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[Illustration: Frontispiece.

"Come forth into the light of things,

Let Nature be your Teacher."

--WORDSWORTH.]

STUDIES OF TREES

BY

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FIRST EDITION

FIRST THOUSAND

1914

PREFACE

In presenting this volume, the author is aware that there are several

excellent books, dealing with one phase or another of tree life, already

before the public. It is believed, however, that there is still need for

an all-round book, adapted to the beginner, which gives in a brief and

not too technical way the most important facts concerning the

identification, structure and uses of our more common trees, and which

considers their habits, enemies and care both when growing alone and

when growing in groups or forests.

In the chapters on the identification of trees, the aim has been to

bring before the student only such characters and facts as shall help

him to distinguish the tree readily during all seasons of the year.

Special stress is laid in each case on the most striking peculiarities.

Possible confusion with other trees of similar appearance is prevented

as far as possible through comparisons with trees of like form or habit.

Only such information is given concerning the structure and requirements

of trees as will enable the reader better to understand the subsequent

chapters. In the second half of the book, practical application is made

of the student's general knowledge thus acquired, and he is acquainted

with the fundamental principles of planting, care, forestry, wood

identification and nature study.

The author recognizes the vastness of the field he is attempting to

cover and the impossibility of even touching, in a small hand-book of

this character, on every phase of tree study. He presumes no further;

yet he hopes that by adhering to what is salient and by eliminating the

less important, though possibly interesting, facts, he is able to offer

a general and elementary \_résumé\_ of the whole subject of value to

students, private owners, farmers and teachers.

In the preparation of Chapter VIII on "Our Common Woods: Their

Identification, Properties and Uses," considerable aid has been received

from Prof. Samuel J. Record, author of "Economic Woods of the United

States." Acknowledgment is also due to the U.S. Forest Service for the

photographs used in Figs. 18, 122 to 138 inclusive and 142; to Dr.

George B. Sudworth, Dendrologist of the U.S. Forest Service, for

checking up the nomenclature in the lists of trees under Chapter V; to

Dr. E.P. Felt, Entomologist of the State of New York, for suggestions in

the preparation of the section of the book relating to insects; to Dr.

W.A. Murrill, Assistant Director of the New York Botanical Gardens, for

Fig. 108; and to Mr. Hermann W. Merkel, Chief Forester of the New York

Zoological Park, for Figs. 26, 59 and 60.

J.J. LEVISON.

BROOKLYN, N.Y.

June, 1914.

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INTRODUCTION

A good many popular books on trees have been published in the United

States in recent years. The continually increasing demand for books of

this character indicates the growing public interest not only in the

trees that we pass in our daily walks, but also in the forest considered

as a community of trees, because of its aesthetic and protective value

and its usefulness as a source of important economic products.

As a nation, we are thinking more about trees and woods than we were

wont to do in the years gone by. We are growing to love the trees and

forests as we turn more and more to outdoor life for recreation and

sport. In our ramblings along shady streets, through grassy parks, over

wooded valleys, and in mountain wildernesses we find that much more than

formerly we are asking ourselves what are these trees, what are the

leaf, flower, twig, wood and habit characteristics which distinguish

them from other trees; how large do they grow; under what conditions of

soil and climate do they thrive best; what are their enemies and how can

they be overcome; what is their value for wood and other useful

products; what is their protective value; are they useful for planting

along streets and in parks and in regenerating forests; how can the

trees of our streets and lawns be preserved and repaired as they begin

to fail from old age or other causes? All these questions and many more

relating to the important native and exotic trees commonly found in the

states east of the Great Lakes and north of Maryland Mr. Levison has

briefly answered in this book. The author's training as a forester and

his experience as a professional arboriculturist has peculiarly fitted

him to speak in an authoritative and interesting way about trees and

woods.

The value of this book is not in new knowledge, but in the simple

statement of the most important facts relating to some of our common

trees, individually and collectively considered. A knowledge of trees

and forests adds vastly to the pleasures of outdoor life. The more we

study trees and the more intimate our knowledge of the forest as a unit

of vegetation in which each tree, each flower, each animal and insect

has its part to play in the complete structure, the greater will be our

admiration of the wonderful beauty and variety exhibited in the trees

and woods about us.

J.W. TOUMEY,

Director, Yale University Forest School.

NEW HAVEN, CONN.,

June, 1914.

STUDIES OF TREES

CHAPTER I

HOW TO IDENTIFY TREES

There are many ways in which the problem of identifying trees may be

approached. The majority attempt to recognize trees by their leaf

characters. Leaf characters, however, do not differentiate the trees

during the other half of the year when they are bare. In this chapter

the characterizations are based, as far as possible, on peculiarities

that are evident all year round. In almost every tree there is some one

trait that marks its individuality and separates it, at a glance, from

all other trees. It may be the general form of the tree, its mode of

branching, bark, bud or fruit. It may be some variation in color, or, in

case of the evergreen trees, it may be the number and position of the

needles or leaves. The species included in the following pages have thus

been arranged in groups based on these permanent characters. The

individual species are further described by a distinguishing paragraph

in which the main character of the tree is emphasized in heavy type.

The last paragraph under each species is also important because it

classifies all related species and distinguishes those that are liable

to be confused with the particular tree under consideration.

GROUP I. THE PINES

[Illustration: FIG. 1.--Twig of the Austrian Pine.]

How to tell them from other trees: The pines belong to the \_coniferous\_

class of trees; that is, trees which bear cones. The pines may be

told from the other coniferous trees by their leaves, which are in

the form of \_needles\_ two inches or more in length. These needles

keep green throughout the entire year. This is characteristic of all

coniferous trees, except the larch and cypress, which shed their

leaves in winter.

[Illustration: FIG. 2.--Twig of the White Pine.]

The pines are widely distributed throughout the Northern Hemisphere,

and include about 80 distinct species with over 600 varieties. The

species enumerated here are especially common in the eastern part of

the United states, growing either native in the forest or under

cultivation in the parks. The pines form a very important class of

timber trees, and produce beautiful effects when planted in groups

in the parks.

How to tell them from each other: The pine needles are arranged in

\_clusters\_; see Fig. 1. Each species has a certain characteristic

number of needles to the cluster and this fact generally provides

the simplest and most direct way of distinguishing the different

pines.

In the white pine there are \_five\_ needles to each cluster, in the

pitch pine \_three\_, and in the Scotch pine \_two\_. The Austrian pine

also has two needles to the cluster, but the difference in size and

character of the needles will distinguish this species from the

Scotch pine.

THE WHITE PINE (\_Pinus strobus\_)

Distinguishing characters: The tree can be told at close range by the

number of needles to each cluster, Fig. 2. There are \*five\* needles

to each cluster of the white pine. They are bluish green, slender,

and about four inches in length.

At a distance the tree may be told by the \*right angles\* which the

branches form with the main trunk, Fig. 3. No other pine shows this

character.

Form and size: A tall tree, the stateliest of the evergreens.

Range: Eastern North America.

Soil and location: Prefers a deep, sandy soil, but will grow in almost

any soil.

Enemies: Sucking insects forming white downy patches on the bark and

twigs, the \_white pine weevil\_, a boring insect, and the \_white pine

blister rust\_, a fungus, are among its principal enemies.

[Illustration: FIG. 3.--The White Pine.]

Value for planting: Aside from its value as an ornamental tree, the

white pine is an excellent tree to plant on abandoned farms and for

woodlands and windbreaks throughout the New England States, New

York, Pennsylvania, and the Lake States.

Commercial value: The wood is easily worked, light, durable, and will

not warp. It is used for naval construction, lumber, shingles,

laths, interior finish, wooden ware, etc.

Other characters: The \_fruit\_ is a cone, four to six inches long.

Comparisons: The tree is apt to be confused with the \_Bhotan pine\_

(\_Pinus excelsa\_), which is commonly grown as an ornamental tree.

The Bhotan pine, however, has needles much longer and more drooping

in appearance.

THE PITCH PINE (\_Pinus rigida\_)

Distinguishing characters: Here there are \*three\* needles to each

cluster, Fig. 4. They are dark, yellowish-green needles about four

inches long. The rough-looking \_branches\_ of the tree may be seen

\_studded with cones\_ throughout the year, and \_clusters of leaves\_

may be seen \_sprouting directly from the trunk\_ of the tree; see

Fig. 5. The last two are very characteristic and will distinguish

the tree at a glance.

Form and size: It is a low tree of uncertain habit and extremely rough

looking at every stage of its life. It is constantly full of dead

branches and old cones which persist on the tree throughout the

year.

Range: Eastern United States.

Soil and location: Grows in the poorest and sandiest soils where few

other trees will grow. In New Jersey and on Long Island where it is

native, it proves so hardy and persistent that it often forms pure

stands excluding other trees.

[Illustration: FIG. 4.--Twig of the Pitch Pine.]

Enemies: None of importance.

Value for planting: Well adapted for the sea coast and other exposed

places. It is of extremely uncertain habit and is subject to the

loss of the lower limbs. It frequently presents a certain

picturesqueness of outline, but it could not be used as a specimen

tree on the lawn.

[Illustration: FIG. 5.--The Pitch Pine.]

Commercial value: The wood is coarse grained and is used for rough

lumber, fuel, and charcoal.

Other characters: The \_fruit\_ is a cone one to three

inches long, persistent on the tree for several years.

THE SCOTCH PINE (\_Pinus sylvestris\_)

Distinguishing characters: There are \*two\* needles to each cluster, and

these are \_short\_ compared with those of the white pine, and

\_slightly twisted\_; see Fig. 6. The \_bark\_, especially along the

upper portion of the trunk, \_is reddish\_ in color.

Form and size: A medium-sized tree with a short crown.

Range: Europe, Asia, and eastern United States.

Soil and location: Will do best on a deep, rich, sandy soil, but will

also grow on a dry, porous soil.

Enemies: In Europe the Scotch pine has several insect enemies, but in

America it appears to be free from injury.

Value for planting: Suitable for windbreaks and woodland planting. Many

excellent specimens may also be found in our parks.

Commercial value: In the United States, the wood is chiefly used for

fuel, though slightly used for barrels, boxes, and carpentry. In

Europe, the Scotch pine is an important timber tree.

Comparisons: The Scotch pine is apt to be confused with the \_Austrian

pine\_ (\_Pinus austriaca\_), because they both have two needles to

each cluster. The needles of the Austrian pine, however, are much

longer, coarser, straighter, and darker than those of the Scotch

pine; Fig. 1. The form of the Austrian pine, too, is more

symmetrical and compact.

[Illustration: FIG. 6.--Twig of the Scotch Pine.]

The \_red pine\_ (\_Pinus resinosa\_) is another tree that has two

needles to each cluster, but these are much longer than those of the

Scotch pine (five to six inches) and are straighter. The bark, which

is reddish in color, also differentiates the red pine from the

Austrian pine. The position of the cones on the red pine, which

point outward and downward at maturity, will also help to

distinguish this tree from the Scotch and the Austrian varieties.

GROUP II. THE SPRUCE AND HEMLOCK

How to tell them from other trees: The spruce and hemlock belong to the

evergreen class and may be told from the other trees by their

\_leaves\_. The characteristic leaves of the spruce are shown in Fig.

9; those of the hemlock in Fig. 10. These are much shorter than the

needles of the pines but are longer than the leaves of the red cedar

or arbor vitae. They are neither arranged in clusters like those of

the larch, nor in feathery layers like those of the cypress. They

adhere to the tree throughout the year, while the leaves of the

larch and cypress shed in the fall.

The spruces are pyramidal-shaped trees, with tall and tapering

trunks, thickly covered with branches, forming a compact crown. They

are widely distributed throughout the cold and temperate regions of

the northern hemisphere, where they often form thick forests over

extended areas.

There are eighteen recognized species of spruce. The Norway spruce

has been chosen as a type for this group because it is so commonly

planted in the northeastern part of the United States.

The hemlock is represented by seven species, confined to temperate

North America, Japan, and Central and Western China.

[Illustration: FIG. 7.--The Norway Spruce.]

How to tell them from each other: The needles and branches of the spruce

are \_coarse\_; those of the hemlock are \_flat and graceful\_. The

individual leaves of the spruce, Fig. 9, are four-sided and green or

blue on the under side, while those of the hemlock, Fig. 10, are

flat and are \_marked by two white lines\_ on the under side.

THE NORWAY SPRUCE (\_Picea excelsa\_)

Distinguishing characters: The characteristic appearance of the

full-grown tree is due to the \*drooping branchlets\* carried on \*main

branches which bend upward\* (Fig. 7).

Leaf: The leaves are dark green in color and are \_arranged spirally\_,

thus making the twigs coarser to the touch than the twigs of the

hemlock or fir. In cross-section, the individual leaflet is

quadrilateral, while that of the pine is triangular.

Form and size: A large tree with a straight, undivided trunk and a

well-shaped, conical crown (Fig. 7).

Range: Northern Europe, Asia, northern North America.

Soil and location: Grows in cool, moist situations.

Enemies: The foliage of the spruce is sometimes affected by \_red

spider\_, but is apt to be more seriously injured by drought, wind,

and late frosts.

Value for planting: Commonly planted as an ornamental tree and for

hedges. It does well for this purpose in a cool northern climate,

but in the vicinity of New York City and further south it does not

do as well, losing its lower branches at an early age, and becoming

generally scraggly in appearance.

[Illustration: FIG. 8.--A Group of Hemlock.]

Commercial value: The wood is light and soft and is used for

construction timber, paper pulp, and fuel.

Other characters: The \_fruit\_ is a large slender cone, four to seven

inches long.

Comparisons: The \_white spruce\_ (\_Picea canadensis\_) may be told from

the Norway spruce by the whitish color on the under side of its

leaves and the unpleasant, pungent odor emitted from the needles

when bruised. The cones of the white spruce, about two inches long,

are shorter than these of the Norway spruce, but are longer than

those of the black spruce.

It is essentially a northern tree growing in all sorts of locations

along the streams and on rocky mountain slopes as far north as the

Arctic Sea and Alaska. It often appears as an ornamental tree as far

south as New York and Pennsylvania.

The \_black spruce\_ (\_Picea mariana\_) may be told from the other

spruces by its small cone, which is usually only about one inch in

length. In New England it seldom grows to as large a size as the

other spruce trees.

It covers large areas in various parts of northern North America and

grows to its largest size in Manitoba. The black spruce has little

value as an ornamental tree.

The \_Colorado blue spruce\_ (\_Picea parryana\_ or \_Picea pungens\_)

which is commonly used as an ornamental tree on lawns and in parks,

can be told from the other spruces by its pale-blue or sage-green

color and its sharp-pointed, coarse-feeling twigs. Its small size

and sharp-pointed conical form are also characteristic.

It grows to a large size in Colorado and the Middle West. In the

Eastern States and in northern Europe where it is planted as an

ornamental tree, it is usually much smaller.

[Illustration: FIG. 9.--Twig of the Norway Spruce.]

HEMLOCK (\_Tsuga canadensis\_)

Distinguishing characters: Its leaves are arranged in \*flat layers\*,

giving a flat, horizontal and graceful appearance to the whole

branch (Fig. 8). The individual leaves are dark green above, lighter

colored below, and are \*marked by two white lines on the under side\*

(Fig. 10).

The leaves are arranged on little stalks, a characteristic that does

not appear in the other evergreen trees.

Form and size: A large tree with a broad-based pyramidal head, and a

trunk conspicuously tapering toward the apex. The branches extend

almost to the ground.

Range: The hemlock is a northern tree, growing in Canada and the United

States.

Soil and location: Grows on all sorts of soils, in the deepest woods as

well as on high mountain slopes.

Enemies: None of importance.

Value for planting: The hemlock makes an excellent hedge because it

retains its lowest branches and will stand shearing. In this respect

it is preferable to the spruce. It makes a fair tree for the lawn

and is especially desirable for underplanting in woodlands, where

the shade from the surrounding trees is heavy. In this respect it is

like the beech.

Commercial value: The wood is soft, brittle, and coarse-grained, and is

therefore used mainly for coarse lumber. Its bark is so rich in

tannin that it forms one of the chief commercial products of the

tree.

Other characters: The \_fruit\_ is a small cone about ¾ of an inch long,

which generally hangs on the tree all winter.

[Illustration: FIG. 10.--Twig of the Hemlock.]

GROUP III. THE RED CEDAR AND ARBOR-VITAE

How to tell them from other trees: The red cedar (juniper) and

arbor-vitae may be told from other trees by their \_leaves\_, which

remain on the tree and keep green throughout the entire year. These

leaves differ from those of the other evergreens in being much

shorter and of a distinctive shape as shown in Figs. 12 and 13. The

trees themselves are much smaller than the other evergreens

enumerated in this book. Altogether, there are thirty-five species

of juniper recognized and four of arbor-vitae. The junipers are

widely distributed over the northern hemisphere, from the Arctic

region down to Mexico in the New World, and in northern Africa,

China, and Japan in the Old World. The arbor-vitae is found in

northeastern and northwestern America, China, and Japan. The species

mentioned here are those commonly found in America.

How to tell them from each other: The \_twigs\_ of the arbor-vitae are

\_flat and fan-like\_ as in Fig. 13; the twigs of the red cedar are

\_needle-shaped or scale-like\_ as in Fig. 12. The foliage of the

arbor-vitae is of a lighter color than that of the red cedar, which

is sombre green. The arbor-vitae will generally be found growing in

moist locations, while the red cedar will grow in dry places as

well. The arbor-vitae generally retains its lower branches in open

places, while the branches of the red cedar start at some distance

from the ground.

RED CEDAR (\_Juniperus virginiana\_)

[Illustration: FIG. 11.--The Red Cedar.]

Distinguishing characters: The tree can best be told at a glance by its

general form, size and leaves. It is a medium-sized tree with a

\_symmetrical, cone-like form\_, Fig. 11, which, however, broadens

out somewhat when the tree grows old. Its color throughout the year

is dull green with a tinge of brownish red, and its bark peels in

thin strips.

[Illustration:

FIG. 12(a).--Twig of Young Cedar.

FIG. 12(b).--Twig of Cedar (Older Tree).]

Leaf: In young trees the leaf is needle-shaped, pointed, and marked by a

white line on its under side, Fig. 12(a). In older trees it is

scale-like, Fig. 12(b), and the white line on its under side is

indistinct.

Range: Widely distributed over nearly all of eastern and central North

America.

Soil and location: Grows on poor, gravelly soils as well as in rich

bottom lands.

Enemies: The "\_cedar apple\_," commonly found on this tree, represents a

stage of the apple rust, and for that reason it is not desirable to

plant such trees near orchards. Its wood is also sometimes attacked

by small \_boring insects\_.

Value for planting: Its characteristic slender form gives the red cedar

an important place as an ornamental tree, but its chief value lies

in its commercial use.

Commercial value: The wood is durable, light, smooth and fragrant, and

is therefore used for making lead-pencils, cabinets, boxes,

moth-proof chests, shingles, posts, and telegraph poles.

Other characters: The \_fruit\_ is small, round and berry-like, about the

size of a pea, of dark blue color, and carries from one to four bony

seeds.

Other common names: The red cedar is also often called \_juniper\_ and

\_red juniper\_.

Comparisons: The red cedar is apt to be confused with the \_low juniper\_

(\_Juniperus communis\_) which grows in open fields all over the

world. The latter, however, is generally of a low form with a flat

top. Its leaves are pointed and prickly, never scale-like, and they

are whitish above and green below. Its bark shreds and its fruit is

a small round berry of agreeable aromatic odor.

ARBOR-VITAE; NORTHERN WHITE CEDAR (\_Thuja occidentalis\_)

Distinguishing characters: The \*branchlets\* are extremely \*flat and

fan-like\*, Fig. 13, and have an agreeable \_aromatic odor\_ when

bruised. The tree is an evergreen with a \_narrow conical form\_.

[Illustration: FIG. 13.--Twig of the Arbor-vitae.]

Leaf: Leaves of two kinds, one scale-like and flat, the other keeled,

all tightly pressed to the twig (see Fig. 13).

Form and size: A close, conical head with dense foliage near the base.

Usually a small tree, but in some parts of the northeastern States

it grows to medium size with a diameter of two feet.

Range: Northern part of North America.

Soil and location: Inhabits low, swampy lands; in the State of Maine

often forming thick forests.

Enemies: Very seldom affected by insects.

Value for planting: Is hardy in New England, where it is especially used

for hedges. It is also frequently used as a specimen tree on the

lawn.

Commercial value: The wood is durable for posts, ties, and shingles. The

bark contains considerable tannin and the juices from the tree have

a medicinal value.

Other characters: The \_fruit\_ is a cone about ½ inch long.

Other common names: Arbor-vitae is sometimes called \_white cedar\_ and

\_cedar\_.

Comparisons: The arbor-vitae is apt to be confused with the true \_white

cedar\_ (\_Chamaecyparis thyoides\_) but the leaves of the latter are

sharp-pointed and not flattened or fan-shaped.

CHAPTER II

HOW TO IDENTIFY TREES--(Continued)

GROUP IV. THE LARCH AND CYPRESS

How to tell them from other trees: In summer the larch and cypress may

easily be told from other trees by their \_leaves\_. These are

needle-shaped and arranged in clusters with numerous leaves to each

cluster in the case of the larch, and feathery and flat in the case

of the cypress. In winter, when their leaves have dropped off, the

trees can be told by their cones, which adhere to the branches.

There are nine recognized species of larch and two of bald cypress.

The larch is characteristically a northern tree, growing in the

northern and mountainous regions of the northern hemisphere from the

Arctic circle to Pennsylvania in the New World, and in Central

Europe, Asia, and Japan in the Old World. It forms large forests in

the Alps of Switzerland and France.

The European larch and not the American is the principal species

considered here, because it is being planted extensively in this

country and in most respects is preferable to the American species.

The bald cypress is a southern tree of ancient origin, the

well-known cypress of Montezuma in the gardens of Chepultepec having

been a species of Taxodium. The tree is now confined to the swamps

and river banks of the South Atlantic and Gulf States, where it

often forms extensive forests to the exclusion of all other trees.

In those regions along the river swamps, the trees are often

submerged for several months of the year.

How to tell them from each other: In summer the larch may be told from

the cypress by its leaves (compare Figs. 14 and 16). In winter the

two can be distinguished by their characteristic forms. The larch is

a broader tree as compared with the cypress and its form is more

conical. The cypress is more slender and it is taller. The two have

been grouped together in this study because they are both coniferous

trees and, unlike the other Conifers, are both deciduous, their

leaves falling in October.

[Illustration: FIG. 14.--Twig of the Larch in Summer.]

THE EUROPEAN LARCH (\_Larix europaea\_)

Distinguishing characters: Its leaves, which are needle-shaped and about

an inch long, are borne in \*clusters\* close to the twig, Fig. 14.

There are many leaves to each cluster. This characteristic together

with the \*spire-like\* form of the crown will distinguish the tree at

a glance.

Leaf: The leaves are of a light-green color but become darker in the

spring and in October turn yellow and drop off. The cypress, which

is described below, is another cone-bearing tree which sheds its

leaves in winter.

[Illustration: FIG. 15.--Twig of the Larch in Winter.]

Form and size: A medium-sized tree with a conical head and a straight

and tapering trunk. (See Fig. 90.)

Range: Central Europe and eastern and central United States.

Soil and location: Requires a deep, fresh, well-drained soil and needs

plenty of light. It flourishes in places where our native species

would die. Grows very rapidly.

Enemies: The larch is subject to the attacks of a \_sawfly\_, which has

killed many trees of the American species. A \_fungus\_ (\_Trametes

pini\_) which causes the tree to break down with ease is another of

its enemies.

Value for planting: A well-formed tree for the lawn. It is also useful

for group planting in the forest.

Commercial value: Because its wood is strong and durable the larch is

valuable for poles, posts, railroad ties, and in shipbuilding.

[Illustration: FIG. 16.--Twig of the Cypress.]

Other characters: The \_fruit\_ is a small cone about one inch long,

adhering to the tree throughout the winter.

[Illustration: FIG. 17.--The Bald Cypress.]

Comparisons: The tree is apt to be confused with the \_American larch\_,

also known as \_tamarack\_ and \_hackmatack\_, but differs from it in

having longer leaves, cones twice as large and more abundant and

branches which are more pendulous.

The larch differs from the bald cypress in the broader form of its

crown and the cluster-like arrangement of its leaves. The twigs of

the bald cypress are flat and feathery. The larch and bald cypress

have the common characteristics of both shedding their leaves in

winter and preferring to grow in moist or swampy soils. The larch,

especially the native species, forms the well-known tamarack swamps

of the north. The bald cypress grows in a similar way in groups in

the southern swamps.

BALD CYPRESS (\_Taxodium distichum\_)

Distinguishing characters: The \*feathery character\* of the \*twigs\*, Fig.

16, and the \*spire-like form\* of the tree, Fig. 17, which is taller

and more slender than the larch, will distinguish this species from

others.

[Illustration: FIG. 18.--Cypress "Knees."]

Leaf: The leaves drop off in October, though the tree is of the

cone-bearing kind. In this respect it is like the larch.

Form and size: Tall and pyramidal.

Range: The cypress is a southern tree, but is found under cultivation in

parks and on lawns in northern United States.

