

# KNOWING YOUR TREES

By  
**G. H. COLLINGWOOD**  
and  
**WARREN D. BRUSH**

*Revised and Edited*  
by **DEVEREUX BUTCHER**



With more than 900 illustrations showing typical trees and their leaves, bark, flowers, and fruits



1964

**THE AMERICAN FORESTRY ASSOCIATION**

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## FOREWORD

We Americans are an outdoor-loving people. At every opportunity we turn to natural beauty for relaxation and enjoyment. Some find it in their own gardens, in the surrounding countryside; others follow highways and byways to distant forests and parks. But whether at our own doorstep or at timberline on some mountain peak, the greatest single factor in this quest is trees.

As individuals, trees shelter and beautify our homes, shade our streets and highways, give charm and dignity to our parks, life and character to our landscapes; in tree communities, they form our hillside woodlands, our forests that sweep to the horizon. Just as products of the forest contribute in a thousand and one ways to our day-by-day life, so do living trees contribute at all seasons of the year to our relaxation and enjoyment.

Thus to know more about trees is to enhance the pleasure we derive from them. And to this purpose KNOWING YOUR TREES is dedicated—to bring to the American people, in picture and in story, the characteristics and important contributions trees make to society. Identification is made easy by actual photographs of the tree, both winter and summer, its leaves, fruit, bark and, when significant, its flower. To obtain such a comprehensive assembly of photographs, The American Forestry Association for years has been searching collections and working directly with photographers in every corner of the nation.

Initial work on KNOWING YOUR TREES was begun in 1932 by G. H. Collingwood, then forester for the Association, and in 1937 the first edition was issued. This was revised in 1941. At this juncture Dr. Warren D. Brush, nationally recognized authority on woods, took up the work and contributed material for additional trees.

By 1963, texts were out of date and the original page forms had become so worn from repeated printing, that it was necessary to edit the texts and reassemble hundreds of photographs or take dozens of new ones for future printings, beginning with the nineteenth, in 1964.

Because Devereux Butcher, in the late 1930's and early 1940's had contributed more than seventy photographs to the early editions of the book, had written a number of texts, and since then has had years of experience in writing, editing and publishing, as well as in photography, in the natural history and nature protection fields, he was chosen to do this work.

Common and scientific names used in the text conform generally to those accepted and published in *Standardized Plant Names* as prepared for the American Joint Committee on Horticultural Nomenclature, although in several cases common names in widespread usage have been retained.

Sources of photographs have been acknowledged throughout.

# EASTERN WHITE PINE

Soft pine, Weymouth pine

*Pinus strobus*, Linnaeus

WHITE PINE, long known as monarch of the eastern forests, flourishes from Newfoundland to Lake Winnipeg in Manitoba, southward through eastern Minnesota, to north-eastern Iowa, and east through Wisconsin, Michigan, New York, New England and Pennsylvania, and along the Appalachian Mountains to northern Georgia. European foresters recognize it as Weymouth pine for Lord Weymouth, who planted it more than two hundred years ago on his English estate.

The sturdy, gradually tapering trunk and the horizontal limbs of the blue-green crown of white pine are a characteristic feature of many northern forests, where trees with trunks six feet in diameter and crowns reaching to a height of 250 feet were reported by the early lumbermen. Next to the sugar pine of California, eastern white pine is the largest pine growing in the United States.

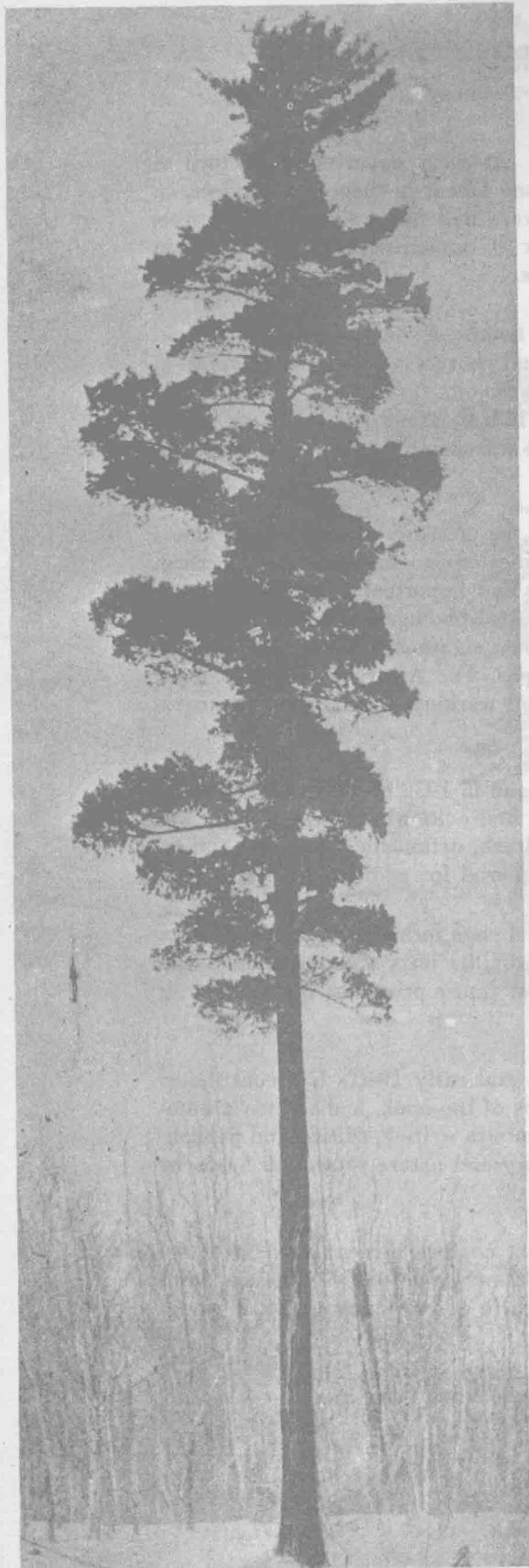
The blue-green needles, three to five inches long, are always borne in bunches of five, and remain on the tree from three to five years. A loose, papery, brown sheath surrounds their base during the spring and early summer. In May and June yellow staminate cone-like blossoms appear on the new shoots of the lower branches and produce quantities of pollen, which is borne great distances by the wind. At the same time, small bright pink cone-bearing ovulate flowers with purple scale margins occur on the ends of the upper young shoots. The staminate blossoms wither and fall soon after they have lost their pollen, but by the end of the first season's growth the tiny upright, green cones are about an inch long. Early in the second season these elongate, turn down the increasing weight, and grow to a length of four to eight inches before turning brown and maturing in August. In September the cone opens and winged seeds are discharged to be carried as far as a quarter of a mile by the wind. The scientific name *strobis* probably refers to the conspicuous cone, being derived from Greek and Latin words for pine cone.

On the branches and young trunks, white pine bark is thin, smooth and greenish brown, but with increasing age it becomes fissured, ridged, darker and heavier, until it may vary from less than an inch to four inches in thickness according to the age and exposure.

