



The Ponderosa Pine of the Southern Rocky Mountains
by Stuart Wier

- Donald Culross Peattie

Ponderosa pine is one of the best-known trees of the American West, and covers a more extensive area than any other American cone-bearing tree. Ponderosa grows from Mexico to British Columbia, and from the Pacific Coast to South Dakota. In the southern Rockies it grows in sunny and fairly dry locations from 5500 feet to 8000 feet elevation, and occasionally to 9900 feet elevation.

Ponderosa pine can endure drought and high temperatures, suiting it to locations where many other kinds of conifers could not survive, including many south-facing and west-facing slopes. In such cases it has a stout and rounded form. In a very dry setting a Ponderosa 10 inches thick may be 120 years old.

Ponderosa has the longest needle of conifer trees in the southern Rockies, and the needles make a musical sighing when the wind blows. On warm summer days the resin in bark and twigs gives forth a delightful odor. When the wind is right on a warm summer evening Ponderosa forests can be scented miles downwind. The trees' natural fragrance is compared to butterscotch or vanilla.

Ponderosa is the common tree of the lower mountain foothills and slopes. In the lower foothills the Ponderosa forests are typically open and parklike. The trees usually reach only moderate size and are separated by fields of grass. Slightly higher up Ponderosa pine is mixed with Douglas fir and may reach large and handsome dimensions. South-facing slopes are often dominated by Ponderosa and the adjacent cooler and wetter north-facing slopes covered with Douglas fir.

Extensive pure forests of Ponderosa grow in northern New Mexico, southern Colorado, and in the Black Hills. Ponderosa does not occur naturally in the western half of Wyoming including Yellowstone and the Tetons.

Mature trees often have wide upper crowns and can be flat-topped, unlike most other conifers. The lower half of the trunk is generally free of limbs. Some Ponderosa are the largest trees in Colorado, reaching 80 to 100 feet high and 3 to 4 feet in diameter, though usually they are not so tall as the firs and spruces of the high forests. The largest Ponderosa pine grows in Oregon. It was 161 feet high and about 8 feet in diameter when measured.

Ponderosa pine generally lives to 250 years or more if conditions permit; the oldest trees are around 650 years old, but it rarely exceeds 500 years. The oldest living Ponderosa in Colorado is 850 years old; the oldest known Ponderosa in Colorado reached 1047 years, in Mesa Verde. Low temperature inhibits Ponderosa growth, so it is generally not found in the higher forests. In southern and central Colorado Ponderosa pine grows on a few warm sites up to 10,000 feet in elevation. There is a fine grove at 9200 feet beside Twin Lakes, Colorado.

The most extensive forests of this tree in Colorado, with the largest individual trees, due to favorable moisture and soil, occur in the southwestern portions of the state. Lumbering cut many of the large trees there. Since the end of lumbering some of this land has been reforested by natural reseeding of this tree.

Ponderosa on the western slope of the southern Rockies can be larger and more majestic than the trees of the eastern side of the mountains. Fine examples are found from Pagosa Springs to Bayfield on the south flank of the San Juan Mountains, on the Uncompahgre Plateau, and on the Blue Mountain Plateau.

Ponderosa pine has a deep taproot, unlike many other conifers in the southern Rocky Mountains. Young trees start by growing a long taproot that may go down farther than the main stem grows upward. This allows the young tree to survive drought that can dry out the topsoil. Mature trees may have a taproot up to 36 feet deep; they also grow a lateral root system that extends as much as 100 feet from the tree to absorb surface moisture quickly from rain and snow. These roots make it very difficult to uproot Ponderosa pine by wind.

It is difficult for young Ponderosa seedlings to germinate and to survive. Seed production is erratic and large seed crops are rare. Seedlings require above-normal precipitation, and that must continue for several years until the new trees are established. Grass, if present, can present a serious obstacle to seedling establishment by competition for moisture. It appears that fires which temporarily suppress or eliminate the grasses may provide the best opportunity for seedling survival. Years of high moisture following both fire and high seed production seem to provide the best chance for new Ponderosa pine trees. The result of all these factors is that successful establishment of Ponderosa pine is infrequent, occurring only in the rare periods when all the factors are favorable. Various combinations of these factors in different degrees, such as the intensity of fire in an area, can produce various age distributions in Ponderosa pine forests. Some are even-aged stands, while others have groups of trees with a variety of ages in each group. In every case regeneration of Ponderosa pine is not common. Intervals as long as forty years or more may pass with few new trees.

