order to keep out any coarse particles that would clog the spray nozzles, and it is a good practice to strain the stock solution of lime while pouring it into the dilution tank. The best material for a strainer is brass wire netting of about 20 meshes to the inch.

Ammoniacal Copper Carbonate.—The formula for ammoniacal copper carbonate is as follows:

Copper carbonate	ounces	5
Strong ammonia (26 Baume)	pints	2 to 3
Water to make	gallons	50

Dilute the ammonia with about 2 gallons of water, as it has been found that ammonia diluted seven or eight times is a greater solvent for copper carbonate than the concentrated liquid. Add water to the carbonate to make a thin paste, pour on about half of the diluted ammonia, and stir vigorously for several minutes; allow it to settle and pour off the solution, leaving the undissolved salt behind. Repeat this operation, using small portions of the remaining ammonia water until all the carbonate is dissolved, being careful to use no more ammonia than is necessary to complete the solution. Then, after adding the remainder of the required quantity of water, the solution is ready for application.

Ammoniacal copper carbonate is a clear, light blue solution, which upon drying leaves little or no stain. As a fungicide it is inferior to Bordeaux mixture, and should be used only as a substitute for the latter, when Bordeaux mixture might discolor adjoining buildings or stain the foliage of ornamental plants or maturing fruits.

Leaf spots or leaf blights are common forms of this type of disease. An ailment of this nature causes discolored spots on the leaves, often resulting in holes and sometimes in the destruction and falling of the foliage. Trees especially susceptible are the Walnut, Elm, Maple, Horse Chestnut and Sycamore. On most trees the spots are reddish brown or darker. The remedy is to collect and burn fallen leaves, to destroy the spores and prevent the spread of the disease, and to spray with Bordeaux mixture to kill attacking spores as they start to grow. The spray should be applied during the dormant season, and repeated when the leaves expand, and perhaps again two or three weeks later.

Another form of leaf spots results from anthracnoses, which affect the stems of young shoots as well as the leaves themselves. On the leaves these attacks produce spots or holes, or cause the foliage to wither as from frost. This disease is especially prevalent on the Sycamore, where it follows the veins of the leaf and then spreads, causing the entire surface to turn brown. It often kills the shoots of young and tender growth, causing them to appear as if killed by frost, and may even kill trees. To control this disease, dead or diseased branches and twigs should be cut away and burned. Either Bordeaux mixture or lime-sulphur should be applied by spraying during the dormant season. Soon after the buds have opened, affected trees should be sprayed with Bordeaux mixture, and this spraying should be done a second and a third time at ten day intervals thereafter.

Powdery mildew is not serious, except to very young trees and nursery stock. This disease spreads over the surface of the leaves, forming a delicate white web resembling dust. It appears on the Oak, Birch, Maple, Poplar and other trees. It may be removed by application of a spray of one pound of potassium sulphide dissolved in fifty gallons of water. Either Bordeaux mixture or diluted copper sulphate also makes an effective spray, if applied two or three times in July and August.

Leaf curl appears on Oaks, giving the leaves a blistered appearance. It should not be allowed to progress unchecked. Fallen leaves should be burned, and the trees should be sprayed during the winter with either copper sulphate or lime-sulphur.

Rust is a fungus which in various forms attacks many kinds of trees, covering the leaves with brown and yellow spore-masses, sometimes causing the leaves to become ragged and unsightly. It attacks such trees as the Linden, Poplar, Ash, and other broad-leaved trees, and also many Conifers. On the Red Cedar it produces the reddish brown globular growths known as cedar apples. Treatment is not always necessary, but when it is needed, Bordeaux mixture should be applied before the leaves open in the spring, and several times during July and August, at two to four week intervals. Removal of the "apples" from Cedars in the early spring is advisable, especially if they are near apple trees, as the cedar apples can readily produce rust on apple trees.

Leaf scorch is an ailment which causes young leaves and tender shoots to wither and die. It is apt to make its appearance during a dry, hot spell, following a damp spring. Many varieties of trees are affected, but Maples seem to suffer most. Helpful treatment may be given by keeping the soil well watered and freely cultivated when the dry season comes, so that moisture and air may reach the root system for the thorough nourishing of the tree.

Poor soil conditions are the cause of many ailments of street shade trees. A common manifestation of trouble of this nature is known as stag-head or top-dry, which results in slow death of the top, producing an effect suggesting the bare horns of a stag. This is apt to indicate lack of water or suffocation of the roots. Enrichment of the soil, a plentiful supply of water and frequent loosening of the soil by cultivation, are necessary to bring about recovery of an affected tree.

CHAPTER XIX.

TREE INSECTS AND THEIR CONTROL

TREES have several insect enemies. In a single season, if allowed to work unchecked, an able-bodied colony of these pests can undo the efforts of years on the part of man and nature. Fortunately for the welfare of the shade tree, most of the damage may be prevented or cured, and it is to the ways and means of achieving one or the other of these results that the tree lover will find he must give careful attention.

Because trees in the forest generally thrive in spite of their insect enemies, it must not be figured that the shade tree may be trusted to care for itself. The two situations are so different as to have little in common. In the forest the tree has nature's equipment for defense, such as ideal conditions for growth and for the development of power of resistance to attacks, and birds and insects of many kinds to destroy the pests and thus help keep them under control. In the artificial environment of the town or city the tree is at a disadvantage. In many situations its life is a struggle for existence. It must overcome the handicaps of packed soil, uncertain water supply, crowded conditions, poisonous gases and the injuries of traffic and lack of bird and insect protectors. Thus hampered, it is not strange that the tree lacks the rugged vitality of its forest kinsmen, and it is not surprising that it should be less sturdy in its resistance to the attacks of insects.

Damage by these natural enemies affects the tree in different ways, ranging from injuries so slight as to call for no attention, to the severe forms which prove fatal. To combat the ravages of the insects requires watchfulness. Proper care and attention on this point are essential, and immunity from damage to highly prized trees is cheaply purchased by the application of adequate safeguards and remedies. The real expense lies in neglect.

Inspection of the trees from time to time is an important part of insect control. Careful examination sometimes results in the discovery of insects which have not yet caused visible damage, and since early action is most effective, this discovery may save much trouble. In a community which has a tree warden or other shade tree officials inspections should be made as a part of the routine work.

In a single volume it is not possible to discuss in detail every insect enemy encountered in all parts of a country as large as the United States. The most that may be attempted is to treat of those which are most common and general in their distribution, to show how these insects and their work may be identified, and to point out the remedies which have been found most effectual. Supplementary information may be obtained from state entomologists. Every state and territory maintains a staff of technical experts and research workers whose function it is to gather and distribute information as to the insects prevalent within that particular field. Similar work is carried on in even more elaborate fashion by the Bureau of Entomology of the United States Department of Agriculture at Washington. Specific inquiries through either of these channels will bring detailed information on local conditions which will often prove helpful.

In communities where there is an efficient shade tree commission, tree warden, arboriculturist or other authority charged with responsibility for shade tree development, these questions will receive more immediate and more localized attention if placed before the proper official.

White marked tussock moth
Hemerocampa leucostigma Abb. & Sm.

1 Side view of full grown caterpillar
2 Male moth at rest
3 Female moth laying eggs on her recently vacated cocoon
4 Several cocoons
5 Cast skins of caterpillars
6 Work of young caterpillars on under surface of leaf
7 Male pupa
8 Branch girdled by caterpillar
9 End of branch broken off at the point where it was girdled

Forest tent caterpillar: maple worm
Malacosoma disstria Hübn

10 Female moth with wings expanded
11 Male moth with wings expanded
12 Egg belt encircling twig
13 Side view of full grown caterpillar
14 Cocoon in a leaf
15 Pupa
16 Cast skins of caterpillar

L. H. Joutel, 1900.

WHITE MARKED TUSSOCK MOTH AND FOREST TENT CATERPILLAR

Of still greater value is the active cooperation of the local authorities in detecting and fighting the insect enemies, and this value lies not only in the matter of technical knowledge but in the facilities for active combat, as well. The owner of a single tree rarely wants to go to the expense of buying equipment for spraying and other forms of treatment. For the municipal government to handle this work for all taxpayers reduces the problem to its simplest terms and produces the greatest degree of efficiency with the least cost to the individual.

The importance of municipal treatment of insect pests is emphasized by the way many insects spread. It is not uncommon for all the trees of a given variety to be affected throughout an entire community. Treatment of an individual tree in the event of such an epidemic obviously accomplishes nothing. The elimination of the visitors from that particular tree may be complete, but renewal of the attack will be made by emigrants from infested neighboring trees which have not been treated. The only effectual measure is to treat all trees of the infested species, and this, of course, cannot be satisfactorily accomplished without centralized authority and action. This constitutes one of the unanswerable arguments in favor of municipal control for street shade trees, however small the community.

In the absence of a branch of the local government prepared for such work, it is important for the individual property owners to act in close cooperation among themselves, to achieve the best possible results and to minimize the cost to each of them. Community ownership of spraying apparatus and other equipment, and community action in undertaking to overcome insect attacks, will lead to a solution of many of the tree owners' most serious problems.

The spread of insects has not infrequently been due to their being carried on young trees from the nursery. For this reason it is important that all trees should be free from insects and diseases when they are sent from the nursery. Reliable nurserymen, in cooperation with state inspectors, endeavor to eliminate these troubles from nursery stock. As an added precaution many kinds can, without injury, be fumigated at the nursery before shipment. It should not be necessary to call attention to the worthlessness of panaceas by which all insect attacks may be prevented by injecting a fluid into the tree, or by driving special medicated nails into them. Fakers and rascals, passing as tree doctors, continue to extract much good money from a gullible public for worthless or even harmful ministrations. Imposition of this character has been so widespread as to cause more than one official warning to be issued against encouraging such methods.

Insect enemies of the trees are of three types, which may be classified as leaf-chewers, sap-suckers and borers. The leaf chewers eat the foliage, the sap-suckers suck the plant juices from the leaves, stems, branches, trunk or roots, while the borers injure a tree by their tunnels making the openings opportunities for the entrance of moisture and decay, but what is more serious, often partially or entirely girdling the inner bark of the tree. In the three classes there are countless subdivisions, some of which require special discussion, but in general the methods of combating are essentially the same throughout any one class.

The leaf-chewing insects may be destroyed by stomach poisons, applied to the leaves through spraying. The poison may be placed on the foliage before the insects have begun active operations in large numbers and be there ready for their first activities, contingent only on its not being washed off by rains.

Elm Leaf Beetle

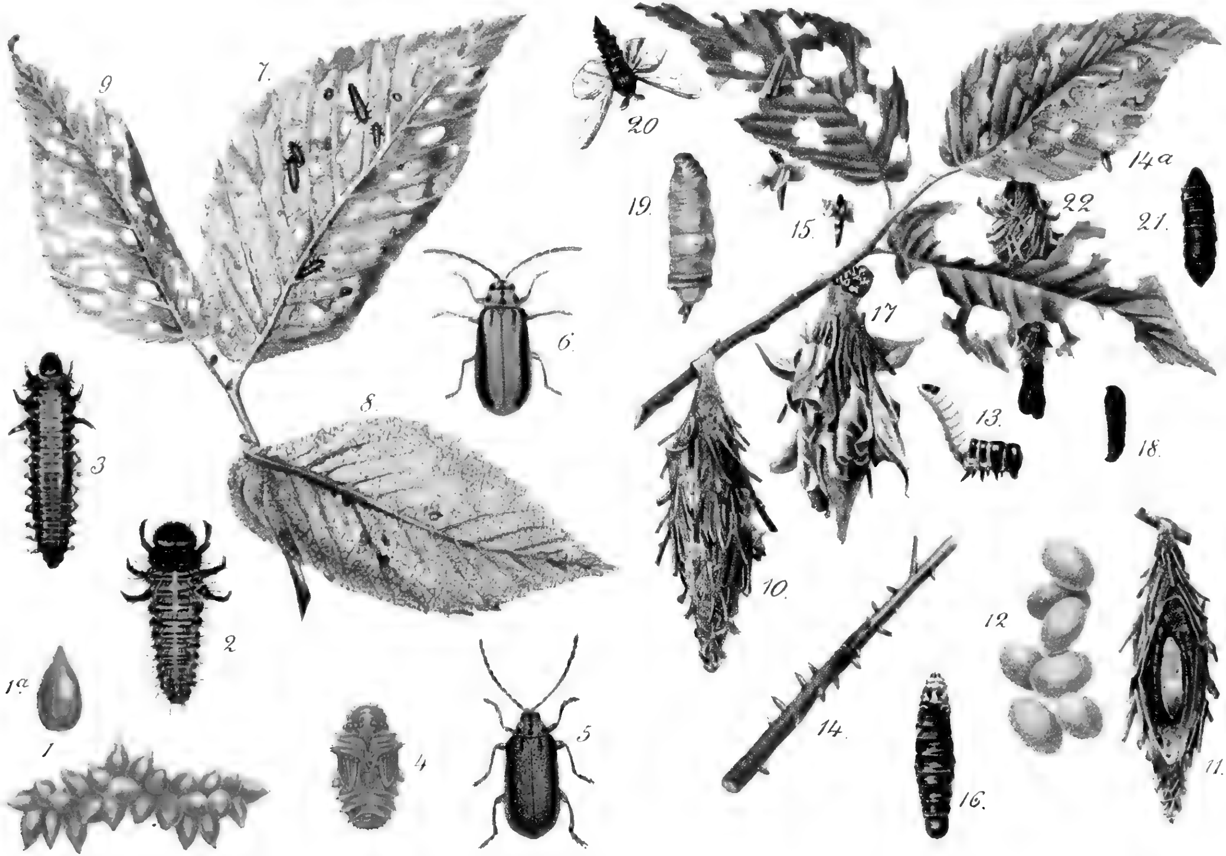
Galerucella luteola Muller

1 Cluster of eggs, enlarged
1*a* Side view of single egg, more enlarged
2 Recently hatched larva or grub, enlarged
3 Full grown larva or grub, enlarged
4 Pupa, enlarged
5 Overwintered beetle, enlarged
6 Fresh, brightly colored beetle, enlarged
7 Leaf showing eating of larvæ or grubs and a few holes eaten by beetles, eggs in clusters, cast larval skins and full grown larvæ
8 Leaf nearly skeletonized by grubs of larvæ and on it three cast larval skins
9 Leaf showing holes eaten by beetles

Bag or Basket Worm

Thyridopteryx ephemeræformis Haworth

10 Bag or larval case as it passes the winter
11 Same as preceding but cut open to show the pupal case and the eggs
12 Several eggs, enlarged
13 Recently hatched larva, enlarged
14 Cases of young larvæ on twig
14*a* Leaf eaten by young larvæ
15 Older larvæ in their bags
16 Full grown larva removed from its case
17 Full grown larva walking with its case
18 Male pupa
19 Female moth
20 Male moth with wings spread
21 Female pupa
22 Bag of male hanging from a leaf and with the empty pupal case protruding from its lower extremity



L. H. Joutel, 1900.

ELM LEAF BEETLE AND BAG OR BASKET WORM

The sap-sucking type, however, cannot be reached by poisons, so they must be killed by contact insecticides; therefore, they have to be destroyed by materials applied after they have begun operations, and every insect must be touched by the appropriate insecticide for it to be effectual.