During the first few years white pine develops a moderately long taproot, with spreading lateral roots. This helps to make young trees easy to transplant. As the tree matures the lateral roots develop more vigorously than the taproot, resulting in a shallow root system similar to that of spruce.

White pine lumber ranks among the principal economic woods of North America. It is creamy white to reddish brown, soft, straight-grained, may be cut with ease, polishes well and when seasoned warps or swells but little. Almost everything from ships' masts to matches, including doors, floors, framing, finish, patterns, models, boxes, crating and novelties have been made of this versatile wood, but it is now largely restricted to the more exacting uses. A cubic

Typical straight trunk of a forest-grown Eastern White Pine. The whorls of the tree's horizontal branches form a narrow irregular crown



T. F. Kouba

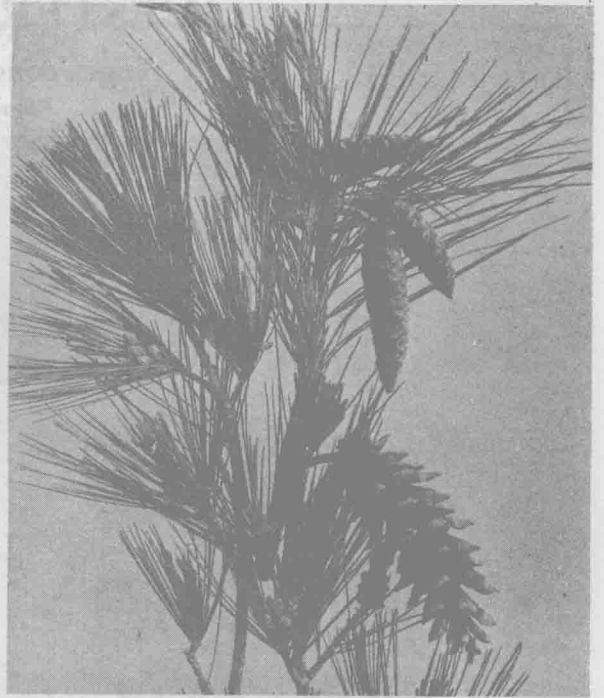
foot when air dry weighs twenty-four to twenty-seven pounds. It is probably the least resinous of all the pine woods, but has a mildly resinous odor. Although not noted for its strength, it compares favorably with ponderosa pine, cottonwood and basswood. The original stand of white pine in the United States and Canada was approximately 750,000,000,000 board feet, of which 600,000,000,000 was in the United States. King of American commercial woods before the present century, it is now exceeded in quantity of lumber produced by the southern pines as a group, Douglasfir, the oaks and ponderosa pine and hemlock.

White pine thrives on deep sandy loams, but will grow under a variety of soil conditions where adequate moisture is available. It grows in nearly pure stands and in mixture with hardwoods, as well as with hemlock and red pine. White pine of the original forests grew to be two hundred to two hundred and fifty years old, with occasional trees of three hundred to three hundred and fifty years. Under modern economic conditions, however, trees are usually cut at sixty to eighty years when they measure from twelve to seventeen inches in diameter and are from eighty to one hundred feet tall. In the original forests, trees from thirty to forty inches in diameter required at least two hundred and forty years to grow. White pine reproduces readily from seed, and with fair soil, sunlight and moisture, will reach heights of ten feet in ten years, twenty-five feet in twenty years, sixty feet in forty years, thus averaging fifteen to eighteen inches each year. Similar trees forty years old may measure from seven to nine inches in diameter and yield fifty to eighty board feet of merchantable material. It is the most rapid growing northern forest tree, occasionally averaging a yearly growth of one thousand board feet an acre over periods of forty to eighty years. It responds to silvicultural treatment and has been more widely planted than any other American tree.

Fire, white pine blister rust and white pine weevil are the white pine's principal enemies, although other pests, such as white pine scale, the pine sawyer and several root fungi and rots, cause heavy damage. Forest fires are particularly damaging to the young growth. Fire is an enemy common to all trees, but white pine blister rust, which entered this country from Europe about thirty years ago, is peculiar to the five-needled pines and takes a heavy toll. This can be controlled by destroying all gooseberry and currant bushes, which are intermediate hosts of the disease, that are found growing within the forest in the vicinity of the trees to be protected. Without the leaves of these plants the disease can neither complete its life cycle nor infect other white pines.

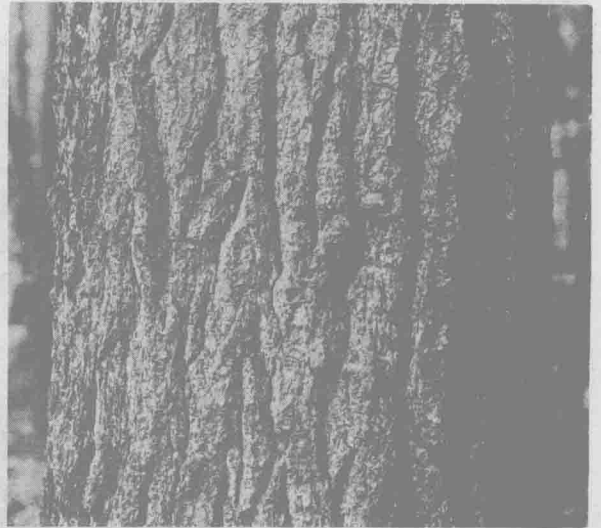
Throughout parts of its range the leader shoots of white pine are killed by the white pine weevil. The tree is not killed, but frequently is so deformed as to make it valueless for lumber. No satisfactory control of the weevil has been developed.

White pine is seldom used for street or roadside purposes, but its vigorous growth and attractive color cause it to be favored as an ornamental tree for lawn and park purposes, as well as for a background for other plantings. It is successfully grown considerably beyond its natural range, and has long been planted in northern Europe.



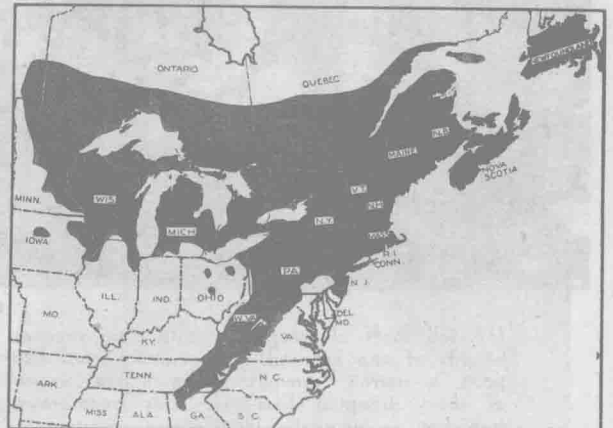
J. Horace McFarland

Long tapering cones, slender bluish green needles in bunches of five, and clusters of yellow pollen-bearing blossoms



U. S. Forest Service

Broad, flat-topped, dark gray longitudinal ridges characterize Eastern White Pine bark



Natural range of Eastern White Pine



# WESTERN WHITE PINE

Finger-cone pine, Idaho white pine

*Pinus monticola*, Douglas



Weldon F. Heald

The tall shaft of Western White Pine reaches heights of one hundred feet or more and supports a narrow, symmetrical, pyramidal crown of short drooping branches. This open-grown tree has an unusually long crown. Frequently, more than half of the trunk is clear of branches

WESTERN WHITE PINE, the silver pine of the Northwest, is native to the region from southern British Columbia across northern Idaho, Montana and Washington, southward through Oregon into California. True to its name, *monticola*, it is confined to the mountains, where in Idaho and Montana it is found at elevations of 2,000 to 5,000 feet above sea level, somewhat higher in Washington and Oregon and up to 10,000 feet in California.