Photographs made in early mining communities show widespread devastation in existing forests caused by logging and fires in the early days of settlement. The disruption in Colorado forests associated with early mining settlements extended all along the "Mineral Belt" where mining was active, from south of Rocky Mountain Park to the San Juans, and greatly increased the presence of pioneer tree varieties typical of early forest recovery from disturbances.

Since about 1900 successful fire-fighting efforts have prevailed, and in this century the frequency of fires in the mountains has been much lower than before the first miners arrived. The suppression of fire in Ponderosa terrain since about 1900 has resulted in more trees but smaller, less robust ones. The weak trees can be infested by bark beetles and other pests.

Ponderosa is adapted to benefit from frequent, low-intensity fires started in summer by lightning. These fires kill smaller plants which compete for moisture. Fires release nutrients in the litter, and prevent accumulation of fuel for severe fires which can destroy the trees' thick bark defenses. Despite these difficulties Ponderosa pines have invaded mountain sides and montane grasslands throughout the central Colorado mountains which were free of trees when the first mining prospectors and settlers arrived around 1850. Several reasons have been suggested, including changes in climate, more fires (eliminating competition for moisture by grasses), fewer fires (here regarded as killing seedlings), and changes in grazing. Areas heavily grazed and then protected from grazing have regenerated well.

Ponderosa is attacked by some 16 kinds of bark beetles among about 100 sorts of insect pests. Other destructive agents include fungus, Dwarf mistletoe (described under the Lodgepole pine), and air pollution notably ozone.

The most serious pest of Ponderosa pine is the mountain pine beetle ().

Beetle-infected wood is stained blue by a fungus which the beetle introduces into the tree and which then spreads and grows by itself. The combined attack of beetle and fungus can kill the tree in two growing seasons. In late summer the female beetle lays eggs in tunnel or "galleries" in the living tissue of the tree just below the bark. The larvae hatch and feed on the blue stain fungi growing in the galleries. In winter the cold larvae are inactive; a severe cold spell can kill them. In spring and early summer the larvae resume feeding on the tree tissue. They transform to adult beetles by midsummer. Female beetles - about 1/5 inch long - emerge in July and August and fly to new trees, and males follow them. The beetles carry fungi spores in depressions on the surface of their heads, which start new fungal colonies. The fungal growths stop fluid flow in the tree which would otherwise kill or drive out the beetles. Healthy trees respond to boring by the beetles by making resin that pushes the beetles from the hole. Resin blobs about an inch across are found on some trees, sometimes with a beetle embedded in them.

The blue fungus can kill a tree in a year by cutting off flow of water and nutrients through the sapwood. The beetle galleries also cut off nutrient flow to a lesser extent.

Beetle attacks are periodic, often coinciding with abundant weak trees lacking moisture resources to combat invasion. Drought and overgrown conditions can cause a shortage of moisture in the trees, making them susceptible to beetle attack. In other years smaller numbers of beetles survive in downed and weak trees.

Ponderosa pines seeds are eaten by quail, grouse, squirrel, Abert's squirrel, mule deer, and mountain sheep. This twigs and needles are browsed by deer, sheep, and elk. The inner bark of young trees is eaten by bears, and by porcupines in winter.

Abert's squirrel, also known as the tassel-eared squirrel, notable for its tasseled or pointed ears, relies almost entirely on the Ponderosa pine tree for its existence. They make large nests of twigs high in tree tops. In the early summer they eat buds, pine pollen, and fungi. In late summer and early autumn the seeds are eaten, and from late fall into spring they survive on the inner bark of twigs. Some trees where the squirrels prefer to dine have piles of litter - discarded twigs and cone scales - around the trunk. These squirrels have grey, brown, or black fur.

Not only Abert's squirrel and the porcupine eat the inner bark of the Ponderosa pine. Late in July of 1805 the Lewis and Clark party were traveling up the Missouri River, nearing the Three Forks in western Montana, when Lewis found pine trees stripped of their bark. Sacagawea explained Indians had done this to obtain the soft inner bark for food. The inner bark of the Ponderosa was eaten by the Indians in time of famine throughout the western continent.

