TREES AND TREE-PLANTING

BY

N

M. S. Hale
August 1893

Yours Truly
Jas. S. Brisbin

TREES

AND

TREE-PLANTING

BY

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INTRODUCTION.

I BELIEVE in God and my country. And if, after an implicit faith in an All-wise Providence, there is any one thing more than another on which I rely, it is the wisdom and prudence of the American people. The seed from the rude sowing of the colonies which hewed out the magnificent states of the East, and established a free and independent government, will never be found wanting in anything which goes to make up a truly great nation. From my earliest youth my voice has ever been raised against the destruction of the forests of America; but, lost amid the whir of saws and the resounding stroke of axes, it was too weak to be heard, until now, the day of reckoning having come, we must dispassionately consider the evil done, and take measures to remedy it in the future. It is the disposition of our people not to take heed of the future, but only to enjoy the present. While the forests of America lasted they could not and would not believe the day would ever come when they would have need of them. But now they see more clearly, and look with dismay on the ruin which their own hands have wrought. To all I would say, be not discouraged, for it is still possible to undo in a great measure the evils of the past, but it will require all of our patience and wisdom, and much more than was ever exhibited by our fathers.

To destroy the forests of America has been a brief work; to replant and reproduce them will be the labor of forty generations, but it can be done. I have written many books and submitted them to my countrymen for their approval, but never have I approached a subject with such diffidence and consciousness of my inability to cope with it as the one treated of in the following pages.

When I learned to love the trees I cannot remember, but I was born under the spurs of the Alleghanies, and passed my infancy in the umbrageous shade of their wide-spreading pines. I fished and hunted along the streams, and she who is the mother of my children often accompanied me in my rambles through the grand old mountain forests of Pennsylvania. How beautiful these mountains were, with their coats of pine, green as the sea! Shade so deep and dark it seemed like night on the brightest day; babbling brooks with sly little nooks by bits of grass, and deep, cool pools where the hermit trout lay. Here was a mossy glen and there a waterfall, yonder a clambering vine in many a wild festoon, and at our feet a bed of moss softer than down. If we turned over a rock in the mountain's side we found ice beneath it even in the hottest days of August. Then there were caves, deep, dark, and cool, filled with ice on the sides dripping with cold water, and stalactites shining overhead. How I remember stealing away and hiding in one of these caves, years and years ago, while the boys brought our brave mountain girls to see it; and when I roared like a bear how they ran like frightened fawns, a white dress glinting here and there through the forest, until all were lost to view in the distance, and Annie Berry sprained her foot so terribly on that day she was laid up for weeks, and the old doctor shook his cane and threatened what he would do if ever we frightened Annie again—all of which we knew was talk, for the doctor loved us too well to harm a hair on our young heads. It was rude, wild sport, and my mind goes back lovingly on a hot August day to the Bear Meadows, Galbraith's Gap, Snowshoe, Pleasant Gap, and the big mountains with their coats of pine.

There are no prettier spots on earth than those near Bellefonte, Pennsylvania, where I was born. Accustomed from infancy to look upon these wild mountains and grand old woods, they became common in my eyes, and, as naturally might be expected, were not appreciated. Much as I loved the trees and mountains, I never fully realized what beautiful things they were until after I came to the plains. For days and days I travelled over the level, arid, treeless prairie, often looking back at night to the place where we had started out in the morning, and which seemed scarcely ten miles distant, but was in reality over thirty. Every traveller has experienced the wonderfully deceptive distances of the plains. Often you would wager you could ride or walk to some distant mountain in a few hours, but you journey on for days and days, and still its barren sides and bald peaks loom up apparently as far off as when you started out. To the man who has been raised in the mountains the absence of trees on vast level flats becomes most painful, and his eyes are constantly unconsciously seeking for a rock, a vine, a tree, a green mountain, or a shady glen where he can lie down and rest. Land; land everywhere, and the sky shut down in great circles upon the level, burning plain. I never could get used to stretching my little piece of canvas to make a shade; it seemed so unnatural, so useless, and, indeed, was no shade at all if compared with the cool depths of the forest. A blazing sun overhead, a hot sand on the earth, and only a narrow strip of cloth between — that is not what the mountain man calls shelter. How often in those hot days did I long for the green mountains, mossy glens, and cool streams of the grand old woods where I was born.

For four years I had lived on the plains surrounded by sage-brush and sand, never once seeing a mountain or forest. Then I was ordered east with troops, to Kentucky. We had been running very fast all night in the cars, and in the morning, just as I was washing in the sleeping-car, I heard the soldiers in the forward coaches cheering. I asked the conductor what was the matter, and he replied, "The soldiers are cheering the trees." We all hastened to the doors and windows, and there, sure enough, found we were running through a grand old Kentucky forest, and it was indeed a most beautiful sight. It had rained the night before, and the dripping trees shone like silver in the newly-risen sun. Grape vines hung in heavy festoons from the arms of giant oaks, woodbines wound about their trunks; the grass on the earth was green as an emerald, and so clean I longed to jump from the cars, lie down on it, and roll over and over and shout for very joy.

"Thank God for noble trees,
How stately, strong, and grand
These bannered giants lift their crests
O'er all this beauteous land."

The sight of a forest in the early morning, when the dew is on the grass and leaves, is at all times beautiful. Even those who have been used all their lives to such magnificent scenes are startled occasionally into an appreciation of their beauty; how then to us who had not seen for years a great tree seemed the forest! It was beautiful beyond description, and even the children clapped their little hands and cried out, "Oh, mamma, see the pretty trees!" I saw a squirrel leap from the grass and run up the trunk of a gnarled oak that perhaps kept silent watch over the grave of some savage warrior, who in his day had been a mighty man. There were great gothic forest aisles, and through the grained and graceful roof of leaves millions of sunbeams shimmered down, lighting up the dark recesses of the woods until the whole resembled some vast cathedral pile.

I compared this scene with those which I had witnessed a thousand times in my boyhood and yet thought nothing of them. It was then I realized fully, possibly for the first time, the beauty and value of woods and mountains. Ever since then I have been pleading,

> "Oh, woodman, spare that tree,
> Touch not a single bough;
> In youth it sheltered me,
> And I'll protect it now."

Not only did I determine to become the friend of the bannered giants that lift their heads to the sky, but to urge the planting of new forests everywhere, and, if possible, cover the barren plains of the West with woods.

Many writers had preceded me, but they all seemed defective in not pointing out how forest-trees could be reproduced. These writers were eloquent in their denunciation of forest destruction, but pointed out no remedy for the evil. I said I will study the lives of the trees, and take up the subject where others have laid it down, showing how to cultivate and grow forest-trees as fruit-trees are now grown.

I soon found the task I had set myself was a most difficult one, for there were no forest-tree nurserymen, and no one willing to become such. They only laughed at the idea of planting oaks, elms, pines, and such "*wild trees*" as they called them. When the facts were sought to be laid before the people they too laughed at me, and the newspapers called me an alarmist, and scoffed at the idea of our forests giving out, or new ones being planted. I was recommended to sow the Alleghany Mountains with clover-seed, and plant the fence corners with sassafras for old women's tea. My articles were denounced as the impracticable vaporings of a madman, and I was even refused a hearing by such respectable journalists as J. W. Forney and Morton McMichael. A few thinking men, however, saw in the subject more than was indicated on the surface, and they slowly came to the support of our projects. One of the earliest to take up his pen and help was the late William Cullen Bryant, the greatest of our American poets. Then came his amiable and able nephew, Charles Bryant, with his excellent book on "Forest Trees," and Browne, with his elaborate work on "Trees of America.' George Pinney of Wisconsin followed, establishing his "Tree Grower," and later, James T. Allen wrote and published his pamphlet on "Forest Growing in Nebraska," and then came J. F. Tallant of Iowa, George W. Minor of Illinois, Herman Trott of Minnesota, R. S. Ellicott of Missouri, Daniel Milliken of Ohio, Honorable Calvin Chambers of Maine, J. Sterling Morton of Nebraska, and others. This able corps of writers and workers soon silenced the scoffers at American forestry, and awakened an interest among the people in the subject of tree-growing. The newspapers were slow to advocate it, but at last, when the New York *World* led off, it was followed by hundreds of papers all over the country.

The pioneer state in the great work of forest-tree planting was Nebraska, and this state, once called "the treeless state," is now nearly covered over with young forests. It will soon be as well timbered as any state from Maine to California. Last year the Nebraskians set out fifteen millions of forest-trees, this year eighteen millions, and next year they will plant over twenty millions. Such enormous plantings cannot but be productive of great results to the state, and already a change has taken place in the climate and rainfall. Mr. J. Sterling Morton invented what he called "Arbor Day," and had it legalized as a holiday. Every year, about the middle of April, the governor of the state issues a proclamation announcing the day, and on its recurrence the entire population cease from their labor and engage in planting trees. This custom is not new. The Germans have a pretty habit of each member of a family living in the rural districts planting a tree at Wissuntide, which comes forty days after Easter. Also at early dawn on the same day their singing societies march to the top of the nearest hill or mountain, and hail the rising sun with songs and pæans of praise for the glory of its warmth and blessing to Ceres and Flora. The old Mexican Indians also plant trees on certain days of the year when the moon is full, and name them after their children. The Aztecs used to plant a tree every time a child was born, and it bore the name of the child. In the State of Nebraska the governor each year offers a large reward to the family that will set out the greatest number of forest-trees. When I was there it was $500 for the first premium, $400 for the second, and so on down to $25. Even the women and children could earn premiums, medals, and diplomas, and great was the competition for these rewards of the state. The results of all have been wonderful. Patches of timber have sprung up everywhere, and where a few years ago only the naked plain was seen, now waves a goodly forest. Trees ten and twelve years old are thirty feet high, and eight to ten inches in diameter. It may be remarked that forest-trees grow in the West with wonderful rapidity, and if care were taken in planting them, all the vast flats from the Missouri River to the Rocky Mountains would soon be covered with forests and farms. It has been demonstrated in Utah and other places that sage-brush land, when irrigated, produces twenty-five, thirty, and even forty bushels of wheat per acre. In Colorado I have seen fifty bushels of wheat per acre cut from land which, before it was irrigated, looked like a worthless gravel-heap.

As an evidence of the rapidity with which trees grow, Mr. James T. Allen of Nebraska says: William Hollenbeck has two hundred acres of timber, mostly ash, planted from seedlings in 1861, and the trees now measure thirty-five inches in circumference, and are over forty feet high. Mr. Hollenbeck also has forty acres of black walnut planted in 1865, and many of the trees now measure thirty-five inches in circumference, and are forty-five feet high. Some of them bore nuts four years from the planting.

There are soft maples growing in Omaha, Nebraska, which at fourteen years of age were forty-three inches in circumference, and forty-five feet high. Two specimens of elms in Douglas County, planted in 1859, were six years ago thirty-eight inches in circumference four feet from the ground, and over thirty feet high. A honey locust planted at Omaha, at thirteen years old was thirty-four feet high, and measured thirty-five inches in circumference four feet from the ground. Cotton-woods in Douglas County, Nebraska, thirteen years old measured twenty-two inches in diameter, and were forty-five feet high. A box elder, growing in my yard at Omaha Barracks, shot up in a single season seven feet. Judge Crounse had a tree that grew seven feet for three consecutive years. All the trees about Omaha Barracks while I was stationed there grew from five to seven feet annually. Many more instances of the rapid growth of trees might be given for the encouragement of tree-planting, but these will suffice here, and those who are curious to learn can read, further on in the pages of this book, hundreds of instances.

What comes of tree-planting is profit, honor, health, and wealth. The progress made by the friends of forestry in America during the past few years is a matter of great congratulation to them. This year we have had a Forestry Congress well attended; Honorable John Sherman of Ohio has brought forward a healthy forest bill, which will be sure to pass at the next meeting of Congress, and the people of the country everywhere are awakening to the importance of both forest-saving and forest-planting. To aid in a humble way this good work the following pages are written, and if they shall make for the trees one true friend I shall esteem myself repaid for writing them. In closing this part of my work it will only be proper for me to make my most humble acknowledgment to Charles Bryant,

D. J. Browne, Andrew S. Fuller, James T. Allen, and others for valuable assistance. Without the aid of their works this book could not have been prepared.

JAMES S. BRISBIN,
U. S. Army.

FORT KEOGH, MONTANA.

TREES AND TREE-PLANTING.

CHAPTER I.

FOREST DESTRUCTION.

Effect of Forest Destruction upon a Country.—Effects Produced in Europe and Asia.—The Ancient Habitableness of those Regions Contrasted with Modern Barrenness and Unproductiveness.—Forests as an Essential to Industry and Comfort.—Dependence of Mankind on Wood.—A Consideration for Future Wants.—Telling Results of the Wilful Waste of the Atlantic States Forests.—Manner of Meeting the Question of Wholesale Destruction.—System of Forest Management in France and Germany.—The Unprotected State of American Forests generally.—The Forest Regions of the Northwest, and a Suggestion for their Preservation.

I HAVE tried for years, in the best way I knew how, to get something definite done to save our forests and replant those destroyed, but the work has been very discouraging.

The waste of timber still goes steadily on, especially in the Western States, and is each year increasing as the forests diminish. Forests are felled, and a man cuts down a tree that his own lifetime and that of all his children added together could not reproduce, yet he thinks no more of his act of vandalism than he would if he were removing a stone, a brier, or a dirt-pile. He does not cut it down because he needs the fuel or wants the lumber, but because it is handy, or because he fancies it shades the ground too much, or he wants to get a bird's nest that is on it, a few nuts a squirrel has hid away in it, a coon off it, or some chestnuts. Any excuse in the world serves as sufficient cause to justify his act of vandalism, and the axe is laid without mercy to the root of the tree. If these individual acts of vandalism were all we had to contend with we might rest easy; but every year great companies with ponderous mills go to the heart of our forests and fell thousands of trees that have been hundreds of years growing. One firm alone in a western state runs two hundred saws. No less than 1,030,000,000 feet of lumber were cut in a single year in the State of Wisconsin. At the present rate ten, or at most twenty, years will see the end, and the forests of Michigan, Minnesota, and Wisconsin will have been destroyed. Fifty thousand acres of Wisconsin timber are annually swept away to supply the Kansas and Nebraska markets alone. New York has lost her maple, walnut, hickory, and has no big woods left worthy the name of forest, unless it is her Adirondacks. How long she will keep it is a question. In Pennsylvania the forests, except small portions of the Alleghanies, have been destroyed. All the remaining regions have been bought up by speculators, and the trees are merely held for a higher market. The fires and the saw-mills will soon do the work, and America become a treeless region.

What difference will it make? ask the careless. A great deal, for with the destruction of timber goes away much of the usefulness of the country. Did you ever see a treeless land, or have you ever read about one? If not, ask travellers, or read carefully the histories of the Roman Empire, Syria, Persia, Asia Minor, and portions of Italy. All these regions were once timbered countries and richly productive. Now they are horrible deserts, seamed with ravines and gullies, piled with ridges of sand, utterly incapable of reproducing the wood which once covered them. Behold the naked rocks and barren wastes of Mount Lebanon made famous by the life of our Saviour. From these mountains once came the timber to supply the surrounding countries; it has long since disappeared, and with it the population. Other causes no doubt assisted to desolate these countries, but, says Marsh: "the destruction of the forests was the chief cause of the present barrenness." I doubt if man can exist in any country entirely destitute of timber. As countries entirely covered with timber are fit only for the abode of savages, so countries entirely denuded of timber become fit only for wild beasts and uncivilized people. Nature seems to have designed that there should be a happy medium in this respect which we cannot disregard without bringing upon ourselves evil consequences. Either extreme produces a like effect—the total destruction of forests unfits a country for the abode of civilized man, while the clothing of it in impenetrable forests does the same. Look at the country around the Mediterranean Sea, once the most populous in the world. Compare the descriptions of ancient writers with what is said of it to-day. Marsh says: "The vast forests have disappeared from the mountain spurs and ridges; the vegetable earth accumulated beneath the trees by the decay of leaves and fallen trunks; the soil of the Alpine pastures which skirted and indented the woods, and the mould of the uplands are washed away; the meadows once fertilized by irrigation are waste and unproductive, because the cisterns and reservoirs that supplied the ancient canals are broken, or the springs that fed them dried up; rivers famous in history and song have shrunk to humble brooklets; the willows that ornamented and protected the banks of the lesser watercourses are gone, and the rivulets have ceased to exist as perennial currents, because the little water that finds its way into their old channels is evaporated by droughts of summer, or absorbed by parched earth before it reaches the lowlands; the beds of the brooks have widened into broad expanses of sand and gravel, over which, though, in the hot season we passed dry-shod; in winter sealike torrents thunder; the entrances of navigable streams are obstructed by sand-bars; and harbors once marts of an extensive commerce are shoaled by deposits of the rivers at whose mouths they lie."

If we admit that trees are an essential to civilization, we may as well at once say man cannot advance in improvement beyond the rudest form of pastoral life without the use of timber. Even in this age of iron, steel, and coal, we can hardly estimate our dependence upon wood. The pen we write with is held by a wooden handle; the chair we sit upon is made of wood, the floor beneath our feet is of wood, and the building in which we live (except possibly the walls) is of wood. This material enters into every want of our lives, and contributes daily and hourly to our convenience. The question naturally arises, Will our countrymen go on destroying an article of such absolute necessity, without some regard to the source of a future supply? As for others I know not, but as for myself I say no; we will stop this wanton destruction of the beautiful trees at once, and so use them as to leave a portion for our children when we are gone.

In some of the older states the want of timber is already severely felt. Hills and mountains once covered with beautiful forests are bald and unsightly. The streams that once turned the mills to denude these forests have dried up, or shrunk away to inconsiderable rivulets. It cannot be otherwise, with our rapidly increasing millions, than that the demand for timber will increase, and the destruction go on rather than diminish. I see no way but to meet this question with sturdy laws. In Germany, France, and some other countries of Europe the forests are the property of the government. Their management has been reduced to a system, and they are guarded with the greatest care from wanton destruction. In our own country I doubt if a like system would work well. The government of the United States has never yet protected its forests, and I doubt if it ever will. Perhaps the better plan would be to turn over the whole question of forestry to the several states and territories of the Union. Timber growing on public lands is everywhere so generally considered as fair game that possibly the government cannot protect it. It did not, or could not, protect the live-oak woods of Florida intended for the use of the navy; it did not protect its forests in Michigan, Wisconsin, or Minnesota, and it is not to-day protecting its woods in Montana or Washington Territories. The Congress either does not wish to be bothered with the subject of forestry or does not care about it. If it does not then desire to undertake it, will it not give it up and let the states and territories try their hand at forest-saving? We have one great belt of timber (the last in the United States) still undestroyed. This magnificent body lies in the Territories of Montana and Washington, and the State of Oregon. It would be a pity to wantonly destroy it, and I believe the people of the West and their legislatures would protect it if it was transferred to them. At all events, is not the experiment worth trying in Washington Territory, at least, where the great red-fir forests exist. I make the suggestion for what it is worth, not knowing if it would work well or not. Certain it is, the old system will not do, and, if continued, the destruction of timber will go on increasing with the lapse of years, until the whole country is depleted of its woodlands, and vast sections rendered hopelessly barren and sterile.

CHAPTER II.

CONSEQUENCES OF FOREST DESTRUCTION.

The Wasteful Havoc of Forest-lands, and its Serious Consequences.—The Indifference Manifested towards Remedying the Evil.—The Action of Public Corporations on Forest-lands.—The Efforts of Dr. Drake to Protect Forests.—The Evil Consequences of Non-attention.—Probable Date of a Timber Famine in the United States.—The Inherited Duties of Americans.—The Destined Uses of Nature's Growth.—Fencing and Railroad Interests as a Means of Forest Destruction.—Annual Destruction and Replacement Contrasted.—Convincing Necessaries.

THE WASTEFUL HAVOC WHICH IS BEING WORKED IN THE WEST, AND THE SERIOUS CONSEQUENCES.

"Our National Legislature," tritely observes Bryant, "is almost wholly indifferent to the fate of our forests, and betrays a destitution of statesmanlike forecast that is painful." If this were all it would not be so bad; but, aside from their indifference, the Congress is constantly squandering large bodies of our forest-lands on public corporations who are obtaining them only for profit, and who will destroy them with more rapacity even than private individuals. Candidly, I believe that very many of our Congressmen do not credit the statements and theories that, by denuding a country of its forests, you can injure its productiveness. Some of them have lived a great many years, and as yet have seen no evil effects from the cutting down of forests, nor have they experienced any scarcity of fire-wood at home. Wise men—to them there is no other land than Spain, and no other age than that in which they live. It is now nearly fifty years since Dr. Drake of Cincinnati proposed to

Congress the importance of saving our forests. Failing in this, he begged the government to at least reserve tracts of woodland around the head-waters of the principal streams, as a means of preventing their diminution. The wise doctor was poohed at, and thought a little cracked. Well, some of the streams he proposed to save are almost valueless, and in a half-century more will be entirely useless for purposes of navigation. Probably the doctor did not anticipate that the time would come when these reserves would become important as a source of timber supply; and if he had proposed such a thing he would have been laughed at outright. It is needless to say that Congress disregarded Dr. Drake's advice, and to-day the children of the very men who poohed at the doctor are suffering for the follies of their fathers. Maine, New York, and Pennsylvania are practically ruined as timber states, and their streams are gradually drying up. In twenty-five years more the Northwestern States will be as bad, or even worse off for timber than the Eastern States are, and in twenty-five years more the timber famine in the United States will begin. Good, say the Congressmen and timber vandals of to-day, we shall be dead by that time, and why should we care what happens then? Americans owe more than any other people on earth to the toils, sacrifices, and forethought of their forefathers, and it is their duty—every man's duty—to transmit the inheritance they received from them to their descendants unimpaired by waste or neglect. Says Bryant: "The length of time required for the growth of timber from the seed to maturity shows conclusively that it was never destined in the order of nature for the exclusive use of a single generation." Nor is this all. The man who wantonly destroys that which he cannot reproduce in his lifetime is not only a coward and a fool, but he commits a flagrant crime against nature and nature's God. I never see a man cutting down a fine tree but I feel like crying out, "Stop thief!!!" What is his life as compared to the life of the tree? If he were immediately to plant another, not in his lifetime, in that of his children or his children's children, would the tree attain to maturity. All this he knows, yet he fells it to the earth and does not even plant another to replace it for future generations. Is not this man a vandal? Surely; and worse, for he is a criminal, and his seed shall suffer for his sins. If the trees could talk, what a pitiful tale they would tell: How they had for ages drawn moisture from the earth and distributed it through ten thousand leaves into the air, to descend again in showers, refreshing the earth and watering the gentle flowers. Even the tiny blades of green grass would cry out,

"Oh, woodman, spare that tree,
Touch not a single bough."

But they must perish from the earth; the fiat has gone forth, and we shall soon be able to say no more:

"Thank God for noble trees!
How stately, strong, and grand
These bannered giants lift their crests
O'er all this beauteous land."

They will be cut down and gone; and the shifting sands alone will mark where they once stood. The bleakness and barrenness of death will cover the earth, the sun pour down his vertical rays, and the scorching winds unchecked howl over the sterile plains.

I fear you will think I am becoming excited over this subject, and I do warm up a little when speaking or writing of the murder of the beautiful trees, which in atrocity is little short of human murder itself. But it is not fine phrases or grandiloquent expressions we want in this case, but facts, cold arguments, to convince the unreasoning and the ignorant. The voracious monster who threatens to devour all our young timber in his insatiable maw are the railroad interests of the United States.

Last year there were 101,000 miles of railway in this country, and this year we are building 16,000 miles of new railway. All these roads have to be tied with comparatively young timber. I have not at hand an estimate of the number of ties used per mile, but the annual consumption is very large. Some years ago to build 71,000 miles of railway required 184,600,000 ties. Ties have to be replaced every seven years, and it is fair to set down the number of ties required annually for future consumption at 160,000,000. As every one knows, railroad ties are cut from young timber, the trees being from eight to twenty inches in diameter, and this demand strikes at the very source of our timber supply.

It is a fact that the fences of the United States have cost more than the land, and they are to-day the most valuable class of property in the United States, except buildings, railroads, and real estate in cities. To keep up the fences requires annually an enormous consumption of timber. The 125,000 farms in Kentucky require 150,000,000 panels of fence to enclose them. The number of rails required is set down at 2,000,000,000, costing $75,000,000. To repair and keep in good order the fences in this one state costs, annually, $10,000,000. Illinois, a comparatively new state, has $200,000,000 invested in fences, but it costs her only about $300,000 annually for repairs, many of her fences being constructed of wire. The whole value of the fences in the United States may be set down at $2,000,000,000, and it costs $100,000,000 annually to keep them in repair.

The city of Chicago alone last year employed 17,800 men in handling lumber. There were 500 clerks, 4000 wood-workers, 2000 sailors, 1000 men to load and unload the vessels, and 10,000 men to handle and prepare the lumber for market, besides 300 proprietors. The lumber brought to Chicago in 1881 exceeded 2,000,000,000 feet, and would have loaded one train of cars 2000 miles long. No less than 300 square miles of land was stripped of trees last year to supply the Chicago market with lumber. These figures are indeed appalling, and may well alarm any one as to the future source of our timber supply. There is no hope of any diminution in the future, for Chicago will require more lumber this year than she did last. The demand is ever increasing, and the supply ever diminishing. Between the two the end must come soon, and the grand old forests disappear. After the Saginaw, Muskegon, Menomonee, Manistee, and Ludington sources are exhausted, the Rocky Mountain slopes and Washington Territory will be stripped of their forests, and then we will have all that is worth taking. Every year we denude 8,000,000 acres of trees, and plant less than 1,000,000 acres to replace them. The end is so plain, even a fool may read it as he runs.

CHAPTER III.

EFFECT OF FORESTS ON A COUNTRY.

The Effect of Trees on Humidity, Evaporation, Rainfall, and Prevailing Winds. — Nebraska's Generous Labor in Behalf of the Reproduction of Trees, and her Reward. — Humidifying Influence of the Pacific Winds on Iowa, Illinois, and Wisconsin.—The Humidity of Forests, to What Due.—The Theory of Condensation in Connection with Trees. — Evil Results of Forest Destruction in Santa Cruz. — The Serious Results of Forest Destruction to Manufacturing Industries. — The Tree-planting of Lower Egypt and Consequent Rainfall.—Moisture Distribution of Kansas and Nebraska, to What Due. — The Agricultural Benefits Derived from Tree-planting in Australia. — The Australian Desert's Reclamation Possible. — The Destruction of Forest-lands for Agricultural Purposes in the United States. — Decrease of Lumber Supply and its Increasing Value. — Precautionary Measures Discussed.

The effect of trees upon the rainfall of a country is no longer disputed by the intelligent. A good-sized peach-tree will give off eighteen pounds, or about two gallons, of moisture every twelve hours. The evaporation of the earth through trees is immense; the roots often draw from springs themselves, and throw off through their branches great volumes of humid air.

Those who have watched the effect of forests on rainfall say that, by commencing at the edge of any dry belt, the forests, and consequent rainfall, may gradually be extended across the whole of the dry belt. The experiment is being tried in Nebraska, and I believe with encouraging results, as the rainfall is gradually increasing. No state in the Union has done more to replace her forests, and I am happy to say Nebraska is already reaping the rewards of her generous labor in behalf of the trees.

At a depth of some twenty feet from the surface of the earth white sand is struck in both Kansas and Nebraska, which is full of water, and in some places forms subterranean streams. This makes both these states famous forest-growing regions, as the roots of the trees readily seek the moist white sand, and the trees grow with a rapidity which is perfectly astonishing.

I think the great currents of air which leave the Pacific coast humid and warm are forced up by the high mountains until they become cold, and are discharged in snows in the Rocky Mountains, when, leaving the mountains dry, they sweep over the great plains, finding no moisture to take up until they cross the Missouri and Mississippi, when, having been recharged, they empty in Iowa, Illinois, and Wisconsin. We know that in Wyoming Territory the dearth is almost complete, and the dry winds blow incessantly. But in Nebraska the heavily timbered heads of her streams give some humidity, and the clouds empty in frequent showers along the Loups, Niobrara, Plattes, Elkhorn, and Missouri. In time, as Nebraska increases her forests, the rains will become more frequent, and some day, should she persist in her present system of tree-planting, she will be as well watered as Iowa, Illinois, Wisconsin, or states farther east.

Every one has noticed the moisture of the soil in a wood. There is as much difference between the soil under trees and that on a barren hill-top as there is in the temperature of a well and an open plain. The humidity of a forest is due to the discharge of moisture through the leaves of the trees. It is this peculiarity which keeps a stream strong and full where it flows for a long distance through woods; not only do the trees shade the stream from the rays of the sun and prevent evaporation, but they keep its banks moist and soft, and, instead of drinking up the stream, frequently contribute to its waters. The Elbe has lost eighteen per cent. of its flow in consequence of cutting away the trees along its banks, exposing its waters to the hot sun.

The island of Santa Cruz, in the West Indies, which twenty-five or thirty years ago was a garden, is now almost a desert in consequence of cutting away the forests. The theory is that the dry currents of air are retarded by forests, and elevated until a point of condensation is reached. Radiation is also prevented, the air cooled, and the clouds, passing over trees, are rendered more easily condensed. Electricity is also a great agent, the trees being negatively charged, and drawing with great power the positively charged clouds. This theory is no longer a matter of doubt or experiment, but a fact demonstrated by experience and a knowledge of the laws that govern the atmosphere.

But not only in Europe, but in America, is the loss of timber already lamentably felt. Many of our rivers have lost half their usefulness for manufacturing purposes. The Connecticut is hardly navigable, and the Kennebec and Merrimac have shrunk one fourth. The Potomac has lost nearly one fourth of its volume, and the Hudson declined a sixth. If the Adirondack wilderness and other forests adjacent were destroyed it would probably, in time, render the Hudson wholly unnavigable.

As has been explained, forests are vast reservoirs of humidity—lessening the dryness of the surrounding atmosphere, and aiding the perennial flow of springs and streams. Says Bryant, "instances are on record of the drying up of springs and rivulets when the woods which shaded them were felled, and of their reappearance when the trees were suffered again to grow."

The increase of rainfall in Lower Egypt since the formation of extensive plantations of trees is proof of their effect upon the rainfall of a country. In 1869 there were fourteen rainy days at the Isthmus of Suez, where rain had rarely if ever before been known, and the cause was ascribed to the planting of large plantations of trees. In Kansas and Nebraska the rains are much more evenly distributed through the seasons than they used to be, and this is undoubtedly due to the stirring of the soil and the planting of trees. A similar change has been noticed in Colorado, where the flow of small streams, it is said, is becoming stronger and more permanent. The waters of the Great Salt Lake, which some years ago seemed to be receding, have again risen, and are every year increasing, as the Mormons open up farms and plant orchards in the Salt Lake valley.

The effect of forests on a country may be set down as follows: First, great humidity of the atmosphere. Second, more rapid evaporation. Third, greater regularity of rainfall. Fourth, diminished force of the prevailing winds. In no country has the effect of settlement on the climate been more apparent than in Australia. Keeping sheep there is in many places no longer as profitable as it used to be; but, on the other hand, large tracts of land that were worthless before have latterly become fit for agriculture. There has been a decided increase of forests and a consequent increase of moisture in many parts, giving hopes that eventually the whole interior desert may be reclaimed. The direct effect of sheep-raising has been to keep down the long grass which formerly afforded material for destructive fires. The trees, young and old, had been periodically burned by these fires, until the country, becoming almost treeless, its climate had been rendered arid and its soil sterile. If the climate in Australia can be changed and rains made to fall by the growing of timber, why not our own country? And why may not our plains, in time, become well-watered regions and good farming countries?

Incredible as it may seem, it is nevertheless true that forests are still felled and burned for the purpose of bringing the land they stand upon under cultivation. From 1860 to 1870 no less than twelve million acres of forest were cut, the timber logged and burned on the ground, so that the land could be farmed. The annual decrease of forests by logging and burning is still, I am told, some eight hundred thousand acres per year. And while we are thus destroying our timber by every possible means, and taking no adequate steps for replacing it, the demand for lumber is increasing at the rate of twenty-five per cent. per annum. I cannot say what is just the annual decrease of our forests, but it cannot be less than eight million acres per annum, while as yet we do not plant more than a tenth of that amount in new timber, outside of Nebraska.

That we have shamefully and wantonly destroyed our forests no right-thinking man will deny. We cannot undo the past, but we may still provide for the future if we set to work with diligence and sense, and earnestly persevere. What, then, should be done? Let every man remember when he fells a big tree he is doing something which he cannot undo, and destroying that which in his lifetime he cannot replace, and let him cut down just as few trees as possible. Farmers should plant hedges around their fields, and avoid cutting down timber for rails or fencing of any kind. Division fences between farms ought always to be made of hedges. Strong herd-laws should be passed in the states and territories, and stock not be allowed to run at large, thus doing away with the necessity of so many fences. Millions of dead capital in the states might thus be utilized and brought into use for other purposes. States should make liberal appropriations, and foster and encourage in every way the replanting of forests. Nebraska has admirable herd and forestry laws, and may be taken as a model in this respect by her sister states. Congress should enact strong laws for the protection of timber on the public domain, or turn it over to the states and territories. If placed under the War Department it would be protected. Overseers of roads should be made to plant trees along the highways at the public expense. Railways should be compelled to plant trees along the whole length of their track on either side, and preserve them from fires. Reservations should be laid off around the heads of rivers and streams, and no timber be allowed to be cut there. It is true that we cannot in one or even two generations repair all the damage that has already been done; but, by beginning at once, we may yet avoid the terrible scourge of a timber famine in the United States.

CHAPTER IV.

DANGER OF TIMBER FAMINE.

Convincing Proofs of the Approach of a Timber Famine.—Manufacture of Charcoal in New England, and Quantities of Wood Annually Consumed thereby. — The Destruction of Forests on the Tittabawassee and Cass Rivers Illustrated. — The Immensity of Forest Destruction in Nevada.—A Prediction of Nevada's Future.

If any one doubts the danger of a timber famine in the United States at some future day, let him look at the destruction of trees in his own neighborhood. Where are the forests that sheltered our youth? Where are the big woods in which we hunted the red deer, the black and gray squirrel, and an occasional bear? Gone, gone, and all the game with them. I remember the furnaces of my own county, Centre, in Pennsylvania, how they never ceased until all the big woods were cut down and burned up into charcoal to make iron.

A few years ago, in the towns of Canaan, Salisbury, Norfolk, Sharon, Cornwall, and Goshen, comprising the northwestern part of Litchfield County, Connecticut, and a small portion of Dutchess County, New York, and Berkshire County, Massachusetts, were no less than twelve iron furnaces for the manufacture of charcoal pig-iron, from iron dug within these districts. These furnaces made about 3500 tons of pig-iron each per year, at a cost of about $40 per ton, or $1,680,000 for the whole. More than half this amount was paid for wood consumed in the shape of charcoal. To run these furnaces one year it required that between four and five hundred acres of land should be stripped of the wood,

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or a total of between five and six thousand acres cut every year.

As every one knows, it takes about twenty years there to make a crop of wood, the whole amount of land stripped bare would be in the neighborhood of one hundred thousand acres, or nearly the whole of the woodland in the section above named. But not only in one or two states, but in all the states the destruction goes steadily on. Take, for the purpose of illustration, the records of the amount of logs rafted out of the great lumber-producing streams of the Saginaw districts for a number of years. In round numbers the Tittabawassee rafted out 288,000,000 feet of logs in 1871, 316,000,000 feet in 1872, and 269,000,000 feet in 1873, and had left each year from two hundred to three hundred million feet. In 1873 the amount left over was stated at 250,000,000 feet. Taking the amount rafted out and the amount left over in 1873, we should have 519,000,000 feet as the total product of the Tittabawassee lumbering that year. Up to August of 1874 there had been rafted out of the Tittabawassee 1,202,371 pieces, or about 215,000,000 feet, and there were left back about 100,000,000 feet, making a total for the year of, say, 315,000,000 feet for 1874, against 519,000,000 feet for 1873.

Let us take the Cass River, the largest lumber-producing stream of this region except the Tittabawassee. In 1871 there were rafted out of the Cass River 55,841,-618 feet of logs; in 1872 there were 99,913,935 feet; in 1873 there were 109,450,140 feet; and in 1874, all the logs being now out, there have been but 48,260,800 feet, and there are no logs left.

We might continue these illustrations by exhibiting the figures for the other streams in this section, and by giving the facts concerning the immense waste of forests, but these will do for one region.

A Virginia City (Nevada) paper says that an immense destruction of the forest is taking place in that vicinity, and in a short time the lumbermen have advanced from the base to the summit of the Sierras, and soon they will go over the crest; consequently it is predicted that when the timber is all gone the snow will melt early in summer, leaving the streams from which they irrigate dry, and cold and fierce winds will have an uninterrupted and unobstructed sweep, making the country uninhabitable.

CHAPTER V.

DESTROYING THE REDWOOD.

A Description of the Redwood Forests.—Lumbering Operations in the Redwood Forests in Detail.—The Advantages of Skilled Axemen in Lumbering Operations.—The Axeman's Efficiency in Time of War.—The Mill Machinery, of What Consisting.—Process of Preparing the Timber.—Immense-sized Trees.—Average Yield of Sawed Stuff per Acre.—The Forest Soil Described.—Depth of Root of the Redwood-tree, to What Due.—A Reasonable Explanation.—Great Age of the Redwood-tree.—Manner of Growth and General Appearance.—Experiences of the Log Camp.—Redwood Logging in California.

A FRIEND of mine, while in California not long ago, made a visit to the Redwood forests on Russian River. His description of what he saw is so graphic and interesting that I give it a place in these chapters. He says: "The nearest mill was twenty miles distant. But such was the purity of the atmosphere that the timber could be seen distinctly, looming up in its gigantic height, twenty miles away on the mountains. After a sharp drive across the plains we descended to the river through a pocket cañon, where forests of fir and laurel line the hillsides. At this season the river is a stream of fifty feet in width, about knee-deep. The other bank is the margin of the red woods. A mile beyond we came to Murphy's mill, located in a valley in the heart of the timber. Though it has been running continuously all summer with a force of twenty-five men, and a capacity for sawing twenty-five thousand feet per day, they have not succeeded in clearing the trees away from dangerous proximity to the buildings.

"Having read newspaper and magazine articles and books of travel laudatory of everything here to a tiresome extent, I took the precaution to carry a tape-line, and propose to set down the sober results of measurement, and will leave the speculative and poetical departments entirely out.

"The men live in little houses scattered along a trout-stream near the mill, the stumps of the trees being in many instances as large as the houses. The mill-building is forty by ninety feet, two stories high. The engine is sixty horse-power, having furnaces consuming less than half the sawdust and slabs produced—a car bears the surplus away to a pile always on fire. The gang of laborers is divided as follows: Sixteen men in the mill, eight in the woods, one cook, and four yokes of oxen. The wages for the eight Chinamen are twenty-six dollars per month; other common laborers, forty dollars. The engineers and sawyers receive from sixty to eighty dollars; and the axemen, who fell the trees, are paid eighty dollars per month—all being 'found.'

"The axeman is the most important man on the premises, for the reason that if he is not expert in felling the timber great annoyance and destruction would follow. The timber is soft and straight-grained, and splits better than chestnut. His axe is light, with a narrow blade, and a helve forty-two inches long. All trees are cut from two sides only; there is no girdling or haggling. He chops both right and left handed, yet has to reach a long way when the trees are very large. In contriving to throw the trees away from the mill or away from other timber, no matter how they lean, brings out the skill of the woodman. But he does it every time. Not only that, but his employers will wager that his skill is so great he will drive a stake, set one hundred and fifty feet distant, with the falling tree; and showed me where he dropped a ten-foot redwood exactly between two stumps, either of which, if struck, would have shivered it; there was less than a foot to spare on either side. All will at once understand that the point is to at once work up the timber without loss or delay and to the best advantage. A mistake made in lodging one of these huge fellows against another would entail hundreds of dollars in the expense and trouble of clearing away the *débris*.

"In the older settled states there are few men left who could take their fathers' places as 'corner-men' at a house-raising. Enough are left to bear witness to the wonderful efficiency of an axe when wielded by skilful hands. It requires more judgment to manage than does the handling of his weapon by a swordsman. This was made plain during the war of the Rebellion by the great superiority of lumbermen and Western men over others when it came to slashing timber for rifle-pits and road-making.

"The mill machinery consists of one sash-saw, cutting logs eight feet in diameter (larger ones have to be slabbed), a circular-saw, edge-saws, and a planer for dressing and finishing. There are two cross-cut saws in the woods, following the axemen. Each saw is run by one man.

"When we arrived, the logging-gang were hitched to a log which they dragged along the ground, sled-fashion, to the mill. Before hauling it the bark was peeled off and the end of the log slightly rounded. Buckets of water poured along the track made it slippery. Then, resting a few times by the way, the oxen 'snaked' the log, five feet in diameter, to the ways at the mill; with a slight purchase and a pull by steam it was rolled on a car and began to travel to the saw. There it was cut by the sash-saw into three huge slabs, which were left clamped together, then rolled over to the circular-saw, which could now manage the pieces. Every twenty seconds a huge plank was sliced off and sent to the 'edger;' thence, in narrower boards, to the 'planer,' and before the mud was dry, it had become dressed-flooring or rustic finish for building. There were thirteen logs in that tree, each sixteen feet long. Another tree measured two hundred and eighty-eight feet from the stump to the end of the last saw-log. It had cut fifty-six thousand feet of boards; the top was left at four feet diameter and near one hundred feet in length. Still another, which they were working into shingles, had already made three hundred thousand, and enough lay there in the log to make one hundred thousand more. It was perfectly free from knots and wind-shakes for two hundred feet. They count usually on having first-class lumber on the first one hundred and fifty feet. We measured two large trees, standing within fifty feet of each other, which were forty-one feet six inches and forty-one feet, respectively, in circumference at five feet from the ground. We afterwards saw still larger trees, but did not measure them, as some of them grew in clumps and were not fairly single stems. My opinion is that the average size may be set down as about eight feet across the stump. The product will run from two hundred thousand to five hundred thousand feet of sawed stuff per acre, as nearly as I could figure, depending on the frequency of the groups and the size of them. There is no undergrowth, and the ground is deep, mellow black soil, capable of producing anything grown in California. After clearing there would be no trouble in ploughing close up to the stumps, as the roots lie far below. One tree having died, fire got into it and burned twenty feet below the surface, leaving a hole like a well where other portions of the trunk could be seen still growing upward. The explanation may be due to their great age, which has allowed for the accumulation of soil around them for hundreds and thousands of years—like the ruins of old cities buried under accumulations of centuries. Attempting to count the rings of annual growth, we found an indefinite and unsatisfactory undertaking. They were very close and blended together. There is no doubt that the largest trees were in existence before the Christian era—possibly as long ago as the building of Rome. The growth here is so dense there is very little foliage as compared with the size of the trunk, and the limbs do not often start nearer than one hundred and fifty feet from the ground. The tree-bole holds its diameter remarkably uniform in its upward growth, and will usually be two feet thick within fifteen feet of the top, where it seems to be broken off at the limit of the fog-line. There is no object at hand affording the spectator an adequate standard of comparison by which the eye may measure the vast height of these trees, which would far out-top the steeple of Trinity Church.