Ranking among the important timber trees of America, western white pine frequently grows in dense stands and develops a tall, slender shaft with a peculiarly short-branched, narrow, symmetrical crown. The trunk is usually clear for a half to two-thirds of its length, has little taper and the slender drooping branches seldom extend more than twelve to fifteen feet. These trees may reach heights of 175 feet and be eight feet in diameter at breast height, but they are more often ninety to 110 feet high and two to three feet in diameter. Rapid growth is combined with long life, for trees of 200 to 500 years are not uncommon.

The silvery gray bark sometimes takes on a tone of purple and is broken into small oblong or rectangular blocks. Trees exposed to the wind become distinctly cinnamon in color. Even on mature trees the bark is seldom more than one and a quarter inches thick, while that on young trees and branches is thin, smooth and bright gray. Very young twigs and shoots are covered with a fine reddish down, which helps distinguish this tree from other white pines.

The pale bluish green leaves or needles are two to four inches long, commonly with a white, frosty appearance and are borne in bundles of five. They differ from the needles of eastern white pine in being thicker and more rigid. They remain three or four years or longer.

The yellow pollen-bearing, staminate flowers or catkins are borne during early spring in clusters of six or seven on the lower branches, while the pale purple ovulate flowers occur on long stalks near the ends of the high branches. From these higher blossoms develop green or dark purple cones, which first stand erect, then become pendulous by the close of the first season. By the end of the second summer they turn yellow-brown and mature to a length of six to ten inches, or occasionally fifteen inches. The slightly curved cones are longer than those of eastern white pine and are so slender as to give rise to the name "finger-cone pine." Trees seldom bear fertile cones before forty to sixty years of age, and then infrequently at intervals of two or more years. Under each cone scale may be found two pale red-brown seeds about a third of an inch long attached to a narrow wing from three-quarters of an inch to an inch long. The seeds are shed in September and October after the cones ripen and may be carried by the wind several hundred feet from the parent tree. Buried in duff and well shaded, seeds retain their vitality several years. Over most of its range the tree reproduces sparingly and the seeds germinate best on exposed moist min-

eral soil, or on humus which keeps moist through the growing season. Many stands of white pine came into being as even-aged forests following the forest fires of 1889 and 1910, from seeds stored in the duff or released from cones that escaped destruction. Seedlings and young trees will endure shade, but, as the tree becomes older, more and more sunlight is demanded.

The pale brown to nearly white wood weighs only twenty-four to thirty pounds to the cubic foot, is straight-grained and easily worked. Although not strong, it is harder and stronger than eastern white pine and for many purposes compares favorably with cypress, any of the spruces and Douglasfir. Its high commercial value is attested by the fact that, among the species with which it is associated, few command a higher price. It is used widely for structural purposes, window and door frames, moldings, matches, and pattern stock.

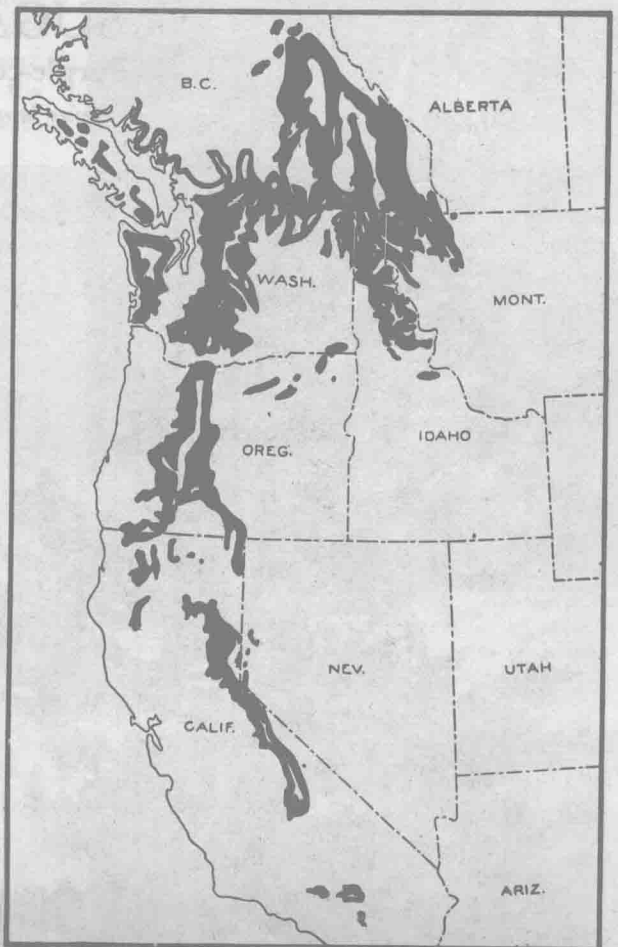
Western white pine develops greatest size and highest economic importance in deep porous soils, on gentle north slopes and flats in northern Idaho and Montana. It seldom grows in pure stands and is most frequently associated with western hemlock, Douglasfir, the several western firs and lodgepole pine. Deep snowfall, a mean annual precipitation of fifteen inches in California to sixty inches near Puget Sound, and a comparatively short growing season characterize the regions where this pine thrives.

While subject to disastrous losses from fire, protection against which is essential, its most dangerous enemy is the white pine blister rust. This fungus disease, first reported on the west coast in 1910, has made serious inroads upon scattered stands of young growth as far south as California. The fungus must find opportunity to live for a period upon the leaves of currant\* and gooseberry bushes before going over to the white pines, and cannot live where either the white pine or currant-gooseberry hosts are absent. Accordingly vigorous efforts are being made by the federal government, supported by the states and private landowners, to control the disease by destroying all the bushes in localities where the white pine is of commercial value.

The mountain pine bark beetle, *Dendroctonus monticolae*, is the principal insect enemy and causes losses amounting to thousands of dollars each year. Control can be secured by felling the infected trees, peeling the bark and burning it. It is subject also to pests common to eastern white pine, but no others are of special significance in its natural range.