Ponderosa pine was first recognized as a unknown tree by Meriwether Lewis on October 1, 1805, at "Canoe Camp" near the modern Orofino Idaho. After a very difficult crossing of the mountains from the Three Forks area on the Lolo Trail, "a stirring episode of heroic scale," Clark had found pines large enough to make dugout canoes on the Clearwater river. Canoe Camp was established at the mouth of the North Fork of the Clearwater. Here five large Ponderosa pines were cut and made into dugout canoes to carry the entire party and its goods down the Clearwater, Snake, and Columbia to the Pacific. Hollowing out the canoe hulls proved too difficult for the party weakened by hunger and illness, and the explorers resorted to the Indian method of burning out trunks. Five boats were finished in short order. The rapids of the Clearwater, Snake and Columbia threatened the expedition. On the second day out one boat struck a rock, split open, and sank. After that they were more careful, but more than once a boat was overturned and equipment lost. Despite these difficulties, the canoes were surely the best way to cross so much rugged country with reasonable effort. In late November they reached the Pacific, Ponderosa pine dugout canoes carrying the Lewis and Clark expedition through a major part of their journey.

On the return trip, back near the Canoe Camp in the Bitterroot Mountains in May 1806, Lewis and Clark learned of another starvation diet - the seeds of the Ponderosa. Lewis wrote in his journal "the seed of this speceis of pine is about the size and shape of the large sunflower; they are nutritious and not unpleasant when roasted or boiled." The same Indians were also eating the a lichen which grows in filaments from the pines. One way to cook it was pit roasting with wild onions.

Ponderosa timber is useful for all sorts of construction. In the ancient southwest it provided roof beams and door lintels in Anasazi pueblos and cliff dwellings. One Ponderosa beam in a kiva roof at Chaco Canyon weighed over a ton. The nearest source for such wood was over 50 miles way. In more recent times pine logs provided the numberless ties for the steam railroads that crossed the mountain passes and penetrated to all the proven diggings of the mining era. Today Ponderosa provides more timber than any other American pine tree, and is second only to Douglas fir for any tree.

The "common" name Ponderosa is fairly new: as recently as the 1920s that name was unknown. Cattlemen did not name their ranches "The Ponderosa," at least until very recently. The young dark-bark form was commonly called bull pine or blackjack pine; the large orange trees were called western yellow pine. The current common name derives from the Latin name, and had the endorsement of the U.S. Forest Service. The Spanish name is Pino real, the royal pine.

David Douglas, a young Scottish naturalist, published the first botanical description of Ponderosa pine in 1830. The species name was given by Douglas, and refers to the ponderous heavy weight of the large Ponderosa logs cut on the Pacific coast where the tree was first identified. Botanists name the Ponderosa pine of the Rocky Mountains and Colorado var., meaning "of the rocks." It differs from the species in having slightly smaller cones, shorter needles, smaller overall size, and often a majority of two-needle bundles. The Rocky Mountain variety intergrades with the species. Ponderosa pine is the state tree of Montana.

Identifying features of Rocky Mountain Ponderosa pine

Needles

Needles normally occur in bundles of two or three, rarely as one, four, or five. Needle length is usually in the range of 4 to 7 inches long. Only Ponderosa pine has such long needles among the conifers of Colorado. Longer needles, up to 11 inches, are found on trees in better conditions, such as moist sites. Needles stick out from the twigs in all directions and persist only a few years, and hence are concentrated at the ends of branches, giving the branches tufted ends. Young foliage tends to be dark green and the older trees have needles tending to yellow-green, though not quite so yellowish as in Lodgepole pine.

Cones

Mature cones are 2 1/2 to 6 inches long, and fairly broad. Each thick hard scale is tipped with a short bristle. The cones open before they fall from the tree. Seeds are about 1/4 inch long, brown or brownish-purple, with wings 1 inch long. When mature cones fall from the tree, they may leave a few scales from the base of the cone attached to the branch.

Bark

Very young trees (less than 1 1/2 inch diameter) have smooth grey bark rapidly becoming darker and broken into small scales. Older trees' bark is thick, dark brown or black, and furrowed. Bark of mature trees (over 100 years) is 2 to 4 inches thick, bright yellow-brown, orange-brown, or cinnamon-red, finally becoming yellow in very large old trees rarely seen now, in broad irregular scaly plates, up to a hand's breadth across, separated by furrows. Even trees below twenty feet in height can have bark in large plates composed of smaller scales. The scales, smaller than an inch across, are pale orange-brown and have curved interlocking edges, and leave a flat shallow depression when they fall from the tree. Some large old trees are entirely covered by thin scales, lacking the plates and furrows. The orange-brown or reddish-brown bark color is similar to the color of the bark of some Lodgepole pine and mature Engelmann spruce, but the bark is not otherwise very similar.