For the leaf-chewers and sap-suckers wholesale destruction is possible, because their destructive work is in the open, on the outside of bark or foliage.

For borers and others, which conduct their operations within the wood or underground, the measures of elimination are aimed at the individual insect, by means of digging it out or by killing by the use of a wire probe or injection of carbon bisulphide.

A point to be remembered in applying remedies by spraying is that the application must be thorough. Thoroughness means completely covering the leaves, in order to make certain that all the insects will be reached by the poison placed on their food, or killing the body of each insect by smothering with a contact insecticide.

Effectual remedial measures require knowledge of the habits of the type of insect to be controlled. This knowledge should at least include the ability to distinguish between the leaf-chewers, the sap-suckers and the borers, in order to determine the steps that must be taken. In compiling the suggestions for treatment, which appear in subsequent pages of this chapter, an effort has been made to give data which will enable the layman to identify and classify the insects that may appear on his trees.

Spraying materials may be bought at seed stores and other places. For small operations it is best, with most of them, to use the commercial preparations rather than to undertake to prepare them at home. In buying them, the highest quality should always be insisted upon. The recognized standard preparations will give the best results. It is poor economy to use a preparation because it may be bought cheap, and it is unwise to experiment with one which is unknown.

The Stomach Poisons.—The standard stomach poisons are arsenate of lead and arsenate of lime (calcium arsenate). Arsenate of lead is the one most used, because it adheres to the foliage longer than any other stomach poison, is highly effective, and does no damage to the leaves when used in proper dilution. Both arsenate of lead and arsenate of lime may be bought in paste or powder form. The powder is to be preferred for the reason that it is not injured by freezing or drying. These poisons are ready for use when purchased, requiring only the addition of water in proportions which will usually be found specified on the label of the container.

If there is preference for preparing a poison at home the formula for arsenate of lead is as follows:

Acetate of lead	12 ounces
Arsenate of soda	4 ounces
Water	15 to 20 gallons

Pour the acetate of lead into a half gallon of water and the arsenate of soda into a similar quantity of water in a separate vessel. The contents of the two vessels should then be poured into a holder, containing from 15 to 20 gallons of water, and well mixed.

Because of their poisonous nature, arsenate of lead and arsenate of lime must be handled with care. Especial safeguards must be used to keep them away from children and domestic animals.

Contact Sprays.—For the killing of sap-sucking insects the contact sprays are required. These materials cause death to the insects by coating and clogging the breathing pores, by direct action on the nerves, or by caus-

Yellow-striped oak caterpillar
Anisota senatoria Abb. & Sm.

1 Egg mass on underside of oak leaf

2 Eggshells on partly eaten leaf

3 Leaf stalk bearing shrunken larvæ infested by parasite and showing the characteristic feeding of nearly full grown caterpillars

4 Side view of nearly full grown larvæ

5 Recently hatched larvæ feeding side by side and showing the skeletonizing in the earlier stages

6 Male

7 Female depositing eggs

Buck or Maia moth
Hemileuca maia Drury

8 Side view of full grown larva

9 Male, showing wings of one side only

10 Egg mass

Archips fervidana Clem.

11 Adult

12 Nest composed of partly eaten, curled leaves

Serica trociformis Burm.

13 Beetle on leaf

14 Same

Two-spotted tree hopper
Enchenopa binotata Say

15 Side view of adult

Archasia Galeata Fabr.

16 Side view of adult of a peculiar tree hopper

Thelia acuminata Fabr.

17 Side view of another tree hopper

Dog day cicada or harvest fly
Tibicen tibicen Linn.

18 Side view of adult in resting position

Acorn weevil
Balaninus nasicus Say

19 Adult on twig

20 Same

L. H. Joutel, 1902

OAK INSECTS

tic action on the tissues. The active elements in these sprays are lime and sulphur compounds, soaps, petroleum oils and tobacco extracts. Some of the sprays are:

Lime-sulphur	Creosote Oil
Kerosene	Miscible Oils
Kerosene Emulsion	40 per cent. Nicotine Sulphate

Fish-oil Soap.

Lime-Sulphur.—This is used against the armored scale insects, such as the oyster-shell scale or the San José scale. Its use is generally confined to the dormant season, between late fall and early spring. It may be used as a spray, or it may be spread on with a paint brush. The chemicals discolor paint, and for this reason spraying should be avoided where the paint on buildings will be reached. The material, as purchased, must be diluted with water before use, and directions as to dilution will usually be found with each purchase. In general it may be said that the lime-sulphur should be used in proportion of 1 pint to each gallon of water.

Kerosene.—Kerosene oil is effective in killing some insects and in the destruction of eggs. It is applied by daubing on the affected surface by means of a mop fastened to a pole. Kerosene is also used to destroy tent or web caterpillars by burning. For this purpose the mop is used as a torch and held against the tent or web, with care to inflict the least possible damage to the tree by the flames.

Kerosene Emulsion.—This is recognized as one of the most effective sprays for contact uses. With variation of the proportion of water, this spray may be used in summer or winter. It is used for the destruction of scales and soft-bodied insects. The emulsion is made of kerosene, soap and water, the soap being required to bring about the mixing of the other ingredients. This mixture may be made at home. The formula:

Kerosene	2 gallons
Fish-oil soap (or laundry soap)	½ pound
Water	1 gallon

(One quart of soft soap may be used instead of the soaps specified above.)

Boil the water and soap together until the soap dissolves. This mixture should then be removed from the fire, the kerosene added and the mixture stirred briskly for five minutes, or until it has the consistency of cream.

This concentrated mixture must be diluted with water at the time of spraying. For use in summer, when the trees are in leaf, the dilution should be at the rate of 5⅔ gallons of water to each gallon of the mixture. For use in winter, when the trees are dormant, the rate should be 1⅔ to 3 gallons of water to each gallon of the mixture. The concentrated mixture will keep for some time in its original form, but the diluted mixture should be used as soon as prepared.

Creosote Oil.—This is used for the destruction of tussock moth egg masses, especially when they cannot be removed successfully. It is applied by daubing with a mop. The oil thickens in cold weather, in which case it requires thinning with turpentine.

Miscible Oils.—There are various miscible oils, which are mixtures to be bought ready-made. Their use is effective in controlling the scale insects. The mixtures are sold under various trade names, and since they vary in strength, careful attention must be paid to the directions for dilution as printed on the labels. These oils are apt to injure foliage if applied during the leaf season, and for this reason they are usually employed as winter sprays. In addition to this factor, winter spraying has the added advantages that the absence of foliage makes it possible to use stronger solution, and also makes it easier to reach the insects with the spray.

Fall Web Worm

Hyphantria cunea Drury

1 Cluster of eggs

2 Dorsal views of full and partly grown larvæ and also a lateral view of a full grown caterpillar

3 Pupa

4 Pupa, enlarged

5 White form of moth in resting position

6 Spotted form of moth with wings expanded

Figures 2, 5 and 6 are on a small web

Spiny Elm Caterpillar

Euvanessa antiopa Linn.

7 Cluster of eggs on a leaf stem

8 One egg, much enlarged, the dot beside it shows its natural size

9 Caterpillar feeding

10 Chrysalis hanging from a leaf stem

11 Butterfly with wings spread

The figures of the egg and caterpillar are on a twig of elm representing the characteristic work of the caterpillar.

L. H. Joutel, 1905.

FALL WEB WORM AND SPINY ELM CATERPILLAR

Nicotine Sulphate.—This is a liquid extract of tobacco, which is effective against aphids, or plant lice, and other soft-bodied insects. It may be bought under numerous trade names. The strength varies with the different preparations, and directions for proper dilution with water are usually printed on the labels. The most used form is the 40 per cent. nicotine sulphate, although any strength may be used when properly diluted. The addition of 1 ounce of soap to each gallon of spray is useful in causing the material to spread and stick.

Fish-oil Soap.—This material, also known as whale-oil soap, is effective against aphids, scale insects and other sap-suckers. For use in summer spraying, dissolve 1 pound of the soap in from 3 to 4 gallons of water. For use against scale insects in winter, dissolve 2 pounds of the soap in each gallon of water. The mixing should be done over a fire and the spray used before the solution is cold, as the mixture congeals upon cooling. Common laundry soap may be used instead of the fish-oil soap.

Poisoned Contact Sprays.—For use against borers, while they are still feeding in the bark, sodium arsenite should be added to either kerosene emulsion or miscible oil sprays. The addition of this poison makes what is known as a poisoned contact spray, which penetrates where ordinary water solutions would be ineffectual. Sodium arsenite may be obtained at drug stores. When diluting the kerosene emulsion or miscible oil for use, add one ounce of sodium arsenite to each gallon of the water employed for dilution, allowing the poison to dissolve before making the final mixture. The poisoned contact sprays are injurious to foliage and should be applied with care.

Carbon Disulphid.—Carbon disulphid partakes of the nature of contact remedies, but its use is along different lines. This substance kills by suffocation and is used against borers, by injections into the openings of their tunnels. The vapor of carbon disulphid is heavier than air, and when it is injected the vapor sinks. The injection is made by using a squirt oil can or a dropper, such as is employed in filling fountain pens. After the injection has been made the hole must be promptly plugged with some such material as grafting wax, putty or soap, to prevent the escape of the vapor. *Carbon disulphid must be handled with care. It is highly inflammable and, when inhaled freely, it is poisonous.*

Spraying Apparatus.—For use in spraying small trees a hand atomizer is adequate. In general appearance this resembles a tire-pump. It is made of copper, brass or heavy tin, and holds about a quart of liquid.

A small compressed-air pump is convenient for spraying operations on a small scale. This pump resembles the fire extinguishers seen in factories and office buildings. It is made of brass or galvanized sheet steel, and holds from 3 to 4 gallons. It is carried by means of a shoulder strap. In preparing it for use the liquid is poured into the tank, the opening closed and air pumped in to provide pressure for forcibly expelling the liquid.

A barrel hand-pump outfit, holding approximately 50 gallons, may be used for spraying a limited number of moderate sized trees like apple trees. The working parts of the pump must be of non-corrosive metal, such as bronze or brass. The pump may be mounted on either the head or side of the barrel, and the whole outfit placed on a wagon or on skids, for convenience in moving from tree to tree.

Next in size and capacity above the barrel hand-pump outfit is the double action hand-pump, employed with 150 or 200 gallon tank, the tank mounted on the running gear of a wagon, and the pump fastened to a small platform at the top of the tank or at the rear end of the wagon. Instead of the tank, a barrel, or a 100 gallon hogshead, may be used, placed at one end of the wagon bed to leave room for pump and operator. A suction hose extends into the container which holds the spray material. The pump is double action with double cylinder, and gives pressure for two lines of hose and for double nozzles.

For results in spraying mature street trees, power sprayers, operated by gasoline engines, must be used, as the other outfits mentioned are not effective for this purpose. It is important that communities and neighborhoods should act together in their purchase and use where no municipal outfit is at hand. The ideal plan, of course, is to have all spraying operations conducted by the local government, since this plan makes it feasible to have even more complete and efficient outfits than are to be expected in community or neighborhood cooperation. The power sprayer gives steadier spray than the hand-pump, insuring a more even and more thorough distribution of the application and makes it possible to reach the tops of the trees. Power sprayers as small as one horsepower may be purchased, while there are larger sprayers of as much as 12 horsepower, with capacity of 50 gallons or more to the minute under pressure of from 150 to 300 pounds. Where a pressure of less than 100 pounds per square inch is used, the material is delivered in the form of a mist within a short distance from the nozzle, which necessitates the nozzle being carried near to the foliage to be sprayed. This practically limits the use of hand pumps to trees not over 30 to 40 feet high and then only after climbing into the trees. The compressed air pumps are not practicable for trees over 10 feet high. For tall trees, a solid stream delivered from a nozzle at a pressure of 150 to 200 pounds will be thrown into spray as it reaches their tops and will then descend as a mist over the tree.

For the most extensive spraying operations motor truck sprayers are sometimes used.

Accessories for Spraying.—There are many types of spraying nozzles, but the one which has been found most generally efficient, for both medium and small outfits, is the whirlpool disc type, adjustable to fine, medium or coarse spray. This nozzle is compact and does not catch in branches or twigs.

For reaching the upper and inner parts of a tree, where a mist spray is used, an extension rod is useful. This is a rod of aluminum, iron or brass, fitted into a bamboo pole, made in lengths of from 6 to 14 feet, and is used for holding the nozzle above the head of the operator.

A combination of nozzle and extension rod is the Worthley nozzle, several feet in length, which directs a solid stream and makes it possible to reach the top of an 85 foot tree while the operator is standing on the ground. For foliage nearer the ground and for small trees the nozzle has a spreader which breaks the force of the solid stream and produces a fan-shaped spray.

For the larger power outfits and heavier work a nozzle like that used on a fire hose, but of smaller size, is best.

The hose used in spraying should be of the best grade, made for high pressure and from ⅜ to ½ inch inside diameter.

In the absence of spraying equipment, a common paint or whitewash brush may be used to good advantage in applying treatment to the trunk and larger branches of a single tree, or even a small number of trees. This method is used against the scale insects, and the spray material is spread on the bark with the brush. Even the caustic lime-sulphur may be thus applied if proper precautions are taken to protect the operator's face and hands. The use of the brush obviates the injury to paint on nearby buildings that might be caused by spraying.

Tree Bands.—The use of tree bands as barriers or traps for insects has occasional value, but they are not as effectual as many people seem to believe. The usefulness of bands is confined to protection against those insects which crawl along the trunk. Against the winged insects they have no value whatever. To be useful at all the bands must be closely watched and kept from clogging, drying out or becoming bridged. They are likely to be injurious to the trees.

A type of banding which proves effective is made of cotton batting, 6 to 8 inches wide, wrapped around the tree with the ends overlapping, and tied securely and snugly by means of a string around its lower edge, with the upper part turned down over the string to form a flange of loose cotton. This stops the insects as they crawl upward. The cotton must be kept in fluffy condition.

The wingless moths, such as those of the cankerworm, and the tussock moth, may be trapped by 12 mesh fly-screen. A strip of the wire screen 12 inches wide should be cut with a top length slightly greater than needed to fit around the tree and a bottom length 6 inches greater. The top edge should be snugly fitted around the tree and fastened with carpet tacks, leaving the lower part standing out in a way suggesting an inverted funnel. The spreading lower edge admits crawling insects, and these should be gathered and crushed daily, to prevent the laying of any eggs.