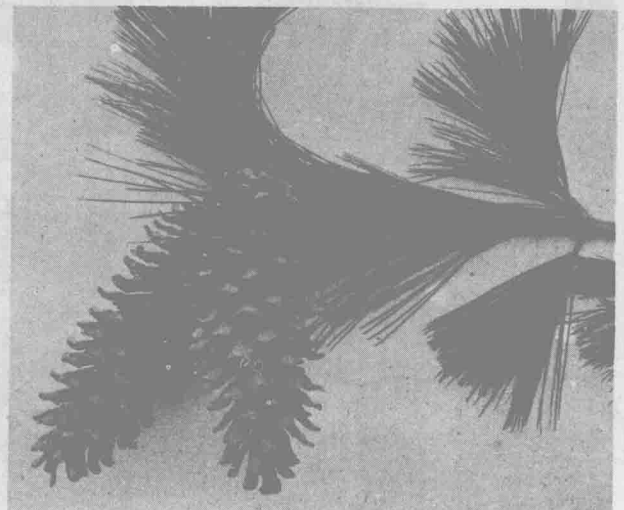
David Douglas, the Scottish explorer and botanist, first reported western white pine on the slopes of Mount St. Helens in Washington in 1825. Soon after, seeds were sent to England, where the tree grows successfully. Because of its extreme hardiness, attractive color, compact pyramidal form and rapid growth during the first years, it is highly desirable for ornamental purposes on home grounds in the Northwest, and as far north as Ottawa, Ontario.

Western white pine is characterized by blue-green needles in bunches of five, cones six to ten inches long, and blocky bark that is gray, grayish purple, or cinnamon in color



Bu. Entomology and Plant Quarantine

Bu. Entomology and Plant Quarantine



# SUGAR PINE

Purple-coned sugar pine

*Pinus lambertiana*, Douglas



SUGAR PINE is the tallest and most magnificent of all the pines. It is one of the *Quinae*—or five-leaves-in-a-bundle pines—and is confined to a narrow strip about 1,000 miles long extending from southwestern Oregon, along the western slopes of the Sierra Nevada and coast ranges of California at elevations of 1,000 to 9,000 feet above sea level, to lower California. Heights of 245 feet, and diameters, breast high, of twelve to eighteen feet have been recorded, but trees 160 to 180 feet high and four to seven feet in diameter are more common. The straight cylindrical trunk of mature trees frequently rises fifty to eighty feet to the first few long horizontal limbs which form the base of a wide crown. These great branches sweep outward and downward in graceful curves. With maturity, the spire-like outline of sugar pine assumes a flattened top similar to that of old eastern white pines. Trees attain ages of 300 to 500 years, and occasionally nearly 600 years, and stand on a broad, shallow root system.

First recorded in 1825, on the Multnomah River in southern Oregon, by David Douglas, it was named *Pinus lambertiana* in honor of his friend, Dr. Aylmer Bourke Lambert, a distinguished British botanist of that time, and author of a book on pines. The name sugar pine refers to the white, crisp globules of resin which exude from the bark after injury. These are sweet, with a pleasant suggestion of pitch flavor, and possess certain cathartic qualities.

As with all true white pines, the deep blue-green needles, which have a whitish tinge, are borne in groups of five. They are two and a half to four inches long stout, stiff, twisted, and remain on the twig through the third year. In early spring light yellow, pollen-bearing flowers, half an inch to an inch long, are borne in clusters on young twigs, simultaneously with light green or pale purple ovulate cones. Before maturing, the cones become dark purple-brown, and stand erect, giving rise to the name "purple-coned sugar pine." By August of the second year, the cones, which are the largest of all pine cones, become pendulous. They attain lengths of eleven to eighteen inches, or occasionally twenty-one inches, and two and a half to three and a half inches in diameter. In October the scales expand to release hundreds of dark, chestnut-brown, winged seeds. Each has a wing one and a half to five inches long, and an edible kernel

U. S. Forest Service

Largest of all pines, the Sugar Pine, magnificent Pacific Coast tree, attains mature heights of 200 to 245 feet



about the size of a grain of corn, which is relished by many birds and mammals. The cones remain on the tree for two or three years. Heavy seed crops occur only at intervals of four to six years and trees under twenty inches in diameter seldom bear. The seeds are carried by the wind about the same distance as the height of the tree. They germinate best on loose, moist soil with a little litter of decayed leaves.

The bark of mature trees is deeply and irregularly grooved into long plate-like ridges, covered with loose purple-brown to cinnamon-red scales, and is two to three inches thick. On young trees the bark is thin, smooth and dull dark gray in color.

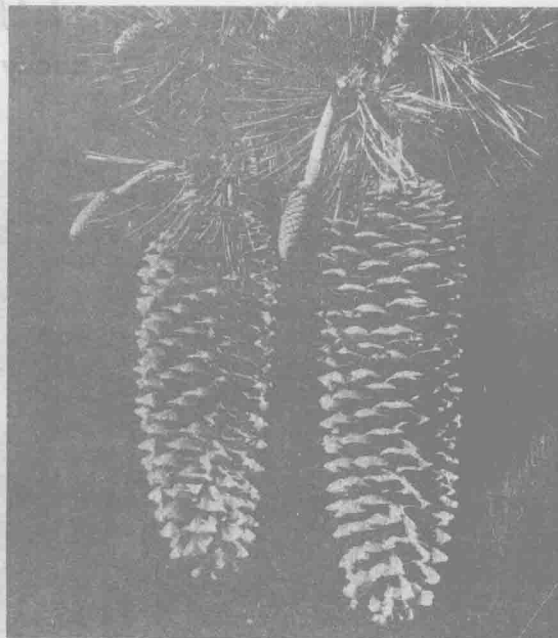
The light colored, soft, straight-grained wood is fragrant, and satiny when planed. It is similar to that of eastern white pine, except that it is whiter, changes color less on exposure, has more conspicuous resin ducts, and has a slightly coarser texture. The wood weighs twenty-two to twenty-five pounds to the cubic foot when air dry. Although not as strong or stiff, it enters into all the uses of eastern white pine. Its remarkable freedom from any tendency to warp and twist with changing moisture, its durability in contact with the soil, and the large boards which are possible, cause it to be used for general construction, interior trim, patterns, and model making. Sugar pine is produced only in Oregon and California where it ranks in volume and value with redwood.

It grows at elevations of 1,000 to 2,000 feet in the coast range, and from 6,500 to 9,000 feet in the Sierra Nevada, in loose, deep, moist but well-drained sandy loams where air humidity, as well as soil moisture, are favorable. Best growth is found in the mountains where the annual precipitation is forty inches or more. Western yellow pine, white fir, Douglasfir, incensecedar, Jeffrey pine and giant sequoia are its principal associates.

Seedlings and trees up to twelve inches in diameter are easily damaged by fire. Thereafter the thick bark and high crown protect the trees against ordinary fires. Lightning is a frequent source of damage because the larger trees stand out above their fellows. Young trees are occasionally attacked by mistletoe, which kills or stunts them. Snow frequently accumulates to a depth of ten or fifteen feet, causing severe breakage to small trees, followed by insect damage, but until white pine blister rust entered the western forests, sugar pine was remarkably free from serious enemies. Because of its great value, the federal government is cooperating with California and Oregon and with private owners to control the disease by destroying all currant and gooseberry bushes within its commercial range. The fungus must spend part of its life on these bushes before it goes on to the pine.