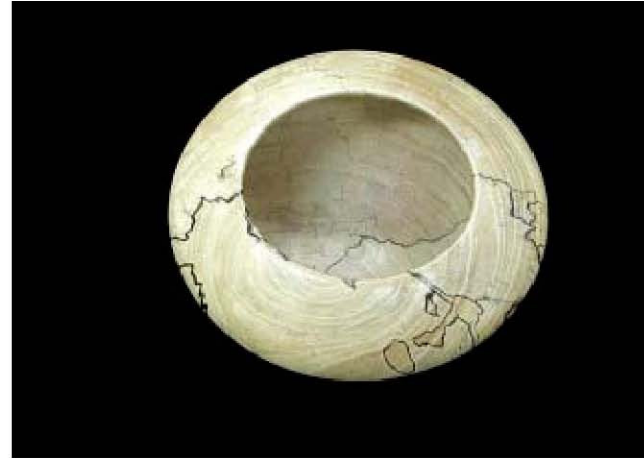


Blue Stain

Blue stain is caused by microscopic fungi that commonly infect only the sapwood of trees, using parts of the sapwood (including simple sugars and starches) for food. They cannot grow in heartwood or most wetwood that does not contain the necessary food substances. Blue stain fungi are prone to cause bluish or grayish discoloration of the wood but they do not cause decay. Blue stain has no effect on the strength of the wood.

In a cross section of wood containing blue stain, the discoloration often appears as pie-shaped wedges, oriented radially, corresponding to the direction of the wood rays. The discoloration may completely cover the sapwood or may appear as specks, spots, streaks, or patches of various color intensities. Blue stains come in various colors, with the most common ranging from blue to bluish black and gray to brown, although various shades of yellow, orange, purple, and red sometimes appear. The exact color of the stain depends on the infecting organism and the species and moisture content of the wood. Sometimes other types of stains are confused with blue stain, such as chemical brown stain.

Some standard lumber grading rules limit the amount of blue stain permitted on structural lumber. Usually this occurs only when the lumber will be exposed (for example, in railings, for which only 25% of the surface may contain blue stain). Structural lumber that will be concealed should not be downgraded for the presence of blue stain. Some people like the decorative look produced in wood by blue stain. In the decorative wood market, spalted wood (caused by certain white-rot fungi, which can actually diminish the strength of wood if allowed to grow too long) is in high demand. White-rot decay fungi create “zone lines” in the wood where territories of competing fungi meet. These lines create a decorative appearance. White-rot fungi occur primarily in hardwoods such as maple, birch, and beech (see **Decay Fungi**).



Preventing blue stain requires that unfavorable conditions for the fungi be maintained (keep the wood dry, maintain temperatures above or below ideal growing temperatures, and protect the wood from insect infestation). Blue-stain fungi are spread by spores, which are produced in abundance. Although the spores of other fungi are normally disseminated by wind, blue-stain spores are “sticky” and are carried into the wood by insects. Once on the surface of a nutrient-rich environment, the spores grow rapidly. Blue-stain fungi can survive but cannot grow in wood with moisture content of 20% or less or in high or low temperatures. Temperatures higher than 150°F are lethal to blue-stain fungi. Dry kiln operators should be able to use drying schedules to control blue stain. In the summer months and in the tropics, dry kiln operators should chemically treat the wood with fungicides in addition to using proper kiln schedules. Chemical fungicides, or biocides, make the sapwood unsuitable as food for blue-stain fungi.

Because sapwood-stain fungi will not grow at temperatures below 35 °F, kiln operators often curtail chemical treatment during winter months in northern locations. However, blue stain can develop in the kiln during the short time (days) that the kiln is at ideal growing temperature. Therefore, the kiln must be set above 130 °F as early as possible. Unfortunately, chemical brown stain occurs in some species of wood that are stored for a time and dried at high temperature. To alleviate this problem, the best procedure is to get the log from the forest (to the mill) to the kiln as quickly as possible. Sodium pentachlorophenol (PCP) had been one of the most effective and widely used fungicides for controlling sapwood stains in lumber. However, the U.S. Environmental Protection Agency curtailed the use of PCP because of adverse effects on workers and the environment. New chemical formulations with lower toxicity levels appear promising for the control of sapwood stain.