Soil and location: Grows naturally in swamps, but will also do well in

ordinary well-drained, good soil. In its natural habitat it sends

out special roots above water. These are known as "\_cypress knees\_"

(Fig. 18) and serve to provide air to the submerged roots of the

tree.

Enemies: None of importance.

Value for planting: An excellent tree for park and lawn planting.

Commercial value: The wood is light, soft, and easily worked. It is used

for general construction, interior finish, railroad ties, posts and

cooperage.

Other characters: The \_bark\_ is thin and scaly. The \_fruit\_ is a cone

about an inch in diameter. The general \_color\_ of the tree is a

dull, deep green which, however, turns orange brown in the fall.

Comparisons: The cypress and the larch are apt to be confused,

especially in the winter, when the leaves of both have dropped. The

cypress is more slender and is taller in form. The leaves of each

are very different, as will be seen from the accompanying

illustrations.

GROUP V. THE HORSECHESTNUT, ASH AND MAPLE

How to tell them from other trees: The horsechestnut, ash, and maple

have their branches and buds arranged on their stems \*opposite\* each

other as shown in Figs. 20, 22 and 24. In other trees, this

arrangement is \*alternate\*, as shown in Fig. 19.

How to tell these three from each other. If the bud is large--an inch to

an inch and a half long--dark brown, and \_sticky\_, it is a

\_horsechestnut\_.

If the bud is \_not sticky\_, much smaller, and \_rusty brown to black\_

in color, and the ultimate twigs, of an olive green color, are

\_flattened\_ at points below the buds, it is an \_ash\_.

[Illustration: FIG. 19.--Alternate Branching (Beech.)]

If it is not a horsechestnut nor an ash and its small buds have

many scales covering them, the specimen with branches and buds

opposite must then be a \_maple\_. Each of the maples has one

character which distinguishes it from all the other maples. For the

sugar maple, this distinguishing character is the \_sharp point of

the bud\_. For the silver maple it is the \_bend in the terminal

twig\_. For the red maple it is the \_smooth gray-colored bark\_. For

the Norway maple it is the \_reddish brown color of the full, round

bud\_, and for the box elder it is the \_greenish color of its

terminal twig\_.

The form of the tree and the leaves are also characteristic in each

of the maples, but for the beginner who does not wish to be burdened

with too many of these facts at one time, those just enumerated

will be found most certain and most easily followed.

[Illustration: FIG. 20.--Opposite Branching (Horsechestnut.)]

THE HORSECHESTNUT

(\_Aesculus hippocastanum\_)

Distinguishing characters: The \*sticky\* nature of the \*terminal bud\* and

its \*large size\* (about an inch long). The bud is dark brown in

color. See Fig. 20.

Leaf: Five to seven leaflets, usually seven. Fig. 21.

Form and size: Medium-sized tree, pyramidal head and coarse twigs.

Range: Europe and eastern United States.

Soil and location: Prefers a deep, rich soil.

Enemies: The leaves are the favorite food of caterpillars and are

subject to a blight which turns them brown prematurely. The trunk is

often attacked by a disease which causes the flow of a slimy

substance.

Value for planting: On account of its showy flowers, the horsechestnut

is a favorite for the park and lawn.

Commercial value: The wood is not durable and is not used commercially.

Other characters: The \_flowers\_ appear in large white clusters in May

and June. The \_fruit\_ is large, round, and prickly.

[Illustration: FIG. 21.--Leaf of the Horsechestnut.]

Comparisons: The \_red horsechestnut\_ differs from this tree in having

red flowers. The \_buckeye\_ is similar to the horsechestnut, but its

bud is not sticky and is of a lighter gray color, while the leaf

generally has only five leaflets.

THE WHITE ASH (\_Fraxinus americana\_)

Distinguishing characters: The terminal \*twigs\* of glossy olive green

color are \*flattened\* below the bud. Fig. 22. The bud is

rusty-brown.

[Illustration: FIG. 22.--Twig of White Ash.]

Leaf: Five to nine leaflets. Fig. 23.

Form and size: A large tree with a straight trunk.

Range: Eastern North America.

Soil and location: Rich, moist soil.

Enemies: In cities it is very often attacked by sucking insects.

Value for planting: The white ash grows rapidly. On account of its

insect enemies in cities, it should be used more for forest planting

and only occasionally for ornament.

Commercial value: It has a heavy, tough, and strong wood, which is

valuable in the manufacture of cooperage stock, agricultural

implements, and carriages. It is superior in value to the black ash.

Other characters: The \_bark\_ is gray. The \_flowers\_ appear in May.

Comparisons: The white ash is apt to be confused with the \_black ash\_

(\_Fraxinus nigra\_), but differs from the latter in having a

lighter-colored bud. The bud of the black ash is black. The bark of

the white ash is darker in color and the terminal twigs are more

flattened than those of the black ash.

[Illustration: FIG. 23.--Leaf of White Ash.]

SUGAR MAPLE (\_Acer saccharum\_)

Distinguishing characters: The \*bud is sharp-pointed\*, scaly, and

reddish brown. Fig. 24.

[Illustration: FIG. 24.--Twig of the Sugar Maple.]

Leaf: Has sharp points and round sinus. Fig. 25.

Form and size: The crown is oval when the tree is young and round in old

age. Fig. 26.

Range: Eastern United States.

Soil and location: Moist and deep soil, and cool, shady positions.

Enemies: Subject to drouth, especially in cities. Is attacked by the

\_sugar maple borer\_ and the \_maple phenacoccus\_, a sucking insect.

Value for planting: Its rich and yellow color in the fall, and the fine

spread of its crown make it a desirable tree for the lawn,

especially in the country.

Commercial value: Its wood is hard and takes a good polish; used for

interior finish and furniture. The tree is also the source of maple

sugar. Fig. 27.

Other characters: The \_bark\_ is smooth in young trees and in old trees

it shags in large plates. The \_flowers\_ appear in the early part of

April.

Other common names: The sugar maple is sometimes called \_rock maple\_ or

\_hard maple\_.

SILVER MAPLE (\_Acer saccharinum\_)

Distinguishing characters: The tips of the \*twigs curve upwards\* (Fig.

28), the bark is scaly, and the leaves are very deeply cleft and are

silvery on the under side.

[Illustration: FIG. 25.--Leaf of Sugar Maple.]

Leaf: Deeply cleft and silvery under side. Fig. 29.

Form and size: A large tree with the main branches separating from the

trunk a few feet from the ground. The terminal twigs are long,

slender, and drooping.

Range: Eastern United States.

Soil and location: Moist places.

Enemies: The \_leopard moth\_, a wood-boring insect, and the

\_cottony-maple scale\_, a sucking insect.

[Illustration: FIG. 26.--The Sugar Maple.]

Value for planting: Grows too rapidly and is too short-lived to be

durable.

Commercial value: Its wood is soft, weak, and little used.

Other characters: The \_bark\_ is light gray, smooth at first and scaly

later on. The scales are free at each end and attached in the

center. The \_flowers\_ appear before the leaves in the latter part of

March or early April.

[Illustration: FIG. 27.--Tapping the Sugar Maple.]

Other common names: The silver maple is sometimes known as \_soft maple\_

or \_white maple\_.

RED MAPLE (\_Acer rubrum\_)

[Illustration: FIG. 28.--Terminal Twig of Silver Maple.]

Distinguishing characters: The \*bark is smooth and light gray\*, like

that of the beech, on the upper branches in older trees, and in

young trees over the whole trunk. Fig. 30. The buds are in clusters,

and the terminal twigs, Fig. 31, are quite red.

[Illustration: FIG. 29.--Leaf of the Silver Maple.]

Leaf: Whitish underneath with three-pointed lobes. Fig. 32.

Form and size: A medium-sized tree with a narrow, round head.

Range: Eastern North America.

Soil and location: Prefers moist places.

Enemies: Leaf blotches (\_Rhytisma acerinum\_) which, however, are not

very injurious.

Value for planting: Suitable as a shade tree for suburban streets. Its

rich red leaves in the fall make it attractive for the lawn.

[Illustration: FIG. 30.--Bark of the Red Maple.]

Commercial value: Its wood is heavy, close-grained, and takes a good

polish. Used for furniture and fuel.

Other characters: The \_bud\_ is small, round, and red. The \_flowers\_

appear before the leaves are out in the early part of April.

[Illustration: FIG. 31.--Twig of the Red Maple.]

[Illustration: FIG. 32.--Leaf of the Red Maple.]

Other common names: The red maple is sometimes known as \_swamp maple\_.

[Illustration: FIG. 33.--Twig of Norway Maple.]

Comparisons: The red maple is apt to be confused with the silver maple,

but the latter can be distinguished by its turned-up twigs and scaly

bark over the whole trunk of the tree, which presents a sharp

contrast to the straight twig and smooth bark of the red maple. The

latter has a bark similar to the beech, but its branches are

\_opposite\_, while those of the beech are \_alternate\_.

NORWAY MAPLE (\_Acer platanoides\_)

Distinguishing characters: The bud, Fig. 33, is \*oval and reddish-brown\*

in color; when taken off, a \*milky juice exudes\*. The bark is close.

Fig. 34

[Illustration: FIG. 34.--Bark of Norway Maple.]

Leaf: Like the leaf of the sugar maple but thicker in texture and darker

in color. Fig. 35.

Form and size: A tall tree with a broad, round head.

Range: Europe and the United States.

Soil and location: Will grow in poor soil.

Enemies: Very few.

Value for planting: One of the best shade trees.

Commercial value: None.

Other characters: The \_bark\_ is close like that of the mockernut

hickory.

Comparisons: The Norway maple is apt to be confused with the \_sycamore

maple\_ (\_Acer pseudoplatanus\_), but differs from the latter in

having a reddish bud instead of a green bud, and a close bark

instead of a scaly bark.

BOX ELDER (\_Acer negundo\_)

Distinguishing characters: The terminal \*twigs are green\*, and the buds

are round and small. Fig. 36.

Leaf: Has three to seven leaflets.

[Illustration: FIG. 35.--Leaf of Norway Maple.]

Form and size: A medium-sized tree with a short trunk and wide-spreading

top.

Range: Eastern United States to the Rocky Mountains.

Soil and location: Grows rapidly in deep, moist soil and river valleys,

but accommodates itself to the dry and poor soil conditions of the

city.

[Illustration: Figure 36.--Twig of the Box Elder.]

Enemies: Few.

Value for planting: Used as a shade tree in the Middle West, but the

tree is so ill formed and so short-lived that it is not to be

recommended.

Commercial value: None. The wood is soft.

Other characters: The \_bark\_ of the trunk is smooth and yellowish-green

in young trees and grayish brown in older specimens. The \_flowers\_

appear in the early part of April. The \_fruit\_ takes the form of

yellowish-green keys which hang on the tree till late fall.

Other common names: The box elder is also commonly known as the

\_ash-leaf maple\_.

GROUP VI. TREES TOLD BY THEIR FORM: ELM, POPLAR, GINGKO AND WILLOW

How to tell them from other trees: The trees described in this group are

so distinctive in their general \_form\_ that they may, for the

purpose of study, be grouped together, and distinguished from all

other trees by this characteristic.

How to tell them from each other: The American elm is \_vase-like\_ in

shape; the Lombardy poplar is narrow and \_spire-like\_; the gingko,

or maidenhair tree, is \_odd\_ in its mode of \_branching\_; and the

weeping willow is extremely \_pendulous\_.

AMERICAN ELM (\_Ulmus americana\_)

Distinguishing characters: The tree can be told at a glance by its

general branching habit. The limbs arch out into a wide-spreading

\*fan or vase-like crown\* which loses itself in numerous fine

drooping branchlets. See Fig. 37.

[Illustration: FIG. 37.--American Elm.]

Leaf: The leaves are simple, alternate, and from 2 to 5 inches long.

[Illustration: FIG. 38.--English Elm in Winter.]

Form and size: It is a tall tree with a trunk that divides a short

distance above ground. Its general contour, together with the

numerous branches that interlace its massive crown, give the elm an

interesting and stately appearance which is unequaled by any other

tree.

[Illustration: FIG. 39.--Lombardy Poplar.]

Range: Eastern North America.

Soil and location: The elm prefers a deep, rich and moist soil, but will

adapt itself even to the poor soil of the city street.

Enemies: \_The leopard moth\_, a wood-boring insect, and the \_elm leaf

beetle\_, a leaf-eating insect, are the two most important enemies of

the tree. Their ravages are very extensive.

Value for planting: The tree has a character of its own which cannot be

duplicated for avenue or lawn planting.

Commercial value: The wood is strong and tough and therefore has a

special value for cooperage, agricultural implements, carriages, and

shipbuilding.

Other characters: The \_buds\_ are small, brown, and smooth, while those

of the European elms are covered with down. The \_small side twigs\_

come out at almost right angles to the larger terminal twigs, which

is not the case in other species of elm.

[Illustration: FIG. 40.--Leaf of Carolina Poplar.]

Other common names: \_White elm\_.

Comparisons: The \_English elm\_ (\_Ulmus campestris\_) is also a tall,

dignified tree commonly seen under cultivation in America, but may

be told from the American species by the difference in their general

contour. The branches of the English species spread out but do not

arch like those of the American elm, and the bark of the English elm

is darker and coarser, Fig. 38. Little tufts of dead twigs along the

main branches and trunk of the tree are characteristic of the

English elm and will frequently help to distinguish it from the

American elm.

The \_Camperdown elm\_ may be recognized readily by its dwarf size and

its low drooping umbrella-shaped crown.

LOMBARDY OR ITALIAN POPLAR (\_Populus nigra, var. italica\_)

Distinguishing characters: Its \*tall, slender, spire-like form\* and

rigidly \*erect branches\*, which commence low on the trunk, make this

tree very distinct at all seasons of the year. See Fig. 39.

Leaf: Triangular in shape, similar to that of the Carolina poplar but

smaller, see Fig. 40.

Range: Asia, Europe, and North America.

Soil and location: The poplar is easily grown in poor soil, in any

location, and is very hardy.

Value for planting: The tree has a distinctive form which makes it

valuable for special landscape effects. It is also used for shelter

belts and screening. Like all poplars it is short lived and will

stand pruning well.

Commercial value: None.

[Illustration: FIG. 41.--Carolina Poplar.]

Comparisons: The \_Carolina poplar\_, or Cottonwood (\_Populus deltoides\_)

can be told from the Lombardy poplar by its wider crown and its more

open branching, Fig. 41. It may be recognized by its big terminal

twigs, which are light yellow in color and coarser than those of the

Lombardy poplar, Fig. 42. Its bark is smooth, light and

yellowish-green in young trees, and dark gray and fissured in older

specimens. Its large, conical, glossy, chestnut-brown bud is also

characteristic, Fig. 42. Its flowers, in the form of large catkins,

a peculiarity of all poplars, appear in the early spring. The

Carolina poplar is commonly planted in cities because it grows

rapidly and is able to withstand the smoke and drouth conditions of

the city. Where other trees, however, can be substituted with

success, the poplar should be avoided. Its very fast growth is

really a point against the tree, because it grows so fast that it

becomes too tall for surrounding property, and its wood being

extremely soft and brittle, the tree frequently breaks in

windstorms. In many cases it is entirely uprooted, because it is not

a deep-rooted tree. Its larger roots, which spread near the

surface, upset the sidewalk or prevent the growth of other

vegetation on the lawn, while its finer rootlets, in their eager

search for moisture, penetrate and clog the joints of neighboring

water and sewer pipes. The tree is commonly attacked by the

\_oyster-shell scale\_, an insect which sucks the sap from its bark

and which readily spreads to other more valuable trees like the elm.

The female form of this tree is even more objectionable than the

male, because in the early spring the former produces an abundance

of cotton from its seeds which litters the ground and often makes

walking dangerous. The only justification for planting the Carolina

poplar is in places where the conditions for tree growth are so poor

that nothing else will grow, and in those cases the tree should be

cut back periodically in order to keep it from becoming too tall and

scraggly. It is also desirable for screening in factory districts

and similar situations.

[Illustration: FIG. 42.--Bud of the Carolina Poplar.]

The \_silver\_ or \_white poplar\_ (\_Populus alba\_) may be told from the

other poplars by its characteristic smooth, \_whitish-green bark\_,

often spotted with dark blotches, Fig. 43. The \_leaves are

silvery-white\_ and downy on the under side. The twigs are dark green

in color and densely covered with a white down. It grows to very

large size and forms an irregular, wide-spreading, broad head, which

is characteristically different from that of any of the other

poplars.

[Illustration: FIG. 43.--Bark of the Silver Poplar.]

The \_quaking aspen\_ (\_Populus tremuloides\_), the \_large-toothed

aspen\_ (\_Populus grandidentata\_) and the \_balsam poplar\_ or \_balm of

Gilead\_ (\_Populus balsamifera\_) are other common members of the

poplar group. The quaking aspen may be told by its reddish-brown

twigs, narrow sharp-pointed buds, and by its small finely toothed

leaves. The large-toothed aspen has thicker and rather downy buds

and broader and more widely toothed leaves. The balsam poplar has a

large bud thickly covered with a sticky, pungent, gelatinous

substance.

GINGKO OR MAIDENHAIR TREE (\_Gingko biloba\_)

[Illustration: FIG. 44.--Gingko Trees.]

Distinguishing characters: The \*peculiar branches\* of this tree \*emerge

upward\* from a straight tapering trunk \*at an angle of about 45°\*

and give to the whole tree a striking, Oriental appearance, which is

quite different from that of any other tree, Fig. 44.

Leaf: Like that of a leaflet of maidenhair fern, Fig. 45.

Range: A native of northern China and introduced into eastern North

America.

Soil and location: The gingko will grow in poor soils.

Enemies: Practically free from insects and disease.

[Illustration: FIG. 45.--Leaves of the Gingko Tree.]

Value for planting: It makes a valuable tree for the street where heavy

shade is not the object and forms an excellent wide-spreading

specimen tree on the lawn.

Other characters: The \_fruit\_ consists of a stone covered by sweet,

ill-smelling flesh. The tree is dioecious, there being separate male

and female trees. The male tree is preferable for planting in order

to avoid the disagreeable odor of the fruit which appears on the

female trees when about thirty years old. The male tree has a

narrower crown than the female tree. The buds (Fig. 46) are very odd

and are conspicuous on the tree throughout the winter. The leaves of

the gingko shed in the winter. In this respect the tree is like the

larch and the bald cypress.

[Illustration: FIG. 46.--Bud of the Gingko Tree.]

The gingko belongs to the yew family, which is akin to the pine

family. It is therefore a very old tree, the remains of the forests

of the ancient world. The gingko in its early life is tall and

slender with its few branches close to the stem. But after a time

the branches loosen up and form a wide-spreading crown. In the

Orient it attains enormous proportions and in this country it also

grows to a fairly large size when planted on the open lawn or in

groups far apart from other trees so that it can have plenty of room

to spread. It then produces a picturesque effect of unusual

interest.

WEEPING WILLOW (\_Salix babylonica\_)

Distinguishing characters: All the willows have a single cap-like scale

to the bud, and this species has an unusually \*drooping mass of

slender branchlets\* which characterizes the tree from all others,

Fig. 47.

[Illustration: FIG. 47.--Weeping Willow.]

Form and size: It grows to large size.

Range: Asia and Europe and naturalized in eastern United States.

Soil and location: Prefers moist places near streams and ponds.

Enemies: None of importance.

Value for planting: The weeping willow has a special ornamental effect

in cemeteries and along lakes and river banks in parks.

Commercial value: It is used in the United States for charcoal and for

fuel.

Comparisons: The \_pussy willow\_ (\_Salix discolor\_) may easily be told

from the other willows by its small size; it is often no higher than

a tall shrub. Its branches are \_reddish green\_ and the buds are dark

red, smooth and glossy. The predominating color of the twigs and

buds in the pussy willow is therefore a shade of \_red\_, while in the

weeping willow it is \_yellowish green\_.

GROUP VII. TREES TOLD BY THEIR BARK OR TRUNK: SYCAMORE, BIRCH, BEECH,

BLUE BEECH, IRONWOOD, AND HACKBERRY

How to tell them from other trees: The \_color of the bark or the form of

the trunk\_ of each of the trees in this group is distinct from that

of any other tree.

How to tell them from each other: In the sycamore, the bark is

\_mottled\_; in the white birch, it is \_dull white\_; in the beech, it

is \_smooth and gray\_; in the hackberry, it is covered with numerous

\_corky warts\_; in the blue beech, the trunk of the tree is \_fluted\_,

as in Fig. 54, and in the ironwood, the bark \_peels\_ in thin

perpendicular strips.

[Illustration: FIG. 48.--Bark of the Sycamore Tree.]

THE SYCAMORE OR PLANE TREE (\_Platanus occidentalis\_)

Distinguishing characters: The peculiar \*mottled appearance\* of the

\*bark\* (Fig. 48) in the trunk and large branches is the striking

character here. The bark produces this effect by shedding in large,

thin, brittle plates. The newly exposed bark is of a yellowish green

color which often turns nearly white later on. \*Round seed balls\*,

about an inch in diameter, may be seen hanging on the tree all

winter. In this species, the seed balls are usually solitary, while

in the Oriental sycamore, a European tree similar to the native one,

they appear in clusters of two, or occasionally of three or four.

See Fig. 49.

[Illustration: FIG. 49.--Seed-balls of the Oriental Sycamore. Note one

Seed-ball cut in half.]

[Illustration: FIG. 50.--Gray or White Birch Trees.]

Leaf: The stem of the leaf completely covers the bud. This is a

characteristic peculiar to sycamores.

Form and size: A large tree with massive trunk and branches and a broad

head.

Range: Eastern and southern United States.

Soil and location: Prefers a deep rich soil, but will adapt itself even

to the poor soil of the city street.

Enemies: The sycamore is frequently attacked by a fungus (\_Gloeosporium

nervisequum\_), which curls up the young leaves and kills the tips of

the branches. Late frosts also often injure its young twigs. The

Oriental sycamore, which is the European species, is more hardy in

these respects than the native one and is therefore often chosen as

a substitute.

Value for planting: The Occidental sycamore is now planted very little,

but the Oriental sycamore is used quite extensively in its place,

especially as a shade tree. The Oriental sycamore is superior to the

native species in many ways. It is more shapely, faster growing, and

hardier than the native one. Both sycamores will bear transplanting

and pruning well.

[Illustration: FIG. 51.--Bark of the Black or Sweet Birch.]

Commercial value: The wood of the sycamore is coarse-grained and hard to

work; used occasionally for inside finishing in buildings.

Other names: \_Buttonball\_, \_buttonwood\_.

Comparisons: The \_Oriental sycamore\_ (\_Platanus orientalis\_) an

introduced species, is apt to be confused with the Occidental

sycamore, but may be told from the latter by the number of seed

balls suspended from the tree. In the case of the Oriental species,

the seed balls hang in \_pairs\_ or (rarely) three or four together.

In the Occidental, the seed balls are generally \_solitary\_ and very

rarely in pairs.

GRAY OR WHITE BIRCH (\_Betula populifolia\_)

Distinguishing characters: The \*dull-white color of the bark\* on the

trunk and the \_dark triangular patches below the insertion of the

branches\_ distinguish this tree; see Fig. 50. The bark of the young

trunks and branches is reddish-brown in color and glossy. The bark

adheres closely to the trunk of the tree and does not peel in loose,

shaggy strips, as in the case of the yellow or golden birch. It is

marked by small raised horizontal lines which are the lenticels or

breathing pores. These lenticels are characteristic of all birch and

cherry trees. In addition to the distinction in the color of the

bark, an important character which distinguishes the gray birch from

all other species of birch, is found in the \*terminal twigs\*, which

are \*rough\* to the touch.

Form and size: A small tree. Frequently grows in clumps.

Range: Eastern United States.

Soil and location: The gray birch does best in a deep, rich soil, but

will also grow in poor soils.

Enemies: The \_bronze-birch borer\_, a wood-destroying insect, and

\_Polyporus betulinus\_, a fungus, are its chief enemies.

Value for planting: Its graceful habit and attractive bark gives the

tree an important place in ornamental planting. It may be used to

advantage with evergreens, and produces a charming effect when

planted by itself in clumps.

[Illustration: FIG. 52.--Bark of the Beech.]

[Illustration: FIG. 53.--Buds of the Beech Tree.]

Commercial value: The wood is soft and not durable. It is used in the

manufacture of small articles and for wood pulp.

Other characters: The \_fruit is a catkin\_.

Comparisons: The \_paper birch\_ (\_Betula papyrifera\_) is apt to be

confused with the gray birch, because both have a white bark. The

bark of the paper birch, however, is a clear white and peels off in

thin papery layers instead of being close. It very seldom shows any

dark triangular markings on the trunk. Its terminal twigs are not

rough and its trunk is usually straighter and freer from branches.

The \_black\_ or \_sweet birch\_ (\_Betula lenta\_) has a bark similar to

the gray birch, except that its color is dark gray. See Fig. 51. The

twigs have an aromatic taste.

[Illustration: FIG. 54.--Trunk of Blue Beech.]

[Illustration: FIG. 55.--Bark of the Ironwood.]

The \_yellow birch\_ (\_Betula lutea\_) has a yellowish or golden bark

which constantly peels in thin, ragged, horizontal films.

