Common Pines of Massachusetts

by GORDON P. DEWOLF, JR.

We tend to take wood for granted; or, if we are very modern, to assume that steel, aluminum, and plastics have made wood obsolete. Such is not the case, and, although wood may not seem very important in a stainless steel and glass office building, it still provides shelter and comfort for most of us.

To the English colonists who settled New England, wood was a vital commodity that shaped their future in an alien land. The trees that they encountered were usually in vast tracts, and some were totally different from any they had known in England.

The colonists' need to clear land for gardens and pastures, combined with the fact that Spain, Portugal and the British West Indies were experiencing a lumber shortage, encouraged the development of a thriving export trade in timber products. White oak barrel staves to make barrels for wine, molasses, and rum were one of the most valuable New England exports. Old England seemed to be interested in only one commodity, however: white pine logs for masts.

Until the settlement of the American colonies, Britain had obtained most of her ship building timber either locally or from various ports around the Baltic Sea. With the growth of population and empire, the numbers and sizes of ships increased. One of the most serious problems for the ship builder was the availability of suitable masts.

At the end of the Colonial period a First Rate ship carrying 120 guns required a main mast 40 inches in diameter and 40 yards (120 ft.) long. A mast this size could be made from several smaller stems, but was expensive. Such "sticks" had been available in logs of Pinus sylvestris from the Baltic, but these soon became rare due to excessive lumbering. White pine (Pinus strobus) from New England was the best substitute.

The need for large white pines for masts for the Royal Navy led to a continuing series of laws restricting the use of white pine and to a lumbering industry set up to supply them. It became illegal to cut white pines over 24 inches in diameter for any other purpose.
Big trees were cut (or poached) of course, and the evidence may be seen in many an old house where the boards for floors and wainscoting are between 20 and 23 inches wide. In many cases the sides of the board are not parallel, one side being straight, the other, tapering. The tapering side was the outside of a great log; the straight side, the middle. Two boards 20 inches wide at the widest end could be obtained from a 40-inch log.

We should not assume that in days of old all trees were sound. Sir John Wentworth, Surveyor General of His Majesty's Wood, recorded in 1771 that:

"This season the Mast Cutters for His Majesty's Contract found in one District a fine Growth of large and uncommonly fair trees, but on cutting them, one hundred and two out of one hundred and six proved rotten at the heart and not worth a shilling."

The whole question of the colonial timber trade is a fascinating one, and has been dealt with by two skillful authors.* Our interest in pines, however, is not in the timber but in the living plant and in particular, those that are commonly available for planting in Massachusetts.

Pines constitute the most important group of lumber trees in the world, and also are highly valued for ornamental planting. There are about 80 species, mostly of temperate regions, but a few occur in the tropical and subtropical climates of the West Indies, Central America, the Philippines, and southeastern Asia.

In nearly all of the species the trunk is typically erect, with whorls of secondary branches inclined more or less at right angles to the trunk. If the terminal bud or shoot of the trunk is destroyed, one or more of the buds or branches in the whorl immediately below the damage becomes erect and assumes the function of the trunk. If a single bud or branch becomes erect, the trunk ultimately has a crook in it at that spot. If two or more buds or branches develop, a forked or multi-trunked tree is the result.

The leaves of pines are narrow and needle-like. The primary leaves (Fig. 1), which may be reduced to mere scales (Fig. 2), are produced on all the growing shoots. In the upper axil of

some of the primary leaves a bud grows forward to produce a cluster or fascicle of 1 to 5 leaves (Fig. 1). This fascicle of leaves consists of a rudimentary mass of stem tissue to which the needles are attached at the tip (Fig. 3). At the base of the needles is a series of closely appressed scale-leaves that form the sheath (Fig. 4). In *Pinus strobus*, the white pine, and species closely related to *P. strobus* (subgen. *Strobus*; syn. sect. *Haploxyylon*) the sheath generally falls away in the first summer (Fig. 3). By contrast, the sheath persists for the life of the fascicle in the hard or yellow pine group (subgen. *Pinus*; syn. sect. *Diploxyylon*).