"Away in the depth of these big woods we found a solitary cow, belonging to the mill. She was quietly ruminating, and seemed glad of companionship. That she was a civilized animal was shown by the polished brass tips on her horns. She was very gentle, and suffered us to pat her neck, while she stopped chewing her cud and put out her nose, breathing big breaths fragrant of milk and grassy odors.

"Returning, a couple of hours were spent wandering about the mill, where a dozen four-horse teams were loading lumber at the big piles. Afterwards a stroll of a few rods to see long-armed Davis, in his 'shirt-sleeves,' swinging in the slow, steady strokes with his long-handled axe, as he opened an eight-foot notch in the side of a three-hundred-footer. He stood on the ground at his work, but once in a while stopped to walk half way around the tree, or shut one eye and look up with the other, as though mentally engaged in taking its weight and in calculating to the fraction of an inch the deviation from its proper course that any probable force might exercise on its fall.

"Once ten rods away, bound for the settlements, the axeman and the mill were hid from view—buried completely by the trees."

LOGGING IN CALIFORNIA.

The following account of the manner of handling the redwood logs is condensed from the *Scientific American* of recent date, and may be found interesting. The manner of preparing the tree, and treating the road on which the logs are snaked out, is the same in detail as is already given in the commencement of this chapter, with the exception that the trees are now felled with saws instead of axes, as hitherto; it being found that the trees jump better from their stumps, and cause less waste by breakage, than when the axe was used.

No wagons are used in the woods, the logs being simply snaked along the ground, and in this manner the loads hauled are sometimes enormous. One train of seven logs, drawn on Humboldt Bay by five yoke of oxen, scaled collectively 22,500 feet, board measure, of mercantile lumber.

Until within the past year all the labor of handling these logs was done with cattle, but now steam is used in many places for this purpose. The machine consists of an upright boiler and engine, somewhat similar to a portable hoisting-engine, except that, instead of a reel to wind the rope on, it has two "gypsy-heads" on each end of the reel shaft. To move this machine around in the woods, they run a line ahead, make it fast to a tree or stump, take two or three turns around the gypsy, and start up the engine. In this way it hauls itself wherever wanted. By the use of this machine heavy logs are brought out of ravines and bad places, where it would be impossible to get them with oxen or horses.

A wooden tramway is used for transporting the logs from the woods to the mills or streams; but, as the more accessible timber is being cut off, this way of conveyance is supplanted by iron and steel rails or locomotives.

There are about forty mills engaged in cutting redwood, the largest of which have a capacity of 75,000 or 80,000 feet per day. Perhaps the average working capacity of all the mills would be about 40,000 feet daily. The amount of redwood sawed by these mills in 1881 was not far from 140,000,000 feet. Of this, 95,000,000 came to the port of San Francisco; the balance, 45,000,000 feet, manufactured, was distributed to the lower ports in California, Mexico, South America, Sandwich Islands, Society Islands, and Australia, vessels going direct from the mills. Very few vessels, however, run all the year round, both on account of the difficulty of keeping them supplied with logs, and because the places where many are situated are not safe harbors for shipping in winter. As very few of the mills are connected with the market by rail, nearly all the lumber is transported by sailing-vessels.

CHAPTER VI.

FAMOUS TREES OF THE WORLD.

The Forest World and Human Life Compared.—Remarkable-sized Trees, Where Found.—The Largest and Oldest Specimens in the World.—Adanson's Experience of the Age of Trees.—"The African Baobab," "Californian Pine," "American Cypress," "The Tree Shelter of Cortez," "The Chestnut-tree of Mount Etna," "The Babylonian Tree," "The Würtemberg Linden-tree," "The Ancient Oaks of England," "The Old Walnut-tree of the Balkans," "The Banyan-tree of Ceylon," "The Ancient Cedar Forest of Lebanon," "The Feathery Cocoanut and Fan-like Palmyra of India," "The Date-tree," "American Trees of Historic Fame," "The Walnut-tree," "The Soap Plant of California," "The Mulberry-tree," "The Jonesia Asika" and "The Tamala of India," "The Shakespearian Mulberry," "The Wadsworth Oak of New York," "The Live-oaks of Florida," and the Grand Oaks of Europe variously and separately Described.—The Oriental Mulberry Proverb.—A Quotation from Genesis.

Tree-life all over the world, in every age and every clime, under Southern sunny skies or the bleak, bare heavens of the North, has its wonderful giant-like monarchs, its hoary old sages, rugged with age, its poetical love-dreaming and love-suggesting specimens, and its useful plain, honest members. In fact, like the human life, the forest denizens have their world within themselves, their kings and sages and plebeian races.

The subject is a vast one; thousands of trees bear names or attributes worthy of description. The most remarkable trees, as to size, are the baobab of Africa, the coniferæ of Upper California, the banyan of India, the lindens of Germany, and the oaks and yews of England.

The African baobab is held by botanists to be the oldest and largest specimen of vegetable growth in the world. Adanson saw one in the Cape Verde Islands within whose trunk, overlaid by three hundred close layers of wood, he discovered an inscription carved by two English travellers three centuries before. By the aid and position of this inscription he was able to arrive at a correct estimate not only of the length of time which it took the tree to grow or increase in size, but the exact age of the tree itself, which he puts down at five thousand one hundred and fifty years. The stem ordinarily attains only ten or twelve feet in height, but is thirty-four feet in diameter; this immense foundation being necessary to support the foliage that grows on it. The main branch rises perpendicularly sixty feet in diameter, and from it shoot other branches, extending horizontally fifty or more feet on all sides, and which, being loaded with the most exuberant growth of leaves, forms a verdant crown of something like one hundred and sixty feet in diameter; a single tree giving thus the appearance of a forest. It is called by a name which signifies "a thousand years," which would seem to be in agreement with the calculation of its age by all herbalists. A group of these baobab trees, crowning the summit of its rocks, gives the name of the Cape Verde Isles—"Green Cape." The next in size, and of course in age, are the celebrated pines of California, known by various popular names among the miners and other inhabitants of the district in which they grow: "The mammoth Washington Tree," which was discovered by the naturalist Lob on the Sierra Nevada, at an elevation of five thousand feet; "The Miner's Cabin," which is large enough for a comfortable dwelling-place, being a hollow tree three hundred feet high, with an excavation seventeen feet in breadth and thirty feet in circumference; "The Three Sisters," three trees which, springing from one root, are so interlaced as to appear but one tree; another, "The Riding School," has been blown down by a terrible storm which swept over the valley. It has a hollow stem into which a horse may be ridden for seventy-five feet and turned around.

These trees stand in groups, and many of them attain four hundred feet in height. Judging from the rings found within those that have been felled, they are mostly three thousand years old. Dr. Bigelow tells of one which he measured: "Eighteen feet from the stump it was fourteen and a half feet in diameter. As the diminution of the annual growth from the heart or centre to the outer circumference or sapwood appeared in regular succession, I placed my hand midway, measuring six inches and carefully counting the rings on that space, which were one hundred and thirty, making the age of the tree, by this computation, one thousand eight hundred and eighty-five years." As to its size, he says, "It required thirty-one paces, three feet each, to measure its circumference, making ninety-three feet;" and to fell it they were obliged to use pump augurs and bore it. It took five men twenty-two days to lay it low, and the mere cutting down cost over five hundred dollars.

It is said there are five hundred of these gigantic trees within an area of fifty acres, ninety of which are of colossal size.

At Chapultepec, Mexico, there is an American cypress which, when the Spaniards entered the country, in 1520, was called "The Cypress of Montezuma," being then of immense size, over forty feet in girth and one hundred and twenty in height. And the province of Oakaca, in the same country, shows the cypress which sheltered Cortez and his troops, still in fine condition. According to De Candole, these trees are four thousand years old.

A chestnut-tree still grows upon Mount Etna, called by the natives "Castagna di Cento Cavalla," because a hundred horsemen can be concealed in its interior; being hollow, and measuring one hundred and eighty feet round. At Babylon stands a willow-tree, in an ancient garden of Semiramis, and supposed to be coeval with her reign. A peculiar sighing sound, heard in its branches, and caused by some action of the wind upon them, is believed by the Arabs to be the voices of spirits hidden within its foliage. As no bird or insect ever lights upon it, or flowers grow, or, indeed, live near it, they think them evil spirits, whose presence is a bane.

By the city of Neustadt, in the kingdom of Würtemberg, there stood a linden-tree which was antique in 1229, for it is written "that the city of Neustadt, then called Helmbundt, was destroyed in 1226 and rebuilt in 1229, near the great linden." It was so well known that for centuries Germans spoke of Neustadt as "the city near the linden." A poem of 1408 describes it as standing near the gate, its branches propped by sixty-seven stone pillars. In 1664 these pillars were increased to eighty-two, and in 1832 to one hundred and six. In 1832 the trunk, at the height of six feet from the ground, measured thirty-seven feet; and it was estimated in that year, when a terrible storm rendered it well-nigh a wreck, to be eight hundred years old.

There are oaks in England planted before the Norman conquest, 1066, and yew-trees still older; one at Fountain Abbey, Ripon, in Yorkshire, was said by Pennant to be twelve hundred years old; another, in a churchyard at Baburn, Kent, measured by Evelyn in 1660, was then two thousand eight hundred and eighty years old, making it three thousand years old if still standing.

In the Baider Valley, near Balaklava, there stands a walnut-tree which, though twelve hundred years old, has not yet forgotten to be useful, but yields annually from eighty to one hundred thousand nuts. It belongs to five Tartar families, who annually divide the nuts between them.

The finest specimen of the celebrated banyan-tree of

Ceylon is found at Mount Lavina, seven miles from Colombo. Two roads run through its stems; some of its fibrous shoots have been trained, like the stays of a ship, to intercept the road, while others hang half-way down, with beautiful vistas of cocoa-palms seen through its pillar-like stems and leaves. It throws a shadow at noon over four acres of ground.

Cedars are found on Mount Lebanon supposed to be the remains of those vast forests from which Solomon cut the timbers for the temple three thousand years ago. Maundrell counted sixteen still standing in 1696 that measured thirty feet, and were over one hundred feet in the spread of the branches.

The feathery cocoanut and the fan-like palmyra of the Deccan countries of India, the hardly less beautiful date-tree, useful for so many purposes that it seems as if a native Hindoo could scarcely get through life without it, are all trees of world-wide note, and many specimens of them are famous both for size and age. The date-tree, besides providing the inhabitants of its vicinity with almost everything used in their domestic economy, its fruit serving them as the chief article of food, the stems and leaves for baskets, mats, roof-covering, and carpet, is the source from which they imbibe their common drink, "tara." Deep incisions being made in the trunk, a pleasant and abundant beverage exudes, both refreshing and invigorating if drank while fresh, but intoxicating if allowed to ferment by exposure to the tropical sun. The tara is much sought for when in the fermented state by the English soldiers, and causes many of the irregularities and crimes recorded of the troops in India. Indeed, it is said that a camp pitched near a "toddy tope," or date grove, is sure to be disorderly.

Among the trees having claim to historic fame, none are more worthily celebrated in our own country than the "Charter Oak" of Hartford, Connecticut, in which was concealed from British tyranny (1687) the charter of the colony for several years. And the "Treaty Elm," under which the good William Penn made his treaty with the Indians in 1682, and which stood upon the banks of the Delaware until the year 1827, when, in spite of the care taken to preserve it, it fell to the ground, and had a regenesis in the shape of canes, snuff-boxes, and drinking-cups.

The walnut-tree, originally called gaulinut, from having been introduced into England from France (ancient Gaul), was once considered by herbalists to be efficacious in all diseases of the head, as it bore the head signature (*i. e.*, a resemblance to the head), the outer skin being the pericranium, the shell the skull, the kernel the brain.

At the end of the sixteenth century walnuts did more service than cannon-balls, as at the siege of Amiens by the Spanish during the opposition to the ascension of Henry Quatre to the French throne, a party of soldiers, dressed as French peasants, brought a cart-load of nuts to sell, and when admitted, as they passed through the gates let some of the nuts spill out, which the sentinels dispersed eagerly to gather up, and while stooping were set upon, killed, and the gates taken by the disguised peasants, who then admitted the Spanish army.

In ancient times the fig-tree was sacred to the gods. Its leaves were used for the crown of Saturn; its branches borne in procession at the feast of Plynteria, when the statue of Minerva was washed. In the Thargelia, or feast of the sun, they wore the fig, and played, on flutes, an ode to "The Fig-tree." The Romans honored it because Romulus and Remus were found under a fig-tree, and it was considered a type of friendship.

Paris has an elm-tree planted in 1605, the leaves of which are as early as those of younger trees.

The soap-plant of California is not only beautiful, but useful, the bulbs being preferred by those who use them to the finest quality of soap. There is another tree, found in South America, the bark of which is used as soap also.

The most beautiful tree of India and, it is said, of the world, called by the natives "Jonesia Asika," bears a red flower resembling the isora, of the most wonderful beauty and sweetness, while the denseness of its foliage is a marvel to behold. Another tree of India, the tamala, bears black blossoms of a most singular shape.

The mulberry, famous the world over, shall close this mere mention of celebrated tree-life. Since the Babylonian lovers, Pyramus and Thisbe, in despair of the "course of true love running smooth," imperilled the spotless white of the mulberry-blossom with their life-blood, this tree, with its dark-winged leaves, its sanguine-juiced fruit, has been sung by poets and lauded by scholars.

The Morea of Greece is named from its fancied resemblance to the shape of the mulberry-leaf. The Reverend F. Gastrel, of Stratford-on-Avon, has sent his name down to ignominious disgrace, having, in the year 1786, "wantonly and brutishly" cut down the favorite tree of Shakespeare, a mulberry planted by the poet's own hands.

The introduction of the mulberry into France for the food of the silkworm was bitterly opposed by the people, and only effected by the will of Henry IV., who foresaw the great wealth to be thus gained. There is a pretty Oriental proverb inculcating patience and hope, which says: "With time and patience each leaf of the mulberry becomes the softest silk."

The Wadsworth oak at Genesee, New York, is said to be five centuries old, and twenty-seven feet in circumference at the base. The massive, slow-growing live-oaks at Florida are worthy of notice on account of the enormous length of their branches. Bartram says: "I have stepped fifty paces in a straight line from the trunk of one of these trees to the extremity of the limbs." The oaks of Europe are among the grandest of trees. The Cowthrope tree is seventy-eight feet in circuit at the ground, and is at least eighteen hundred years old. Another in Dorsetshire is of equal age. In Westphalia is a hollow oak, which was a place of refuge in the troubled times of mediæval history. The great oak at Saintes, in southern France, is ninety feet in girth, and has been ascertained to be two thousand years old. This monument still flourishes, or did recently, and commemorates a period which antedates the first campaign of Julius Cæsar.

And the Lord God planted the trees of the field—"every tree that is pleasant to the sight, and good for food; the tree of life also in the midst of the garden, and the tree of knowledge of good and evil," under the shadow of which Eve and Lucifer had that agreeable little intercourse from which came all this trouble and confusion.

CHAPTER VII.

THE OLDEST TIMBER IN THE WORLD.

Where Found, and Uses to which Put.—Its Present Preserved Condition and Sacred History.—The Ancient Trees of America, Where Found.—Petrified Relics.—Evidences of Ancient Tree-growth in Nevada.—Indian Tradition on the Tree-growth of Nevada.—Carbonized Tree-trunks.

Probably the oldest timber in the world, which has been subjected to the use of man, is that found in the ancient temple of Egypt in connection with stone-work, which is known to be at least four thousand years old. This, the only wood used in the construction of the temple, is in the form of ties, holding the end of one stone to another at its upper surface. When two blocks were laid in place an excavation about an inch deep was made in each block, in which a tie shaped like an hour-glass was driven. It is, therefore, very difficult to force any stone from its position. The ties appear to have been of the timarisk or Shittim wood, of which the ark was constructed—a sacred tree in ancient Egypt, and now very seldom found in the valley of the Nile. The dovetail ties are just as sound now as in the days of their insertion. Although fuel is extremely scarce in the country, these bits of wood are not large enough to make it an object with the Arabs to heave off layer after layer of heavy stone to obtain them. Had they been of bronze, half of the old temple would have been destroyed years ago, so precious would they have been for various purposes.

The oldest timber in America undoubtedly existed in

Nevada and California. That in California has happily been preserved, but the ancient trees of Nevada have long since disappeared. There are, however, still to be seen many petrifactions of these ancient giants, which tell us what these forests once were, long before the landing of Columbus on our shores.

In the bottom of the main shaft of the Virginia City Coal Company, Eldorado Cañon, Lyon County, Nevada, was encountered the trunk of a tree four feet in diameter, a lone relic of an ancient and extinct forest. Where cut through by the shaft, this old tree was found to be perfectly carbonized—turned into coal; outside the old log was completely crusted over with iron pyrites, many of which were so bright that the crystals shone like diamonds. These pyrites also extend into the body of the log, filling what were apparently once cracks of windshakes, and even forming clusters about what was once the heart of the tree. This relic of an old time lay far below the two veins of coal. The finding of this old trunk is evidence that the country ages and ages ago was covered by a forest of large trees; though the native timber growth, when the country was first visited by the whites, and as far back as the traditions of the Indians extend, was but a scrubby species of nut-pine. A few miles from the shaft in which this carbonized tree was found, are to be seen on the surface the petrified remains of many large trees. In the early days of Washoe, before the prospector had broken them up for specimens, pieces of tree-trunks two and three feet in diameter, and twenty or thirty feet in length, were to be seen lying upon the surface of the ground.

CHAPTER VIII.

THE BEAUTY OF TREES.

Their Varieties of Feature and Form and Diversity of Character.—The Attributes of Trees.—The Essential Condition of Beauty in Trees.—Beauty of Forest Retreats.—The Forest Enjoyments and Joyous Inhabitants.—Individual and Collective Beautifying of Trees, How Realized.

Among all the millions of human beings who have existed since time began, no two have been alike. All their illimitable varieties of expression are produced by the varied combinations of only half a dozen features included in a circle of six to eight inches in diameter. While amid all these forms of expression many are known as being of exquisite beauty. So with the endless diversity of character that may be exhibited among trees, with the multitude of features and form given by their trunks and myriads of branches, limbs, and twigs, their infinitude of leaves and blossoms, of all sizes, forms, and colors; their towering outlines delineated on the azure canopy of the skies, and the ever-varying play of light and shadow of their foliage. There are subtle expressions in trees, as in the human face, that are difficult to analyze or account for.

Sunny cheerfulness, gayety, gloom, sprightliness, rudeness, sweetness, awkwardness, and eccentricities are all attributes of trees, as well as of human beings. Some trees look sulky or sad, as old oaks, or balsams, and repel sympathy. People never love such trees; they are only endured by way of variety. A healthy, vigorous sugar-maple looks warm, sunny, and deep-blossomed;

the voluptuous magnolias and the wide-winged apple-tree, bending down with loads of fruit to shade and cover all, convey to us at once the idea of human love and sympathy. These are the trees we are forced to love, because they are beautiful; have souls that thrill a sympathetic chord in our own souls. The children will not cry when the stiff and stoical old balsam fir and Lombardy poplar are cut down; but lay low an old and favorite apple-tree, or oak, or maple, under whose shade they have played, and their hearts will be quick to feel the difference between trees. No tree has the highest beauty of its type without the appearance in its whole bearing of robust vigor. This is the essential condition of all beautiful trees. Thriftiness cannot make an elm look like an oak, but rather marks more sharply the difference between them, making the elm appear more graceful and the oak more majestic. Yet thriftiness changes the forms of some trees. Few trees attain the full measure of their beauty through thrift unless they are fully exposed on all sides to the sun. We do not mean that all trees will not be beautiful without such complete exposure, but that to realize the highest beauty of which any one is capable, it must be exposed. A greater variety of beauty can be attained by grouping one or more varieties or species, thus contrasting several expressions of form or foliage. But in this case we sacrifice the highest type of individual perfection to produce a more striking effect with several trees. But the same fact may be observed with reference to the group; its full beauty can be realized only by having the trees in luxurious growth, and exposed collectively to the sun.

What is a forest? How grand, how silent and beautiful! Let us saunter forth after breakfast in the grand old woods, and, finding a pleasant spot, sit on a moss-covered log that not long ago stood erect and for five hundred years waved his feathery crest to the gentle breeze. It has resisted the crumbling power of Time's history remarkably well, and furnishes a nidus for the growth of the beautiful moss, whose Calyptra, with its cardinal's hat off, wooes the gentle zephyrs passing over its soft bed.

This is a cool arbor — "a boundless contiguity of shade," where, undisturbed by the heathen shot-gun, the feathered songsters congregate to pour forth their matin lays in peace and fill their crops with the devastating insects that would denude the old forest-trees of their beauty and leave them to wither in lifeless decay. Hear the sprightly bluejay pipe his saucy notes, and mock in great glee the chattering squirrel on yonder huge knot contiguous to a safe retreat. Listen to the half-dozen birds in yonder thicket, personified by the merry, mischievous catbird. He is really the only bird in the thicket, and he laughs to think how he is fooling an unfeathered biped, with mouth agape, wondering at his mixed minstrelsy.

Hark! The woodpecker taps with lightning rapidity the dry limb on the top of yon elm, and as the taps echo among the cool arbors of the forest he chants his homely notes and thanks Heaven that he lives. The fish-hawk screams along the streams, and his voice strikes terror into the small song-birds, who have ventured near in search of food.

In the distance, in the dark aisles of the forest, the loud notes of the hooting owl come booming on the air, and a thousand hearts beat momentarily in great fear. There goes one of the tribe known as the mink, and he proudly trots along with a mouse in his mouth and his head erect. And there comes a hawk from the barn-yard with a hen in her talons, pursuing the course marked out for her on the map of hawk-life, however detrimental that course may be to the housewife's anticipated chicken-pie. Insect life's ten thousand notes ascend to heaven in pæans of praise, and feeble, finite man worships in wonder and amazement the omnipresent Creator of all. The solitude of the forest is the place to see, listen, meditate, and worship. There we come in contact with the God of nature, and feel that it is good that we have been born.

CHAPTER IX.

INFLUENCE OF TREES ON CLIMATE.

Forest Resources of India.—Formation and Development of the Forest Service of India.—Utility of Indian Forests, of What Consisting.—Traces of Flooded Areas.—Decrease of Stream in Punjab Rivers, to What Due.—The Temperature of Russia, How Affected by Forest Destruction.—Difficulty of Replanting Trees in Russia.—A Striking Illustration of a Forest-denuded Country.—Khanate of Bokhara.—Its Fertility Now and Thirty Years ago Contrasted. — Bavarian Observations. — Ascertained Influence of Forests on Climate, Relative Moisture, Fertility, and Healthfulness, with Illustrations. — The Distribution of Rainfall and Forests of the United States.—Serious Discoveries in the United States in Connection with Forest Destruction.—An Unpleasant Future Prospect.—Industrious Prosperity of the United States, How Threatened. — Saying of Dr. Hayes and How it Concerns the United States.

A great deal has already been said in these chapters about the influence of trees on the climate of a country, but as some people seem to be sceptical on this subject we will add for their benefit a few more facts.

The formation and development of the forest service of India has been followed by a succession of reports that bring into prominence the great and varied forest resources of that country.

The work of classifying, demarcating, working, and managing was commenced and conducted so recently as the year 1863, and hence a thorough examination of the forests of India has not been completed. The expanse of country under the direct control of the government comprises every variety of climate, elevation, and temperature, and almost every form of soil and sub-soil.

The general forest administration has, therefore, to deal with the treatment of a great variety of forests, from the cool shade of the cedars that crown the middle ranges of the Himalayas, to the arid plains of the South, where the stunted vegetation scarcely yields a rafter for the peasant's hut, and thence to the tropical forests of Burmah, where the deep-green shade is never pierced by the sun's rays.

The utility of these forests consists of their supplies of timber-woods and other products for building, manufactures, food, or for the use and convenience of the people, while they indirectly affect the climate and soil, maintaining the supply of water in springs, streams, and even rivers. In certain parts there exist evidences that at some former period, where there was rice cultivation on a wide scale, there must have been large areas flooded with fresh water for a long succession of years, and that not by fitful floods of sudden inundation, but in a steady, quiet manner. At present there are to be seen only the dry beds of torrents, running as a torrent during the rainy season, and having a very small supply of water at other times. This phenomenon, as we are informed in Mr. Powell's report, so commonly observed in all the Punjab streams coming from the now denuded lower hills, points inevitably to the conclusion that forest denudation has deprived these rivers of their steady water supply, and hence ruined the rainless countries that were dependent on them.

The winters in Russia are becoming colder every year, and the summers hotter, more dry, and less fruitful, owing, as it is clearly proved by Palingston, to the destruction of the woodlands which formerly abounded in the southern districts. The clearing of these lands has caused such an evaporation that many once capacious watercourses have become mere swamps, or are completely dry. The Dnieper becomes every day more shallow, and its tributaries are no longer worthy the name of streams. The question of replanting has frequently been agitated, but the dried condition of the earth in many places in southern Russia makes it a matter of great difficulty.

A striking illustration of the results which have followed the denuding of a country of its forest trees, and a result which has been brought about within the short period of thirty years, is afforded by the Khanate of Bokhara, in Asia, a country situated between 35° and 45° north latitude, and 60° and 70° longitude east from London. Thirty years ago the Khanate was one of the most fertile provinces of central Asia, well wooded and watered, and was considered an earthly paradise. Twenty-five years ago a mania for forest-clearing broke out and continued until the timber had nearly all been destroyed. What trees were spared by rulers and people were afterwards destroyed in course of a civil war. The consequence of this ruthless destruction of forest growth is now painfully manifest in immense dry and arid wastes, and the watercourses have become dry and useless channels. To ascertain by scientific observations the influence of forests on the annual rainfall, moisture of the air and ground, and on the climate generally, the Bavarian government established in different parts of the kingdom seven stations, at each of which daily observations were made at two different points, one situated in the middle of a large open field, the other in the middle of a large forest. These observations, according to Dr. Ebermeyer's report, agree with the observations and opinions given by Humboldt, De Saussure, Herschel, and other scientists in regard to the great influence of forests on the climate, relative moisture, fertility, and healthfulness of a country, and are confirmed by the present physical condition of the Mediterranean shores, which, since the Alps, Apennines, and Pyrenees were deprived of their forests, have lost the verdure and fertility so glowingly described by ancient geographers and historians. Rivers famous in story and song have sunk into insignificant streamlets, subject to sudden rises and overflows inundating and covering with gravel and sand the former fertile valleys. The destruction of the forests of the Vosges and Cevennes sensibly deteriorated the famous fertility of Elasas and the rich valleys of the Rhone.

The same discoveries, although in a lesser degree, we are now making in various parts of the United States. The wholesale stripping of our republic's soil of its timber, continued at its present accelerated rates, a quarter of a century later will be followed by a long era of physical degeneracy and climatic deterioration that must sap its industrial and even its intellectual energies, and reduce its fair and salubrious bosom to the aspect of a South American llano.

Unless there can be excited a national interest in this subject, and preventive measures are set on foot, the vast interior of the United States must part with a great portion of its magnificent agricultural, manufacturing, and commercial prosperity.

I say that the distribution of rainfall in the United States is almost identical with the distribution of its forests. The eastern one third of the United States is a well-watered and well-wooded area. The prairie region east of the Missouri has a moderate amount of rain. The parallel of 60° is the northern limit of the forests. Dr. Hayes said he had often covered a whole forest, well grown, with his hat. This was in Greenland, but unless we protect our forests the same may some day be said of the United States.

CHAPTER X.

WARMTH OF TREES IN WINTER AND COOLNESS IN SUMMER.

Temperature of Trees.—Their Winter Warmth and Summer Coolness.—Differences of Temperature of Different Trees Illustrated.—Heat-producing Property of Trees Exemplified.—Local Heating Influence of Forests.—The Additional Property of Evergreens.—Their Twofold Office.

Trees have temperature. The shade of some is much cooler and pleasanter than others. If you do not believe it, try the shade of a maple and then that of a pine, and note the difference.

So, too, some trees are warmer in winter than others. We all know that a stove throws out heat by reason of the fuel it contains, and that in a like manner the food taken by an animal is, as so much fuel to a stove, the source from whence animal heat is derived, and which is given off to the surrounding atmosphere precisely as heat is given off from the stove; but it is not so well known that trees give off heat in the same way. They feed, their food is decomposed, and during decomposition heat is generated and the surplus given off to the atmosphere. "If any one will examine a tree a few hours after the cessation of a snow-storm, he will find that the snow for perhaps a quarter of an inch from the stem of the tree has been thawed away more or less, according to the severity of the cold. This is owing to the waste heat from the tree. If he plants a hyacinth four inches or more under the surface of the earth in November, and it immediately becomes frozen in and stays frozen solid till March, yet, when it shall then be examined, it will be found that by the aid of its internal heat the bud has thawed itself through the frozen soil to the surface of the ground. These facts show the immense power in plants to generate heat, and the more trees there are on a property the warmer a locality becomes. Evergreens, besides possessing this heat-dispensing property, have the additional property of keeping in check cold winds from other quarters, thus filling as it were, the twofold office of stove and blanket."

CHAPTER XI.

THE BLOOD OF TREES.

Experiments in Connection with the Circulation of Sap in Trees.—Variety of Sap-exuding Trees.—Non Sap-yielding Species.—The Influence of Climate on Flow of Sap.—Composition of Sap, to What Due. — Distinctive Characteristics of Sap-yielding Trees Demonstrated.—Effect of the Temperature of Soil and Atmosphere on Sap-flow.—Principal Ingredients of Sap.—Daily Meteorological Observations and What they Prove.—Explanations on the Alternations of Sap-flow.—The Observations of Biot and Nevins, and What they Determine.—The Opinion of Mr. Hubbard Confirmed by Experiments.—The Absorbent Power of Roots.—Development of Leaf and Flower, How Influenced, and Origin of their Vitality.

A SERIES of experiments made by Professor W. S. Clarke, President of the Massachusetts Agricultural College, throws much light on a subject which has hitherto remained in great obscurity—the circulation of sap in trees—and promises an understanding of many things connected with pruning and transplanting which have hitherto been veiled in obscurity. Unable, from want of space, to present our readers with the full report, we endeavor to condense the material portions into a brief space. The familiar facts—that sap flows from wounds in certain trees in the spring, that from the sap of the maple sugar is obtained, and that the peculiarities of the season affect the quality and quantity of the flow, suggested these experiments, whose object was to determine the amount, pressure, and composition of sap which might be obtained from different species of woody oxogens. The great majority of trees and shrubs, it was found, do not at any season of the year bleed from wounds in the wood, and but few of the species which, in our northern latitude, exhibit this phenomenon at all do so when clothed in foliage. The striking and extraordinary differences thus evidenced are not accounted for by any peculiarity of structure or habitat. The soft and spongy wood of the willow and elm, growing in moist ground, seem specially suited to absorb and pour forth water before the expansion of their leaves or flowers in the spring; but examination shows that they contain no unusual amount of sap at that time. Of more than sixty species of trees and shrubs tested by Professor Clarke, only six—*Betula*, which includes the birch; *Acer*, the maples; *Vitis*, the vines; *Ostrea*, the hornbeam; *Juglans*, walnuts; and *Carya*, the hickories—showed any tendency to bleed. The genus *Carya* exudes but very little, and possibly *Fagus*, the beech; and *Carpinus*, the hop hornbeam, may do the same, though no satisfactory test was applied.

It was found that each species had its own time of beginning the flow of sap; that the flow then steadily increased in quantity and force until the maximum was reached, when it gradually declined; and that the composition of the sap of the several species differed remarkably, both according to the date of the flow and the time of its beginning.

This singular periodicity demonstrates that the absorption of water by the rootlets is not caused by osmose or any other merely physical force, but is the result of that specific life which imparts to every plant its distinctive characteristics.

The sugar maple, which begins its flow in October, reaches its maximum about the first of April, and ceases about the first of May. The black birch begins the last of March, reaches its maximum in a single month, and stops entirely about the middle of May. The wild summer grape-vine commences the first of May, arrives at its maximum by the twenty-fifth of the same month, and ceases early in June. Differences in the season of flowing are of course accompanied by corresponding differences in the temperature of the soil and atmosphere, as also in the chemical condition of the sap. The principal ingredient of maple sap is cane sugar; of birch sap, grape sugar; and of vine sap, mucilage or gum.

But why do we find cane sugar in the maple, and not in the birch? and why only gum in the vine? Possibly because these several transformations of the starch (which descended to the root of the plant and was deposited in its cells, or in those of the stem, as the result of the previous season's growth) require different periods of time. The maple is the only one gorged with sap during the six months which intervene between the fall of the leaf and the beginning of spring growth. This affords ample time for the necessary chemical changes, and may account for the fact that the maple is the only indigenous tree from which crystallizable cane sugar can be profitably extracted. Birches are next in order. Being filled with sap for several weeks before a bud begins to expand, we may reasonably expect to find in them the formation at least of grape sugar; and in the north of Europe a sweet syrup is obtained from their sap by evaporation. At last the vine. The beginning of the motion of its sap is deferred until about the first of May, at which time it seems to contain no sugar of any kind. Three weeks later it acquires a sweetish taste, and we may then find a trace of grape sugar. At this period the beginning of vegetable growth is attended by the rapid exhalation of the water of the crude sap and the assimilation of its gum in the formation of cellulose, and this is precisely the transformation which ordinarily occurs in plants at the beginning of the vegetating season. A careful comparison of the daily weight of the sap from several sugar-maple-trees with the meteorological observations of the same period, conclusively proves that while the general flow corresponds with the season—rising to a maximum and declining—the daily and hourly flow varies with the weather. Steadily and severely cold and uniformly warm and foggy weather are the most unfavorable, while the best sap days are bright and warm, preceded by freezing nights.

The variations of temperature which affect the flow of maple sap are most likely to occur when the ground is covered with snow, because the heat of the sun during the day cannot then overcome the cooling influence of night. The most probable explanation of the effect of these alternations appears to be that the contracting influence of the cold drives sap from the outer tissue of the tree into the heart-wood of the higher parts of the trunk. Meanwhile absorption goes on as usual underground, and thus, when relief is afforded by the expansive influence of the sun, the sap rushes again to the surface and flows abundantly. This explanation is confirmed by the observations of Biot, in France, as to the poplar; and by Nevins, in Ireland, as to the elm. To determine whether sap would flow from the heart-wood of a sugar-tree a piece of gas-pipe was driven to a depth of six inches. The flow was regular and long-continued, but not abundant. From another tree a piece of bark five inches wide and three inches high was removed, and a piece of sheet-iron driven into the bark below to catch the sap which flowed very profusely but stopped very early. From the first tree the sap flowed eleven days longer than from the last, but the latter yielded twelve pounds more of the fluid.

In case of a tree tapped on both the north and south sides at the same level, it was found that the north spout yielded daily about twice as much sap as the south, and continued to flow nearly two weeks longer. To discover whether the sweetness of the sap was the same in all parts of the same tree, spouts were inserted in a tree which had never previously been tapped—one at the usual height, one fifty feet higher, where the trunk was about five inches in diameter, and a limb thirty-five feet from the ground was cut. In several hours the lower spout yielded six pounds of sap, the limb two ounces, and the upper spout none at all. Similar experiments of other trees showed the flows of sap to be most free within twelve feet of the earth, diminishing rapidly above that height. Experiments upon the roots proved that the sap flowed from both ends of a cut root, and that it all contained sugar.

The largest flow noticed during any one spring day was from a healthy shade-tree, six feet five inches in circumference, March 23, and amounted to ten pounds and three ounces. Sap gathered from the latter tree November 7 was found to contain only half as much sugar as that obtained in March from the first tree. Mr. Hubbard, an experienced sugar-maker, is of the opinion that the amount of sugar obtained from a single tree cannot be augmented much by multiplying the number of spouts.

Two half-inch holes about two inches deep suffice for ordinary trees, while four spouts and two buckets are used for very large trees. The average annual product of the sugar maple varies from twelve to twenty-four gallons of sap, yielding from two to three pounds of sugar, though the yield of a single tree is said to have exceeded thirty pounds in one season.

Birches seem to exceed all other trees in the amount of sap which they yield—black, yellow, paper, and gray or white birch were tested and reached the maximum of fifteen pounds per day per spout. They were tapped March 19, commenced yielding on the 25th, and ended the last of April.

At six o'clock, A.M., April 2, the two gauges in a black birch—the first at the ground and the second thirty feet higher up—indicated respectively pressures of 56.65 and 26.74 feet of water, the difference corresponding almost exactly to the difference in height. A hole being bored at 12.30 P.M. opposite the lower gauge, the pressure fell in fifteen minutes equal to 10.27 feet of water. Upon closing the hole the pressure rose to its former level in ten minutes. A stop-cock having been inserted into the hole, it was found that the communication between it and each of the two gauges was almost instantaneous; proving that the tree was entirely filled with sap and exerted its pressure freely in all directions. This sap-pressure continued to increase until May 11, when it represented a column of water 84.77 feet high—probably the highest pressure of sap ever before recorded. This pressure gradually decreased until May 27, when the lower gauge indicated zero. The suction manifested by the birch was very little, never exceeding nine feet of water, and continued for but a few days.

To determine whether this pressure was due to the vital action of the roots alone, a root was followed for a distance of ten feet from the tree, and then, one foot below the surface, cut off. To this detached root, one inch in diameter, a gauge was attached, April 26. The pressure became immediately evident, and rose, with slight fluctuations, until noon of April 30, when it indicated a column of water 85.80 feet high. The original experiment of applying a gauge to the grape-vine, first tried by Rev. Stephen Hales, of England, one hundred and fifty years ago, was now repeated, May 9, and on the 24th showed a pressure of 49.52 feet of water—six and a half more than was observed by Hales.

The peculiar features of the vine-sap are its lateness in the season, its apparent independence of the weather, its moderate and uniform rise to its maximum, its gradual decline to zero without marked fluctuations, and its almost unvarying suction of from 4.5 to 6.5 feet of water between June 20 and July 20, when the observations ceased.

The general indications of the mercurial gauge seem to show that the flow of sap is caused by the absorbent power of the roots forcing water into the tree, and as, even in the maple, the sap rarely rises more than twenty feet from the ground, and the development of leaf and flower buds is not usually affected by any mechanical pressure of the sap forced into them from below, their vitality is stimulated to activity by the genial influence of the sun, and their growth is, in its beginning, caused by the assimilation of organic substances accumulated during the preceding season of vegetation.

These experiments and observations are not final and conclusive in several respects, but they may be looked upon as having opened the door to an almost exhaustless subject of which the world needs information. I hope they will be read with interest by the most indifferent, and will be carefully studied in all their relations to the natural world by those who delight in such researches.

CHAPTER XII.

SHELTER-BELTS.

Vegetable Need of Protection Illustrated. — Observed Fallacies and Reasonable Contradictions.—Laws of Heat Radiation Demonstrated. —Nightly Atmospheric Heating.—Condition and Elevation of Air Favorable to Vegetable Life.— Atmospheric Vapor, How Supplied. — The Benefits of Transpiration of Forests. — Observations in Europe, and What they Prove.—A Conclusion Established.—Adduced Facts.—Motion of the Atmosphere.—Liquid and Aerial Motion Contrasted. — Aerial Motion Illustrated. — Protective Systems and their Controlling Influences.—Experienced Facts *versus* Theory.—A Study for the Orchardist and Farmer.—Experienced Testimony on the Influence of Shelter-Belts.

The following article from the pen of Professor Gale speaks for itself, and I need make no apology for inserting it here.

"Both animal and vegetable life need protection. Nor do we all see eye to eye in regard to the theory of protection. This is well illustrated in the following statement from a late number of the *Scientific American:* 'A well-grown evergreen-tree gives off continually an exodium of warmth and moisture that reaches a distance of its area in height; when the tree-planters advocate shelter-belts surrounding a tract of fifty or more acres, when the influence of such belt can only reach the height of the trees of such belt, they do that which will prove of little value.' There are two fallacies here. First, that the climatic influence of a tree arises from its power to send off an 'exodium of warmth' into the surrounding atmosphere. In relation to this we will only ask how many Christmas-trees will be required to keep our parlor warm next winter? The second fallacy is that shelter-belts can effect climatic changes only through their power to send off an 'exodium of warmth.' While the writer of this article may have aimed at a very good thing, he has certainly missed the point as far as shelter-belts are concerned.

"Holding that forest-culture in Kansas can be made a success, and that it is necessary to the prosperous settlement of the state, we desire to prove that forest-culture in the form of extended and carefully arranged shelter-belts must have efficient climatic influence. In proof of this let us state some of the simple laws which govern the radiation of heat and the motion of the atmosphere.

"LAWS OF HEAT.

"1. Heat is radiated from all bodies and in all directions, the angle of incidence and of reflection being equal.

"2. Heat of high intensity passes almost unobstructed through some bodies, while the same bodies are opaque to heat of a lower intensity; thus the sun sends its intense heat through the glass into the green-house, while the plants cannot radiate that heat back again through the glass into the open air. This fact can be illustrated by a heated ball and a plate of glass, showing the heat of low intensity is almost entirely retained by the glass. The vapor of water operates almost like the plate of glass, permitting the free passage of the heat from the sun, but checking very largely the radiation from the earth. Thus an atmosphere saturated with vapor will check radiation with seventy times the power of a dry atmosphere.

"3. The point of saturation varies with the temperature of the atmosphere. Then the cooler the atmosphere the drier it will be, and hence the more rapid the radiation of heat; or, the drier the atmosphere under any circumstances, the more rapid the radiation of heat. It is calculated by Professor Tyndall that one tenth of the heat radiated from the earth is retained within ten feet of the earth's surface by the vapor held in the atmosphere.

"4. It is found that during the night-time the atmosphere becomes sensibly warmer to the height of one hundred and fifty feet, as shown in the following table:

"Let the thermometer upon the grass represent zero, and at one inch above the grass it will read three degrees higher; and

At	6 inches	above	the	grass	it	will	read	6	higher.
"	1 foot	"	"	"	"	"	"	7	"
"	12 feet	"	"	"	"	"	"	8	"
"	50 feet	"	"	"	"	"	"	10	"
"	150 feet	"	"	"	"	"	"	12	"

You will notice that two thirds of the entire rise of temperature occurs below twelve feet, and five sixths of the increase in temperature below fifty feet. That is, the vapor within fifty feet of the earth is five times more important to vegetable life than that contained within one hundred feet above that point, and the vapor within twelve feet of the earth's surface has twice as much influence upon climatic conditions as one hundred and thirty-eight feet of atmosphere above that point.

"These facts lead us at once to the conclusion that, as far as vegetable life is concerned, we are most interested in the condition of the air within twelve or fifteen feet of the earth's surface, and that a vapor-laden atmosphere near the surface of the earth, not subject to violent commotion, must be a matter of the gravest moment.

"Now it is well known that vegetable life, as well as the earth itself, is sending off continually a vast amount of vapor into the atmosphere. Every spear of grass and every leaf is pumping up the moisture from the earth, and sending it forth into the air in the form of vapor, thus giving the earth a glassy covering, opaque to radiated heat of a low intensity. The amount of water drawn from the soil by growing trees and given off in the form of vapor from the leaves is simply immense. Thus it is stated that the eucalyptus of Australia will absorb ten times its weight in a single day (Rept. No. 159, H. R. U. S., on Timber Culture, page 94). A small pear-tree has been found to absorb and give off more than its own weight of water in forty hours. The effect of this transpiration is seen in the prevailing moisture of the forest. We have only to surround a house with a dense growth of timber, and we learn the immediate result in the dampness and mildew which pervade the dwelling. Hence the amount of moisture pumped up by the growing trees, often from great depths, can hardly be measured. This process will be constantly varying in its activity with the conditions of vegetable life.