Sugar pine sustains a rapid rate of growth to a remarkably advanced age. During its first century of life, favorably located sugar pine will average one foot in height-growth each year. Many acres with 192,000 board feet of merchantable timber have been recorded, while 75,000 to 150,000 board feet to the acre are not uncommon. The ability of young sugar pine to endure shade enables it to start among other species, but as it grows older it demands more and more sunlight. It meets severe competition, however, from ponderosa pine.

Although not widely planted for reforestation or ornamental purposes in the West, individual specimens for sugar pine have been established in a number of eastern states. It has proved hardy in sheltered locations, as far north as Massachusetts, but under these conditions grows more slowly than the native eastern white pine, *Pinus strobus*. David Douglas introduced sugar pine in England in 1827, and occasionally specimens are now found among collections of trees on estates and in parks there.



George E. Stone

Sugar pine has the largest cones of all—ten to twenty inches. The bark is three inches thick, gray-brown, broken into ridges



U. S. Forest Service

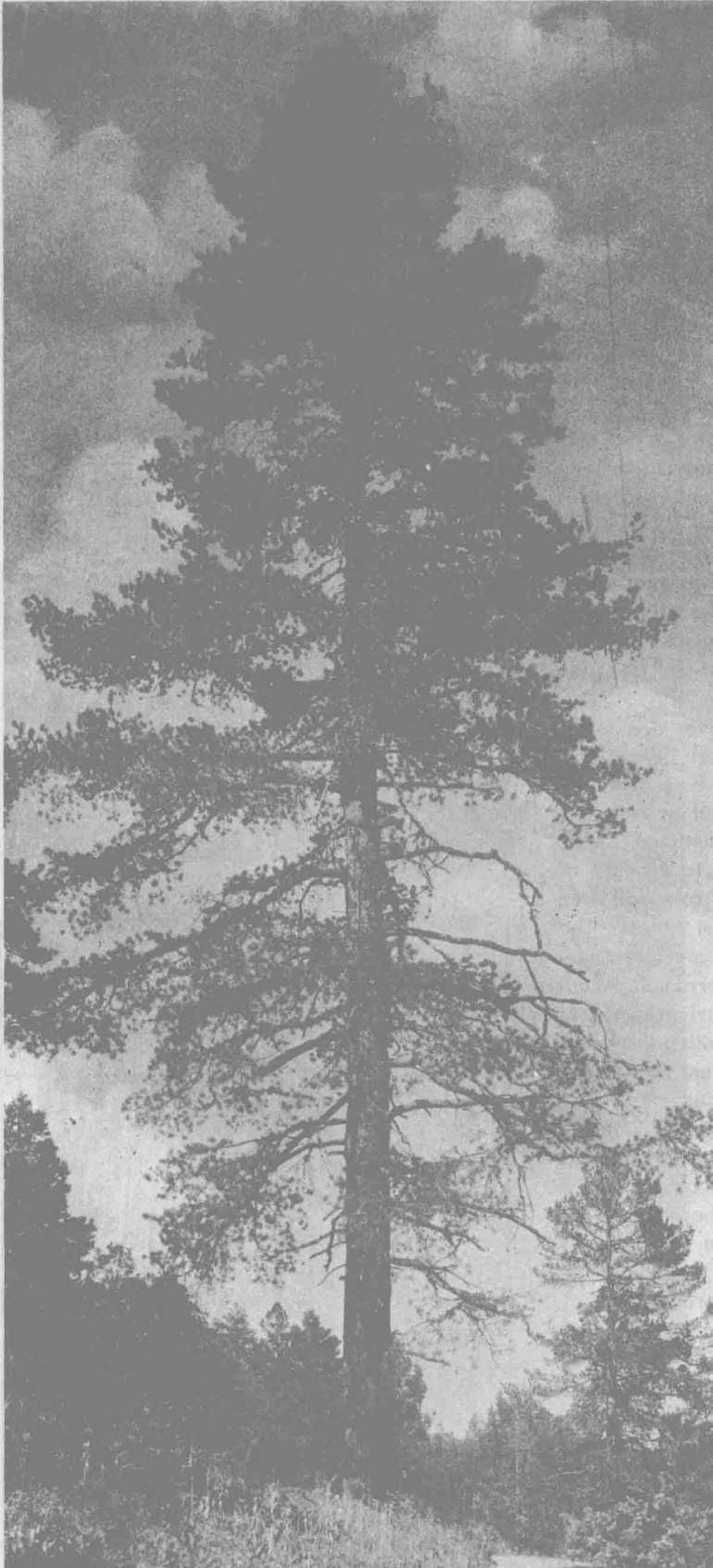


Natural range of Sugar Pine

# LIMBER PINE

## Rocky Mountain white pine

*Pinus flexilis*, James



LIMBER PINE is one of the smaller white pines. It is usually bushy, with branching trunks, and when growing near timberline may be only a dwarf ground cover. It grows singly or in small groups throughout the higher eastern slopes of the Rocky Mountain region from Alberta and Montana to western Texas and northern Mexico, and westward into Nevada and southern California. It is fairly common at elevations between 4,000 and 12,000 feet on exposed, rocky slopes, the tops of ridges and foothills, and sometimes in moist canyons or along the banks of mountain streams.

Usually a low, many-branched tree, limber pine occasionally develops an undivided trunk thirty, fifty, or even eighty feet tall, whose diameter is two to five feet. Ordinarily, however, the trunk tapers rapidly, and is seldom clear of branches for more than ten to twenty feet. Distinctly regular whorls of slender, tough branches stand out at right angles to the main trunk of smaller trees, and may extend to the ground. Larger trees have extremely long branches which bend gracefully toward the ground. The outer ends of the branches of the upper crown tend to assume a vertical position, giving a peculiar up-reaching effect. The twigs and branches are capable of being bent to such an amazing extent that it is called limber pine, and scientists named it *flexilis*.

Growth is slow, but its life is fairly long. Individual trees may take 200 years to attain diameters of nine or ten inches, while others may reach eighteen to twenty-two inches in 200 to 300 years. Some trees are believed to live 1050 years or more. Trees of greatest size are found in the high mountains of Arizona and New Mexico.

Each stout, stiff, dark green needle is one and a half to three inches long in closely pressed clusters of five. The needles remain on the twig for five or six years. They are forward pointing, densely crowded and compressed rather than flaring, and appear as short tufts on the ends of the branches. Under a magnifying glass the margins are smooth with only an occasional semblance of teeth.

Limber Pine is a white pine of the high mountains. It has a relatively short trunk and long slender branches

Reddish, pollen-bearing, staminate flowers are borne on spikes throughout the crown, while the bright red-purple ovulate cone-bearing ones are generally in clusters near the top. The relatively thick, oval cones mature in late summer or early autumn of the second year, and shed their seed in September or early October. The cones are three to ten inches long, peculiar in that their broadly oval, light yellowish brown scales are greatly thickened, but without prickles, and are green or rarely purple at maturity. Instead of hanging down from the branch they remain erect, and at maturity stand out horizontally or decline only slightly. By early winter they fall from the trees without breaking up. The hard shelled, deep reddish brown seeds are mottled with black and are from a third to a half inch long. Each narrow, rudimentary wing generally remains on the inner cone scale so as to leave a clean seed. Large seed crops occur at irregular intervals, but small quantities are released locally nearly every season. They are sought out by birds and rodents, which play an important part in disseminating them.