The \_European white birch\_ (\_Betula alba\_) has a dull-white bark

like the native white birch, but has smooth terminal twigs instead

of rough ones. It is commonly seen in the United States on lawns and

in parks.

AMERICAN BEECH (\_Fagus americana\_)

Distinguishing characters: The \*close-fitting, smooth, gray bark\* will

tell this tree from all others except the red maple and yellow-wood.

See Fig. 52. The red maple may then be easily eliminated by noting

whether the branches are alternate or opposite. They are alternate

in the beech and opposite in the maple. The yellow-wood may be

eliminated by noting the size of the bud. The \*bud\* in the

yellow-wood is hardly noticeable and of a golden yellow color, while

that of the beech is very \*long, slender, and sharp-pointed\*, and

chestnut brown in color. See Fig. 53.

Form and size: It grows tall in the woods, but on the open lawn spreads

out into a massive, round-headed tree.

Range: Eastern Canada and United States.

Soil and location: Prefers a rich, well-drained soil, but will grow in

any good soil.

Enemies: \_Aphides\_ or plant lice that suck the sap from the leaves in

spring and early summer are the chief enemies of the tree.

Value for planting: The pleasing color of its bark, its fine spread of

branches, which gracefully droop down to the ground, and its

autumnal coloring, make the beech a favorite for lawn and park

planting. The several European species of beech are equally

charming.

[Illustration: FIG. 56.--Bark of the Hackberry.]

Commercial value: The wood is strong, close-grained, and tough. It is

used mainly for cooperage, tool handles, shoe lasts, chairs, etc.,

and for fuel.

Other characters: The \_fruit\_ is a prickly burr encasing a sharply

triangular nut which is sweet and edible.

Comparisons: The \_European beech\_ (\_Fagus sylvatica\_), and its weeping,

purple-leaved, and fern-leaved varieties, are frequently met with in

parks and may be told from the native species by its darker bark.

The weeping form may, of course, be told readily by its drooping

branches. The leaves of the European beeches are broader and less

serrated than those of the American beech.

BLUE BEECH OR HORNBEAM (\_Carpinus caroliniana\_)

Distinguishing characters: The \*fluted\* or muscular effect of its

\*trunk\* will distinguish the tree at a glance, Fig. 54.

Leaf: Doubly serrated; otherwise the same as that of ironwood.

Form and size: A low-spreading tree with branches arching out at various

angles, forming a flattened head with a fine, slender spray.

Range: Very common in the eastern United States.

Soil and location: Grows in low wet woods.

Enemies: None of importance.

Value for planting: Its artistic branching and curious trunk give the

tree an important place in park planting.

Commercial value: None.

Other characters: The bark is smooth and bluish gray in color.

Comparisons: The blue beech or hornbeam is often confused with the

\_ironwood\_ or \_hop hornbeam\_ (\_Ostrya virginiana\_). The ironwood,

however, has a characteristic bark that peels in perpendicular,

short, thin segments, often loose at the ends. See Fig. 55. This is

entirely different from the close, smooth, and fluted bark of the

blue beech. The color of the bark in the ironwood is brownish, while

that of the blue beech is bluish-gray. The buds of the ironwood are

greenish with brown tips, while the bud of the blue beech shows no

green whatever.

HACKBERRY (\_Celtis occidentalis\_)

Distinguishing characters: The tree may be told readily from other trees

by the \*corky tubercles\* on the bark of the lower portion of the

trunk. See Fig. 56.

Leaf: Has three predominating veins and is a bit more developed on one

side than on the other.

Form and size: A small or medium-sized tree with a single stem and broad

conical crown.

Range: United States and Canada.

Soil and location: Grows naturally in fertile soils, but will adapt

itself to almost sterile soils as well.

Enemies: The hackberry is usually free from disease, though often its

leaves are covered with insect galls.

Value for planting: It is extensively planted as a shade tree in the

Middle West, and is frequently seen as an ornamental tree in the

East.

Commercial value: It has little economic value except for fuel.

Other characters: The \_fruit\_ is berry-like, with a hard pit. The fleshy

outer part is sweet.

Other common names: \_Nettle tree\_; \_sugarberry\_.

GROUP VIII. THE OAKS AND CHESTNUT

How to tell them from other trees: The oaks are rather difficult to

identify and, in studying them it will often be necessary to look

for more than one distinguishing character. The oaks differ from

other trees in bearing \_acorns\_. Their \_leaves\_ have many lobes and

their upper lateral \_buds\_ cluster at the top of the twigs. The

general contour of each oak presents a characteristic branching and

sturdiness uncommon in other trees.

The chestnut differs from other trees in bearing \_burs\_ and its

\_bark\_ is also distinctly characteristic.

How to tell them from each other: There are two groups of oaks, the

\_white oak\_ and the \_black oak\_. The white oaks mature their acorns

in one year and, therefore, only acorns of the same year can be

found on trees of this group. The black oaks take two years in which

to mature their acorns and, therefore, young acorns of the present

year and mature acorns of the previous year may be found on the same

tree at one time. The \_leaves\_ of the white oaks have rounded

margins and rounded lobes as in Fig. 57, while those of the black

oaks have pointed margins and sharp pointed lobes as shown in Figs.

60, 62 and 64. The \_bark\_ of the white oaks is light colored and

breaks up in loose flakes as in Fig. 58, while that of the black

oaks is darker and deeply ridged or tight as in Figs. 59 and 61. The

white oak is the type of the white oak group and the black, red and

pin oaks are types of the other. For the characterization of the

individual species, the reader is referred to the following pages.

[Illustration: FIG. 57.--Leaf and Fruit of White Oak. (Quercus alba.)]

WHITE OAK (\_Quercus alba\_)

Distinguishing characters: The massive ramification of its branches is

characteristic of this species and often an easy clue to its

identification. The \*bark\* has a \*light gray color\*--lighter than

that of the other oaks--and breaks into soft, loose flakes as in

Fig. 58. The \*leaves are deeply lobed\* as in Fig. 57. The \*buds are

small, round and congested\* at the end of the year's growth. The

acorns usually have no stalks and are set in shallow, rough cups.

The kernels of the acorns are white and palatable.

Form and size: The white oak grows into a large tree with a

wide-spreading, massive crown, dissolving into long, heavy, twisted

branches. When grown in the open it possesses a short sturdy trunk;

in the forest its trunk is tall and stout.

Range: Eastern North America.

[Illustration: FIG. 58.--Bark of White Oak. (Quercus alba.)]

Soil and location: The white oak thrives in almost any well-drained,

good, deep soil except in a very cold and wet soil. It requires

plenty of light and attains great age.

Enemies: The tree is comparatively free from insects and disease except

in districts where the Gipsy moth is common, in which case the

leaves of the white oak are a favorite food of its caterpillars.

[Illustration: FIG. 59.--Bark of Black Oak. (Quercus velutina).]

Value for planting: The white oak is one of the most stately trees. Its

massive form and its longevity make the tree suitable for both lawn

and woodland planting but it is not used much because it is

difficult to transplant and grows rather slowly.

Commercial value: The wood is of great economic importance. It is heavy,

hard, strong and durable and is used in cooperage, construction

work, interior finish of buildings and for railroad ties, furniture,

agricultural implements and fuel.

Comparisons: The \_swamp white oak\_ (\_Quercus platanoides\_) is similar to

the white oak in general appearance of the bark and form and is

therefore liable to be confused with it. It differs from the white

oak, however, in possessing a more straggly habit and in the fact

that the bark on the under side of its branches shags in loose,

large scales. Its buds are smaller, lighter colored and more downy

and its acorns are more pointed and with cups more shallow than

those of the white oak. The tree also grows in moister ground,

generally bordering swamps.

[Illustration: FIG. 60.--Leaf and Fruit of Black Oak. (Quercus

velutina).]

BLACK OAK (\_Quercus velutina\_)

Distinguishing characters: The \*bark\* is black, rough and cut up into

firm \*ridges\* especially at the base of the tree, see Fig. 59. The

\_inner bark\_ has a \_bright yellow color\_: the \*leaves\* have \_sharp

points\_ and are wider at the base than at the tip as shown in Fig.

60. The buds are \_large, downy\_ and \_sharp pointed\_. The acorns are

small and have deep, scaly cups the inner margins of which are

downy. The kernels are yellow and bitter.

Form and size: The tree grows in an irregular form to large size, with

its branches rather slender as compared with the white oak and with

a more open and narrow crown.

Range: Eastern North America.

Soil and location: It will grow in poor soils but does best where the

soil is rich and well drained.

Enemies: None of importance.

Value for planting: The black oak is the poorest of the oaks for

planting and is rarely offered by nurserymen.

Commercial value: The wood is heavy, hard and strong, but checks readily

and is coarse grained. It is of little value except for fuel. The

bark is used for tannin.

Other common names: \_Yellow oak\_.

Comparisons: The black oak might sometimes be confused with the \_red\_

and \_scarlet oaks\_. The yellow, bitter inner bark will distinguish

the black oak from the other two. The light-colored, smooth bark of

the red oak and the dark, ridged bark of the black oak will

distinguish the two, while the bark of the scarlet oak has an

appearance intermediate between the two. The buds of the three

species also show marked differences. The buds of the black oak are

covered with hairs, those of the scarlet oak have fewer hairs and

those of the red are practically free from hairs. The leaves of each

of the three species are distinct and the growth habits are

different.

RED OAK (\_Quercus rubra\_)

Distinguishing characters: The \*bark\* is perpendicularly fissured into

long, \_smooth, light gray strips\_ giving the trunk a characteristic

\*pillar effect\* as in Figs. 61 and 94. It has the straightest trunk

of all the oaks. The leaves possess \_more lobes\_ than the leaves of

any of the other species of the black oak group, see Fig. 62. The

acorns, the largest among the oaks, are semispherical with the cups

extremely shallow. The buds are large and sharp pointed, but not as

large as those of the black oak. They also have a few fine hairs on

their scales, but are not nearly as downy as those of the Black oak.

[Illustration: FIG. 61--Bark of Red Oak.]

Form and size: The red oak is the largest of the oaks and among the

largest of the trees in the northern forests. It has a straight

trunk, free from branches to a higher point than in the white oak,

see Fig. 94. The branches are less twisted and emerge at sharper

angles than do those of the white oak.

Range: It grows all over Eastern North America and reaches north farther

than any of the other oaks.

Soil and location: It is less fastidious in its soil and moisture

requirements than the other oaks and therefore grows in a great

variety of soils. It requires plenty of light.

[Illustration: FIG. 62.--Leaf and Fruit of Red Oak.]

Enemies: Like most of the other oaks, this species is comparatively free

from insects and disease.

Value for planting: The red oak grows faster and adapts itself better to

poor soil conditions than any of the other oaks and is therefore

easy to plant and easy to find in the nurseries. It makes an

excellent street tree, is equally desirable for the lawn and is

hardly surpassed for woodland planting.

Commercial value: The wood is hard and strong but coarse grained, and is

used for construction timber, interior finish and furniture. It is

inferior to white oak where strength and durability are required.

PIN OAK (\_Quercus palustris\_)

Distinguishing characters: Its method of \*branching\* will characterize

the tree at a glance. It develops a well-defined \_main\_ ascending

\_stem\_ with numerous \_drooping\_ side \_branches\_ as in Fig. 63. The

buds are very small and sharp pointed and the leaves are small as in

Fig. 64. The bark is dark, firm, smooth and in close ridges. The

acorn is small and carries a light brown, striped nut, wider than

long and bitter. The cup is shallow, enclosing only the base of the

nut.

[Illustration: FIG. 63.--Pin Oaks in Winter.]

Form and size: The pin oak is a medium-sized tree in comparison with

other oaks. It develops a tall, straight trunk that tapers

continuously through a pyramidal crown of low, drooping tender,

branches.

Range: Eastern North America.

Soil and location: It requires a deep, rich, moist soil and grows

naturally near swamps. Its roots are deep and spreading. The tree

grows rapidly and is easily transplanted.

Enemies: None of importance.

Value for planting: The pin oak is an extremely graceful tree and is

therefore extensively used for planting on lawns and on certain

streets where the tree can find plenty of water and where conditions

will permit its branches to droop low.

Commercial value: The wood is heavy and hard but coarse grained and

liable to check and warp. Its principal use is in the construction

of houses and for shingles.

[Illustration: FIG. 64.--Leaf and Fruit of Pin Oak.]

CHESTNUT (\_Castanea dentata\_)

Distinguishing characters: The \*bark\* in young trees is smooth and of a

marked reddish-bronze color, but when the tree grows older, the bark

breaks up into \*diamond-shaped ridges\*, sufficiently characteristic

to distinguish the tree at a glance, see Fig. 65. A close

examination of the \_terminal twig\_ will show \_three ridges\_ and \_two

grooves\_ running down along the stem from the base of each leaf or

leaf-scar. The twig has no true terminal bud. The fruit, a large,

round \*bur\*, prickly without and hairy within and enclosing the

familiar dark brown, sweet edible nuts is also a distinguishing mark

of the tree.

Leaf: The leaves are distinctly long and narrow. They are from 6 to 8

inches long.

Form and size: The chestnut is a large tree with a massive trunk and

broad spreading crown. The chestnut tree when cut, sprouts readily

from the stump and therefore in places where the trees have once

been cut, a group of two to six trees may be seen emerging from the

old stump.

[Illustration: FIG. 65.--Trunk of Chestnut Tree.]

Range: Eastern United States.

Soil and location: It will grow on rocky as well as on fertile soils and

requires plenty of light.

Enemies: During the past nine years nearly all the chestnut trees in the

United States have been attacked by a fungus disease (\_Diaporthe

parasitica\_, Mur.) which still threatens the entire extinction of

the chestnut trees in this country. No remedy has been discovered

and all affected trees should be cut down and the wood utilized

before it decays and becomes worthless. No species of chestnut tree

is entirely immune from this disease, though some species are highly

resistant.

Value for planting: The chestnut is one of the most rapidly growing

hardwood trees but, on account of its disease, which is now

prevalent everywhere, it is not wise to plant chestnut trees for the

present.

Commercial value: The wood is light, not very strong and liable to warp.

It is durable when brought in contact with the soil and is therefore

used for railroad ties, fence-posts, poles, and mine timbers. It is

also valuable for interior finish in houses and for fuel. Its bark

is used in the manufacture of tanning extracts and the nuts are sold

in cities in large quantities.

CHAPTER III

HOW TO IDENTIFY TREES--(Continued)

GROUP IX. THE HICKORIES, WALNUT AND BUTTERNUT

How to tell them from other trees and from each other: The hickory

trees, though symmetrical, have a rugged \_appearance\_ and the

\_branches\_ are so sturdy and black as to give a special distinction

to this group. The \_buds\_ are different from the buds of all other

trees and sufficiently characteristic to distinguish the various

species of the group. The \_bark\_ is also a distinguishing character.

The walnut and butternut have \_chambered piths\_ which distinguish

them from all other trees and from each other.

SHAGBARK HICKORY (\_Hicoria ovata\_)

Distinguishing characters: The yellowish brown \*buds\* nearly as large as

those of the mockernut hickory, \_are each provided with two long,

dark, outer scales\_ which stand out very conspicuously as shown in

Fig. 67. The \*bark\* in older specimens \*shags\* off in rough strips,

sometimes more than a foot long, as shown in Fig. 68. These two

characters will readily distinguish the tree at all seasons of the

year.

[Illustration: FIG. 66.--A Shagbark Hickory Tree.]

Leaf: The leaf is compound, consisting of 5 or 7 leaflets, the terminal

one generally larger.

Form and size: A tall, stately tree--the tallest of the hickories--of

rugged form and fine symmetry, see Fig. 66.

Range: Eastern North America.

Soil and location: The shagbark hickory grows in a great variety of

soils, but prefers a deep and rather moist soil.

Enemies: The \_hickory bark borer\_ (\_Scolytus quadrispinosus\_) is its

principal enemy. The insect is now killing thousands of hickory

trees in the vicinity of New York City and on several occasions has

made its appearance in large numbers in other parts of the country.

Value for planting: It is difficult to transplant, grows slowly and is

seldom found in nurseries.

[Illustration: FIG. 67.--Bud of the Shagbark Hickory.]

Commercial value: The wood is extremely tough and hard and is used for

agricultural implements and for the manufacture of wagons. It is

excellent for fuel and the nuts are of great value as a food.

Other characters: The fruit is a nut covered by a thick husk that

separates into 4 or 5 segments. The kernel is sweet.

Other common names: \_Shellbark hickory\_.

MOCKERNUT HICKORY (\_Hicoria alba\_)

[Illustration: FIG. 68.--Bark of the Shagbark Hickory.]

Distinguishing characters: The \*bud\* is the largest among the

hickories--nearly half an inch long--is hard and oval and covered

with \_yellowish brown\_ downy \_scales\_ which \_do not project\_ like

those of the shagbark hickory, see Fig. 69. The twigs are extremely

coarse. The \*bark\* is very tight on the trunk and branches and has a

\_close\_, hard, \_wavy\_ appearance as in Fig. 70.

Leaf: The leaf consists of 5, 7 or 9 leaflets all of which are large and

pubescent and possess a distinct resinous odor.

Form and size: A tall tree with a broad spreading head.

Range: Eastern North America.

Soil and location: The mockernut hickory grows on a great variety of

soils, but prefers one which is rich and well-drained.

Enemies: The same as for the shagbark hickory.

Value for planting: It is not commonly planted.

Commercial value: The wood is similar to that of the shagbark hickory

and is put to the same uses.

Other characters: The fruit is a nut, larger and covered with a shell

thicker than that of the shagbark. The husk is also thicker and

separates into four segments nearly to the base. The kernel is small

and sweet.

Other common names: \_Bigbud hickory\_; \_whiteheart hickory\_.

Comparisons: The \_pignut hickory\_ (\_Hicoria glabra\_), sometimes called

broom hickory or brown hickory, often has a shaggy bark, but differs

from both the shagbark and the mockernut hickory in possessing buds

very much smaller, twigs more slender and leaflets fewer. The nut

has a thinner husk which does not separate into four or five

segments. The tree prefers drier ground than the other hickories.

[Illustration: FIG. 69.--Bud of the Mockernut Hickory.]

The \_bitternut\_ (\_Hicoria minima\_) can be told from the mockernut

and other species of hickory by its bud, which has no scales at all.

The color of its bud is a characteristic orange yellow. The bark is

of a lighter shade than the bark of the mockernut hickory and the

leaflets are more numerous than in any of the hickories, varying

from 7 to 11. Its nuts are bitter.

BLACK WALNUT (\_Juglans nigra\_)

Distinguishing characters: By cutting a twig lengthwise, it will be seen

that its \*pith\* is divided into little \_chambers\_ as shown in Fig.

71. The bud is dark gray and satiny. The bark is dark brown and

deeply ridged and the fruit is the familiar round walnut.

[Illustration: FIG. 70.--Bark of the Mockernut Hickory.]

Form and size: A tall tree with a spreading crown composed of stout

branches. In the open it grows very symmetrically.

Range: Eastern United States.

Soil and location: The black walnut prefers a deep, rich, fertile soil

and requires a great deal of light.

Enemies: The tree is a favorite of many caterpillars.

Value for planting: It forms a beautiful spreading tree on open ground,

but is not planted to any extent because it is hard to transplant.

It grows slowly unless the soil is very deep and rich, develops its

leaves late in the spring and sheds them early in the fall and

produces its fruit in great profusion.

Commercial value: The wood is heavy, strong, of chocolate brown color

and capable of taking a fine polish. It is used for cabinet making

and interior finish of houses. The older the tree, usually, the

better the wood, and the consumption of the species in the past has

been so heavy that it is becoming rare. The European varieties which

are frequently planted in America as substitutes for the native

species yield better nuts, but the American species produces better

wood.

[Illustration: FIG. 71.--Twig of the Black Walnut. Note the large

chambers in the pith.]

[Illustration: FIG. 72.--Twig of the Butternut. Note the small chambers

in the pith.]

Other characters: The \_fruit\_ is a large round nut about two inches in

diameter, covered with a smooth husk which at first is dull green

in color and later turns brown. The husk does not separate into

sections. The kernel is edible and produces an oil of commercial

value.

The \_leaves\_ are compound and alternate with 15 to 23 leaflets to

each.

Comparisons: The \_butternut\_ (\_Juglans cinerea\_) is another tree that

has the pith divided into little chambers, but the little chambers

here are shorter than in the black walnut, as may be seen from a

comparison of Figs. 71 and 72. The bark of the butternut is light

gray while that of the black walnut is dark. The buds in the

butternut are longer than those of the black walnut and are light

brown instead of gray in color. The form of the tree is low and

spreading as compared with the black walnut. The fruit in the

butternut is elongated while that of the black walnut is round. The

leaves of the butternut have fewer leaflets and these are lighter in

color.

GROUP X. TULIP TREE, SWEET GUM, LINDEN, MAGNOLIA, LOCUST, CATALPA,

DOGWOOD, MULBERRY AND OSAGE ORANGE

TULIP TREE (\_Liriodendron tulipifera\_)

Distinguishing characters: There are four characters that stand out

conspicuously in the tulip tree--the \*bud\*, the \*trunk\*, the

persistent \*fruit cups\* and the wedged \*leaf\*.

The bud, Fig. 74, about three-quarters of an inch long, is covered

by two purplish scales which lend special significance to its whole

appearance. The trunk is extremely individual because it rises stout

and shaft-like, away above the ground without a branch as shown in

Fig. 73. The tree flowers in the latter part of May but the cup that

holds the fruit persists throughout the winter. The leaf, Fig. 75,

has four lobes, is nearly as broad as it is long and so notched at

the upper end that it looks different from any other leaf.

[Illustration: FIG. 73.--The Tulip Tree.]

[Illustration: FIG. 74.--Bud of the Tulip Tree.]

Form and size: The tulip tree is one of the largest, stateliest and

tallest of our trees.

Range: Eastern United States.

Soil and location: Requires a deep, moist soil.

Enemies: Comparatively free from insects and disease.

Value for planting: The tree has great value as a specimen on the lawn

but is undesirable as a street tree because it requires considerable

moisture and transplants with difficulty. It should be planted while

young and where it can obtain plenty of light. It grows rapidly.

Commercial value: The wood is commercially known as \_whitewood\_ and

\_yellow poplar\_. It is light, soft, not strong and easily worked. It

is used in construction, for interior finish of houses, woodenware

and shingles. It has a medicinal value.

Other characters: The \_flower\_, shown in Fig. 75, is greenish yellow in

color, appears in May and resembles a tulip; hence the name tulip

tree. The \_fruit\_ is a cone.

Other common names: \_Whitewood\_; \_yellow poplar\_; \_poplar\_ and \_tulip

poplar\_.

SWEET GUM (\_Liquidambar styraciflua\_)

[Illustration: FIG. 75.--Leaf and Flower of the Tulip Tree.]

Distinguishing characters: The \_persistent, spiny\_, long-stemmed round

\*fruit\*; \_the corky growths on the\_ \*twigs\*, the characteristic

\_star-shaped\_ \*leaves\* (Fig. 76) and the very shiny greenish brown

buds and the perfect symmetry of the tree are the chief characters

by which to identify the species.

Form and size: The sweet gum has a beautiful symmetrical shape, forming

a true monopodium.

[Illustration: FIG. 76.--Leaf and Fruit of the Sweet Gum. Note the corky

ridges along the twig.]

Range: From Connecticut to Florida and west to Missouri.

Soil and location: Grows in any good soil but prefers low wet ground. It

grows rapidly and needs plenty of light.

Enemies: Is very often a favorite of leaf-eating caterpillars.

Value for planting: The tree is sought for the brilliant color of its

foliage in the fall, and is suitable for planting both on the lawn

and street. In growing the tree for ornamental purposes it is

important that it should be frequently transplanted in the nursery

and that it be transported with burlap wrapping around its roots.

Commercial value: The wood is reddish brown in color, tends to splinter

and is inclined to warp in drying. It is used in cooperage, veneer

work and for interior finish.

Other characters: On the smaller branches there are irregular

developments of cork as shown in Fig. 76, projecting in some cases

to half an inch in thickness.

Other common names: \_Red gum\_.

Comparisons: The \_cork elm\_ is another tree that possesses corky ridges

along its twigs, but this differs from the sweet gum in wanting the

spiny fruit and its other distinctive traits.

AMERICAN LINDEN (\_Tilia Americana\_)

[Illustration: FIG. 77.--Bud of the Linden Tree.]

Distinguishing characters: The great distinguishing feature of any

linden is the \*one-sided\* character of its \*bud\* and \*leaf\*. The

bud, dark red and conical, carries a sort of protuberance which

makes it extremely one sided as shown in Fig. 77. The leaf, Fig. 78,

is heart-shaped with the side nearest the branch largest.

[Illustration: FIG. 78.--Leaves and Flowers of the European Linden.]

Form and size: The American Linden is a medium-sized tree with a broad

round head.

Range: Eastern North America and more common in the north than in the

south.

Soil and location: Requires a rich, moist soil.

[Illustration: FIG. 79.--European Linden Tree.]

[Illustration: FIG. 80.--Bud of the Umbrella Tree.]

Enemies: Its leaves are a favorite food of caterpillars and its wood is

frequently attacked by a boring insect known as the \_linden borer\_

(\_Saperda vestita\_).

Value for planting: The linden is easily transplanted and grows rapidly.