"Extended observations in Europe have proved that there is a marked excess in the rainfall of an extensive forest over that of the open country. This should be expected, since the falling rain, as it reaches the prevailing moisture of the forest, must condense and carry much of its vapor to the ground.

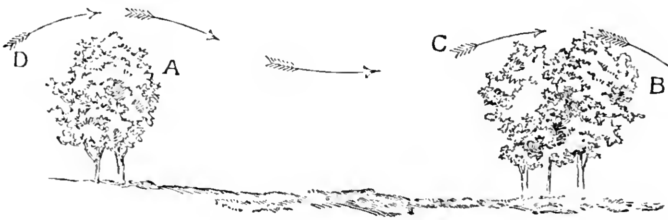
"If the positions above taken be correct, we should expect that wooded lands should be cooler than the open fields in the daytime, and warmer in the night; and such a conclusion has been clearly established by extended observations, made under the direction of the Bavarian government during the last six years.

"The facts adduced prove that all vegetable life will cover itself with a glassy mantle, in density proportioned to the luxuriance of growth, and nearly opaque to the heat radiated from the earth.

"How can this glassy mantle be retained as a nightly and constant protection to vegetable life, or must it be swept away by the prevailing winds? To answer this question intelligently, we must consider briefly some of the simple laws which govern atmospheric motion.

"MOTION OF THE ATMOSPHERE.

"There is a marked contrast in the motion of a liquid like water, and an elastic, gaseous fluid like air. If we place an impediment in a creek the water immediately flows around the impediment, and will not flow over it as long as a clear way can be found to either the right or the left. But the air not only moves around on either side, but piles up in front of whatever checks its course and rolls over the top of the impediment as readily as it passes around. Thus a grove of timber or a thin shelter-belt effectually checks the motion of the wind.



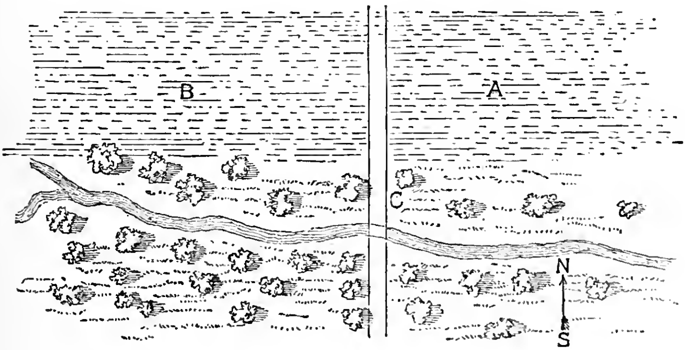
The wind rises over the trees, as indicated by the arrows in the figure, and, instead of falling like water to the ground, it flows on, as shown, and does not reach the original level until it has gone a distance of eleven times the height of the wind-breaks. There will be a quiet atmosphere immediately about the trees, but to eleven times the height of the shelter-belt, and even in the teeth of the wind at D, there will be a quiet atmosphere. It is well known that while the wind may sweep with fearful velocity over a forest and powerfully agitate the tops of trees, the motion is comparatively slight within the forest; the same is true of a succession of shelter-belts. The wind will sweep with great force over the trees at C, while all below remains quiet. The extent of these quiet spaces, A and B, will of course depend upon the height of the shelter-belts. Any one who will take the trouble can test the correctness of these views for himself.

"We expect that the most important and positive results will follow a well-devised system of protection. It would exert a controlling influence over all farm operations. A judicious system of protection would be attended with the most beneficent results, while under certain other conditions it might be attended with disaster.

"FACTS.

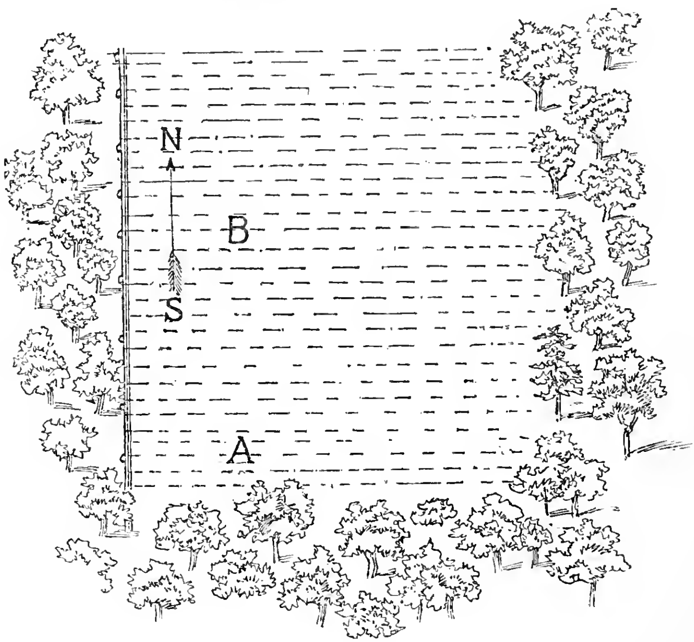
"All this, some will say, is theory. But Kansas in 1874 gave us, along the line of the M. K. and T. R. R., and in other parts of the state, some important facts in this direction. There are many parts of the state where corn was an entire failure. In a few localities corn matured a fair crop, even in exposed conditions. And there were other localities where corn yielded a crop only under very favorable conditions of culture and protection. It is these localities that are most interesting to us now. Space will permit at present the presentation of only a few of these cases reported to me by Robert Miliken, H. E. Van Deman, and others.

"We have here represented a corn-field, Isaac Smith's, fourteen miles south of Emporia. A B, corn-field, at C the road passes through the timber, leaving an opening

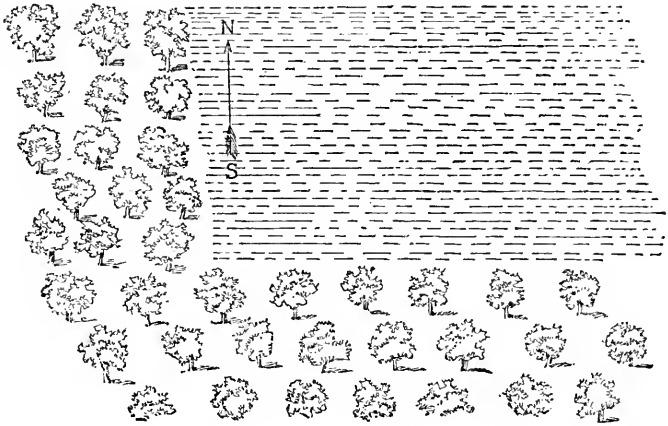


for the wind. As a consequence no corn matured near the road on either side. The timber south of B was very heavy, and the yield of corn in that part of the field was forty bushels to the acre; while south of A the timber was much lighter, and as a result the yield of corn was not more than twenty bushels to the acre.

"The figure below represents a field of corn reported by Mr. Van Deman, situated on the Neosho River, two miles south of Neosho Falls. At A the field of corn was forty bushels to the acre. Further north, at B, beyond the influence of the southern protection, the corn dried up and was much lighter.



"The following figure represents a corn-field north and east of an orchard eighteen years old, trees large and closely planted, Linn County, Kansas. Reported by



M. F. Leasure as yielding, in 1874, twice the corn of any other land upon the farm, though in ordinary seasons the corn is not as good as from some other parts of the farm.

"Another case is that of B. F. Leonard, ten miles east of Emporia. Mr. Leonard had two fields in corn last year on land cleared of timber, and at least one half mile from the prairie on the south. 'He raised,' says Mr. Miliken, 'the largest and heaviest corn I saw in 1874.' Corn from this field took the premium at the Linn County Fair, and was good enough for any season. The yield was sixty bushels per acre. Several other cases have been reported, with a careful attention to all incidental circumstances, so as to leave no doubt in regard to the direct influence of protection upon the corn crop of that immediate vicinity. In one case the corn was good for fifteen or twenty rods north of the timber, while beyond that line there was little or no corn. In another county, where a medium crop was made without protection, the lightest corn is reported on the southern side of the fields, where most exposed to the winds. The above cases are only given as examples of those which have been reported. They are facts which the practical farmer and orchardist in Kansas need to study. If we doubt the deductions of science, we certainly ought not to be slow in accepting the testimony of experience. Tree-planters have long advocated shelter-belts, for they know the deductions of science are in their favor, and the testimony of experience has been brought across the ocean to prove these positions; but the disasters of 1874 have brought out the experienced testimony of hundreds in Kansas. These can say, at least, that we know whereof we affirm when we report that in our experience shelter-belts have exerted a controlling influence on farm crops.

"It is time for the farmers of Kansas to look at the practical side of this question.

"The whole matter of protection needs to be thoroughly studied. Let the whole subject be carefully systematized with reference to the broadest results. We need to consider at large what to plant, when to plant, in what way to combine and extend our shelter-belts; how the interests of neighborhoods, towns, and even counties, run together in this work; how the interest of every property-holder may be concerned in this matter; what may be justly claimed of our state and government to encourage the work; and, lastly, how to reach and gain the attention of the great mass of farmers on this question. These points are too broad and too important for a brief discussion."

CHAPTER XIII.

KINDS OF TREES TO PLANT.

The White, Blue, Black, Green, Red, and European Ashes.—Their Growth, Usefulness, and Manner of Culture.—Climate and Soil best Suited to their Growth.—Distinguishing Traits and Properties of Varieties.—The Mountain Ash.—Its Deportment, Uses, and Manner of Propagating.—Its Enemies.—The American Flowering Ash Described.

It is not so difficult to raise timber as many people imagine. The lack of correct information on this subject is, I believe, to a great extent the reason why so little timber is planted. If farmers only knew how to plant, and when and where, they would not be slow to raise trees. Now let us see if we cannot give some simple directions for the planting of trees. First, then,

THE ASH.

This is one of the best trees for forest-culture. It grows rapidly, is easily raised, and of great money value. Mr. Hollenbeck, of Nebraska, has, in Douglas County, a piece of ash timber he planted in 1861, and many of the trees now measure thirty-eight inches in circumference, and are over forty feet high. Mr. Budd, of Iowa, has a grove that has done better still. He says ten acres, thinned to six feet apart, contained twelve thousand trees, and at twelve years of age were eight inches in diameter and thirty-five feet high. The wood from thinning paid all expenses of planting and cultivation. The bodies of the trees cut out sold for forty cents each, and the tops were worth ten cents more. Ten acres of this timber, twelve years old, was estimated to be worth six thousand dollars. Young ash, if cut low at eight years of age, and a light furrow turned over the stumps, will sprout and be ready for a second cutting in eight years. Mr. Budd says ten acres of black ash, planted for hoop-poles in rows four feet apart, may be half thinned in five years, and at three cents per pole will yield $1620. The remaining half, or fifty-four thousand poles, cut two years later for large hoop-poles, at six cents per pole, will yield $4860. The ash seed should be sown in the fall, in rows two feet apart, and covered with one inch of earth. In winter scatter a litter of straw three inches deep over the ground. The straw should be renewed early in the spring. The plants will grow as soon as the frost is gone, and will be twelve to fourteen inches high by fall. This will make an admirable nursery, from which the trees should be transplanted when one year old, and set out in the forest ground four feet apart. Work the ground the same as for corn, and keep the weeds down; the closer the trees are planted the straighter they will grow, and be free from lower limbs.

THE WHITE ASH.

The ashes greatly resemble each other in their quality of wood, but for profit and cultivation the white and blue ashes undoubtedly lead. Most of the farm utensils manufactured in this country are partially constructed of ash, and on this account are greatly preferred by the European farmer to those manufactured in his own country; this is owing to the excellence of the ash used in their construction. Owing to the rapid consumption of ash, not only for farming utensils, but for any purpose where toughness and durability are wanted, there is not the slightest doubt that the ash will be one of the most profitable trees planted.

The white ash is one of our largest trees when it has attained its full growth; it is usually from two to three feet in diameter, with a straight trunk free from branches to the height of thirty or forty feet. We find the white ash in the New England States, New York, in the Northern States, and in the Dominion of Canada, but it is fast becoming scarce. It is common, but not by any means abundant, in northern Illinois and Iowa, but is met with less frequently in proceeding southward. It also grows to a small extent in southern Kansas, but is so small and crooked that it is worthless, except for fuel.

The white ash needs a moist, cool, deep soil, and will not thrive to any extent in poor, dry land. The prairies of Iowa and Illinois afford the best soil for the cultivation of the white ash; the other members of the ash species would thrive and perhaps be of more value farther south. Those trees of the ash family that have been of the most rapid growth afford the best timber, while that from slow-growing, stunted trees is generally weak and brittle.

Ash is very extensively used in constructing carriages, furniture, and agricultural implements; it also makes very good firewood. The supply is fast diminishing and its use increasing, and those who propose to take advantage of this cannot be too soon in planting and getting ready to help fill the demand. The American ashes are diœcious, *i. e.*, the fertile and the barren flowers are on different trees. Seed is only produced by white-ash trees that are growing in open ground; it bears transplanting well, even when partially grown. It is a handsome and ornamental tree, and the only insect that attacks it is the May-bug, which devours the leaves early in the summer. The seed is ripe in October, and falls with the first frost.

THE BLUE ASH.

This tree grows principally upon the river bottoms of the Mississippi valley; also on the banks of the Illinois

River and its branches as far north as Bureau County, beyond which it becomes rare. It is about two feet in diameter, and reaches sixty or seventy feet in height. Its distinguishing trait from other members of its species is the triangular shape of the young shoots. The bark of old trees is not like that of the white ash, deeply furrowed, and divided into small spaces. The blue ash has the same qualities as other members of the ash genus, but possesses in a greater degree durability when exposed to the alternations of dryness and moisture: this quality has been satisfactorily proven in its use for posts, rails, stakes, etc., in rural fences; where it grows it is employed for the same purposes as the white ash. Michana claims that a blue color can be extracted from the inner bark, and doubtless from this fact it has derived its name. It is planted and treated the same as the white ash, but I would suggest a more southern climate than for the white ash—south of latitude 40°.

BLACK ASH

has the same characteristics as others of the ash family: its chief use is in the manufacture of barrels, baskets, and hoops for barrels, but it is less durable than others of its species when exposed to the weather. When green it can scarcely be burned, but when seasoned is very good fuel. A great deal of alkali can be obtained from its ashes. It can be raised on ground that is too wet to produce other valuable kinds of timber; it is to be planted the same as others of its species.

RED ASH

is said to be more numerous than any of its brethren in Pennsylvania, New Jersey, Maryland, and Virginia. Doctor Gray affirms that it is very rare west of the Alleghanies, but it is found in various portions of Iowa and Illinois. Its uses are the same as the white and blue ashes, and it has all the properties for which they are prized. It is cultivated as are the others of the ash family. It is smaller than the white ash.

GREEN ASH.

This is quite an ordinary-sized tree, and is chiefly found upon the banks of rivers. It is quite a handsome tree, its leaves being very nearly alike on both sides. It possesses the good qualities of the rest of the family, and the only drawback to its culture is its inferior size. Its seed, contrary to that of the blue and white ashes, germinates readily if sown dry in spring. It is cultivated like the rest of its genus.

EUROPEAN ASH.

This is a very lofty tree, the growth of which, in certain locations, resembles that of the white and blue ashes, and is only cultivated in the United States for its beauty. Its wood does not begin to compare with the white and the blue ashes for durability; hence I see no reason why it should be recommended for forest cultivation.

THE MOUNTAIN ASH.

This tree is cultivated for ornament in many parts of the United States, within the neighborhoods of Boston, Philadelphia, etc., where it attains considerable dimensions, sometimes reaching the height of thirty feet. Its deportment is somewhat restricted when fully grown, but is more loose and gracefully disposed when the tree is young. In color its bark is gray on old trees, but purplish-brown on young trees. Its leaves, which are spear-shaped and toothed on their edges, and smooth on their upper surface, are composed of eight or nine pairs of leaflets and an odd one terminating its length. Its flowers, which blossom in May and June, occur in large, fragrant white clusters, and are succeeded by berries of a brilliant scarlet color.

Of the many varieties of the mountain ash, the small-fruited variety is indigenous to the whole range of the Alleghanies, and is distinctively distinguishable by the dark-brown gloss of its young branches and by its scarlet berries.

Most of its varieties may be propagated by seed, which should be gathered as soon as ripe. Macerate in water before sowing, to separate the seeds from the pulp. Sow in beds of light, rich soil at two or three inches apart, and cover to the depth of half an inch. By the end of the first season the plants should average a height of eighteen inches. Separate and transplant the most thrifty to situations of permanency, after which their growth will be moderately rapid, and their attained height reach eight to ten feet at the end of the fifth year.

The mountain ash is subject to the attacks of several species of borers, one of which is specially noticed as its enemy by Browne in his "Trees of America." This beetle varies in length from a little more than one half to three fourths of an inch. The upper side of the body of the perfect insect is marked with two longitudinal white stripes between three others of a light-brown color, while the face, the antennæ, the under side of the body, and the legs are white. It comes forth from the trunks of the trees early in June, making its escape in the night, during which time only it uses its ample wings in passing from one tree to another in search of companions and of food. In the daytime it keeps at rest among the leaves of the plants on which it feeds.

In the months of June and July the females deposit their eggs upon the bark of the trees, near the roots, and the larvæ or borers hatched from them consist of fleshy, whitish grubs, without legs, nearly cylindrical in their form, and tapering a little from the first ring to the end of the body. The head is small, horny, and of a brownish color. The first ring is much larger than the others, the next two very short, and, like the first, are covered with punctures and very minute hairs. This grub with its strong jaws cuts a cylindrical passage through the bark, and pushes its castings backward out of the hole, while it bores upward into the wood. It continues in the larva state two or three years, during which it penetrates eight or ten inches into the trunk of the tree, its burrow at the end approaching to and being covered only by the bark. It is in this situation that its transformation takes place, which is completed about the first of June, when the beetle gnaws through the bark that covers the end of the burrow, and comes out of its place of confinement in the night. One of the oldest, safest, and most successful modes of destroying this borer is to thrust a wire into the hole it has made, or, what would probably answer as well, to plug it up with soft wood. The apple-tree, as well as quince, June-berry, and various specimens of thorns and aronias, are attacked by the larvæ of this beetle.

THE AMERICAN FLOWERING ASH.

This tree is a native of North America, and attains the height of thirty or forty feet. It has an abundant and extensive foliage, and is highly prized as an ornamental tree. Its general characteristics are so similar to the manna ash of Europe that it has been supposed one of the same species. It blooms in April and May, and its flowers are distinguished from those of the common ash by having corollas. This tree yields a clear, liquid-like substance, which oozes from its trunk and limbs under the influence of a hot sun. This substance first resembles drops of honey, of a sweetish taste, accompanied by a slight degree of bitterness, but granulates on exposure to the atmosphere. This variety of the ash is propagated from seed, by grafting or budding, and by cuttings and layers.

CHAPTER XIV.

THE WALNUT.

Its Culture, Usefulness, and Productiveness.—Value of the Walnut as a Crop.—Seed per Acre.—Its Nativity.—Traces of its Antiquity and Introduction into Europe.—Recognized Roman Varieties and their Names.—Its Modern Cultivation and Increased Varieties.—The Black Walnut.—Where Found, Attainable Size, and Attendant Features.—The Butternut.—Climate best Suited to its Growth.—General Qualities.—Its Medicinal Properties.—The English Walnut.—Its Cultivation, Distinguishing Properties, and Fruitfulness.

The walnut is a favorite tree, and very useful. It grows admirably in rocky ground, and thrives best in land with a yellow subsoil. To prepare the land, furrow out as if for corn, and drop the walnuts, one in a hill, four feet apart. Cover lightly with a hoe or plough. The seed should be planted soon after it falls from the tree, and is best dropped with the hull on. If this cannot be done, bury the seed, but by no means allow it to dry. Seed is also good dropped in February and covered in the spring. The frost cracks the walnut shell, and the sprout will start out soon after being covered in April or May. Forty acres of walnut timber will yield the farmer in ten years more than if the land is planted every season in grain. The trees will grow the first year ten or twelve inches, the second thirty, and the third year four to five feet. The first and second year the ground may be planted between the rows with potatoes or corn, and it will not hurt the young trees, walnut striking a deep root and drawing its sustenance from the subsoil. To make the trees bear nuts early, dig under and cut the tap-root. Fruit-trees that do not bear may also be made to do so by cutting their main or tap roots. Mr. Hollenbeck has a grove of forty acres of walnut, planted in 1865, and the trees average twenty-seven inches in circumference and are thirty-five feet high. Many of them bore nuts four years after planting, and six years from planting the trees had a peck of nuts each. Three bushels of nuts with the hulls on will plant an acre four feet apart, or one and three quarter bushels hulled will plant the same amount of land.

The walnut is a native of the mountains of Asia, from the Caucasus almost to China. It is supposed to be the Enoz of the Bible. The Greeks had it from Asia; and Nicander, Theophrastus, and others mention it under the names of *Carya basilike* (or royal nut). Pliny informs us that it was introduced into Italy from Persia, an introduction which must have been of early date, for, although it be doubtful whether it be alluded to by Cato, it is certainly mentioned by Varro, who was born in the year 116 B.C. The Romans called it *Nux Persica*, *Nux Regia*, *Nux euboca*, *Jovis glans*, *Dinglans*, *Juglans*, etc. They recognized several varieties, and among them the soft-shelled walnut is still cultivated, which several of the commentators have confounded with the peach. In modern days the cultivation has been extended, and the number of varieties considerably increased. Jean Bauhin noticed six only. Micheli, under Cosmo III. of Medici, describes thirty-seven, of which the original specimens are still preserved; some of these, however, are with difficulty distinguished from each other.

THE BLACK WALNUT.

This tree is found in the Atlantic States and the Mississippi Valley, in most places where the soil is deep and rich. It is also found in Illinois, but where it once ranked in that state with the ash and hickory, and was very abundant, it has now become scarce.

Bryant, in his work on trees, speaks of one that he met near "Roslyn, on Long Island, about twenty miles from the city of New York. It stands on the grounds of William C. Bryant, and sprang from the seed in the year 1713, in the garden of a Quaker named Mudge. At three feet from the ground it is twenty-five feet in circumference. At the height of twelve or fifteen feet the trunk divides itself into several branches, each of which by itself would constitute a large tree; the whole forming an immense canopy, overshadowing an area one hundred and fifty feet in diameter."

The wood of the black walnut is extensively used in the manufacture of furniture, all species of cabinet-ware, gun-stocks, etc. Its excessive use is rendering the supply rather scanty. Fruit-trees, from some unknown cause, will not thrive near it; but silver maples, birches, and other varieties of trees may be planted between the walnut-trees with rather a beneficial effect, as they prevent the low branches from spreading, as they otherwise would, a distance of about ten or twelve feet. These small branches should be pruned out from time to time. The black walnut is apt to throw out very heavy branches while young; these should be pruned off close to the tree, otherwise it will have a tendency to form a low, heavy, spreading top.

THE BUTTERNUT.

This tree is common throughout the northern portion of the United States, from the Atlantic to the Rockies: it thrives best in a cold climate. Its wood is soft, fine-grained, and of a light-brown color; is easily worked, and its uses are sufficiently varied to warrant its cultivation an object of pecuniary interest. It is also valuable for its fruit. From a single planting the kernel becomes larger, fuller, and easier of extraction, while the shell becomes very much thinner. New England has the largest butternut-trees to be found in this country.

A fluid extract of the inner bark of the root of this tree is used in cases of dysentery, habitual constipation, and other bowel complaints, and as a gentle cathartic, operating without producing debilitating effects. The preparations of the butternut are much used in domestic practice for the ailments of children, especially in throat disease.

THE ENGLISH WALNUT

is largely cultivated in Europe, both for its timber and fruit. The black walnut is far superior, both as a shade-tree and for its timber. It would hardly pay to cultivate the tree excepting for its fruit, which is always marketable. The blossoms are very apt to be nipped and destroyed by the spring frosts, and, like the black walnut, fruit-trees will not thrive near it. Its exhalations are so disagreeable that we have authentic cases on record where people have been seriously affected by sleeping in its shade. It is best propagated by grafting.

CHAPTER XV.

THE MAPLES.

The Sugar Maple: its Productiveness, Peculiarities of Growth, Foliage, and Manner of Culture.—A Proposition Worthy of Note.—Placing Maple-groves with Respect to Shelter.—The Advantages of Regular Planting.—Thrift of Trees when Transplanted from Dense Thickets.—Preferable Transplants.—Timber and Fuel Qualities of Maple.—Its Ornamental Standard.—The Chief Uses of Maple.—Peculiarity of its Seed.—Soil best Adapted to its Growth.—The Soft Maple: its Wild and Cultivated Thrift, Manner of Planting, and Uses.—The Red Maple: Range of Growth, Native Home and Standard Timber, and other Qualities.—The Ash-leaved Maple: its Uses, Growth, and Ornamental Advantages.—The Striped Maple: Where Found, Growth, and Ornament.—The Norway Maple: its Advantages.—The Large and Round-leaved Maples generally Described.

SUGAR MAPLE.

Mr. Pinney, an experienced tree-grower, says an acre of sugar maples at twenty-five years of age will average one foot in diameter and produce two thousand pounds of sugar annually. When the trees measure twenty inches they will give sixty thousand feet of lumber, worth $2500, besides a great deal of fuel. A peculiarity of this tree is, its body increases faster in size than its top. It can, therefore, be planted very closely. Two hundred trees will grow on an acre. Maple-seed ripens in October, and should be planted in rows the same as ash, but not so thickly. After planting, allow the tree to stand two years in the nursery, and then transplant to ground where it is to grow permanently. Old sugar orchards, with trees left scattering and thin, usually pay a good interest on the value of the land. Two or three hundred maples will thus usually occupy as many acres, often interspersed with beech, basswood, or hickory. The labor of gathering the sap over a larger area is much increased, while the production of sugar is diminished. I do not know that any one has practically tested the plan, but it seems to me that a regularly planted sugar-maple grove on good land, but not too high-priced, ought to pay at least as well as the average of farming operations. Many farms are already scarce of wood, and to grow two or three acres of sugar-maple orchard would kill two birds with one stone. To accomplish a third object, the sugar bush ought to be planted in such shape and position as to protect the farm from the prevalent destructive winter winds. A grove of trees on the west side of every grain farm would often be worth the use of the land simply as a shelter-belt to protect winter grain. As forests are being cleared off, many farmers are learning for the first time the importance and necessity of these shelter-belts of trees to protect their crops. But to the plan. For convenience in sap-gathering the sugar orchard should be planted in as compact a form as possible, and in regular rows ten feet apart each way. This will give, if there are no vacancies, four hundred and thirty trees per acre. But when young the trees will grow better if planted closer, say in rows five feet apart, and cultivated for two or three years. Once or twice scarifying the surface during the summer to destroy weeds will answer if you can get two or three year old trees to start with. Often trees ten or fifteen feet high, from new-growth woods, can be bought at small cost, and when this is possible it is always preferable. A young tree taken from a dense growth in the woods, where it has been stunted and smothered, will grow much more rapidly when planted where it can have room to spread, if it is well cultivated and pruned. These unpruned masses of young trees in a forest, each choking the other, and neither half living, are the bug-bear which deters hundreds from planting trees. Farmers see how small a growth these make, and conclude that forest-growing is a very slow and unprofitable business. Yet when these same trees are planted by the road-side, often foot-bound with grass, their growth is much more rapid. I have in my mind a line of noble maples, planted seventeen years ago this spring by a public road, which have for two or three years been large enough to tap. They were got from the woods, and were the size of whipstalks when planted. Young trees of equal size, then, left in the same woods uncared for, are not half their size. Yet these trees have stood in grass most of the time since planted. Cultivated in orchards, with room enough to grow, and yet so close as to keep down the grass, their growth would probably have been even larger than it is. The principal objection to the maple for timber is the facility with which it decays when exposed to the weather. For fuel, the sugar maple is the American tree *par excellence*, not second to hickory, which is claimed by many Eastern people to be superior to all others for heat-producing qualities; it forms a dense, broad-based, round-topped, frequently egg-shaped head of deep-green foliage, clean, and more free from insects of all kinds than any other deciduous tree we know. It justly claims a place at the head of American ornamental trees. Being hardy, it is easily transplanted in large sizes, and bears cutting back very patiently. We have known of large trees, three to four inches in diameter, with the tops all cut off, being moved from northern Wisconsin to the prairies of Illinois, and being successfully transplanted. This tree is by far the most valuable of its species; its wood is hard, heavy, strong, close and fine grained; has a silky lustre when polished. The curled maple and bird's-eye maple are the same as the sugar maple, the curl or bird's-eye being caused by the undulations and inflections of the fibre. Its chief uses are in the manufacture of cabinet work, gearings of mills, and in naval architecture.

Sugar made from the maple commands a much higher price than that made from sugar-cane; the syrup made from maple sap is ranked among syrups as A No. 1.

The seeds are in pairs, and are united at the base, but only one of each pair is of any account, the other being worthless. The trees never produce seed two years in succession.

The sugar maple will not thrive in poor, sandy soil, but requires almost any good tillage land. It will not live where the soil is saturated with water during the growing season. Bryant speaks of losing a number of sugar maples in the wet season of 1874, which had been growing several years upon land which, in an ordinary season was dry enough for cultivation. It continues to grow after the silver maple has arrived at maturity, so that a tree-grower should not be discouraged at its slow growth in its early stages. The black sugar maple, though formerly classed as a different tree from the sugar maple, is now generally considered as a variety of sugar maple. Its general properties and its sap are the same; its general appearance is darker, and its leaves are larger, darker, and less scolloped than the sugar maple.

THE SOFT MAPLE.

The soft maple, in its wild state, is an uncouth and shaggy tree; when grown closely, in a cultivated grove, it is much improved in appearance and a most useful tree. I have seen numerous patches well shaped and eight and ten feet high at three and four years of age. In Nonoma County, Iowa, maple-trees, seven years old from the seed, were large enough to make three ten-foot rails, and an acre yielded three thousand rails. This timber is always in great demand for manufacturing purposes. Its growth in seven years equals that of the walnut in ten. The seeds ripen in June and should be sown in mellow ground as soon as they fall. Plant one and a half inches deep with drills in rows twenty inches apart. They will come up in six days. Keep the weeds out until the plants get a good start. The first year they will grow eighteen or twenty inches. They should be transplanted the next spring, and set out twenty-seven hundred to the acre. They will grow four to five feet the second year. A soft maple planted in 1861 is now forty-nine inches in circumference four feet from the ground.

The red or soft maple has a wider range of growth than the sugar maple, being found farther north, and grows in the South quite down to the Gulf of Mexico. Its native home is in the low, rich soil in the swamps and along the borders of streams, yet it is frequently met on high lands, but growing less vigorously. In any location it makes a more rapid growth than the sugar maple. The wood is fine-grained and compact, more frequently curly than the sugar maple, but very seldom growing in birds'-eyes. The timber, for solidity and strength, is much inferior to that of the sugar maple, and is of much less value for fuel. It is, however, more valuable as a shade-tree and for planting for forest growth. Its habits being as desirable as the sugar maple and its growth being much more rapid, and an additional beauty found in its foliage, makes it very desirable for transplanting. The additional beauty is the deep scarlet-red color of the twigs and flowers very early in the spring, long before any other flowers appear. The wood of the red maple is suitable for turning and carving, and it is much used for the stocks of shotguns, rifles, etc. It is sometimes confounded with the silver maple, but its wood is harder and finer grained. It grows to the height of sixty or seventy feet, and from two to three feet in diameter. It is hardly probable that it will ever be cultivated for anything but its beauty. The seeds are about half as large as those of the sugar maple, are a deep red, and are ripe about the same time.

BOX ELDER, OR ASH-LEAVED MAPLE.

A very ornamental tree, and in favorable situations reaches the height of fifty or sixty feet; it grows along the banks of streams; its growth is astonishingly rapid. It is very short-lived in dry soil. Sugar is made from its sap. This and its rapidity of growth render it a very desirable tree for planting for the production of sugar. It is a singularly beautiful tree while standing alone; it has a round, symmetrical top, and very deep, dense foliage. A large proportion of its seed is worthless; it is planted and raised the same as the sugar maple.

THE MOOSE-WOOD OR STRIPED MAPLE.

This is a very small tree, generally from ten to twenty feet in height. It is found among the Alleghanies, and from Maine to Wisconsin and southward. It has deep, dense, heavy leaves, and smooth, light-green, striped bark. The wood is of a more durable character than the other maples, the only objection to it being its inferior size. It, therefore, is only of use as an ornamental tree. I would suggest grafting to any one that intends raising it, as it is said to reach three or four times its ordinary size when grafted.

THE NORWAY MAPLE.

This tree, when first starting to grow, is very tardy for the first two or three years, but afterwards is of very rapid growth. Its foliage is more dense, its leaves come earlier in the spring and retain their verdure later in the fall than the sugar maple; hence it has some slight advantages over the sugar maple as an ornamental tree.

THE LARGE-LEAVED MAPLE.

This is a most graceful tree, and, when grown in soil and climate favorable to its thrift, attains a height varying from forty to ninety feet, with a diameter of from two to five feet. The bark of its trunk is rough and of a dark-brown color, and that of its wide and spreading branches ash gray. Its leaves vary in size, the largest being nearly a foot broad. It bears a very fragrant, greenish-yellow flower, which appears during the months of April and May. Its latitude of growth is between forty and fifty degrees north, and it is indigenous to the northwest coast of North America, where it is found in woody, mountainous regions along the sea-coast, and on the great rapids of the river Columbia. Its wood is of a whitish tint, of a grain scarcely inferior to the finest satin-wood, and is well adapted for cabinet-making.

This species produces sap in abundance, and might be made use of for sugar-making, as its saccharine property is equal to many of its congeners. It is a highly ornamental tree, and attention to its suitability for general cultivation cannot be too warmly recommended. It is propagated by layers and of rapid growth.

THE ROUND-LEAVED MAPLE.

The round-leaved maple is a native of the northwestern coast of the American continent, between the forty-second and fiftieth degrees of latitude, where it arrives at the height of from twenty to forty feet. Its branches are pendent, slender, and somewhat crooked; bark, when young, smooth and of a green color. This species may readily be distinguished by the regular form of its leaves, which are heart-shaped, equally lobed and nervated, of a pale, reddish-green color, smooth above and downy beneath, with lobes acute and sharply serrated. Its flowers, which are of a middling size, appear in April and May. Its wood is fine, white, and close-grained, very tough, and susceptible of a good polish.

This species is confined to the woody, mountainous country that skirts the shores, and is particularly abundant in the region of the rapids of the river Columbia. It is propagated by layers, and is of rapid growth, the annual shoots often acquiring a length of six to ten feet.

CHAPTER XVI.

THE ELMS.

The White Elm.—Its Usefulness and Demand.—Growth and Attainment.—Elms, How Planted.—Additional Cropping of Area.—Resistance against Insects.—Its Use as a Shade-tree.—The Elm as Described by Michaux.—Its Ancient and Modern Popularity.—Soil Suited to its Growth.—Effect of Crowded Planting on its Appearance.—Its Ornamental Usefulness.—The Corky White Elm.—Its Distinguishing Features.—Its Additional Name.—The Wahoo, or Winged Elm.—Its Distinguishing Growth and Scarcity.—Uses to which Put.—Its Medicinal Properties.—The Red Elm.—Its Relative Kindred.—Elevated Home.—Its Growth and Usefulness.—Soil Suited to its Growth.—Durability of its Wood.—The Uses of Small Specimens.—Its Enemies and Objections.

WHITE ELM.

THE white elm is a fine forest tree, and the demand for this wood is every year increasing as the old stock disappears. Plough-handles, cheese-boxes, chairs, and many manufactured articles are made from this wood.

A field of white elms planted in Nebraska has done remarkably well.

An avenue of these trees is unsurpassed for road shade. The growth is rapid, they have finely shaped heads, and are not easily damaged by insects or winds. Two elms near Omaha, planted in 1859, now measure forty and forty-two inches in circumference four feet from the ground. Some tall-growing tree may be planted with them, and cut away at the end of ten years. Elms should be set out eight feet apart. A small tree, when the size of a small whip, was brought from Belgium thirty years ago, and now presents a rich and magnificent appearance, the trunk measuring two feet eight inches in diameter in one direction, and over three feet in another. Michaux says that the white elm "is the most magnificent vegetable of the temperate zone." It is the popular shade-tree of many portions of the United States. Horace, Ovid, and many other both ancient and modern poets speak of the elm, not only on account of its beauty, but the strange combination of grace, beauty, and majesty. It is the most popular tree for planting in parks, along avenues, and in cities, and, in short, wherever shade or beauty is required. It often reaches the height of from ninety to one hundred feet; it loses a great deal of its grace and beauty if grown in a forest where it is crowded among other trees.

It grows chiefly in a moist soil; it sometimes thrives in a dry, but never in sterile soil. Its wood is chiefly used for the panels of carriages, naves of wheels, boxes, barrels, etc. It is seldom used for lumber when any other timber can be obtained, as it warps badly. It is only as an ornamental tree that I would advise farmers to cultivate it, and as a shade-tree I cannot too strongly recommend it. The corky white elm is sometimes mistaken for the white elm, but can easily be distinguished by the corky ridges on its branches. It is sometimes called river elm: its wood is tougher and of somewhat finer grain than the white elm.

THE WAHOO, OR WINGED ELM.

This rather uncommon species of the elm is so scarce that little can be said in regard to it. It grows to the height of thirty or forty feet, and is distinguished by the corky ridges on the opposite side of its branches. Its wood is very fine-grained, and fit for turning, but is so uncommon that I cannot recommend its culture. Its most extensive use is in the construction of carriages.

A fluid extract from the bark of the root of this tree is used as a tonic, alterative, and laxative, and is especially beneficial in hepatic derangements, whether accompanying or preceding intermittents, or occurring independently of malaria. In constipation, due to hepatic torpor, it is highly recommended.

THE RED ELM.

The red elm is the brother of the white elm, but it inhabits higher and dryer ground. As a shade-tree it is splendid, and grows rapidly. The wood is used for carriages, and also makes excellent fuel. Trees of this kind, planted in 1861, grew to be twelve inches in diameter in ten years. They are often, however, attacked by insects, which burrow under the bark for sap.

It will thrive in low, wet soil, is a medium-sized tree, about fifty or sixty feet in height, and from two to three feet in diameter; it also thrives on dryer ground and higher up than the rest of the native species. The red elm does not compare with the white elm in grace and beauty, but its wood is much more durable and tougher when exposed to atmospheric changes. The small specimens are used as wagon-hubs, carriage-hubs, etc., not being so very liable to crack in seasoning. In some sections of the country it is used for rails; the only objection to it for this purpose is its liability to rot on contact with the ground. The sap-wood in the red elm is very small.

CHAPTER XVII.

THE LOCUST.

The Honey-Locust.—Where Found and Convenient Usefulness.—Its Growth and Value.—Locust-wood as Pavement.—An Exceptional Specimen.—Uses of the Thorny and Thornless Varieties, and their Characteristics.—Distinguishing Variety Features.—Its Resisting Properties to Destructive Agencies.—Experience of Mr. Helme on Locust-planting.—Manner of Sowing its Seed for Hedge.—Manner of Transplanting Explained.—Its Usefulness as a Wind-break.—Successful Hedge-growing Experiments.—The Water-Locust.—Its Growth.—General Characteristics Compared with the Honey-Locust.—Where Found and Soil Suitable to its Growth.—The Yellow and Common Locust variously Described.—The Rose-flowered Locust Described.

THE HONEY-LOCUST.

This is an admirable hedge-plant and a tree of great value, and on the river bottoms of Illinois honey-locusts are found from eighty to one hundred feet high and four feet thick. Dr. Warder, of Ohio, thinks this tree is very valuable on account of its rapid growth. He sold one acre of locust-trees fifteen years old for one thousand dollars. The wood is much used for paving streets. A locust in Omaha, planted twelve years ago, measured thirty-one inches four feet from the ground, and was thirty-five feet high. The thornless locust is best for forests, and the thorny variety for hedges. In the thorny variety the thorns are stout, often triple or compound; leaflets lanceolate, oblong, somewhat serrated; flowers greenish and very fragrant; blossoms the middle of June; pods linear-elongated, from twelve to seventeen inches long, often twisted; filled with sweet pulp between the seeds. It was named in honor of Gleditsch, a botanist contemporary with Linnæus. Michaux, sent out by France twenty years ago, predicted that it would become valuable as a hedge-plant.

Mr. Helme says: "In 1838 I found this tree growing on the Mississippi, from St. Louis to Wisconsin. Those on the Mississippi, I think, are not identical with ours, for they are less thorny and the bark a darker color." A correspondent from Illinois states that if they stand near the yellow-locust they are affected with the borer; but ours are not, for a few years since all the yellow-locusts in our city were destroyed by the borer, but the honey-locusts, standing side by side with them, were not affected in the least. They will grow on any soil, wet or dry, and receive no injury from cold at thirty-four degrees below zero.

Mr. Helme says: "Six years ago I set fifty rods, one foot apart, cut back the second year to one foot from the ground, and it would turn stock in four years."

To plant a hedge, gather the seeds in the fall; in April mix them with sand, keep them moist and warm until they sprout, then sow in drills two inches deep; set the plants when one year old, cutting to within two inches of the ground. At the end of two years cut back to three inches, after which trim once a year. A man with a pair of twelve-inch shears will trim eighty rods per day, and for a wind-break I consider it invaluable. Cut back once a year, and then trim the sides to keep them tidy.

I left ten rods of my hedge as an experiment, and it is now six years old and from twelve to fifteen feet high, and will turn all large stock.

A correspondent of mine says he has been successful in setting plants three feet apart. I have no doubt a good hedge could be thus obtained, for the branches grow at nearly right angles with the trees, and they would have more room and light in this way and be less apt to smother.

Another authority says: "I raised and set plants one hundred and seventy rods in the spring of 1871, have trimmed it once, and now it is acknowledged by all who have seen it to surpass any hedge they have ever seen. And now, in conclusion, I would say, for a hedge do not let it get over three feet high; and, furthermore, time will prove it to be the only successful hedge-plant for Michigan."

THE WATER-LOCUST.

This is a much smaller tree than the honey-locust, but its general characteristics are the same. It is found in the southern portion of Illinois. It is inferior to the wood of the honey-locust, and is not much used even where it is the most common. Its height is from forty to sixty feet. It is found growing principally on the river-banks and in the swamps of Illinois.

THE YELLOW LOCUST.