The cone, seed and needle characteristics of both limber pine and whitebark pine (*Pinus albicaulis*) help to distinguish these two species from the other American pines. With certain mountain pines of the old world, they are classed as *cembrae* or stone pines, in distinction to the more common and usually larger white pines of the *strobi* group.

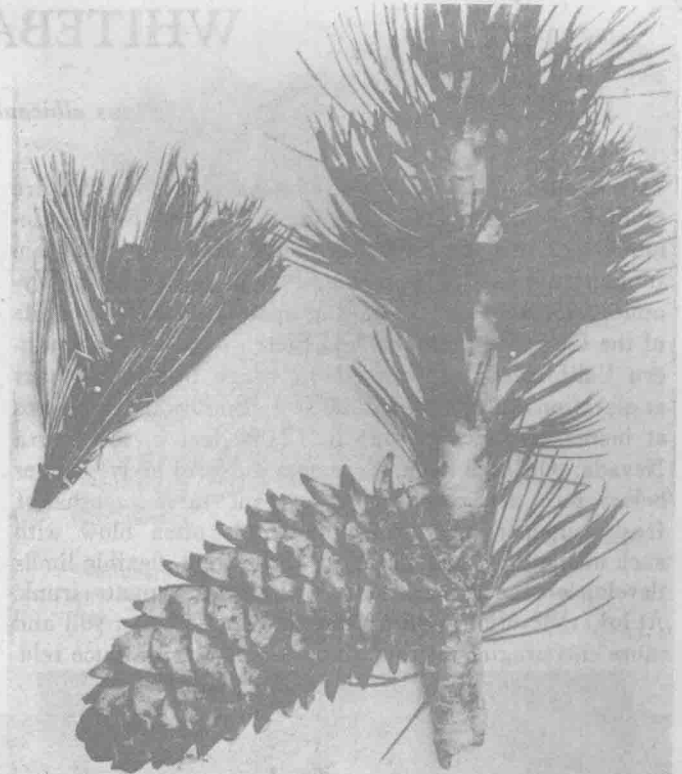
The bark on old limber pine trunks is dark brown or almost black, one and a half to two inches thick, with deep furrows between wide rectangular blocks. On trees eight to twelve inches in diameter the bark is broken into small, thin, gray-brown plates, while on younger trees it is a bright gray, often silvery, thin and smooth.

The tree's exceedingly slow growth and limby structure cause the light, soft wood to be dense and usually full of knots. The heartwood is pale lemon yellow, while the thin layer of sapwood is nearly white. The wood is very heavy when green, but a cubic foot when air dry weighs only about twenty-eight pounds, and is seldom found in commercial sizes. It is occasionally used for rough construction lumber, as well as for log cabins, fuel and mine props.

Pure stands of limber pine are sometimes found, but this species is more common as an individual, or in small groves in mixture with mountain hemlock, Lyall larch, whitebark, lodgepole and bristlecone pines at high elevations, and with Douglasfir, white fir, Engelmann spruce, and ponderosa pine at lower elevations. It is less abundant in the Pacific Coast states than in the Rocky Mountains region.

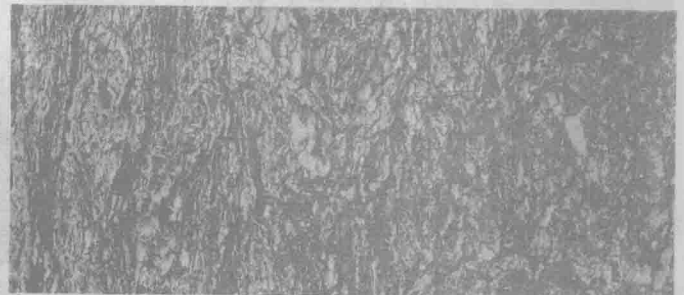
Young trees, especially, suffer heavily from surface fires, but the long taproot and the flexible limbs make limber pines resistant to wind damage. As with other five-needled pines, it is subject to white pine blister rust, but the generally scattered distribution seldom calls for special protective measures.

While not suited for forest planting, the slow growth and unusual outline of limber pine, resulting from the horizontal and pendulous branches, indicate possibilities for landscape use. It prospers under most western conditions, and thrives in the Northeast when planted in well drained soil at the base of a moist slope.



U. S. Forest Service

One- and two-year-old cones grow among the forward-curved needles which are in bundles of five



U. S. Forest Service

The gray bark of youth turns brown and rough with maturity



Natural range of Limber Pine



# WHITEBARK PINE

*Pinus albicaulis*, Engelm

THE wind-distorted crown of whitebark pine is a feature of high mountain areas from north central British Columbia, southward irregularly along the Rocky Mountain summits of Alberta, Montana, Idaho, northwestern Wyoming, and northern Utah, and again along the summits of the Cascade Mountains and Sierra Nevada into southern California. In its northern range this pine grows at elevations of 6,000 to 7,000 feet. Southward it thrives at increasing elevations up to 12,000 feet in the Sierra Nevada. On high summits temperatures of sixty degrees below zero are relieved by a scant three months of frosty summer, and prevailing winds often blow with such unabating force that most of the stout, flexible limbs develop on the leeward side of the thick, squatty trunk. At lower elevations and in protected coves, better soil and more encouraging surroundings combine to produce rela-

tively tall and symmetrical trees. Even here, however, heights of more than sixty feet or diameters exceeding two feet at breast height are rare. Where undisturbed by wind, the side branches, and especially those of the upper crown, stand almost erect.

Whitebark pine has five stout, stiff, slightly incurved needles in a bundle, therefore belonging to the white pine group. The needles are one and a half to two and a half inches long, marked on the back with one to three rows of light colored pores or stomata. The needles are usually clustered toward the end of the stout, orange branchlets, and remain from four to eight years before they are shed.

Scarlet male and female catkins appear during early July on the growth of the preceding year. In late summer of the second year, the ovulate ones develop into small round, almost stemless cones which are one and a half to three inches long. They ripen in August and are ordinarily a dark purplish brown. Inside and at the base of each cone scale are two sweet-kernelled, winged seeds, plump on one side and flattened on the other. They are nearly half an inch long and about one-third of an inch in diameter. The narrow translucent wings stick to the sides of the cone scale so that the seeds must break loose. They are shed slowly through the late autumn and early winter. Squirrels, chipmunks, and other small animals and birds seek them greedily and are largely responsible for their distribution. The busy rodents often store the seeds in narrow rock crevices on high, exposed elevations where germination may take place. Too often the tender young seedlings are whipped and worn in two against the sharp granite rocks by constant winds. At high elevations the surviving trees may sprawl over the rocks to form low springy mats of tough limbs, which provide shelter for mountain goats, bears, deer, and other animals, and not infrequently for an occasional traveler or sheep herder. Heavy snows keep the trees flattened during most of the year, leaving little time for the limbs to lift themselves. The bark of the larger trunks sometimes carries a whitish cast, while young trunks and twigs



Devereux Butcher

A dweller of high places, subject to unabating winds, Whitebark Pine develops a thick, squatty form which with age and depending on exposure may become distorted in shape



are clothed with fine, white pubescence. This is responsible for the common name "whitebark," as well as for the scientific name *Pinus albicaulis*, which may be translated as "the pine with the white stem."