It is used for lawn and street planting but is less desirable for these

purposes than the European species.

Commercial value: The wood is light and soft and used for paper pulp,

woodenware, cooperage and furniture. The tree is a favorite with bee

keepers on account of the large quantities of nectar contained in

its flowers.

Other characters: The \_fruit\_ is like a pea, gray and woody. The

\_flowers\_ appear in early July, are greenish-yellow and very

fragrant.

Other common names: \_Bass-wood\_; \_lime-tree\_; \_whitewood\_.

Comparisons: The \_European lindens\_, Fig. 79, of which there are several

species under cultivation, differ from the native species in having

buds and leaves smaller in size, more numerous and darker in color.

THE MAGNOLIAS

The various species of magnolia trees are readily distinguished by their

buds. They all prefer moist, rich soil and have their principal value as

decorative trees on the lawn. They are distinctly southern trees; some

species under cultivation in the United States come from Asia, but the

two most commonly grown in the Eastern States are the cucumber tree and

the umbrella tree.

[Illustration: FIG. 81.--Bark of the Black Locust.]

CUCUMBER TREE (\_Magnolia acuminata\_)

Distinguishing characters: The \*buds\* are \_small\_ and \_slender\_ compared

with those of the other magnolia trees and are \_covered\_ with small

silvery silky \_hairs\_. The \*habit\* of the tree is to form a straight

axis of great height with a symmetrical mass of branches, producing

a perfect monopodial crown. The tree is sometimes known as \_mountain

magnolia\_.

UMBRELLA TREE (\_Magnolia tripetala\_)

Distinguishing characters: The \_buds\_, Fig. 80, are extremely \_long\_,

often one and a half inches, have a \_purple color\_ and \_are smooth\_.

The tree does not grow to large size and produces an open spreading

head. Its leaves, twelve to eighteen inches long, are larger than

those of the other magnolia trees. The tree is sometimes called

\_elkwood\_.

BLACK LOCUST (\_Robinia pseudacacia\_)

Distinguishing characters: The \*bark\* of the trunk is \_rough\_ and

\_deeply ridged\_, as shown in Fig. 81. The \*buds\* are \_hardly

noticeable\_; the twigs sometimes bear small spines on one side. The

leaves are large, compound, and fern-like. The individual leaflets

are small and delicate.

Form and size: The locust is a medium-sized tree developing a slender

straight trunk when grown alongside of others; see Fig. 82.

Range: Canada and United States.

Soil and location: The locust will grow on almost any soil except a wet,

heavy one. It requires plenty of light.

Enemies: The \_locust borer\_ has done serious damage to this tree. The

grubs of this insect burrow in the sapwood and kill the tree or make

it unfit for commercial use. The \_locust miner\_ is a beetle which is

now annually defoliating trees of this species in large numbers.

Value for planting: It has little value for ornamental planting.

Commercial value: Though short-lived, the locust grows very rapidly. It

is extremely durable in contact with the soil and possesses great

strength. It is therefore extensively grown for fence-posts and

railroad ties. Locust posts will last from fifteen to twenty years.

The wood is valuable for fuel.

[Illustration: FIG. 82.--Black Locust Trees.]

Other characters: The \_flowers\_ are showy pea-shaped panicles appearing

in May and June. The \_fruit\_ is a small pod.

Other common names: \_Yellow locust\_; \_common locust\_; \_locust\_.

Comparisons: The \_honey locust\_ (\_Gleditsia triacanthos\_) can be told

from the black locust by the differences in their bark. In the honey

locust the bark is not ridged, has a sort of dark iron-gray color

and is often covered with clusters of stout, sharp-pointed thorns as

in Fig. 83. The fruit is a large pod often remaining on the tree

through the winter. This tree has an ornamental, but no commercial

value.

[Illustration: FIG. 83.--Bark of the Honey Locust.]

HARDY CATALPA (\_Catalpa speciosa\_)

Distinguishing characters: The tree may be told by its \*fruit\*, which

hang in long slender pods all winter. The leaf-scars appear on the

stem in whorls of three and rarely opposite each other.

Form and size: The catalpa has a short, thick and twisted trunk with an

irregular head.

Range: Central and eastern United States.

[Illustration: FIG. 84.--Hardy Catalpa Trees.]

[Illustration: FIG. 85.--Bark of the Flowering Dogwood.]

Soil and location: It grows naturally on low bottom-lands but will also

do well in poor, dry soils.

Enemies: Practically free from disease and insects.

Value for planting: The catalpa grows very rapidly and is cultivated in

parks for ornament and in groves for commercial purposes. The \_hardy

catalpa\_ is preferable to the \_common catalpa\_ for planting.

Commercial value: The wood is extremely durable in contact with the soil

and is consequently used for posts and railroad ties.

Other characters: The \_flowers\_, which appear in late June and early

July, are large, white and very showy.

Other common names: \_Indian bean\_; \_western catalpa\_.

Comparisons: The \_white flowering dogwood\_ (\_Cornus florida\_) is a small

tree which also has its leaves in whorls of three or sometimes

opposite. It can be readily told from other trees, however, by the

small square plates into which the outer bark on the trunk divides

itself, see Fig. 85, and by the characteristic drooping character of

its branches. It is one of the most common plants in our eastern

deciduous forests. It is extremely beautiful both in the spring and

in the fall and is frequently planted for ornament. There are many

varieties of dogwood in common use.

WHITE MULBERRY (\_Morus alba\_)

A small tree recognized by its \_small round reddish brown buds\_ and

\_light brown, finely furrowed\_ (wavy looking) \_bark\_.

The tree, probably a native of China, is grown under cultivation in

eastern Canada and United States. It grows rapidly in moist soil and is

not fastidious in its light requirements. Its chief value is for

screening and for underplanting in woodlands.

The \_red mulberry\_ (\_Morus rubra\_) is apt to be confused with the white

mulberry, but differs in the following characters: The leaves of the red

mulberry are rough on the upper side and downy on the under side,

whereas the leaves of the white mulberry are smooth and shiny. The buds

in the red are larger and more shiny than those of the white.

The \_Osage orange\_ (\_Toxylon pomiferum\_) is similar to the mulberry in

the light, golden color of its bark, but differs from it in possessing

conspicuous spines along the twigs and branches and a more ridged bark.

CHAPTER IV

THE STRUCTURE AND REQUIREMENTS OF TREES

To be able fully to appreciate trees, their mode of life,

their enemies and their care, one must know something of

their structure and life requirements.

Structure of trees: Among the lower forms of plants there is very little

distinction between the various parts--no differentiation into root,

stem, or crown. Often the lower forms of animal and vegetable life

are so similar that one cannot discriminate between them. But as we

ascend in the scale, the various plant forms become more and more

complex until we reach the tree, which is the largest and highest

form of all plants. The tree is a living organism composed of cells

like any other living organism. It has many parts, every one of

which has a definite purpose. The three principal parts are: the

stem, the crown, and the root.

The stem: If we examine the cross-section of a tree, Fig. 86, we will

notice that it is made up of numerous rings arranged in sections of

different color and structure. The central part is known as the

\_pith\_. Around the pith comes a dark, close-grained series of rings

known as the \_heartwood\_, and outside the heartwood comes a lighter

layer, the \_sapwood\_. The \_cambium layer\_ surrounds the sapwood and

the \_bark\_ covers all. The cambium layer is the most important

tissue of the tree and, together with part of the sapwood,

transports the water and food of the tree. It is for this reason

that a tree may be hollow, without heart and sapwood, and still

produce foliage and fruit.

[Illustration: FIG. 86.--The Cross-Section of a Tree.]

The crown: The crown varies in form in different species and is

developed by the growth of new shoots from buds. The bud grows out

to a certain length and forms the branch. Afterwards it thickens

only and does not increase in length. New branches will then form

from other buds on the same branch. This explains in part the

characteristic branching of trees, Fig. 87.

[Illustration: FIG. 87.--Characteristic Form and Branching of Trees.

The trees in the photograph are pin oaks.]

The leaves are the stomach and lungs of the tree. Their broad

blades are a device to catch the sunlight which is needed in the

process of digesting the food of the tree. The leaves are arranged

on the twigs in such a way as to catch the most sunlight. The leaves

take up the carbonic acid gas from the air, decompose it under the

influence of light and combine it with the minerals and water

brought up by the roots from the soil. The resulting chemical

combinations are the sugars and starches used by the cambium layer

in building up the body of the tree. A green pigment, \_chlorophyll\_,

in the leaf is the medium by which, with the aid of sunlight, the

sugars are manufactured.

[Illustration: FIG. 88.--Roots of a Hemlock Tree in their Search for

Water.]

The chlorophyll gives the leaf its green color, and this explains

why a tree pales when it is in a dying condition or when its life

processes are interfered with. The other colors of the leaf--the

reds, browns and yellows of the fall or spring--are due to other

pigments. These are angular crystals of different hues, which at

certain times of the year become more conspicuous than at others, a

phenomenon which explains the variation in the colors of the leaves

during the different seasons.

It is evident that a tree is greatly dependent upon its leaves for

the manufacture of food and one can, therefore, readily see why it

is important to prevent destruction of the leaves by insects or

through over-trimming.

The root: The root develops in much the same manner as the crown. Its

depth and spread will vary with the species but will also depend

somewhat upon the condition of the soil around it. A deep or a dry

soil will tend to develop a deep root, while a shallow or moist soil

will produce a shallow root, Fig. 88.

The numerous fine hairs which cover the roots serve the purpose of

taking up food and water from the soil, while the heavy roots help

to support the tree. The root-hairs are extremely tender, are easily

dried out when exposed to the sun and wind, and are apt to become

overheated when permitted to remain tightly packed for any length of

time. These considerations are of practical importance in the

planting of trees and in the application of fertilizers. It is these

fine rootlets far away from the trunk of the tree that have to be

fed, and all fertilizers must, therefore, be applied at points some

distance from the trunk and not close to it, where merely the large,

supporting roots are located. In the cultivation of trees the same

principle holds true.

Requirements of trees: Trees are dependent upon certain soil and

atmospheric conditions which influence their growth and development.

(1) Influence of moisture: The form of the tree and its growth and

structure depend greatly upon the supply of moisture. Botanists

have taken the moisture factor as the basis of classification and

have subdivided trees into those that grow in moist places

(\_hydrophytes\_), those that grow in medium soils (\_mesophytes\_), and

those that grow in dry places (\_xerophytes\_). Water is taken up by

the roots of the tree from the soil. The liquid absorbed by the

roots carries in solution the mineral salts--the food of the

tree--and no food can be taken up unless it is in solution. Much of

the water is used by the tree and an enormous amount is given off in

the process of evaporation.

[Illustration: FIG. 89.--Dead Branches at the Top Caused by Insufficient

Water.]

These facts will explain some of the fundamental principles in the

care of trees. To a tree growing on a city street or on a lawn where

nature fails to supply the requisite amount of water, the latter

must be supplied artificially, especially during the hot summer

months, or else dead branches may result as seen in Fig. 89. Too

much thinning out of the crown causes excessive evaporation, and too

much cutting out in woodlands causes the soil to dry and the trees

to suffer for the want of moisture. This also explains why it is

essential, in wooded areas, to retain on the ground the fallen

leaves. In decomposing and mixing with the soil, the fallen leaves

not only supply the trees with food material, but also tend to

conserve moisture in the ground and to prevent the drying out of the

soil. Raking off the leaves from wooded areas, a practice common in

parks and on private estates--hurts the trees seriously. Some soils

may have plenty of moisture, but may also be so heavily saturated

with acids or salts that the tree cannot utilize the moisture, and

it suffers from drought just the same as if there had been no

moisture at all in the soil. Such soils are said to be

"physiologically dry" and need treatment.

In the development of disease, moisture is a contributing factor

and, therefore, in cavities or underneath bandages where there is

likely to be an accumulation of moisture, decay will do more damage

than in places that are dry and exposed to the sun.

(2) Influence of soil: Soil is made up of fine particles of sand and

rock and of vegetable matter called \_humus\_. A tree will require a

certain soil, and unsuitable soils can be very often modified to

suit the needs of the tree. A deep, moderately loose, sandy loam,

however, which is sufficiently aerated and well supplied with

water, will support almost any tree. Too much of any one constituent

will make a soil unfit for the production of trees. If too much clay

is present the soil becomes "stiff." If too much vegetable matter is

present, the soil becomes "sour." The physical character of the soil

is also important. By physical character is meant the porosity which

results from breaking up the soil. This is accomplished by ploughing

or cultivation. In nature, worms help to do this for the soil, but

on streets an occasional digging up of the soil about the base of

the tree is essential.

Humus or the organic matter in the soil is composed of litter,

leaves and animal ingredients that have decayed under the influence

of bacteria. The more vegetable matter in the humus, the darker the

soil; and therefore a good soil such as one finds on the upper

surface of a well-tilled farm has quite a dark color. When, however,

a soil contains an unusual quantity of humus, it is known as "muck,"

and when there is still more humus present we find \_peat\_. Neither

of these two soils is suitable for proper tree growth.

[Illustration: FIG. 90.--A Tree in the Open. Note the full development

of the wide crown with branches starting near the ground. The tree is

the European larch.]

(3) Influence of light: Light is required by the leaves in the process

of assimilation. Cutting off some of the light from a tree affects

its form. This is why trees grown in the open have wide-spreading

crowns with branches starting near the ground as in Fig. 90, while

the same species growing in the forest produces tall, lanky trees,

free from branches to but a few feet from the top as in Fig. 91.

Some trees can endure more shade than others, but all will grow in

full light. This explains why trees like the beech, hemlock, sugar

maple, spruce, holly and dogwood can grow in the shade, while the

poplar, birch and willow require light. It also explains why, in

the forest, the lower branches die and fall off--a process known in

Forestry as "natural pruning," The influence of light on the form of

trees should be well understood by all those who plant trees and by

those designing landscape effects.

[Illustration: FIG. 91.--A Tree in The Forest. Note the tall stem free

from branches and the small, narrow crown.]

(4) Influence of heat: Trees require a certain amount of heat. They

receive it partly from the sun and partly from the soil. Evaporation

prevents the overheating of the crown. The main stem of the tree is

heated by water from the soil; therefore trees in the open begin

growth in the spring earlier than trees in the forest because the

soil in the open is warmer. Shrubs begin their growth earlier than

trees because of the nearness of their crowns to their root systems.

This also explains why a warm rain will start vegetation quickly.

Too much heat will naturally cause excessive drying of the roots or

excessive evaporation from the leaves and therefore more water is

needed by the tree in summer than in winter.

(5) Influence of season and frost: The life processes of a tree are

checked when the temperature sinks below a certain point. The tree

is thus, during the winter, in a period of rest and only a few

chemical changes take place which lead up to the starting of

vegetation. In eastern United States, growth starts in April and

ceases during the latter part of August or in early September. The

different parts of a tree may freeze solid during the winter without

injury, provided the tree is a native one. Exotic trees may suffer

greatly from extreme cold. This is one of the main reasons why it is

always advisable to plant native trees rather than those that are

imported and have not yet been acclimatized. Frosts during

mid-winter are not quite as injurious as early and late frosts and,

therefore, if one is going to protect plants from the winter's cold,

it is well to apply the covering early enough and to keep it on

late enough to overcome this difficulty.

The mechanical injuries from frost are also important. Snow and

sleet will weigh down branches but rarely break them, while frost

will cause them to become brittle and to break easily. Those who

climb and prune trees should be especially cautious on frosty days.

(6) Influence of air: On the under side of leaves and on other

surfaces of a tree little pores known as \_stomata\_ may be found. In

the bark of birch and cherry trees these openings are very

conspicuous and are there known as \_lenticels\_. These pores are

necessary for the breathing of the tree (respiration), whereby

carbonic acid gas is taken in from the air and oxygen given out. The

process of assimilation depends upon this breathing process and it

is therefore evident that when the stomata are clogged as may occur

where a tree is subjected to smoke or dust, the life processes of

the tree will be interfered with. The same injurious effect results

when the stomata of the roots are interfered with. Such interference

may occur in cases where a heavy layer of soil is piled around the

base of a tree, where the soil about the base of a tree is allowed

to become compact, where a tree is planted too deep, or where the

roots are submerged under water for any length of time. In any case

the air cannot get to the roots and the tree suffers. Nature takes

special cognizance of this important requirement in the case of

cypress trees, which habitually grow under water. Here the trees are

provided with special woody protuberances known as "cypress knees,"

which emerge above water and take the necessary air. See Fig. 18.

Conclusions: From the foregoing it will be seen that trees have certain

needs that nature or man must supply. These requirements differ

with the different species, and in all work of planting and care as

well as in the natural distribution of trees it is both interesting

and necessary to observe these individual wants, to select species

in accordance with local conditions and to care for trees in

conformity with their natural needs.

CHAPTER V

WHAT TREES TO PLANT AND HOW

The following classification will show the value of the more important

trees for different kinds of planting. The species are arranged in the

order of their merit for the particular object under consideration and

the comments accompanying each tree are intended to bring out its

special qualifications for that purpose.

Conditions for tree growth in one part of the country differ from those

of another and these lists, especially applicable to the Eastern States,

may not at all fit some other locality.

TREES BEST FOR THE LAWN

DECIDUOUS

1. American elm (\_Ulmus americana\_)

One of the noblest of trees. Possesses a majestic, wide-spreading,

umbrella-shaped crown; is easily transplanted, and is suited to a

variety of soils.

2. Pin oak (\_Quercus palustris\_)

Has a symmetrical crown with low-drooping branches; requires a moist

situation.

3. European linden (\_Tilia microphylla\_)

Possesses a beautiful shade-bearing crown; grows well in ordinary

soil.

4. Red maple (\_Acer rubrum\_)

Shows pleasing colors at all seasons; grows best in a fairly rich,

moist soil.

5. Copper beech (\_Fagus sylvatica\_, \_alropurpurea\_)

Exceedingly beautiful in form, bark, and foliage and possesses great

longevity and sturdiness. It is difficult to transplant and

therefore only small trees from 6 to 10 feet in height should be

used.

6. Coffee tree (\_Gymnocladus dioicus\_)

A unique and interesting effect is produced by its coarse branches

and leaves. It is free from insects and disease; requires plenty of

light; will grow in poor soils.

7. European white birch (\_Belula alba\_)

A graceful tree and very effective as a single specimen on the lawn,

or in a group among evergreens; should be planted in early spring,

and special care taken to protect its tender rootlets.

8. Gingko or Maiden-hair tree (\_Gingko biloba\_)

Where there is plenty of room for the spread of its odd branches,

the gingko makes a picturesque specimen tree. It is hardy and free

from insect pests and disease.

9. Horsechestnut (\_Aesculus hippocastanum\_)

Carries beautiful, showy flowers, and has a compact, symmetrical

low-branched crown; is frequently subject to insects and disease.

The red flowering horsechestnut (\_A. rubicunda\_) is equally

attractive.

[Illustration: FIG. 92.--A Lawn Tree. European Weeping Beech.]

10. Sugar maple (\_Acer saccharum\_)

Has a symmetrical crown and colors beautifully in the fall; requires

a rich soil and considerable moisture.

11. Soulange's magnolia (\_Magnolia soulangeana\_)

Extremely hard and flowers in early spring before the leaves appear.

12. Flowering dogwood (\_Cornus florida\_)

Popular for its beautiful white flowers in the early spring and the

rich coloring of its leaves in the fall; does not grow to large

size. The red-flowering variety of this tree, though sometimes not

quite as hardy, is extremely beautiful.

13. Japanese maple (\_Acer polymorphum\_)

It has several varieties of different hues and it colors beautifully

in the fall; it does not grow to large size.

CONIFEROUS

14. Oriental spruce (\_Picea orientalis\_)

Forms a dignified, large tree with a compact crown and low branches;

is hardy.

15. Austrian pine (\_Pinus austriaca\_)

Is very hardy; possesses a compact crown; will grow in soils of

medium quality.

16. Bhotan pine (\_Pinus excelsa\_)

Grows luxuriantly; is dignified and beautiful; requires a good soil,

and in youth needs some protection from extreme cold.

17. White pine (\_Pinus strobus\_)

Branches gracefully and forms a large, dignified tree; will thrive

on a variety of soils.

18. European larch (\_Larix europaea\_)

Has a beautiful appearance; thrives best in moist situations.

19. Blue spruce (\_Picea pungens\_)

Extremely hardy; forms a perfect specimen plant for the lawn.

20. Japanese umbrella pine (\_Sciadopitys verlicillata\_)

Very hardy; retains a compact crown. An excellent specimen plant

when grouped with other evergreens on the lawn. Does not grow to

large size.

21. Mugho pine (\_Pinus mughus\_)

A low-growing evergreen; hardy; important in group planting.

22. Obtuse leaf Japanese cypress (\_Retinospora obtusa\_)

Beautiful evergreen of small size; hardy; desirable for group

planting.

23. English yew (\_Taxus baccata\_)

An excellent evergreen usually of low form; suitable for the lawn,

massed with others or as a specimen plant; will grow in the shade of

other trees. There are various forms of this species of distinctive

value.

TREES BEST FOR THE STREET

1. Oriental sycamore (\_Platanus orientalis\_)

Very hardy; will adapt itself to city conditions; grows fairly fast

and is highly resistant to insects and disease.

2. Norway maple (\_Acer platanoides\_)

Very hardy; possesses a straight trunk and symmetrical crown; is

comparatively free from insects and disease and will withstand the

average city conditions.

3. Red oak (\_Quercus rubra\_)

Fastest growing of the oaks; very durable and highly resistant to

insects and disease; will grow in the average soil of the city

street.

[Illustration: FIG. 93.--Street Trees. Norway Maples.]

4. Gingko (\_Gingko biloba\_)

Hardy and absolutely free from insects and disease; suited for

narrow streets, and will permit of close planting.

5. European linden (\_Tilia microphylla\_)

Beautiful shade-bearing crown; is very responsive to good soil and

plenty of moisture.

6. American elm (\_Ulmus americana\_)

When planted in rows along an avenue, it forms a tall majestic

archway of great beauty. It is best suited for wide streets and

should be planted further apart than the other trees listed above.

Requires a fairly good soil and plenty of moisture, and is therefore

not suited for planting in the heart of a large city.

7. Pin oak (\_Quercus palustris\_)

This tree exhibits its greatest beauty when its branches are allowed

to droop fairly low. It, moreover, needs plenty of moisture to

thrive and the tree is therefore best suited for streets in suburban

sections, where these conditions can be more readily met.

8. Red maple (\_Acer rubrum\_)

Beautiful in all seasons of the year; requires a rich soil and

considerable moisture.

TREES BEST FOR WOODLAND

FOR OPEN PLACES

1. Red oak (\_Quercus rubra\_)

Grows rapidly to large size and produces valuable wood; will grow in

poor soil.

2. White pine (\_Pinus strobus\_)

Rapid grower; endures but little shade; wood valuable; will do well

on large range of soils.

3. Red pine (\_Pinus resinosa\_)

Very hardy; fairly rapid growing tree.

4. Tulip tree (\_Liriodendron tulipifera\_)

Grows rapidly into a stately forest tree with a clear tall trunk;

wood valuable; requires a fairly moist soil. Use a small tree, plant

in the spring, and pay special attention to the protection of the

roots in planting.

5. Black locust (\_Robinia pseudacacia\_)

Grows rapidly; adapts itself to poor, sandy soils. The wood is

suitable for posts and ties.

6. White ash (\_Fraxinus americana\_)

Grows rapidly; prefers moist situations. Wood valuable.

7. American elm (\_Ulmus americana\_)

Grows rapidly to great height; will not endure too much shade; does

best in a deep fertile soil. Wood valuable.

8. European larch (\_Larix europaea\_)

Grows rapidly; prefers moist situations.

[Illustration: FIG. 94.--Woodland Trees. Red Oaks.]

FOR PLANTING UNDER THE SHADE OF OTHER TREES

9. Beech (\_Fagus\_)

Will stand heavy shade; holds the soil well along banks and steep

slopes. Both the American and the English species are desirable.

10. Hemlock (\_Tsuga canadensis\_)

Will stand heavy shade and look effective in winter as well as in

summer.

11. Dogwood (\_Cornus florida\_)

Will grow under other trees; flowers beautifully in the spring and

colors richly in the fall.

12. Blue beech (\_Carpinus caroliniana\_)

Native to the woodlands of the Eastern States; looks well in spring

and fall.

TREES BEST FOR SCREENING

1. Hemlock (\_Tsuga canadensis\_)

Will stand shearing and will screen in winter as well as in summer.

Plant from 2 to 4 feet apart to form a hedge.

2. Osage orange (\_Toxylon pomiferum\_)

Very hardy. Plant close.

3. English hawthorn (\_Crataegus oxyacantha\_)

Flowers beautifully and grows in compact masses. Plant close.

4. Lombardy poplar (\_Populus nigra var. italica\_)

Forms a tall screen and grows under the most unfavorable conditions.

Plant 8 to 12 feet apart.

Quality of trees: Trees grown in a nursery are preferable for

transplanting to trees grown in the forest. Nursery-grown trees

possess a well-developed root system with numerous fibrous rootlets,

a straight stem, a symmetrical crown, and a well-defined leader.