This tree is sparingly produced in its native home—Kentucky and western Tennessee—where it attains a height of from thirty-five to fifty feet and a diameter of ten to twelve inches, and is also successfully cultivated as an ornamental tree in many parts of the United States as far north as Connecticut. It forms a considerable spread of foliage, composed of rows of leaflets, broadly oval, smooth, two inches broad and from three to four long. The branches, being, like the petioles and leaf-nerves, of a yellowish hue, contrast admirably with the dark-green of its trunk-bark. It flowers in April and May, forming elegant white, pendulous racemes six to ten inches long, slightly odoriferous. Its seeds are contained in flat pods, and mature in the United States in the month of August. It is propagated from seed, and its favorite soil is a loose, deep, and fertile one. The wood of this tree is soft and fine-grained, but is very little made use of except for the vegetable coloring which its heart imparts for the purpose of dyeing. Botanical interest and ornamental purposes are the chief inducements to cultivate this species.

THE BLACK OR COMMON LOCUST.

The common locust is indigenous to the country west of the Alleghanies as far as Arkansas; and without the maritime parts, to the distance of forty to ninety miles, it is planted for purposes of utility and ornament from Maine to Georgia, and often attains a height of eighty or ninety feet and a diameter sometimes exceeding four feet; but under ordinary instances, or in its wild state, it does not ordinarily exceed half these dimensions.

It is valued for the properties of its wood and the beauty of its foliage and flowers. When young its branches tend upward, but as the tree increases in age they become more horizontal. The bark of its trunk and principal branches is very thick and deeply furrowed, and in young trees is studded with strong hooked prickles, which disappear as the tree grows old. This tree bears a very agreeable foliage, each leaf being composed of opposite leaflets from eight to twelve in number. It is particularly adapted for planting along roadsides and in the neighborhood of cities and towns, and would be very effective for park purposes. It produces a perfectly white, sometimes yellowish, flower, disposed in pendulous bunches from three to five inches long, from which is diffused an agreeable odor.

The common locust varies considerably in its native localities, and numerous varieties have been produced from seed, the foliages of which are distinct when the plants are young; so we may regard the several varieties, commonly treated as species, as the result of soil and climate. Its growth in favorable soils is fairly rapid, and the durable properties of the wood fit it for posts, fencings, axletrees of timber-wagons, and for many other useful purposes where exposure to weather is necessitated.

THE ROSE-FLOWERED LOCUST.

This tree appears to be chiefly confined to the Alleghanies, where it is found on the banks of rivers in Georgia and Carolina, growing to a height varying from thirty to forty feet. The bark is of a dull red, particularly that of young trees and shoots, and is covered with a clammy, adhesive substance. The branches are armed with spines, and the foliage is thicker and of a darker green than that of the common species. Unlike the common locust-tree, its flowers, which occur in numerous open bunches four or five inches long, are of a beautiful rose color mixed with white, but are destitute of fragrance. The properties of its wood are similar to those of the common locust, but it is considered less durable. As an ornamental tree it is rendered conspicuous by its large, roseate flowers. It is propagated and treated in the same manner as the common species, from which it is dissimilar in but very few points.

CHAPTER XVIII.

THE CHESTNUT.

A Favorable Notice.—Its Remunerative Returns.—Manner of Setting Out and Caring For.—Benefits of Cutting Back.—Ground Suited to its Growth.—A Difficulty of its Raising.—Manner of Sowing its Seed.—Winter Preservation of Plants.—Time to Transplant.—A Release from a Difficulty.—Chestnut-planting in Nevada and Productiveness.—Growth of the Chestnut in North Carolina, and its Great Growth in Europe.—An Old Tree and its Productive Bearing.—Uses of Chestnut Wood.—Its Durability.—The Chincapin.—Where Found.—Quality of its Fruit.—Durability of Wood.—Its Growth Influenced by Climate.

A beautiful tree and a favorite with nearly every one. A lot planted in Mt. Pleasant, Iowa, eleven years ago, are now making a better return than the same number of acres in orchard. At Des Moines chestnut-trees four years old from the seed have borne fruit. They should be set out four thousand to the acre, and gradually thinned, as they increase in size, to three hundred to the acre. They will then be twelve feet apart. A grove of chestnuts may be cut down at twelve or fifteen years of age, and in twelve years will be ready for another cutting. The growth of the sprouts will be more rapid than the original growth of the tree. The stumps should be cut low and covered with a thin layer of earth. Side-hills and rocky land are the best for chestnut cultivation. The great difficulty in growing this tree is to get it started properly. Care must be taken to keep the seed from rotting or moulding. The seed should be kept through the winter in sand, dampened and placed in a cool cellar. In the spring plant the chestnuts in rows three feet apart, and drop the nuts like potatoes, six inches apart, covering them with only half an inch of soil. In the fall, before frost, cover the young shoots with a litter of straw six inches deep. They should be transplanted when one year old. This tree has always been considered hard to raise, but it has been because it has not been understood. Treated in the way I describe, twelve chestnuts will raise eleven trees.

In Nevada, California, the proprietor of some public gardens obtained from France some of the finest specimens of chestnuts, and planted them on his place in 1872. In 1882 the trees bore fruit, and they are described the past year as being heavily loaded with fruit, and the nuts were the largest ever seen. The burs contained from three to seven large-sized nuts, some of them exceeding in size a large plum. The climate is admirably adapted to it. In North Carolina we have trees that at six feet from the ground measure from fifteen to sixteen feet in circumference. But we read of trees in Europe that far exceed our chestnuts of North Carolina in size, viz.: The great chestnut grove of Mount Etna, one tree of which is one hundred and sixty feet in circumference. Michaux describes one growing near Sancerre, in France, which at six feet from the ground is thirty feet in circumference. Six hundred years ago it was called the Great Chestnut, and, although it is believed to be more than one thousand years old, its trunk is still sound and its branches annually laden with fruit. The principal use of the wood of the chestnut is for the inside work of cars and for cabinet-ware; although the grain is coarse, yet, when oiled and varnished, it makes quite a presentable appearance. It is used for making fences, and rails made of this wood have been known to last fifty years.

THE CHINCAPIN.

This variety of the chestnut on a small scale is found as a shrub in New Jersey, Pennsylvania, and Delaware, but in the Southern States it grows to the height of thirty or forty feet. The fruit is small, but sweet. The wood is much more durable than the chestnut, but on account of its small size it will hardly pay any but one having the curiosity to raise it.

CHAPTER XIX.

THE BOX-ELDER.

Its Nativity.—Range of Growth and Soil Suited to its Growth.—General Appearance and Duration of Life.—Description of its Wood, Bark, and Leaf.—Large Specimens, Where Found.—Manner of Sowing its Seed.—A Suggestion by Michaux.—Date of Introduction into Europe.—Attained Height.

This tree is a native of the United States and Canada, where, especially in bottoms which skirt rivers, in soil deep, fertile, and moist, it is most common, and found to attain its greatest size. West of the Alleghanies it flourishes in open ground with trees of other varieties, though in such situations its growth is somewhat more stunted. It seldom, however, exceeds fifty feet in height, with a trunk twenty inches in diameter.

Its range of growth does not extend beyond the fifty-fourth degree of north latitude, and south to the Southern States, where, in Georgia and Tennessee, it thrives, and, when cultivated in soil and situations favorable to it, attains its amplest dimensions. Its trunk, separating into branches at no great height from the ground, forms a loose and wide-spreading head of dense foliage, giving to it an ornamental appearance. In America, where effect and shade are the objects of its raising, it merits attention owing to its rapid growth and massive, showy foliage. It is not a long-lived tree, arriving at maturity in fifteen or twenty years. Its wood is fine-grained and of a yellowish color, variegated at its heart with bluish and rose-colored veins. In middle life the proportion of sap-wood to heart is large. In color, the bark of this tree, when grown, is brown; but when young the bark is of a beautiful pea-green color and smooth surface. Its leaf is oval-shaped, terminating in a point, and deeply toothed on its edges.

Some of the large specimens of this tree are to be found in Pennsylvania, specimens having been seen growing on the Schuylkill River and in Philadelphia of the height of fifty feet and a four-foot circumference of trunk.

Its seed, as soon as practicable after gathering, should be thickly sown, as about half of them are false, and not over one in ten will germinate. Sow in the fall in shallow furrows, and cover only one and a half inches deep with earth. In somewhat moist and deep soil the plants grow rapidly, and should be protected, during the fall and winter, with a covering of straw. Plant them out in the spring four feet apart, and they will grow the first year ten to sixteen inches. I have seen nursery plants, two years old, six feet high and one inch in diameter. Box-elders of eleven years old measured thirty inches in circumference and were thirty feet high.

A suggestion from Michaux says that, from its rapid growth, if cut down and "layered" it might form a valuable underwood, to be used for fuel, charcoal manufacture, and other purposes; but, on trial of this, it has been found that the "layer" soon decays.

The introduction of this tree into England dates from 1688, and since that time its growth has extended to the continent of Europe, where, especially in Austria, a specimen of it attained the excessive height of eighty feet.

CHAPTER XX.

THE BIRCH.

The Canoe-Birch.—Its Romantic and Legendary Connections.—Youthful Reminiscences.—Its Native Home and Attainable Dimensions.—Color and Use of its Bark.—European and American Birch.—Their Growth.—Advantages of Dense Sowing.—Its Value as Fuel.—Characteristics.—Seed, Where Obtained.—Soil Suited to its Production.—Black Birch.—Its Usual Height.—Its Wood Described.—Where Found.—Seed, when Ripe.—Yellow Birch.—Where it Thrives.—Height and General Characteristics.—The Red Birch.—Its Proportions.—Its Climate.—Seed, when Ripe.—The White Birch.—Its Insignificance.—Its Only Virtue.

Of this tree there are two principal kinds, the white or European birch and the American canoe-birch. The latter is connected with the legends of our Indians, and is emphatically a tree of romance and poetry. The birchen rod has had much to do with our public schools, and most of our great men have been soundly thrashed with it when boys. Both European and American birches grow to a large size in northern latitudes.

When planted thickly the young birch grows up very straight and graceful. Who of us, when farmer-boys, have not cut a birchen rod for our line, and raised the speckled beauties from their native stream. Birch makes excellent fuel, and is valuable for cabinet-work. In northern Michigan the canoe-birch grows to a height of seventy feet. Its bark is white, and the tree highly ornamental. Seed can always be obtained in Wisconsin. The seed-bed should be light, sandy loam, and the seed should be covered but lightly, and well sheltered from the sun until the plants are two or three inches high.

BLACK BIRCH.

This tree is usually from fifty to sixty feet in height; its wood is fine-grained, and very suitable for inside finishing, as it takes a high polish. It is found in the northern section of our country. The seed is ripe about the first of November.

YELLOW BIRCH.

This tree also thrives in the cooler portions of our country. Its height is sixty or seventy feet; trunk straight and circular; its twigs have a very pleasant odor; its wood is very fine-grained and fit for turning. Its seed is ripe about the middle of October. It makes excellent fuel.

RED BIRCH.

Height, seventy feet, and about two feet in diameter. It was named by Michaux. Contrary to the others of its species, it thrives best in warm latitudes. Its seeds ripen in the beginning of June, and as soon as gathered should be sown; shield the young trees from the sun.

CANOE-BIRCH.

This tree is found in the northern portion of our country, and in British America, in the regions of the Saskatchewan River, it is said to reach from eighteen to twenty feet in circumference. The bark is very white, and is used by the Indians, *voyageurs*, trappers, and traders for manufacturing the birch canoe, of which we hear so much in both the poetry and song of our country. It makes excellent firewood, and thrives in wet soil. The seeds ripen about the first of July.

THE WHITE BIRCH.

This tree is quite insignificant, its only virtue being its beauty; its wood is very soft and decays very quickly, and does not even make good fuel.

CHAPTER XXI.

THE HICKORY.

Its Favored Emblematic Character.—Productive Qualities.—Manner of Planting for Fruit and for Wood.—The Shellbark Hickory.—Its Features, Form, and Character.—Its Twofold Merits.—The Thick Shellbark Hickory.—General Characteristics.—Quality of its Fruit.—Composition of Leaf.—Pignut Hickory.—Its Size, Attainable Height, and Particular Qualities.—Quality of its Fruit, and for What Used.—The Mocker Nut.—Attainable Height and Size.—Manner of Growth.—Its Fruit Described.—Distinguishing Characteristics.—Probable Reason of its Name.—The Pecan Nut.—Its Attainable Height.—Quality of its Wood and Fruit.—General Appearance and Productiveness.—The Bitter-Nut Hickory.—Its Associate Trees.—Where Found and Progressive Decrease.—Its Liability to Destruction.

This emblematic tree of America, and the representative of the character of one of our greatest men, will always be a favorite with our people, not only on account of its history, but its valuable nut-bearing qualities and its wood.

The shellbark is the best for planting, either for wood or for fruit. If planted for nuts it should be kept in the nursery until two or three years old, and then transplanted. To make it bear early, dig under and cut the tap-root as close to the surface as possible. For timber and rapid growth, in transplanting dig the holes deep, and see that the tap-root is put in perfectly straight. The nuts should be dropped four feet apart each way, and, if planted in ground where the trees are to remain, the plants should be thinned so as to keep the branches from touching. Hickories are rather slow of growth, so I would advise that it be transplanted after the first year to the place it is to occupy permanently. A nursery of young trees should be carefully weeded and cultivated until they have arrived at such height as to render them safe from the encroachment of weeds.

SHELLBARK HICKORY.

This is a lofty tree, reaching to the height of eighty feet, with a diameter of two feet; the trunk is of the same diameter and without limbs for the greater portion of its height. This tree is noted for the exfoliation of the outer bark, which is divided into long, narrow, scale-like plates, adhering by only one end or the middle. It has been found that those trees that have been transplanted bear the best fruit, while those that have not make the best timber. This tree merits cultivation more than any tree of its species, both for fuel, timber, and its fruit, which, to my taste, is much superior to the walnut.

THICK SHELLBARK HICKORY.

This tree bears a slightly flattened, thick-shelled, strongly-pointed nut, with a light, apple-green hull. It is a very tall tree, and is sometimes mixed with the shellbark hickory on account of their both having the same general characteristics. The leaves are the same color, and are veined alike, but differ in being composed of seven, and sometimes nine, leaflets, while the leaves of the shellbark hickory are invariably composed of five. The kernel has a very poor flavor, and is enclosed in a thick, hard shell of a light orange color.

PIGNUT HICKORY.

This is a large tree, growing to the height of eighty feet, and about four feet in diameter. It is found in its greatest abundance east of the Alleghanies. It is not at all common in our Western States. It is called the toughest of the whole hickory genus, and is used where toughness and durability are most needed. The nut is small, roundish, ovate, hull very thin, and when ripe splits in the centre, and adheres to the nut after it has fallen from the tree. Kernel very small and usually bitter. It is only fed to animals, and is never marketable.

THE MOCKER NUT.

This tree grows to the height of fifty or sixty feet, and about twenty inches in diameter. It is the slowest growing of all the hickories, and hence cultivators will hardly care to wait for its growth. It bears a nut nearly six-angled, shell very thick and hard, large, heavy husks, and of a light Vandyke-brown color. The old trees are covered with a thick, rugged, hard bark; wood very tough and strong and makes excellent fuel. It probably derives its name from the difficulty one experiences in extracting the kernel from the hard, heavy shell.

THE PECAN NUT.

This tree grows to a height of sixty or seventy feet, with a diameter of from two to three feet. This is a very beautiful tree; tall, straight, and well-shaped trunk. The timber is inferior to the rest of the hickories, but it more than pays the cost of cultivation by the proceeds of the sale of its fruit, which is superior to any nut, either native or foreign, on account of the excellence of its flavor. The nut is thin-shelled, very sweet, and the kernel is not divided by partitions. I agree with Mr. Bryant in condemning the practice, worthy only of vandals or barbarians, of chopping down the trees to gather the fruit, thus diminishing not only the number of trees, but the quantity of fruit. This practice of chopping down the pecan-trees cannot be too strongly condemned; and I doubt not, if it were not that it has been practised so much, and is still practised, where it can be done with impunity, the pecan-nut would be more highly valued and better known; but let it continue a few years longer and the pecan will advance in value as the trees decrease in number.

THE BUTTERNUT HICKORY.

This member of the hickory family I cannot recommend, on account of its being liable to be attacked by a small black beetle, which bores through the inner bark and deposits its eggs, which usually number from twenty to thirty, in a cell about an inch long. The young, when they are hatched, bore in different directions, and thus girdle the tree, which soon dies. It is found with the black walnut, red elm, laurel oak, and bur oak. It was at one time very plentiful in the neighborhood of Princeton, New Jersey, but owing to the ravages of *Scalytus Caryæ* (the small black beetle above mentioned) it has become scarce, and continues to become more so every year. The wood in the old trees is soft, and the timber of the young trees is to be preferred for any purpose but fuel. It is found in the Western States on the rich bottom lands, and on the outskirts of prairies, where the land is deep and rich.

CHAPTER XXII.

THE PINES.

Their Rank among Trees. — Uses to Which Put. — Produce of the Pine. — Places Famous for its Growth. — Its Ornamental Advantages. — The White Pine. — Its Attainable Height and Size. — Scarcity of the Pine in New England and Other States, and Cause. — Present Supply, from Where Procured. — Future Prospects of Pineries. — Its Accommodating Growth. — Soil Suited to its Growth. — Effect of Varied Soils on Quality of its Wood. — An Objection to its Ornamental Qualities. — Properties of its Wood as Fuel. — A Suggestion on Planting the Pine. — The Red Pine. — Its Nativity. — Attainable Height. — Soil Suited to its Growth. — General Appearance. — Durability and Quality of its Wood. — Its Beautifying Advantages. — Experienced Difficulties of Raising. — Practised Roguery in Selling Seed. — Gray and Scrub Pine. — Its Diffused Range of Growth and Attainable Size. — For What Used and for What Recommended. — Its Advantages for Ornamental Purposes. — Its Easy Culture. — The Yellow Pine: Where Found. — Its Substituted Name. — Peculiarities of its Growth. — Soil Suited to its Abundant Growth. — Its Good Qualities and Chief Uses. — Pitch Pine. — Its Confined Range of Growth. — Soil Suited to its Growth, and its Attainable Height. — Its Particular Properties. — Its Chief Uses. — Its Undesirable Peculiarities. — Stone Pine. — Where Found. — Chief Uses and Adaptability. — Properties of its Seed and Durability of its Wood. — Reason of its Non-extensive Cultivation. — Loblolly Pine: Its Disadvantages and General Uselessness. — Scotch Pine. — Its Relative Merits Compared with the White Pine. — Its Usefulness and Recommended Culture. — Austrian Pine: as Recommended by Bryant, Loudon, and Bayreuth. — Where Found. — Purpose for which Cultivated. — Its Durability and Other Advantages. — Scrub Pine. — Where Found and its Uselessness. — Corsican Pine. — Its Nativity, Valuableness, Attained Height, and Manner of Growth. — Its Ornamental Advantages. — Table-Mountain Pine. — Its Height and Appearance. — Where Found and General Worthlessness.

This genus ranks among our first forest-trees, and is more widely used for building purposes than any tree we have. The greatest amount is produced from two species. From the pine is produced immense quantities of pine-tar, resin, and pitch, North and South Carolina taking the lead, "The Barrens" of these two states being justly famous, not only for the quantity but for the quality. But not only is it useful for building purposes, but also for ornamental purposes, the only trouble being that these trees are found mostly west of the Rocky Mountains.

THE WHITE PINE.

This is one of the best-known of our American trees, and reaches a height of from one hundred to one hundred and eighty feet, with a diameter of from two and a half to six feet. So much of our pine has been cut and shipped to the Old World that, where the pine was formerly abundant, as in New England, northern New York, and Pennsylvania, it has now become scarce, and large tracts that were thought to be inexhaustible are now bare and devoid of pine. The Northwestern States at present furnish nearly all of our pine, but it is needless to expect even here a renewal of the pine, for the tide of immigration is so great that, before a second supply will have time to grow, the country will be populated, and instead of pine-forest we will have comfortable farms and cities. The white pine is a hardy tree, and accommodates itself to almost every variety of soil. The wood of the white pine that is grown on dry uplands is harder, more resinous, stronger, and has a much coarser grain than that grown in moister soils. It is a very graceful tree, its foliage being soft, its color a deep, rich green; the only objection to it as an ornamental tree being the formal arrangement of its branches in whorls, but this is lost sight of in a large tree. Its wood burns freely, but does not give much heat; hence it is not fit for much until it has reached a convenient size for hewing into timber, or for lumber. Hence I would suggest that, in planting the young trees, they be set eight feet apart, and the intervening spaces be filled with trees of easier propagation, which may be cut out and used before the pines become crowded. Great care should be taken to preserve the leading shoots of the young pines, as they are very tender, and apt to be broken by the intervening branches.

THE RED PINE.

This tree is common in the northern part of the United States, a portion of the British provinces, and also in some parts of Michigan and Wisconsin.

It frequently reaches the height of from eighty to ninety feet, with a diameter of two feet. It grows in dry, sandy soils, and has a beautiful straight trunk, and furnishes planks forty feet long without a blemish. The wood, for some uses, is preferable to the white pine, as it is heavy, strong, and very durable; it also is a very beautiful tree, and is sometimes planted around private residences in the rural districts on account of the beauty of its trunk and branches.

The only trouble one experiences in the cultivation of this tree is the difficulty in procuring the young trees for planting, as seven eights of the trees bought for cultivation usually perish during removal, no matter how carefully handled; it is very difficult, nay, in fact, impossible, to give a succinct reason for this, as the young trees of the red pine that are raised in nurseries are usually hardy and strong plants that transplanting would not seem to affect. The seed of this tree is also very difficult to obtain, and "some rogues have been known to sell the seed-cones of the gray pine to unsophisticated people for those of the red pine, which they much resemble."

GRAY OR SCRUB PINE.

This tree is found very widely diffused all along the northern portion of the United States, and thence to the Arctic Ocean; in lower Canada and Labrador it is only a straggling shrub from three to ten feet in height.

In Wisconsin it is a middle-sized tree. Messrs. Lapham, Knapp, and Crocker, in their report on the forests of Wisconsin, speak of it as reaching the height of sixty or seventy feet, and furnishing hewn lumber thirty or forty feet long and eight inches square.

The logs are seldom sawn into lumber, as they are light and hardly ever found suitable. The fibre is straight and the wood tough. I would only recommend this tree for cultivation as a tree fit for fuel, as it burns readily and gives great heat. Loudon speaks very highly of the gray pine as an ornamental tree, but I have never admired it, as the old cones cling to the branches and turn black, and remain so for years; this, with the number of dead twigs scattered promiscuously over the branches, give the trees while yet comparatively young the appearance of age and decrepitude. It is easily transplanted and needs no especial care.

YELLOW PINE.

This tree is found from the New England States to Florida. In the West it is found in Kentucky, Tennessee, and Missouri; and Bryant claims to have found small trees among the sand-hills at the south end of Lake Michigan. In St. Louis considerable quantities of this lumber were brought from the Gasconade River and sold under the name of Gasconade pine. Michaux claims for this tree, which grows to the height of fifty or sixty feet, that "the concentrical circles of the wood are six times as numerous in a given space as those of the loblolly or pitch pines." It grows most abundantly in the poorest soils. Its heart is fine grained and moderately resinous, which renders it compact without great weight. Its chief uses are in flooring, and for the masts, yards, and decks of vessels. The tree is of moderately slow growth. I would recommend the yellow pine not only on account of its qualities as a timber tree, but also on account of its beauty, its limbs forming from the top a regular cone.

PITCH PINE.

This tree is confined to the Atlantic States, it never being found west of the Alleghanies, and occupies, like most of its brethren, sandy, poor soil; it seldom exceeds from thirty-five to forty feet in height, with a diameter of from twelve to eighteen inches. Sometimes it reaches the height of about eighty feet, but this is only when found in swamp-land. The wood of this tree is unusually resinous, knotty, and heavy, three fourths of the wood being sap-wood. The chief use of this tree is for the amount of pitch it yields. It also makes very good fuel, as it burns with a steady, strong flame and gives great heat. I would not recommend it for culture, as there are so many better varieties of pine that far exceed it in value, both as a lumber tree and for fuel. Loudon recommends it as an ornamental tree, but I cannot say that I admire his taste, as it is very knotty and generally has a great many excrescences.

STONE PINE.

This tree is found extensively in the Alps and in Siberia; its chief use is for carving and fancy inlaid work, it being especially adapted for this work on account of the absence, or nearly so, of the grain; the wood is soft and very durable. The seeds yield a very odoriferous oil, and are sometimes used for food. This tree is a very handsome tree, and the only reason for not cultivating it extensively is its slowness of growth, which fact, I dare say, has kept it from becoming as well known as other less valuable of its species.

LOBLOLLY OR OLDFIELD PINE.

This tree cannot be given much space, as it is not only inferior as a "thing of beauty" to many others of its brethren, but its timber is very spongy and not worth anything, excepting where other lumber is hard to find.

The grain is straight and without knots, but is composed mostly of sap-wood, and warps very badly on exposure to the weather.

SCOTCH PINE.

This tree, which very much resembles the yellow pine, has given rise to a great deal of controversy as to its relative merits as compared with the white pine. European arborists claim that it is much superior to the white pine, but this claim Americans refuse to admit; but it is hardly fair to make a comparison, as the two trees are so dissimilar. I cannot too strongly recommend this tree, as it is easily cultivated, very hardy, and widely known as a first-class lumber tree.

AUSTRIAN PINE.

This tree, which to my mind, on close inspection, is stiff and formal, is recommended by Bryant, Loudon, Bayreuth, and others as a very ornamental tree. It is found mostly in Austria and the adjacent country; is cultivated chiefly for its turpentine and as fuel; its timber is very tough and durable. It has a very picturesque appearance when seen singly from a distance. It makes splendid wind-breaks.

SCRUB PINE.

Found in New Jersey, Pennsylvania, and some of the adjacent states. It is a low, dwarfish tree, and is fit for absolutely nothing, being the poorest one of its species.

CORSICAN PINE.

This tree, which is a native of Corsica, is very valuable as a lumber tree, and reaches the height of from one hundred to one hundred and forty feet. It is very short-lived and of very rapid growth, growing very nearly three feet in one year; its growth is just about two thirds as fast again as the Scotch pine. Loudon speaks of a tree in the garden of the Horticultural Society of London which at the age of twelve years, in 1834, was twenty feet high, and in 1837 was twenty-five feet high. It is strongly recommended for ornamental purposes, but I doubt if plants of this species can be safely handled here; but if in any place, it would in all probability be Kansas or some of the adjacent states.

TABLE-MOUNTAIN PINE.

Height about forty feet, numerous branches, habits and general appearance of the Scotch pine. I cannot recommend it either for lumber or as an ornamental tree. It is found chiefly on the Blue Ridge Mountains.

CHAPTER XXIII.

CEDARS.

White Cedar. — Where Found and Soil Suited to its Growth. — Its Chief Uses. — Its Ornamental Value. — The Red Cedar. — Its Attainable Growth, Usefulness, and General Appearance.—Its Vegetating Properties.—Reasons for its Non-extensive Culture.—Common Juniper. — Its Nativity. — The Attainable Growth of Varieties. — Its Medicinal and other Properties. — How Propagated. — Care Necessary for the Protection of Young Plants.—The Cedran-tree.—Where Indigenous.—Its Antidotary Properties.

WHITE CEDAR.

This tree is found in swampy ground all along the Atlantic coast from Massachusetts to Florida: its chief uses are in the manufacture of shingles and woodenware for household purposes. I have seldom seen it advertised in nursery catalogues, and I am in doubt as to whether it would grow to any height in any other locality than that which it at present occupies. It is a very slow grower, and a very ornamental tree, which fact alone should entitle it to more consideration than it receives.

RED CEDAR.

This tree grows to the height of thirty or forty feet, with a diameter of twelve or fifteen inches; it is used for posts, rails, rustic work, and ship-building, but more especially for use in the manufacture of lead-pencils and penholders. It has long, spreading branches that are sometimes longer than the trunk of the tree; others are more conical, but these are more generally those that are cultivated and placed in shape by careful training. It is very slow of growth, and as an ornamental tree it will not do, becoming at an early age ragged and unsightly in appearance. Seed vegetates the second year. Protect from the sun when it first grows. It will never be extensively cultivated for timber, on account of its slow growth.

COMMON JUNIPER.

This tree is a native of both the Old and the New World, but our American variety is nothing more than a straggling shrub. It is the chief food of a great many varieties of birds. The European variety under favorable circumstances reaches a height of from eighteen to twenty feet, with a diameter of from six to eight inches, but in Europe they grow to a considerable size. The berries of this tree are used in the manufacture of medicines, and as an extract to flavor liquors, especially gin. The Scotch and Swedish varieties are chiefly used as ornamental trees, and as such merit attention.

They are chiefly propagated by cuttings rooted by means of a bottom-heat. Great care should be taken to preserve the young trees from the frost, as a great many have been destroyed by severe winters.

THE CEDRAN-TREE.

This is a species of the family of cedars, and is found indigenous only in Central America. It is of more stunted growth than any of its brethren of northern latitudes, and bears a large bean, similar in size, shape, and color to a horse-chestnut, but very brittle. To Mr. John P. Curry is due the honor of having first introduced this tree to public notice. His attention was first called to the cedran-tree while on the Isthmus as consulting engineer for the Panama Railroad Company, by observing the neutralizing effect that its beans exercised upon a snake-bitten buzzard. The bird was struck by a rattlesnake, and then made its way to a cedran-tree, and after pecking at one of its beans flew off apparently uninjured. A native to whom Mr. Curry related the incident scouted the idea of a rattlesnake-bite being dangerous, and exemplified his confidence in the efficiency of an antidote by bringing a snake of twelve rattles the following day, and allowing himself to be bitten by it. He then took a cedran bean, and, having chewed it, swallowed a portion, and saturated the wound with his saliva; after which treatment no disagreeable feelings or unpleasant effects resulted from the bite. Mr. Curry, after having been thus satisfied of the marvellous curative powers of these beans, verified his experience by writing to the *Alta California* newspaper, and carried about a peck of the beans to San Francisco, where many successful experiments of their efficiency were made by Professor Lanzwert, a German physician, on dogs, cats, rabbits, etc., which were allowed to be bitten by rattlesnakes. After these tests the neutralizing power of these beans was found never to fail when applied to human beings bitten by these reptiles.

Very few physicians, however, had any knowledge of the curative properties possessed by this tree until a tincture was manufactured from its roots by Parke Davis & Co. about three years ago. Its extracts are considered a safer antidote than whiskey or alcohol, producing as they do a chemical reaction of the blood in from six to eight hours; but for snake-bite their neutralizing effect is almost instantaneous after being taken into the system. They are also a cure for gout, and an antidote for hydrophobia.

Mr. Curry's experience, since, further evinces the frequency of rattlesnake-bite being completely neutralized and cured by simply eating a portion of a bean, or taking a tea made from half a bean.

Therefore it would seem, from the incident of the buzzard having been bitten, and its instinctive knowledge of the antidotary power of this tree, that to science has been given a remedy for prevention of the effects of so many occasional diseases before considered incurable, thus proving conclusively that nature is continually making experiments, as well as man, and bringing to observing human beings, through the instincts of animals, birds, and even insects, grand discoveries in science, meteorology, and medicine.

CHAPTER XXIV.

LINDENS.

Where Found.—Their Classification.—Quality and Durability of their Wood.—Their Ornamental and other Uses.—European Linden.—Its Principal Uses and Growth.—White Linden.—Description of Leaf.—Range of Growth.—A Specified Variety.—Buffalo Berry.—Its Attainable Height and Deportment.—How Propagated.—Its Esteemed Quality and Relative Resemblance.—Quality and Usefulness of its Fruit.—Manner of Planting for Fruit Production.—Japan Sophora.—Its Nativity.—How best Propagated.—Quality of its Wood and for What Used.—Soil Favorable to its Thrift.—Sassafras.—Its Domestic Uses.—Properties and Uses of its Wood.—How Propagated.—Its Ornamental Advantages.

The lindens are found in the Northern and Middle States, along the Alleghany Mountains, and in the Mississippi Valley. These trees may be classed with those that cannot be used for lumber until they have arrived at quite a large size. It takes the place of the pine for a great many things, its wood being soft and light, and of very little durability; it is much used as an ornamental tree. The inner bark of the tree is separated from the rough outer bark by saturation, and is much used as a twine by gardeners, etc.

EUROPEAN LINDEN.

The principal use of this tree is the manufacture of "bass matting," which is imported in quantity from Europe. It is quite a large tree, and well worthy of cultivation as a shade-tree. It sheds its leaves quite early in the autumn.

WHITE LINDEN.

The leaves of this tree are smooth, bright green above, and silvery underneath. It is not found as far north as many of its brothers, nor is it as large a tree. The common weeping linden of our nurseries is of this species.

BUFFALO BERRY.

This tree grows to a height of from twenty to thirty feet. It is propagated from the seed or by suckers. It is esteemed more for its fruit than for its lumber; it much resembles the buckthorn, and I doubt not would make an equally good hedge; its fruit is manufactured into pies, tarts, preserves, and a great many household delicacies. The trees are strictly diœceous, and both sexes must be planted in close proximity to obtain fruit.

JAPAN SOPHORA.

This tree is a native of Japan. It is best propagated by layers or from the seed. Little is known of this tree in this country excepting that it is hard, compact, and fit for ornamental work. It does not thrive in Illinois prairie-soil, but under favorable auspices is said to grow quite rapidly farther south.

SASSAFRAS.

This tree is surely the old woman's friend. Who has not gone to some old village grandmother and been dosed with sassafras-tea, much to the edification of the old lady, and then swore like a pirate or looked helplessly down one's nose and waited for further developments? It is found as a shrub or tree of some small size. The bark, of late, has much gone out of date as a medicine.

Bedsteads made of sassafras-wood are never infested with vermin. The wood is not very strong, but fine, close-grained, and fit for cabinet-work. It is propagated by suckers or by seed.

It is a handsome, ornamental tree, and I would recommend its culture around some of the beautiful homesteads scattered about the country that have a great many less ornamental trees than the sassafras, and whose appearance would be much benefited by it.

CHAPTER XXV.

LARCHES.

The Black Larch, or Tamarack.—Its Singular Beauty, Attainable Height, and Appearance.—Its Range of Growth.—Soil Suited to its Growth, with Difference of Opinion.—Its Durability and Usefulness.—A Practised Fraud Unearthed.—The European Larch. —Its Attainable Height, Range, Rate of Growth, and General Contour.—Its Ornamental and Timber Excellence.—Durability and Uses of its Wood.—Larch-growing in England and Scotland.—Ages of Maturity.—Foreign Testimony on its Durability.—Its Adapted Uses.—Places Favorable to its Propagation.—Where to Select and Obtain Seed.—Mr. Thomas Lake's Experience in Growing Larch.

THE BLACK LARCH, OR TAMARACK.

This singularly beautiful tree grows to the height of from ninety to one hundred feet, with a diameter of from two to three feet. It is perfectly straight, with leaves of a light-bluish color. It grows as far north as Hudson's Bay, but is found in the United States in only swampy soil. I, for one, cannot understand this, as in British America it thrives in almost any soil. It is a very strong and durable wood, and among our most valuable for timber and rafter-beams; uprights made of it are said to last a great length of time.

It is a handsome and a very ornamental tree. That which grows the farthest north is far superior to our swamp-growing species.

Some unsophisticated horticulturists have been swindled into buying the black larch as the European species—a deception that is very easy of accomplishment with those not acquainted with the different varieties of trees.

EUROPEAN LARCH.

This tree rises to the height of from ninety to one hundred feet, and in general contour much resembles the black larch. It is found in the Alps of France and Switzerland, of the Tyrol, and in the Carpathian Mountains, and in various mountainous districts of Europe. Thanks to the assiduous care of the Duke of Athol, it has been planted in England as a forest-tree, and duly recognized as one of much excellence both as an ornamental and a timber tree. It is very durable, and adapted to a variety of uses, and is daily growing in greater demand.

Loudon says: "The rate of growth of the larch in the climate of London is from twenty to twenty-five feet in ten years from the seed, and nearly as great on the declivities of hills and mountains in the Highlands of Scotland. A larch cut down near Dunkeld, after it had been sixty years planted, was one hundred and ten feet high, and contained one hundred and sixty cubic feet of timber. In a suitable situation, the timber is said to come to perfection in forty years, while that of the pinaster requires sixty years, and that of the Scotch pine eighty years."

W. C. Bryant, in his excellent work on trees, says: "The larch, planted four feet apart each way, may in ten years be large enough for fence-posts. At that distance, about twenty-seven hundred would grow on an acre."

A great deal of foreign testimony may be cited in regard to the durability of this tree, as, for instance, tried by driving a post made of it alongside an oaken post in the Thames River, where the tide rose and wet it and then subsided and left it exposed to the drying influence of the sun. The oak posts were renewed twice before any alteration was noticed in the larch. The vine-props of a great many German vineyards are made of this timber, and have been handed down from generation to generation, and will still be handed down, in an almost perfect state of preservation. M. Brissel de Monville says that he has examined trees in the forests of Switzerland that have been struck by lightning and badly shattered, and yet the heart-wood is still perfectly sound, and the uninjured limbs continue to grow in a perfectly healthy condition; and even trees that had lain on the ground for years and become thoroughly dried out have not rotted, but have become brittle with old age and may still be scaled off. It is the best timber for rails, fences, etc., and anything that requires to withstand the weather.

The larch appears to grow best on uplands, and I doubt not with a little care and attention some of our own hills and prairies could be covered with a luxuriant growth of larches. It does not seem to thrive on low, damp plains, and I would not recommend any one to try it in such places, as a failure might prejudice them against a tree that is destined to become one of our most useful and ornamental trees.

Great care should be taken, in the purchase and selection of seed, to obtain it from thoroughly reliable parties, as large quantities of worthless old stuff are sold for good seed that no one could make grow. I would recommend seed from the Tyrol in Switzerland, or from the Valais of Switzerland, both of which are usually purchased by the horticulturists of France, Germany, and Scotland.

In closing these remarks about the European larch, I would like to call attention to the experience of Mr. Thomas Lake, a resident of Winnebago County, Illinois. In a recent letter Mr. Lake says: "A few years since I saw in the *Rural New-Yorker* the European larch advertised for sale by Robert Douglas & Sons, Waukegan, Illinois, and being well acquainted with the fast growth and value of those trees in my native home, England, I bought and planted nine thousand, and have but to regret that I did not multiply that number by ten at that time. They were quite small when I bought them—many not larger than a lead-pencil and not over a foot high. My ignorance as to how this climate would suit them was the only reason I did not venture to plant more at that time. Many of those trees are now standing thirty feet high and six to seven inches through at base, as straight as an arrow, and much admired by those who see them. My mode of planting is to plough the ground deep—the deeper the better—and make it as mellow as possible. I do not advocate deep planting. I mark out with the plough furrows four feet apart each way. As I plant, I settle the fine earth firmly around the roots with my foot. Get the ground ready as early in the spring as possible for your trees, as the English larch is about the first tree that starts. At corn-planting time I planted two grains or more of corn on the south side of each little tree; if more than two grew, I pulled them up. The corn-stalks acted as a shade for the young trees through the heat and drought of summer, and I think it saved many, as the season was extremely dry.

"Many think that when they have planted, their work is ended, but it is just begun if one is resolved to succeed. I kept the young larches well cultivated with the corn-cultivator, not allowing any weeds or grass to grow. I harvested corn enough to pay for the labor, and produced the largest ears grown on the farm. The reason of this was that there were only two stalks to the hill, and they were well and often tended. I followed the same course the next season, and intended to do so the third, but in this I was prevented, as the trees had grown so fast that I could not get the horse and cultivator through without injuring them. That season they covered the ground and choked out the grass and weeds—so ended my labor."

CHAPTER XXVI.

THE MAGNOLIAS.

The Cucumber-tree. — Its Range and Manner of Growth. — Its Attainable Height and Ornamental Character.—How Propagated.—Yellow Cucumber-tree. — Where Found. — Its Beauty and Ornamental Character. — Quality and Durability of its Wood. — A Reason for its Scarcity.—Small Magnolia, Sweet Bay.—Its Attainable Height.—Its Limited Range and Exceptional Ornament. —A Perfect Specimen Described.—How to Preserve its Seed and Young Plants.—Great-leaved Magnolia—Its Rarity and Remarkable Characteristics.—Umbrella-tree.—Its Resemblance to the Great-leaved Magnolia. — Its Range of Growth and Favorable Soil.—Its Usual Height.—Its Artistic Beauty, Odoriferous Qualities, and Peculiar Tendency. —Ear-leaved Magnolia, or Ear-leaved Umbrella-tree.—Where Found.—Its Height.—Its Pleasing and Distinguishing Features.— Yulan Magnolia.— Its Foreign Nativity and Recent Introduction into the United States.—Its Distinctive Character and Odoriferous Production.—The Foliage of Young Trees Described. — Recommended Specimens. — The Conspicuous-flowered Magnolia. — Its Distinguishing Difference. — The Empress Alexandrina's Conspicuous-flowered Magnolia.—Date of Introduction into England.—Its Parallel of Thrift and Its Floral Productiveness. Manner of Planting.—*Magnolia Purpurea.*— ts Nativity.—Color of Bloom.—How Grown, and Medicinal Properties.

THE CUCUMBER-TREE.

This tree is found in western New York, through Ohio and Indiana, southern Illinois, and south to the Gulf of Mexico. It is about the largest of its species excepting the big laurel. It is of very rapid growth, fine shape, and of an ornamental character. Unlike any other magnolia, the flowers of this tree add very little to its beauty, as they consist of six twisted, scraggy petals, without any beauty or special color. Its wood is of the same order as the linden, basswood, etc., and is seldom used for any purpose where other lumber can be obtained. The tree should be propagated by layers, and the seed sown while in a moist state, as it will not germinate if once dry. Shade the young plants from the sun when they first start to grow, and during the first period of cold weather.

YELLOW CUCUMBER-TREE.

This tree is found in Georgia and South Carolina chiefly; it is noted for the extreme beauty of its large yellow flowers, which form quite a contrast to its rich green foliage. It is one of the most ornamental of its genus, and is as hardy as any of its species, notwithstanding what Loudon says to the contrary, as it will withstand the Massachusetts winters. Its wood is on a par with that of the cucumber-tree, and is not used for building purposes.

SMALL MAGNOLIA, SWEET BAY.

This tree, which grows to the height of thirty or forty feet, is seldom found west of the Alleghany Mountains. It is one of the most ornamental of an ornamental species; its leaves are large, of a dark-green glossy color on top, and of a creamy white underneath. In the South this tree is grown all the year round. The most perfect tree of this variety that I have ever seen was in the grounds of Girard College, Philadelphia. It rose to a height of about twenty-five feet, perfectly symmetrical, and it seemed as if there was not a branch or a leaf out of place; and I remember to this day how the air was perfumed for some distance around it. The seeds soon become rancid, and should be kept in some damp place or in rotten wood until they are ready for setting out. When young, the plants, which do not grow very fast, should be shielded from the sun.

GREAT-LEAVED MAGNOLIA.

This is one of the most uncommon of our American trees. It is not found in abundance anywhere, and is chiefly remarkable on account of the size of its leaves and flowers. Its leaves are two and three feet long, and its flowers from ten to twelve inches across; the wood is soft and of no practicable value. The tree is apt to be hurt by high winds.

UMBRELLA-TREE.