The bark is scarcely more than half an inch thick and comparatively tender. For many years it remains characteristically smooth, but with maturity develops narrow vertical and horizontal cracks with the outer surface covered by thin light gray to brown scales. Beneath the scales, the inner bark is reddish brown. The winter buds are more or less egg-shaped, and about one-third to one-half inch long.

Whitebark pines are seldom large enough or in sufficiently heavy stands to be of commercial importance. Occasionally, however, individual trees at lower elevations may be cut for fence posts or lumber. The wood is light in weight, nearly white, brittle, and marked by many close annual rings. Superficially, it resembles the wood of western white pine and, no doubt, small quantities are sawn and marketed with this more important relative. No figures are available for the stand estimate.

During its early development, whitebark pine is fairly tolerant to shade, but with maturity it demands full sunlight. Its growth is so slow that timberline trees scarcely five feet high have been found to be fully 500 years old. Other trees only three and a half inches in diameter have revealed as many as 225 annual rings. John Muir, with the aid of a magnifying glass, is reported to have counted seventy-five annual rings in a twig only one-eighth of an inch in diameter. A veteran tree with a trunk seventeen inches in diameter is recorded as being 800 years old.

Ordinarily whitebark pine associates with other hardy mountain trees such as alpine fir, limber pine, Engelmann spruce, foxtail pine, Lyall larch, western juniper, Rocky Mountain juniper, and knobcone pine. Of all these trees, whitebark pine is most frequently confused with limber pine, *Pinus flexilis*. In general the range of whitebark pine is more northerly, but the two trees may occupy the same area in several regions. Both are five-needled pines with many common characteristics. They are best distinguished by their cones. Limber pine cones are three to ten inches long, with slightly reflexed scales, while those of whitebark pine are only one and a half to three inches long and more nearly cylindrical, with thickened scales armed with sharp points. The rows of light colored pores or stomata are on all sides of the limber pine needles instead of being limited to the back side, as with whitebark pine.

Like all five-needled pines, whitebark pine is susceptible to the white pine blister rust. Because of its scattered growth and relatively low commercial value, however, no special protective efforts are being made. Bark beetles also take a fairly heavy toll, but the greatest enemy is fire. Its natural habitat makes it particularly susceptible to lightning.

Whitebark pine is suitable for ornamental purposes and is so used to a limited extent. Trees selected from high elevations may maintain an inherited tendency to develop low spreading forms suitable for many landscape purposes.



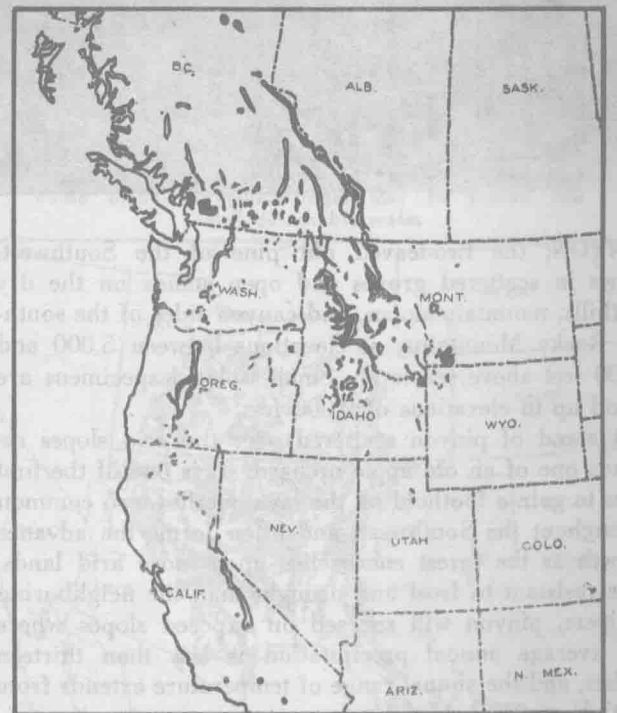
Asahel Curtis

Whitebark pine has stout, stiff, in-curved needles, one to two and a half inches long, in bundles of five. The cones are small, almost stemless and dark, purplish brown



Devereux Butcher

The pale gray cast of the bark and stems gives Whitebark Pine its name



The natural range of Whitebark Pine

# PINYON PINE

Colorado pinyon pine, Nut pine

*Pinus edulis*, Engelmann



U. S. Forest Service

Low, round-headed Pinyon Pines, with far-reaching horizontal branches, grow in open stands over the lower slopes of the southern Rocky Mountains

PINYON, the two-leaved nut pine of the Southwest, grows in scattered groves and open stands on the dry foothills, mountain slopes, and canyon sides of the southern Rocky Mountains, at elevations between 5,000 and 8,000 feet above sea level. Small isolated specimens are found up to elevations of 9,000 feet.

A stand of pinyon scattered over the arid slopes reminds one of an old apple orchard. It is one of the first trees to gain a foothold on the lava overflows so common throughout the Southwest, and often forms the advance growth as the forest encroaches upon more arid lands. Less resistant to frost and drought than the neighboring junipers, pinyon will succeed on exposed slopes where the average annual precipitation is less than thirteen inches, and the annual range of temperature extends from 110° F. to 25° below zero.

This is one of four nut pines of the Southwest. Chief

among the numerous details by which they may be distinguished is the manner in which the leaves or needles are borne. The Parry pinyon, *Pinus parryana*, has the needles in clusters of four; the Mexican pinyon, *Pinus cembroides*, usually in clusters of three; the singleleaf pinyon, *Pinus monophylla*, usually has single leaves; and the stout, dark, yellowish green needles of *Pinus edulis* are borne in pairs or occasionally in clusters of three. The ranges of these pines overlap, but all are confined to the Southwest. The needles of *Pinus edulis* are sharp-pointed, often curved, with smooth margins, and seven-eighths of an inch to one and three-fourths inches long. Those of seedlings and of new growth are a bright bluish green. They remain on the branches as long as nine years but begin to fall with the fourth season.

This small, scraggy nut pine grows in association with the western junipers, ponderosa pine, Gambel oak, the

mountain mahoganies, and in pure stands over small areas. As the range extends south from northern Colorado over New Mexico to the Pecos River in Texas and throughout much of Arizona and southeastern Utah, it forms a woodland type of considerable local importance. Best growth is attained on mesas and slopes where the sandy or gravelly soil is moderately deep and rich, but the tree is more frequently found on poor rocky soils.