Another approach to preventing blue stain relates to the fact that fungi tend to be territorial. By inoculating wood with a commercially available colorless mutant fungus, stains that develop from other fungi can be prevented. This colorless fungus, a mutant of the sapstain fungus, was developed for the

pulp industry and is commercially known as C97. (Currently C97 is available from only one supplier—AgraSol of Raleigh, North Carolina, 919–831–2240.) A problem with this approach arises if the wood is to be stained with a commercial finish. Sapstain fungi change the porosity of the wood, which might result in a splotchy appearance after staining. Sealing the wood before staining could solve this problem.

Because spores germinate rapidly on untreated sapwood, lumber must be treated—with fungicide or mutant fungus—immediately after the logs are sawed. The mutant fungus has demonstrated beneficial effects in treating both logs and sawn boards at sawmills, but it is still in a trial stage. If used in the sawmill, treatment should be applied as soon as possible after the logs arrive, or after the boards are cut, or certainly no longer than 36 hours after arrival in the yard. Chemically treated lumber should be stacked on stickers immediately after fungicide treatment. Under commercial operating methods, chemical fungicides will usually not soak into the board more than 1/32 in. Therefore, it is important to kiln dry the treated boards as soon as possible at initial dry-bulb temperatures >130°F to prevent the internal growth of fungi that have penetrated deep enough to escape the fungicide.

Glossary

Decay Fungi. Two major kinds of decay fungi are recognized: brown rot and white rot. Brown-rot fungi extensively remove only cellulose from the wood, which takes on a browner color and can crack across the grain, shrink, collapse, and be crushed into powder. White-rot fungi remove both lignin and cellulose from the wood, which may lose color and appear “whiter” than normal. The wood does not crack across the grain, and until severely degraded, it retains its outward dimensions, does not shrink or collapse, and often feels light and spongy. Brown-rot fungi commonly colonize softwoods (conifers), and white-rot fungi commonly occur in hardwoods (broad-leaved trees), but both brown- and white-rot fungi occasionally colonize both types of wood.

Blue Stain. A bluish or grayish discoloration of sapwood caused by the growth of certain dark-colored fungi on the surface and in the interior of the wood; growth is made possible by the same conditions that favor the growth of other fungi.

Chemical Brown Stain. A chemical discoloration of wood, which sometimes occurs during air or kiln drying of several species, apparently caused by the concentration and modification of extractives.

Iron Tannate. A bluish black surface stain on oak and other tannin-bearing woods following contact of the wet wood with iron or with water in which iron is dissolved.

Mineral Stain. An olive to greenish black or brown dis-coloration in hardwoods, particularly maple, caused by bird peck or other injury and found either in mass discoloration or mineral streaks. The mineral associated with such streaks is frequently calcium oxalate, which has a tendency to dull machining knives.

Stain. A discoloration in wood that may be caused by micro-organisms, metals, or chemicals. The term also applies to materials used to impart color to wood.

Sticker Stain. A gray to blue or brown chemical stain occurring on and beneath the surface of boards where they are in contact with stickers (also fungal sapstain when found only in the sticker area).

Water Stain. A yellowish to blackish surface discoloration caused by water that dripped onto the wood during drying.

Weathering. A very thin grayish brown surface discoloration on lumber that has been exposed to the weather for a long time.

Wetwood. Green wood with abnormally high moisture content that generally results from infections in living trees by anaerobic bacteria but may also result from water logging during log ponding. Wetwood can occur in both softwoods and hardwoods; the green lumber is usually difficult to dry without defects. Although difficult to recognize, wetwood is often characterized by a translucent, water-soaked appearance and a sour or rancid odor.



FOREST HEALTH NOTE

January 2005



Mountain Pine Beetle

Hosts:

Lodgepole pine, ponderosa pine, western white pine, sugar pine, and white bark pine.

Importance:

The mountain pine beetle (MPB) is the most destructive tree-killing beetle in Oregon. Between 1975 and 1989, the average area of pine mortality from MPB infestations was estimated at more than one million acres per year. The threat of MPB infestations in older, unmanaged pine stands is great enough to influence forest management decisions in much of eastern Oregon.