Sticky bands are useful against the ascent of caterpillars and wingless moths. The sticky material may be bought ready for use. In preparing to apply it, the tree should first be encircled with a 2 inch strip of cotton, snugly wrapped around the trunk in a way to fill all the crevices of the bark. Over this there should be placed a 5 inch strip of building tar-paper, tightly drawn and securely tacked at its overlapping ends. The sticky substance is then applied to this paper. It should be renewed when it becomes dry or covered with dust or insects, as its stickiness is its one point of efficacy. It should not come in contact with the tree, although occasionally it is recommended to apply such material directly to the trunk high enough to be above persons passing. There is danger from a girdling effect due to the hardening of the material (Hopkins, U. S. Dept. of Agr.) and due to the penetration of possible injurious substances in the material. A sticky fly-paper may be used, over bands of cotton and with the edges securely bound with string.

Safeguards against insect attacks are as important in their way as the application of remedies after the attacks have taken hold. Much damage may be prevented by advance precautions. Among the most important steps of this character is the providing of good cultural conditions and careful attention to all pruning, or accidental injuries and cavities.

Since trees which are strong and healthy are in best position to resist insect attacks, it is important that weakened trees should be stimulated by enrichment of the soil. This may be accomplished by applying nitrate of soda, stable manure, or other fertilizer containing nitrogen. This stimulus, combined with pruning and frequent cultivation, will produce new vitality and prove helpful in enabling a tree to combat its insect enemies with its own forces.

ALL SHADE TREES

BORING INSECTS

Parandra Borer

Habits and Damage. This borer probably destroys the bases of more shade trees than any other insect enemy. It is especially prevalent in the eastern part of the United States. The adult is a large brown beetle, which lays its eggs in the heartwood near the ground wherever a wound affords an opening. Egg-laying takes place shortly after Chestnut trees blossom. Upon hatching, the grubs feed on the wood and completely honeycomb the base of the tree. Their work continues for 3 or 4 years and frequently their presence is not known for the reason that the wound through which entrance was gained heals over. Besides their attacks at the base, the grubs also enter wounds in the larger limbs. Trees severely attacked have nothing but an outer shell and trunks and limbs are easily broken by the wind.

Remedies. Because of the difficulty of detecting the presence and ravages of this borer, it is important to take steps to prevent a tree from becoming infested. The most direct measure is to promptly treat all wounds and cavities. New injuries, scars and other wounds exposing the wood should be painted or so treated that they will quickly heal and no decay be started. Cavities should be thoroughly cleaned and filled, with every care taken to see that all infested parts of the wood are dug out.

ASH

Ash-bud Gall-mite

Habits and Damage. This mite attacks flower buds and causes them to develop into abnormal, berry-like form, resembling the galls to be found on Oaks. Clusters of the galls are to be found hanging from the ends of branches. In their later stages of development the galls turn red, changing to brown. The abnormal growth comes, presumably, from injuries caused by the mites in feeding. No particular damage to the tree results.

Remedy. Thorough spraying is usually successful in the elimination of the mites. The spraying should be done during the winter with some form of contact poison, such as kerosene emulsion or a miscible oil solution.

SAP SUCKING INSECTS

San José Scale

Habits and Damage. This sap-sucking scale devotes its attacks largely to fruit trees, but sometimes damages the Elm and other shade trees as well. Of the Elms the Eu-

Remedies. This scale may be kept in check by thorough spraying with lime sulphur, miscible oils, fish-oil solution or kerosene emulsion. The spraying should be done during the dorropean variety is most subject to attack. The scale infests trunk, limb and branches. After passing the winter, partly grown, on the bark it matures in early June and produces a new generation. Breeding is repeated several times during the summer. The young insects are visible to the eye as they crawl along the bark before settling down and implanting their beaks in the bark. Because of the enormous multiplication by rapidly succeeding generations, a slight infestation in the spring may become very serious during the season.

The mature scale is the size of a pinhead, or smaller, and is scarcely perceptible unless present in abundance. Severe infestation encrusts trunk and limbs with ashy-gray scales which produce a yellow, oily fluid when scraped with a knife; the foliage appears spotted and diseased. A slight attack merely checks growth of the part affected, while a heavy attack causes branches and twigs to die and sometimes kills young trees as well.

mant season, between late fall and early spring, when the tree is bare of leaves. For heavy attacks one treatment should be given in the fall after the leaves drop and another in spring just before the buds swell.

BEECH

LEAF-CHEWING INSECTS

Gipsy Moth

Habits and Damage. This leaf-eating insect is prevalent in New England, where it has caused the death of thousands of trees. The male is dark brown with black wing markings; the female is white with black wing markings. The grubs are hatched in the spring, from eggs laid the previous July on the trunks or underside of branches of trees, in cavities in the bark or on stones and rubbish. The egg mass is rounded or oval, coated with yellowish hairs and resembling a sponge in appearance. The young grubs eat holes in the opening leaves, and in case of severe attack, the end of June brings total destruction of the foliage. Trees weakened by severe infestation are subject to attack from boring insects. It may be safely said that the gipsy moth, where prevalent, is the most destructive of all insect enemies of the trees.

Remedies. The conspicuous appearance of the egg masses makes them easily located during the fall or winter. Since it is impossible to gather these egg masses without scattering the eggs and thus spreading the infestation, other methods of control are necessary. In Massachusetts the attempt to gather egg masses is forbidden for this reason. Creosote with a small amount of lampblack added, is effectual if applied with a brush to the egg clusters. In Massachusetts a creosote mixture quite generally used is made up of five parts of creosote, two parts of carbolic acid, two parts of spirits of turpentine and one part of coal tar.

Placing a sticky band around the trunk prevents caterpillars from climbing a tree, and is useful after the treatment of the egg clusters. The bark should be first scraped, to give a smooth surface, and the

It is a recently introduced insect so far confined to a limited range. In that area it is serious.

Its seriousness is probably part due to its being in surroundings where its natural insect and disease enemies have not been introduced.

sticky material applied with a paddle, evenly, in a thin layer.

When young caterpillars are found on the leaves in spring the foliage should be thoroughly and evenly sprayed with arsenate of lead paste, in proportion of one pound to ten gallons of water.

The seriousness of the attacks of this insect class it as one that requires State activity in suppression.

SAP-SUCKING INSECTS

Aphids

Habits and Damage. Beech trees are subject to attack from the Beech-tree blight aphis and the woolly Beech aphis. Both are bluish-white and woolly. The first named attacks the underside of the branches and the second the underside of the leaves. They are sap-suckers, and they mar a tree's appearance by causing loss of leaves. They sometimes kill twigs and even young trees.

Remedy. These insects may be destroyed by spraying in spring with kerosene emulsion or 40 per cent. nicotine sulphate, applied when the invasion is first noted.

BIRCH

LEAF CHEWING INSECTS

Gipsy Moth

(See description and remedies under Beech)

BORING INSECTS

Bronze Birch Borer

Habits and Damage. This borer's attacks are often fatal. The borer is a slender, flat, footless grub, creamy white in color, attaining a length of about ¾ inch, developing into a winged beetle which is small and slender and olive-bronze in coloring. Egg-laying takes place in May or early June, in crevises on rough surfaces of the bark. When hatched, the grubs bore through the bark and make zigzag tunnels in bark and sapwood, spending the winter in chambers in the wood and emerging in April or May as adult beetles, leaving oval holes in the bark. Severe attack causes the top branches to die and the vitality of the tree to deteriorate until, at the end of a year or two, the tree dies. The presence and work of the borer is shown by

Prevention and Control. There is no remedy for the attack of this borer. Probing, which is effectual against other borers, does no good because of the winding character of the channels; nor is it possible to remove the borer by cutting, because of the winding course of the channels and the large number of the grubs. Pruning of infested branches may prolong the life of a tree, but the only safe way is to cut and burn the tree as soon as dead or dying tops or other signs of infestation are manifest.

reddish or rusty brown spots on the white bark of trunk and larger branches; and under the bark will be found winding channels. Ridges are often to be seen on the bark of branches, over the burrows. These signs show themselves before the top begins to die.

The injury is due to the burrows in the bark cutting off the passage of the descending sap, death resulting from girdling that may be as thorough as though done with an ax.

The elimination of this borer demands neighborhood action, as the cutting of a single tree will do no good if other trees are infested.

THE BOX ELDER

SAP-SUCKING INSECTS

Box Elder Plant-bug

Habits and Damage. This sap-sucking, red insect feeds on the leaves and tender growth of the Box Elder. The bug first appears about the time the Box Elder buds open in the spring, and lays its eggs in the crevices of the bark. On hatching, the young travel to the foliage, and great numbers of them may be seen crawling along the trunk. The late summer is spent in feeding. In the fall the bug becomes a troublesome household pest, because of its habit of crawling up walls and into houses and cellars in search of winter quarters.

Remedies. Spraying is the best means of controlling this insect. The spray should be applied as soon as the bugs appear in the spring. Soap solution or kerosene emulsion will be found effective.

When the bugs appear in the fall they should be killed by pouring hot water or kerosene over them. It will also be found comparatively easy to sweep them in quantities into a vessel containing kerosene.

Box Elder Aphis

Habits and Damage. This is a sap-eating insect, the eggs of which hatch in the spring when the tree's buds begin to open. The hatching process takes place on the bark and the young insects migrate at once to the leaves and tender twigs, where they feed. A half-dozen or more generations may develop during a single season. The insects are pale green in color and they cover the leaves and twigs with a soot-like coating, while a sticky liquid will be found on the leaves and on the ground. The feeding stunts the leaves and the fungus deposit gives the tree an unsightly appearance.

Remedy. It is not difficult to control this insect. Spraying is the most effectual method. The sprays should be 40 per cent. nicotine sulphate and should be applied in the spring when the tree starts its growth for the new season.

ELM

LEAF CHEWING INSECTS

Elm-leaf Beetle

Habits and Damage. Attacks all Elms, especially the English Elm. Causes leaves to fall; if not checked, it brings about complete loss of leaves and if repeated sufficiently often will cause the death of tree.

The first sign of damage is the appearance of irregular holes in leaves in early spring. These come from attacks by the full-grown beetle, which has just come from its winter quarters in barns, sheds and similar shelter. At this time eggs are laid on the under side of the leaves. In June these eggs hatch into larvae or grubs which grow to be one-half inch in length; the larvae feed on the leaves, giving the leaves the appearance of skeletons or lacework. Within 15 to 20 days after hatching the larvae develop into pupae, or young beetles, which are to be found at the foot of the tree. Just before this change the larvae may be seen crawling down the trunk. In another week the young beetles become fully grown.

The eggs are orange-yellow in color, and occur in clusters of from five to twenty, in irregular rows on the under side of the leaves. The larvae are yellowish black to blackish. The pupae are orange-colored.

Remedy. The best control is by the use of arsenate of lead, by spraying, whenever and as often as there are signs of attack. This poison should be applied to the foliage in the early spring, just after the buds have burst, and again two weeks later. If rains fall after the spraying it may be necessary to apply the poison a third or even a fourth time. The poison must reach the under side of the leaves to be effective against the eggs and the larvae. The first spraying is intended to kill the adults and prevent the laying of eggs; the later sprayings are additional safeguards against possible survivors.

To destroy the pupae at the base of the tree scalding water, thick soapsuds or a solution of kerosene should be poured over them in liberal quantities; this should be used promptly and repeated whenever and as often as may be necessary until all the insects are destroyed. The surface of the soil should be turned by digging, to expose any insects which may have buried themselves. In the case of a large tree it is sometimes necessary to climb to the forks of limbs and gather stragglers.

Combined action on the part of the entire neighborhood is essential in undertaking the destruction of the Elm-leaf beetle. Unless all trees are treated, the results will be without value, as the beetles will travel from infested trees to those which may have been treated. Another factor in the importance of cooperative action is that expensive spraying apparatus is required for trees as large as Elms and this apparatus should be owned by the town or city government or by a number of individual property owners.

Brown-tail Moth

Habits and Damage. This leaf-eating insect causes great damage in New England and a severe attack destroys leaves as fast as developed. The eggs hatch early in August, after having been laid in July in oblong clusters covered with brown hair on the underside of the leaves. The young caterpillars make tents for them-

Remedies. Cutting off the winter tents and burning them is an effectual method of destroying this pest. This must be done before the caterpillars emerge in the spring. It is also useful to spray with arsenate of lead when the leaves are full grown and again when the caterpillars hatch.

selves by fastening leaves together with a web of silk. These tents are at the ends of twigs. Before going into winter quarters in the tents, the young caterpillars feed on the leaves, giving them a skeleton-like appearance, but without serious damage. When the buds begin to form in the spring the grubs start to devour the bud scales and small leaves. This spring feeding sometimes strips a tree of leaves altogether. The growth of an infested tree is badly checked.

In appearance the adult moth is pure white and the tip of the abdomen is covered with dark brown hairs. The moths appear during the first week of June and for several weeks they may be seen clustered around electric arc lights. The caterpillars are covered with poisonous barbed hairs which cause severe irritation when brought into contact with the human skin.

San José Scale

(See description and remedies under Ash)

Bagworm

Habits and Damage. Less common than the Elm-leaf beetle, but causes some damage. Appears in bags, woven by the insect itself from bits of foliage and a silk fibre. The eggs are laid within the bags in September and hatch into caterpillars the following spring. The caterpillars begin at once after hatching to feed on the leaves and to construct bags for themselves. The insect carries its bag with it in moving from limb to limb or even from tree to tree. In winter the bags are conspicuous on the leafless branches.

Remedies. The bagworm has natural enemies which usually serve to keep it within bounds. The simplest remedy is to pick the bags from the tree, wherever this can be done, and burn them. Where the bags can not be thus picked by hand, or to destroy any which may have been overlooked, the tree should be sprayed with arsenate of lead soon after the time of hatching in the early spring.

Concerted action on the part of an entire neighborhood is essential in the treatment of the bagworm.

Spiny Elm Caterpillar

Habits and Damage. A black, spiny caterpillar, marked with red, and about 2 inches long; found in groups. Eats the leaves. Its presence is shown by partly eaten leaves or by entire branches or leaves becoming bare.

Remedies. When the first signs of injury appear the affected parts of the tree should be thoroughly sprayed with arsenate of lead. Where the clusters are such as to make it possible to remove them bodily without much

When fully developed the caterpillar becomes a chrysalis resembling a sea-shell, which is fastened to a limb, and which develops into a butterfly, which in turn lays eggs.

damage to the tree the twigs carrying the caterpillars should be cut off. When this is done the caterpillars may be easily destroyed by burning, by dipping in kerosene or by crushing.

Fall Webworm

Habits and Damage. This pest may be recognized by its tent-like web containing a quantity of hairy caterpillars together with skeletonized leaves, the latter usually brown. The young webworm, or pupa, spends the winter in silken cocoons, in cracks and crevices of fences or tree boxes, under doorsteps, on basement walls, or among sticks and rubbish. In May the pupa becomes a moth, which lays its eggs on the underside of leaves. The young worms when hatched feed in groups and construct their web to cover several leaves, sometimes an entire limb of considerable size. In July, when fully grown the worms crawl down the tree. A second crop develops in August in temperate climates, and in the South a third crop is known.