In the early spring elongated clusters of dark red, pollen-bearing, staminate flowers cover the tree, while on the ends of the twigs are short-stalked, purplish, ovulate blossoms. The staminate flowers soon drop, but the ovulate ones develop in August and September of the second year into egg-shaped, shiny, yellowish brown cones about an inch to two inches long. The cone scales are relatively few in number and without prickles. In pairs, on the scales near the middle of each cone, are two to thirty red-brown, mottled, nut-like seeds.

Piñon (pin-yone) is the name given by the early Spanish explorers. The tree was described by Cabeza de Vaca in 1536. Although several other pines produce edible seeds, the scientific name *Pinus edulis* refers specifically to the large seeds of this tree.

Although piñon bears abundant crops of seeds at intervals of two to five years, only a small percentage is fertile, and the power to germinate is soon lost. So large a part of the crop is eaten by birds, small animals, and gathered by Indians or local settlers that natural reproduction is poor. Weevils may also enter the seed before the cones open. For these reasons, the maintenance and reproduction of natural stands is difficult.

Pinyon nuts were formerly a staple item in the fall and winter diet of southwestern Indians and Mexicans, but they are now sold largely for use as a delicacy. To prevent the seeds from spoiling and to retain their flavor, they are usually baked immediately after being gathered.

The reddish brown bark is irregularly furrowed with shallow diagonal ridges and varies from half an inch to an inch thick.

The pinyon tree is usually only fifteen to twenty feet high, but reaches heights of thirty-five to fifty feet. The trunk is rarely free from branches for more than six or eight feet. Trees may attain breast high diameters of twelve to thirty inches in 150 to 375 years, but the growth is always slow. The root system is shallow.

The wood is soft, without special strength, and weighs about thirty-seven pounds to the cubic foot when air dry. Considerable quantities are used locally for fuel, fence posts, corral posts, telephone poles, mine logging, charcoal, and general construction. It is not durable in contact with the soil.

Pinyon is seldom injured by fire, but excessive grazing may destroy the seedlings. The worst enemy is probably a two-host fungus disease similar to white pine blister rust. As in the case of the white pine pest, the alternate host of the "pinyon blister rust" is a wild currant. Damage is chiefly sustained by seedlings and younger trees.

Although peculiar to the Southwest, this tree has been successfully planted in the eastern states where it has proved a hardy, slow growing, compact, bushy evergreen as far north as Massachusetts.



U. S. Forest Service

Dark, yellowish green needles are borne in pairs, and the large edible nuts grow in egg-shaped cones, at the ends of the branches



W. H. Schaffer

Mature trunks are clothed with reddish brown bark whose shallow irregular ridges may be broken into small detachable scales



Natural range of Piñon Pine

# SINGLELEAF PINYON PINE

## One-leaf pine

*Pinus monophylla*, Torrey and Fremont

SINGLELEAF PINYON is unique among all American species of pine in that its needles occur singly (or occasionally in twos), from which it derives the name *monophylla*, meaning one leaf. Its range extends from southeastern Idaho southwest through Nevada to the foothills of the Sierra Nevada in eastern California and south along the east slopes of these and the San Bernardino Mountains of southern California; thence northeast in central and northwestern Arizona northward through Utah west of the Wasatch range. It is found mostly on dry, low

mountain slopes, canyon sides and foothills, where it frequently forms pure open stands over large areas between 2,000 and 7,000 feet above sea level. The largest trees and heaviest stands occur at the lower elevations.

Singleleaf pinyon is characteristically a low, spreading tree. In protected and otherwise favorable situations it may reach a height of from thirty-five to fifty feet but, as a rule, it does not exceed twenty-five feet in height and from twelve to fifteen inches in diameter. The short trunk, which is rarely straight, is often divided near the



Devereux Butcher

Characteristically a low spreading tree, Singleleaf Pinyon Pine may reach a height of from 35 to 50 feet



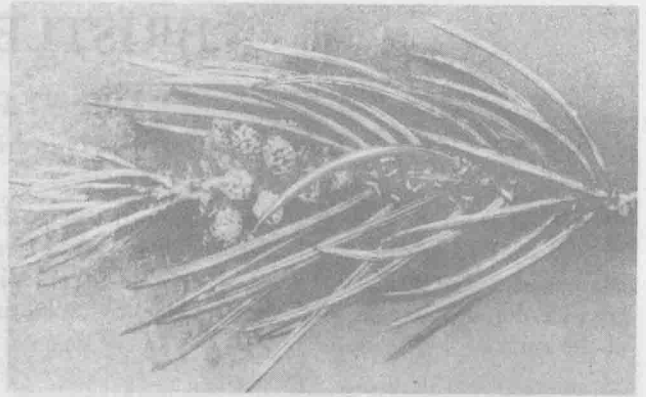
ground into several spreading stems, the rising branches forming, when the tree is young, a rather compact pyramidal crown. In mature trees the crown is rather flat and is made up of short, heavy, twisted and bent branches, which often hang low, giving the appearance of an old apple tree. The stout branchlets are light orange-colored at first, later becoming dark brown.

The general color of the foliage is pale yellow-green with a whitish tinge. The single, or very occasionally double, leaves, generally about one and a half inches long, are stiff, prickly and curved toward the branch. A season's growth of leaves usually remains on the tree about five years; sometimes, however, the leaves persist for ten to twelve years.

The male or staminate flowers are in dark red spikes, while the short-stalked pistillate ones, which develop into cones, are in purplish clusters. The short oblong cones, one and a half to two and a half inches long, mature in August of the second season. They shed their seeds, which leave their thin narrow wings attached to the cone scales, within about a month afterward, when the tips of the scales become shiny and a deep russet brown. Most of the empty cones fall from the tree during the winter or spring. The seeds, dark chocolate brown, with dull yellowish areas, have long served as an important article of food for the Indians of Nevada and California. This has given the tree one of its common names—"nut pine." The species bears some seed nearly every year and abundantly at intervals of two or three years. The wingless seeds fall near the tree and are eaten by birds and squirrels.

On the trunks of young trees the bark is smooth and dull gray, while on older trees it is roughly and irregularly furrowed, with thin, close, dark brown, sometimes reddish brown, scales. The narrow-ringed wood is moderately light, moderately soft and very brittle. The yellowish brown heartwood is surrounded by a thick layer of almost white sapwood. Large quantities are used locally for fuel and fence posts.

Singleleaf pine, is an exceedingly slow-growing tree that reaches an age of from 100 to 225 years. In thin dry soil, growth is especially slow, and in such locations trees from four to six inches in diameter are from eighty to 100 years old. Trees occurring in deeper soils grow more rapidly; those from ten to twelve inches in diameter being from 150 to 160 years old.



Devereux Butcher

The single or occasionally double needles are pale green, stiff and curved; the female flower clusters are purplish



Devereux Butcher

Cones are short and oblong, from one and a half to two inches long. They mature in August of the second season



Devereux Butcher

On old trees the bark is rough and irregularly furrowed, with thin, close, dark brown, sometimes reddish scales



Natural range of Singleleaf Pinyon Pine