Trees grown in neighboring nurseries are preferable to those grown

at great distances, because they will be better adapted to local

climatic and soil conditions. The short distances over which they

must be transported also will entail less danger to the roots

through drying. For lawn planting, the branches should reach low to

the ground, while for street purposes the branches should start at

about seven feet from the ground. For street planting, it is also

important that the stem should be perfectly straight and about two

inches in diameter. For woodland planting, the form of the tree is

of minor consideration, though it is well to have the leader well

defined here as well as in the other cases. See Fig. 95.

When and how to procure the trees: The trees should be selected in the

nursery personally. Some persons prefer to seal the more valuable

specimens with leaden seals. Fall is the best time to make the

selection, because at that time one can have a wider choice of

material. Selecting thus early will also prevent delay in delivery

at the time when it is desired to plant.

When to plant: The best time to plant trees is early spring, just before

growth begins, and after the frost is out of the ground. From the

latter part of March to the early part of May is generally the

planting period in the Eastern States.

Where one has to plant both coniferous and deciduous trees, it is

best to get the deciduous in first, and then the conifers.

How to plant: The location of the trees with relation to each other

should be carefully considered. On the lawn, they should be

separated far enough to allow for the full spread of the tree. On

streets, trees should be planted thirty to thirty-five feet apart

and in case of the elm, forty to fifty feet. In woodlands, it is

well to plant as close as six feet apart where small seedlings are

used and about twelve feet apart in the case of trees an inch or

more in diameter. An abundance of good soil (one to two cubic yards)

is essential with each tree where the specimens used are an inch or

two in diameter. A rich mellow loam, such as one finds on the

surface of a well-tilled farm, is the ideal soil. Manure should

never be placed in direct contact with the roots or stem of the

tree.

Protection of the roots from drying is the chief precaution to be

observed during the planting process, and for this reason a cloudy

day is preferable to a sunny day for planting. In case of

evergreens, the least exposure of the roots is liable to result

disastrously, even more so than in case of deciduous trees. This is

why evergreens are lifted from the nursery with a ball of soil

around the roots. All bruised roots should be cut off before the

tree is planted, and the crown of the tree of the deciduous species

should be slightly trimmed in order to equalize the loss of roots by

a corresponding decrease in leaf surface.

The tree should be set into the tree hole at the same depth that it

stood in the nursery. Its roots, where there is no ball of soil

around them, should be carefully spread out and good soil should be

worked in carefully with the fingers among the fine rootlets. Every

root fibre is thus brought into close contact with the soil. More

good soil should be added (in layers) and firmly packed about the

roots. The last layer should remain loose so that it may act as a

mulch or as an absorbent of moisture. The tree should then be

thoroughly watered.

[Illustration: FIG. 95.--Specifications for a Street Tree.]

After care: During the first season the tree should be watered and the

soil around its base slightly loosened at least once a week,

especially on hot summer days. Where trees are planted on streets,

near the curb, they should also be fastened to stakes and protected

with a wire guard six feet high. See Fig. 95. Wire netting of

½-inch mesh and 17 gauge is the most desirable material.

[Illustration: FIG. 96.--A Home Nursery. (Austrian pines in front.)]

Suggestions for a home or school nursery: Schools, farms, and private

estates may conveniently start a tree nursery on the premises and

raise their own trees. Two-year seedling trees or four-year

transplants are best suited for this purpose. These may be obtained

from several reliable nurseries in various parts of the country that

make a specialty of raising small trees for such purposes. The cost

of such trees should be from three to fifteen dollars per thousand.

The little trees, which range from one to two feet in height, will

be shipped in bundles. Immediately upon arrival, the bundles should

be untied and the trees immersed in a pail containing water mixed

with soil. The bundles should then be placed in the ground

temporarily, until they can be set out in their proper places. In

this process, the individual bundles should be slanted with their

tops toward the south, and the spot chosen should be cool and shady.

At no time should the roots of these plants be exposed, even for a

moment, to sun and wind, and they should always be kept moist. The

little trees may remain in this trench for two weeks without injury.

They should then be planted out in rows, each row one foot apart for

conifers and two feet for broadleaf trees. The individual trees

should be set ten inches apart in the row. Careful weeding and

watering is the necessary attention later on.

CHAPTER VI

THE CARE OF TREES

STUDY I. INSECTS INJURIOUS TO TREES AND HOW TO COMBAT THEM

In a general way, trees are attacked by three classes of insects, and

the remedy to be employed in each case depends upon the class to which

the insect belongs. The three classes of insects are:

1. Those that \*chew\* and swallow some portion of the leaf; as, for

example, the elm leaf beetle, and the tussock, gipsy, and brown-tail

moths.

2. Those that \*suck\* the plant juices from the leaf or bark; such as the

San José scale, oyster-shell, and scurfy scales, the cottony maple

scale, the maple phenacoccus on the sugar maples, and the various

aphides on beech, Norway maple, etc.

3. Those that \*bore\* inside of the wood or inner bark. The principal

members of this class are the leopard moth, the hickory-bark borer, the

sugar-maple borer, the elm borer, and the bronze-birch borer.

The chewing insects are destroyed by spraying the leaves with arsenate

of lead or Paris green. The insects feed upon the poisoned foliage and

thus are themselves poisoned.

The sucking insects are killed by a contact poison: that is, by spraying

or washing the affected parts of the tree with a solution which acts

externally on the bodies of the insects, smothering or stifling them.

The standard solutions for this purpose are kerosene emulsion, soap and

water, tobacco extract, or lime-sulfur wash.

[Illustration: FIG. 97.--A Gas-power Spraying Apparatus.]

The boring insects are eliminated by cutting out the insect with a

knife, by injecting carbon bisulphide into the burrow and clogging the

orifice immediately after injection with putty or soap, or in some cases

where the tree is hopelessly infested, by cutting down and burning the

entire tree.

[Illustration: FIG. 98.--A Barrel Hand-pump Spraying Outfit.]

For information regarding the one of these three classes to which any

particular insect belongs, and for specific instructions on the

application of a remedy, the reader is advised to write to his State

Entomologist or to the U.S. Bureau of Entomology at Washington, D.C. The

letter should state the name of the tree affected, together with the

character of the injury, and should be accompanied by a specimen of the

insect, or by a piece of the affected leaf or bark, preferably by both.

The advice received will be authentic and will be given without charge.

[Illustration: FIG. 99.--Egg-masses of the Tussock Moth.]

When to spray: \_In the case of chewing insects\_, the latter part of May

is the time to spray. The caterpillars hatch from their eggs, and

the elm leaf beetle leaves its winter quarters at that time. \_In the

case of sucking insects\_, the instructions will have to be more

specific, depending upon the particular insect in question. Some

sucking insects can best be handled in May or early June when their

young emerge, others can be effectively treated in the fall or

winter when the trees are dormant.

How to spray: Thoroughness is the essential principle in all spraying.

In the case of leaf-eating insects, this means covering every leaf

with the poison and applying it to the under side of the leaves,

where the insects generally feed. In the case of sucking insects,

thoroughness means an effort to touch every insect with the spray.

It should be borne in mind that the insect can be killed only when

hit with the chemical. The solution should be well stirred, and

should be applied by means of a nozzle that will coat every leaf

with a fine, mist-like spray. Mere drenching or too prolonged an

application will cause the solution to run off. Special precautions

should be taken with contact poisons to see that the formula is

correct. Too strong a solution will burn the foliage and tender

bark.

Spraying apparatus: There are various forms of spraying apparatus in the

market, including small knapsack pumps, barrel hand-pumps, and

gasolene and gas-power sprayers, Figs. 97 and 98. Hose and nozzles

are essential accessories. One-half inch, three-ply hose of the best

quality is necessary to stand the heavy pressure and wear. Two

50-foot lengths is the usual quantity required for use with a barrel

hand-pump. Each line of hose should be supplied with a bamboo pole

10 feet long, having a brass tube passed through it to carry the

nozzle. The Vermorel nozzle is the best type to use. The cost of a

barrel outfit, including two lines of hose, nozzles and truck,

should be from $30 to $40. Power sprayers cost from $150 to $300 or

more.

Spraying material:

\_Arsenate of lead\_ should be used in the proportion Of 4 pounds of the

chemical to 50 gallons of water. A brand of arsenate of lead

containing at least 14 per cent of arsenic oxide with not more than

50 per cent of water should be insisted upon. This spray may be used

successfully against caterpillars and other leaf-eating insects in

the spring or summer.

\_Whale-oil soap\_ should be used at the rate of 1½ pounds of the soap

to 1 gallon of hot water, if applied to the tree in winter. As a

spray in summer, use 1 pound of the soap to 5 gallons of water. This

treatment is useful for most sucking insects.

\_Lime-sulfur wash\_ is an excellent material to use against sucking

insects, such as the San José scale and other armored scales. The

application of a lime-sulfur wash when put on during the dormant

season is not likely to harm a tree and has such an excellent

cleansing effect that the benefits to be derived in this direction

alone are often sufficient to meet the cost of the treatment.

Lime-sulfur wash consists of a mixture, boiled one hour, of 40

pounds of lime and 80 pounds of sulfur, in 50 gallons of water. It

may be had in prepared form and should then be used at the rate of 1

gallon to about 9 gallons of water in winter or early spring before

the buds open. At other times of the year and for the softer-bodied

insects a more diluted mixture, possibly 1 part to 30 or 40 parts of

water, should be used, varying with each case separately.

\_Kerosene emulsion\_ consists of one-half pound of hard soap, 1 gallon

of boiling water, and 2 gallons of kerosene. It may be obtained in

prepared form and is then to be used at the rate of one part of the

solution to nine parts of water when applied in winter or to the

bark only in summer. Use 2 gallons of the solution to a 40-gallon

barrel of water when applying it to the leaves in the summer.

Kerosene emulsion is useful as a treatment for scale insects.

\_Tobacco water\_ should be prepared by steeping one-half pound of

tobacco stems or leaves in a gallon of boiling water and later

diluting the product with 5 to 10 gallons of water. It is

particularly useful for plant lice in the summer.

The life history of an insect: In a general way, all insects have four

stages of transformation before a new generation is produced. It is

important to consider the nature of these four stages in order that

the habits of any particular insect and the remedies applicable in

combating it may be understood.

All insects develop from \_eggs\_, Fig. 99. The eggs then hatch into

caterpillars or grubs, which is the \_larva\_ stage, in which most

insects do the greatest damage to trees. The caterpillars or grubs

grow and develop rapidly, and hence their feeding is most ravenous.

Following the larva stage comes the third or \_pupa\_ stage, which is

the dormant stage of the insect. In this stage the insect curls

itself up under the protection of a silken cocoon like the tussock

moth, or of a curled leaf like the brown-tail moth, or it may be

entirely unsheltered like the pupa of the elm leaf beetle. After the

pupa stage comes the \_adult insect\_, which may be a moth or a

beetle.

A study of the four stages of any particular insect is known as a

study of its \_life history\_. The important facts to know about the

life history of an insect are the stage in which it does most of its

feeding, and the period of the year in which this occurs. It is also

important to know how the insect spends the winter in order to

decide upon a winter treatment.

IMPORTANT INSECTS

THE ELM LEAF BEETLE

Life history: The elm leaf beetle, Fig. 100, is annually causing the

defoliation of thousands of elm trees throughout the United States.

Several successive defoliations are liable to kill a tree. The

insects pass the winter in the beetle form, hiding themselves in

attics and wherever else they can secure shelter. In the middle of

May when the buds of the elm trees unfold, the beetles emerge from

their winter quarters, mate, and commence eating the leaves, thus

producing little holes through them. While this feeding is going on,

the females deposit little, bright yellow eggs on the under side of

the leaves, which soon hatch into small larvae or grubs. The grubs

then eat away the soft portion of the leaf, causing it to look like

lacework. The grubs become full grown in twenty days, crawl down to

the base of the tree, and there transform into naked, orange-colored

pupae. This occurs in the early part of August. After remaining in

the pupa stage about a week, they change into beetles again, which

either begin feeding or go to winter quarters.

Remedies: There are three ways of combating this insect: First, by

\_spraying the foliage\_ with arsenate of lead in the latter part of

May while the beetles are feeding, and repeating the spraying in

June when the larvae emerge. The spraying method is the one most to

be relied on in fighting this insect. A second, though less

important remedy, consists in \_destroying the pupae\_ when they

gather in large quantities at the base of the tree. This may be

accomplished by gathering them bodily and destroying them, or by

pouring hot water or a solution of kerosene over them. In large

trees it may be necessary to climb to the crotches of the main limbs

to get some of them. The third remedy lies in gathering and

\_destroying the adult beetles\_ when found in their winter quarters.

The application of bands of burlap or "tanglefoot," or of other

substances often seen on the trunks of elm trees is useless, since

these bands only prevent the larvae from crawling down from the

leaves to the base and serve to prevent nothing from crawling up.

Scraping the trunks of elm trees is also a waste of effort.

[Illustration: FIG. 100.--The Elm Leaf Beetle. (After Dr. E.P. Felt.)

1. Egg cluster, enlarged. 1a. Single egg, greatly enlarged. 2. Young

larva, enlarged. 3. Full grown larva, much enlarged. 4. Pupa, enlarged.

5. Overwintered beetle, enlarged. 6. Fresh, brightly colored beetle,

enlarged. 7. Under surface of leaf showing larvae feeding. 8. Leaf eaten

by larvae. 9. Leaf showing holes eaten by beetles.]

THE TUSSOCK MOTH

Life history: This insect appears in the form of a red-headed,

yellow-colored caterpillar during the latter part of May, and in

June and July. The caterpillars surround themselves with silken

cocoons and change into pupae. The mature moths emerge from the

cocoons after a period of about two weeks, and the females, which

are wingless, soon deposit their eggs on the bark of trees, on

twigs, fences, and other neighboring objects. These eggs form white

clusters of nearly 350 individual eggs each, and are very

conspicuous all winter, see Fig. 101.

Remedies: There are two ways of combating this insect: (1) By spraying

with arsenate of lead for the caterpillars during the latter part of

May and early June. (2) By removing and destroying the egg masses in

the fall or winter.

[Illustration: FIG. 101.--The Tussock Moth. (After Dr. E.P. Felt.)

1. Caterpillar. 2. Male moth. 3. Female moth laying eggs. 4 Cocoons. 5.

Cast skins of caterpillar. 6. Work of young caterpillar. 7. Male pupa. 8

and 9. Girdled branches.]

THE GIPSY MOTH

Life history: This insect, imported from Europe to this country in 1868,

has ever since proved a serious enemy of most shade, forest, and

fruit trees in the New England States. It even feeds on

evergreens, killing the trees by a single defoliation.

The insect appears in the caterpillar stage from April to July. It

feeds at night and rests by day. The mature caterpillar, which is

dark in color, may be recognized by rows of blue and red spots along

its back. After July, egg masses are deposited by the female moths

on the bark of trees, and on leaves, fences, and other neighboring

objects. Here they remain over the winter until they hatch in the

spring. The flat egg masses are round or oval in shape, and are

yellowish-brown in color. See Fig. 102.

Remedies: Spray for the caterpillars in June with arsenate of lead and

apply creosote to the egg masses whenever found.

THE BROWN-TAIL MOTH

Life history: This insect was introduced here from Europe in 1890 and

has since done serious damage to shade, forest, and fruit trees, and

to shrubs in the New England States.

It appears in the caterpillar stage in the early spring and

continues to feed on the leaves and buds until the last of June.

Then the caterpillars pupate, the moths come out, and in July and

August the egg clusters appear. These hatch into caterpillars which

form nests for themselves by drawing the leaves together. Here they

remain protected until the spring. See Fig. 103.

Remedies: Collect the winter nests from October to April and burn them.

Also spray the trees for caterpillars in early May and especially in

August with arsenate of lead.

[Illustration: FIG. 102.--The Gipsy Moth. (After F.W. Rane Mass. State

Forester.)]

[Illustration: FIG. 103.--The Brown-tail Moth. (After F.W. Rane, Mass.

State Forester.)]

[Illustration: FIG. 104.--Larva of the Leopard Moth.]

THE FALL WEBWORM

The caterpillars of this insect congregate in colonies and surround

themselves with a web which often reaches the size of a foot or more in

diameter. These webs are common on trees in July and August. Cutting off

the webs or burning them on the twigs is the most practical remedy.

[Illustration: FIG. 105.--Branch Showing Work of the Leopard Moth Larva.]

THE LEOPARD MOTH

Life history: This insect does its serious damage in the grub form. The

grubs which are whitish in color with brown heads, and which vary in

size from 3/8 of an inch to 3 inches in length (Fig. 104), may be

found boring in the wood of the branches and trunk of the tree all

winter. Fig. 105. The leopard moth requires two years to complete

its round of life. The mature moths are marked with dark spots

resembling a leopard's skin, hence the name. Fig. 106. It is one of

the commonest and most destructive insects in the East and is

responsible for the recent death of thousands of the famous elm

trees in New Haven and Boston. Fig. 107.

[Illustration: FIG. 106.--The Leopard Moth.]

Remedies: Trees likely to be infested with this insect should be

examined three or four times a year for wilted twigs, dead branches,

and strings of expelled frass; all of which may indicate the

presence of this borer. Badly infested branches should be cut off

and burned. Trees so badly infested that treatment becomes too

complicated should be cut down and destroyed. Where the insects are

few and can be readily reached, an injection of carbon bisulphide

into the burrow, the orifice of which is then immediately closed

with soap or putty, will often destroy the insects within.

[Illustration: FIG. 107.--Elm Tree Attacked by the Leopard Moth.]

THE HICKORY BARK BORER

Life history: This insect is a small brown or black beetle in its mature

form and a small legless white grub in its winter stage. The beetles

appear from June to August. In July they deposit their eggs in the

outer sapwood, immediately under the bark of the trunk and larger

branches. The eggs soon hatch and the grubs feed on the living

tissue of the tree, forming numerous galleries. The grubs pass the

winter in a nearly full-grown condition, transform to pupae in May,

and emerge as beetles in June.

Remedies: The presence of the insect can be detected by the small holes

in the bark of the trees and the fine sawdust which is ejected from

these holes, when the insects are active. It is important to

emphasize the advisability of detecting the fine sawdust because

that is the best indication of the actual operations of the hickory

bark borer. These holes, however, will not be noticeable until the

insect has completed its transformation. In summer, the infested

trees show wilted leaves and many dead twigs. Holes in the base of

the petioles of these leaves are also signs of the working of the

insect. Since the insect works underneath the bark, it is

inaccessible for treatment and all infested trees should be cut down

and burned, or the bark removed and the insects destroyed. This

should be done before the beetles emerge from the tree in June.

PLANT LICE OR APHIDES

These often appear on the under side of the leaves of the beech, Norway

maple, tulip tree, etc. They excrete a sweet, sticky liquid called

"honey-dew," and cause the leaves to curl or drop. Spraying with

whale-oil soap solution formed by adding one pound of the soap to five

gallons of water is the remedy.

STUDY II. TREE DISEASES

Because trees have wants analogous to those of human beings, they also

have diseases similar to those which afflict human beings. In many cases

these diseases act like cancerous growths upon the human body; in some

instances the ailment may be a general failing due to improper feeding,

and in other cases it may be due to interference with the life processes

of the tree.

How to tell an ailing tree: Whatever the cause, an ailing tree will

manifest its ailment by one or more symptoms.

A change of color in the leaves at a time when they should be

perfectly green indicates that the tree is not growing under normal

conditions, possibly because of an insufficiency of moisture or

light or an overdose of foreign gases or salts. Withering of the

leaves is another sign of irregularity in water supply. Dead tops

point to some difficulty in the soil conditions or to some disease

of the roots or branches. Spotted leaves and mushroom-like growths

or brackets protruding from the bark as in Fig. 108, are sure signs

of disease.

In attempting to find out whether a tree is healthy or not, one

would therefore do well to consider whether the conditions under

which it is growing are normal or not; whether the tree is suitable

for the location; whether the soil is too dry or too wet; whether

the roots are deprived of their necessary water and air by an

impenetrable cover of concrete or soil; whether the soil is well

drained and free from foreign gases and salts; whether the tree is

receiving plenty of light or is too much exposed; and whether it is

free from insects and fungi.

If, after a thorough examination, it is found that the ailment has

gone too far, it may not be wise to try to save the tree. A timely

removal of a tree badly infested with insects or fungi may often be

the best procedure and may save many neighboring trees from

contagious infection. For this, however, no rules can be laid down

and much will depend on the local conditions and the judgment and

knowledge of the person concerned.

[Illustration: FIG. 108.--A Bracket Fungus (\_Elfvingia megaloma\_) on a

Tulip Tree.]

Fungi as factors of disease: The trees, the shrubs and the flowers with

which we are familiar are rooted in the ground and derive their food

both from the soil and from the air. There is, however, another

group of plants,--\_the fungi\_,--the roots of which grow in trees and

other plants and which obtain their food entirely from the trees or

plants upon which they grow. The fungi cannot manufacture their own

food as other plants do and consequently absorb the food of their

host, eventually reducing it to dust. The fungi are thus

disease-producing factors and the source of most of the diseases of

trees.

When we can see fungi growing on a tree we may safely assume that

they are already in an advanced state of development. We generally

discover their presence when their fruiting bodies appear on the

surface of the tree as shown in Fig 109. These fruiting bodies are

the familiar mushrooms, puffballs, toadstools or shelf-like brackets

that one often sees on trees. In some cases they spread over the

surface of the wood in thin patches. They vary in size from large

bodies to mere pustules barely visible to the naked eye. Their

variation in color is also significant, ranging from colorless to

black and red but never green. They often emulate the color of the

bark, Fig. 110.

Radiating from these fruiting bodies into the tissues of the tree

are a large number of minute fibers, comprising the \_mycelium\_ of

the fungus. These fibers penetrate the body of the tree in all

directions and absorb its food. The mycelium is the most important

part of the fungous growth. If the fruiting body is removed, another

soon takes its place, but if the entire mycelium is cut out, the

fungus will never come back. The fruiting body of the fungus bears

the seed or \_spores\_. These spores are carried by the wind or

insects to other trees where they take root in some wound or crevice

of the bark and start a new infestation.

[Illustration: FIG. 109.--The Fruiting Body of a Fungus.]

The infestation will be favored in its growth if the spore can find

plenty of food, water, warmth and darkness. As these conditions

generally exist in wounds and cavities of trees, it is wise to keep

all wounds well covered with coal tar and to so drain the cavities

that moisture cannot lodge in them. This subject will be gone into

more fully in the following two studies on "Pruning Trees" and "Tree

Repair."

[Illustration: FIG. 110.--The Birch-fungus rot. (\_Polyponis betulinus\_

Fr.) Note the similarity in the color of the fruiting body and bark of

the tree.]

While the majority of the fungi grow on the trunks and limbs of

trees, some attack the leaves, some the twigs and others the roots.

Some fungi grow on living wood some on dead wood and some on both.

Those that attack the living trees are the most dangerous from the

standpoint of disease.

The chestnut disease: The disease which is threatening the destruction

of all the chestnut trees in America is a fungus which has, within

recent years, assumed such vast proportions that it deserves special

comment. The fungus is known as \_Diaporthe parasitica\_ (Murrill),

and was first observed in the vicinity of New York in 1905. At that

time only a few trees were known to have been killed by this

disease, but now the disease has advanced over the whole chestnut

area in the United States, reaching as far south as Virginia and as

far west as Buffalo. Fig. 111 shows the result of the chestnut

disease.

The fungus attacks the cambium tissue underneath the bark. It enters

through a wound in the bark and sends its fungous threads from the

point of infection all around the trunk until the latter is girdled

and killed. This may all happen within one season. It is not until

the tree has practically been destroyed that the disease makes its

appearance on the surface of the bark in the form of brown patches

studded with little pustules that carry the spores. When once

girdled, the tree is killed above the point of infection and

everything above dies, while some of the twigs below may live until

they are attacked individually by the disease or until the trunk

below their origin is infected.

All species of chestnut trees are subject to the disease. The

Japanese and Spanish varieties appear to be highly resistant, but

are not immune. Other species of trees besides chestnuts are not

subject to the disease.

[Illustration: FIG. 111.--Chestnut Trees Killed by the Chestnut

Disease.]

There is no remedy or preventive for this disease. From the nature

of its attack, which is on the inner layer of the tree, it is

evident that all applications of fungicides, which must necessarily

be applied to the outside of the tree, will not reach the disease.

Injections are impossible and other suggested remedies, such as

boring holes in the wood for the purpose of inserting chemicals, are

futile.

The wood of the chestnut tree, within three or four years after its

death, is still sound and may be used for telephone and telegraph

poles, posts, railroad ties, lumber and firewood.

Spraying for fungous diseases: Where a fungous disease is attacking the

leaves, fruit, or twigs, spraying with Bordeaux mixture may prove

effective. The application of Bordeaux mixture is deterrent rather

than remedial, and should therefore be made immediately before the

disease appears. The nature of the disease and the time of treatment

can be determined without cost, by submitting specimens of affected

portions of the plant for analysis and advice to the State

Agricultural Experiment Station or to the United States Department

of Agriculture.

Bordeaux mixture, the standard fungicide material, consists of a

solution of 6 pounds of copper sulphate (blue vitriol) with 4 pounds

of slaked lime in 50 gallons of water. It may be purchased in

prepared form in the open market, and when properly made, has a

brilliant sky-blue color. Spraying with Bordeaux mixture should be

done in the fall, early spring, or early summer, but never during

the period when the trees are in bloom.