Remedies. Like the bagworm, the fall webworm has natural enemies, which usually keep it in check. When artificial control is necessary, the best method is to destroy the cocoon in winter by hand picking and burning. The burning of the tents is also necessary. If foliage becomes affected it should be sprayed with lead arsenate. To apply the spray a barrel pump mounted on a horse-drawn cart may be used in a small community, with good results. This should have fifty feet or more of garden hose. A ten foot bamboo pole, carrying the spray nozzle at the end, is helpful in causing the spray to reach the upper limbs. For larger communities a power pump, horse-drawn or motor driven, is most efficient.

To provide suitable apparatus, the spraying should be cooperative. All trees should be sprayed as those left untreated would communicate the web-worms to others near at hand.

Forest Tent Caterpillar

Habits and Damage. This is the caterpillar which sometimes is so abundant in forests as to strip completely the foliage of trees over hundreds of square miles. In appearance, it presents a blue head and it has silver spots, diamond shaped, down the back. The young caterpillars emerge from the eggs when the leaf growth begins in the early spring. They feed on the leaves and may destroy all the foliage. They are to be found in colonies on the trunk and larger limbs, and are frequently seen hanging by silken threads. Early in June they leave the tree and take shelter under stones, woodpiles, fences and other hiding places, emerging early in July as moths. The eggs are laid a little later, around slender twigs.

Remedies. When not destroyed by their natural enemies, these caterpillars must be given careful attention as soon as detected. The egg masses on twigs may be hand picked and destroyed or they may be daubed with creosote, or sprayed with kerosene emulsion or with one of the miscible oils of standard make. Early spring spraying with lead arsenate is effective, when done with thoroughness.

Cankerworm

Habits and Damage. This is the worm commonly known as the "measuring worm" or "looper," because of its curious way of looping its body in crawling. An attack by this species may result in the destruction of the entire foliage of a tree. The species is divided into spring and fall types; the latter is the one which attacks shade trees. The eggs of the fall moth, shaped like flowerpots, are laid in regular rows, usually in rings around twigs near the end of a branch. The eggs hatch into caterpillars when the leaves start to expand in the spring. These caterpillars feed on the leaves, and in June spin silken threads by which they descend to the ground to bury themselves beneath the surface. They emerge late in the fall. The egg-layers have no wings and must crawl up the trunk of a tree to deposit their eggs.

Remedies. If unchecked by their natural enemies the cankerworms become a serious menace to trees. The first step is to prevent the wingless females from crawling up the trunks in order to lay eggs. This may be done by banding the trees with some sticky substance or cotton batting. (Page 192.) These bands should be placed late in September and kept in position until the end of May. Where banding has not been done, or where it has not proved effectual, a tree which shows signs of being heavily infested should be promptly sprayed with arsenate of lead. Necessity for spraying is shown by the appearance of perforations in the leaves when they are opening in early spring.

White-marked Tussock Moth

Habits and Damage. One of the worst insect enemies to the Elm and other shade trees, sometimes destroying the foliage of the trees in an entire community. City trees seem especially susceptible to its attacks. When a tree becomes infested the signs are at once visible, in the form of conspicuous egg masses on the trunk or larger limbs; these masses are present from the time of the egg-laying in September, until the following spring. They are shiny white, frothy looking patches, with four or five hundred eggs in a single cluster. Hatching takes place in May, with a second brood in August, and each cluster may produce hundreds of caterpillars. The caterpillars immediately attack the leaves, first reducing them to transparent skeletons and finally devouring all but the principal veins. After five weeks the caterpillars weave cocoons in which they go through the stages of transformation, emerging as moths to repeat the egg-laying and hatching process for a second time and in warm climates for a third time during the same season. The full grown

Remedies. Destruction of the egg masses in the fall or winter is the simplest and most effectual means of control. They may be easily picked off by hand, or scraped off and burned; or they may be destroyed by spraying or daubing with creosote oil, kept liquid by being mixed with turpentine. It will be found that because the masses are loosely attached the removal can be accomplished with little effort. If any of the eggs remain and are hatched the tree must be thoroughly sprayed with arsenate of lead, completely covering all infested foliage. The spraying should be done with equipment and method similar to those outlined for the control of the fall webworm. (Page 203).

The tussock moth does not appear every year, for the reason that it has a number of natural enemies which keep it in check.

caterpillar is more than an inch long, with red head, three black plumes, and four yellow, brush-like tufts on the back.

Community action is essential to the destruction of the tussock moth. To treat one tree and neglect another will not protect even the tree which is given care, as the caterpillar travels from one tree to another. All trees should be treated at the same time.

Large Elm Sawfly

Habits and Damage. This is an insect much like a caterpillar, which eats leaves and girdles the bark of twigs, often causing a tree to have an appearance of having been damaged by fire. Another form of damage to the leaves is the appearance of blisters, caused by the habit of the female of making slits in the leaves and thrusting eggs into these pockets. The eggs hatch in early summer and produce yellowish-white worms, coiled and cylindrical, with white lines down the middle of their backs. These worms feed on the leaves for several weeks and then bury themselves in the ground at the base of the tree for the winter. Mating and the deposit of eggs take place in the spring.

Remedies. If the presence of the sawflies is detected during the fall or winter, they should be destroyed at once, by burning the debris or rubbish in which they may be hidden or by breaking up the ground at the base of the tree in which they may be buried, and crushing them. In the spring as many as possible should be picked from the foliage, or infested leaves taken off and destroyed. If spraying becomes necessary lead arsenate should be thoroughly applied.

BORING INSECTS

Elm Borer

Habits and Damage. This boring insect does great damage to the Elm, and is especially apt to attack a tree weakened by disease or from other cause. At times it becomes epidemic and may destroy the trees of an entire community or neighborhood. The eggs are laid singly or in groups on the bark at any time between May and August, by a gray, long-horned beetle about one-half inch long and marked with red lines and black spots. The eggs hatch into very small grubs without feet, and these grubs immediately tunnel through the bark into the cambium layer. Here they continue their boring, excavating wider cavities as they grow larger. When these cavities encircle a limb or trunk the effect is to girdle and kill. The grub is white and more than an inch long when grown. On reaching full growth it cuts out a cell under the bark and emerges in the spring as a beetle, making its exit through a round hole which it cuts

Method of Combat. There is no way to destroy this borer except by total removal of such part of the tree as may be infested. If the attack of the beetles is discovered when the infested area is small and confined to the branches, it is possible to save the tree. On the other hand, if the trunk has been attacked there is nothing to do but cut the tree down. In removing branches or cutting down the tree it is essential that the wood be burned, as this is the only way to prevent the borers from migrating to other trees near at hand.

Since the borer is most apt to attack a tree already weakened, one of the most efficient safeguards against attack is to provide each tree with proper nourishment and protect it from injuries of all kinds.

in the bark. The damage to a tree shows itself first in leaves turning brown at the ends of infested branches, then by the death of branches and finally in the death of the tree. In dying trees, the bark on trunk and larger branches may be easily peeled off in patches, and underneath these the grubs are found.

Leopard Moth

Habits and Damage. This moth takes its name from the leopard-like spots on its white wings. The adult moth lays eggs in crevices of the rough bark, a single specimen sometimes depositing 700 or 800 eggs. The larvae, or grubs, hatch within 10 days and at once begin their destructive work of feeding on the wood, boring toward the heart of the tree as they feed. Twigs infested break off, the bark splits and forms ugly scars, and chips and matted discharges are found at the entrance to the burrow. The grubs' period of activity continues for two years, serious damage is caused and frequently the death of the tree results from girdling of the trunk. In about two years the grub changes into a chrysalis and then into a moth, and egg-laying follows. Even when the attack is not so severe as to cause death, the growth of a tree is seriously hampered.

Treatment. The control of this insect is difficult. When a tree or limb has become badly infested before discovery of the attack, the only recourse is to cut and burn the infested part immediately, even if this involves cutting down the tree itself. This drastic action is necessary to prevent the spread of the pest to other trees. In cutting and burning, care should be exercised, and prompt action employed, to keep the borers from escaping and migrating.

If a tree shows a few burrows, it is sometimes possible to arrest the damage by injecting carbon disulphid into the channels. This kills the borers. In some cases the borers may be killed bodily by probing with a flexible wire inserted into the channel. *Action should always be immediate* when the borer's presence is detected.

Because of this borer's tendency to migrate from tree to tree, community or cooperative work is always necessary.

Twig Girdler

Habits and Damage. The pet habit of this insect is to destroy twigs and branches by girdling them until they fall off, or die and remain hanging. The girdler appears in late summer or early fall and is apt to feed on the thin bark of twigs before laying eggs. The female attacks twigs from ¼ to 1½ inches in diameter, and cuts rings around them deep into the wood; the eggs are laid in openings cut through the bark. It is these wounds that cause the twig to die. After the eggs are hatched the grubs feed on the wood for a year or more. Examination of the burrow in a fallen

Treatment. There is no remedy for this insect pest, but it contributes to its own destruction by remaining in the falling or broken twig. It is important to gather and burn the twigs as soon as they fall or break, for the purpose of destroying the girdlers. This is the only treatment to be given. Nature helps in destroying the pest by letting them overcrowd each other in the individual twig.

twig will disclose the presence of the grub. Trees often become badly deformed as a result of this insect's work.

SAP-SUCKING INSECTS

Oyster-shell Scale

Habits and Damage. This scale may be recognized by its shape and appearance. In color it is brown or grayish, and in form it is long and curved, spreading at one end. It is easily moved by prying beneath it with a finger nail or knife-blade. The eggs are laid in the fall and remain all winter under the parent scale, encrusting the bark of a branch. Hatching takes place about the time apple-blossoms fall, and produces crawling insects which thrust their sharp beaks into the bark and feed on the sap for several weeks, until maturity and repetition of egg-laying. Two broods a year are developed even as far north as New Jersey.

Treatment. Nature provides for the destruction of a large percentage of oyster-shell scales, through the agency of enemy insects. It is unsafe, however, to leave the work to these enemies, and spraying is necessary for complete elimination. The only time this spraying is effectual is immediately after hatching, shortly after the season at which apple-blossoms fall, when the lice-like insects are crawling, or have just inserted their beaks into the bark. Whenever these insects are visible they should be sprayed with miscible oils (lime sulphur hard on foliage), with kerosene emulsion, or with whale-oil soap in the proportion of one pound of soap to five gallons of water.

Woolly Elm-bark Aphis

Habits and Damage. This insect causes more damage to the looks of a tree than to its growth. Its attacks produce knotted and gnarled twigs and trunks on young trees. The American Elm is especially susceptible. An infested tree shows the rough knots, with clusters of white, woolly substance and lice-like insects. These insects appear during the spring and summer, and spend their entire lives on a single tree.

Remedies. The insect is easily controlled by spraying with 40 per cent. nicotine sulphate, with kerosene emulsion or with a solution (5 to 7 per cent.) of one of the standard miscible oils. The spray should be applied thoroughly to the bark. If miscible oil is used the spray should be applied in the winter time; the other should be used as needed.

European Elm Scale

Habits and Damage. While not often the direct cause of a tree's death, this sap-eating scale causes injuries which, by weakening the tree, lead to fatal attack by borers. The scale winters in crevices of the bark on the trunk and the larger limbs. At this period its color is brown, and it is embedded in a white substance resembling cotton. With the approach of warm weather eggs are deposited, and these hatch in early summer, producing insects resembling lice. These insects have coloring of

Remedies. Winter spraying is the most effectual means of destroying the scale. The spray should be kerosene emulsion, or a water solution of one of the standard miscible oils. Not so effectual, but useful when needed, is summer spraying with one of these preparations during the hatching season, in June or July.

lemon-yellow. They settle on leaves and twigs, feeding there until late summer, when they return to the trunk or larger limbs.

GALL INSECTS

Gall Aphids

Habits and Damage. These sap-sucking insects disfigure a tree by causing the growth of swellings known as galls. These galls sometimes become so numerous as to create alarm, but the damage is more to appearance than to growth or vitality. A tree is seldom harmed in health by them.

Remedies. Spraying is seldom necessary but if desired a tree may be sprayed with kerosene emulsion or miscible oil solution. If the galls appear on more than one tree in a neighborhood all of those infested should be treated.

GUM (SWEET)

LEAF-CHEWING INSECTS

Forest Tent Caterpillar

(See description and remedies under Elm)

HACKBERRY

LEAF-CHEWING INSECTS

Spiny Elm Caterpillar

(See description and remedies under Elm)

Hackberry Butterfly Caterpillar

Habits and Damage. This leaf-chewer causes serious damage to the foliage of the Hackberry. Two generations develop yearly, from eggs deposited on the leaves. The caterpillar is green in color, with pale spots and lines along the back and projections at each end. It is found on the under side of the leaf. At maturity the caterpillar develops into a russet gray butterfly, spotted with brown. The presence of the caterpillar is indicated by the damage resulting from its leaf-eating habits.

Remedies. These caterpillars fall to the ground with the dropping leaves in the autumn and it then becomes a simple matter to destroy them by raking and burning the leaves. Spraying the tree with lead arsenate while the caterpillars are feeding is also a means of control.

GALL INSECTS

Hackberry Gall Insects

Habits and Damage. The galls produced by this insect mar the appearance of a tree by disfiguring the foliage, but otherwise they do no particular harm. In the spring, when the buds begin to swell and open, the insect

Remedies. It is not often necessary to apply treatment against this insect, as the damage is usually slight. When treatment is needed the tree should be sprayed with kerosene emulsion or water-soluble oil. The spray should be feeds on the tender growth and lays eggs on the leaves. In three weeks these eggs hatch and galls result from swellings caused by the attacks of the young insects in feeding. The galls produce deformities on leaves, leaf-stems and twigs.

applied in the spring, at the time of the first appearance of the young insects on the leaves, before the galls close up.

HICKORY

LEAF-CHEWING INSECTS

Walnut Caterpillar

Habits and Damage. This leaf-chewing caterpillar sometimes strips a tree of all its leaves. Its favorite is the Walnut, but it also attacks the Butternut and the Hickory. In extreme cases of repeated yearly attacks the death of the tree results. The caterpillars hatch from eggs laid by moths in July on the underside of leaves. Upon hatching the caterpillars attack the leaves and continue to feed until early fall. In full growth the caterpillar is nearly two inches long. It is black and covered with hairs of a dirty gray color.

Remedies. The simplest remedy, where possible, is to collect the caterpillars while they are on the tree. Where this can not be done because of the size of the tree a spray of lead arsenate will be found effectual.

Gipsy Moth

(See description and remedies under Beech)

BORING INSECTS

Hickory Bark Beetle

Habits and Damage. This boring insect is a serious menace to the Hickory, frequently causing the death of trees. The beetles are hatched from eggs laid, about the time the pollen falls from Hickory tassels, in cells at the sides of a vertical channel excavated by the parent beetle between the inner bark and the wood. At first the grubs feed on the inner layer of bark and tunnel the surface of the wood on either side of the vertical channel, producing a design resembling a centipede. In case of severe infestation these tunnels may completely girdle a tree and cause its death. Later the grubs tunnel toward the surface of the bark, where they winter, emerging in the spring as beetles. The work of the insect is indicated by damage to leaves at the base of the leaf-stems, in the spring, and by clean round holes in the bark; the foliage fades and dies in early autumn.