This tree much resembles the great-leaved magnolia in the length of its leaves. It is found in deep, rich, cool soil, from western New York to the Gulf of Mexico. The usual height of the umbrella-tree is about thirty feet, which it seldom exceeds. The leaves are from two to two and a half feet in length, with a width of from six to eight inches, and form quite a beautiful and artistic curve, hence the name umbrella-tree. Its flowers are large and beautiful, and from six to eight inches in breadth. They have quite a sweet though rather heavy odor. The terminal buds of this tree are very tender and apt to be injured by the cold. It also has a tendency to throw out suckers at its base; these should be carefully trimmed off, or they will sap the body of the tree.

EAR-LEAVED MAGNOLIA, EAR-LEAVED UMBRELLA-TREE.

This tree is only found at the base of the Alleghanies. Its height is about forty feet, and it is distinguished for the beauty of its flowers. Cultivators prefer this species to any of its genus, on account of its pleasing fragrance. It is hardy around Philadelphia and farther south. It is not very plentiful anywhere. Its leaves are from eight to twelve inches long, heart-shaped at the base, and smooth on both sides. The branches are slenderer than the rest of its family. It bears a white flower, from five to seven inches in breadth.

YULAN MAGNOLIA.

This tree has but lately been tried in this country, and can as yet hardly be pronounced upon. In all probability it will prove a success. It can hardly be called a tree, however, but only a shrub. It bears a beautiful white flower, which makes its appearance before the leaves, and has a very sweet, penetrating odor. It is found in greatest profusion about New York, where it is hardiest. In young trees the leaves are from six to eight inches broad, and three to four inches across the widest portion.

I would especially recommend the following for cultivation: Conspicuous-flowered magnolia and Empress Alexandrina's. In the conspicuous-flowered magnolia, though very closely resembling the other species, one accustomed to trees would distinguish the difference by the odor of the blossoms and in the thickness of the branches, the conspicuous-flowered magnolia having much the stoutest branches. The Empress Alexandrina's conspicuous-flowered magnolia was first brought into England by Sir James Banks about the year 1788, where, after a hard struggle, it at length, after eight or ten years, attracted attention, and became one of the leading hot-house shrubs. It flowers every year, and thrives best in the neighborhood and about the same parallel as London, New York, and Philadelphia. To give some idea of the immense number of flowers this tree bears, I will cite an instance from Browne's work on trees. He says: "An original imported plant, trained against a wall at Woombybury, in England, measured twenty-seven feet in height, and covered a space laterally of twenty-four feet, and had on it, in April, 1835, five thousand flowers.

This tree will thrive in any rich, free soil, properly drained and slightly enriched. As a background, it should have an ivy-covered wall, or some kind of evergreen shrub or plant, on account of its bearing flowers before leaves. Plant in pots after taking the small shrub from tree. Keep for first two years in pots, and then set out. By this means we may escape the danger from frost, as the young trees are very easily nipped.

"MAGNOLIA PURPUREA."

This plant, first introduced into England about the year 1790, is a native of Japan. Its flowers are purple without and white on the inside. It should be grown from the seed in loose earth slightly enriched. The bark is used medicinally, and emits a very pleasant odor when bruised. This plant is not well known in this country.

CHAPTER XXVII.

YELLOW WOOD.

Its Rarity and Limited Height. — Where Found and General Characteristics. — Manner of Preserving and Sowing its Seed. — The Dogwood. — Cornel Dogwood. — Its Singularity of Species and Diffused Growth. — Its Ornamental and Useful Advantages. — Method of Preparing and Sowing its Seed. — The Jamaica Dogwood.—Description and Medicinal Properties.—The Date Plum. —Persimmon. —Its Usual Height and Size.— Peculiarities of its Foliage and Bark. — Effect of Frost on its Fruit. — Description and Uses of its Wood. — Preserving its Seed. — The Mulberry. — Red Mulberry. — Where Found, Attainable Height, and Manner of Growth. — Durability and Uses of its Wood. — Its Ornamental Value.—How to Obtain its Seed.—The Black Mulberry.—Its Foreign Origin. — Its Comparative Growth and Productiveness. — Its Dedication. —Weight of its Wood per Cubic Foot. — Effect of Age on its Fruitfulness. — The White Mulberry-tree. — Its Main Distinguishing Feature. — Its Growth. — Countries to which Indigenous. — Purpose for which Introduced into the United States, and Results.

This is a rare tree, and seldom exceeds forty feet in height. It is found in Kentucky and Tennessee, and according to William C. Bryant is much more hardy several degrees farther north. The foliage is quite brilliant and has a very sweet odor, only, to my notion, a little heavy and dead. The flowers are in long, pendulous clusters. This tree would make quite a valuable timber tree; but, owing to its scarcity, it has never been used. When first planted it is said to be of slow growth, but after the first two or three years takes a sudden start, goes ahead quite rapidly, and soon reaches its full height. The seed of this tree should be kept in rotten wood, or in damp sand, during the winter, and covered very lightly in the spring. If it is sown dry it will not vegetate until the next year.

THE DOGWOOD.—CORNEL DOGWOOD.

This is the only species of dogwood in the United States. It is found in nearly every state of the Union, and is from twenty to thirty feet high. It has a diameter of from ten to twelve inches. The wood is hard, strong, heavy, has a very fine grain, and is used for small panel work, and for almost anything where it is necessary to give a high polish. The flowers are small and form in clusters, surrounded by four large white leaves. It also bears a red berry, which forms a pleasant contrast to the large white leaves, and makes the dogwood one of our most ornamental trees. The seeds of the dogwood require from two to three years to make them vegetate, but Michaux gives the following method: Gather the seeds in the fall, clear them of their pulpy covering by rubbing them in water, cover them with earth in a box, and place them in the cellar till spring, care being taken to keep the earth moist.

JAMAICA DOGWOOD.

This tree belongs to a large and important order of the pulse family, familiar representatives of which are found in the locust, tamarind, and the like. The majority of the plants that belong to this widely diffused order are indigenous to foreign lands. When full grown this tree attains a height of twenty to twenty-five feet, has a bright-colored, smooth bark, and very irregular, spreading branches. The wood is very heavy and resinous, of a light-brown color, coarse and cross-grained, and lasts almost equally in or out of water. It makes excellent piles for wharves, and is reckoned the most lasting timber in America, every way as good as the English oak, and having such a leaf. The blossoms are very white and sweet, small, and in bunches, as full as the tree can hold. After the bloom come bunches of a membranous substance, looking like hops at a distance, in which are contained the seed. Calyx of a brownish red, covered with greenish hairs. The leaves are twice pinnatifid, somewhat coriaceous, covered with a fine down when young, afterwards becoming almost globous, and deciduous. Leaflets about two inches long, twelve to sixteen lines broad, and pointed. The leaves are shed early in the year, and previous to the development of the new foliage the flowers make their appearance. This tree is easily propagated by seeds or cuttings, and stakes cut from it soon take root and form an excellent live fence. The bark of the trunk is very astringent; a decoction of it stops the immediate discharge of ulcers, especially when it is combined with mangrove bark. It cures the mange in dogs, and would probably answer well for tanning leather. The bark of the root, pounded, is used in catching fish; if mixed with the water in some convenient part of a river or creek, whence its influence may spread, in a short time the fish that lie under the rocks or banks rise to the surface, where they float as if dead. Fish caught in this manner are eaten without hesitation, and are not considered unwholesome.

The bark of the root, to be effectual, should be gathered during the period of inflorescence. When chewed it has an unpleasant taste. It yields its virtues to alcohol, but not to water. A saturated tincture prepared from the bark is used as an anodyne in toothache, and found very efficacious, not only affording relief when taken internally, but uniformly curing the pain when introduced upon a dossil of cotton into the tooth.

The preparation of the bark for the sport of fish-catching is as follows: Being detached from the roots, it is mashed up with what is termed in the West Indies temper lime and the low wines or lees of the still-house, and the mixture distributed into small baskets, from which it is gradually washed out by persons holding the baskets in the water, no doubt with the certainty of stupefying or narcotizing a large number of fishes. Most of the larger fishes recover after a time from the influences of the drug, but a great sacrifice of the smaller ones is occasioned by the process. It has been observed that the eel is the only fish that could not be intoxicated with a common dose.

Experiments have demonstrated the power of this drug, in large doses, to produce prompt paralysis of the motor nerves, while it does not affect the seat of intelligence nor the great centres of innervation.

THE DATE-PLUM PERSIMMON.—PERSIMMON.

The persimmon-tree usually reaches the height of from fifty to sixty feet, and from twenty to twenty-four inches in diameter. The leaves are about five inches long and pointed, of a beautiful dark bottle-green, with a glossy face and glaucous underneath; the bark is very rough, the limbs and branches crooked and twisted. This tree usually has a conical and rather open top; its fruit varies in shape and in time of ripening, and is best if ripened before frost, and not, as most people suppose, after frost. Frost removes the astringency of the persimmon, but at the same time spoils it if it has not reached a certain stage of maturity. The wood of the persimmon is hard, heavy, and of a very fine grain, and is much used in place of ash as axle-trees for carriages and wagons, but its principal use is for carving. Keep the seed moist, and plant in the seed-bed until one year old, then transplant.

THE MULBERRY.—RED MULBERRY.

This tree is found east of the Mississippi River, and reaches a height of from seventy to eighty feet. While in its young state it makes very rapid progress, but after it has reached a few inches in diameter it seems to fall back, and becomes of much slower growth. Its timber is very strong, tough, compact, and durable. Its chief use is for posts, fences, and rural buildings. Its fruit, too, is esteemed a delicacy by many. It is a handsome, ornamental tree, and is usually covered by myriads of birds that come to feast on the berries. To obtain the seed the berries should be taken when fully ripe and washed, the seed that falls to the bottom only being used; these should be laid by until spring, and then lightly covered with mould. The first year the young trees will grow to the height of from twelve to fifteen inches. Its fruit is very much increased in size by cultivation, but the birds generally save all trouble as to picking by being beforehand, and obtaining the best that is to be had.

THE BLACK MULBERRY.

This tree, though a native of Europe, is found in a wild state in this country. It is not nearly as large as the red mulberry, and is of much slower growth. Its wood is not of any value, but its fruit is from two to three times as large as the red mulberry. This tree grows to the height of from twenty to thirty feet. Its leaves are broad, rough, and heart-shaped at the base. On account of its comparative slowness in putting forth its leaves the mulberry was dedicated by the Greeks to Minerva, the goddess of war. When perfectly dry the wood of the black mulberry weighs only about forty pounds to the cubic foot. As it increases in age it increases in fruit, so that an old tree will produce not only more but better fruit than a young one.

THE WHITE MULBERRY.

The leaves of this tree are its main distinguishing mark, being about eight inches long and about six inches broad, and heart-shaped. The tree grows to a height of from thirty to forty feet. It is only found in a really wild state in China, but exists in a semi-wild state widely scattered over Europe and Asia, and is found sparingly all over the United States. It was first introduced into this country for the purpose of feeding the silk-worm, but it has never proved of practical value. At the time of the silk-worm craze in 1830 the white mulberry took a big boom, but has since gradually sunk down into utter insignificance. It may, however, at some future period, arise to eminence as food for the silk-worm.

CHAPTER XXVIII.

THE BOW-WOOD, OR OSAGE ORANGE.

Range of Growth, and Soil Favorable to its Growth.—Its Attainable Height.—The Incorruptible Property of its Wood.—Color of its Wood, Uses for which Fit, and Advantages.—Its Productiveness and Famed Elasticity.—Its Foliage and Fruit Described.—States best Suited to its Thrift.—Difference of Bearing of the Male and the Female Tree.—A Fruitful Yield.

This tree is found chiefly in the rich bottom-lands of Louisiana, Texas, and New Mexico, where it reaches the height of from twenty-five to thirty-five feet. The wood, which takes a beautiful polish, and is easily mistaken for satin-wood, is hard, tough, and very elastic, and, strange to say, is incorruptible, a rotten stick of Osage orange being never seen; though it will waste away, it will never rot. In color it is of a bright yellow, and is fit for any purpose where lumber is exposed to changes of weather, as it does not shrink nor swell on exposure to water or heat.

In a few years a plantation of Osage orange-trees would reproduce itself. It is so pregnant with suckers that, like the chestnut, the more it is cut down the more shoots it will throw out, and thus the Osage plantation will grow thicker and thicker. The Osage Indians have rendered the wood of the Osage orange famous from their skilful use of it in the manufacture of their bows.

It is a beautiful deciduous tree, and has a smooth, grayish-yellow bark, and while young has a beautiful roundish appearance; but, like youth and beauty, when old age appears it becomes wrinkled in its bark and scraggy in its branches. Its foliage is of a beautiful dark green, smooth and polished on the top and slightly seamed underneath; the leaves are about three or four inches long and as many broad. The spines that cover the branches are straight and strong, and about two inches in length.

The fruit is about the size and appearance of a large Seville orange. It consists of numerous small radiating fibres that meet and join a small ball-like centre of soft, woody fibre. The orange, when wounded, exudes a milk-like fluid that on exposure to the air turns to a white, coagulated mass, but turns black when left to dry on the hands. It is found scattered all over the country, but is at its best in Arkansas, Louisiana, Texas, and New Mexico. There is a curious instance related by Browne, viz.: Two trees were planted by Mr. McMahon, of Philadelphia, close together; one of them bore fruit in a perfect condition, and continued to do so for some years, while the other bore only fruit whose seed was abortive. Mr. McMahon was puzzled for a time to account for this, but after mature study he came to the conclusion that they were male and female; the female bearing the perfect fruit, while the male could only produce abortive fruit. Two other trees situated about four hundred yards away showed the same result.

At Beaver Dam, in Virginia, a female tree of this species yielded fruit to the number of one hundred and fifty, many of which weighed eighteen or nineteen ounces each.

From the wood of the Osage orange is obtained a yellow dye; the inner bark is very fine and white, and might be manufactured into fine linen. The chief use of the tree is for hedges. It has been tested as a food for silk-worms, but with poor success, most of the worms dying, and those that lived were weak and puny.

CHAPTER XXIX.

THE AILANTUS, OR TREE OF HEAVEN.

Its Height, Size, and Nativity.—Its Adaptability to Arid Places, with Recommendation.—Manner of Growth, Description and Uses of its Wood.—Description of its Leaf and Flower.—When First Introduced into the United States and by Whom.—Successful Propagation Instanced.—How Propagated.

This tree, which grows to the height of sixty or seventy feet, with a diameter of two feet, is a native of China, and has quite recently been transplanted to the arid steppes of Siberia with great success, as it has a strong tendency to hold the sand together and keep it from shifting. In the first period of its existence it is of very rapid growth, and does not slacken until about the twelfth year, and then it gradually becomes slower and slower of growth. The wood is hard, very fine grained, and fit for cabinet-work. It has been strongly recommended for planting on the arid plains of western Kansas.

This gigantic tree is justly called by the ancients the "Tree of Heaven." The leaves are from one and a half to six feet in length, having leaflets with coarse, granular teeth near the base. Its flowers are of a whitish green and of a very disagreeable odor.

The ailantus was first introduced into the United States by Mr. William Hamilton in 1784, and a sucker, planted from the original tree in 1809, is at present standing in the Bartram Botanic Garden.

In 1820 Mr. William Prince, of Flushing, Long Island, imported the ailantus from Europe, and from this stock most of the trees around New York have been supplied. This tree may be propagated from seeds, suckers, or cuttings.

CHAPTER XXX.

THE BUCKEYE.

Similarity of Species and General Characteristics to Horse-chestnuts. —Horse-chestnut Buckeye. —Its Elevation and Nativity. —Its Manner of Growth and Soil Suited to its Growth. —Its Foliage and Fruit Described. —Its Ornamental Value. —Specified Varieties. —When Introduced into the United States.—Repulsiveness of its Leaves to Insect Ravages.—Description of its Wood.—Use to which Put in Europe.—Use as Recommended by Du Hamel. —Produce of its Bark. —Bleaching Properties of its Nut. —Its Artistic Beauty. —Ohio Buckeye.— Height. —For what Recommended.—Its Uselessness as a Timber Tree.—The Sweet Buckeye.—Its Attainable Height.—Origin of its Name.—Uses of its Wood.—How Propagated.—Popularity of its Nut-husks.—The Red Buckeye.—Its Stunted Growth.—Its Floral and Odorous Properties.—Where Found.—Effect of its Bark on Fish.—Another Use of its Bark.—Its Largest Specimen.—Its Supposed Nativity.—Its Introduction into Britain, and Ornamental Use.—Results of Grafting. —An Opinion.—The Edible Buckeye Described.

Sometimes the two families of buckeyes and horse-chestnuts are mixed by persons that do not know the difference between the families, and are called separate trees; but their general characteristics are so much alike that, for one, I cannot see why a difference should exist at all, and I class them all under one head—First, the

HORSE-CHESTNUT BUCKEYE.

This tree, which rises to the height of eighty feet, was first known to Europe at Constantinople about the beginning of the sixteenth century, and is only cultivated here as an ornamental tree. It is of very rapid growth in soils that suit it. The fruit or nuts, ground and mixed with meal, are used as a cure for broken-winded horses. Its leaves are large, dark green, and very beautiful, and make quite a handsome, showy appearance in contrast to its beautiful flowers, which, peeping out in clusters from among the dark-green, graceful foliage, make it one of our most beautiful trees. The fruit ripens about the middle of September, and is enclosed in a thick, prickly husk. The following is a list of the horse-chestnuts:

Double-flowered Horse-chestnut; an uncommon variety.
Ohio Horse-chestnut, or Fœtid Buckeye.
Smooth-leaved Horse-chestnut.
Variegated-leaved Horse-chestnut.
Scarlet-flowered Horse-chestnut.
Fern-leaved Horse-chestnut.
Pale-flowered Horse-chestnut.
Silver-leaved Horse-chestnut.

The native country of the horse-chestnut is claimed by some as northern Asia, and by others as India. It was first introduced into this country about the middle of the seventeenth century; the first tree is said to be still standing on the estate of Mr. Lemuel Wells, of Yonkers, New York.

The horse-chestnut requires a deep, free soil, and will only flower in a fully sheltered place.

Its foliage is seldom or never eaten by the larvæ of insects; its wood is white and very soft, and will only weigh about thirty-eight or forty pounds to the cubic foot; in Europe the greater portion of the sabots are made from it. Du Hamel and many other eminent authorities recommend its use in the manufacture of water-pipes.

The bark yields a yellow dye, and is very bitter to the taste. The nuts are used in Ireland to whiten linen; they are first rasped into the water and allowed to macerate for some time, and when applied to the linen the saponaceous matter exudes from the raspings and bleaches it. The potash of the horse-chestnuts is among the finest and best in use.

To the painter, the magnificence of its stature and the richness of its drapery, especially when clothed in the beauty of its broad, palmated leaves and embroidered with its profusion of silvery flowers, more than atone for exceeding regularity of form, terminating, as it always does if left to nature, in an exact parabola; its massive and luxuriant beauty contrasts well with trees of a more airy character, and thus produces that breadth of light and shade so essential to landscape scenery.

OHIO BUCKEYE.*

This tree reaches the height of forty or fifty feet; it is one of the first trees to put forth leaves in the spring. It is only recommended for its beauty; cattle sometimes kill themselves from gorging with the nuts. As a timber tree it is a delusion and a snare, and not worth cultivating.

THE SWEET BUCKEYE.

This tree reaches the height of from ninety to a hundred feet, and from two to three feet in diameter; it has not the disagreeable odor of the foregoing members of its species, hence the name of sweet buckeye. It loses its leaves early in September, and cannot be used for ornamental purposes. Its wood is used for log-houses, wooden bowls, etc. It is propagated from slips, seeds, and by grafting. The husks that contain the nuts are not covered by thorny spines, but are quite smooth.

THE RED BUCKEYE.

This species is little more than a large shrub. It has large, bright spikes of red flowers that have a very pleasant odor. It is found widely scattered through all the rich bottom lands east of the Mississippi. The humming-

* The introduction of this species of chestnut into, and its extensive growth and rapid thrift in, Ohio occasioned the peculiar appellation of "Buckeye" to that state; which name it still retains, and is familiarly applied to the state and its belongings.

birds seem to enjoy these red flowers, as there are always scores and scores of them around the tree while in bloom. The bruised branches and bark of this tree are used in place of the fish-berry in order to stupefy the fish in small ponds; it has such an effect on them that they can easily be taken up in the hand. It also takes the place of soap in washing woollen cloth. The tree in the garden of Mr. Landreth, of Philadelphia, is the largest of its species known on this continent, being about twenty-five feet high, with a trunk three and three quarter feet in circumference. It is found more especially in the small valleys of Virginia, Arkansas, and Louisiana, and is said also to be a native of Japan and Brazil. Since its introduction from Brazil into Britain, in 1711, it has been extensively cultivated all through Europe as an ornamental tree. I am of the opinion that better results may be had from this tree by grafting, viz.: A plant of the dwarf species was engrafted on the common horse-chestnut-tree, and produced a beautiful, pendulous, low tree; and it is likely a little care and cultivation would unite the beauty of this tree with the size of some of its larger brethren of less beauty, and so be a gain to both.

THE EDIBLE BUCKEYE.

This species in its natural state is of low growth, seldom exceeding four feet, and is of the evergreen variety; but with proper or careful management in its culture it attains the height of a moderately tall shrub or small tree.

In its native soil this tree produces abundant flowers, which continue to bloom for three months or longer, at a time, too (April and May), when very few trees or shrubs are in bloom, forming one of the grandest floral ornaments of the shrubbery. Its leaflets, from five to seven in number, are of an oval-obovate form, and velvety-canescent beneath, supported on long, slender petioles, gracefully disposed. Combined with the feathery lightness of the racemes of its flowers, they give the plant a showy and elegant appearance. This shrub is indigenous to the southeastern parts of the United States, where it is usually found growing on the banks of streams or rivulets. It may be propagated either from layers or seed. When its nuts are used in the raising they should be sown immediately after gathering. A small fruit is produced by this plant which may be eaten either boiled or roasted, like the chestnut of Europe.

CHAPTER XXXI.

THE TUPELO.

The Tupelo, Black Gum, or Pepperidge.—Its Variety and Allied Characteristics.—Their Floral Fragrance.—How Raised, Size, and Range of Growth.—Texture of its Wood and for What Esteemed.—Its Two-fold Property.—Its Variety of Name.—Description of its Berries and their Sustaining Usefulness.—Its Attainable Height and Places Favorable to its Growth.—Its Uses in Virginia.—The Wild Lime-tree.—Its Resemblance to the Black Gum-tree, and Exception.—Description and Uses of its Wood.—Buoyant Property of its Roots.—The Esteemed Delicacy of its Fruit.—Its Height and Size.

TUPELO, BLACK GUM, OR PEPPERIDGE.

The tupelos are deciduous trees of North America, with characteristics so nearly allied that I have called them only two distinct varieties. They produce an agreeable, fragrant flower early in the spring, and are well described and beautifully expressed by Cowper:

> "Though leafless, well attired, and thick beset
> With blushing wreathes, investing every spray."

This tree is middle-sized, and is found from Massachusetts to Illinois, and from thence south to the Gulf of Mexico. It is raised from seed generally, but the first year the seed does not vegetate. Its grain is so interwoven that I am afraid even the patience of Job, famed in Biblical history, would give way under such a task, and he would fall from grace, or, in other words, he would swear, had he been compelled to cut some of the black gum. It is held in high estimation as wagon-hubs, rollers, and cylinders; it is also fit for turning-work, and, to my notion, would make first-class ornamental work, as

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the glue-pot would not have to come into requisition so often to glue together some of the parts in our furniture. It is very hard to transplant unless removed wholly or carefully root-pruned in the nursery. This tree has quite a variety of names; some of them are as follows: Gum-tree, yellow gum-tree, sour gum-tree, pepperidge-tree, wild pear-tree, etc. The berries of this tree are small, blue-colored, and afford myriads of robins their daily sustenance. It sometimes attains a height of fifty or sixty feet, and is found only in moist or damp places. It is used in Virginia to make mauls, and in ship-building.

THE WILD LIME-TREE.

This tree closely resembles its brother, the black gum-tree, except in its fruit, which is larger, its wood softer, and it has a stone that is deeply grooved on both sides; its fruit is intensely acrid. It attains a height of seventy or eighty feet, with a diameter of four or five feet at the surface of the earth, and at about six or seven feet a diameter of thirty to forty inches. When the leaves first unfold themselves in the spring they are downy, but as they gradually spread out they become smooth on both sides. The wood is extremely white and reasonably soft when unseasoned, but very light and hard when dry; and, as it possesses the same beautiful grain as the other members of this species, it is made into bowls, platters, trays, etc. The roots when seasoned are so light that they take the place of cork, and are much used by the fishermen to buoy up their nets. Its fruit is esteemed a delicacy, and is sold under the name of the Ogeechee lime, for the purpose of preserving in sugar, which, when properly prepared, is said to possess a most delicate and delicious flavor.

CHAPTER XXXII.

THE JUNEBERRY.

Its Noticeable Beauty.—Its Attainable Height.—Its Floral and Fruit Productiveness.—Its Foliage Described.—The Non-distinctive Difference of European and American Varieties.—Its Range of Growth.—Soil and Situation Suitable to its Thrift.—Use of its Fruit.—The Papaw.—Its Stunted Growth.—Its Floral and Fruit-bearing Properties.—Its Limited Latitude of Growth.—Properties of its Wood and Fruit.

This tree is only worthy of notice on account of its beauty. It reaches the height of thirty or forty feet; its flowers are white and are produced in long panicles; its leaves are from two to three inches in length, of a beautiful oval shape, and smooth on both sides. The fruit is about one eighth of an inch in diameter, red in an immature state, and of a dark purple when fully ripe, and is covered with a bloom. Of this fruit the largest tree rarely yields more than half a pound. It greatly troubles most people to distinguish the European and American varieties from each other, as they have so many points in common; so much so, that many people class them together and make no distinction whatever. The Juneberry, with the exception of the maritime parts of the United States, is spread all over the northern half of the Western Continent, from Georgia to Hudson's Bay. It multiplies very rapidly on the fertile banks of streams and in swampy ground, although it sometimes occurs in dry, rocky places, but then is never of vigorous growth and is rather sickly. Its fruit is used for food in North America.

THE PAPAW.

The papaw is commonly only a large shrub, but by extraordinary effort it sometimes reaches the height of twenty or twenty-five feet, with a diameter of eight inches. It bears a purple flower of great beauty, with an oblong fruit with an egg-custard consistency and taste. It is most too rich for most people. The trunk of the tree is covered with a silver-gray bark, which is finely polished and very smooth. It has not been observed north of the Schuylkill River, Pennsylvania; it is a sure indication of the richness of the soil. It seldom produces shoots of more than five or six inches in length, hence a plant in ten years does not reach above three or four feet in height. Portions of the wood have a rank and fœtid smell. The fruit is eaten by few people except negroes; a spirituous liquor has been made from it, but it is of little worth, and has a very deleterious effect upon those who are in the habit of using it.

CHAPTER XXXIII.

THE CATALPA.

Its Scattered Range, Height, and Growth.—Its Flower and Foliage Described.—Occurrence of its Bud and Fall of Leaf.—Its Climate and Thrift.—Its Self-propagating Properties.—Durability and other Properties of its Wood.—Its Seed Described.—Manner of Culture.—A New-England Specimen Described.—The Medicinal Properties of its Bark.—The Poisonous and Medicinal Property of its Flower.—Its Annual Beautifying Productiveness.

This tree, which grows to the height of seventy or eighty feet, and has a diameter of from two to three feet, is found scattered from the Gulf of St. Lawrence to the Gulf of Mexico, and from the Atlantic to the Pacific. It has a very beautiful flower, and large heavy foliage which renders the tree liable to be broken by heavy winds. The leaves are late in appearing in spring, and fall as soon as the first frost comes. The catalpa flourishes where the winters are not too severe, the young trees springing up and thriving from the seed dropped by the old trees. The wood is very much like the butternut, but withstands the weather better, and takes a very high polish; in some sections the catalpa is worked up into posts, and has been found very lasting and not very sensitive to change of weather. The seeds are contained in a long, slender, round pod; they are folded in a thin, membranous wing, and are flat and very narrow. If planted in the spring and covered lightly they vegetate very easily, and the young shoots transplant readily. Its bark is of a silvery-gray color, and but lightly furrowed; the leaves are heart-shaped; the flowers white, and marked with yellow and purple spots. In favorable seasons they are succeeded by capsules, or seed-pods, which closely resemble those of the common cabbage, but on a larger scale.

The first tree of this species planted in New England stands in front of the late residence of Mayor Babcock, in Washington Street, Hartford, in the State of Connecticut. It is of large size, and when in bloom is one mass of sweet-scented, beautiful flowers. It is over eighty years of age.

The wood of the catalpa resembles that of the sycamore, but is susceptible of a much higher polish and has not the reddish tinge, being a grayish white. If the bark be bruised in the spring a very venomous odor is exhaled. In a thesis at the Jefferson Medical College of Philadelphia, the bark of this tree was maintained to be a tonic, and more powerfully antiseptic than that of the *Cinchona officinalis.* It is a very good and sure antidote for the bites of snakes. The honey collected from the flowers is very poisonous, and produces effects closely allied to the effects of the honey collected from the yellow jasmine. The flowers are also valuable as a remedy for asthma.

It is usually grown from seed, but will readily grow from cuttings. The tree is of very rapid growth until it has reached the height of twenty feet, which it attains usually in about ten years. In free, rich soils the trees continue flowering every year, making a splendid appearance, not only from the large size and lively color of the blossoms, but from the fine pale green of their leaves.

CHAPTER XXXIV.

THE HACKBERRY.

Its Attainable Height and Size.—Its Appearance and Characteristics. —Description and Uses of its Wood.—Its Odorous Production.— Its Range of Growth.—The Largest of its Species, Where Growing.—How Propagated.—Its Enemies.—The Red-bud.—Its Stunted Growth.—Its Floral and Seed Productiveness.—How Propagated. —Similarities of its Species, and Distinguishing Features.—Use of its Bark.—Culinary Usefulness of its Flower, Bud, and Pod.

THE HACKBERRY.

THIS tree, which rises to the height of from eighty to ninety feet, with a diameter of eighteen to twenty-four inches, and a trunk straight and undivided for a great height, is supported on all sides by great roots that project two feet or more from the ground. The wood splits very easily, and is of a clear white color; it cannot stand much exposure to the weather. It has been used for inside work, but has been found to warp and become so crooked that its use for that purpose has been discontinued. This is a fine tree, but cannot be safely recommended for cultivation for the sake of its timber, as it is only fit for making flat barrel-hoops. The bark of this tree is of a grayish color, and covered with asperities which are scattered unevenly over the surface. The flowers, which appear in May, are a small white variety, with a very fine odor. The banks of the Delaware, just above the city of Trenton, New Jersey, may be considered as the northern limit of this tree: it is found in narrow stretches east of the Alleghanies, but west of them it exists profusely all over the broad valleys and rich bottom-lands. The largest tree of this species in the United States stood at Springfield, Massachusetts, and measured fourteen feet around the base.

It is propagated best in layers, but great care should be taken to keep the hackberry moth from eating the leaves and the tender young plants. The moth is a brilliant insect, three and a half inches long, half an inch thick, of a beautiful apple-green color, marked in an artistic manner with white, and shaded with pink.

THE RED-BUD.

This is either a small tree or a large shrub, but usually the latter; it reaches the height of from twelve to thirty feet. Its flowers are small and of a fine pink color; they cover the tree all over, and present quite a beautiful appearance. The flowers are succeeded by a red berry, which contains the seed. The plant is easily propagated by simply sowing the seed in ground scraped over with a rake or a hoe. There is a great similarity between the red-bud of Europe and the red-bud of this country, but they are easily distinguished by the heart-shaped leaves of the American variety, and the less number of leaves and flowers. The bark of the young trees is used to dye wool of a nankin color. The French Canadians use the flowers in salads and pickles, and, from their agreeable acid taste, both the flowers and the buds may be fried in butter and eaten the same as the siliquastrum. The flower-buds and pods may be pickled in vinegar.

CHAPTER XXXV.

THE FRINGE-TREE.

Its Limited Height.—Its Native Range and Ornamental Value.—Its Floral Productiveness.—Its Variety of Name.—Its Classified Belongings.—Its Medicinal and other Properties—Its Possible Perfectness by Grafting.—The Iron-Wood.—Where Belonging.—Height of Tree, Uses and Durability of its Wood.—Manner of Growth.—Its Disadvantages as a Timber Tree.

THE FRINGE-TREE.

This tree only reaches from twenty to thirty feet in height, but bears flowers when only four or five feet high. It is native from Pennsylvania to the Gulf of Mexico, but is quite hardy farther north. As an ornamental tree it is a perfect success, but it does not remain in bloom for any period of time. It blossoms in June, and has beautiful purple, berry-like flowers that grow in clusters; its petals very much resemble fringe cut from white paper. It is known by various names; among which are snowflower-tree, snowdrop-tree, broad-leaved Virginian snowflower-tree, narrow-leaved Virginian snowflower-tree, and seaside-inhabiting Virginian snowflower-tree. This latter is a native of North America, and grows in boggy woods by the seaside.

The order to which this tree belongs embraces some trees and shrubs that are native to both hemispheres, and are for the most part deciduous. Some are timber trees, some are medicinal, which in general are bitter; one genus produces a valuable oil, and from others is produced the sweet, purgative manna. As most of the trees of this order might be grafted on one another, it is probable that their flowers might be reciprocally fecundated, in which case some curious hybrids might be produced between the privet and the lilac, the privet and the olive, the lilac and the ash, etc.

THE IRON-WOOD.

This tree belongs to the northern portion of the United States and Canada. It grows to the height of from thirty to forty feet. The wood is very heavy, compact, and durable; also exceedingly fine grained. It is used for beetles, mallets, wedges, cogs of mill-wheels, etc. It is of very slow growth, and on this account it is ineligible for timber, though it is a great success as an ornament, having light, slender, graceful branches, and a beautiful green foliage. Canes, umbrella-handles, and fancy carved-work are sometimes made from the wood of this tree. It is by no means common, and hence is not so well known as a great many of its more fortunate but not so worthy brethren; the only drawback to its culture as a timber-tree is its slowness of growth and small height.

CHAPTER XXXVI.

THE BUTTONWOOD, ASPEN, AND POPLAR.

The Buttonwood or Plane-tree.—Its Extensive Range and Abundant Growth.—Its General Appearance and Elevation.—Its Peculiar Disadvantages.—Description of its Seed and Manner of Sowing.—The Aspen.—Its Numerous Species and Resemblances.—Value of its Wood.—Disagreeable Character of its Seed.—The American Aspen.—Where Found and Limited Height.—Description and Uses of its Wood.—Its Common Characteristics.—Large Aspen.—Its Advantages.—Uses and Properties of its Wood.—Downy-leaved Poplar.—Its Southern Nativity.—Attainable Height and Size.—Peculiarities of its Foliage.—Its Uselessness as Lumber.—The Balsam Poplar.—Where Found and its Uselessness.—The White Poplar.—Its Ornamental Value.—Its other Advantages.—Its Superior Qualities and Chief Uses.—How Propagated and Attainable Height.

THE BUTTONWOOD, OR PLANE-TREE.

This tree is common throughout the Northern, Middle, and Western States. It rises to a height of from one to three hundred feet, with a diameter of from two to eight feet. It is not valuable either as a timber tree or as an ornamental tree, on account of its being liable to warp and crack, and the rapidity with which it decays on exposure to the weather. As an ornamental tree it is often attacked by a peculiar blight which greatly disfigures it; *i. e.*, the bark peels off in spots, leaving the tree with the appearance of a man with the small-pox, or a tree that has been partially burned with powder and the discolored bark has started to peel off. The seeds occur in balls, are covered with plumy tufts, and are about an inch in diameter. They may be sown when ripe, or kept until spring, soaked in water and then sown, or by cuttings of the last year's wood.

THE ASPEN.

There are many species of the aspen, most of which attain considerable size. Their foliage and wood greatly resemble each other, and most of them are of very rapid growth, but are equalled if not excelled by far more valuable timber trees, and hence in this country are not valued so much for timber, because for the same labor we obtain a much better article. The seeds are covered with a cotton-like down, which becomes a great nuisance by being continually blown over everything, so that for shade, when planted near a house, the male tree should always be preferred.

AMERICAN ASPEN.

This tree, which seldom exceeds the height of thirty or forty feet, is found in the British Provinces, and in the northern part of the United States. It has a soft, white wood with the grain very much interwoven, and is sometimes used in the manufacture of base-ball bats, as it will dent nearly through before breaking. It is a very short-lived tree. It has the common characteristics of the rest of its family, and should be propagated the same way.

LARGE ASPEN.

This tree grows and is found in the same locality as the American aspen, but is much longer lived and a more valuable tree. It is sometimes sawed into square timber and used where it can be kept dry; it has a great deal of spring and does not easily settle. This tree is cut into rails and the bark peeled off, otherwise it would rot and require renewal every three or four years; if peeled they last from fifteen to twenty years.

DOWNY-LEAVED POPLAR.

This species is rather rare in the North, but is found from Tennessee southward. It grows to the height of from eighty to ninety feet, with a diameter of three feet. It has a downlike covering to its leaves in their first growth. It has no value as a lumber tree, as it will not stand the changes of weather, and is not used even where it is the most plentiful.

THE BALSAM POPLAR.

The balsam poplar is rare in the United States, but is common in British America. It is a large tree, but useless either for timber or fuel.

THE WHITE POPLAR.

This tree is one of the most common throughout our country, and has been planted as an ornamental tree from time to time, but in a little while, instead of being a thing of beauty and a joy forever, it becomes a nuisance, from the number of suckers it throws out. It is best for large cities, as it stands the smoke and dust better than most trees. It is the chief of its family, both for fineness, whiteness, and strength; it is not liable to either split or warp, and affords a good firm hold to nails; it is chiefly used for bowls, trays, etc. It reaches the height of from ninety to one hundred feet, with a diameter of six feet. It is propagated by suckers, slips, branches, etc. Its disposition to sucker would be no drawback in forest culture.

CHAPTER XXXVII.

CHERRY-TREES.

Wild Black Cherry.—Its Native Range.—Preferred Use of its Wood. — Its Ornamental Character. — Its Productiveness. — Manner of Preserving and Sowing its Seed. — The Wild Red Cherry. — Its Attainable Height and Size.—Its Qualities Contrasted with the Black Cherry.—Description and Qualities of its Wood.—Its Spontaneous Growth.—Its Special Property.—The Wiid Cherry.—Its Medicinal Properties.

WILD BLACK CHERRY.

This tree is found all over the United States east of the Rocky Mountains. I have not seen much of it in the neighborhood of Iowa and Illinois, although the soil is eminently well fitted for it, but this is partly explained by the great prairie fires that have ravaged these districts and have destroyed the cherry-trees, while trees of the oak and hickory genus were not damaged, being much tougher and hardier. It was formerly much used in cabinet-work, and is preferred for many things to the black walnut. I have heard of some of the old houses of Virginia in which all the inside wood-work was made of cherry, and was fairly dark with age. A great many of the old fowling-pieces and pistols have highly polished cherry stocks that are not only things of beauty, but also good, serviceable weapons. The wood is not liable to warp, is of a light-red color, and darkens with age. It is a fine ornamental tree, but cannot be kept clear of caterpillars in open ground, becoming even more infested with these pests than apple-trees are. It is never attacked by the caterpillar when growing in a grove or in forests. The timber is not of value until it has attained considerable size. The fruit ripens in August; the seed should be thickly sown and the trees then thinned out, as they make excellent firewood. The seed should not be allowed to become dry, but be mixed with damp sand, and sown either in the fall or in the spring.

WILD RED CHERRY.

This tree grows to the height of from thirty to forty feet, with a diameter of from eight to twelve inches. It has all the good points of the black cherry, but is much inferior in size. The wood is of a light-red color and not inferior to that of the preceding species for cabinet-work. The wild red cherry springs up spontaneously wherever the country has been ravaged by fire. It is the only native species of cherry on which the cultivated cherries will grow and succeed if grafted on.

Wild-cherry bark is said to have a tonic and stimulating influence on the digestive apparatus, and a simultaneous sedative action on the nervous system and circulation. The fluid extract is used in all cases where it is desirable to give tone and strength to the system without causing too great an action of the heart and strain on the blood-vessels. It has also been found useful in hectic fever, some forms of dyspepsia, and irritability of the nervous system.

CHAPTER XXXVIII.

THE WILLOWS.

The White Willow.—Its Ornamental Value and Elevated Growth.—Manner of Growth and Usefulness.—Its Supposed Worthlessness the Result of Fraud.—Description of its Wood.—The Brittle Willow.—Its Height, Growth, Rarity, and Uses.—Weeping Willow.—Its Ornamental Advantages.—Places Favorable to its Growth.—Largest Specimens, Where Produced.—Grafting of the Kilmarnock and American Willow.—Shining Willow —Its Exceeding Ornament.—Its Growth on Careful Culture.—Its Favorite Places of Growth.—How Recognized.—Peculiar Feature of its Leaves.

THE WHITE WILLOW.

This is a very ornamental tree, and rises to the height of eighty or ninety feet, with a diameter of from four to six feet. It is rapid of growth, and makes a good wind-break. Some sharpers, quite recently, praised the white willow up to be such an excellent hedge-plant, and circulated such extravagant stories of its beauties in that respect, that enormous quantities of shoots and cuttings were sold, and this fraud was carried to such an extent as to injure the reputation of the tree as a wind-break and for fuel. I, for one, however, can testify that in a short time, if grown thickly together, it forms an almost impenetrable wind-break. The trees are not worth much for lumber on account of not being able to withstand the changes of weather. The wood is white, soft, and light. It produces long, straight, lithe poles, which are sometimes used for fence-rails. Its most extensive use is in the production of charcoal for gunpowder; it is also used for tanning purposes.

THE BRITTLE WILLOW.

This species grows to the height of ninety feet, and is rather rare in some sections of the country. It is used in the manufacture of baskets. A brother species, the Bedford willow, is the most valuable willow of the British Isles.

WEEPING WILLOW.

. This well-known tree is cultivated only for ornament, and is found principally on the shores of lakes, ponds, and streams. Long Island produces the largest trees of this family. The American and Kilmarnock willows are grafted on other species, several feet from the ground, as they do not rise to any height if grown from cuttings.

SHINING WILLOW.

This is the most ornamental tree of all the willows. If carefully cultivated, it may reach the height of fifteen or twenty feet, but in its wild or native state it is much smaller. It is most frequently found among the mountains and along the streams of New England, and is recognized by its leaves, which have the appearance of being varnished. It is never found west of New York.

CHAPTER XXXIX.

THE SPRUCES.

White Spruce.—Its Attainable Height and Size.—Its Northern Nativity.—Principal Uses of its Wood.—The Oil Extracted from its Branches.—The Black Spruce.—Atmosphere Favorable to its Development.—Its Wild Luxuriance.—Description of its Cones.—Manner of Securing its Seed.—The Red and Blue Spruces.—Their Resemblance to the White Spruce.—The Norway Spruce.—Its Height.—Peculiarities of its Growth.—Its Age of Maturity and Where Indigenous.—Its Resinous Extract.—Uses of its Bark.—Importation of Young Trees to England and Uses to Which Put.—Durability of its Wood.—Effect of Soil on the Qualities of its Wood.—Its General Appearance and Persistent Growth.—Its Usefulness as Shelter.—Its Properties Preferable to those of the Black Spruce.—Manner of Saving and Sowing its Seed.—Hemlock Spruce.—Where Indigenous.—Elevation Favorable to its Thrift.—Texture and Characteristics of its Wood.—Peculiarities of Grain.—Its Beautifying Character.—Its Value Compared with other Timber Trees.—Balsam Fir.—Its Nativity.—Its Height and Size.—Medicinal Properties and Ornamental Advantages.—Fraser's Fir.—Where Found and General Characteristics.