Look For:

- √ Small clumps or large areas of pines with red crowns and tubes of pitch exuding from the trunk (Figures 1 & 2). Over-stocked pine stands >60 years old with a breast height diameter between 6"-26" for lodgepole pine and 6"-40" for ponderosa pine are susceptible to MPB attack.
- √ Seasonal changes in the appearance of a tree's crown can indicate beetle attack. During May-June, the foliage of pines attacked the previous year turns yellow (Figure 3). By July, the crowns of trees that were yellow in May are now red. Pines newly attacked in July-August will have pitch tubes present on the bark, but the crowns remain green.



Pitch tubes on the bark of lodgepole pine.



Pitch tubes on the bark of ponderosa pine.



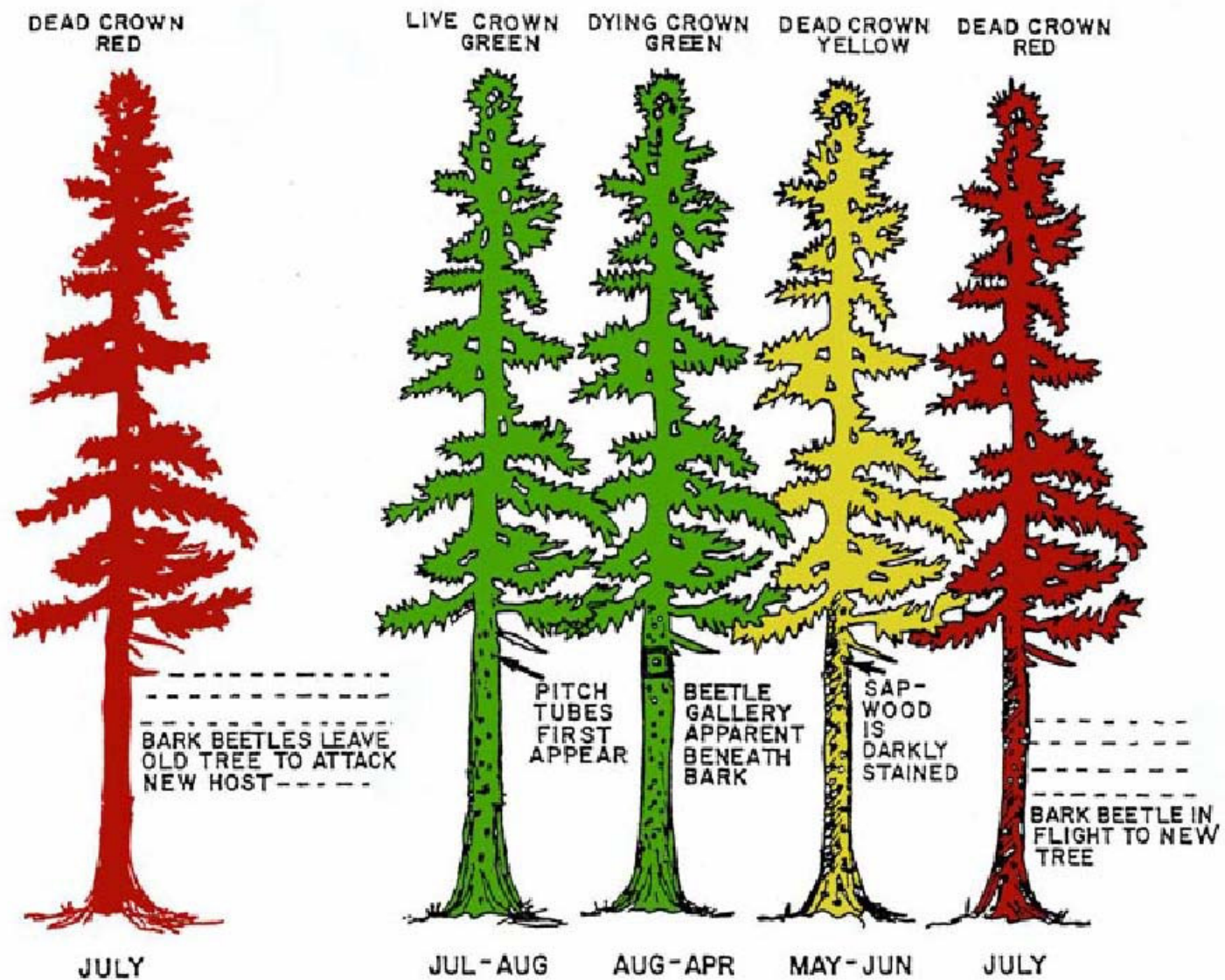
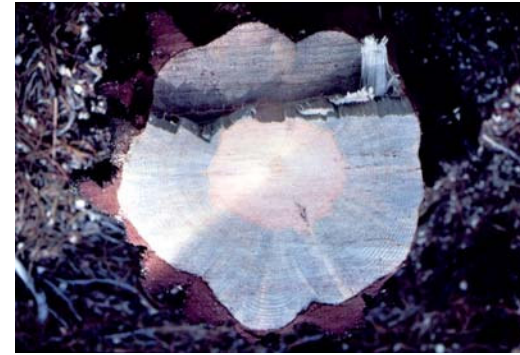
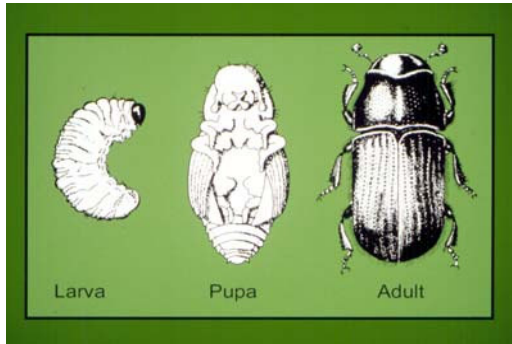