Control. It takes a vigorous tree to combat this enemy, and for this reason it is important to keep Hickories in good condition. In case of slight attack, an efficient aid to control is to stimulate the vigor of the tree by use of fertilizer, thus enabling the tree to resist the damage. Keeping the trunk covered with strong whale-oil soap-suds will prove helpful. If a tree is seriously affected it should be cut down and burned, to protect neighboring trees from infestation.

Twig Girdler

(See description and remedies under Elm)

GALL INSECTS

Gall Aphis

Habits and Damage. Swellings which resemble tumors and cause deformity of the twigs and leaves are produced by this insect when spring growth starts. The actual damage is slight, but the appearance of a tree may be badly marred by the galls.

Remedy. To destroy these insects a spring spraying of kerosene emulsion should be applied at the time the buds are opening. This kills the insects and prevents the creation of the deforming gall growths.

HONEY LOCUST

White-marked Tussock Moth. **Twig Girdler.**

(See description and remedies under Elm)

HORSE CHESTNUT

White-marked Tussock Moth. **Leopard Moth.**

Oyster-shell Scale

(See description and remedies under Elm)

BORING INSECTS

Twig Girdler

(See description and remedies under Elm)

Linden Borer

Habits and Damage. This beetle confines its attacks to the Linden, in which respect it is different from other insect enemies of this tree, listed above. The attacks often cause serious injury. The borer eats the green bark of growing shoots, the leaf stems and the larger veins on the underside of the leaves. The attack becomes noticeable toward the close of summer. Damage by boring is done by the grub, which eats its way under the bark and deep into the wood of the trunk, near the ground, and into exposed roots and lower limbs. The insect appears in May and begins its attack. Eggs are laid soon afterwards in incisions in the bark. After passing through transformations from grub to beetle, the insect leaves the tree through holes in the bark. The time of departure is throughout the summer. In appearance the beetles are long-horned, with six black spots on the back.

Remedies. The surest method of destroying this borer is to dig it out bodily, whenever this is possible. This is especially desirable in the case of a valuable tree, to make sure of the elimination of the enemy. Another method employed with good results is to kill the borer bodily, by probing with a wire into the burrow. Injection of carbon disulphid is effectual when thoroughly done. Spraying with poisoned miscible oil solution in the late summer helps in the destruction of the borers. When a tree is heavily infested and badly damaged it is best to cut the tree down and burn it, as the damage can not be overcome and the tree is a menace to its neighbors if it is allowed to stand.

SAP-SUCKING SCALE INSECTS

Oyster-shell Scale

(See description and remedies under Elm)

San José Scale

(See description and remedies under Ash)

MAGNOLIA

SAP-SUCKING SCALE INSECTS

Magnolia Soft Scale

Habits and Damage. This scale encrusts the branches of the Magnolia and Tulip tree so thickly at times as to cause the tree to sicken and die. After spending the winter on the bark the scales feed there during the spring and summer and produce a new generation toward fall. In September the young insects settle so densely on the twigs as completely to hide the bark. At this time the young may be seen crawling about, preparing to settle. The fully grown scale is a vivid gray or light brown, knotty and prominently raised. The young scale is black. In addition to the damage caused by the feeding, the scale secretes an offensive honey-dew which invites fungus growth and clogs the pores of the leaves.

Remedies. Spraying is the best means of controlling this scale. The spray should be applied late in September, at the time when the young have just made their appearance. Ten per cent. kerosene emulsion has been found effective, as has miscible oil solution. Winter spraying with undiluted crude petroleum is advocated by some authorities as an efficient means of control.

MAPLE

LEAF-CHEWING INSECTS

Forest Tent Caterpillar | **White-marked Tussock Moth**
Bagworm | **Brown-Tail Moth**

(See descriptions and remedies under Elm)

Green-striped Maple Worm

Habits and Damage. While not prevalent every year, this worm does serious damage to the Maples at times and has been known to strip trees of all their foliage. The moth appears in May or June, an insect with woolly body, pale yellow, and having a wingspread of two inches. Eggs laid on the underside of leaves hatch into caterpillars within ten days. The caterpillar is smooth, a pale yellowish green, and grows to be two inches long; it is striped lengthwise with dark green and has long horns back of the head. The worm feeds on leaves.

Remedies. Natural enemies, including birds and insects, serve to keep this worm in check for the greater part of the time. When a tree becomes infested it should be sprayed with lead arsenate as soon as the caterpillars make their appearance. Prompt action is needed to prevent destruction of the foliage. To pick by hand such caterpillars as may be in reach is helpful in ridding young trees of this enemy.

BORING INSECTS

Sugar Maple Borer

Habits and Damage. This is the worst insect enemy of the Sugar Maple. It differs from other borers in that its attack is made against trees which have not been weakened. As a result of its work large limbs and even entire trees may be killed. The parent insect appears between June and August, emerging from oval holes in the bark. At this stage it is a thick, black beetle, about one inch long, with short horns, and marked with brilliant yellow. Egg-laying occurs during July or August, causing discoloration of the bark upon the trunk and larger branches. The larvae begin boring soon after hatching, and their work causes a flow of sap and throws out a substance which often forms a small mass on the surface at the point of entrance. The first winter is spent on the sapwood and in the following spring the borer tunnels between bark and sapwood or into the outer sapwood. The burrows during the second summer are half an inch or more in width and almost as deep, and they form serious wounds. If these tunnels girdle a tree or limb they cause death.

The presence of the borer may be detected by various signs, including dead limbs, dead areas of bark, ridges or elevations just under the bark, naked scars on limbs or trunk, especially near the base of a large limb, oval holes about half an inch wide and a substance resembling sawdust at the base of the tree or in bark crevices. Sometimes the leaves on a limb will suddenly dry up and die, and a flow of sap and "sawdust" will be found somewhere on the limb.

Remedies. Careful examination of trees for signs of the presence of borers should be made every spring and fall. If discoloration of the bark and exuding sap indicate that eggs have been laid, or if sawdust or excrement have exuded, prompt action for control should follow. The first step is to cut away the bark and follow the burrow till the grub is located and destroyed. The cutting must be done with great care, with clean surfaces, and the wounds covered with creosote-tar mixture or two coats of good white lead paint. Sometimes the grub may be reached, and killed by probing with a flexible wire to the end of the burrow. Carbon disulphid injected into the holes will kill the borers if all openings are promptly plugged with wax, soap, clay or putty to shut out air, but when this method is used it is not possible to know that the borer has been killed.

Spraying the tree in late summer with poisoned kerosene emulsion or miscible oil is effective in killing borers which have just penetrated the bark. The spray should be confined to the trunk and the larger branches and care must be taken that none of it reaches the foliage, as the leaves are seriously injured by these solutions.

Trees which are badly infested, or dying trees or branches, should be cut down and burned. This should be done during the winter and spring, to prevent any of the adult beetles from emerging and causing damage to other trees.

Leopard Moth

(See description and remedies under Elm)

Carpenter Worm

Habits and Damage. While seldom causing the death of a tree, this worm is responsible for serious deformities which result in unsightly appearance. Its eggs are laid near wounds or scars and it is through such

Prevention and Remedies. The most effectual treatment of this insect is to take steps to prevent a tree from becoming infested. Since wounds and scars invite the laying of eggs, it is important to see that no wounds openings that the caterpillars, when hatched, enter the wood to begin their work. Wounds and scars are a constant invitation to this insect, and its preference for such injuries is a strong argument for protecting trees from injury and the careful dressing and treatment of wounds. The insect lives for about three years, and spends almost the entire time eating into and feeding on the heart-wood. The burrow may be half an inch in width, and will cause the wilting of twigs and unsatisfactory growth.

Egg-laying occurs early in the summer, and, soon after hatching, the caterpillar burrows into the heart-wood. When the insect emerges, after three years of damage, it is in the form of the adult moth.

occur and that such injuries as may come are carefully and promptly cleaned and dressed with tar or paint. (Page 145).

When a tree becomes infested, winter is the time for destroying the worm. During that season all infested wood should be cut away and burned. Into the wounds caused by the cutting and the tunneling, carbon disulphid should be injected as an added measure of control, and the wounds should immediately be plugged and sealed with soap, grafting-wax, clay or putty.

Maple and Oak Twig Pruner

Habits and Damage. This enemy specializes on the Maple and the Oak, and while it does not kill the trees it impairs their looks by severing twigs and causing them to fall to the ground or hang to branches. The grub passes the winter in the severed twig, emerging in June as a pupa or chrysalis. In July the parent beetle lays its eggs on small twigs and, upon hatching, the grubs begin at once to feed on the wood, making tunnels which sever the twigs. During the summer the ground is covered with twigs cleanly cut off, as with a saw. In the center of each twig is a burrow, filled with debris, and in this burrow will usually be found a white grub with brown jaws. Many twigs almost severed will be seen hanging from the tree. Damage to the shape of the tree is the most serious result.

Remedies. Since the insects remain in the severed ends, the best remedy is to gather and burn the fallen and hanging twigs. This should be done before June, the time for the adult beetles to leave the twigs in which the winter has been spent. Action at this time will prevent the laying of eggs for the production of a new brood.

SAP-SUCKING INSECTS

Oyster-shell Scale

(See description and remedies under Elm)

Cottony Maple Scale

Habits and Damage. Considerable damage sometimes results from the attack of this insect. The presence of the scale is first noticeable in June, when the body of the adult female

Remedies. It is not always necessary to apply remedies, but if needed, a spraying with dilute kerosene emulsion, summer strength, is effectual if used during the hatching season. Brush-becomes conspicuous on a twig by the appearance of white egg masses resembling cotton. The eggs hatch from early summer to August, and soon after hatching the young settle on twigs and the underside of leaves and begin to feed, causing the leaves to turn a sickly yellow. Sometimes the leaves become covered with honeydew. Badly infested branches are apt to die. In winter the parent scale, brown in color, oval shaped, and about $\frac{1}{16}$ inch long, is found on the under side of twigs and branches.

ing with a stiff broom over the surface covered by the white egg-masses will probably destroy the eggs and thus prevent the production of a new brood. In some communities the eggs are destroyed by jets of water at high pressure, applied by a power sprayer. Cutting and burning twigs carrying the egg-masses is simple and useful.

Gloomy Scale

Habits and Damage. Although it prefers the soft or silver Maple, this scale is apt to damage all Maples. Its attacks are especially common in the South. In appearance the scale is yellow and shaped like a pouch. The immature scale spends the winter attached to the bark, and devotes the spring to feeding. Its eggs are laid and hatched in the early summer, and the young crawl about for a day or two before settling down to feed and build new scales. Several generations follow the first, during the summer. The presence of the scale is indicated by a roughening of the smooth bark and the appearance of dark gray, scurfy patches with grain-like surface. Wherever the scales may have peeled off, white rings are found.

Remedy. Miscible oil solution is the most efficient means of control. This solution should be applied by spraying during the winter. It will usually be found to serve the purpose.

Terrapin Scale

Habits and Damage. This scale takes its name from resemblance to a miniature terrapin. It is a raised, reddish scale, $\frac{1}{16}$ to $\frac{1}{8}$ inch in length and half as wide, with ridges along its edges. The scale encrusts twigs and drains their vitality by sap-sucking, causing the foliage to wilt and die. The hatching season extends from June through the greater part of the summer, and the young insects, of licelike appearance, infest green shoots and the large veins of the leaves. On the infested twigs, and beneath them, a sootlike growth and honeydew are to be seen. It also infests Oriental Plane.

Remedies. Early spring spraying applied before the buds have opened, is an efficient method of controlling this insect. For this purpose kerosene emulsion and miscible-oil solution are most satisfactory.

SAP-SUCKING APHIDS

Woolly Maple and Alder Aphis

Habits and Damage. This insect is more injurious than the cottony maple scale. It shows itself in the early spring as a fluffy mass resembling cotton, on the under side of folded leaves, and it looks so formidable as to cause the tree owner much concern. The cottony mass contains aphids hatched from eggs which were laid the previous fall in cracks and under loose bark on the trunk of the tree. At maturity these insects leave the Maple and migrate to an Alder where they produce several generations that feed on the bark of twigs and branches throughout the summer. In the fall the final generation returns to the Maple preparatory to the production of a brood which furnishes the eggs for the following season's hatching. Very little injury is caused the Maple.

Remedies. Because of the relative harmlessness of this insect, treatment is not really necessary. Spraying with 40 per cent. nicotine sulphate or kerosene emulsion is effectual.

Norway Maple Aphis

Habits and Damage. This insect is found on the under side of Norway Maple leaves during the summer, causing them to show brown blotches. The leaves are also coated with the sticky substance known as honeydew, and so much of this substance is produced that the ground under the tree becomes more or less covered with it. The leaves sometimes fall, disfiguring the tree for the season and impairing growth. The aphis may be recognized by its yellowish green color, with markings of brown, its reddish eyes and long, hairy antennae.

Remedy. Spraying is usually enough to destroy this insect. The spray should be 40 per cent. nicotine sulphate, mixed with soap and diluted. It should be applied as soon as possible after the insects are discovered on the leaves, and the spraying should be aimed particularly at the under side of the leaves. Where an insecticide is not available, a stream of water from a garden hose, applied frequently and with force, will keep this aphid under control.

GALL INSECTS

Gall Insects and Mites

Habits and Damage. Several forms of gall-making insects and mites infest Maples, causing the growth of galls which disfigure the trees and sometimes cause the premature falling of leaves. Serious damage is comparatively rare.

Remedy. When a tree is badly infested a thorough spraying with kerosene emulsion or miscible-oil solution will prove effectual, if applied during the winter.

OAK

LEAF-CHEWING INSECTS

Gipsy Moth

(See description and remedies under Beech)

Brown-Tail Moth—Oaks are very susceptible (See under Elm).

Bagworm **White-marked Tussock Moth**

Forest Tent Caterpillar

(See descriptions and remedies under Elm)

Fall Cankerworm

Habits and Damage. This leaf-chewer develops from the spring cankerworm, the moth usually emerging from the chrysalis stage late in the fall. The parent moth is wingless, and crawls up nearby trees or bushes to lay eggs for the spring hatching. The characteristics of the worm and the damage it causes are the same as those given for the spring cankerworm. (See Elm).

Remedies. The treatment for this worm is the same as that given for the cankerworm under Elm.