WHITE SPRUCE.

This tree sometimes attains the height of sixty feet, with a diameter of from fifteen to twenty inches. It is found from the northern portion of the United States to the Arctic Ocean, but is not quite so common as the black spruce in the United States and Canada. Its principal use is for the masts and spars of vessels, and also as a substitute for white pine in floors, rafters, and beams of buildings, as it is much tougher and does not warp or crack. Spruce-beer is manufactured from a concentrated oil or essence that is extracted from the small branches.

BLACK SPRUCE.

The black spruce must have a cool, moist atmosphere in order to arrive at its full development, and thrives more luxuriantly in wilds congenial to its growth than under the most skilful culture. The cones are smaller and shorter than those of the white spruce, and are produced in great abundance; they are ripe at the end of autumn, and should be immediately gathered and stored away, as the cones open and the seeds escape.

RED AND BLUE SPRUCES.

The red and blue spruces are closely analogous to the white spruce, and differ only in the production of the cones—the blue spruce producing cones when only three or four feet high.

NORWAY SPRUCE.

The Norway spruce reaches to the height of from one hundred and twenty to one hundred and fifty feet. It is a beautiful, straight tree, with a diameter of from two to five feet. Michaux claims that it is one hundred years attaining its full growth. It is indigenous to the northern parts of Europe and Asia, but south is found only among the mountains. It is found farther north in Europe and Asia than any other timber tree excepting the birch. The resin is the Burgundy pitch of commerce. The bark is used for tannery purposes, and trees are imported into England while only eight or ten inches in diameter, where the lumber is used for fencing, roofs of buildings, and many other purposes. Its wood is very durable, more so than any of the spruce family excepting the larch. The wood of the Norway spruce varies according to the land upon which it is grown; it is usually very light and elastic. The timber that possesses these qualities in the smallest degree is usually raised on light, poor, sandy soil. To most artistic eyes the Norway spruce is not a thing of beauty, on account of its stiff, formal appearance, but, clothed in verdure and standing in the middle of a lawn, it has a very pleasing effect. It is a splendid tree for shelter-belts, and has been recommended again and again for this purpose. It is perfectly hardy, is rapid and vigorous of growth, and transplants very readily. It is of perfectly persistent growth, and will push its branches over any obstacle until it has attained its full development. The Norway spruce is much preferred to the black spruce, but for what reason I do not know, as they both have the same qualities, unless it be that the Norway varieties are of much faster growth. The seeds ripen about the first of November, and the cones, in order to obtain the seed, must be dried in the sun or kiln-baked, and then the seed will very readily drop out. In planting, the seeds should be set about four feet apart, and the young trees carefully tended until they have reached the height of from three to four feet; then transplant, and place in their proper positions; or the alternate rows may be thinned out, and willows planted in their places.

HEMLOCK SPRUCE.

This tree is found as far north as Hudson's Bay, and from the Atlantic to the Pacific. It thrives best in cold places, and is found near the top and on the slopes of some of our highest mountain-ranges. It is of a coarse texture and not very durable, but is much more serviceable than the white pine, as it is stronger and gives a better hold to nails, screws, etc. As its cost of manufacture and transportation is as great as that of white pine, and its market value less, it is not likely to be much used while pine is abundant.

There is one peculiarity about the grain of the hemlock, and that is, in ascending three or four feet it makes a complete turn round the tree, just the same as the rifling of a gun-barrel.

It is one of the most beautiful of the evergreen trees, and is cultivated on that account. It is much used for the studding of houses, in-door work, or work of any description that is kept from exposure to the weather. The only way to transplant it successfully is to keep it two or three years in the nursery and tend it carefully. I do not recommend the hemlock for cultivation, as there are so many more valuable and better timber trees; for instance, the white, Scotch, and red pines.

BALSAM FIR.

This is a native of the coldest portions of the continent. It rises to a height of forty feet, with a diameter of from fifteen to eighteen inches; it tapers very rapidly from the base up; the wood is white, soft, and of no strength; the resin is deposited in clumps and blisters on the trunk and branches, and is used for medicinal purposes. It is passable as an ornamental tree, but soon becomes old and decrepit and loses its branches and leaves.

FRASER'S FIR.

This is a variety that is found from the New England States southward. It has the general characteristics of the rest of its species, but is not so hardy. It has smaller leaves, and more numerous and smaller cones.

CHAPTER XL.

THE DECIDUOUS CYPRESS.

Its Ornamental Character, Southern Home, and Dispersed Growth.—Soil Suited to its Growth, and Attainable Height.—Peculiarities of its Growth.—Its Associate Tree.—Description and Properties of its Wood.—Its Usefulness and Indifference to Climatic Influences.—White and Black Cypresses.—Value of the Cypress.—Its Seed.—Manner of Sowing and Cultivating.

THIS ornamental tree properly belongs to the Southern States, but is found scattered all over the eastern and extreme western sections of our country, also in the more fertile parts of the Mississippi valley. It grows in swamps or wet, moist soil, and reaches to the height of one hundred and thirty feet, and is destitute of branches for a great portion of its height, with a slightly flattened top. In the bayous of Mississippi and Louisiana we find the cypress and the tupelo growing in about four feet of water, with trunks so thickly interlaced that it is impossible to swing an axe with any kind of effect among them; the water from these bayous is the color of brandy, from the roots of the cypress. The wood is lighter and less resinous than that of the pines, is much finer grained and more elastic, and when first cut it is white, but on exposure to the air turns of a light, reddish color; it also stands the changes of climate very well, and wet or dry weather does not seem to affect it in the slightest degree. It is used for posts, shingles, hogsheads, casks, etc.; many of these articles lasting a lifetime. The cypresses that grow surrounded by water are called white cypresses, and those that grow in dryer land are called black cypresses.

The cypress, if carefully cultivated, would be of inestimable value. It will grow as far north as St. Louis. As an ornamental tree, it is much esteemed on account of its light, graceful foliage. It is very easy to raise either from the seed or from slips. If raised from seed the young plants should be kept covered and shielded from the sun. Transplant the cypress while small, as the tap-root strikes very deep wherever the soil will permit it. To obtain the seed, store the cones in a dry place and raise the seed that falls from the cone only; those that remain in the cone rarely, if ever, germinate.

CHAPTER XLI.

THE AMERICAN ARBOR-VITÆ.

Its Northern Home.—Its Favorite Soil.—Its Attainable Height and Size.—Uses and Properties of its Wood.—Its Ornamental Advantages.—Manner of Planting Explained.—Its Varieties.—Important Varieties.—Its Medicinal Properties.

THIS tree is quite common in the northern section of the United States and the Dominion of Canada, but is only found in the more southern portions of the country as a green-house tree, and then only in a very puny, sickly state. It grows best in swamps, on the rocky banks of streams, borders of rivers, ponds, etc. It usually reaches to the height of from fifty to sixty feet, with a diameter of from eighteen to twenty inches. In the neighborhood of the Great Lakes it is called the white cedar, but the name arbor-vitæ being more appropriate, I prefer to use it. The wood of this tree is light, soft, and very elastic, and withstands the changes of weather for a great number of years; it is frequently used for posts, rails, telegraph-poles, etc., many of which have been known to last for from sixty to seventy years. It is a very ornamental hedge-tree, and bears training and pruning to any extent, so much so that trees that have been trained and pruned with compact foliage keep a much more ornamental appearance than those of more open foliage. For hedge-planting, plant the trees eighteen or twenty inches apart in single rows; for a wind-break plant from thirty to forty inches apart in a double row, and plant in such a way that the trees of the back row fill the spaces between the trees of the front row. Although eminently a swamp tree, it grows well on most any free, cool, fertile soil, except stiff clays. When planted for timber it should be planted close together. It thrives from layers or cuttings. It produces a variety of trees by cultivation from seed, some of which are very beautiful, among which are some with silver-tipped leaves, others of a golden hue, and some dwarfed varieties, so that there is a wide field for experiment among cultivators. The following are some of the most important varieties: Siberian arbor-vitæ, a tree of very slow growth; gigantic arbor-vitæ, an immense tree found in Oregon; Nee's arbor-vitæ, a very hardy variety found on the Pacific coast; Chinese arbor-vitæ, of value only as an ornamental tree, and Japanese arbor-vitæ, a very ornamental tree, much more so than the American variety, as it has beautiful, light, graceful branches and foliage. Regarding the medicinal properties of this tree —*Thuja occidentalis*—a fluid extract of its leaves, prepared by Parke Davis & Co., has given excellent results in the treatment of malarial diseases, and the saturated tincture may be given for pulmonary hemorrhage, and also applied to cancerous ulcerations, warts, etc. A salve made with the leaves used to be a remedy employed by the Indians for the relief of rheumatism, and a poultice of the leaves made with milk has been highly spoken of for the same purpose. By distillation the leaves yield a yellowish-green volatile oil, which has been used as a vermicide, and the distilled water has been praised as a remedy for dropsy.

Thus far *Thuja* appears to have been employed empirically only, but it would seem, on reviewing the affections in which it has been of service, that its action may become very useful to the practitioner in the treatment of malignant diseases, especially in diminishing tendencies to bleeding, relieving the violence of pain, and causing contraction of unstripped muscular fibres.

CHAPTER XLII.

THE YEW.

The English Yew.—Its Foreign Origin.—Its Famed Longevity.—Its Symbolic Uses.—The Immensity of its Foliage.—Properties and Uses of its Wood.—Its Latitude of Thrift.—American Yew, or Ground Hemlock.—Its Stunted Growth, and Semi-evergreen Properties.—Effect of Cultivation on its Growth.—Its Artistic Advantages.

THE ENGLISH YEW.

This tree does not properly belong to this country, as it is a native of England, Europe, and Asia. It is famous on account of its length of life, there being many of the yews that are over a thousand years of age. From time immemorial it has been planted as a symbol of grief, in churchyards, most probably on account of its dark, beautiful foliage; some of these trees reach an immense size, not so much in girth, but in the spread of their branches and the thickness of the foliage. The wood is very strong, fine grained, elastic, and unexcelled for durability. The yew succeeds much farther north in Europe than it does in this country; its cultivation being very unsatisfactory in this country as far north as Philadelphia. It should be planted in a shaded situation and carefully tended, and then perhaps it may amount to something, but even this is doubtful.

THE AMERICAN YEW, OR GROUND HEMLOCK.

This variety always grows in evergreen woods, and is always a straggling, prostrate shrub. Bryant says: "I have seen it in the cold, dark, evergreen forests of New England, the prostrate stem extending ten or fifteen feet, buried or rooted in the leaves and mould, and throwing up, at intervals of one and two feet, branches from two to four, and even five feet in height. In such situations it retains the dark green of its foliage unchanged through the winter. It bears cultivation well, and is much improved by it, as it grows to a much larger size. When it is thickly shaded the foliage becomes rusty during the winter, but ordinarily it is of a beautiful dark green, and may be trained by pruning into any desired shape.

CHAPTER XLIII.

THE BOX-TREE AND HOLLY.

The Box-tree.—Its Foreign Origin.—Its Western Attainments.—Its Usual Height.—Quality, Property, and Uses of its Wood.—Adaptability of its Foliage to Fantastic Designings.—How Propagated.—Winter Preservation of the Dwarf Species.—The Holly.—Its Varieties.—The American Variety Considered.—Its Range of Growth and Favorite Soil.—Its Ornamental Perfection.

THE BOX-TREE.

This tree, although a native of Europe and Asia, may truly be said to be cosmopolitan. It reaches its greatest height in this country in Philadelphia. Who has not seen it used as an edging or border for walks, and admired the rich, dark, chrome-green of its leaves? It usually reaches to the height of from thirty to forty feet, with a very heavy wood—in fact, so heavy that it will sink in water—and so closely and finely grained that it is used for the finest kind of mathematical-instrument work, and for the finest kinds of carving. In some of the finest European gardens the box-tree was formerly pruned into fanciful figures, and, on account of the thickness of its foliage, was especially adapted to this kind of work.

The box is best propagated from cuttings from six to eight inches long, which readily root if put in early in the fall in a frame of sandy soil; transplant to permanent position in the spring.

The dwarf species of the box, used for edging walks, should be carefully covered with snow, or some other covering that should remain all winter, care being taken not to smother it.

THE HOLLY.

There are two varieties of this tree, the American and the European holly.

The American holly is found from Maine to Texas, and from Montana on the north to New Mexico on the south; it grows to the height of from sixty to seventy feet, but in the New England States it is only a straggling shrub. It thrives best in deep, rich loam; it will grow in dry, sandy soil, but not in cold, wet lands, or stiff clay.

The wood of the holly is very ornamental—white, hard, and fine grained—and is esteemed for turning and fancy-work, where that of the box or any other tree of the same character can be used.

It is nowhere abundant, and is of very slow growth, but wherever it can be suitably grown it merits more attention than has yet been bestowed on it. It makes a very useful and ornamental tree.

CHAPTER XLIV.

THE LAUREL.

The American Laurel.—Density of its Growth.—Its Resemblance to the Box.—A Name Derived from its Uses.—Description and Properties of its Wood.—Soil and Climate of Thrift.—Its Seed and Flower Described.—Care Necessary to its Raising.—Sheep Laurel.—A Contrasted Difference.—Properties of its Leaves.—The Great Laurel.—Region of its Abundance.—Climate and Situation Congenial to its Growth.—Its Attained Height.—Its Floral Productiveness.—The Rose Bay.—Its Elevated Home.—Its Diminutive Height.—Its Beautifying Advantages.—Soil Unfavorable to its Thrift.—The Carolina Laurel Described and Qualified.

THE AMERICAN LAUREL.

This shrub grows in such thick and unwieldy masses that it is almost impenetrable, as its thick, unyielding branches interlock with each other; it reaches sometimes to the height of eight or ten feet, and some claim that in the Southern States it reaches even higher, but this I cannot vouch for, as I have never seen it. Torrey claims that it attains the height of twenty feet in the Catskill Mountains, and Bryant speaks of laurel that was fifteen feet high and had a diameter of three inches.

The laurel very closely resembles the box, more so than any other of the American trees, and in fact it is well fitted to supply its place. It is often called spoonwood by the backwoods settlers, as they manufacture a great many of their rude kitchen utensils from it; it is hard, close grained, and takes a fine polish. It will survive in most any soil except limestone clays, and thrives best with a slight northern exposure, its leaves being more brilliant and thicker than when exposed to the southern sun. It will not bear transplanting, especially if of any size. The seed is small and requires the greatest skill to raise plants from it. The tree has flowers of a red color.

SHEEP LAUREL.

This laurel has smaller leaves and flowers of a deeper red than the American laurel, and continues a longer time in bloom. This also goes by the name of sheep-kill, as a great many sheep die from the effects of eating its leaves; but Bryant explains this, and probably he is right, by saying that it is more from the indigestible nature of the leaves than from any poison contained in them.

THE GREAT LAUREL.

This species is found in New England, but much more abundantly farther south; cool, moist, deeply shaded situations are most congenial to its growth. It is found mostly along mountain torrents, and in these favorable situations reaches the height of twenty-five or thirty feet; it bears a rose-colored flower with yellow dots on the inside, but sometimes the flowers are a pure white, with very thick leaves that are from four to ten inches long. Although a native of the Northern States, this tree is not cultivated as much as the rose bay.

THE ROSE BAY.

This tree is a native of the highest summits of the Alleghanies, and is found scattered all along the mountainous region from the Catskills to the lowest edges of the Blue and Alleghany ridges. It is much smaller than the great laurel, as it seldom reaches the height of six feet, and is always cultivated for its beauty; it does not thrive in soils impregnated with lime; in transplanting, place in a bed of swamp-muck and rotten wood.

THE CAROLINA LAUREL.

This species of laurel is indigenous to the Southern States, and is found in abundance in the maritime districts of Carolina, Georgia, Florida, and Louisiana. It is an associate of the water oak and red maple, and attains its most vigorous growth the more southern is its field of propagation. It requires a cool and humid soil as an essential to its thrift, and is often found in swamps. Its wood is rose-colored, strong, and durable, with a fine, compact grain. Being susceptible of a brilliant polish, its wood is highly valued for the manufacture of furniture requiring a high degree of beauty, and might be substituted for mahogany. Its leaves, which are about six inches long, oval-acuminate, and glaucous on the under surface, diffuse a strong odor, and may be used in cookery.

This tree is of elevated growth, sometimes attaining to a height of from sixty to ninety feet. It flowers in May. The female flowers occur in loose bunches, while those of the male occur in long clusters from the axils of the leaves. The varieties of this tree differ distinctly in their characteristics according to the latitude in which they grow. They may be propagated from seed, cuttings, or layers.

CHAPTER XLV.

TIMBER TREES.

List of the most Valuable Timber Trees in the United States, and their Suitable Climate.—Coniferous Trees.—Number of Seeds to the Pound of Each Species.

THE following is a list of the most valuable timber trees in the United States, viz.:

1. White Oak.
2. Bur Oak.
3. Sugar Maple.
4. White Ash.
5. Blue Ash.
6. Red Ash.
7. Black Walnut.
8. Butternut.
9. Chestnut.
10. Shellbark Hickory.
11. Pignut Hickory.
12. Linden, or Basswood.
13. Tulip-tree.
14. European Larch.
15. Norway Spruce.
16. White Pine.
17. Scotch Pine.
18. Red Pine.
19. Corsican Pine.
20. Catalpa.

Of this list, Nos. 5, 6, 13, 19, and 20 are best suited to the climate of the southern half of the territory for which this work is designed. Nos. 7 and 9 would probably not succeed in the most northern half of the United States, while Nos. 4, 12, 16, 17, and 18 would be of doubtful value near the southern limit. I am indebted to Mr. Bryant's extremely useful work on trees for the foregoing list, which I think will be invaluable to tree-growers, and I would also like to thank Mr. Douglass for the following list, or rather table, of the number of seeds in a pound of each of the following twenty species of coniferous trees:

	No. of Seeds in a Pound.
Nordmann's Fir	8,000
Common Silver Fir	8,000
Siberian Silver Fir	40,000
Fraser's Balsam Fir	45,000
Hemlock Spruce	100,000
Norway Spruce	58,000
Balsam Fir	33,000
White Spruce	160,000
African Cedar	7,000
Cembran Pine	2,700
White Pine	20,000
Austrian Pine	28,000
Scotch Pine	69,000
Corsican Pine	33,000
Pitch Pine	66,000
Mugho Pine	70,000
Seaside Pine	12,000
European Larch	60,000 to 75,000
American Arbor-Vitæ	320,000
Chinese Arbor-Vita	33,000
Pear	12,000 to 15,000
Apple	12,000

CHAPTER XLVI.

THE EUCALYPTUS, OR THE FEVER-TREE.

Its Nativity.—When Discovered, and by Whom.—When Introduced into France.—Its Medicinal Qualities, and by Whom Discovered.—Its Antiseptic Properties.—The Healthful Results of its Planting in Malarial Districts. — Its Tour of Travel and Introduction into America.—Eucalyptus-planting by the Trappist Monks, and Expected Results.—Record of the Eucalyptus as a Disinfectant.—Instanced Results of its Antiseptic and Disinfecting Properties.—Eucalyptus-planting in New Orleans, and Healthful Results.—The Eucalyptus as a Preventive against Yellow and Jungle Fever, and Efforts for its Introduction into India.—Experience of English Tree-growers in Raising the Eucalyptus.—Its Destined Future.—Climate Best Suited to its Growth.—Its Successful Raising on the Pacific Coast.—Experiments on the Virtues of the Eucalyptus and Results in Detail.—Its Odorous Properties.—Its Other Uses.—Eucalyptus-planting in California, and Probable Returns.—An Opinion in Regard to the Southern and Southwestern States.

Among his other great enterprises, Garibaldi, the great Italian hero, engaged in planting the eucalyptus, or blue gum-tree, about Rome, to prevent the malarial fever with which the inhabitants of that city were afflicted. As this tree is little known in our country, some account of it may not be uninteresting.

According to the best authorities it is an Australian production, and was first discovered by the French scientist La Nillardière, who visited Van Dieman's Land in 1792. It was brought into the south of France about the beginning of the present century, and noble specimens of it are now growing in the public gardens of Nice, Cannes, Hyères, and Algiers. Its medicinal qualities did not, however, become known until about thirty years ago. The Spaniards first discovered that it was a preventive of fever, and the colonists of Tasmania used its leaves for a number of purposes. It was not until 1860 that its full power became known; and, as a hygienic measure, it was introduced into the Spanish realm as an antiseptic. The people of Valentia were suffering from malarial fever. Eucalyptus-trees were planted about the city, and a marked improvement in the healthfulness of the locality followed. So popular did it become that the trees had to be guarded, the inhabitants stealing the leaves every opportunity they had to make decoctions to drink. The Spaniards named the eucalyptus the fever-tree, and soon after it was introduced into Algeria. It next travelled to the Cape of Good Hope, Corsica, Sicily, South America, and California.

Garibaldi's attempt to introduce it into Rome was not entirely new; many years ago a few dozen specimens were planted about the walls, and although nearly all the trees lived, but few of them were vigorous. After a trial of many years in southern France it has failed to become hardy or suck up and destroy the poisonous vapors of the swamps in which it was planted.

The Trappist monks of the Tre Fontane set out large plantations of eucalyptus-trees, and have tended them with the utmost care. This may fairly be looked upon as a decisive experiment. The place known as Tre Fontane, or Three Fountains, lies some miles south of Rome, and is the seat of a magnificent monastery. Its climate, once healthy, in consequence of the destruction of all the timber in the vicinity has become so deadly that, notwithstanding its splendid buildings, rich mosaics, marbles, and frescoes, the place is wholly deserted during the summer months. To live there in June, July, and August is said to be almost certain death.

The record of the eucalyptus-tree as an antiseptic and disinfectant is excellent. The districts in which it is indigenous are healthy, and those into which it has been introduced and thriven have become healthy. A few miles from Algiers is a farm which was once noted for its deadly fevers. Life on it in the summer months was almost impossible. In the year 1867 the owners planted thirteen hundred eucalyptus-trees, and they grew nine feet in thirteen months, and not a single case of fever appeared, nor has there been any fever there since. Now if the eucalyptus will make the sickly climate of the Fontane healthy, it can safely be relied on as an antiseptic and disinfectant; and I advise those curious in such matters to watch the success of the Trappist monks in its cultivation.

Near Constantine, Algeria, there were vast swamps, never dry even in the hottest months, and productive of violent periodic fevers. About fourteen thousand eucalyptus-trees were planted there, and they soon dried up every square foot of the swamp and killed off the fevers. Maison Carrie, near Hanasch, was once a great market for quinine, as there was much fever, but since the blue-gum has been planted there the demand has almost entirely ceased. Mexico and Cuba were, also, a great many years ago, large consumers of quinine, and, as the mercantile books of export show, since the introduction of eucalyptus into those countries the demand has greatly fallen off.

Mr. John P. Curry relates the successful completion of a contract for planting two hundred thousand slips of the Australian gum-tree—eucalyptus—in the city of New Orleans. He says: "The sprouts having been raised in a hot-house, the planting of these trees commenced some six years ago, the city government paying at the rate of ten cents for each tree planted. It has already been proven beyond question that this tree, when full-grown, absorbs, or, rather, kills the spores and 'miasmas' in all malarial and fever-ridden districts wherever planted. It is also believed, by scientists and many medical experts, that it will prove a safeguard against the spread of yellow-fever, as it has been seen that, since these trees have been planted in the city of New Orleans, yellow-fever has not become epidemic in that usually yellow-fever section."

It is reported a very unhealthy railroad-station in the Department of Var, southern France, has been made healthy by a grove of forty eucalyptus-trees.

Efforts are now being made to introduce this wonderful tree into Ceylon as an antidote to jungle-fever, and it is also being carried over in large numbers to the jungles of India. The English have given it great attention, but the most intelligent of English tree-growers believe it too delicate to stand the cold water of English springs. The eucalyptus seems destined to make the tour of the world, but it will be found to grow best in the La Plata states and in California. Referring to our own country, planters have met with the most wonderful success in cultivating it on the Pacific coast. One gentleman, who planted several thousand trees at Wilmington, California, says: "When set out they were only from three to five inches in height, and in one year they grew six and eight feet high." Another gentleman, the editor of the *Kern County Courier*, who owns a farm on which he is experimenting with eucalyptus-trees, wrote: "I have given the eucalyptus what I regard as a reasonably fair test on my own farm. This farm is cultivated by two Chinese families, one of the families near the north and the other near the south end of the land, about three fourths of a mile apart. The localities both parties inhabit are favorable to the development of malaria. The soil is rich, moist, and teeming with vegetable life, and the free sweep of the prevailing wind is obstructed by the intervention of dense thickets. As might be expected, they have every year, during the heated term, suffered from malarial fever. Last winter we determined to test the virtues of eucalyptus. In February we gave to the party at the north end two ounces of blue-gum seed, with directions that it should be planted near the house. It germinated finely, and produced thousands of young plants, but, unfortunately, most of them were killed by frost. About twelve hundred, however, survived. These, when the heated term had commenced, had attained an average height of about two feet, and emitted a strong aromatic or camphorous odor, perceptible at a distance of a hundred yards. In due time the party at the south end were visited by their usual mildly distressing fever, but, up to the present time (nearly the end of the fever season), we have looked in vain for the first symptoms to develop at the other end. They are all, to their own astonishment, in the most robust health. These trees now average more than three feet in height, and the atmosphere at their house is strongly impregnated with their odor. We have investigated in vain for some other cause to which to attribute the anomalous state of health of the inmates, and can find none but the reputed sanitary properties of this tree."

But not only has the eucalyptus-tree become a favorite in California for its well-known medicinal properties, but it grows so fast and to such an enormous size that it is now being planted for wood. The enterprising Californians have thought it worth while to form a company for the purpose of raising eucalyptus. A gentleman writing of the company said:

"Two hundred acres of choice land have been secured within a mile or two of Los Angeles, on which eucalyptus, only four years and a half old from the seed, are now growing, which measure sixteen inches in circumference and twenty-two feet in height. It is estimated each of these trees is worth one dollar for fuel and more than that for manufacturing purposes. Foresters calculate that six hundred can be grown to the acre, and it requires no great calculation to show how profitable such a business may be made. The company organized in

Los Angeles propose purchasing land at thirty dollars per acre, and the cost of seed, planting, etc., will probably average twenty-five cents per tree. The total for six hundred trees and the acre of land will reach one hundred and eighty to two hundred dollars. At the end of four years, supposing the trees to succeed as the average do, the timber will be worth six hundred dollars.

"As these trees stump and sprout rapidly, another such yield of timber may be expected in four years more. Fuel, as is known, is very expensive in all the great valleys of California. But, with the eucalyptus-tree, the farmers seem to have the remedy in their own hands; beyond which it affords an opportunity of securing an income by the sale of timber for manufacturing purposes."

Farmers in California are generally availing themselves of the advantages to be derived from the eucalyptus. Mr. J. H. Byers, who has a farm near the town of Colusa, on the west bank of the Sacramento River, planted fifty thousand eucalyptus of the narrow-leaved, iron-barked variety, which he intends growing as an orchard, the trees being set out about ten feet apart. His reason, he says, for planting iron-bark instead of gum-tree, or blue-gum, is that they stand the frost better.

While I was at San Francisco Mr. W. A. Mathews came down from Sacramento to purchase fifty thousand eucalyptus of the iron-bark variety, which he said he was going to plant on about one hundred acres of rich land that had never been broken. He said he would raise cotton the first year between the rows of trees, and the second year sugar-beets, after which the trees would be grown alone, as they would probably cast too much shade for the successful cultivation of crops with them.

Mr. Mathews in one season raised fifty thousand trees eight inches high from two and a half pounds of seed gathered from trees grown in Oakland, California. This is quite important, as it proves the native California seed will germinate quite as readily as the imported article. He used on one piece of land equal quantities of imported and California seed, and said he found the result so much in favor of the California seed that hereafter he would use no other kind.

It is unnecessary to discuss further the merits of the eucalyptus-tree; the evidence already adduced is so overwhelming in its favor that it must commend itself strongly to the favor of our farmers and tree-growers. It should be given a full and fair trial in all the states. I think it would thrive luxuriantly in the South. It should be planted at once in all our fever-and-ague districts; and if it will suck up and dissipate the poisonous vapors lurking in the swamps of Arkansas and other Southern states it will do service for America worth millions, and alleviate much suffering, as well as save many valuable lives. Let us by all means give the eucalyptus a fair trial.

The Wilmington *Enterprise* reports that Colonel D. B. Wilson planted a park of two thousand eucalyptus-trees on the 20th of March, 1875. "The trees, when set out, were from four to six inches in height, and many of the lower branches in a year grew over four feet in length. It is no exaggeration to say that these trees have grown four feet in five months. We have similar instances of the extraordinary growth of the eucalyptus in San Diego."

The eucalyptus has a tall, reddish, smooth stem, with ragged, hanging bark, and of a delicious, odorous, resinous, gummy smell. It grows to a diameter of from forty to forty-five inches. It is used as a scent for cigars, medicine, tonic, throat-lozenge, and, above all, as a bath.

The leaves and small branches are put in hot water, and it is stated that such baths remove neuralgic pains, rheumatism, and the malaria incidental to the country. The flower of the eucalyptus tribe is very like the myrtle flower, is full of honey, and attracts a multitude of flies, bees, etc., and the birds naturally follow, for they find not only food, but thick, warm, leafy cover in winter, and shelter from the burning sun in summer.

Finally, our opinion is that the cultivation of the eucalyptus-tree will prove a most powerful climatizing agency towards the reclaiming of the uninhabitable malarious regions of our Southern and Southwestern States.

CHAPTER XLVII.

THE OAK.

Its Rank among Trees.—Procuring and Sowing its Seed.—The Burr Oak.—Its Attainable Growth.—Description of the Burr Oak as given by Dr. P. R. Hoy.—Its General Appearance and Beautifying Character.—Durability of its Wood.—Manner of Growth.—Its Utility and Ornament.—Its Abundance and Distribution.—Its Zone of Thrift.—Characteristics of its Foliage.—Conditions by which to Distinguish Species.—Opinions on Transplanting.—The White Oak, the Post Oak, the Swamp Chestnut Oak, the Black Oak, the Scarlet Oak, the Red Oak, the Pin Oak, the Willow Oak, the Laurel Oak, the Black-Jack Oak, the Spanish Oak, and the Live-Oak Separately and Variously Described.

The oak is the most valuable of all trees. It can readily be raised from the seed, which should be gathered in the fall, after the acorns drop. The best month to gather seed is October, and it should be planted at once, or kept in a cool, moist condition until spring. The plants should be set out about eight feet apart, and between the rows some upright-growing trees can be planted as nurses for the oaks. These latter should be cut away whenever it is necessary to make room for the growth. Burr oak and chestnut oak are best for fuel, and red oak the best for rails.

THE BURR OAK.

The burr oak attains immense size in Indiana and some other Northern States. A gentleman living in Marion County, Indiana, told the writer: "The burr oaks in this neighborhood attain the diameter of six feet, and with a stem, in one instance, of sixty feet high without a limb." The following description of the burr oak is given by Dr. P. R. Hoy, of Racine, an accomplished naturalist, and member of the Philadelphia Academy of Natural Sciences: "This is, perhaps, the most ornamental of our oaks. Nothing can exceed the graceful beauty of these trees when not crowded or cramped in their growth, but left free to follow the laws of their development. Who has not admired these trees in our extensive burr-oak openings? Its large leaves are a dark green above and a bright silvery white beneath, which gives the tree a singularly fine appearance when agitated by the wind. The wood is tough, close-grained, and more durable than the white oak, especially when exposed to frequent changes of moisture and dryness. Did the tree grow to the same size it would be preferred for most uses. Abundant and richly worthy of cultivation, both for utility and ornament, burr oaks in Wisconsin do not generally attain more than one foot in diameter, and the limbs grow near the ground, making a sort of espalier, and rarely growing higher than thirty to forty feet, straight, with very rough bark. The acorn is enclosed in a burr something like a chestnut, hence their name."

This is the most useful of all trees. Loudon describes somewhere in the neighborhood of one hundred and twenty, and this number has since been added to. These trees are found mostly in the temperate zone; those that we find in the tropics are in elevated positions. It is found distributed over Europe and North America. These trees are of a beautiful appearance, and have not been paid sufficient attention as ornamental trees. Bryant says: "In many of the oaks the form of the leaves varies so much with different conditions of the tree, or different stages of its growth, that it constitutes an uncertain characteristic by which to distinguish the species. Consequently, where the wood is similar, different species are sometimes confounded under one name. The fructification affords a more certain mode of distinction."

It seems to be the opinion of many that the oak should be left where it grows from the seed, but throughout Europe the tree-planters affirm that it is best to transplant them.

THE WHITE OAK.

This is one of our most lofty trees. It is found almost everywhere east of the Mississippi, although in some sections it is by no means abundant. It is mostly found on soils of moderate fertility. It is used wherever strength, compactness, or durability are wanted. It is next to the live-oak in value. I would here call the attention of the landowners of Illinois to the rapid destruction of the white oak in their state, and would mildly intimate that they will run short of timber if they do not take means to stop the wholesale destruction. The white oak is one of the slowest growers, but does not slacken its growth as it becomes larger.

THE POST OAK.

This tree, which grows to the height of about forty feet, is met with in a soil of yellow, clayey loam. It is inclined to branch, and seldom or never furnishes timber of any length. Its acorns are small and sweet. The wood is more durable than the white oak; it is strong, fine-grained, and of a yellowish color. It is used in the construction of posts, wagon-wheels, etc.

THE SWAMP CHESTNUT OAK.

This tree grows to the height of eighty or ninety feet, with a circumference of from six to eight feet, and preserves its thickness from forty to fifty feet. It is found in rich bottom-lands. Rock chestnut oak is one of the varieties of this tree; its wood is so heavy as to sink in water. Swamp white oak is another variety of this tree. It is very marked, and is found farther north than the chestnut oak, and its wood is of much better quality.

THE BLACK OAK.

This is one of our largest and loftiest trees, being ninety feet or more in height, and from five to six feet in diameter. Its wood is rather coarse-grained, but possesses considerable strength and durability. It is esteemed next to the live-oak. Its bark is used for dyeing and also for tanning, being very rich in tannic acid. This tree ripens its fruit biennially. As is the case with all the trees that ripen their fruit biennially, the quality of the timber is inferior to that of the timber that ripens its fruit annually. It is found all over the United States, and flourishes in poorer soils than the white oak. It is the only one of the oak family that grows on the barren sand-ridges of Illinois.

THE SCARLET OAK.

Some botanists call the scarlet oak merely a variety of the black oak; but it differs in some particulars, viz., the leaves turn to a bright red in the fall; the acorns have a white kernel, and not yellow, as in the black oak. The wood is of a very poor quality, and for fuel and timber I cannot say that it is to be recommended very highly for cultivation.

THE RED OAK.

Height, eighty feet; diameter, six feet; and is the fastest-growing of the oaks. Is a very handsome and ornamental tree, and will grow on almost any soil, either rich or poor. It is found all over the United States. The wood is coarse-grained, of a red color, open pores, and of little durability. It is sometimes used when timber is not abundant.

THE PIN OAK.

This is a large, ornamental tree, coarse-grained, open-pored, and not very durable. It thrives best in moist ground. It has a conical head and a light-green, beautiful foliage.

THE WILLOW OAK.

The willow oak grows to the height of fifty or sixty feet. Its leaves very much resemble those of the willow. The wood is very coarse-grained and strong, but it is not fit for fuel. If any amateur has any curiosity on the subject of this tree I would advise him to cultivate it, but that is the only time I would recommend it for cultivation.

THE LAUREL OAK.

This tree usually reaches from forty to fifty feet in height, and is about two feet in diameter. It much resembles the laurel in its foliage, and so takes its name. It is used in rural districts for rails; sometimes for house-frames. The wood is coarse-grained and not valuable.

THE BLACK-JACK OAK.

The only use I ever found this tree put to was for fuel, and as such it is esteemed more than any other of the oak family. It is a small tree, with generally a very crooked trunk. It grows in any soil, but is found in the most barren. It seldom exceeds thirty feet in height.

THE SPANISH OAK.

This tree is sometimes confounded with the red oak, whose wood it very much resembles. It is common in the maritime parts of the Southern States and southern Illinois, but is scarce in the Mississippi valley. In favorable situations it becomes a large tree.

THE LIVE-OAK.

The famous live-oak is found only in the Southern States, more especially in Florida. It is more esteemed for ship-building than any tree known. It is, like the cork oak, an evergreen. It frequently reaches from eighty to ninety feet in height, and from five to six feet in diameter.

CHAPTER XLVIII.

THE BERBERRY.

Its Attainable Growth under Culture.—The Common Berberry.—Its Ornamental Value and Manner of Training.—Its Thrift and General Appearance.—Where Indigenous.—Soil Suitable to its Thrift.—Its Floral and Fruit Productiveness.—Uses of its Fruit and Leaves.—Medicinal and other Properties of its Bark.—A Prejudice against it.—Varieties and Original Species, How Raised.—*Berberis aquifolium.*—Its Beauty.—Its Range of Growth and High Altitude of Thrift.—Quality and Color of its Fruit.—Its Botanical Description.—Medicinal Properties of its Root.—Its Medicinal Extracts, and Complaints for which Prescribed.—Medicinal Properties of its Berries.

COMMON BERBERRY.

THE many species of berberries in a wild state are mere shrubs, but when cultivated attain considerable elevation, sometimes arriving at the height of thirty feet. The common berberry when raised for ordinary purposes, such as hedging, requires but little culture, but when grown for ornament the lower branches to the height of eight feet of its trunk should be trimmed; so, also, the many suckers which it throws out should be removed as they appear. Treated in this way, and nourished by a deep, well-manured soil, it forms a singularly beautiful tree, and will endure to a great age. Its growth is rapid, of an upright stem, with branched, drooping foliage. It is indigenous to both the Eastern and Western hemispheres; and in the United States has naturalized itself in waste places and about cultivated grounds, in which situations it is found of ordinary thrift, more especially on calcareous soils. Its blossoms, which appear in April, May, and June, are of a yellow color, abundant, and produce a pleasing appearance; but in order to reduce the number of bunches, and so increase the size of its fruit, the racemes of its flowers should be thinned out. It bears a fruit of an oblong, oval form, which, when ripe, is of a red, white, purple, or black color, according to variety of species. Its berries, while green, pickled in vinegar make a good substitute for capers, also as a flavoring, and when fermented produce an acid wine; when ripe, and prepared as jellies and other preserves, they are considered delicious and extremely wholesome. Its leaves, which are acid in taste, might be used, like sorrel, to season meat with; a yellow dye is procured from the inner bark of both the stem and roots, and its astringent principle is so abundant that it is sometimes used in tanning leather, which it dyes a fine yellow. Medicinally its bark is purgative and tonic.

There exists a prejudice against the berberry as a hedge-plant, on account of its supposed influence in producing blight in corn-crops when sown in proximity thereto, by impoverishing the soil through the agency of its numerous suckers. Varieties are raised by suckers, but when an original species is required seed is used in its propagation.

"BERBERIS AQUIFOLIUM," OR THE HOLLY-LEAVED BERBERRY.

Of this genus there are four species—*Berberris repens*, *aquifolium*, *pinnata*, and *nervosa*—which have green, unequally pennate leaves, and dark globose berries. The holly-leaved berberry is a shrub of considerable beauty, and is on this account cultivated in gardens and by florists, who find a large sale for it as a flowering-shrub. The species *Aquifolium* inhabits the coast-range mountains, and delights in the high altitudes common to the middle elevations of the Big Horn and Wolf ranges, the head-waters of Arkansas, and in the Capatoon ranges. It is generally found abundantly upon exposures to the south and east, in the rich vegetable mould which covers these hill-sides, and upon almost barren, rocky places, especially the felspathic granite, and porphyritic formations. It flowers in May, and ripens its fruit in August and September. The fruit is acidulous, and in flavor reminds one of the lime; dark purple in color, and covered with a bluish bloom.

The botanical description of the holly-leaved berberry is as follows: It is a shrub which grows to the height of six feet, on the Pacific coast, with leaflets in pairs from seven to eleven; the lower pair distant from the stem, ovate to oblong-lanceolate, one and one half to four inches long, acuminate, evergreen, shining above, numerous spinous teeth; racemes one and one half to two inches long, clustered chiefly in the subterminal axils; fruit globose.

The root of this plant is the part which is used as medicine. It is extremely hard and tough, of a bright, golden-yellow color, with an intense but pleasant bitter taste. It yields its virtues to water and dilute alcohol, and makes a very good medicinal preparation. The medicinal extracts of this plant are useful in the complaint known as "mountain fever," which is a bilious fever often assuming the typhoid form; and they are also valuable in venereal affections, and in disorders of the stomach arising from improper and insufficient food, privations, etc., to which persons are often subjected in the western mountain country. Its berries are often employed as a remedy in scurvy, and are made into sauce and used as food.

CHAPTER XLIX.

THE BUCKTHORN.

Its Growth and General Appearance.—Its Floral and Fruit Productiveness.—Medicinal and other Uses of its Berries.—Its Ornamental Value.—Its Suitability as a Hedge-plant.—How Propagated, and Manner of Culture and Training.—Its other Characteristics.

This tree is of low growth, rarely exceeding fifteen feet in height, having numerous and irregular branches covered with thorns. Its leaves are of a bright-green color, about an inch in length and smooth of surface. Its flowers, which appear in May and June, form in clusters, and are of a yellowish-green color. Its fruit ripens and is gathered in autumn in the northern part of the United States, and is of a globular form and bluish-black color. The juice of its berries is used as a dye or stain, and also as a vegetable paint. Its berries are strongly purgative, but are not much used in medicine owing to the severity of their action.

The buckthorn is cultivated both for use and ornament in the New England States and other places, and is considered very suitable for hedging, in consequence of its robust and rigid habit of growth. It may be propagated from seed, cuttings, or layers, and will thrive best in a rich, moist soil. For hedging, sow seed to the depth of half an inch, in a shady situation, so as to prevent the sun acting severely on the young plants as they come above ground; transplant at nine inches apart in single rows, and prune back in the following spring to within six or eight inches of their bed's surface; this will cause the hedge to be thick at the bottom, which is a considerable advantage where strength and durability are requisite. All that remains at this period of their growth is to keep the plants clear from weeds, and trim the hedge every season. The month of June has been found a good time to clip, as the plants soon recover their beauty of foliage, owing to the active circulation of their sustaining juices at that season.

As this plant attains considerable height, it is well suited for arching or trellis-work, and, by being trained, will form a beautiful, densely shaded arbor or covered walk. Its natural growth being sufficiently interwoven, it needs no interlacing, and may be clipped into any shape or form which the caprice of the grower may imagine. It is not habited to throw out suckers, nor is it ever encumbered by dead wood. Owing to the green coloring contrasted by its flowers, it does not show much gayety when in bloom; but when laden with its bluish-black berries it presents quite a striking appearance, highly ornamental.