STUDY III. PRUNING TREES

FUNDAMENTAL PRINCIPLES

Trees are very much like human beings in their requirements, mode of

life and diseases, and the general principles applicable to the care of

one are equally important to the intelligent treatment of the other. The

removal of limbs from trees, as well as from human beings, must be done

sparingly and judiciously. Wounds, in both trees and human beings, must

be disinfected and dressed to keep out all fungus or disease germs.

Fungous growths of trees are similar to human cancers, both in the

manner of their development and the surgical treatment which they

require. Improper pruning will invite fungi and insects to the tree,

hence the importance of a knowledge of fundamental principles in this

branch of tree care.

[Illustration: FIG. 112.--A Tree Pruned Improperly and too Severely.]

Time: Too much pruning at one time should never be practiced (Fig. 112),

and no branch should be removed from a tree without good reason for

so doing. Dead and broken branches should be removed as soon as

observed, regardless of any special pruning season, because they are

dangerous, unsightly and carry insects and disease into the heart of

the tree. But all other pruning, whether it be for the purpose of

perfecting the form in shade trees, or for increasing the production

of fruit in orchard trees, should be confined to certain seasons.

Shade and ornamental trees can best be pruned in the fall, while the

leaves are still on the tree and while the tree itself is in

practically a dormant state.

Proper cutting: All pruning should be commenced at the top of the tree

and finished at the bottom. A shortened branch (excepting in poplars

and willows, which should be cut in closely) should terminate in

small twigs which may draw the sap to the freshly cut wound; where a

branch is removed entirely, the cut should be made-close and even

with the trunk, as in Fig. 113. Wherever there is a stub left after

cutting off a branch, the growing tissue of the tree cannot cover it

and the stub eventually decays, falls out and leaves a hole (see

Fig. 114), which serves to carry disease and insects to the heart of

the tree. This idea of close cutting cannot be over-emphasized.

Where large branches have to be removed, the splitting and ripping

of the bark along the trunk is prevented by making one cut beneath

the branch, about a foot or two away from the trunk, and then

another above, close to the trunk.

[Illustration: FIG. 113.--Branches Properly Cut Close to the Trunk.]

Too severe pruning: In pruning trees, many people have a tendency to cut

them back so severely as to remove everything but the bare trunk and

a few of the main branches. This process is known as "heading

back." It is a method, however, which should not be resorted to

except in trees that are very old and failing, and even there only

with certain species, like the silver maple, sycamore, linden and

elm. Trees like the sugar maple will not stand this treatment at

all. The willow is a tree that will stand the process very readily

and the Carolina poplar must be cut back every few years, in order

to keep its crown from becoming too tall, scraggy and unsafe.

[Illustration: FIG. 114.--A Limb Improperly Cut. Note how the stub is

decaying and the resulting cavity is becoming diseased.]

Covering wounds: The importance of immediately covering all wounds with

coal tar cannot be overstated. If the wound is not tarred, the

exposed wood cracks, as in Fig. 115, providing suitable quarters for

disease germs that will eventually destroy the body of the tree.

Coal tar is by far preferable to paint and other substances for

covering the wound. The tar penetrates the exposed wood, producing

an antiseptic as well as a protective effect. Paint only forms a

covering, which may peel off in course of time and which will later

protrude from the cut, thus forming, between the paint and the wood,

a suitable breeding place for the development of destructive fungi

or disease. The application of tin covers, burlap, or other bandages

to the wound is equally futile and in most cases even injurious.

[Illustration: FIG. 115.--Result of a Wound not Covered with Coal Tar.

The exposed wood cracked and decay set in.]

SPECIAL CONSIDERATIONS

Pruning shade trees: Here, the object is to produce a symmetrical crown

and to have the lowest branches raised from the ground sufficiently

high to enable pedestrians to pass under with raised umbrellas. Such

pruning should, therefore, necessarily be light and confined to the

low limbs and dead branches.

Pruning lawn trees: Here the charm of the tree lies in the low reach of

the branches and the compactness of the crown. The pruning should,

therefore, be limited to the removal of dead and diseased branches

only.

Pruning forest trees: Forest trees have a greater commercial value when

their straight trunks are free from branches. In the forest, nature

generally accomplishes this result and artificial pruning seldom has

to be resorted to. Trees in the forest grow so closely together that

they shut out the sunlight from their lower limbs, thus causing the

latter to die and fall off. This is known as natural pruning. In

some European forests, nature is assisted in its pruning by workmen,

who saw off the side branches before they fall of their own accord;

but in this country such practice would be considered too expensive,

hence it is seldom adopted.

TOOLS USED IN PRUNING

Good tools are essential for quick and effective work in pruning. Two or

three good saws, a pair of pole-shears, a pole-saw, a 16-foot single

ladder, a 40-foot extension ladder of light spruce or pine with hickory

rungs, a good pruning knife, plenty of coal tar, a fire-can to heat the

tar, a pole-brush, a small hand brush and plenty of good rope comprise

the principal equipment of the pruner.

SUGGESTIONS FOR THE SAFETY OF TREE CLIMBERS

1. Before climbing a tree, judge its general condition. The trunk of a

tree that shows age, disease, or wood-destroying insects generally has

its branches in an equally unhealthy condition.

2. The different kinds of wood naturally differ in their strength and

elasticity. The soft and brash woods need greater precautions than the

strong and pliable ones. The wood of all the poplars, the ailanthus, the

silver maple and the chestnut, catalpa and willow is either too soft or

too brittle to be depended upon without special care. The elm, hickory

and oak have strong, flexible woods and are, therefore, safer than

others. The red oak is weaker than the other oaks. The sycamore and

beech have a tough, cross-grained wood which is fairly strong. The

linden has a soft wood, while the ash and gum, though strong and

flexible, are apt to split.

3. Look out for a limb that shows fungous growths. Every fungus sends

fibers into the main body of the limb which draw out its sap. The

interior of the branch then loses its strength and becomes like a

powder. Outside appearances sometimes do not show the interior

condition, but one should regard a fungus as a danger sign.

4. When a limb is full of holes or knots, it generally indicates that

borers have been working all kinds of galleries through it, making it

unsafe. The silver maple and sycamore maple are especially subject to

borers which, in many cases, work on the under side of the branch so

that the man in the tree looking down cannot see its dangerous

condition.

5. A dead limb with the bark falling off indicates that it died at least

three months before and is, therefore, less safe than one with its bark

tightly adhering to it.

6. Branches are more apt to snap on a frosty day when they are covered

with an icy coating than on a warm summer day.

7. Always use the pole-saw and pole-shears on the tips of long branches,

and use the pole-hook in removing dead branches of the ailanthus and

other brittle trees where it would be too dangerous to reach them

otherwise.

8. Be sure of the strength of a branch before tying an extension ladder

to it.

STUDY IV. TREE REPAIR

Where trees have been properly cared for from their early start, wounds

and cavities and their subsequent elaborate treatment have no place. But

where trees have been neglected or improperly cared for, wounds and

cavities are bound to occur and early treatment becomes a necessity.

There are two kinds of wounds on trees: (1) surface wounds, which do not

extend beyond the inner bark, and (2) deep wounds or cavities, which may

range from a small hole in a crotch to the hollow of an entire trunk.

Surface wounds: Surface wounds (Fig. 116) are due to bruised bark, and a

tree thus injured can no longer produce the proper amount of foliage

or remain healthy very long. The reason for this becomes very

apparent when one looks into the nature of the living or active

tissue of a tree and notes how this tissue becomes affected by such

injuries.

[Illustration: FIG. 116.--A Surface Wound Properly Freed from Decayed

Wood and Covered with Coal Tar.]

This living or active tissue is known as the "cambium layer," and is

a thin tissue situated immediately under the bark. It must

completely envelop the stem, root and branches of the trees. The

outer bark is a protective covering to this living layer, while the

entire interior wood tissue chiefly serves as a skeleton or support

for the tree. The cambium layer is the real, active part of the

tree. It is the part which transmits the sap from the base of the

tree to its crown; it is the part which causes the tree to grow by

the formation of new cells, piled up in the form of rings around the

heart of the tree; and it is also the part which prevents the

entrance of insects and disease to the inner wood. From this it is

quite evident that any injury to the bark, and consequently to this

cambium layer alongside of it, will not only cut off a portion of

the sap supply and hinder the growth of the tree to an extent

proportional to the size of the wound, but will also expose the

inner wood to the action of decay. The wound may, at first, appear

insignificant, but, if neglected, it will soon commence to decay

and thus to carry disease and insects into the tree. The tree then

becomes hollow and dangerous and its life is doomed.

Injury to the cambium layer, resulting in surface wounds, may be due

to the improper cutting of a branch, to the bite of a horse, to the

cut of a knife or the careless wielding of an axe, to the boring of

an insect, or to the decay of a fungous disease. (See Fig. 117.)

Whatever the cause, \_the remedy lies in cleaning out all decayed

wood, removing the loose bark and covering the exposed wood with

coal tar\_.

In cutting off the loose bark, the edges should be made smooth

before the coal tar is applied. Loose bark, put back against a tree,

will never grow and will only tend to harbor insects and disease.

Bandages, too, are hurtful because, underneath the bandage, disease

will develop more rapidly than where the wound is exposed to the sun

and wind. The application of tin or manure to wounds is often

indulged in and is equally injurious to the tree. The secret of all

wound treatment is to keep the wound \_smooth, clean\_ to the live

tissue, \_and well covered\_ with coal tar.

The chisel or gouge is the best tool to employ in this work. A sharp

hawk-billed knife will be useful in cutting off the loose bark. Coal

tar is the best material for covering wounds because it has both an

antiseptic and a protective effect on the wood tissue. Paint, which

is very often used as a substitute for coal tar, is not as

effective, because the paint is apt to peel in time, thus allowing

moisture and disease to enter the crevice between the paint and the

wood.

[Illustration: FIG. 117.--A Neglected Surface Wound. Note the rough

surface of the wound, the want of a coal tar covering and the fungous

growth that followed.]

Cavities: Deep wounds and cavities are generally the result of stubs

that have been permitted to rot and fall out. Surface wounds allowed

to decay will deepen in course of time and produce cavities.

Cavities in trees are especially susceptible to the attack of

disease because, in a cavity, there is bound to exist an

accumulation of moisture. With this, there is also considerable

darkness and protection from wind and cold, and these are all ideal

conditions for the development of disease.

The successful application of a remedy, in all cavity treatment,

hinges on this principal condition--\_that all traces of disease

shall be entirely eliminated before treatment is commenced\_.

Fungous diseases attacking a cavity produce a mass of fibers, known

as the "mycelium," that penetrate the body of the tree or limb on

which the cavity is located. In eliminating disease from a cavity,

it is, therefore, essential to go \_beyond\_ the mere decaying surface

and to cut out all fungous fibers that radiate into the interior of

the tree. Where these fibers have penetrated so deeply that it

becomes impossible to remove every one of them, the tree or limb

thus affected had better be cut down. (Fig. 118.) The presence of

the mycelium in wood tissue can readily be told by the discolored

and disintegrated appearance of the wood.

The filling in a cavity, moreover, should serve to prevent the

accumulation of water and, where a cavity is perpendicular and so

located that the water can be drained off without the filling, the

latter should be avoided and the cavity should merely be cleaned out

and tarred. (Fig. 116.) Where the disease can be entirely

eliminated, where the cavity is not too large, and where a filling

will serve the practical purpose of preventing the accumulation of

moisture, the work of filling should be resorted to.

[Illustration: FIG. 118.--A Cavity Filled in a Tree that Should Have

Been Cut Down. Note how the entire interior is decayed and how the tree

fell apart soon after treatment.]

Filling should be done in the following manner: First, the interior

should be thoroughly freed from diseased wood and insects. The

chisel, gouge, mall and knife are the tools, and it is better to

cut deep and remove every trace of decayed wood than it is to leave

a smaller hole in an unhealthy state. The inner surface of the

cavity should then be covered with a coat of white lead paint, which

acts as a disinfectant and helps to hold the filling. Corrosive

sublimate or Bordeaux mixture may be used as a substitute for the

white lead paint. A coat of coal tar over the paint is the next

step. The cavity is then solidly packed with bricks, stones and

mortar as in Fig. 119, and finished with a layer of cement at the

mouth of the orifice. This surface layer of cement should not be

brought out to the same plane with the outer bark of the tree, but

should rather recede a little beyond the growing tissue (cambium

layer) which is situated immediately below the bark, Fig. 120. In

this way the growing tissue will be enabled to roll over the cement

and to cover the whole cavity if it be a small one, or else to grow

out sufficiently to overlap the filling and hold it as a frame holds

a picture. The cement is used in mixture with sand in the proportion

of one-third of cement to two-thirds of sand. When dry, the outer

layer of cement should be covered with coal tar to prevent cracking.

[Illustration: FIG. 119.--A Cavity in the Process of being Filled.]

[Illustration: FIG. 120--The Same Cavity Properly Filled.]

Trees that tend to split: Certain species of trees, like the linden and

elm, often tend to split, generally in the crotch of several limbs

and sometimes in a fissure along the trunk of the tree. Midwinter is

the period when this usually occurs and timely action will save the

tree. The remedy lies in fastening together the various parts of the

tree by means of bolts or chains.

A very injurious method of accomplishing this end is frequently

resorted to, where each of the branches is bound by an iron band and

the bands are then joined by a bar. The branches eventually outgrow

the diameter of the bands, causing the latter to cut through the

bark of the limbs and to destroy them.

Another method of bracing limbs together consists in running a

single bolt through them and fastening each end of the bolt with a

washer and nut. This method is preferable to the first because it

allows for the growth of the limbs in thickness.

[Illustration: FIG. 121.--Diagram Showing the Triple-bar Method of

Fastening Limbs.]

A still better method, however, consists in using a bar composed of

three parts as shown in Fig. 121. Each of the two branches has a

short bolt passed through it horizontally, and the two short bolts

are then connected by a third bar. This arrangement will shift all

the pressure caused by the swaying of the limbs to the middle

connecting-bar. In case of a windstorm, the middle bar will be the

one to bend, while the bolts which pass through the limbs will

remain intact. The outer ends of the short bolts should have their

washers and nuts slightly embedded in the wood of the tree, so that

the living tissue of the tree may eventually grow over them in such

a way as to hold the bars firmly in place and to exclude moisture

and disease. The washers and nuts on the inner side of the limbs

should also be embedded.

A chain is sometimes advantageously substituted for the middle

section of the bar and, in some cases, where more than two branches

have to be joined together, a ring might take the place of the

middle bar or chain.

Bolts on a tree detract considerably from its natural beauty and

should, therefore, be used only where they are absolutely necessary

for the safety of the tree. They should be placed as high up in the

tree as possible without weakening the limbs.

CHAPTER VII

FORESTRY

STUDY I. WHAT FORESTRY IS AND WHAT IT DOES

Although Forestry is not a new idea but, as a science and an art, has

been applied for nearly two thousand years, there are many persons who

still need an explanation of its aims and principles.

Forestry deals with the establishment, protection and utilization of

forests.

By establishment, is meant the planting of new forests and the cutting

of mature forests, in such a way as to encourage a natural growth of new

trees without artificial planting or seeding. The planting may consist

of sowing seed, or of setting out young trees. The establishment of a

forest by cutting may consist of the removal of all mature trees and

dependence upon the remaining stumps to reproduce the forest from

sprouts, or it may consist of the removal of only a portion of the

mature trees, thus giving the young seedlings on the ground room in

which to grow.

By protection, is meant the safeguarding of the forest from fire, wind,

insects, disease and injury for which man is directly responsible. Here,

the forester also prevents injury to the trees from the grazing and

browsing of sheep and goats, and keeps his forest so well stocked that

no wind can uproot the trees nor can the sun dry up the moist forest

soil.

[Illustration: FIG. 122.--A Forest of Bull Pine Cut on Forestry

Principles. (Photograph taken on the Black Hills National Forest, South

Dakota.)]

By utilization, is meant the conservative and intelligent harvesting of

the forest, with the aim of obtaining the greatest amount of product

from a given area, with the least waste, in the quickest time, and

without the slightest deterioration of the forest as a whole. The

forester cuts his mature trees, only, and generally leaves a sufficient

number on the ground to preserve the forest soil and to cast seed for

the production of a new crop. In this way, he secures an annual output

without hurting the forest itself. He studies the properties and values

of the different woods and places them where they will be most useful.

He lays down principles for so harvesting the timber and the

by-products of the forest that there will be the least waste and injury

to the trees which remain standing. He utilizes the forest, but does not

cut enough to interfere with the neighboring water-sheds, which the

forests protect.

[Illustration: 123.--A White Pine Plantation, in Rhode Island, Where the

Crowns of the Trees Have Met. The trees are fifteen years old and in

many cases every other tree had to be removed.]

Forestry, therefore, deals with a vast and varied mass of information,

comprising all the known facts relating to the life of a forest. It does

not deal with the individual tree and its planting and care,--that would

be arboriculture. Nor does it consider the grouping of trees for

aesthetic effect,--that would be landscape gardening. It concerns itself

with the forest as a community of trees and with the utilization of the

forest on an economic basis.

Each one of these activities in Forestry is a study in itself and

involves considerable detail, of which the reader may obtain a general

knowledge in the following pages. For a more complete discussion, the

reader is referred to any of the standard books on Forestry.

The life and nature of a forest: When we think of a forest we are apt to

think of a large number of individual trees having no special

relationship to each other. Closer observation, however, will reveal

that the forest consists of a distinct group of trees, sufficiently

dense to form an unbroken canopy of tops, and that, where trees grow

so closely together, they become very interdependent. It is this

interdependence that makes the forest different from a mere group of

trees in a park or on a lawn. In this composite character, the

forest enriches its own soil from year to year, changes the climate

within its own bounds, controls the streams along its borders and

supports a multitude of animals and plants peculiar to itself. This

communal relationship in the life history of the forest furnishes a

most interesting story of struggle and mutual aid. Different trees

have different requirements with regard to water, food and light.

Some need more water and food than others, some will not endure much

shade, and others will grow in the deepest shade. In the open, a

tree, if once established, can meet its needs quite readily and,

though it has to ward off a number of enemies, insects, disease and

windstorm--its struggle for existence is comparatively easy. In the

forest, the conditions are different. Here, the tree-enemies have to

be battled with, just as in the open, and in addition, instead of

there being only a few trees on a plot of ground, there are

thousands growing on the same area, all demanding the same things

out of a limited supply. The struggle for existence, therefore,

becomes keen, many falling behind and but few surviving.

[Illustration: FIG. 124.--Measuring the Diameter of a Tree and Counting

its Annual Rings.]

This struggle begins with the seed. At first there are thousands of

seeds cast upon a given area by the neighboring trees or by the

birds and the winds. Of these, only a few germinate; animals feed on

some of them, frost nips some and excessive moisture and unfavorable

soil conditions prevent others from starting. The few successful

ones soon sprout into a number of young trees that grow thriftily

until their crowns begin to meet. When the trees have thus met, the

struggle is at its height. The side branches encroach upon each

other (Fig. 123), shut out the light without which the branches

cannot live, and finally kill each other off. The upper branches vie

with one another for light, grow unusually fast, and the trees

increase in height with special rapidity. This is nature's method of

producing clear, straight trunks which are so desirable for poles

and large timber. In this struggle for dominance, some survive and

tower above the others, but many become stunted and fail to grow,

while the majority become entirely overtopped and succumb in the

struggle; see Fig. 139.

But in this strife there is also mutual aid. Each tree helps to

protect its neighbors against the danger of being uprooted by the

wind, and against the sun, which is liable to dry up the rich soil

around the roots. This soil is different from the soil on the open

lawn. It consists of an accumulation of decayed leaves mixed with

inorganic matter, forming, together, a rich composition known as

\_humus\_. The trees also aid each other in forming a close canopy

that prevents the rapid evaporation of water from the ground.

The intensity of these conditions will vary a great deal with the

composition of the forest and the nature and habits of the

individual trees. By composition, or type of forest, is meant the

proportion in which the various species of trees are grouped; i.e.,

whether a certain section of woodland is composed of one species or

of a mixture of species. By habit is meant the requirements of the

trees for light, water and food.

[Illustration: FIG. 125.--Mountain Slopes in North Carolina Well Covered

with Forests.]

Some trees will grow in deep shade while others will demand the

open. In the matter of water and food, the individual requirements

of different trees are equally marked.

The natural rapidity of growth of different species is also

important, and one caring for a forest must know this rate of

growth, not only as to the individual species, but also with respect

to the forest as a whole. If he knows how fast the trees in a

forest grow, both in height and diameter, he will know how much

wood, in cubic feet, the forest produces in a year, and he can then

determine how much he may cut without decreasing the capital stock.

The rate of growth is determined in this way: A tree is cut and the

rings on the cross-section surface are counted and measured; see

Fig. 124. Each ring represents one year's growth. The total number

of rings will show the age of the tree. By a study of the rings of

the various species of trees on a given plot, the rate of growth of

each species in that location can be ascertained and, by knowing the

approximate number of trees of each species on the forest area, the

rate of growth of the whole forest for any given year can be

determined.

[Illustration: FIG. 126.--Bottom Lands Buried in Waste from Deforested

Mountains. Wu-t'ai-shan, Shan-si Province, China.]

[Illustration: FIG. 127.--Eroded Slope in Western North Carolina.]

Forests prevent soil erosion and floods: Forests help to regulate the

flow of streams and prevent floods. Most streams are bordered by

vast tracts of forest growths. The rain that falls on these forest

areas is absorbed and held by the forest soil, which is permeated

with decayed leaves, decayed wood and root fibers. The forest floor

is, moreover, covered with a heavy undergrowth and thus behaves like

a sponge, absorbing the water that falls upon it and then permitting

it to ooze out gradually to the valleys and rivers below. A forest

soil will retain one-half of its own quantity of water; i.e., for

every foot in depth of soil there can be six inches of water and,

when thus saturated, the soil will act as a vast, underground

reservoir from which the springs and streams are supplied (Fig.

125). Cut the forest down and the land becomes such a desert as is

shown in Fig. 126. The soil, leaves, branches and fallen trees dry

to dust, are carried off by the wind and, with the fall of rain, the

soil begins to wash away and gullies, such as are shown in Fig. 127,

are formed. Streams generally have their origins in mountain slopes

and there, too, the forests, impeding the sudden run off of the

water which is not immediately absorbed, prevent soil erosion.

[Illustration: FIG. 128.--Flood in Pittsburgh, Pa.]

Where the soil is allowed to wash off, frequent floods are

inevitable. Rain which falls on bare slopes is not caught by the

crowns of trees nor held by the forest floor. It does not sink into

the ground as readily as in the forest. The result is that a great

deal of water reaches the streams in a short time and thus hastens

floods. At other periods the streams are low because the water which

would have fed them for months has run off in a few days. The farms

are the first to suffer from the drouths that follow and, during the

period of floods, whole cities are often inundated. Fig. 128 shows

such a scene. The history of Forestry is full of horrible incidents

of the loss of life and property from floods which are directly

traceable to the destruction of the local forests and, on the other

hand, there are many cases on record where flood conditions have

been entirely obviated by the planting of forests. France and

Germany have suffered from inundations resulting from forest

devastation and, more than a hundred years ago, both of these

countries took steps to reforest their mountain slopes, and thereby

to prevent many horrible disasters.

[Illustration: FIG. 129.--Planting a Forest with Seedling Trees on the

Nebraska National Forest. The man on the right is placing the tree in a

slit just made with the spade. The man on the left is shoveling the dry

sand from the surface before making the slit for the tree.]

[Illustration: FIG. 130.--Diagrammatic Illustration of a Selection

Forest.]

How forests are established: New forests may be started from seed or

from shoots, or suckers. If from seed, the process may be carried on

in one of three ways:

First, by sowing the seed directly on the land.

Second, by first raising young trees in nurseries and later setting

them out in their permanent locations in the forest. This method is

applicable where quick results are desired, where the area is not

too large, or in treeless regions and large open gaps where there

is little chance for new trees to spring up from seed furnished by

the neighboring trees. It is a method extensively practiced abroad

where some of the finest forests are the result. The U.S.

government, as well as many of the States, maintain forest-tree

nurseries where millions of little trees are grown from seed and

planted out on the National and State forests. Fig. 129 shows men

engaged in this work. The fundamental principles of starting and

maintaining a nursery have already been referred to in the chapter

on "What Trees to Plant and How."

The third method of establishing a forest from seed is by cutting

the trees in the existing forest so that the seed falling from the

remaining trees will, with the addition of light and space, readily

take root and fill in the gaps with a vigorous growth of trees,

without artificial seeding or planting. This gives rise to several

methods of cutting or harvesting forests for the purpose of

encouraging natural reproduction. The cutting may extend to single

trees over the whole area or over only a part of the whole area.

Where the cutting is confined to single trees, the system is known

as the "Selection System," because the trees are selected

individually, with a view to retaining the best and most vigorous

stock and removing the overcrowding specimens and those that are

fully mature or infested with disease or insects.