BORING INSECTS

Carpenter Worm **Maple and Oak Twig Pruner**

(See descriptions and remedies under Maple)

Leopard Moth

(See description and remedies under Elm)

Two-lined Oak and Chestnut Borer

Habits and Damage. This borer is the most serious insect enemy of the Oak. It prefers trees weakened by disease or by attacks from other insects, but may attack perfectly healthy trees. An attack by this insect is very apt to prove fatal. Laid in the early summer, in deep cracks in the bark, the eggs hatch into flat milky or yellowish white grubs with large heads. These grubs burrow through the bark and by fall each of them bores a tunnel which may be three feet in length diagonally and across the grain, in the inner bark and outer wood. During the winter the grubs remain in the outer bark, emerging late in the following spring as brownish or black beetles, ¼ to ⅔ inches long, with two yellow lines along the back. The tunnels made by the borer are apt to girdle the tree and prevent the flow of sap, causing death.

Treatment. When a tree is badly infested there is no remedy. When a tree is but slightly affected, spraying of the trunk during the fall with poisoned kerosene emulsion will establish control.

Gray Aphis

This is a large plant louse nearly ¼ inch long. It collects in masses on the under side of branches, sucking sap and exuding a honeydew more pronounced and objectionable than that of the Norway Maple aphid. They appear in midsummer and increase until frost. They are not likely to kill the tree but branches may succumb where the infestation is severe. It is also sometimes seen on the Linden and on the Pin Oak.

The treatment is the same as for other aphids.

SAP-SUCKING SCALE INSECTS

Pubescent Oak Kermes

Habits and Damage. This sap-sucking scale insect confines its attacks to twigs and leaves, and does no damage beyond checking growth. It appears on Oaks only. The young insects, hatched late in the fall, spend the winter on the bark. In the spring, when White Oak buds begin to open, the insects attack the new leaves and tender young growth. The attack causes crumpling, and later in the season death results to the parts affected. The older leaves and twigs are studded with stationary brown, pea-shaped scale insects. Some of the leaves which have been killed remain on the tree all winter.

Remedy. A simple means of control is spraying with a solution of one part of miscible oil to 15 parts of water. This should be applied when the insects appear in the spring, at the time White Oak buds begin to open.

Obscure Scale

Habits and Damage. This sap-sucking scale insect has much the same characteristics and appearance as the Gloomy Scale, (see Maple), but is somewhat coarser. Its attacks are confined to Oaks, and it sometimes does serious damage to young trees and branches. In the case of severe infestation it may cause the death of the tree or the affected parts.

Remedy. Winter spraying with miscible-oil solutien is effectual in the control of this scale.

GALL INSECTS

Oak Galls

Habits and Damage. The Oaks are especially subject to the visitations of gall-making insects affecting all parts of a tree from roots to buds. The galls produced by these insects are swellings of various shapes and sizes,

Treatment. No action is necessary, unless a fine tree is infested repeatedly for several years. In such a case the gall-laden parts should be cut and burned. The fallen leaves bearing the galls should be burned as well.

particularly on twigs and the under side of leaves. There are several hundred varieties of the insects. Their principal damage is to the appearance of a tree and serious injury is not caused.

POPLAR

LEAF-CHEWING INSECTS

Cottonwood, Poplar and Willow Leaf-beetle

Habits and Damage. These leaf-eaters are active in every state of their development from birth to maturity and death, and the several succeeding generations of a single season may destroy all the leaves on a tree. They appear in the spring, after wintering on the tree, and at once begin feeding on the developing leaves, usually on the under side. In a short time the parent lays eggs on the under side of the leaves, producing a new generation. This process is repeated from three to five times each season. The presence of the insect is shown by leaves partly or entirely bitten through, early in the season, and later entirely consumed, by the beetles and grubs. As grubs the insects are short, stout, soft-bodied and spotted; upon developing into beetles they are hard-shelled, spotted or striped, and half an inch long. The eggs are yellow or reddish and are found in batches. Upon reaching maturity, the beetles issue from skins fastened to leaves, sometimes called "hangers."

Remedy. Spraying with lead arsenate is the most efficient measure of control for this insect. This spraying should be done as soon as the growth of the tree starts in the spring, when there are signs of the presence of the beetles. Care must be taken to direct the spray against the under side of the leaves. Soap added to the spraying material will be useful by causing the spray to stick to smooth leaves.

Bagworm
Spiny Elm Caterpillar
Large Elm Sawfly
Brown-Tail Moth
Forest Tent Caterpillar
White-marked Tussock Moth
Fall Webworm

(See descriptions and remedies under Elm)

Cottonwood Dagger Moth

Habits and Damage. The leaf-chewing caterpillar of this moth does serious damage to the Carolina Poplar and Willow in the prairie regions of the United States. A tree may be entirely stripped of leaves by the attacks of the two generations produced in a season. This caterpillar has a thick coat

Remedy. Spraying is the most effectual remedy for this insect. Lead arsenate, thoroughly applied, will rid a tree of infestation.

of yellow hairs, long, soft and drooping, with five tufts of stiff black hairs on its back. The moths emerge from the chrysalis in the spring and lay their eggs. From these are developed the caterpillars, which feed on the leaves and which when at rest, curl up on the under side of leaves.

SAP-SUCKING INSECTS

San José Scale

(See description and remedies under Ash)

BORING INSECTS

Aspen Borer

Habits and Damage. This borer does considerable damage to Poplars, and is especially prevalent in the middle and western states. The parent insect is a gray beetle, cylinder shaped, having brown spots. This beetle's eggs are laid in a scar in the bark, in May, June and July. On hatching, the grub begins its mining, and spends its first year tunneling just beneath the bark, following this with two years of mining deep into the wood. The boring grub is cylindrical, yellowish, and has a number of fine, short, hard points on a plate immediately behind its head. The sign of this borer's presence is the appearance, in June or July, of irregular scars on the trunk of a tree, especially near crotches, from which there exudes sap carrying fibrous dust from the boring. Later there is an enlargement of the holes, with increased mass of discharge.

Remedies. Spraying infested trunks in late summer with poisoned kerosene emulsion or miscible-oil solution is effectual in destroying the young grubs in the outer bark. Another helpful measure is painting the eggs with creosote or carbolineum. When the young borers begin to tunnel into the wood in the fall, they may be dug out and killed; careful attention should be given to dressing the wounds caused by this treatment. Trees badly infested should be cut and burned.

Bronze Birch Borer

(See description and control under Birch)

Mottled Willow and Poplar Borer

Habits and Damage. Of the enemies of Poplars and Willows this is the most dangerous. The parent insect is a broad and stocky snout-beetle of dark brown coloring mottled with gray, and with pinkish tint at the rear of the wing covers. In length it is about 3/8 inch. After emerging from the chrysalis stage in June or July the beetles feed on the young bark and after a fortnight the female deposits eggs in cavities

Remedies. The surest way to destroy this enemy is by cutting and burning infested limbs or badly infested trees. This must be done in early summer, before the insects emerge from the interior, in order to make sure that all of them are destroyed. This season is a time of great activity on the part of the grubs and the exuding sap and "sawdust" make it easy to detect their presence. A thorough coating of the bark with lead gouged in the bark of young growth. Upon hatching, the young penetrate the bark and winter beneath it. In the spring they resume feeding on the cambium or inner bark. When fully grown, a few weeks later, they bore into the wood and into the pith, and tunnel a gallery in the latter soft material. The presence and activity of the borer are shown by dead or dying limbs, swellings and dead patches of bark, often cracked, on limbs or trunk, fading foliage and the oozing of sap and "sawdust" from points of attack. The half-inch white grub will usually be found in the burrow when an injured twig is split open.

arsenate in July, has been found effectual, as has also the painting of trees with kerosene emulsion in April.

Cottonwood Borer

Habits and Damage. This borer does much damage, causing death or so weakening a tree as to cause it to be broken off by the wind. The grub is long and cylindrical, yellow colored, and is hatched from eggs laid in July and August, in small punctures in the bark, at or below the ground level. The young borers mine under the bark and deep into the wood, throwing out shredded sawdust. The mines thus made at the base of the tree are responsible for the weakness that makes the tree fall before heavy winds. Sickly tops, and collections of the shredded borings on the ground, are the indications of the borer's work. The borer continues his tunneling for two years.

Remedies. Destruction by digging out the young borer is the most successful remedy; or carbon disulphid, injected into the hole which shows fresh sap and borings, will prove effectual if the hole is promptly plugged and sealed with grafting wax, putty, soap or clay. Spraying the trunk with poisoned kerosene emulsion, or miscible-oil, is advocated by some authorities for killing the borers when young.

Carpenter Worm

(See description and remedies under Maple)

Twig Girdler

Oyster-shell Scale

(See descriptions and remedies under Elm)

SAP-SUCKING GALL INSECTS

Poplar Leaf-stem Gall-aphis

Habits and Damage. The gall formed by this insect takes the form of a swelling of the stem, in which a large brood of living lice is born in midsummer. The aphids feed on

Remedies. Unless the attack is exceedingly severe, no treatment is necessary. In extreme cases the destruction of the insects may be accomplished by gathering the infested leaves the tender growth and cause dropping of leaves, marring the appearance of the tree and littering the ground underneath. Trees are not seriously damaged.

and burning them or dipping them in kerosene.

SYCAMORE

LEAF-CHEWING INSECTS

Bagworm **White-marked Tussock Moth**

(See descriptions and remedies under Elm)

SAP-SUCKING INSECTS

Sycamore Lace Bug

Habits and Damage. While it does not kill trees nor cause serious damage, this sap-sucking insect is responsible for discoloring the foliage of the Sycamore and for causing the premature falling of leaves, marring the tree's beauty and littering the ground. The bug appears in the spring, with the starting of growth, and starts feeding on the foliage. Within a week or two the females deposit eggs on the under side of leaves, and these hatch in another fortnight. The young insects feed on the leaves immediately. The adult bugs have lacelike wings, prettily marked. They are to be found with their wingless offspring, in colonies on the under side of leaves. Two or more generations are produced in a single season.

Remedy. The insect may be controlled and destroyed by spraying with soap solution, but this is not necessary unless the invasion is unusually heavy.

TULIP TREE

SAP-SUCKING INSECTS

Tulip Tree Aphis

Habits and Damage. This species of sap-sucking insect infests branches, twigs and leaves during the growing season, feeding on the sap by means of pointed beaks. The presence of the aphis is indicated by sticky honeydew on the parts affected, and by ants which feed on this honeydew. The aphis causes leaves to curl and fall, littering the ground, but no serious injury results. In appearance the insect is reddish brown, with pale green abdomen.

Remedy. Spraying with 40 per cent. nicotine sulphate is effectual in destroying this insect. The spray should be applied as soon as the presence of the aphis is detected.

Tulip Tree Soft Scale

Habits and Damage. This sap-sucking scale insect sometimes causes serious damage to the branches of a tree. The young spend the winter on the bark, and the following spring and summer they use the bark as their feeding and breeding ground. They are gray or brown, about ¼ inch long and almost as wide, and prominently raised. In severe attacks they encrust the underside of branches so thickly as to give them a sickly, blackened appearance, and the death of the branches may result.

Remedy. Winter spraying with crude petroleum is effectual. Miscible-oil solution, applied in winter, also has its advocates. On small trees whale-oil soap in a proportion of one pound to four gallons of water, makes a satisfactory spray, if applied just after the young are hatched, early in September.

WALNUT

Walnut Caterpillar

(See description and remedies under Hickory)

CHAPTER XX.

MUNICIPAL CONTROL OF SHADE TREES

TO make street tree planting successful and satisfactory there must be one central head charged with full responsibility and armed with authority to establish and enforce suitable regulations. This is necessary in order to bring about systematic choice of species for planting, to insure correct spacing between trees, and to provide for proper pruning as well as adequate protection against insects and diseases.

This central control is just as important in connection with trees as in the matter of sewer systems, water-pipes, sidewalks and paving. Public health and convenience make it necessary for these improvements to be in the hands of city or town or district authorities, and the public's interest in the shade trees of the community calls for giving them similar treatment. When individual tastes and preferences in the matter of shade trees are permitted to control, one man may plant a Silver Maple, the man next door choose an Ailanthus, another select the Norway Maple, and near at hand may come in bewildering succession a Scarlet Oak, a Sycamore, a Tulip, a Sugar Maple and a Horse Chestnut. The result of this wide variation of choice is certain to present a riot of size, shape and coloring as the trees develop and their widely different characteristics become emphasized. Such a street will have an uneven and ragged appearance satisfactory to no one.

Each street shade tree should be looked upon in its relationship to all the other trees along that street, or, at any rate, to those along a particular part of the thoroughfare. The planting of them according to the personal tastes of the different owners is as inimical to the general effect as would be the paving of the street in front of each property according to the personal preferences of its occupant. In this selection it is imperative that there should be harmony of choice and concert of action. In a real sense, each tree planted belongs to the entire neighborhood. That the man who cuts down his own fine tree injures the property of his neighbors is recognized in the law of one state. To plant an undesirable species or type of tree is an offence equally serious.

With the lack of uniformity that goes hand in hand with haphazard planting is irregularity in the spacing of trees. One man may want a tree in the center of his lot frontage, while his next door neighbor may choose to place one at each side. Individual preference may cause one man's tree to crowd that of his neighbor so closely that both will soon be completely misshapen. Across the street there may be a gap of 200 feet or more between trees. One condition is as bad as another. Overcrowding and excessive gaps are to be avoided, as harmony is as essential in spacing as in species.

There is further danger in individual tastes being exercised on the trees throughout the period of development and growth. Such danger exists with reference to trimming. One may like the trees pruned so low that the branches touch the hats of passers-by. Another may prefer the complete elimination of the lower branches, and accordingly, trim his thrifty and growing shade tree close to the very top; while a third may be too busy to trim his trees either way. Such diversity brings about an unevenness and raggedness fatal to the desired effect.

Choice of tree guards may give rise to further disparity, if one uses fancy pine pickets, painted red, another wire-mesh, while a third uses wrought iron of highly ornate design, and a fourth none at all. The result of these varying tastes and opinions is an assortment of tree guards as picturesque and kaleidoscopic as the mixture of trees themselves, or of possible treatment in trimming.

In the matter of other care, difficulties also arise from leaving the responsibility on the individual property owner. Protection from insects is one of the serious problems in tree care. Insect enemies are various and insidious. They do not advertise and they do not carry banners nor herald their attacks with blare of trumpets. They come quietly and by stealth, and frequently serious damage is done before the property owner knows that anything is wrong. That every man along a street should give adequate study and attention to insect pests and their habits is hardly to be expected; and even the man who does know something about the subject may suffer because of lack of knowledge or indifference on the part of his neighbor, or because he lacks facilities for proper protection. Few things could be more discouraging than for the man who conscientiously and painstakingly rids his own trees of insects to find that a fresh supply drops in on him from the tree of his next door neighbor.

These problems are cited without intent to discourage the tree planter, but rather with the thought of pointing out some of the difficulties that are possible and showing how they may be avoided. The solution is to be found in the municipal or community control of all shade trees. In European cities, the control is almost invariably vested in the municipal government, and in the United States, those cities which have made the greatest progress in shade tree development have established shade tree control with highly satisfactory results.