CHAPTER L.

THE GORDONIA.

The Woolly-flowered Gordonia.—Its Attainable Height.—Its Southern Nativity.—Its General Appearance Described.—Description and Uses of its Bark and Wood.—Its Botanical Description.—Its Agreeable Floral Production.—Soil Suited to its Thrift.—Its Artificial Raising.—How Propagated.—The Pubescent-leaved Gordonia.—Where Indigenous.—Its Ornamental Value and Extensive Culture.—Its Floral Bearing.—Its Foliage Described.

THE WOOLLY-FLOWERED GORDONIA.

THIS is a sub-evergreen tree, and attains the height of from fifty to sixty feet, with a diameter of stem eighteen or twenty inches. It is a native of low latitudes, and appears to be confined to the maritime parts of the United States from Virginia to lower Louisiana. Its growth is straight and clear of shoots to about half its height, where its branches diverge regularly, and, as they ascend, spread more loosely, forming an extensive spread of foliage. The bark on old trees, which is used in tanning, is thick and furrowed, but is smooth while the tree is young. The leaves are toothed on the edges, from three to six inches in length, alternate, oval-acuminate in shape, and smooth and glossy on the upper surface. It blooms about the middle of July, and its flowers, which are broad, white, and sweet-scented, come forth in succession during August and September. This tree possesses the singularly agreeable property of bearing flowers when it is only three or four feet high.

The wood of the gordonia is light, of a mahogany hue and silky texture, which fits it for use in the inside of furniture. It is, however, liable to decay when exposed to alternations of temperature. A barren, moist soil is best suited to its growth, where its thrift is surprisingly luxuriant. When artificially raised the soil should be prepared of a compost of peat, leaf-mould, and sand, kept moist and shaded from the sun. It is propagated generally by layers, but sometimes from seed, and belongs to the same natural family as our tea-plant of commerce, *bohæ.*

THE PUBESCENT-LEAVED GORDONIA,

or *Franklinia*, is a deciduous tree of small growth, rarely exceeding thirty feet in height. It is indigenous to the State of Georgia, and possesses no remarkable properties except ornament, for which it has been extensively cultivated. It bears a white flower about three inches in diameter, of an agreeable odor, which blooms in July and continues to bud and blow till destroyed by the frost. Its native soil, like that of the preceding species, is poor and swampy. Its leaves are shiny above, oblong in shape, and finely toothed on their edges.

CHAPTER LI.

THE PRIDE OF INDIA.

Its Climate of Thrift, and Attainable Growth.—Its Beautifying and Ornamental Elegance.—Its Diffused Existence.—Opinions as to its Nativity.—How Propagated and Manner of Culture.—Its Favorite Soil.—Description of its Leaf, Flower, and Fruit.—Medicinal Properties of its Berries.—Description and Uses of its Wood.—Its Seed, How Obtained.

The Pride of India flourishes in Florida and other Southern States, where it attains its fullest magnitude, arriving at the height of from thirty to forty feet in favored situations, and is highly esteemed for its beautifying and ornamental elegance. It is also widely diffused through many countries of Europe and Asia, and is chiefly cultivated for the beautifying effect produced by its floral productiveness and magnificent foliage. Opinions have fixed Persia as the country of its original nativity, while others hold that it has been naturalized to the United States at an early age, being found growing in wild profusion in the forests of the South.

This tree may be propagated from seed, which should be sown in beds of light, moderately rich soil at not less than two inches apart, so as to allow for the development of its leaves and shoots. Its favorite ground is a warm loamy or sandy soil, which well fits it for planting in worn-out fields. The young plants may be taken up at the end of the first season and planted in nursery lines; and at the end of the second year they can be removed to their position of permanency. When planted singly its growth is less elevated than when grown collectively. Its leaves are large, of a dark-green color, doubly pinnate, and composed of smooth, acuminate, denticulated leaflets. They change color and fall on the arrival of cold weather, which in the Southern States usually sets in about December. Its odorous flowers, which appear in April or May, resemble those of the lilac-tree, and form beautiful axillary clusters at the extremity of the shoot. Its fruit is round or oblong in shape, of a yellowish color when ripe, and is supposed to be somewhat poisonous, and has been used, mixed with grease, to destroy rats and other vermin. An oil is extracted from the pulpy part of its berries, of a bitter taste, which is considered a narcotic stimulant. The wood of this tree is of a reddish color, sufficiently strong and durable for use in architectural structures, is sometimes used as a substitute for ash, and is said to make good fuel.

To obtain the seed for sowing, the berries should be mixed with a light, sandy earth, and laid in a flat heap of not more than two inches in depth, and allowed to remain in that state for a year, when the seed may be separated from the soil by sifting.

CHAPTER LII.

THE MAHOGANY-TREE.

Where Indigenous.—Its Primitive Nativity.—Its General Physique Described.—Its Floral Productiveness.—Peculiarity of its Seed.—A Reason for its Dispersed Existence.—Season of Felling.—Varieties, and Renowned Uses of its Wood.—Unseasonable Felling, and Precautionary Measures to Prevent Imperfectness.—Date when Introduced into England.—An Interesting Account of its Introduction.—Effect of Soil and Climate on the Texture of its Wood.—Its Durability.—Its Present Uses.—Dimensions of Exported Logs and their Value.—Method of Test for Soundness in Logs.—How the Mahogany became Naturalized to the Eastern Hemisphere.—A Species of the Burman Forests.—Its Characteristics Compared with those of its American Cousin.

THE mahogany-tree is indigenous to the southern parts of Florida, and is found in its primitive nativity in the warmest parts of the American continent. It is an intertropical tree and grows plentifully in the West India Islands, though the principal supply to the United States is received from Central and South America. In physique it is one of the most beautiful and magnificent of trees, and as a growth it is considered one of the most valuable of the vegetable kingdom. Its trunk often reaches to the height of forty feet, with a diameter of six feet; and its proportionately large and numerous branches, covered with a dense, glossy foliage, form a wide-spreading summit which extends over a considerable area and throws a shade pleasantly cool and impenetrable. It bears variously-colored flowers, some whitish, others red or saffron color. Its seed, which is enclosed in a shell or thick husk, ripens about the middle of summer, and disperses itself over extensive areas by means of its winglike appendages, some falling into crevices or clefts of rock, others upon more nutritious soil, but all or many germinating, and after years at length attain immense proportions, and reproduce in turn. The flight of the seed of the mahogany-tree accounts, to a great extent, for its dispersed existence, it never being found growing in groups or clusters, as might be supposed. The usual season for felling this tree is spring or autumn. If felled in the intermediate months the wood is liable to crack in seasoning; but as a precautionary measure to this event, if immersed in water as soon as possible after being felled, or until shipment kept in a moist atmosphere, no damage need be expected, as the temperature during transportation and the gradual seasoning of a more temperate climate than its own prevent the cracking which might otherwise be occasioned.

The wood of the mahogany-tree has long been known for its excellence of qualities for all domestic furnishings. Its introduction into England dates back to 1724, and an interesting account of the use to which it was first put in that country is given in Browne's "Trees of America." He says: "Dr. Gibbons, an eminent physician in the beginning of the last century, had a brother, a West India captain, who brought over some planks of this wood as ballast. As the doctor was then building a house in King Street, Covent Garden, his brother thought they might be useful to him, but the carpenters finding the wood too hard for their tools, they were laid aside as useless. Soon after, Mrs. Gibbons wanted a candle-box; the doctor called on Wollaston, his cabinet-maker, in Long Acre, and requested him to make one of some wood that lay in his garden. Wollaston also complained that it was too hard; the doctor said that he must get stronger tools. The candle-box at last was made, and so highly approved of that the doctor insisted on having a bureau made of the same wood, which was accordingly done; and the fine color, polish, etc., were so pleasing that he invited all his friends to come and see it. Among them was the Duchess of Buckingham, who begged some of the wood of Dr. Gibbons, and employed Wollaston to make a similar bureau." From this introduction it came into general use throughout the civilized world.

The wood of the mahogany-tree is of various degrees of shade, though its most common color is a reddish and yellowish brown, often mottled and veined with darker hues; there are also several special varieties much admired for their beauty and variety of coloring. The wood of the branches is closer grained, more rich and variegated, and therefore more adapted for ornamental purposes, than that of the trunk, which is considered more valuable. The texture, however, varies according to the soil and situation upon which it is grown: that which grows upon rocky ground or elevated places being heavy, close-grained, of small dimensions, and variously tinted; while the light and porous descriptions are produced upon low-lying and rich soil. It is a very strong and durable wood when kept dry, and was formerly used in ship-building, for which purpose its strength and solidity well fitted it. It is at present most generally used in cabinet-making, for which purpose it is universally admired.

Of the exported wood from Central America there are some logs of immense size and value on record. The largest measured seventeen feet in length, fifty-seven inches in breadth, and sixty-four inches in depth. Another log of seven tons realized on sale in England a rate of £210 per ton; from this we may imagine the extraordinary value of this wood. The trunk of the tree, from its size, is deemed the most valuable portion, and on being felled is subjected to a test to ascertain its soundness. The usual method resorted to in this test is that by which the unimpeded transmission of sound becomes discernible (or otherwise) throughout the log. In the case of an impediment or faulty part the sound produced by a tap on one end of the log is not conveyed throughout its length to the other end, and so it becomes known if the wood be in a state of decay.

The mahogany has become naturalized to the Eastern Hemisphere by its introduction into India, where it thrives luxuriantly, and in many parts grows abundantly. A species of this tree is found growing profusely in the forests of British and Independent Burmah, where it is known by the name of "Pingado," and is used as railroad ties, and in bridging and buildings, as beams and piles. It is largely exported from that country, and is considered a strong, serviceable, and durable timber, and bears many characteristics in common with its fellow of the American continent.

CHAPTER LIII.

GRAPE-VINES.

The American Wild Vine.—Attention Paid to its Classification.—Distinctive Characteristics of Species.—Delicacy of their Habit.—Traits of Good Quality of the Grape-vine.—Where Indigenous.—Its General Bearing.—The Celebrated Varieties of North America.—Their Favored Qualities.—Collective Sketches of the Qualities and Properties of the most Hardy Varieties.—Manner of Planting the Grape-vine, and After-Management.

THE AMERICAN WILD VINE.

The classifying of the many species of the grape-vine has, of late years, been given much attention, and the distinctive characteristics of each studied and published for public reading, so as to induce an interest for their more general culture. In most varieties the form and color of the leaf, the shape, color, and quality of the fruit, and the manner of inducing a successful thrift in the vinery have been the subjects of investigation and inquiry.

The production of the grape-vine for ornament, its after-culture, and the necessary care required to perfect its appearance are the principal points of acquirement; but when planted with the object of producing fruit the necessity of understanding the many peculiarities of the different varieties becomes a most prominent feature in the study. The grape being a fruit most subject to epicurian criticism, and the many varieties being produced with more or less success as the reward of patient exertion, it needs the utmost familiarity of the grower with the many delicacies of its habit in progressive growth to meet the many comments which may be brought to bear upon its quality. To be welcomed by the public a new grape should be: First, a vigorous grower, with strong and durable foliage; Second, it must be hardy; Third, the fruit must be of high quality. There are other requirements under these general heads—the roots must be firm and capable of withstanding the attacks of insect enemies; the productive organs must be normal and cultured to their proper development with the utmost care, so that a full and satisfactory crop may be grown. The skin must be thick and tough, so that the fruit will not burst or rot while ripening, and keep well after packing for winter use.

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The American wild vine is indigenous to the United States, and is found in wild profusion in sheltered situations in woods from British America to the most southern of the Southern States. The general bearing of this tendril-climber is of good height, sometimes running to the highest tree-top. Its branches are clothed with a covering of brownish soft hairs or pubescence. Its leaves are usually from four to six inches in diameter, three-lobed in some varieties, and covered on their under sides with a rusty-brown coating of a mucous consistency. Its flowers, borne on numerous racemes with short branches, appear in June, and are of a yellowish-green color. Its fruit when ripe, according to variety, is generally of a dark purple, amber colored, or greenish white, of a pleasing flavor and juicy pulp.

Of the many varieties of this species cultivated in North America the most celebrated are the Isabella and Catawba. These two varieties are specially preferred in the middle and northern parts of the United States, principally on account of the abundance and quality of their fruit and the facility with which they are propagated. As it will be unnecessary to enter into a consideration of the many varieties, we shall mention only a few that have been successfully brought under cultivation, and give collective sketches of the qualities and properties of the most hardy, as follows:

THE ISABELLA GRAPE-VINE.

The Isabella grape variety possesses great vigor of growth and is an abundant fruit-bearer. It flourishes as far north as New York, and produces large, dark-purple, juicy berries of an oval form and musky flavor. It thrives best in a moderately rich, loose, and moist soil, free from alkali, salts, or other impurities; generally, cleared wood-land with an aspect inclined towards the South or East, sheltered from the wind and shaded from the intense heat of the sun, is well fitted for its growth. The region of the maize or Indian-corn crop may be relied on as being well suited to the production of this grape. Its range of thrift extends along the Atlantic coast, and west, beyond the Rocky Mountains, as far north as the forty-ninth degree of latitude. "The most favorable season for planting this variety is near the end of February in the Southern States, and about the first of April in Pennsylvania and New York."

THE CATAWBA GRAPE.

This vine was originally obtained from the banks of the Catawba River, and is an abundant fruit-producer. Its berries are large, and occur in loose bunches of a beautiful appearance, varying in color and flavor according to the degree of shade and sunshine to which they are subjected during development. The effect of the sun produces a bluish-purple color on those fully subjected to its influence, while the berries which grow partially or entirely in the shade vary in color from a lilac hue to a translucent white. The Catawba grape is an early variety, is much esteemed as a table fruit, and is considered one of the most popular for winter use and long keeping.

THE ELSANBOROUGH GRAPE.

The Elsanborough vine is indigenous to New Jersey, where it was originally produced. It is noted for the production of a sweet, juicy fruit, which grows in medium-sized clusters, of a blue color, and is said to make an agreeable wine.

THE CAROLINA GRAPE.

This variety is esteemed as a table fruit. Its berries are large, of an oblate form, pale-red color, sweet, pleasant-flavored, and juicy. The original vine is said to have been found on the eastern coast of Maryland. It is deemed suitable to our climate as far north as Philadelphia, and might be successfully cultivated as a wall fruit in much higher latitudes. This, with the other varieties, may be propagated from seed, cuttings, or layers, and by grafting and inoculation.

In planting the grape-vine, the first consideration necessary to success is the choosing of a favorable site; this should be facing south or east.

Having pitched upon the ground, the next operation is to dig parallel trenches, at from five to ten feet apart, according as the ground is flat or steep. Where the slope is considerable it will be only necessary to have these trenches five feet apart, and as the situation approaches to a plain or level surface the full distance of ten feet will be required between each trench. The trenches should be dug to the depth of two feet on a plain surface, and to four feet on a hill-side, in order that the roots may penetrate to moisture and be beyond the reach of drought. In selecting cuttings, they should be chosen from the most fruitful and healthy part of the vine, and cut off close to the parent stem; and, as the top buds of all shoots are unfruitful, they should be trimmed off in an oblique direction, the sloping side being opposite that containing the uppermost bud. The cuttings should be planted in such a manner as to leave a single bud above ground, even with the surface, and, to insure the thrift of the future vine, the trenches should be filled in and around them with virgin or vegetable mould, which may be obtained from the nearest woods, if not already at hand; or, rotted manure will answer the purpose if procurable; and in case a settlement or depression of the earth occurs, so as to expose more than one bud, soil should be promptly added to make up the discrepancy. The most favorable time for planting is when the atmosphere is calm, and as soon after the separation of the cutting from the old vine as practicable.

CHAPTER LIV.

THE COMMON APPLE-TREE.

Diffusion of the Common Apple-tree.—Period of Cultivation in the United States.—Its Original Nativity.—Its Wild Thrift and General Deportment.—The Many Varieties of its Parentage.—Hinderances to its Longevity.—Exceptional Trees, Where Grown.—Soil and Situation Necessary to Perfect its Productiveness.—How Propagated.—Management Necessary when Propagating from Seed.

The common apple-tree is widely diffused over many of the countries of the northern half of the Eastern Hemisphere, where it is found as far north as the sixty-second degree of latitude, and southward in China, Japan, and the southern parts of India. It is also indigenous to North America, where it grows in a wild, stunted state on the borders of woodlands and in hedgerows, but was not brought under culture in the colonies until the seventeenth century, when zeal and rural economy in its cultivation were attended with most successful results. As to its also being a native of the eastern part of the world we can have no doubt, as mention is made of its fruit by the writers of Holy Writ, and authority has since established the estimation in which it was held; and, also, "it has been singularly connected with the first transgression and fall of man, the fruit of which is said to have been eaten by Eve in Paradise." This tree, in its natural state, under favorable nurture, usually attains the height of thirty or forty feet, with a diameter of twelve to eighteen inches. Its natural growth of trunk is crooked and distorted, and that of its branches horizontal and wide spreading, and covered with an abundant foliage. It is the parent of innumerable varieties, called cultivated trees, which have been produced from its seed and by grafting. Of these varieties it is impossible to give an account within our limit, as they are numerous and constantly being multiplied.

Owing to the perishable nature of the wood of the common apple-tree, its length of life is limited; but in a few cases trees have been known to complete their second century. "One of these was growing near Plymouth, in Massachusetts. Another in Hartford, Connecticut, was brought from England in 1645, and grew on the Charter-Oak Place, and consequently must be more than two hundred years old."

The apple-tree under cultivation, in order to perfect its productiveness, requires a soil abounding in marls, marly clays, or calcareous limestone; and will also, especially those of the early sort, produce fruit to perfection in light, rich, sandy soils. Late varieties succeed best when planted in a soil that is strong and clayey.

A position sheltered from the extremes of heat and cold and the influence of high winds, with an undulating surface, is best adapted for apple-orchards, and it has been found that moderately steep declivities have been successful in the production of fruit. Deep-sunk valleys or very elevated or exposed situations are unfavorable to the production of the apple. A southerly direction is a most advantageous one, in view that the trees receive the greatest benefit from the sun, and yet are not fully exposed to its extreme influence; and if the plantation or orchard be in the neighborhood of an extensive body of water, a position facing northward has proved to be decidedly favorable.

The apple-tree is propagated from seed, grafting, and inoculation, and by cuttings and layers; and it has been found that the hardiest and best stocks are those raised from the seed of the wild crab.

In propagating from seed, the pomace should be strewed and covered with earth in shallow trenches about eighteen inches apart, so as to allow of the young plants being cultivated without disturbing them. In the fall thin out the most vigorous and healthy, and transplant in a well-manured soil, in rows eighteen inches apart and the same distance from each other, where they should be allowed to remain until the fourth year, when they will probably have acquired half an inch or more in diameter, and of sufficient growth to bear the operation of grafting or trimming back. During the growth of the plants for the second and third years no knife should be used, especially on those shoots which occur a foot or more from the ground, but the soil upon which they grow should be kept perfectly free from weeds and subjected to repeated hoeings.

CHAPTER LV.

THE GOLDEN ORANGE-TREE.

Doubts of the Nativity of the Golden Orange-tree.—Its Believed Origin.—Where Abounding in the United States, and by Whom Introduced.—Record of its Early Notice.—Its Attainable Height under Culture.—Its Majestic Bearing and Floral and Fruit Productiveness.—Its Many Varieties Variously Described and Qualified.—Soil and Climate Suited to its Thrift.—How Propagated.—Manner of Raising from Cuttings.—Uses for which Principally Cultivated.—Description and Usefulness of its Wood.—Its Greatest Enemy.

Doubts exist as to the nativity of this tree, but it is believed to have been originally a native of the warmer parts of Asia, and to have been introduced into America about the period of the first settlements, where it has become acclimated to the warmer portions of the mainland, and to the tropical and temperate islands of its coast waters. It is found to exist in Florida, where, not only in plantations along the coast, but in the interior wilds, extensive groves are met with; these trees, however, are not considered of American origin, having, as is supposed, been introduced by the Spaniards at the time of their settlements in that country.

"The first distinct notice of this fruit on record is by Avicenna, an Arabian physician, who flourished in the tenth century, and, according to Galesio, the Arabs, when they entered India, found the orange-trees there and brought them to Europe by two routes—the sweet ones through Persia to Syria and thence to the shores of Italy and the south of France, and the bitter ones by Arabia, Egypt, and the north of Africa to Spain and Portugal."*

* Browne's "Trees of America," p. 61.

It was also found indigenous to India and China on the Portuguese reaching these countries during their discoveries of the sixteenth century.

The orange-tree, under favorable culture, attains to a height of from twenty-five to thirty feet; it is of upright growth, and branches out with majestic luxuriance of foliage, forming a summit regularly symmetrical. Its leaves are of moderately large size, of a fine shiny-green color on top, and beautifully shaped. Its pleasing odorous flowers occur in small clusters on the branches, and are of the varieties of white tinged with pink. The bark of the trunk on old trees is of an ash-gray color, while that of the branches is of a soft green. The perfect uniform straightness of its trunk, the regular distribution of its branches, and the great richness of its foliage, flowers, and golden fruit give it a decided superiority of appearance and usefulness over other trees, and it is hardly possible to conceive or imagine an object more delightful, these qualities entitling it to be considered one of the most magnificent and beautiful productions of the vegetable kingdom.

There are many varieties of the orange which are supposed to have been derived from the common species; but whether from its natural habit to change, original differences of the stock, or from the diverse soil and climate from which they have been produced, it has not yet been determined. The following are the most important varieties:

Navel golden-fruited orange-tree is a native of the torrid zone, being chiefly cultivated in Brazil, where it flourishes in all its magnificence, and produces a fruit similar to the common orange, but slightly more oblong, of a most delicious and agreeable flavor, and yellowish, juicy pulp. Its fruit is distinguished by an excrescence which grows at the end opposite the stem, into which all disagreeable impurities are drawn, leaving its pulp in possession of all its pleasing qualities.

To J. D. Browne belongs the honor of introducing this variety into the United States, he having brought several trees from Brazil in 1835, which were planted in Florida and are believed still to exist.

The Chinese golden-fruited orange-tree is a much esteemed variety, with ovate, oblong leaves, and smooth, round fruit. It is indigenous to France, Portugal, and Italy.

Pear-shaped golden-fruited orange-tree. This is one of the most hardy trees of its kind, and is well worthy of cultivation. It produces a large, pear-shaped fruit, from which it derives its name.

The blood-red-pulp golden-fruited orange-tree is distinguished by the color of its fruit, which is reddish-yellow; is of medium size, round and rough-skinned, and contains a pulp irregularly mottled with crimson.

Sweet-skinned golden-fruited orange-tree. This is a much favored fruit-bearing variety. It produces fruit the pulp of which is of a deep-yellow color, sub-acid, soft and melting.

Mandarin orange-tree. This tree is indigenous to China, and is cultivated for the superior quality of its fruit, which is of a deep orange color, sweet, soft-rinded, and possesses the peculiar characteristic of the pulp being in a separated state from the rind, even allowing of the motion of the pulp within.

Seedless golden-fruited orange-tree. Of all the varieties, this tree is considered the most productive. It bears a small, round, thin-rinded, seedless fruit with a deliciously sweet-flavored pulp.

Bitter golden-fruited orange-tree. This tree is of stunted growth, spiny limbed, and subdivided into several varieties, among which are the horn-fruited, much esteemed for the delicious perfume of its flowers; the female Bigarade, having the peculiar characteristic of producing a two-folded fruit, or, "orange within orange;" the curled-leaved Bigarade, of stunted growth, with small, blunt, curled leaves, clustered blossoms, and coarse fruit; the double-flowered Bigarade, prized for the production of deliciously fragrant double flowers; the bitter orange-tree, distinguished by its dark fruit, filled with bitter, sour pulp, and the myrtle-leaved Bigarade, suited for garden culture, owing to its showy floral and fruit productiveness.

The orange-tree is cultivated in various soils, but flourishes best in a warm, fertile compost of sand and loam, with a prevailing atmosphere of 62° to 84° F. temperature. Upon the position and soil depend the thrift of the trees, and in order to insure this they should be sheltered from the disturbing influences of high or chilly winds; so, also, a uniform salubrity of air conduces to a deliciously rich flavoring of the fruit, while excessively heated temperature tends to enlarge its rind and impair the quality of its pulp.

It is propagated by cuttings, layers, and grafting. As the plants raised from seed do not readily bear fruit or bloom, they are usually propagated to increase variety and supply grafting stocks.

The manner of raising these trees from cuttings in England, as described by Browne in his "Trees of America," is as follows: "Take the youngest shoots, and also a quantity of the two-year-old shoots; these may be cut into lengths of from nine to eighteen inches. Take the leaves off the lower part of each cutting to the extent of about five inches, allowing the leaves above to remain untouched; then cut right across, under an eye, and make a small incision in an angular direction on the bottom of the cutting. When the cuttings are thus prepared, take a pot and fill it with sand; size the cuttings, so that the short ones may be all together, and those that are taller in a different pot. Then, with a small dibble, plant them about five inches deep in the sand, and give them a good watering from above, to settle the sand about them. Let them stand a day or two in a shady place, and if a frame be ready with bottom heat, plunge the pots to the brim. Shade them well with a double mat, which may remain till they have struck root; when rooted, take the sand and cuttings out of the pot, and plant them into single pots, in the proper compost. Plunge the pots with the young plants again into a frame, and shade them for four or five weeks, or till they are taken out with the pots, when they may be gradually exposed to the light. From various experiments, Mr. Henderson, of Woodhall, England, found that pieces of two-year-old wood struck quite well; and, therefore, in place of putting in cuttings six or eight inches long, he took off cuttings from ten inches to two feet long, and struck them with equal success. Although he at first began to put in cuttings only in the month of August, he afterwards put them in at any time of the year, except when the plants were making young wood. By giving them a gentle bottom heat, and covering them with a hand-glass, they will generally strike root in seven weeks or two months."

The uses for which orange-trees are cultivated are principally their fruit and showy appearance, and the agreeable pleasure derived from the grove when in bloom and fruit-laden. Its wood is hard, compact, of a yellowish color, slightly odorous, and capable of being polished, and is chiefly used in making fancy articles, such as boxes, dressing-cases, etc.

The tree, while growing, is subject to the attacks of an insect, or bark-louse. Many remedies have been tried to prevent its ravages, such as fumigating the trees, smearing them with lime, potash, sulphur, quicklime, salt, glue, etc., but all have proved ineffectual to arrest the action of this sly destroyer.

CHAPTER LVI.

PROPAGATION OF TREES.

Propagating.—Contrast of Theory and Practical Knowledge.—Methods of Propagating.—Varieties from Original Species, How Produced.—Seeding.—Time and Manner of Sowing, with Necessary Considerations.—Preparation of the Soil.—Cuttings.—What they Are.—When, Where, and What to Select.—Period of Longevity, How Ascertained.—Cause of Decay in Cuttings.—Characteristics of their Growth.—How Set Out.—Evergreens.—When Propagated from Cuttings.—Necessary Precautions.—Layering.—Origin of Method.—Governing Laws of Growth in Layers.—Methods of Layering Described.—Budding.—Inserted and Annular Budding, How Performed.—Object of the Methods.—Seasonable Time for Operating.—Grafting.—The Splice, Saddle, and Cleft Modes Separately Explained.—Pruning.—The Object of Pruning and the Benefits Effected Thereby.

PROPAGATING.

The methods of propagating the several varieties of trees require close attention, and they are in themselves of such importance to the grower that to acquire an accurate knowledge of the art mere theory will not suffice, but a thoroughly practical application of patience and perseverance will only succeed in dealing with their many delicacies and afford a successful issue of the undertaking.

Season, perfected condition of the bud or graft, position as to shelter and influence of the sun, quality of seed, fitness of soil to variety, and many other considerations have to be reviewed, the determining of which is of the utmost importance in the production of a successful growth.

The methods of propagating, when it becomes necessary to preserve or increase an original species, or vary another variety, either for ornament or other purpose, demand distinct treatment. Variations from original species are also sometimes produced by the transfer of a plant from its primitive soil and climate to one of greater or less richness and intensity; and when this change is so effective as to produce its natural dissolution, it then becomes necessary to convey the reconstructive members in part from a tree of the same variety, and by gradual insertion or inoculation of them produce or reconstruct it to its natural perfection. Variations of species produced by such transfers are sometimes an improvement upon the original, producing, as they often do, pleasing variety of color and form of foliage which contribute largely to the genera of reserved growths. Whenever these varied species present quality and merit to warrant their reservation either for exceptional ornament or productiveness, they should be closely attended to; and, when being removed from the seed-bed, ought to be so planted as to be conveniently superintended, when every characteristic of their growth and appearance should be noted so as to supply detail of their merit and worthiness. From such varieties, or "sports," our many cultivated fruit-trees and flowering-shrubs have been obtained; produced as they have been by the breaking-up of the natural habit of the original wild genera, they afford variety of color and foliage highly pleasing and ornamental. These valuable additions should on no account be lost sight of, but increased, as there is a likelihood of the original tree or shrub being lost by the course of nature or by accident; and for this purpose propagating by layering, budding, and grafting is most usually resorted to.

SEEDING.

Raising trees from seed requires more care and attention than persons unacquainted with their growth are inclined to consider. The leading thought of inexperience is that nature supplies every want for the nourishment and thrift of plants; and that all that is necessary for their production is to procure and sow the seed, and the earth will of itself, without further trouble, bring forth its increase. Practice and experience point to a further necessity, and convince us that this is not so; but that in the preparation of the soil, sowing of seed, after-culture, and protective measures against the influence of climate the tree-grower will find sufficient for his participation to keep him from idleness and inconsiderate conclusions.

The time for sowing the seed of the different species of trees varies so considerably that no decided information on this subject can be given for the collective genera. Seeds of different species, or even varieties of the same species, differ in vitality so widely that, to determine the time of the seasonable sowing of each separately, experience alone will teach; yet the vitality in seed of some species may be prolonged by due regard to the conditions of treatment, while that in others will seldom exist after the first season. Therefore, to accommodate the vital spark in seed of all species, the most favorable time of sowing is immediately after the gathering in, precaution being, of course, taken in the meantime for their preservation against influences of climate. The ground to be sown should be ploughed deep and thoroughly pulverized by a number of harrowings and rakings previous to sowing the seed, and, if not naturally rich, should be made so by an addition of some of the many manures in general use, such as old barn-yard, leaf-mould, rotted sods, bone-dust, or ashes. The seed soil being thus far prepared, shallow trenches of about one foot wide and at two to four feet intervals, according to the intended manner of cultivating, are to be run, and in these the seeds should be strewn at about two inches distance between each (to allow for the thrift of the young sprouts), and covered over evenly with soil to the depth of from one to two inches. All that is now required for the production of healthy growth is to keep the weeds under, and the soil loose between the trenches with cultivator or spading-fork, and prevent the appearance of obnoxious growths among the young plants.

Some varieties of plants require shading from the sun and protection from the first winter's frost, and for this reason are sown in beds about four feet square, so as conveniently to allow the construction of a frame to ward off any injurious influences which might naturally be brought to bear against the thrift of the young seedlings. The soil in these frames should be composted to the same degree of fineness and richness as that required in trench-seeding in the open ground; but this will depend entirely upon the variety which it is intended to nourish. No general rule can be applied, either for protection or richness of soil, as each separate species of tree has its own peculiarities in these respects, and thrives only when afforded a sufficiency of soil and climate according to its natural habit.

The seed may be sown broadcast in these beds, and covered lightly with fine leaf-mould, after which the frame may be constructed about them, consisting of boards a foot or more in width, placed round the edges of the bed and covered by a lath screen or coarse matting. The lath screen is considered the most convenient covering, as it admits the genial warmth of the sun to the plants without exposing them to its full influence.

CUTTINGS.

Propagating from cuttings is the mode employed in the production of certain species of trees, and when seed of other kinds cannot be readily obtained cuttings are used in their production. Though cuttings of some species of trees take a longer time to produce or emit roots than others, yet all kinds may be so propagated if allowed sufficient time for the formation of their roots. The root-producing substance, alburnum, or sap, partakes of the nature, in productive thrift, of the growth of which it is the life-blood; so it may be inferred that, according as the growth of the species is rapid or tardy, the period of perfecting of the roots may be determined.

Cuttings are detached branches or ends of branches of trees, usually from six to twelve inches in length, and are selected from shoots of the latest growth, though, in this case, if the tree is of considerable size and age, it will be necessary to select from the latest and lower shoots, and not from the main stem or first branches, as it has been decided that these latter participate in the age of the tree, while the later shoots bear age only from their year's origin; therefore this consideration is important as fixing the period of longevity of species propagated by cuttings. This peculiar characteristic may be accounted for from the fact of the yearly formation of sap-wood producing shoots which exist and thrive as part of itself, having birth as it were together, and increasing in size and strength proportionately with the natural transformation of sap-wood to wood of compressed texture.

Cuttings of deciduous trees should be selected in the fall, and chosen from those limbs which are of apparent healthy vigor, tied in bundles and stored away till the following spring. The most convenient and safe way of preserving them during winter is by a covering of earth or other substance of sufficient depth to be out of the reach of frost. They should be cut smooth and square through the stem, and immediately under a bud, as this operation, when performed with nicety—care being taken not to crush the cutting in any of its parts—will facilitate the early production of the root, and prevent a hasty decay of the inserted end. There is an objection to the "slant cut," especially for cutting of trees or shrubs having a pith, as in them the absorption of water is great, and consequently the decay of the lower part of the cutting hastened.

When planted in the open ground, cuttings should be so placed uprightly to nearly their full length that only an inch or two of their tops will be visible above ground. They are usually planted in rows of two to four feet interval, and two to four inches between plants in the length of the row; but the distance between plants will chiefly depend upon the object for which they are being raised.

Evergreens, being of a more tender nature than deciduous trees, require greater attention for their successful production, and are chiefly grown from seed, except when it becomes necessary to multiply or preserve a particular species or variety of species, in which instance they are propagated from cuttings or layers. They all, or nearly all, require artificial heat for their production, and for this reason are usually raised in hot-beds.

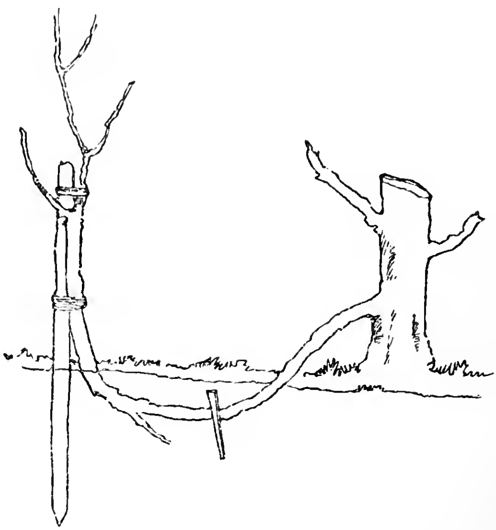
In the instance of cuttings of evergreens being placed under frame after selection in the fall, the debarring of the heating influence of the sun from them by shade becomes a necessity, so as to prevent an unseasonable or untimely growth of leaf, and allow for the prior development of the roots. This is owing to the decreased temperature requisite for the production of the root as compared with the warmth necessary for the growth of leaves.

The cuttings of evergreens are usually placed in rows, at six inches apart, and the soil firmly pressed about them to about one half their length, which is generally from two to three inches.

LAYERING.

The method of layering has been obtained by observation of nature's growth, and has been established upon the fact of reproduction by the emission of roots from branches inserted in earth, under the same law which governs the growth of cuttings; though in layering, as in cuttings, the sap, which is the principle of growth in both, is not entirely restricted or cut off in its flow, but allowed a passage and continued supply till the production of roots, by the fact of its being necessarily kept in connection with its parent stem. The seasonable flow of sap which is drawn up by the roots of trees for the nourishment and growth of their stems and branches diffuses itself throughout, when, having performed its offices, it returns through the inner bark and deposits a thin layer of sap-wood or alburnum: so it may be conceived that the branches and roots are composed alike of this substance.

In layering, a branch may be chosen at a convenient height from the ground, and, if not of such convenience, bent till brought in contact with the ground, as shown below, where it is to be inserted, or covered over with

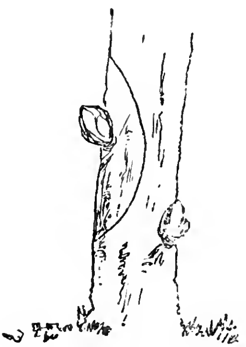


earth, and kept in position by means of a forked peg. Previous to insertion or covering over of the bent branch or layer an incision is commonly made in the lower side, generally of half the depth of the branch, and a slit run in the direction of the extremity of the limb of about the same length as the incision is in depth, or of such length as to allow of the easy upward turning of the layer, which is then to be doubly pinioned by an additional peg, driven so as to keep the limb in an upright position, to which it is to be lashed by means of bark bands, or other convenient material, so as to prevent its being disturbed by wind or other cause. When the growth of the limb or branch which it is intended to layer is not within easy bending distance of the ground, recourse is had to a contrivance which conveys the soil to the requisite height, so as conveniently to insert the branch at a particular point, and it grows naturally. For this purpose most generally an earthenware pot or wooden box is used, which is so made as to allow of a division of about two inches to the extent of half its breadth or diameter, and to its full height, for the easy insertion of the branch to its centre. On the branch being thus inserted, and the division closed by a piece of lath sufficiently wide to cover the opening or slit at the bottom and side, the pot is filled with earth, and so allowed to remain till the roots have formed upon the layer. It is, however, necessary that the outside of the pot or box be protected from the drying influence of the sun and wind, as too sudden or excessive evaporation necessitates frequent watering and, consequently, extra labor.

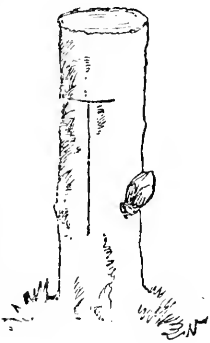
The most fitting season for layering deciduous trees is in the spring when the leaves have just put forth, so as to take full advantage of the entire season's growth, for the perfecting of the roots previous to separating the branch from the parent stock in the following fall. The operation, however, should not be delayed longer than midsummer, unless it be intended that the layer should have the second season for perfecting its root, which is sometimes necessary in the case of some evergreens and deciduous trees tardy in emitting roots.

BUDDING.

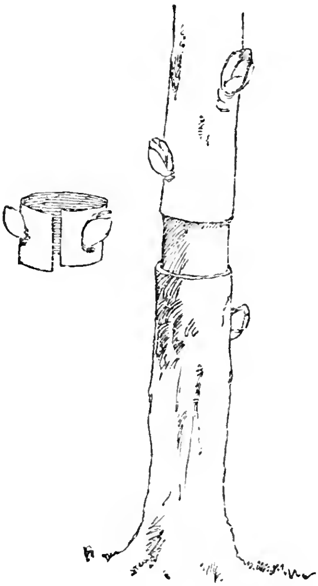
Budding is performed by the transfer of a bud of one tree to the stem or branch of another, generally members of the same genus; though in some species exceptions exist which do not allow of this assimilated connection. The object of budding is to convey the natural qualities of one variety to those of another, either to produce ornamental difference or to multiply productive species, and also to supply deficiencies of limbs in trees naturally of sparse growth. As in layering to produce roots, so in budding, alburnumous substance or sap forms the union between the bud and stock. The operation is usually performed in summer, on the development of the buds of the same season's growth; and as it is required that the bark shall part easily from the wood, both the stock and bud should be of equal advancement in the growth of the season. The sap at this season being in a semi-fluid state, by the action of its natural properties detaches, though little, the bark from the wood, and allows of its being easily raised for the insertion of the portion of bark attached to the bud. The operation of striking out a bud is performed by the insertion of a knife about an inch



below the bud, and a cut run to the depth of the bark upward, and curved to about one half inch above it, as shown in the figure on preceding page. This slice, with a thin layer of sap-wood adhering, is then carefully detached from the tree, when the bud will be ready for transfer to the stock. The stock, which should not exceed an inch in diameter, whether as seedling or branch, is previously prepared for the reception of the bud by making a cut downward and across it to the depth of the bark, and of an inch or so in length in the form of a T, as seen in this figure. The portion of the bark containing the bud is then inserted in this T-shaped slit, the edges of which are to be slightly raised to receive it in such a position that the uppermost portion of the bark containing the bud will fit exactly with the head of the T cut in the stock, so as to admit of the free downward passage of the sap, which forms its annealing substance. The bud, after insertion as above described, is to be bound securely in its place by means of a bandage of woollen yarn, scutched flax, bark bands, or other material. In this state it is allowed to remain for three or four weeks, or until it has united firmly with the stock, when the bandage may be removed. As the season of growth will be nearly over by the time the operation has reached this stage of perfection, the bud need not be expected to push fully into growth till the following spring, though signs of its vitality are often perceptible at an earlier period. Every effort should now be made to nourish its growth, and for this reason all sources of waste of nutritious substances should be cut off, such as suckers or sprouts and any superfluous height of stock.



Another mode, called the annular budding method, is recommended for its excellence in propagating some



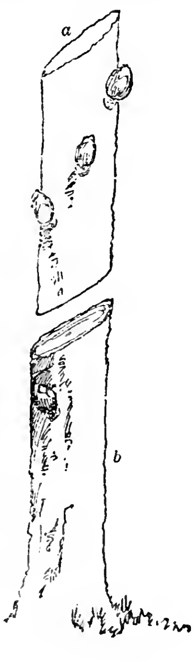
forest-trees. It differs from the foregoing by the fitting of the bud to the stock instead of inserting it under the bark; and has the advantage of being successfully performed in the early spring, or as soon as the bark can be detached from the tree. The bud is separated from its tree by a circular cut, extending completely round the stem or branch, and a similar displacement of bark, of the same circuit and height, is made in the stock so as to admit of the bud and its appended parts fitting exactly into it. This necessitates that the size of the branch from which the bud is taken and that of the stock to which it is to be affixed be equal, or nearly so. A similar treatment is required for this as for the method of inserted buds; but the result of the season's growth will be more apparent in this than in the latter, owing to the advantage derived from the more extended time for its union with the stock.

GRAFTING.

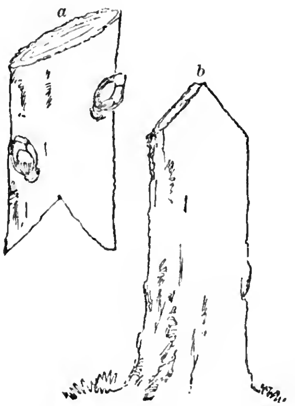
The grafting methods have been long practised and are at present the most commonly used in propagating trees, especially fruit-bearing varieties. Though of old origin, yet they would seem to be not generally understood. They are, however, a necessary acquirement for persons interested in the production of variety, or in the preserving of a particular species.

There are three modes in common practice at present, the splice, cleft, and saddle graft, each approved and advocated upon its own particular merits.