Figure 4: The cycle of mountain pine beetle attack and tree decline.

Infestation Characteristics:

The cycle of beetle attack and tree decline is shown in Figure 4. In Oregon, there is generally one generation of mountain pine beetle a year. Newly attacked trees will have pitch tubes on the trunk, but crowns remain green. Pitch tubes do not always mean that the tree will die, particularly if the MPB attacks are on ponderosa pine. In some cases pines that will die can be identified in the fall and winter by patches of bark removed by woodpeckers feeding on grubs. Tree death is confirmed when the crown changes color in May-July of the year following the attack. Removing the bark of infested trees will reveal a gallery pattern characteristic for this beetle (Figure 5). From August of the year the tree is attacked to June of the following year beetle life stages can be found beneath the tree's bark (Figure 6). The sapwood from a MPB infested elongating and yellow. Larvae are very small and most easily seen with the aid of a hand lens. It is estimated that each larva destroys 6-to-10 fascicles (= bundles) of pine needles during its development. As larvae tree





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is darkly stained by a fungus the beetle introduces into the tree (Figure 7).

The most spectacular MPB outbreaks occur in unmanaged lodgepole pine stands where tree mortality is often on a landscape level. In general, mountain pine beetle infestations develop in overstocked pine stands. Among host trees, lodgepole, sugar, and western white pine are more susceptible to attack than ponderosa. When lodgepole pine and ponderosa pine are growing together, lodgepole is often attacked, but not the ponderosa component. Based on aerial survey data, sugar pine is particularly vulnerable to MPB attack during drought periods.

Site Class affects the pattern of tree killing by the mountain pine beetle in ponderosa pine stands. Trees growing on Site IV and better have a low susceptibility to mountain pine beetle attack. Ponderosa pine mortality from beetle attacks increases as site quality decreases. In overstocked stands growing on Sites V-VII, tree mortality during MPB outbreaks can be extensive and concentrated in the largest trees.

In the case of lodgepole pine, Site Class appears to make little difference in the pattern of tree mortality. For lodgepole pine stands, the probability of MPB infestation increases with the stand's basal area and tree size. Stands with basal areas of 44–100 square feet per acre are considered to have a low probability of MPB attack

Management:

Thinning pine stands to prevent over stocking is essential to reduce the hazard of MPB attacks. Guidelines for thinning pine stands are available from Service Foresters, OSU Extension Service and OSU Extension Circular 1106 (September, 1982). Thinning pine stands can reduce tree mortality even if conducted in the midst of a bark beetle outbreak. It is important that thinning operations be conducted so that slash accumulations do not provide breeding sites for other bark beetles such as the pine engraver beetle in eastern Oregon and the California fivespined ips in western Oregon.

Pines growing in overstocked mixed conifer stand are also susceptible to MPB attack. To maintain the pine component in a mixed conifer stand, especially on poorer sites, it is advisable to reduce the basal area to that recommended for a pure pine stand.

Preventing Mountain Pine Beetle Attacks With Insecticide:

Chemical insecticides can be used to protect high value pines near homes or structures. An insecticide solution sprayed to run-off on the trunk of ponderosa pine is an effective preventative treatment. Insecticides should be sprayed as far up the trunk as possible, preferably to a height of 30 feet. The insecticide treatment should be made in June, before the beetle flight in July.