Through city control it becomes a simple matter to see that trees are planted and cared for properly. The Shade Tree Commission, city tree expert or other responsible head of the work is in position to settle questions as they arise, including the choice of variety, exact location, details of planting, necessary care and protection and the other points involved in securing best results in shade tree development. Under such central control, uniformity of species along any street is assured by the provision that no property owner may plant an undesirable variety, or one lacking in harmony with its shade tree neighbors. Uniformity in spacing is brought about by the location being officially approved in its relation to the location of existing or proposed trees. In short, no tree may be planted without formal approval of type and placement, and since these two points are the very foundation of good planting the importance of control is obvious.

Central control may give further uniformity by regulating the type of guards that shall be used. This is a minor point, perhaps, but it is not to be ignored in the general effect of street development.

In protecting trees against insects and diseases, central control is most important. In order that pests may be successfully combated, it is essential that their attacks should be anticipated as frequently as possible, or at least that they should be detected promptly after beginning their destructive work. To the untrained eye this is not always possible. The tree borer, for instance, works in the dark, hiding himself soon after birth by eating his way into the inner wood of the tree, there boring an intricate system of tunnels. To the observer of surface appearances, no damage is visible, possibly for years, or until the injury becomes manifest through dying branches. The tree is then frequently past saving. Under a well-organized shade tree government it is possible for the city's trained workers to detect attacks and prevent serious injury. This applies to diseases as well as to insect enemies. By the timely detection and treatment of these dangers, the trees of an entire neighborhood may be saved.

Even spraying, simple as it may seem, is a process best handled by the community-at-large. To spray a small tree, in the early years, is easily accomplished by the use of a garden spraying apparatus; but when the tree becomes larger, the outfit must be more powerful. For the individual to have such equipment is scarcely expected. For the city or town government to have outfits which will care for all the trees of the community is the simplest, most efficient and most economical plan and, therefore, the most logical and desirable.

Central control by the municipal government is to be commended from every point of view, and where such control is lacking, property owners should insist that it be provided.

It will be found that the creation of such control will be a step of great importance in developing attractive streets.

Probably the most satisfactory way of securing supervision is through an unpaid commission of three or five members, which in turn employs an executive officer. In a small place a commission of three persons may be best, one being appointed every two years for a six-year term. In large places five members may be better, and the ideal term would be 10 years. A compromise would be a five-year term, a new member being appointed each year. The great reason for long-term appointees is that it takes two or three years for a member of such a board or commission to see and realize the things needed to be done and the policies that should be carried out. Because it takes a long time to get results in growing street trees, the policies should be as nearly continuous as possible and the terms of the members long enough to insure a majority of experienced persons on the board at all times.

The method of appointing the commissioners is not so important as that each shall be selected from the territory as a whole rather than from a part of it. In some places, where the term of service is ten years, each one's successor is appointed by the remaining commissioners, subject to confirmation by the court. Where this is done a member is not permitted to succeed himself. In other places the commission is appointed by the court; in others, it is elected by the city legislative body or is appointed by the mayor, subject to the approval of the legislative body. The important point is to keep the administration as nearly as possible on a purely business basis.

A good board can accomplish nothing without liberal funds. There are two methods of providing these: (1) By an appropriation from the general tax levy and (2) by direct assessment against the properties, collectible with the other taxes. If the funds are provided by appropriation, a fixed minimum, expressed in millage of the tax rate, should be provided in the organization of the commission. This minimum should be such that a fair amount of maintenance work can be done when no other funds are available. Councils that appropriate money sometimes hamper boards by withholding appropriations. Work of the nature of tree planting should not be permitted to suffer or be lost by a year's neglect. The fund provided by this minimum amount should not be so large that regular additional appropriations will not be needed to carry on the work properly, as this will give a desirable point of contact of the commission or board with the ordinary channels of expressing public sentiment in the district interested. The minimum appropriation mandatory should be sufficient to prevent injury from lack of care of work already begun. A period of minimum care and attention, while a board and the people or their representatives are coming to a new understanding of one another's position, is not necessarily a detriment, provided a reasonable maintenance has been possible in the interim, but without such care the results are ruinous, and work would better not be started than be undertaken with the possibility of such a period of neglect occurring.

In New Jersey, 100 towns and cities have manifested recognition of the worth of trees by creating shade tree commissions. Every community in Massachusetts is safeguarding its trees through an appointed guardian, vested with adequate power. Other states and individual cities are giving increasing attention and appropriations to undertakings of the same nature and are making increasingly liberal expenditures to preserve existing trees and provide new ones to meet recognized needs. In the face of this, it is safe to assume that the practical American spirit will not be slow to insist that, if the municipality spends public funds for planting and protecting its trees, every precaution shall be taken to prevent private agencies or individuals from causing trees damage, which would undo the work and destroy the fruits of the labor and money expended for the conservation of shade and the beautification of the community.

After a proper governing board is provided, the securing of a competent executive is a matter of ordinary business procedure. It is usually desirable that he shall be not only a good executive but also a man with a knowledge of trees and trained in their care, so that he may be a competent adviser of the board as well as its executive.

There has been a most unfortunate tendency to call such a man a "Forester" and the department that employs him a Forestry Department. It is no more appropriate to call a man in such a position a forester than an orchardist. A forester grows trees for the products that may be obtained when the tree is cut down, an orchardist grows them for the fruits that may be harvested during life,while the street tree warden cultivates them for the pleasure and comfort they may give by their very existence. He is more nearly comparable to a landscapist than to either of the other two, but it is a little difficult to determine just the name that should be applied. Arboriculturist would be distinctive and, if adopted, would not long seem formidable. Tree Warden would make a perfectly good name. Other tenable names would be Town Tree Expert, Shade Tree Expert, and City or Town Tree Engineer. The name City Forester has been so much used largely because many graduates in forestry have deserted real forestry for this line of work, but have taken the title with them. It is to be hoped and expected that as the country develops, there will be many cities that will obtain forests that will require real forestry work of some one, in which case the continuation of the present practice of using the term "Forester" for street tree workers may prove very confusing, in not distinguishing real forestry work for a city from purely shade tree work.

CHAPTER XXI.

LEGAL VALUE OF SHADE TREES

SHADE trees have a value which may be translated into dollars and cents. In no other investment may the individual or community achieve manifold profits such as those accruing from tree planting. Along with the dividends in beauty and comfort must be reckoned the cash value of each tree successfully planted and grown.

Strikingly illustrative of the dollar and cent value of shade trees is the definite appraisal placed on them by city authorities. Springfield, Massachusetts, may be cited as an example. Figures show that Springfield has more trees in proportion to population than any other American city, and the municipal government places an appraisal value of $100 on each tree. With a total of 25,000 trees in the city, this gives an appraised value of $2,500,000 to be counted as an added asset of the community. Ann Arbor, Michigan, uses a similar method of computation and reckons the value of its 8000 trees at $800,000. In reaching these figures the city officials followed the formula worked out by Prof. Filibert Roth, one of the foremost of American foresters, who formulated the first basis for shade tree valuation in this country.

In undertaking to set a standard for tree values consideration must be given to many factors. A tree may be of value only for its lumber, or for its shade, or it may be as priceless as Hartford's Charter Oak or the world famous Cambridge Elm. With much depending on location and individual beauty, it is impossible to approach shade tree values without the law of averages.

With a shade tree certain factors are recognized as establishing definite value. For the single specimen these are such characteristics as size, form, type of foliage, longevity, ability to thrive under the local conditions, relative immunity from attack of insects and diseases, vigor of growth, shape, condition with respect to wounds and cavities and ravages of insects and diseases.

Methods of appraisal have become fairly well standardized through experience. As a result of close observation, more than one tree formerly appraised at high value for street purposes has been "marked down" in some localities, because of the local development of increasing troubles affecting them, such as the ravages of the elm beetle or the leopard moth, inability to withstand dry weather, or other conditions.

Location is a factor of much importance in connection with accurate valuation. A tree in the center of a narrow walk may become a nuisance as traffic increases, and for this reason it is not as valuable as one set in a tree-belt. A well-planted avenue gives to each of its trees greater value than an avenue poorly planted, and the tree which is one of a uniform line has greater value than the tree in a line which is irregular. A tree top close to others is of less value than one with plenty of room for its growth. A wide tree-belt gives a tree more value than does a narrow one. A narrow street lessens a tree's value; a wide street enhances it, by giving it the necessary room and by making it possible for water mains, sewers and other underground construction to be placed farther from the tree's roots. The greater the distance of a tree from the curb, the better its chances for satisfactory growth, and therefore, the greater its value, since nearness to the curb involves closer amputation of the roots in the placing of street, curb, and underground construction, with the added danger of injury from horses, street traffic and kindred elements. The existence of numerous water and gas pipes, sewers and conduits is apt to necessitate much digging, and this interferes with tree values. Manufacturing districts, with their atmosphere of smoke and gases, are not good tree locations, and although trees are desirable in such districts, they do not attain the maximum of value against these handicaps. Similar disadvantages accrue to the tree so located as to suffer from sun-scorch or drought.

Character and quality of soil enter largely into the value of the individual shade tree. If a tree is located in favorable soil, its value is much increased. Cultivated soil is better than a lawn, of course, but, next to cultivation, lawn conditions are most favorable to proper growth and development. Abnormal soil conditions and unsuitable soil texture work against a tree and its value. The distance from a residence and its direction in relation thereto, involve a tree's worth in terms of shade and, therefore, play a part in its general appraisal. There is on oiled roads also a possibility of injury to the roots themselves, if the oil filters through the soil.

Shade tree valuation has been approached in various ways by students of the question. The methods followed may be summed up under seven headings, as follows:

(1) **The Arbitrary Method.**—This is an elemental basis for providing penalties for damage to trees, with an effort to establish some relationship between the penalty and the value of the tree itself. In Massachusetts, a state law authorizes the court to place a fine of not less than $5.00, nor more than $150 for injury or destruction of an individual tree. The assessment of actual damage is left to the discretion of the court. The earliest application of this principle in American records was the action of the town meeting of Newark, New Jersey, on February 6,

1676. This action was based on the premise that "The Town, seeing some trees spoiled in the streets by barking or otherwise * * * hath agreed that no green tree within the Town, as marked with N, shall be barked or felled, or any otherwise killed, under the penalty of 10 shillings (for each tree) so killed."

Judicial recognition of this method of computing damages has been given in various suits at law. In Olean, New York, judgment of $150 against a gas company was awarded for four trees destroyed by escaping gas in soil, and this judgment was affirmed by the Court of Appeals. In Kansas City, judgment of $200 was obtained against a telephone company, because the linemen, without consulting the owner, had chopped out the top and center of a tree, causing its death. This decision is of especial interest, for the reason that the verdict involved a single tree only, and that tree a Poplar with a girth of but six inches. One wonders what the verdict would have been in the case of a magnificent Elm or some other really desirable tree. In New York State a verdict of $500 apiece for the destruction of a row of trees was awarded against an offending construction company. In the case of Bathgate vs. North Jersey Street Railway Company, (70 Atlantic Reporter, 132 etc.) it was shown that four of Bathgate's trees had been injured and eventually killed by electric current from the company's wires. Damages were awarded in the sum of $500, and the decision of the lower court was upheld by the Court of Errors and Appeals.

(2) **Replacement Value.**—In the application of this method computation is based on the cost of removing a damaged tree and its subsoil, if the latter has become vitiated, and replacing them with a good tree and good soil. This plan contemplates that the new tree shall be, as nearly as practicable, of the same size as the tree which

had to be removed, and a guaranty is required to protect the owner in the matter of satisfactory growth for the transplanted tree.

(3) **The Roth Method.**—This was evolved by Professor Filibert Roth, Dean of Forestry at the University of Michigan, and is based on profound study and observation covering many years. In his lectures Professor Roth discussed the subject for a generation or more and his calculations attracted such widespread attention that they were published in the *Michigan Manual of Forestry*, Vol. II. As a minimum estimate Professor Roth advocates computing the cost of establishing a tree at $15, plus compound interest at 5 per cent. for the 25 years which must elapse before the tree has achieved its full value by reaching the point of development at which it is really serving its full purpose. After this point has been reached, he figures, the tree "pays its own way" by its usefulness and beauty. The value of the tree, at the end of the 25 year period, therefore, is the $15 investment with added interest in the sum of $36.80, or a total appraisal of $51.80. Professor Roth suggests further that the cost of caring for the tree might also be added.

(4) **The Circumference Measurement Method.**—This allows a valuation of approximately $5.00 per inch of circumference, breast high measurement.

(5) **The Diameter Measurement Method.**—Many landscape architects, foresters and others, who have given serious thought to the subject, advocate the method which bases appraisal on a tree's diameter 4½ feet from the ground. This plan allows $10 per inch of diameter.

(6) **The Square-foot Basal Area Method.**—This plan, devised by Mr. George H. Parker, of Hartford, Connecticut, bases valuation on an allowance of $75 per square foot of basal area, breast high measurement, subject to

specified modifications and deductions for defects of species, trunk, crown and other factors. Under Mr. Parker's supervision 271 trees on Washington Street, in Hartford, of which 216 were more than one foot in diameter, were appraised at $37,500.00 or an average of $138.41 for each tree.

(7) **The Square-inch Basal Area Method.**—In figuring the area of a trunk this method reduces the computation to square inches. It has been used by Mr. W. W. Colton, to estimate the value of the street trees of that suburban beauty spot, Newton, Massachusetts. Taking a maximum of 75 cents for each square inch of basal area, Mr. Colton, as city forester of Newton, placed a valuation of $1,516,602 on 12,577 trees. This was an average of $120.50, and the figures were reached after deductions as indicated in Plan 6.

Newark, New Jersey, has had an annual appraisal of its trees for 10 years. This appraisal is made by the City Shade Tree Commission, at the request of the City Auditor. The inventory carries a valuation of the shade trees upon the public thoroughfares and in the city parks; and the financial department of the city government, very properly, lists the total amount among the assets of the municipality. The Newark figures have been based largely on replacement value, which is manifestly inadequate, as the trees could not be replaced with others of equal size at the valuation of $2,037,532.50 given for 66,308 trees, an average of $30.72.

As a concrete example of results to be attained through application of various plans of appraisal, the Newark trees might be estimated under four methods. Under the Roth plan, the trees would be given a valuation of $3,330,884, equivalent to $50.23 apiece, which is still inadequate. By figuring the basal area, and allowing $1.00 per square inch, instead of 75 cents as allowed under the Colton plan, the valuation averages $88.52 per tree, which reaches gross figures of $5,869,936; from which, in the absence of precise figures for each tree, a deduction of 10 per cent. is made for defects, including faulty location and insect damage, reducing the average per tree to $79.67 and the total for the city to $5,282,966.