The most preferable season for performing the operation is in spring, just as the buds begin to swell, and when the sap is in brisk motion, both for evergreens and deciduous trees. The selection of the scions should take place in the previous autumn, when the tree from which they are to be taken is in leaf, so as to insure the possession of the most vigorous shoots. These should be chosen from branches most exposed to the sun, and may consist of the last summer's growth, or, which is still more preferable, might be selected from among any shoots which may have sprung from the lower portion of the tree-stem. They are usually cut in lengths of three or four inches, so as to leave from three to five buds for the production of new shoots, and may be from one fourth to one inch in diameter, though they may be larger or smaller according to requirements. In all cases they should be as nearly as possible on an equality of size with the stock or branch into which they are to be grafted, so as to admit of the bark of both being exactly united, and to facilitate the flow of sap which forms the cementing substance between them.



The operation of splice-grafting is usually performed on seedlings, and when the scions are of about one half inch diameter, and consists of the stock being cut in an upward oblique direction, and the scion in a similar manner, so as to have the connection of these members as exact as possible. This being completed, the scion (*a*), or graft, is to be so fitted as to bring both or one of its barked edges in exact junction with the bark of the stock (*b*), where it is to be bound immovably with the most soft, tensive lashing at hand; after which, to exclude air and rain, around the outside, to above and below the points of union of the stock and scion, should be smeared grafting-wax or other compost.



In saddle-grafting the stock (*a*) is cut so as to bring its head to the form of a wedge, and the scion (*b*) at its lower end is similarly treated by being cut to the same angle, though in a reversed direction, so as to admit of its being placed upon the stock with its bark in exact contact with that of the stock. This method is employed when the scion is of moderate size. The necessary precaution of binding and protecting the graft is the same in this as in the foregoing.

Cleft-grafting is the simplest and easiest of execution, and a mode which is principally employed when the stock exceeds the graft in size. In the case of a seedling being the stock upon which to graft, it is cut square across, at the height of two or more feet from the surface of the ground, and a cleft made in its head into which a scion or graft (*b*), formed to the shape of a wedge of one or two inches in length, is inserted. The same operation of cutting back is also necessary on a branch being used as stock, but in both instances, if it is possible, the seedling or branch might be so accommodatingly cut as to bring the breadth of the graft and the width of the stock-head of equal dimensions, that the inside of the bark of each on

both sides meets the other; but when this union of the two edges cannot be conveniently made, then it is usual that two scions be inserted so as to perfect the juncture. It is not, however, advisable that more than one of the two remain, in case they both have united. The most healthy is generally retained, the other being sawed off close to the stock. The cleft in the stock being sufficient in itself to retain the graft firmly in its place, no other protective measures need be employed other than those necessary to exclude the air, protect exposed portions of the wood from the action of moisture, and the graft and stock from the encroachments of motive agencies. Of the many composites in use for grafting-wax, the following is given and recommended by Andrew S. Fuller, in his work on "Forest-Tree Culture:" The ingredients are beeswax, resin, and tallow, in the following proportions: One pound of tallow, two pounds of beeswax, and four pounds of resin melted together. If to be used in cool weather, a little more tallow may be added.

In splice and saddle grafting, if successful, the union of the graft with the stock will be accomplished at the end of the fourth month, about which time also the bandage may be loosened, so as to admit the air gradually, or until the scion has become accustomed to the change, when it may be entirely withdrawn.

PRUNING.

The benefit of pruning forest-trees is more lightly thought of than it deserves. Upon this operation depends the healthy thrift of all members of the growth acted on, as well as its future deportment and usefulness.

To prune a tree so as to serve the purpose for which it is wanted, observation of its natural habit will soon teach the planter how much or how little is required to be cut away. Care, however, is necessary that it be not pruned to such an extent as to weaken or check its growth, nor should the whole of the branches prunable be cut off at once, as some, which it is ultimately requisite to trim away, may at that particular stage of growth be beneficial to the tree of which they are members.

Again, it may be observed that there are many cases of failure from not pruning enough; so between these two questions the considerations of the planter must take a moderate tendency, in conformity, of course, with his own observations, in connection with the natural habit of the tree he is to practise on, and the purpose for which his exertions are designed.

The great object of pruning is to obtain a straight stem, regular outline of tree, and equalize the members necessary to support its thrift. For the first of these requirements it is usual to begin training while the tree is young, and for this reason the nursery is the place best suited to start from, as the limbs of the trees in their infancy are smaller and their tendency more easily observable then than if left till of greater maturity; besides, the wounds formed by the separation of young branches from their parent stem will not be so large as to require any serious attention.

The shade necessary for the protection of the tree-stem from the drying influences of the sun makes it necessary that the lower branches of young trees, especially if growing in open ground, be preserved for the purpose to which they are best suited; generally trees so situated require at least two thirds of their height as a source of shade to their stems, and for the production of that vital property naturally possessed by the leaves so indispensable to growth. But when trees are grown collectively, and for the production of timber, so that individually they shade each other, then they can be conveniently pruned to two thirds of their height, allowing only the remaining one third as a requisite shade.

The most suitable time for the pruning of trees is in midsummer, when the leaves are in full bloom and the sap in a state of quietude. They may also be pruned at the commencement of winter, as at this season any wounds formed will readily heal, owing to the influences of climate brought to bear upon the exposed parts. Some species, however, owing to the sparseness of sap-circulation in their systems, may be pruned at any time without injury; but the great desideratum in all instances is to effect the operation without having any cause to fear the result.

In pruning large trees, when the wounds are of considerable size, it is requisite that they be protected from the decomposing influence of moisture by applying a thin coat of common grafting-wax to the exposed wood; or varnishing the parts with a preparation of gum-shellac dissolved in alcohol will fill and dry the pores of the wound and exclude any injurious agencies.

The pruning of evergreens is not so generally necessary as for deciduous trees, the object to be obtained in the cultivation of them being so different that only the matter of taste will serve as a guide. Their principal uses being ornament and shelter, these requirements necessitate but little work for the knife, as for such purposes the trees are more beneficial and attractive when allowed to retain their natural fantastic diversity.

CHAPTER LVII.

ON PLANTING.

What to Plant.—Preparation of the Soil.—Influence of Soil, Situation, and Climate on Certain Species. —Dr. John A. Warden's Facts in Connection with Tree-planting. —Congenial Soil of Species.—On Natural and Artificial Grouping.—Dispersion of Species, to What Due.—Base of Successful Forestry.—Combined Species and Obnoxious Exceptions.—On Planting for Shelter-hedge or Screen. —Species Adapted to each Purpose. —On Planting Hillsides. —A Philosophical Suggestion. —The Notching or Pitting Process for the Production of Stock Plants. —Separated Existence of Certain Species, and Care Necessary to their Successful Production.—Nurses.—What they Are.—Uses for which Designed.—Species most Easily Produced or Obtained.—Manner of Planting, and their Utility. —Nurses in Use for Specified Species. —Nurses as a Source of Profit. — On Close Planting and its Resulting Economy. —Rapidity of Growth of Hardy Trees. —Transplanting Seedlings. —Transplanting Trees of Large Size.

When, what, and how to plant is a question which many desire to have answered.

"When to plant, though an important question, needs not much consideration. Plant when you get ready, fall or spring; but be sure to have the soil ready for the reception of your trees before bringing them on the ground; let it be dry enough to crumble; never plant when it is wet and clammy.

"The ground should be as well prepared as for a tillage crop, and where at all possible to plough the land, do it as a valuable preparation, because of the advantage it gives to the young plants that are to be introduced.

"Another point in having the land well prepared is the great advantage of being able to set treble the number of trees, to say nothing of the great desideratum of more rapid growth as a result of the cultivation they receive, and the sooner, as a consequence, they may be left to themselves.

"Soils of different localities seem to exercise an important influence in deciding the thrift of certain species of trees. The amount of moisture in the soil will often prove more favorable to one species than to another; more elevation and exposure may be congenial to one species and adverse to others."

Dr. John A. Warder, to whom we are indebted for many instructive facts in connection with tree-planting, writes:

"In our northern regions we find the American larch and the arbor-vitæ occupy together very often the low, mucky soils of flats and ponds; near them the hemlock covers broad flats of low and wet land, with elms and black ash, red maples, and other trees of water-loving character. Here, in the higher latitudes, we may expect to find the native spruces and balsams, while at greater elevations, and even on rocky points, with the least moisture and soil, the junipers thrive, and on the thin, sandy lands large areas will be covered with the gray pine on the eastern mountains, while near it, on the sandy flats, the white pine forms our valuable forests, with the red pine grouped together on its favorite localities to the eastward. So with the hard-wooded, deciduous trees, each has its favorite locality, where it seems best to thrive, though in many places several species may have similar habitats, with the result of a mixed forest. Thus we often find the sugar maples, white ash, hackberry, and some oaks and elms, with wild cherry and tulip trees, grouped together. Again, on more clayey lands, are the white oak and beech more prevalent, and in wet flats the swamp oaks and sweet gums constitute the leading species."

The red and black oaks will be found most abundant on the more sandy soils, and the post, black-jack, and laurel-leaved oaks have their favorite locality on formations of finely siliceous soils. In middle latitudes and northward, on rich lands, the burr oak will prevail. The white elm yields its finest results on humid lands, while the red elm prefers a drier and more porous but rich soil. The walnut is found in its grandest proportions only on the richest river alluvions, but the butternut finds its congenial home among the rocks of the northern valleys. The shellbark hickory prefers clay flats; the pecan, rich river alluvions; while the large shellbark, with the pignut, are most abundant on fertile, rolling uplands. Of these great classes, we observe that nature usually groups certain species more or less exclusively together. "In one region, or on one area, there are pines, chiefly of single species; in another tract the spruces or the firs will prevail; and so, too, among the broad-leaved trees, made up of many genera and species, and apparently mingled rather promiscuously together, the willows and poplars will be more or less grouped by themselves; the oaks will prevail here, the maples and ash there, and the magnolias will prevail on one side. The various species of trees seem to have their preference for this or that locality, and appear more or less abundantly in this or that position. Independently of these results, that seem traceable to the influence of soils and elevation, in connection with latitude, the natural grouping of species, either separately or combined, must often depend upon accidental circumstances. Willows and cotton-woods shed their numerous light seeds at a season when they are floated upon the swollen waters of our streams, and as the floods subside they are stranded upon the emerging sand-bars, where they find a favorable soil, and burst into growth in immense numbers of a single species. The burned pine forests of mountain regions receive the seeds of the aspens that are often sown over wide tracts in the same way; and in clearing of forest-lands the neglected elms furnish innumerable seeds that reproduce an abundant succession of verdure among the stumps of other trees. There are also a great number of self-sown plants of other species from previous years' seeding that may have been kept in abeyance for a greater or less period by the original forest, which now, opened to the air and light, will enter the struggle for life and contest the ground inch by inch with the new seedlings. Hence the mixed character of the second growth of trees, and the ultimate result generally shows which were the fittest and hardiest. Those of most vigorous, thrifty growth, and notably those with broadest foliage, usually prevail by overshadowing those of more tardy progress. It should also always be borne in mind that some trees are obnoxious to the healthful growth of some others, and perhaps this is nowhere more apparent than in the case of broad-leaved trees, and those with needle-shaped leaves, commonly known as evergreens. The overshadowing by the former is destructive of the latter. Successful forestry is based upon their separate planting; or, if placed in the same subdivision of the forest, either for the effect of contrast or because of peculiar adaptation to the soil, each should be massed by itself as much as possible—evergreens with evergreens, and deciduous trees with those of their own class; and in both cases those which are not obnoxious to one another. Observe in combinations of species which of them have a similar or an unequal rate of growth in their infancy, so that the stalwarts shall not smother the weaklings that may be most valuable and desirable in the end. These are important considerations that will require a knowledge of the character of each, and, as this may not always be possessed by the tree-planter, he will be required to exercise constant watchfulness and observation of their behavior.

"In planting for shelter use any or some of the many trees at your command, and plant them where they will produce the desired protection. For field wind-breaks the leafless trees have much value, and their judicious disposition will greatly check the cutting storms. When we come to select plants best suited to the protection of our own homes and their surroundings we find abundant material from which to make a choice. For trees and for tall screens the favorite with many is the Norway spruce, which grows rapidly, is easily transplanted and managed, and presents a welcome tint of green that is always persistent and full. The other spruces are also desirable, particularly the white and black, as they bear the knife and shears very well, and may easily be kept within due bounds when used as hedges for shelter. The majority of wind-breaks planted in the prairies are composed of deciduous trees, and are usually of the commonest species, such as the cotton-woods, box-elder, soft maples, etc.—any tree of rapid growth or that can be most cheaply procured. This practice, however, need not prevent the use of hard-wood and other trees in making shelters; but, in instances, impatience may prevail over judgment as to the more valuable species, and induce the use of trees of rapid growth to insure a speedy result. The native hemlock is particularly commended as a lawn tree standing alone, but it is also one of the very best species for forming a screen or shelter-hedge, as it may be clipped to a perfect plane, and, where necessary, can be confined to narrow limits.

"The common red cedar, called the 'poor man's evergreen,' on account of its cheapness and the facility with which it may be produced in all parts of this country, as well as the certainty and rapidity of its growth, is a most useful and valuable plant for the farmer. Though not of so fine a color as some others, this tree makes a dense foliage when set as a shelter-belt and wind-break. It also makes a close hedge, and might be used to advantage as a screen and as a protective hedge for gardens and about hot-beds.

"Whether a selection be made from the so-called cheap trees, such as white willows, cotton-woods, soft maples, or noble oaks, hard maples, white ash, the elms, wild cherry, walnut, or hardy evergreens be chosen, we do not recommend neglect in planting these invaluable aids to good farming.

"A strip of one rod in width will be needed if it is proposed to plant but a single row, and several rods wide must be prepared if it be designed to plant a good windbreak of many rows, which is the better plan.

"After harrowing the ground, a furrow is struck for every row of trees, and these furrows may be four feet apart, for then the plants may be set every four feet. This requires very little labor unless large trees are selected, and if these be large evergreens they need not be so close, but more care will be required in planting.

"The young trees, when planted with reasonable care and well fixed in the soil by pressure of the foot, will be sure to grow; but so will the weeds, and the plantation must be cultivated for about two seasons, so as to keep down all intruders. With this treatment their growth is greatly enhanced and they will the sooner shade the ground, when they will suppress the weeds and take care of themselves.

"In planting in situations where there are steep declivities, rocky protruding ledges, or other obstructions, it is the part of good philosophy to embrace and make the most of the conditions which happen to surround us. In all such restricted situations, as in similar difficulties everywhere, let us not be discouraged, but adopt the more expensive and less promising plans.

"In such cases, the planting is done by 'notching,' for small nursery trees, that are inserted into the slit made with a heavy planting-spade, and made firm by the same instrument or with the foot.

"With larger trees, the plan of 'pitting' is pursued, opening holes a foot or more in diameter, into which separate trees are inserted.

"Where not supplied with stock for the production of desirable forest-trees, have furrows ploughed at close intervals, as guides to the planter of seeds or of little trees, and to facilitate cultivation by hand, to subordinate such weeds and other undesirable growths as might interfere with the trees that are intended to constitute the crop. Planted or sown in such a manner, the growth of the plants will not be so rapid as when well cultivated.

"In open woods, and in accidental vacancies, the 'notching' process, for the production of young oaks, ashes, and other species, has been extensively practised, and with good results.

"The catalpa, white ash, black walnut, black cherry, and other valuable species will grow well enough on their congenial soils when once well established, even without the thorough preparation needed for arable lands, but they must be planted thickly, either alone or with nurses, and they must be kept free from the intrusion of weeds until they completely shade the surface, even if this requires double the number of years usually found necessary on the more level plantations. With nurses, the free use of low-growing bushes would be advisable.

"Of this character, even the common elder and sumac bushes would be very desirable nurse-plants, as they are readily produced by inserting bits of roots into the spade-notches, and because, when shaded by the growing trees, they will gradually be smothered and disappear, after having for a few years pretty effectually shaded the surface of the ground and yielded some profit as a subsidiary crop of berries and leaves.

"The planter is particularly enjoined to beware of the effects of rank, coarse-growing, annual weeds, and also of the blue-grass of rich soils."

NURSES.

"Nurses are surplus trees or shrubs introduced into the plantation for a temporary purpose, for the occupancy of the ground, to shelter and protect the permanent plants that are designed to constitute the future forest, and to aid in forming them into well-shaped trees as well as for their use as subsidiary products.

"The trees, shrubs, or bushes selected for use as nurses should not so greatly exceed in size and vigor the permanent trees as to endanger the growth of the plants designed for the future forest; they need to be looked after lest they crowd and injure those trees which are to form the permanent stock. This is especially necessary if they be free-growing—such as many of the kinds grown in this country. Hence, for the purpose of nurses, we should select trees which are of the second class in respect to size. Of the many in use as nurses to different species of trees, the cotton-wood, box-elder, hackberry, white maple, elms, green ash, and white willow are the most easily obtained or produced, and in cases where the first cost of the young trees is small, the nurse-plants may consist of supernumeraries of the species planted.

"Shrubs may be utilized as nurses if set in alternate rows and cultivated with the trees, and may be brought into requisition as a source of profit in use as wattles for temporary fences, as osiers, hoops, hurdles, and hazels or filberts, for their nuts. Wherever labor could be controlled for the cutting and preparation of the crop of herbage, so useful now for tanning, the sumac would promise a valuable return. Many of the smaller-growing osier willows might be planted in the same way, with prospect of yielding good returns. They may all be grown from cuttings, that should be planted at the same time as the trees—the latter, being put into rows eight feet apart, could have a double row of the willows set between them. Eighteen inches wide would be sufficient for the willows, with spaces of three feet three inches on either side between them and the permanent trees. This plan would be particularly applicable to plantations of some of our oaks and hickories, which are usually slow in their growth.

"It is recommended in planting the black walnut, that instead of an entire block of this species, which is uncertain in its results, every fifth row be planted with nuts, while the four intervening rows on either side be set with any of the common kinds as nurses, and as their growth increases, and consequently space is needed for the thrift of the walnut, the adjoining rows of nurse-trees may be cut down, and so the next, till a clear space of sixteen feet is made to allow of the development of the permanent tree. This manner of proceeding, though remunerative in the case of the black walnut, has proved to be with other species a false economy on the part of the planter, under the delusive idea that he could grow among the trees a half crop of other plants to pay him for the labor of cultivating his trees. For the first year he may reap his reward; in some cases, perhaps, also for the second year, but, meanwhile, when so widely planted, the trees suffer from branching and by leaning out on either hand for the light and air. It is true that in some cases, with very strong and rapid-growing species, tall-growing kinds of Indian corn in the alternate rows might supply the need of the supernumerary trees.

"The white willow has been used as a nurse to the sugar maple and oaks with the object of saving the more valuable stock-plants, by filling up with willow-cuttings to shade the ground, thus diminishing the expense of planting and cultivation, and at the same time to force the upward growth of the trees and to prevent their branching.

"In planting the oaks at eight feet apart each way, with alternating willow-cuttings in the rows, and with alternating rows of willows set four feet apart, after the second year's growth the ground will be found so shaded as to require no other culture, and it becomes necessary to cut off the interfering branches from the willows. Meanwhile the oaks will have made satisfactory progress and have reached a greater height than those of blocks planted with the same stock set at four feet apart and continuously cultivated so as to keep the ground loose and clean.

"Unless care be taken to subordinate these nurses they will be likely to overwhelm the more valuable plants, and they are not, therefore, recommended for all purposes, as their growth is so vigorous that their excessive thrift supplants the more valuable tree. As soon as the permanent tree has reached sufficient size to shade the ground, little trouble need be experienced by the sprouting of the willow-stumps, as they will in their turn furnish material cuttings for other plantations.

"Evergreens which have been used as nurses to other evergreens are to be treated in the same way.

"When the thickly set trees have reached a height of from eight to twelve feet and make a dense thicket, so as to endanger the sturdiness of the plants, instead of chopping them at the ground the stems are lopped off at the height of four, five, or six feet, leaving all below to shade the ground and for the important work of aiding in the destruction of the side-limbs of the other trees, which thus soon lose their lower branches by the processes of nature, and not only is this more cheaply, but it is also much better done than by the laborious process of trimming. The lopped trees do not recover their upright habit of growth, but are soon overpowered by those which are left, that now grow with renewed vigor, and, while the beheaded trees continue to drag out a miserable existence, they are still doing a good work in aiding in the perfection of the shafts of their more favored fellows.

"The white ash, hard maples, oaks, elms, hickories, chestnuts, beeches, and many other desirable species, may all be economically grown by the aid of the cheap nurse-trees in the manner recommended for the walnut.

"Some persons have thought the recommendation to plant trees at every four feet, or even more closely, was a waste of good material. It is not so, but a gain rather than a loss always follows from the close setting of the trees. The first cost of most of the stocks planted is a small matter compared to the labor of cultivation, to say nothing of the improved shape of the young trees and the economy that follows in the matter of cultivation. Therefore, to produce a tall and healthy growth of trunk on trees, whether planted on hill-side, in valley, or on open plain, be assured that, after a judicious selection of the species best adapted to soil and situation, they should be planted very thickly, say every four feet, or about three thousand trees to the acre, and the happiest results with the least expenditure of labor may be anticipated."

RAPIDITY OF GROWTH OF HARDY TREES.

"The following varieties, all things considered, are the best for general cultivation in the northwest: Cottonwood, soft maple, silver poplar, black cherry, ash-leaved maple, catalpa, black walnut, and white walnut. R. C. Raymond, of Council Bluffs, Iowa, states that the following-named varieties, planted when one foot in height, attain the following diameters and heights when ten years of age:

	Diameter, Inches.	Height, Feet.
Cottonwood	9	35
Soft maple	8	30
Silver poplar	9	30
Black cherry	6	28
Ash-leaved maple	5½	27
Catalpa	6	25
Black walnut	5	20
Butternut	5	20

"The Hon. Suel Foster, of Muscatine, Iowa, reports the following as the growth of the varieties named, twenty years after transplanting:

	Diameter, Inches.	Height, Feet.
Soft maple......................	16	35
Hard maple......................	14½	20
Black cherry....................	11	40

"The chestnut, twenty-four years from seed, grew to be 10 to 16½ inches in diameter, and 30 to 36 feet in height. The European larch, ten years transplanted, attained a diameter of 4 to 7½ inches, and were 20 to 30 feet in height."

TRANSPLANTING SEEDLINGS.

"The time for transplanting seedlings is a consideration dependent chiefly upon the thrift which the plants are likely to make in the seed-bed, and upon the dispersion therein; as also upon their kind.

"In case of their being sown too thickly, it will then be necessary to give them more room, and for this purpose the healthiest and most vigorous are taken up after the first season and set out in nursery-grounds prepared for their reception.

"As the thrift of the many species is so varied, a general direction cannot be here given for all; but usually those kinds with abundance of roots may safely be transplanted in the fall following their sowing, giving at the same time due consideration for their protection against extremes of temperature during winter.

"In no wise is it advisable to transplant permanently, or even remove, species which are naturally of sparse root-growth till the spring, as the roots of such are not fully formed in, or hardy enough after, one season's growth to withstand the nipping effects of a winter's frost. Fall planting would be injurious to them, and would probably retard their growth, if not kill them.

"With plants of a more mature growth, say of the third season and upward, the fall of the leaf may be taken as a set time to operate upon them (unless the approach of winter be precipitate after this annual occurrence), as the time which intervenes between then and the setting in of frost, in most latitudes, will be sufficient to allow for the settlement of the earth in which the plants are fixed, and to prepare the seedling for an early start in the following spring.

"On the transplanting of seedlings of the first season's growth, if any side-shoots exist they should be cut off, leaving only the single stem. As it is particularly requisite to have this member as straight as possible, it should not in any way be interfered with till after it has presented some traits of deportment, after which, if necessary, it may be headed back in accordance with the purpose for which it is intended.

"Almost all seedlings require cultivating for a few years after being transplanted from the seed-bed, after which they may be conveyed to situations intended for their permanency.

"Previous to transplanting young trees their roots are subjected to a process of pruning, which exercises an important influence on their future thrift; making the wounds, by a course of natural change, throw out an abundance of fibrous rootlets, thereby enlarging the field of nourishment, and establishing an equilibrium of supply and demand so essentially necessary to a vigorous growth. This operation is more confined to plants grown from seed than from cuttings; as in the latter kinds the roots are not long, but numerous and spreading; yet, when convenient, their roots, also, should be released from any superfluous growth by being judiciously trimmed, as any wounds thereby formed do not by any means injure, but in their turn emit rootlets which are formed by the same law that governs the production of similar growth in layers.

"Some kinds of trees, as the oak, hickory, and black walnut, produce long, carrot-like roots, which penetrate the soil to some considerable depth, and they are, therefore, an inconvenient species to transplant if allowed to remain in the seed-bed till their roots have fully taken hold; and upon this consideration may be determined the length of time which may be given them previous to removal to permanent sites. In the event of their lengthy existence in the seed-bed their roots may be exposed to injury on being taken up, in which case they are operated on as before described, and all injured parts trimmed off smoothly, no jagged wounds being allowed to remain attached, as these by their liability to early decay retard the thrift of the plant, and, sooner or later, convey disease to that portion of the trunk which they were designed to support and nourish.

"Too great attention cannot be given to the subject of root-pruning, as upon this operation depends the after-vigor of the tree. In any event, whether from injury which necessitates it, or on the removal of the plant from the seed-bed, the tap-root should be cut off to one third or so of its length, or at such a length as will conveniently admit of its being placed in an easy position in the soil; this will facilitate, if required, the removal of the tree in after-years, besides tending greatly to its successful thrift.

"The following table may be useful to the planter, in showing the number of trees that may be raised on an acre of ground, when set out at any of the under-mentioned distances:

Distance Apart.	No. of Plants.	Distance Apart.	No. of Plants.
1 foot..........	43,560	9 feet..........	537
1½ "	19,360	12 "	302
2 feet..........	10,890	15 "	193
2½ "	6,969	18 "	134
3 "	4,840	21 "	98
4 "	2,722	24 "	75
5 "	1,742	27 "	59
6 "	1,210	30 "	48

TRANSPLANTING LARGE TREES.

"The many efforts to transplant trees of large size, and effect their successful thrift, have met with some instances of failure, owing to the want of due regard to the several requirements which tend to the success of the undertaking. In some instances, the injury to the roots on being extracted from the soil, and the after-neglect of precautionary trimming of the injured parts previous to again inserting them, have been the source from whence decay and disease have originated, to the destruction of the growth operated on. Again, the want of experience in the preparation of the soil suitable for transplants, and the preserving of the quietude of the tree till Nature enforces self-reliance and support by her production of agencies for this requisite, have been the cause of failure.

"As the component material forming some soils varies from that of others, it is necessary that the planter be experienced in such matters, so as to come to a correct conclusion of the suitability of the soil to the growth of the species before he undertakes the removal of the tree from its ground. Generally the tree should be transplanted to soil of the same character as that from which it is taken: and this may be held as a criterion of its adaptability, that the nearer these soils approach in character the more confidence may be reposed in the future thrift of the tree.

"One description of soil may be wet and porous, as the clayey sorts, while another may be dry and sandy. Each requires distinct preparation, conformable to many emergencies. The liability of any soil to retain moisture to excess necessitates that such methods be adopted as to prevent the flooding of the roots, which often occurs when the common system of hole-digging in clayey soils is resorted to, where the space excavated becomes a reservoir for the reception of surface-drainage and percolating moisture. When such soil is to be planted in, the best form to give the bottom of the excavation is convex or dome-shaped, so that any water which may pass through the soil is carried off to the sides on its reaching the more elevated portion of the bottom; and, to convey this casual flow to a distance beneath the root-bed, it will be well to have holes bored, say two in each pit, with a post-auger or other instrument. This will keep the roots from an excess of moisture, which would possibly be injurious to them. On no account should the bottom of a pit in which a tree of large size is to be planted have a concave form, as the weight of the tree and of the earth thrown in around it will likely act in such a manner as to induce a distortion of the roots by throwing them out of their natural position, 'which in most trees is at a slight angle from the stem downward.'

"In instances where the roots of transplants, as in seedlings, are so long that they inconvenience the planting of the tree, they are cut off, not entirely, but to a necessary length, as it has been found that by so doing the setting of the roots is hastened by the emission of rootlets from the wounds so made. It may also be borne in mind that it does not follow from allowing numerous roots to adhere to a tree on its being transplanted that each and every one of them will draw sustaining food from the soil. On the contrary, either from disposition, or from decay caused by contact with uncongenial exposure, many become unsustaining; and this fact, therefore, enforces the necessity of due attention being paid to the growth above ground, which should be pruned to conform to the amount of nutriment likely to be supplied to it.

"Another necessary precaution, to prevent the displacement of the roots, when once placed in the ground, and to keep the tree from excessive oscillation, has to be considered. The usual plan adopted for such an emergency is the placing of stakes close to the tree-stem, where they are lashed, their stability being relied upon to keep the tree from being so shaken as to cause any motion of its roots till they have taken firm hold in the ground. Another method in use is the staying of the stem by means of four lengths of wire which are made fast to it at a convenient height from the ground, and extended downward and outward till they reach the surface, where their ends are wound round pegs driven firmly, so as to keep the wire in a state of tension and the tree in an upright position in the centre of the circle so formed.

"Roots of large trees, when placed in ground without pruning, are extended as nearly as possible conformable to their natural repose, and in this position are bound down by means of forked pegs. By the adoption of this plan a great deal of the necessity of outside supports, or stays, is lessened, as the pegs hold the roots so firmly that no danger of their displacement need be anticipated."

CHAPTER LVIII.

THE MEDICINAL PROPERTIES OF THE TREES OF THE UNITED STATES.

THE following chapter has been prepared for this work at my request, by Messrs. Parke Davis & Co., manufacturing chemists, of Detroit, Michigan. I was led to solicit the aid of this firm in the preparation of this portion of my work through the reputation which it has achieved in investigating the medicinal properties of the indigenous flora. Prior to its efforts there had been no systematic attempt in this direction, and such additions to the *materia medica* as had been made from this source were largely through accidental acquaintance with the medicinal virtues of particular drugs. Messrs. Parke Davis & Co. have for several years been investigating our flora, and while they have found many to be of negative medicinal value, the list of those which have proven serviceable is sufficiently large and important to have made a success of their laudable undertaking. These investigations referred to have, moreover, peculiarly fitted them for the task which they have kindly assumed in connection with this book.

As might naturally have been expected of a country of the dimensions of the United States, with its diversity of climate and soil, and the variety in the physical conformation of its territory, the variety of its medicinal flora is great. Nature has in no sense of the word been remiss in her bestowal of medicinal blessings to the people of this country, and, while we are not fully committed to the belief that she has provided in each section a growth of the drugs best suited to the relief of the diseases peculiar to that section, we nevertheless believe, as the result of no little attention to the subject, that there are indigenous drugs much better suited to many of the diseases of this country than are some of the remedies of foreign extraction, the use of which medical fashion has perpetuated since their original introduction.

There are, moreover, but few of the foreign trees from which we derive our medicines which either do not attain to considerable perfection in the natural state in this country, or which may not be successfully cultivated in some section of our vast territory—in some of its valleys, on some of its mountain-sides, or along some of its water-courses. The actual and possible medicinal wealth of the United States of America is imperfectly appreciated even by medical men. Of late years more attention than heretofore has been directed to our indigenous medicinal flora, and the additions from this source to the *materia medica* have been of such a nature as to encourage and stimulate further research in this direction.

In the consideration which we purpose giving the trees of this country which furnish substances employed in medicine we shall not confine ourselves strictly to our indigenous flora, nor to such trees as may be regarded as forest-trees. Some valuable trees have been introduced, and, though they have become naturalized and acclimated, are not strictly entitled to be classed as natives. Some of our flora, too, which are rich in medicinal principles, are not of sufficient size to justify their classification among the forest-trees, that is, in the general acceptation of the term.

In this consideration of trees from a medicinal point of view we shall make no attempt at classification. The difficulties in the way of a perfect classification of drugs are insuperable, and are recognized as such by both physicians and pharmacists. Many efforts, some of which have been exceedingly elaborate, have been made at such a classification, but while each may be tolerably well adapted to the special need desired, none has yet been made which is adapted to the requirements of all. For instance, the classification made by the botanist has nothing especially to commend it to the pharmacist, who has chiefly to do with the physical properties of drugs; while such a one as may be suited to the needs of either of these is of no value to him interested particularly in investigating the physiological action of drugs. Inasmuch, moreover, as the therapeutical properties of medicines cannot be predicated with absolute safety in either their botanical, chemical, or physiological peculiarities, the practical physician requires a classification different from that best suited to the needs of either of the others named. The necessarily brief consideration which we shall give of the medicinal trees of the United States is intended for neither of these professional callings, and we deem it not incumbent on us to attempt a classification adapted to either. Being thus freed from any obligation of the nature indicated, we shall, we think, best subserve the convenience of our readers by a simple alphabetical arrangement of our subjects, and without reference to any of the features selected as bases of classification.

ABIES. The genus *Pinus* of Linnæus is divided into three genera: *Pinus*, *Abies*, and *Larix*. The *Abies* embraces the firs and spruces, of which there are many varieties. Two of these, *A. excelsa* and *A. Canadensis*, are of especial interest, from a medicinal point of view, as furnishing respectively Burgundy and Canada, or Hemlock, pitch. Burgundy pitch is a resinous exudate from the stem of the *A. excelsa*, or spruce fir. The variety most prized is imported from Switzerland. In its pure state it is quite hard and brittle, and of a yellowish-opaque color. Its chief use is as an excipient for various plasters. It is itself lightly rubefacient, and may even produce a slight inflammation in sensitive skins; occasionally also vesication and ulceration may attack the seat of its application. It is useful in rheumatic pains of a chronic nature, and particularly, perhaps, in lumbago. Canada pitch is very closely analogous to Burgundy pitch in its properties, but is more readily softened by heat, a property which sometimes offers an objection to its substitution for the latter.

Æsculus hippocastanum (Horse-chestnut). The bark of the horse-chestnut has been an object of much interest, because of its furnishing a possible substitute for cinchona. The bark of branches of trees of from three to five years of age is considered the best. The claims which have been made for it in this connection cannot, however, be said to have been substantiated, although the bark certainly does possess some degree of antiperiodic property. It may be given in substance or in the form of a decoction or extract. The dose of the bark is from half an ounce to an ounce.

Æsculus pavia, the red buckeye of the Southern States, yields a fruit which is actively poisonous, producing symptoms analogous to those caused by strychnia. It has not been utilized to any extent in medicine.

Ailanthus glandulosa. This tree, popularly known as the "Tree of Heaven," which has been of late years cultivated to some extent in this country as a shade-tree, has valuable medicinal properties. The bark is a very active anthelmintic, its administration being followed by copious stools, with which are usually associated traces of the worm (tapeworm) when it is present in the intestines. The dose for this purpose is about thirty grains.

The bark, or its fluid extract, has also been used with good effect in nervous affections, such as nervous palpitation of the heart, hiccough, etc., and in spasmodic asthma.

ALDER (AMERICAN). The bark of the root of the common, or smooth, alder is possessed of alterative properties, and is also astringent and emetic. It is quite a popular domestic "blood-purifier," and has even received favorable mention as a remedy in scrofula by the medical profession.

ALDER (BLACK). The bark and the berries of the black alder both contain the medicinal principle of the shrub. It is recommended as a tonic and alterative, and enters largely into the proprietary alterative compounds on the market. It has been proposed as a substitute for Peruvian bark, but it cannot supply the place of the latter, except possibly as a tonic and stomachic in dyspepsia. The dose of the powdered bark is about a teaspoonful. A preferable form of administration is the decoction made by boiling two ounces of the bark in three pints of water, down to a quart. One or two wineglassfuls of this is a dose.

AMERICAN ASPEN (see *Populus*).

AMERICAN POPLAR (see Tulip-tree).

AMERICAN SILVER FIR (Balm of Gilead). This is a member of the *Abies* family, already referred to, and is the source of Canada balsam.

ANDROMEDA ARBOREA (Sorrell-tree). This beautiful tree takes its common name from the acid taste of its leaves, which are used by hunters to allay thirst, and form also a pleasant, cooling drink in fevers.

ANGELICA-TREE (*Arabia spinosa*). The properties of this tree reside in its bark, and are described as stimulant diaphoretic. The bark is used in chronic rheumatism and in cutaneous eruptions. In some parts of the country it has a reputed value as a remedy in syphilis. The berries also contain a certain percentage of the medicinal principle of the tree, and a spirituous infusion of them is said to relieve the pain of a carious tooth when applied to the cavity. The bark may be administered either in the form of a fluid extract or in decoction.

Arbor-vitæ (*Thuja Occidentalis*). The leaves or small twigs of this tree are the part used. This drug possesses, to a certain degree, antiperiodic properties, and it has also been used as a remedy in coughs and rheumatism. Within a few years arbor-vitæ has been recommended on the authority of gentlemen of high standing in the medical profession as a remedy in cancer. Dr. J. R. Leaming, of New York City, has spoken of it in a manner which furnishes grounds for no very inconsiderable hope from it in this disease; and Dr. J. B. Rice, of Fremont, Ohio, reports a remarkable cure from its use in the Michigan *Medical News*, of Detroit, Michigan. The position of both of these gentlemen in the profession demands for this article a further and thorough test of the claims which they make for it.

Auranthi (Orange). A native of China and India, the orange was thence introduced into Europe, and afterwards transplanted to America during the early history of the country. Various parts of the tree are used in medicine. The leaves, which are bitter and aromatic, are in some places employed, in the form of an infusion, as a gently stimulating diaphoretic; but the rind of the fruit is the part of most value in medicine. There are two varieties, the bitter and the sweet. The bitter is a mild tonic, carminative, and stomachic; while the sweet is simply aromatic. Neither is much used by itself, but enter quite largely as correctives into various tonic compounds.

Betula lenta (Sweet Birch). This tree is also variously known as black birch, cherry birch, and mountain mahogany. It is remarkable for the aromatic flavor of its bark and leaves, which, in the form of an infusion, are an agreeable and gently stimulating diaphoretic. It yields an oil which analysis has shown to be identical with the oil of wintergreen.

Black Haw (*Viburnum prunifolium*). This tree-like shrub is conspicuous for the beauty of its foliage and flowers. It has within a few years been advanced to the front rank among remedies employed to prevent miscarriages. Although for a long time enjoying a mere local reputation, in some sections, as a remedy in threatened abortion, it was not until the year 1876 that it was brought prominently to the notice of the medical profession, in a paper read before the American Gynæcological Society, by Professor E. W. Jenks, late of Detroit, but now of Chicago, Illinois. The high position occupied by Doctor Jenks in his profession vested his claims for black haw with much interest, and the tests to which they were soon after put have but tended to substantiate them. It acts as a sedative to that irritable condition of the womb which manifests itself both in habitual miscarriages and in painful menstruation, for which latter condition it is perhaps more valuable than even in threatened abortion.

The bark of the root is the part employed, and it is most conveniently given in the form of a fluid extract.

Black Walnut (*Juglans nigra*) is not so extensively employed in medicine as its congener, the white walnut or butternut (*Juglans cinerea*). The expressed juice of the rind is said to have cured herpes, eczema, etc.; and a decoction of the rind possesses also the property of removing worms from the intestines. The leaves have been latterly very highly recommended as a remedy in scrofula.

Black Oak (*Quercus tinctoria*). The black oak is one of the loftiest and most majestic trees of the forest. Its bark is strongly astringent, and is largely employed in tanning and dyeing. Its astringent properties suggest its use in diarrhœa, and as an injection in lax conditions of the mucous membrane of either intestines or other surface covered with this membrane. In relaxed uvula and sore-throat, and as an astringent wash in spongy granulations (proud flesh), hemorrhoids, etc., it has proven of value. The ground bark, incorporated in a poultice, has proven useful in gangrenous or mortified conditions. Baths of a decoction of oak-bark are valuable in weak children, whose lax condition is the result of debilitating disease.

Broad-leaved Laurel (*Kalmia latifolia*), known also as mountain laurel, sheep laurel, calico bush, etc. This tree-like shrub is quite an active poison, and should be employed as a medicine with considerable care. In medicinal doses it is an alterative, depresses the heart's action, and is somewhat astringent. It has been successfully employed, because of its alterative properties, as a remedy in chronic syphilitic affections. Applied externally, the decoction of the leaves has been found valuable in scald head, but owing to the poisonous nature of the substance it must be employed with prudence.

The leaves are the parts employed in medicine, and may be employed either in the form of a decoction or tincture.

Butternut (*Juglans cinerea*). Butternut is a mild cathartic, and operates without pain or irritation, or the subsequent constipation which is the objection to most other cathartics. It is also a domestic remedy of some repute in chronic rheumatism, and in some sections has a reputed value as an anti-intermittent.

The leaves of the butternut have, in the past few years, been recommended in the treatment of diphtheria, and the reports of eminent French experiments have been very favorable, and have to a certain degree been corroborated by tests in this country. A strong infusion is the form in which they are applied, and may be given either as a spray, or applied, by means of a swab, directly to the membrane. If further trials prove equally satisfactory with those which have already been made, butternut leaves will be established as a valuable addition to the *materia medica* for this grave affection.

California Bay Laurel (*Oreodaphne Californica*). An evergreen tree of considerable size, which is indigenous to California. This tree was first brought to notice as a medicine by Dr. L. Mann, of California, who found it of much value in a variety of affections, prominent among which are nervous headache and atonic diarrhœa. Dr. Mann's first reference to the medicinal virtues of the California laurel was in *New Preparations*, in 1879, from which the following is excerpted: "The peculiar odor and effect of the leaves upon myself first attracted my attention to this tree as of value therapeutically, and I have since experimented somewhat with its use in practice. The first effect of inhaling the odor of the leaves is, as I have above stated, an almost unendurable frontal headache, and after a period the spinal nerves are painfully irritated also. Its principal effect, however, is upon the cerebro-spinal nervous system. For several years I have treated nervous headache with the laurel quite successfully by instructing the patient to inhale the odor from the pressed leaves, taking care not to continue the inhalation beyond the point of relief." Dr. Mann discovered another quality in the tree which vests it with additional interest: "The laurel has another use which may seem incongruous when considered in connection with its powerful medicinal action. It is, however, highly prized by all who have used it as a flavor, or seasoning for food. It may be used with roasts, stews, soups, stuffing for game and poultry, sausages, or any preparation of meat where a condiment is necessary. In my opinion it is far superior to any of the savory herbs in use, but great care should be used not to exceed the proper quantity for the purpose, which can only be decided by experience. I am accustomed to use five leaves for a ten-pound roast, and usually lay the leaves upon the bottom of the pan under the meat before placing the pan in the oven. They will bear considerable cooking. A skilful cook will soon learn by experience how much is needed for the desired flavor, and I have no doubt that all who taste it will agree with me that it is the most delicate seasoning which they have found. In my own family we do not consider a soup or roast complete without a flavor of laurel, and should not be surprised that, if properly introduced, it will become as popular and as great a necessity as tea and coffee. I hope that some enterprising chemist will analyze this drug, in order that we may know definitely to what its peculiar properties are due, and whether it is at all objectionable as a dietary article. It is certainly a very contradictory drug, producing in large doses almost toxical effects, while in small doses it becomes a stimulant to the appetite.

CARYA (Hickory). Both the leaves and the bark of the hickory are medicinal. They are possessed of very decided tonic properties, and, when given in the form of infusion, are valuable in atonic dyspepsia, besides possessing also antiperiodic properties sufficiently marked to make them valuable both as a preventive and curative of ague.

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