Fig. 130 is a diagrammatic illustration of the operation of this

system. In another system the cutting is done in groups, or in

strips, and the number of areas of the groups or strips is extended

from time to time until the whole forest is cleared. This system is

illustrated in Fig. 131. Still another method consists in

encouraging trees which will thrive in the shade, such as the beech,

spruce and hemlock, to grow under light-demanding trees like the

pine. This system presents a "two-storied" forest and is known by

that name. The under story often has to be established by planting.

[Illustration: FIG. 131.--Diagrammatic Illustration of the Group or

Strip System.]

In the system of reproducing forests from shoots or suckers, all

trees of a certain species on a given area are cut off and the old

stumps and roots are depended upon to produce a new set of sprouts,

the strongest of which will later develop into trees. The coniferous

trees do not lend themselves at all to this system of treatment,

and, among the broadleaf trees, the species vary in their ability to

sprout. Some, like the chestnut and poplar, sprout profusely; others

sprout very little.

How forests are protected: Forestry also tries to protect the forests

from many destructive agencies. Wasteful lumbering and fire are the

worst enemies of the forest. Fungi, insects, grazing, wind, snow and

floods are the other enemies.

[Illustration: FIG. 132.--The Result of a Forest Fire. The trees,

lodgepole pine and Englemann spruce, are all dead and down. Photograph

taken in the Colorado National Forest, Colorado.]

By wasteful lumbering is meant that the forest is cut with no regard

for the future and with considerable waste in the utilization of the

product. Conservative lumbering, which is the term used by foresters

to designate the opposite of wasteful lumbering, will be described

more fully later in this study.

Protection from fire is no less important than protection from

wasteful lumbering. Forest fires are very common in this country and

cause incalculable destruction to life and property; see Fig. 132.

From ten to twelve million acres of forest-land are burnt over

annually and the timber destroyed is estimated at fifty millions of

dollars. The history of Forestry abounds in tales of destructive

fires, where thousands of persons have been killed or left

destitute, whole towns wiped out, and millions of dollars in

property destroyed. In most cases, these uncontrollable fires

started from small conflagrations that could readily, with proper

fire-patrol, have been put out.

There are various ways of fighting fires, depending on the character

of the fire,--whether it is a surface fire, burning along the

surface layer of dry leaves and small ground vegetation, a ground

fire, burning below the surface, through the layer of soil and

vegetable matter that generally lines the forest floor, or a top

fire, burning high up in the trees.

When the fire runs along the surface only, the injury extends to the

butts of the trees and to the young seedlings. Such fires can be put

out by throwing dirt or sand over the fire, by beating it, and,

sometimes, by merely raking the leaves away.

Ground fires destroy the vegetable mold which the trees need for

their sustenance. They progress slowly and kill or weaken the roots

of the trees.

[Illustration: FIG. 133.--A Top Fire near Bear Canyon, Arizona.]

Top fires, Fig. 133, are the most dangerous, destroying everything

in their way. They generally develop from surface fires, though

sometimes they are started by lightning. They are more common in

coniferous forests, because the leaves of hardwoods do not burn so

readily. Checking the progress of a top fire is a difficult matter.

Some fires will travel as rapidly as five miles an hour, and the

heat is terrific. The only salvation for the forest lies, in many

cases, in a sudden downpour of rain, a change of wind, or some

barrier which the fire cannot pass. A barrier of this kind is often

made by starting another fire some distance ahead of the principal

one, so that when the two fires meet, they will die out for want of

fuel. In well-kept forests, strips or lanes, free from inflammable

material, are often purposely made through the forest area to

furnish protection against top fires. Carefully managed forests are

also patrolled during the dry season so that fires may be detected

and attacked in their first stages. Look-out stations, watch-towers,

telephone-connections and signal stations are other means frequently

resorted to for fire protection and control. Notices warning campers

and trespassers against starting fires are commonly posted in such

forests. (Fig. 143.)

[Illustration: FIG. 134.--Sheep Grazing on Holy Cross National Forest,

Colorado. The drove consists of 1600 sheep, of which only part are shown

in the photograph.]

The grazing of sheep, goats and cattle in the forest is another

important source of injury to which foresters must give attention.

In the West this is quite a problem, for, when many thousands of

these animals pass through a forest (Fig. 134), there is often very

little young growth left and the future reproduction of the forest

is severely retarded. Grazing on our National Forests is regulated

by the Government.

As a means of protection against insects and fungi, all trees

infested are removed as soon as observed and in advance of all

others, whenever a lumbering operation is undertaken.

[Illustration: FIG. 135.--A Typical Montana Sawmill.]

How forests are harvested: Forestry and forest preservation require that

a forest should be cut and not merely held untouched. But it also

demands that the cutting shall be done on scientific principles, and

that only as much timber shall be removed in a given time as the

forest can produce in a corresponding period. After the cutting, the

forest must be left in a condition to produce another crop of

timber within a reasonable time: see Fig. 122. These fundamental

requirements represent the difference between conservative lumbering

and ordinary lumbering. Besides insuring a future supply of timber,

conservative lumbering, or lumbering on forestry principles, also

tends to preserve the forest floor and the young trees growing on

it, and to prevent injury to the remaining trees through fire,

insects and disease. It provides for a working plan by which the

kind, number and location of the trees to be cut are specified, the

height of the stumps is stipulated and the utilization of the wood

and by-products is regulated.

Conservative lumbering provides that the trees shall be cut as near

to the ground as possible and that they shall be felled with the

least damage to the young trees growing near by. The branches of the

trees, after they have been felled, must be cut and piled in heaps,

as shown in Fig. 122, to prevent fire. When the trunks, sawed into

logs, are dragged through the woods, care is taken not to break down

the young trees or to injure the bark of standing trees. Waste in

the process of manufacture is provided against, uses are found for

the material ordinarily rejected, and the best methods of handling

and drying lumber are employed. Fig. 135 shows a typical sawmill

capable of providing lumber in large quantities.

In the utilization of the by-products of the forest, such as

turpentine and resin, Forestry has devised numerous methods for

harvesting the crops with greater economy and with least waste and

injury to the trees from which the by-products are obtained. Fig.

136 illustrates an improved method by which crude turpentine is

obtained.

[Illustration: FIG. 136.--Gathering Crude Turpentine by the Cup and

Gutter Method. This system, devised by foresters, saves the trees and

increases the output.]

Forestry here and abroad: Forestry is practiced in every civilized

country except China and Turkey. In Germany, Forestry has attained,

through a long series of years, a remarkable state of scientific

thoroughness and has greatly increased the annual output of the

forests of that country.

In France, Switzerland, Austria, Hungary, Norway, Sweden, Russia

and Denmark, Forestry is also practiced on scientific principles and

the government in each of these countries holds large tracts of

forests in reserve. In British India one finds a highly efficient

Forest Service and in Japan Forestry is receiving considerable

attention.

In the United States, the forest areas are controlled by private

interests, by the Government and by the States. On privately owned

forests, Forestry is practiced only in isolated cases. The States

are taking hold of the problem very actively and in many of them we

now find special Forestry Commissions authorized to care for vast

areas of forest land reserved for State control. These Commissions

employ technically trained foresters who not only protect the State

forests, but also plant new areas, encourage forest planting on

private lands and disseminate forestry information among the

citizens. New York State has such a Commission that cares for more

than a million acres of forest land located in the northern part of

the State. Many other States are equally progressive.

The United States Government is the most active factor in the

preservation of our forests. The Government to-day owns over two

hundred million acres of forest land, set aside as National Forests.

There are one hundred and fifty individual reserves, distributed as

shown in Fig. 137 and cared for by the Forest Service, a bureau in

the Department of Agriculture. Each of the forests is in charge of a

supervisor. He has with him a professional forester and a body of

men who patrol the tract against fire and the illegal cutting of

timber. Some of the men are engaged in planting trees on the open

areas and others in studying the important forest problems of the

region. Fig. 138.

[Illustration: FIG. 137.--Map Showing Our National Forests.]

[Illustration: FIG. 138.--Government Foresters in Missouri Studying the

Growth and Habits of Trees. They are standing in water three feet deep.]

Where cutting is to be done on a National Forest, the conditions are

investigated by a technically trained forester and the cutting is

regulated according to his findings. Special attention is given to

discovering new uses for species of trees which have hitherto been

considered valueless, and the demand upon certain rare species is

lessened by introducing more common woods which are suitable for use

in their place.

Aside from the perpetuation of the national forests, the U.S.

Forest Service also undertakes such tree studies as lie beyond the

power or means of private individuals. It thus stands ready to

cooperate with all who need assistance.

STUDY II. CARE OF THE WOODLAND

Almost every farm, large private estate or park has a wooded area for

the purpose of supplying fuel or for enhancing the landscape effect of

the place. In most instances these wooded areas are entirely neglected

or are so improperly cared for as to cause injury rather than good. In

but very few cases is provision made for a future growth of trees after

the present stock has gone. Proper attention will increase and

perpetuate a crop of good trees just as it will any other crop on the

farm, while the attractiveness of the place may be greatly enhanced

through the intelligent planting and care of trees.

How to judge the conditions: A close examination of the wooded area may

reveal some or all of the following unfavorable conditions:

The trees may be so crowded that none can grow well. A few may have

grown to large size but the rest usually are decrepit, and

overtopped by the larger trees. They are, therefore, unable, for the

want of light and space, to develop into good trees. Fig. 139 shows

woodland in such condition.

[Illustration: FIG. 139.--Woodland which Needs Attention. The trees are

overcrowded.]

There may also be dead and dying trees, trees infested with

injurious insects and fungi and having any number of decayed

branches. The trees may be growing so far apart that their trunks

will be covered with suckers as far down as the ground, or there may

be large, open gaps with no trees at all. Here the sun, striking

with full force, may be drying up the soil and preventing the

decomposition of the leaves. Grass soon starts to grow in these open

spaces and the whole character of the woodland changes as shown in

Figs. 140 and 141.

[Illustration: FIG. 140.--First Stage of Deterioration. The woodland is

too open and grass has taken the place of the humus cover.]

Where any of these conditions exist, the woodland requires

immediate attention. Otherwise, as time goes on, it deteriorates

more and more, the struggle for space among the crowded and

suppressed trees becomes more keen, the insects in the dying trees

multiply and disease spreads from tree to tree. Under such

conditions, the soil deteriorates and the older trees begin to

suffer.

[Illustration: FIG. 141.--Second Stage of Deterioration. The Surface

Soil of the Wooded Area Has Washed Away and the Trees Have Died.]

The attention required for the proper care of woodland may be summed

up under the four general heads of \_soil preservation\_, \_planting\_,

\_cutting\_, and \_protection\_.

Improvement by soil preservation: The soil in a wooded area can best be

preserved and kept rich by doing two things; by retaining the

fallen leaves on the ground and by keeping the ground well covered

with a heavy growth of trees, shrubs and herbaceous plants. The

fallen leaves decompose, mix with the soil and form a dark-colored

material known as \_humus\_. The humus supplies the tree with a

considerable portion of its food and helps to absorb and retain the

moisture in the soil upon which the tree is greatly dependent. A

heavy growth of trees and shrubs has a similar effect by serving to

retain the moisture in the soil.

Improvement by planting: The planting of new trees is a necessity on

almost any wooded area. For even where the existing trees are in

good condition, they cannot last forever, and provision must be made

for others to take their place after they are gone. The majority of

the wooded areas in our parks and on private estates are not

provided with a sufficient undergrowth of desirable trees to take

the place of the older ones. Thus, also, the open gaps must be

planted to prevent the soil from deteriorating.

Waste lands on farms which are unsuited for farm crops often offer

areas on which trees may profitably be planted. These lands are

sufficiently good in most cases to grow trees, thus affording a

means of turning into value ground which would otherwise be

worthless. It has been demonstrated that the returns from such

plantations at the end of fifty years will yield a six per cent

investment and an extra profit of $151.97 per acre, the expense

totaling at the end of fifty years, $307.03. The value of the land

is estimated at $4 per acre and the cost of the trees and planting

at $7 per acre. The species figured on here is white pine, one of

the best trees to plant from a commercial standpoint. With other

trees, the returns will vary accordingly.

[Illustration: FIG. 142.--A Farm Woodlot.]

The usual idea that it costs a great deal to plant several thousand

young trees is erroneous. An ordinary woodlot may be stocked with a

well-selected number of young trees at a cost less than the price

generally paid for a dozen good specimen trees for the front lawn.

It is not necessary to underplant the woodlot with big trees. The

existing big trees are there to give character to the forest and the

new planting should be done principally as a future investment and

as a means of perpetuating the life of the woodlot. Young trees are

even more desirable for such planting than the older and more

expensive ones. The young trees will adapt themselves to the local

soil and climatic conditions more easily than the older ones. Their

demand for food and moisture is more easily satisfied, and because

of their small cost, one can even afford to lose a large percentage

of them after planting.

The young plants should be two-year-old seedlings or three-year-old

"transplants."

Two-year-old seedlings are trees that have been grown from the seed

in seed beds until they reach that age. They run from two to fifteen

inches in height, depending upon the species.

Three-year-old "transplants" have been grown from the seed in seed

beds and at the end of the first or second year have been taken up

and transplanted into rows, where they grow a year or two longer.

They are usually a little taller than the two-year-old seedlings,

are much stockier and have a better root system. For this reason,

three-year-old transplants are a little more desirable as stock for

planting. They will withstand drought better than seedlings.

The best results from woodland planting are obtained with

native-grown material. Such stock is stronger, hardier and better

acclimated. Foreign-grown stock is usually a little cheaper, owing

to the fact that it has been grown abroad, under cheap labor

conditions.

The trees may be purchased from reputable dealers, of whom there are

many in this country. These dealers specialize in growing young

trees and selling them at the low cost of three to ten dollars per

thousand. In States in which a Forestry Commission has been

inaugurated, there have also been established State nurseries where

millions of little trees are grown for reforestation purposes. In

order to encourage private tree planting, the Forestry Commissions

are usually willing to sell some of these trees at cost price, under

certain conditions, to private land owners. Inquiries should be

made to the State Forestry Commission.

Great care must be taken to select the species most suitable for the

particular soil, climatic and light conditions of the woodlot. The

trees which are native to the locality and are found growing

thriftily on the woodlot, are the ones that have proven their

adaptability to the local conditions and should therefore be the

principal species used for underplanting. A list from which to

select the main stock would, therefore, vary with the locality. In

the Eastern States it would comprise the usual hardy trees like the

red, pin and scarlet oaks, the beech, the red and sugar maples, the

white ash, the tulip tree, sycamore, sweet gum and locust among the

deciduous trees; the white, Austrian, red, pitch and Scotch pines,

the hemlock and the yew among the conifers.

With the main stock well selected, one may add a number of trees and

shrubs that will give to the woodland scene a pleasing appearance at

all seasons. The brilliant autumnal tints of the sassafras,

pepperidge, blue beech, viburnum, juneberry and sumach are

strikingly attractive. The flowering dogwood along the drives and

paths will add a charm in June as well as in autumn and an

occasional group of white birch will have the same effect if planted

among groups of evergreens. Additional undergrowth of native

woodland shrubs, such as New Jersey tea, red-berried elder and

blueberry for the Eastern States, will augment the naturalness of

the scene and help to conserve the moisture in the soil.

Two or three years' growth will raise these plants above all grass

and low vegetation, and a sprinkling of laurel, rhododendron, hardy

ferns and a few intermingling colonies of native wild flowers such

as bloodroot, false Solomon's seal and columbines for the East, as

a ground cover will put the finishing touches to the forest scene.

As to methods of planting the little trees, the following

suggestions may prove of value. As soon as the plants are received,

they should be taken from the box and dipped in a thick puddle of

water and loam. The roots must be thoroughly covered with the mud.

Then the bundles into which the little trees are tied should be

loosened and the trees placed in a trench dug on a slant. The dirt

should be placed over the roots and the exposed parts of the plants

covered with brush or burlap to keep away the rays of the sun.

When ready for planting, a few plants are dug up, set in a pail with

thin mud at the bottom and carried to the place of planting. The

most economical method of planting is for one man to make the holes

with a mattock. These holes are made about a foot in diameter, by

scraping off the sod with the mattock and then digging a little hole

in the dirt underneath. A second man follows with a pail of plants

and sets a single plant in this hole with his hands, see Fig. 129,

making sure that the roots are straight and spread out on the bottom

of the hole. The dirt should then be packed firmly around the plant

and pressed down with the foot.

Improvement by cutting: The removal of certain trees in a grove is often

necessary to improve the quality of the better trees, increase their

growth, make the place accessible, and enhance its beauty. Cutting

in a wooded area should be confined to suppressed trees, dead and

dying trees and trees badly infested with insects and disease. In

case of farm woodlands, mature trees of market value may be cut, but

in parks and on private estates these have a greater value when left

standing. The cutting should leave a clean stand of well-selected

specimens which will thrive under the favorable influence of more

light and growing space. Considerable care is required to prevent

injury to the young trees when the older specimens are cut and

hauled out of the woods. The marking of the trees to be removed can

best be done in summer when the dead and live trees can be

distinguished with ease and when the requisite growing space for

each tree can be judged better from the density of the crowns. The

cutting, however, can be done most advantageously in winter.

Immediately after cutting all diseased and infested wood should be

destroyed. The sound wood may be utilized for various purposes. The

bigger logs may be sold to the local lumber dealers and the smaller

material may be used for firewood. The remaining brush should be

withdrawn from the woodlot to prevent fire during the dry summer

months.

In marking trees for removal, a number of considerations are to be

borne in mind besides the elimination of dead, diseased and

suppressed trees. When the marker is working among crowding trees of

equal height, he should save those that are most likely to grow into

fine specimen trees and cut out all those that interfere with them.

The selection must also favor trees which are best adapted to the

local soil and climatic conditions and those which will add to the

beauty of the place. In this respect the method of marking will be

different from that used in commercial forestry, where the aim is to

net the greatest profit from the timber. In pure forestry practice,

one sees no value in such species as dogwood, ironwood, juneberry,

sumac and sassafras, and will therefore never allow those to grow up

in abundance and crowd out other trees of a higher market value. But

on private estates and in park woodlands where beauty is an

important consideration, such species add wonderful color and

attractiveness to the forest scene, especially along the roads and

paths, and should be favored as much as the other hardier trees. One

must not mark too severely in one spot or the soil will be dried out

from exposure to sun and wind. When the gaps between the trees are

too large, the trees will grow more slowly and the trunks will

become covered with numerous shoots or suckers which deprive the

crowns of their necessary food and cause them to "die back." Where

the trees are tall and slim or on short and steep hillsides, it is

also important to be conservative in marking in order that the stand

may not be exposed to the dangers of windfall. No hard-and-fast rule

can be laid down as to what would constitute a conservative

percentage of trees to cut down. This depends entirely on the local

conditions and on the exposure of the woodlot. But in general it is

not well to remove more than twenty per cent of the stand nor to

repeat the cutting on the same spot oftener than once in five or six

years. The first cutting will, of course, be the heaviest and all

subsequent cuttings will become lighter and lighter until the

woodlot is put in good growing condition. On private estates and

parks, where beauty is the chief aim, the woodland should be kept as

natural, informal and as thick as possible. Where the woodland is

cut up by many paths and drives, density of vegetation will add to

the impression of depth and distance.

Protection: This subject has already been discussed considerably in the

previous study on Forestry, and here it becomes necessary merely to

add a few suggestions with special reference to private and park

woodlands.

Guarding woodlands from \_fire\_ is the most important form of

protection. Surface fires are very common on small woodland holdings

and the damage done to the standing vegetation is generally

underestimated. An ordinary ground or surface fire on a woodland

area will burn up the leaf-litter and vegetable mold, upon which the

trees depend so much for food and moisture, and will destroy the

young seedlings on the ground. Where the fire is a little more

severe, the older trees are badly wounded and weakened and the

younger trees are frequently killed outright. Insects and disease

find these trees an easy prey, and all related forest conditions

commence to deteriorate.

Constant watchfulness and readiness to meet any emergency are the

keynote of effective fire protection. Notices similar to the one

shown in Fig. 143 often help to prevent fires. It is also helpful to

institute strict rules against dropping lighted matches or tobacco,

or burning brush when the ground is very dry, or leaving smouldering

wood without waiting to see that the fire is completely out. There

should be many roads and foot-paths winding through the woodland in

order that they may serve as checks or "fire lanes" in time of fire.

These roads and paths should be kept free from brush and leaves and

should be frequently patrolled. When made not too wide,

unpretentious and in conformity with the natural surroundings, such

drives and paths can become a very interesting feature of the place,

winding through the woodland, exposing its charms and affording

opportunity for pleasant driving and walking. The borders of the

paths can be given special attention by placing the more beautiful

native shrubs in prominent positions where they can lend increased

attractiveness.

In case of fire, it should be possible to call for aid by telephone

directly from the woodland and to find within easy reach the tools

necessary to combat fire. It is also important to obtain the

co-operation of one's neighbors in protecting the adjoining

woodlands, because the dangers from insects, disease and fire

threatening one bit of woodland area are more or less dependent upon

the conditions in the adjoining woodland.

[Illustration: FIG. 143.--Poster Suitable for Private Woodlands and

Forest Parks. The translations in Italian and Polish have been used by

the writer in this particular instance to meet the local needs.]

As to other forms of protection, passing mention may be made of the

importance of keeping out cattle, sheep and hogs from the woods, of

eliminating all insects and disease, of keeping the ground free from

brush and other inflammable material, of retaining on the ground all

fallen leaves and keeping the forest well stocked with little trees

and shrubs.

Forest lands may be exempted from taxation: In New York and other States

there exists a State law providing for exemption or reduction in

taxes upon lands which are planted with forest trees or maintained

as wooded areas. The object of the law is to encourage home forestry

and to establish fairness in the agricultural land-tax law by

placing forest lands in the same category with other crop-producing

lands. For detailed information and a copy of the law, one should

address the local State Forestry Commission.

CHAPTER VIII

OUR COMMON WOODS: THEIR IDENTIFICATION, PROPERTIES AND USES

Woods have different values for various practical purposes because of

their peculiarities in structure. A knowledge of the structural parts of

wood is therefore necessary as a means of recognizing the wood and of

determining why one piece is stronger, heavier, tougher, or better

adapted for a given service than another.

Structure of wood: If one examines a cross-section of the bole of a

tree, he will note that it is composed of several distinct parts, as

shown in Fig. 145. At the very center is a small core of soft tissue

known as the \_pith\_. It is of much the same structure as the pith of

cornstalk or elder, with which all are familiar. At the outside is

the \_bark\_, which forms a protective covering over the entire woody

system. In any but the younger stems, the bark is composed of an

inner, live layer, and an outer or dead portion.

Between the pith at the center and the bark at the outside is the

wood. It will be noted that the portion next to the bark is white or

yellowish in color. This is the \_sapwood\_. It is principally through

the sapwood that the water taken in by the roots is carried up to

the leaves. In some cases the sapwood is very thin and in others it

is very thick, depending partly on the kind of tree, and partly on

its age and vigor. The more leaves on a tree the more sapwood it

must have to supply them with moisture.

[Illustration: FIG. 144.--Pine Wood. (Magnified 30 times.)]

Very young trees are all sapwood, but, as they get older, part of

the wood is no longer needed to carry sap and it becomes

\_heartwood\_. Heartwood is darker than the sapwood, sometimes only

slightly, but in other instances it may vary from a light-brown

color to jet black. It tends to fill with gums, resins, pigments and

other substances, but otherwise its structure is the same as that of

the sapwood.

[Illustration: FIG. 145.--Cross-section of Oak.]

The wood of all our common trees is produced by a thin layer of

cells just beneath the bark, the \_cambium\_. The cambium adds new

wood on the outside of that previously formed and new bark on the

inside of the old bark. A tree grows most rapidly in the spring, and

the wood formed at that time is much lighter, softer and more

porous than that formed later in the season, which is usually quite

hard and dense. These two portions, known as \_early wood\_ or spring

wood, and \_late wood\_ or summer wood, together make up one year's

growth and are for that reason called \_annual rings\_. Trees such as

palms and yucca do not grow in this way, but their wood is not

important enough in this country to warrant a description.

[Illustration: FIG. 146.--White Oak Wood. (Magnified 20 times.)]

If the end of a piece of oak wood is examined, a number of lines

will be seen radiating out toward the bark like the spokes in a

wheel. These are the \_medullary rays\_. They are present in all

woods, but only in a few species are they very prominent to the

unaided eye. These rays produce the "flakes" or "mirrors" that make

quartersawed (radially cut) wood so beautiful. They are thin plates

or sheets of cells lying in between the other wood cells. They

extend out into the inner bark.

While much may be seen with the unaided eye, better results can be

secured by the use of a good magnifying glass. The end of the wood

should be smoothed off with a very sharp knife; a dull one will

tear and break the cells so that the structure becomes obscured.

With any good hand lens a great many details will then appear which

before were not visible. In the case of some woods like oak, ash,

and chestnut, it will be found that the early wood contains many

comparatively large openings, called \_pores\_, as shown in Figs. 146

and 147. Pores are cross-sections of vessels which are little

tube-like elements running throughout the tree. The vessels are

water carriers. A wood with its large pores collected into one row

or in a single band is said to be \_ring-porous\_. Fig. 146 shows such

an arrangement. A wood with its pores scattered throughout the

year's growth instead of collected in a ring is \_diffuse-porous\_.