Guided by these various methods, a plan may be worked out which may be called the Newark method, attained by a combination of the Parker and Colton systems of computation. In this method let us use as a basis of value the square-inch area of the trunk, 4½ feet from the ground, and allow a maximum valuation of $1.00 to the square inch of basal area. In the case of a tree 18 inches in diameter, with a basal area of 264.7 square inches, the value shown would be $264.70. This, of course, would apply only to a perfect tree with long life prospect, properly placed and in ideal condition. Deductions must be made for (1) variation from desirable species; (2) condition of trunk; (3) condition of top; (4) position with reference to curb and other menacing construction, and probability of continuance of life; (5) environment, scenic value and general desirability. For each of these items a perfect tree would score 20 per cent. Proportionate deduction is made for defects or variations. The sum of the five items, after deductions have been made, represents the percentage of the tree's value in relation to the value of the perfect tree.

To apply this method to trees of various species requires the adoption of a basic value for the several varieties, formulated on a sliding scale which gives the highest mark to species most suitable for a particular community and most permanent as to life, and the lowest mark to those least desirable. As an example of this sliding scale a basic species-value for New Jersey towns and cities has been worked out which gives a species score of 20 to the American Elm, Norway Maple, Red Oak and Pin Oak, and which grades other trees thus: Oriental Plane 18, European Linden 18, American Ash 17, Red Maple 17, Sycamore Maple 17, Sugar Maple 16, Horse Chestnut 16, Tulip 16, Silver Maple 15, and the Carolina Poplar 15.

All things considered, this basis of valuation seems to come nearer than any other to establishing the true value of to-day, and does not conflict radically with Professor Roth's dictum that "from the standpoint of city beautification, and considering the enjoyment people get out of them, good shade trees are worth $100 apiece." This method differs from the Parker and Colton plans in no other particular than in the value of the unit. It must be remembered that the Roth method was promulgated 30 years ago, the Parker method in 1907 and the Colton method in 1916. In keeping with all else, tree planting has increased in cost within recent years, and it is proper to recognize this in formulating a present-day table of values.

Application of various figures to individual trees affords concrete example of the workings of the plans of appraisal. The experience of Newark, New Jersey, may be accepted as typical of what can be accomplished in any municipality and for this reason recourse could be had to the admirable records of that city in working out a table of values for particular specimens. This table would take account of one tree of each of nine species set out in Newark, since the city undertook municipal planting in 1904. These 9 trees could be regarded as thrifty representatives of the city's total planting of 32,000 trees, showing the rate of growth under favorable conditions.

They would be all the more typical for the reason that Newark can point to a great many other trees of each species which have shown the same rate of growth and development. The trees included in the tabulation would be selected specimens in perfect condition, with no deduction necessary for defects. The Newark authorities maintain that of much this perfect condition is due to the excellent tree guards used, and this is a point for the consideration of other cities.

Familiarity with the cost of replacing these trees with others of similar size prompts the statement that the Roth method does not produce figures that would cover replacement value at the present increased costs. On the other hand, the allowance of $10 for each inch of diameter gives figures that appear excessive in some instances, and this is as much to be avoided as undervaluation.

Tree appraisal figures tell their own story. They bear out the truth that tree planting is to be considered as an investment rather than as an expense, and they show that the investment is profitable in dollars and cents.

CHAPTER XXII.

SHADE TREES AND THE LAW

IN law, as well as from the point of view of city beautification, shade trees have come to have recognized value. This legal recognition manifests itself in the writing of laws to protect trees and to encourage their planting. Laws of this nature exist in various parts of the United States as matters of state legislation and in many communities as items of regulation by cities, towns and villages. Wherever such laws have been put into effect their operation has stimulated the planting of shade trees and giving them the care necessary for their best development.

Shade tree legislation in the United States began with the passage of a state law by the Commonwealth of Massachusetts in 1854. Prior to that time, there had been scattered attempts to regulate the growth of trees, but this was the first law to give the trees of an entire state adequate attention. Theretofore, shade trees had been planted by the citizens of communities throughout the country on streets and private property bordering the highways, but little thought had been given to the care and replacement of the trees planted. This part of the undertaking was left for future generations.

The Massachusetts law was an important step in the direction of regulation, but it lacked much that was necessary to make it properly effective. It remained for New Jersey, in 1893, to pass the first really comprehensive state law pertaining to the care of shade trees. In 1899, Massachusetts once more took the question before its legislature, with the result that a law was passed providing that every town must elect a Tree Warden, and defining the duties and powers of the office thus created. In 1907, Pennsylvania enacted a shade tree law to a large extent modelled on the New Jersey law and its amendments. These three states were the pioneers. The successful operation of their laws attracted the attention of people elsewhere, and numerous states now have laws governing the planting and care of shade trees. It is a tribute to the foresight and intelligence with which New Jersey, Massachusetts and Pennsylvania handled the subject that the laws of these three states are still considered the models for such legislation.

The close kinship of the laws of New Jersey and Pennsylvania make it possible to summarize them as one. Under the provisions of these measures, the governing body of any city, town, township, borough or other municipality may vote to accept the provisions of the law for application locally; a shade tree commission is then established and to this commission all matters pertaining to shade tree planting and care are entrusted. Nothing can be done without the approval and authority of the commission. The law covers planting, pruning, spraying and removal, thus giving the local government the complete control so necessary to satisfactory development of a shade tree system.

Additional power of much importance is given through the provision that the shade tree authorities need not wait until property owners decide that their particular street should have shade trees. The commission may proceed on its own initiative. After determining that a street needs trees, it gives public notice of intention to plant. All persons interested are then given a hearing on the subject, and after this, the work proceeds along lines followed in other public improvements. The commission determines the species to be used and the exact location of each tree. After the planting has been completed, the cost is certified to the taxation authorities, to be assessed against the property directly affected. This assessment becomes a lien on the property and the taxes are collected with other taxes. Funds for maintaining the shade tree department are derived from a tax in an amount not to exceed $\frac{1}{10}$ of a mill on the dollar of assessed valuation in the municipality.

The law authorizes the commissions to pass ordinances covering all phases of planting, protection, regulation and control of shade trees. These have proved extremely efficient in protecting trees from damage by electric light, telephone and telegraph companies and other public utilities and in preventing wilful or malicious injury by individuals. Shade trees need protection and it is only through the operation of laws, with proper penalties, that this protection can be given.

The shade tree laws of Massachusetts, as codified and revised in 1915, make it compulsory for every town to elect a tree warden, to have charge of the planting and care of shade trees. His powers are very definite and he is responsible for proper shade tree development in his community. In cities, there are no tree wardens, but the duties and responsibilities created under the shade tree law are imposed on such city officials as have charge of the care of trees. In addition to outlining the duties and powers of the town and city authorities, the law also provides that the tree warden of a town or the proper officials of a city may pass special ordinances and regulations governing shade trees, adapting these regulations to local conditions, but without conflict with the state law.

In the protection of trees along public thoroughfares the Massachusetts law has proved itself very efficient, but it has not accomplished as much as the laws of some other states along the line of promoting the planting of trees. The weak point in this respect is that the state law provides no funds for carrying out the provisions of the act. The matter of raising funds by taxation is left to local option, which has crippled the operation of the law in many communities. Some municipalities have officers empowered to enforce the shade tree laws, but are not sufficiently aroused to the importance of the question to appropriate sufficient funds for the maintenance of the work. The result is a failure to realize the best possibilities in shade tree development. Another criticism of the Massachusetts law is that it is a mistake to have tree wardens elected. This subjects the office to political influences, which are undesirable and which could be avoided by having the office appointive, subject to approval by a State officer trained in tree culture and connected with the Department of Conservation.

Perhaps the most important feature of the Massachusetts law is its requirement that every town in the state must have a tree warden. This provision is tangible recognition of the value of shade trees to a community, and placing it on the statute books has resulted in arousing new interest in the subject of trees and tree planting. The powers conferred on the municipal authorities are necessarily broad, but even in this respect attention is given to preventing an unsatisfactory use of these powers in certain important particulars. In the original law the final decision for the removal of public trees rested with the tree warden. Under the revised law recognition is given the right of the private citizen and property owner to have a voice in the disposal of such trees. To this end the warden or other official is required to hold a public hearing, duly advertised, before any public tree may be removed. Even after this hearing there is provision for appeal to the highest officer of the town or city, followed by an appeal to the courts if the objector considers it of enough importance. This feature has been found well worth while.

Study of the various laws and observation of their workings suggest that an ideal arrangement would be a combination of the best features of the laws of New Jersey, Pennsylvania and Massachusetts. This could be achieved through an enactment requiring that every city or town appoint a shade tree commission, and that this body employ a trained expert to give attention to the interests of the trees. Provision should be made, of course, for revenue for carrying on the work. The plan might well be extended to provide that towns too small for an arrangement of this kind might combine with other towns and organize a joint council to handle shade tree matters for all of the towns involved. One expert could thus serve several towns with slight cost to each of them. Division of the expense would be easily determined on a basis of property valuation, population and area. A plan of this kind has large possibilities in the way of inviting interest in shade trees in communities which might otherwise consider themselves too small to undertake the proper handling of the question.

A good state law should have the support of good local laws in the communities throughout the state. Important cities in the three states named have followed up the passage of general laws by the passage of local ordinances and special laws. Some of these municipal governments have been working under such legislation for a number of years, and in many of them the results have been highly satisfactory. Examples of carefully framed and extremely practical regulations are the ordinances in effect in Newark, New Jersey; Philadelphia and Johnstown, Pennsylvania; and Boston, Massachusetts. Several other Massachusetts town and cities have admirable laws, as Newton, Worcester and Fitchburg. The village of Brookline has what is perhaps the best organized shade tree department in Massachusetts and its success has been such as to make it well worth copying.

It is necessary, of course, in formulating local legislation, to have due regard to the local conditions. The regulations which would be wise and necessary in one community might not fit some other place. There are many general requirements, however, which will apply anywhere and these must not be neglected. Among the latter are the regulations for shade tree protection from injury or damage. In any town or city it should be made illegal and subject to a fine, for any person to affix or attach anything to any tree or to the guard or stakes protecting a tree. This is intended primarily to bar the nailing of advertising signs to trees or the fastening of wires or other things to them. Similar provision should be made to prevent the cutting, painting or marking of trees for any purpose other than protection of the trees themselves, and then only under written permit and directions from the authorities. It is also necessary to forbid cutting, destroying or in any way injuring trees; and since climbing causes injury, this should be expressly forbidden.

Safeguards should also be provided to prevent any person from placing about the base of a tree such harmful substances as oil, salt water, liquid dye or other matter injurious to tree life, including waste from ice-cream freezers. This provision should be so devised as to prevent the discharge of gas in any way that will harm the root system of trees, or any other parts. Penalties should be provided for any person who permits a horse or other animal to injure a tree by biting or otherwise. Stringent legislation is also necessary to make it unlawful for any person to hamper or interfere with the work of an authorized employee of the shade tree department in the pursuit of his duties in caring for and preserving trees.

With increasing interest in municipal shade tree activities there will necessarily be many points on which local experience will be lacking. The shade tree authorities will find it well to profit by the experience of other communities, for in this way they will learn many of the things necessary. One of the foremost of these is that no man should accept a position of authority without a full sense of his obligation to the community. He cannot afford to become lax in his knowledge of shade tree laws or the correct interpretation of them, and when he is in doubt on any point he should seek the counsel of his municipal legal adviser, or the State Forestry authorities. The tree official will find that it is undesirable to antagonize property owners unnecessarily. Even in carrying out a requirement that causes objection, tact and discretion will serve better than arbitrary methods.

An important point in popularizing a shade tree department is that the official in charge make friends with the property owners. One of the surest ways to bring this about is to consult the owners of adjacent property when contemplating important pruning or other work on the trees along any street. To go at work of this kind without conference frequently causes trouble. Experience shows that if the property owners are consulted beforehand, they will almost invariably agree to the plan under consideration.

Some of the other important points to be regarded by the successful tree warden or supervisor are that irresponsible tree peddlers or self-styled repair experts must be discouraged, that the rights of the trees come first, and that public service corporations must not be allowed to damage trees through the stringing of wires, the laying of pipes or in any other way.

Some states have tried to curb incompetent tree workers by a system of licenses based on examination. This would be a help where there is not a thorough system of tree supervision as there is in Massachusetts and would be a help to private individuals wishing to have work done on their own grounds.

When appropriations are insufficient to meet reasonable demands the issuing of permits to responsible and competent firms or adjoining property owners for planting or pruning puts the work on a wrong basis, but is better than no control.

ARBOR DAY IS OBSERVED ON FOLLOWING DATES.

Alabama	February 22.
Arizona	In five northern counties, Friday following first day of April. Elsewhere, Friday following first day of February.
Arkansas	First Saturday in March.
California	March 7.
Colorado	Third Friday in April.
Connecticut	In early May, by proclamation of the governor.
Delaware	In April, by proclamation of the governor.
Florida	First Friday in February.
Georgia	First Friday in December.
Hawaii	First Friday in November.
Idaho	Various dates in April selected by county superintendents.
Illinois	Proclamation of the governor.
Indiana	Third Friday in April.
Iowa	Proclamation by the governor.
Kansas	Option of the governor.
Kentucky	In the fall by proclamation of the governor.
Louisiana	Second Friday in January, by resolution of State board of education.
Maine	Option of the governor.
Maryland	Second Friday in April. Proclamation of the governor.
Massachusetts	Last Saturday in April.
Michigan	Proclamation of the governor. Usually last Friday in April.
Minnesota	Proclamation of the governor. Usually latter part of April.
Missouri	First Friday after first Tuesday in April.
Montana	Second Tuesday in May.
Nebraska	April 22 (birthday of J. Sterling Morton).
Nevada	Proclamation of the governor.
New Hampshire	Proclamation of the governor.
New Jersey	Second Friday in April.
New Mexico	Second Friday in March. Proclamation of the governor.
New York	Friday following 1st of May.
North Carolina	Friday after November 1.
North Dakota	Option of the governor.
Ohio	Proclamation of the governor. About the middle of April.
Oklahoma	Friday following the second Monday in March.
Oregon	Second Friday in April.
Pennsylvania	Proclamation of the governor.
Porto Rico	Last Friday in November.
Rhode Island	Second Friday in May.
South Carolina	Third Friday in November.
South Dakota	No law, but generally observed in April throughout the State.
Tennessee	Appointed by county superintendents, in November.
Texas	February 22.
Utah	April 15, by statute.
Vermont	Option of the governor. Usually first Friday in May.
Virginia	Proclamation of the governor. In the spring.
West Virginia	Usually observed on the second Friday in April.
Wisconsin	Proclamation of the governor. Usually the first Friday in May.
Washington	Proclamation of the governor. Usually the first Friday in May.
Wyoming	Proclamation of the governor. Usually the first Friday in May.

The "Father of Arbor Day" was J. Sterling Morton, who, at a meeting of the State Board of Agriculture in Lincoln, Neb., on Jan. 4, 1872, introduced a resolution setting aside April 10 for tree planting. Kansas and Tennessee took up the lead in 1875 and in 1882 North Dakota and Ohio followed. Other states then adopted the idea. In 1885 the Nebraska legislature passed an act changing the date to April 22, Mr. Morton's birthday, and making it a legal holiday in the State.

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