The following insecticides can be used for preventing bark beetle attacks on standing pines:

- Ground applications to forest trees**

Carbaryl

- Ground applications to ornamental trees**

Carbaryl

Permethrin + C

Handling Infested Firewood:

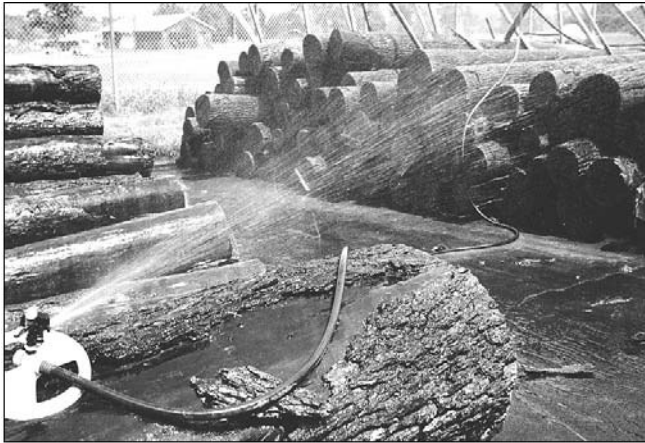
Do not cut firewood from beetle infested trees when pine foliage is yellow (May-June). If wood cut at this time is carried home, the emerging beetles may attack pines growing near houses or used in landscaping. Any wood cut from declining pines, those with yellow-green foliage, should be stored away from living pines and covered with clear plastic to destroy emerging beetles. See OSU Extension publication FS 279 (September, 1981) for instructions.

WARNING: WHEN USING PESTICIDES, ALWAYS READ AND FOLLOW THE LABEL.

TechLine



Forest Products Laboratory



Deterioration affects the value of softwood logs for uses ranging from lumber to pulp chips. Logs should be processed as soon as possible after felling, especially during warm weather. Until they are processed, measures must be taken to maintain log quality. Logs should be brought to a log yards as soon as possible. Storing logs in the forest or on the landing for long periods attracts wood-boring insects and can encourage insect outbreak.

Logs must be stored under conditions that minimize defects associated with shrinkage, end checking, and attacks by fungi, bacteria, and insects. Shrinkage defects are minimal during periods of cloudy, wet weather and low temperatures.

DRY LAND STORAGE

Logs stored on a landing or dry land log yard are subject to end checking, blue stain, and ambrosia beetle attacks. Storage during warm weather quickly degrades pine logs; ponderosa pine can develop blue stain within just a few days of felling. Dry land storage is recommended only for short periods from late spring to late fall, If temperatures are less than 32 degrees, logs can be stored for longer periods.

High-quality logs (such as peelers and high-quality sawlogs) can be protected by brushing or spraying an end coating- a wax based sealer- on the ends of logs. Treating the ends of higher quality logs with a chemical fungicide before applying an end coating helps prevent sap staining.

If logs are to be sawn into lumber, store the logs with bark intact to reduce checking and blue stain, however even logs with the bark intact can become infected because many wood-boring insects often carry spores. Logs for posts, poles, and pulpwood are often debarked soon after felling to reduce loss from insects borers and decay and to decrease sapwood moisture content. The disadvantages of early debarking are extensive surface checking and end splitting. Sapwood staining can also be substantial. All logs should be placed on skids, keeping them above the ground, and the log yard should be kept free of vegetation.

Wet Storage

When logs must be stored for long periods at temperatures above freezing, it is best to keep logs soaking wet. Storing logs under sprinklers or in a log pond helps prevent end checking and slows deterioration caused by insects, fungal stain and decay. However, Chemical staining can occur under wet conditions.

Today, softwood logs decked in the log yard are typically protected by water sprinkling during warm weather.

Sprinkling provides an effective than dry land storage. To be effective, the ends of logs and exposed wood must be kept wet continuously during the entire storage period.

Sprinkling reduces available oxygen, thereby deterring sapwood staining and decay.

Pond storage includes logs that are stored in mill ponds, lakes, rivers and saltwater estuaries. Although pond storage was once common practice, it is seldom used today except in British Columbia and southeastern Alaska. Defects such as honeycomb, collapse and ring failure can result when logs are stored in water for more than a year.