Maple, as shown in Fig. 152, is of this character.

[Illustration: FIG. 147.--Example of the Black Oak Group. (Quercus

coccinea.) (Magnified 20 times.)]

All of our broadleaf woods are either ring-porous or diffuse-porous,

though some of them, like the walnut, are nearly half way between

the two groups.

If the wood of hickory, for example, be examined with the magnifying

lens, it will be seen that there are numerous small pores in the

late wood, while running parallel with the annual rings are little

white lines such as are shown in Fig. 149. These are lines of \_wood

parenchyma\_. Wood parenchyma is found in all woods, arranged

sometimes in tangential lines, sometimes surrounding the pores and

sometimes distributed over the cross-section. The dark, horn-like

portions of hickory and oak are the \_woodfibers\_. They give the

strength to wood.

In many of the diffuse-porous woods, the pores are too small to be

seen with the unaided eye, and in some cases they are not very

distinct even when viewed with a magnifier. It is necessary to study

such examples closely in order not to confuse them with the woods of

conifers.

The woods of conifers are quite different in structure from

broadleaf woods, though the difference may not always stand out

prominently. Coniferous woods have no pores, their rays are always

narrow and inconspicuous, and wood parenchyma is never prominent.

The woods of the pines, spruces, larches, and Douglas fir differ

from those of the other conifers in having \_resin ducts\_, Fig. 144.

In pines these are readily visible to the naked eye, appearing as

resinous dots on cross-sections and as pin scratches or dark lines

on longitudinal surfaces. The presence or absence of resin ducts is

a very important feature in identifying woods, hence it is very

important to make a careful search for them when they are not

readily visible.

How to identify a specimen of wood: The first thing to do in identifying

a piece of wood is to cut a smooth section at the end and note

(without the magnifier) the color, the prominence of the rays and

pores, and any other striking features. If the pores are readily

visible, the wood is from a broadleaf tree; if the large pores are

collected in a ring it belongs to the ring-porous division of the

broadleaf woods. If the rays are quite conspicuous and the wood is

hard and heavy, it is oak, as the key given later will show. Close

attention to the details of the key will enable one to decide to

what group of oaks it belongs.

In most cases the structure will not stand out so prominently as in

oak, so that it is necessary to make a careful study with the hand

lens. If pores appear, their arrangement, both in the early wood and

in the late wood, should be carefully noted; also whether the pores

are open or filled with a froth-like substance known as \_tyloses\_.

Wood parenchyma lines should be looked for, and if present, the

arrangement of the lines should be noted.

[Illustration: FIG. 148.--(Magnified about 8 times.)]

If no pores appear under the magnifying lens, look closely for resin

ducts. If these are found, note whether they are large or small,

numerous or scattered, open or closed, lighter or darker than the

wood. Note also whether the late wood is very heavy and hard,

showing a decided contrast to the early wood, or fairly soft and

grading into the early wood without abrupt change. Weigh the piece

in your hand, smell a fresh-cut surface to detect the odor, if any,

and taste a chip to see if anything characteristic is discoverable.

Then turn to the following key:

KEY

I. WOODS WITHOUT PORES--CONIFERS OR SO-CALLED "SOFTWOODS"

A. Woods with resin ducts.

1. Pines. Fig. 144. Resin ducts numerous, prominent, fairly evenly

distributed. Wood often pitchy. Resinous odor distinct. Clear

demarcation between heart and sapwood. There are two groups of

pines--soft and hard.

(a) Soft Pines. Wood light, soft, not strong, even-textured, very

easy to work. Change from early wood to late wood is gradual and the

difference in density is not great.

(b) Hard Pines. Wood variable but typically rather heavy, hard and

strong, uneven textured, fairly easy to work. Change from early wood

to late wood is abrupt and the difference in density and color is

very marked, consequently alternate layers of light and dark wood

show. The wood of nearly all pines is very extensively employed in

construction work and in general carpentry.

2. Douglas fir. Resin ducts less numerous and conspicuous than in the

pines, irregularly distributed, often in small groups. Odorless or

nearly so. Heartwood and sapwood distinct. The wood is of two kinds.

In one the growth rings are narrow and the wood is rather light and

soft, easy to work, reddish yellow in color; in the other the growth

rings are wide, the wood is rather hard to work, as there is great

contrast between the weak early wood and the very dense late wood of

the annual rings.

Douglas fir is a tree of great economic importance on the Pacific

Coast. The wood is much like hard pine both in its appearance and

its uses.

3. Spruces. Resin ducts few, small, unevenly distributed; appearing

mostly as white dots. Wood not resinous; odorless. The wood is white

or very light colored with a silky luster and with little contrast

between heart and sapwood. It is a great deal like soft pine, though

lighter in color and with much fewer and smaller resin ducts. The

wood is used for construction, carpentry, oars, sounding boards for

musical instruments, and paper pulp.

4. Tamarack. Resin ducts the same as in the spruces. The color of the

heartwood is yellowish or russet brown; that of the distinct sapwood

much lighter. The wood is considerably like hard pine, but lacks the

resinous odor and the resin ducts are much fewer and smaller.

The wood is used largely for cross-ties, fence posts, telegraph and

telephone poles, and to a limited extent for lumber in general

construction.

B. Woods without resin ducts.

1. Hemlock. The wood has a disagreeable, rancid odor, is splintery, not

resinous, with decided contrast between early and late wood. Color

light brown with a slight tinge of red, the heart little if any

darker than the sapwood. Hemlock makes a rather poor lumber which is

used for general construction, also for cross-ties, and pulp.

2. Balsam fir. Usually odorless, not splintery, not resinous, with

little contrast between early and late wood. Color white or very

light brown with a pinkish hue to the late wood. Heartwood little if

any darker than the sapwood. Closely resembles spruce, from which it

can be distinguished by its absence of resin ducts.

The wood is used for paper pulp in mixture with spruce. Also for

general construction to some extent.

3. Cypress. Odorless except in dark-colored specimens which are somewhat

rancid. Smooth surface of sound wood looks and feels greasy or waxy.

Moderate contrast between early and late wood. Color varies from

straw color to dark brown, often with reddish and greenish tinge.

Heartwood more deeply colored than the sapwood but without distinct

boundary line.

Wood used in general construction, especially in places where

durability is required; also for shingles, cooperage, posts, and

poles.

4. Red Cedar. Has a distinct aromatic odor. Wood uniform-textured; late

wood usually very thin, inconspicuous. Color deep reddish brown or

purple, becoming dull upon exposure; numerous minute red dots often

visible under lens. Sapwood white. Red cedar can be distinguished

from all the other conifers mentioned by the deep color of the wood

and the very distinct aromatic odor.

Wood largely used for pencils; also for chests and cabinets, posts,

and poles. It is very durable in contact with the ground.

\_Western red cedar\_ is lighter, softer, less deeply colored and less

fragrant than the common Eastern cedar. It grows along the Pacific

Coast and is extensively used for shingles throughout the country.

5. Redwood. Wood odorless and tasteless, uniform-textured, light and

weak, rather coarse and harsh. Color light cherry. Close inspection

under lens of a small split surface will reveal many little resin

masses that appear as rows of black or amber beads which are

characteristic of this wood.

Redwood is confined to portions of the Pacific Coast. It is used for

house construction, interior finish, tanks and flumes, shingles,

posts, and boxes. It is very durable.

II. WOODS WITH PORES--BROADLEAF, OR SO-CALLED "HARDWOODS"

A. Ring-porous.

1. Woods with a portion of the rays very large and conspicuous.

Oak. The wood of all of the oaks is heavy, hard, and strong. They may be

separated into two groups. The white oaks and the red or black oaks.

(a) White oaks. Pores in early wood plugged with tyloses, collected in

a few rows. Fig. 146. The transition from the large pores to the

small ones in the late wood is abrupt. The latter are very small,

numerous, and appear as irregular grayish bands widening toward the

outer edge of the annual ring. Impossible usually to see into the

small pores with magnifier.

(b) Red or black oaks. Pores are usually open though tyloses may

occur, Fig. 147; the early wood pores are in several rows and the

transition to the small ones in late wood is gradual. The latter are

fewer, larger and more distinct than in white oak and it is

possible to see into them with a hand lens.

The wood of the oaks is used for all kinds of furniture, interior

finish, cooperage, vehicles, cross-ties, posts, fuel, and

construction timber.

2. Woods with none of the rays large and conspicuous.

(a) Pores in late wood small and in radial lines, wood parenchyma in

inconspicuous tangential lines.

Chestnut. Pores in early wood in a broad band, oval in shape, mostly

free from tyloses. Pores in late wood in flame-like radial white

patches that are plainly visible without lens. Color medium brown.

Nearly odorless and tasteless. Chestnut is readily separated from

oak by its weight and absence of large rays; from black ash by the

arrangement of the pores in the late wood; from sassafras by the

arrangement of the pores in the late wood, the less conspicuous

rays, and the lack of distinct color.

The wood is used for cross-ties, telegraph and telephone poles,

posts, furniture, cooperage, and tannin extract. Durable in contact

with the ground.

(b) Pores in late wood small, not radially arranged, being distributed

singly or in groups. Wood parenchyma around pores or extending wing-like

from pores in late wood, often forming irregular tangential lines.

1. Ash. Pores in early wood in a rather broad band (occasionally

narrow), oval in shape, see Fig. 148, tyloses present. Color brown

to white, sometimes with reddish tinge to late wood. Odorless and

tasteless. There are several species of ash that are classed as

white ash and one that is called black or brown ash.

(a) White ash. Wood heavy, hard, strong, mostly light colored except

in old heartwood, which is reddish. Pores in late wood, especially

in the outer part of the annual ring, are joined by lines of wood

parenchyma.

(b) Black ash. Wood more porous, lighter, softer, weaker, and darker

colored than white ash. Pores in late wood fewer and larger and

rarely joined by tangential lines of wood parenchyma.

The wood of the ashes is used for wagon and carriage stock,

agricultural implements, oars, furniture, interior finish, and

cooperage. It is the best wood for bent work.

[Illustration: FIG. 149.--Hickory Wood. (Magnified 45 times.)]

2. Locust. Pores in early wood in a rather narrow band, round, variable

in size, densely filled with tyloses. Color varying from golden

yellow to brown, often with greenish hue. Very thin sapwood, white.

Odorless and almost tasteless. Wood extremely heavy and hard,

cutting like horn. Locust bears little resemblance to ash, being

harder, heavier, of a different color, with more distinct rays, and

with the pores in late wood in larger groups.

The wood is used for posts, cross-ties, wagon hubs, and insulator

pins. It is very durable in contact with the ground.

(c) Pores in late wood comparatively large, not in groups or lines.

Wood parenchyma in numerous fine but distinct tangential lines.

[Illustration: FIG. 150.--Elm. (Magnified 25 times.)]

Hickory, Fig. 149. Pores in early wood moderately large, not abundant,

nearly round, filled with tyloses. Color brown to reddish brown;

thick sapwood, white. Odorless and tasteless. Wood very heavy, hard,

and strong. Hickory is readily separated from ash by the fine

tangential lines of wood parenchyma and from oak by the absence of

large rays.

The wood is largely used for vehicles, tool handles, agricultural

implements, athletic goods, and fuel.

(d) Pores in late wood small and in conspicuous wavy tangential bands.

Wood parenchyma not in tangential lines.

Elm. Pores in early wood not large and mostly in a single row, Fig. 150

(several rows in slippery elm), round, tyloses present. Color brown,

often with reddish tinge. Odorless and tasteless. Wood rather heavy

and hard, tough, often difficult to split. The peculiar arrangement

of the pores in the late wood readily distinguishes elm from all

other woods except \_hackberry\_, from which it may be told by the

fact that in elm the medullary rays are indistinct, while they are

quite distinct in hackberry; moreover, the color of hackberry is

yellow or grayish yellow instead of brown or reddish brown as in

elm.

The wood is used principally for slack cooperage; also for hubs,

baskets, agricultural implements, and fuel.

[Illustration: FIG. 151.--(Magnified about 8 times.)]

B. Diffuse-porous.

1. Pores varying in size from rather large to minute, the largest being

in the early wood. Intermediate between ring-porous and diffuse-porous.

Black Walnut. Color rich dark or chocolate brown. Odor mild but

characteristic. Tasteless or nearly so. Wood parenchyma in numerous,

fine tangential lines. Wood heavy and hard, moderately stiff and

strong. The wood is used principally for furniture, cabinets,

interior finish, moulding, and gun stocks.

2. Pores all minute or indistinct, evenly distributed throughout annual

ring.

(a) With conspicuously broad rays.

1. Sycamore. Fig. 151. Rays practically all broad. Color light brown,

often with dark stripes or "feather grain." Wood of medium weight

and strength, usually cross-grained, difficult to split.

The wood is used for general construction, woodenware, novelties,

interior finish, and boxes.

2. Beech. With only a part of the rays broad, the others very fine, Fig.

151. Color pale reddish brown to white; uniform. Wood heavy, hard,

strong, usually straight-grained.

The wood is used for cheap furniture, turnery, cooperage,

woodenware, novelties, cross-ties, and fuel. Much of it is

distilled.

(b) Without conspicuously broad rays.

1. Cherry. Rays rather fine but very distinct. Color of wood reddish

brown. Wood rather heavy, hard, and strong.

The wood is used for furniture, cabinet work, moulding, interior

finish, and miscellaneous articles.

2. Maple, Fig. 152. With part of the rays rather broad and conspicuous,

the others very fine. Color light brown tinged with red. The wood of

the hard maple is very heavy, hard and strong; that of the soft

maples is rather light, fairly strong. Maple most closely resembles

birch, but can be distinguished from it through the fact that in

maple the rays are considerably more conspicuous than in birch.

The wood is used for slack cooperage, flooring, interior finish,

furniture, musical instruments, handles, and destructive

distillation.

3. Tulip-tree, yellow poplar or whitewood. Rays all fine but distinct.

Color yellow or brownish yellow; sapwood white. Wood light and soft,

straight-grained, easy to work.

The wood is used for boxes, woodenware, tops and bodies of vehicles,

interior finish, furniture, and pulp.

4. Red or sweet gum. Rays all fine but somewhat less distinct than in

tulip tree. Color reddish brown, often with irregular dark streaks

producing a "watered" effect on smooth boards; thick sapwood,

grayish white. Wood rather heavy, moderately hard, cross-grained,

difficult to work.

The best grades of figured red gum resemble Circassian walnut, but

the latter has much larger pores unevenly distributed and is less

cross-grained than red gum.

The wood is used for finishing, flooring, furniture, veneers, slack

cooperage, boxes, and gun stocks.

[Illustration: FIG. 152.--Maple. (Magnified 25 times.)]

5. Black or sweet birch, Fig. 151. Rays variable in size but all rather

indistinct. Color brown, tinged with red, often deep and handsome.

Wood heavy, hard, and strong, straight-grained, readily worked. Is

darker in color and has less prominent rays than maple.

The wood is used for furniture, cabinet work, finishing, and

distillation.

6. Cottonwood. Rays extremely fine and scarcely visible even under lens.

Color pale dull brown or grayish brown. Wood light, soft, not

strong, straight-grained, fairly easy to work. Cottonwood can be

separated from other light and soft woods by the fineness of its

rays, which is equaled only by willow, which it rather closely

resembles. The wood is largely used for boxes, general construction,

lumber, and pulp.

How to judge the quality of wood: To know the name of a piece of wood

means, in a general way, to know certain qualities that are common

to all other pieces of wood of that species, but it does not explain

the special peculiarities of the piece in question or why that

particular piece is more suitable or unsuitable for a particular

purpose than another piece of the same species. The mere

identification of the wood does not explain why a particular piece

is tougher, stronger or of darker color than another piece of the

same species or even of the same tree. The reason for these special

differences lies in the fact that wood is not a homogeneous material

like metal. Within the same tree different parts vary in quality.

The heartwood is generally heavier and of deeper color than the

sapwood. The butt is superior to the top wood, and the manner in

which the wood was sawed and dried will affect its quality. Knots,

splits, checks, and discoloration due to incipient decay are defects

worth considering. Wood that looks lusterless is usually defective,

because the lack of luster is generally due to disease. Woods that

are hard wear best. Hardness can be determined readily by striking

the wood with a hammer and noting the sound produced. A clear,

ringing sound is a sign of hardness. The strength of a piece of wood

can be judged by its weight after it is well dried. Heavy woods are

usually strong. A large amount of late wood is an indication of

strength and the production of a clear sound when struck with a

hammer is also an evidence of strength.

CHAPTER IX

AN OUTDOOR LESSON ON TREES

The importance of nature study in the training of the child is now well

recognized. The influences of such study from the hygienic, moral and

aesthetic point of view are far reaching and cannot be expressed in

dollars and cents. In his association with nature, the child is led to

observe more closely and to know and to be fond of what is truly

beautiful in life--beautiful surroundings, beautiful thoughts and

beautiful deeds. He is inspired with reverence for law, order and truth

because he sees it constantly reflected in all works of nature. The

social instinct is highly developed and even the parents are often

bettered through the agency of their children.

The only way, however, to study nature--especially plants--is to study

it out of doors. Our present tendency to gather in cities demands the

upbuilding influences of trips into the open in order to equip the child

mentally and physically to face the world and its work with the strength

and tenacity characteristic of the country-bred. Moreover, the study of

objects rather than books is an axiom in modern education and here, too,

we can readily see that the best way to study trees is to take the pupil

to the trees. Such studies are more lasting than book study because they

emphasize the spirit and the goal rather than the petty facts.

Educators and parents are now recognizing the value of outdoor trips

for their children and are beginning to indulge in them quite

frequently. In many instances teachers about to take out their children

for a day have inquired of the writer how to go about giving a general

field lesson when they reached the park or woodland. The purpose of this

chapter is to answer such a question and yet it is evident that it

cannot be answered completely. What to observe out doors and how to

present one's impressions is a broad question and varies with the

knowledge and ability of the teacher as well as with the age and

experience of the children. The how and the what in nature study is of

greater import than the hard, dry facts and that must be left entirely

to the teacher. A few suggestions, however, may not be amiss:

1. General observations with a view to character building: First of all

it is important to remember that the great value of all tree and

nature study is the inculcation in the minds of the children of an

appreciation and love for the beautiful. Inspiring them to \_love\_

trees generally means more than teaching them to \_know\_ trees. Mere

facts about trees taught in an academic way are often no more

lasting than the formulae in trigonometry which most of us have long

ago forgotten. The important thing is that permanent results be left

and nothing else will produce such lasting impressions as the study

of trees out of doors.

[Illustration: FIG. 153.--Trees Have Individuality.]

General observations about trees can be made by pointing out the

beauty and character of the individual forms and branching, their

harmony in their relations to each other as factors of a beautiful

composition and the wealth of shades and colors in their leaves,

bark and flowers. Compare, for instance, the intricate ramification

of an American elm with the simple branching of a sugar maple, the

sturdiness of a white oak with the tenderness of a soft maple, the

wide spread of a beech with the slender form of a Lombardy poplar,

the upward pointing branches of a gingko with the drooping form of a

weeping willow. At close range, each of these trees reveals itself

as an individual with a character quite its own. At little distance

you may see them grouped together, subordinating their individuality

and helping to blend into a beautiful composition with a character

all its own. There is nothing more inspiring than the variety of

greens in the spring foliage, the diversity of color in the spring

blossoms and the wonderful display of autumnal tints offered by the

sweet gum, sassafras, dogwood, black gum, red maple, sugar maple,

scarlet oak, blue beech, sorrel tree, ash and gingko. The white bark

of the gray birch, the dark bark of the black oak, the gray of the

beech, the golden yellow of the mulberry and the mottled bark of the

sycamore are interesting comparisons. The smooth bark of the

mockernut hickory contrasts greatly with the shaggy bark of the

shagbark hickory--members of the same family and yet how different.

A wonderful opportunity is thus offered for a comparative study of

human nature--individuality and community life, all reflected in

trees.

With this preliminary study and with the addition of some remarks on

the value of trees as health givers and moral uplifters, the child

is interested and attracted. The lesson so far has attained its aim.

2. Specific observations with a view to training the observative powers:

The child's training in closeness of observation and scientific

precision may be the next consideration. His enthusiasm will now

prompt him to lend his interest for greater detail. We can teach him

to recognize a few of the common trees by their general

characters--an American elm by its fan-shaped form, a gray birch by

its white bark, a white pine by the five needles to each cluster, a

horsechestnut by its opposite branching and big sticky bud and a

willow by its drooping habit. After that we may introduce, if the

age of the pupils justifies, more details extending to greater

differences which distinguish one species from another.

The lesson might continue by pointing out the requirements of trees

for water and light. Find a tree on some slope where the roots are

exposed and another which is being encroached upon by its neighbor,

and show how in one case the roots travel in search of water and

food and in the other the branches bend toward the light, growing

more vigorously on that side. Compare the trees on the open lawn

with those in the grove and show how those in the open have grown

with branches near the ground while those in the woodland are

slender, tall and free from branches to some distance above the

ground. Point out the lenticels on the bark of birch and sweet

cherry trees and explain how trees breathe. Compare this process

with that of the human body. You may now come across an old stump

and here you can point out the structure of the wood--the sapwood,

cambium and bark. You can illustrate the annual rings and count the

age of the tree. At another point you may find a tree with a wound

or bruised bark and here you can readily make a closer study of the

cambium layer and its manner of growth.

The adaptation of plants to the seasonal changes opens another

interesting field of study for beginners. If the season is the fall

or winter, note how the trees have prepared themselves for the

winter's cold by terminating the flow of sap, by dropping their

leaves too tender to resist the winter's cold, and by covering their

buds with scales lined with down on the inside. Observe how the

insects have spun for themselves silken nests or remain preserved in

the egg state over the winter. If the season is spring or summer the

opposite may be noted. See how everything turns to life; how the

buds are opening, the leaves emerging, the sap running, seeds

germinating and flowers blooming.

The soil conditions on the lawn and in the grove furnish another

interesting feature of comparison and study. In the grove, you can

demonstrate the decomposition of the fallen leaves, the formation of

humus and its value to the tree. The importance of the forest soil

as a conservator of water and its relation to stream flow and soil

erosion can be brought out at this juncture. An eroded bank and a

slope covered with trees and shrubs would provide excellent models

for this study. A consideration of the economic value of the trees

would also be in place.

3. Civic lessons reflected in trees: The community life of trees in the

grove, their growth, struggles for light and food and their mutual

aid can be brought out and compared with the community life among

people. The trees may here be seen struggling with each other for

light and food, forcing each other's growth upward, some winning out

and developing into stalwart and thrifty specimens and others

becoming suppressed or entirely killed. On the other hand they may

be seen helping each other in their community growth by protecting

each other from windfall and by contributing to the fertility of the

forest soil in dropping their leaves and shading the ground so that

these fallen leaves may decompose readily.

[Illustration: FIG. 154.--Trees also Grow in Communities.]

4. Enemies of trees: An old stump or tree may be seen crumbling away

under the influence of fungi and here the children may be shown the

effects of tree diseases both as destroyers of life and as

up-builders, because fungi turn to dust the living trees and build

up others by furnishing them with the decomposed wood matter.

Insects too, may be invading the old dead tree, and something of

their nature, habits and influences may be gone into. They may be

shown as wood borers, leaf eaters, or sap suckers, all injurious to

the tree. On the other hand they may be shown as seed disseminators

and as parasites on other injurious insects; all benefactors.

Forest fires as an enemy of trees might be touched upon by noting

how easily the leaves may be ignited and a surface fire started when

the season is dry. Top and ground fires emanating from surface fires

can then be readily explained.

[Illustration: FIG. 155.--Trees Blend Together to Form a Beautiful

Composition.]

5. Expression: The pupils have by this time been taught to feel the

beautiful, to observe carefully and to reason intelligently and they

may now be trained to express themselves properly. This may be

accomplished by asking them to remember their observations and to

write about them in the classroom. The lesson may be supplemented

with effective reading about trees and forests. Interesting reading

matter of this sort can be found in abundance in children's readers,

in special books on the subject and in Arbor Day Manuals published

by the various State Education Departments.

6. Preparation: In order to save time looking for objects of interest

and for the purpose of correlating the various observations so that

all will follow in orderly sequence, it is well for the teacher or

leader to go over the ground beforehand and note the special

features of interest. The various topics can then be given some

thought and a brief synopsis can be drawn up to serve as a

memorandum and guide on the trip.

It is also well to be provided with a hatchet to cut into some

decayed stump, a trowel to dig up the forest soil, a knife for

cutting off twigs and a hand reading glass for examining the

structural parts of the various objects under observation. A camera

is always a valuable asset because the photographs hung in the

classroom become records of great interest to all participants.

7. Suggestions for forming tree clubs: A good way to interest children

in trees and nature study is to form, among them, a Tree Club. The

idea has been fully developed in Brooklyn, N.Y., Newark, N.J., and

other cities and consists of forming clubs of children in the public

schools and private institutions for the purpose of interesting them

in the trees around their school and their homes. The members of

these clubs are each given the tree warden's badge of authority and

assigned to some special duty in the preservation of the local

trees. A plan of study and of outdoor trips is laid out for them by

their director and at stated periods they are given illustrated

lectures on trees and taken to the neighboring parks or woodlands.

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