The growing shoot produces at its tip a terminal bud surrounded by a whorl of generally 5 lateral branch buds (Fig. 5). One or more of these buds may be modified to form a young female cone, one evidence that the cone is simply a modified branch (Fig. 5). The young female cone continues its development through the summer of the year it is formed; the branch buds remain dormant until the following spring. The male cones are produced in clusters in the base of the terminal bud, in the same relative positions as the fascicles of leaves.
Fig. 3. Fascicles of leaves of the white pine group after the sheath scales have fallen.

Fig. 4. Base of fascicle of leaves showing sheathing scales.
In all of the white pines the female cones are produced at the tip of the first flush of growth in the spring. If there is a second flush of growth later in the season, the cones will seem to be borne laterally. In some of the hard pines the young female cones are borne laterally (not at the tip) on the first flush of growth (Fig. 6).

The young female cones are pollinated in the spring of the year of their formation. They enlarge somewhat during that summer, become dormant in the fall and rapidly enlarge to maturity during the second spring and summer. Generally the cones open at maturity during the fall of the second year and shed their seeds.

Some pines (P. rigida and P. sylvestris) produce cones every year. In many species, however, cones are only produced at longer intervals, sometimes only every 5 to 10 years. The seeds may be small and winged, or large and nut-like. In some species the cones do not open at all, or do not open immediately and the seeds consequently are retained for several years or indefinitely.

Pines generally produce a tap-root; hence a deep, well-drained (but not necessarily rich) soil suits them best. Their roots are easily injured by drying so, except in seedling stages, they must be moved with a ball of soil. Bushiness in growth may be promoted by removing the terminal buds of the branches, which stimulates the growth of lateral buds. Propagation is generally by seed. Selected clones must be propagated by grafting.

Each year, sometime between spring and fall, the oldest needles on the twigs turn brown and fall away. This is a natural phenomenon and not a cause for alarm. The term evergreen simply means that the green leaves of one year are retained on the plant until new leaves are formed the following year. In general, the leaves of pines are retained for two or more years according to each individual species. Leaves on vigorously growing young plants usually are retained longer than those on plants that are growing slowly. Leaves on leading shoots may be retained longer than those on branch twigs. Finally, pines growing in exposed situations, or at the limit of their hardiness, will generally shed their leaves sooner than trees growing under more favorable circumstances.

Fig. 5. Branch tip showing terminal bud surrounded by a whorl of three lateral branch buds and two female cones.
Fig. 6. Female cone in subterminal position on the twig.

Fig. 7. Pine needle scale on leaves of Pinus mugo.
Key to the Identification of Common Pines in Massachusetts

A. Sheaths of the needle clusters deciduous
   AA. Sheaths of the needle clusters persistent

B. Needles 1 to 4 in a fascicle
   BB. Needles 5 in a fascicle

C. Needles with conspicuous whitish exudations of rosin, persistent 10 to 12 years
   CC. Needles without rosin exudate, persistent for less than 10 years

D. Needles drooping on the twigs
   DD. Needles straight, twisted or curved, but not drooping

E. Twigs hairy, at least when young, needles 3–5 in. long
   EE. Twigs smooth, without hairs, needles 5–8 in. long

F. Needles twisted, 1–3 in. long
   FF. Needles straight or curved

G. Needles curved, directed forward
   GG. Needles straight, more or less spreading

H. Winter terminal buds acute, stomates in rows only on the back of each needle
   HH. Winter terminal buds with an elongate tip, stomates in rows on all three sides of each needle

I. Winter terminal buds ¼ in. long, the tips of the scales appressed
   II. Winter terminal buds ½–¾ in. long, tips of the scales spreading

J. Sheaths of the fascicles persistent but reflexed the 1st year, deciduous the 2nd or 3rd year
   JJ. Sheaths of the fascicles persistent for the life of the fascicle

K. Twigs ⅓–⅔ in. diameter, needles ⅜–1½ in. long
   KK. Twigs more than ⅖ in. diameter, needles more than 1½ in. long

L. Twigs more than ⅔ in. diameter, needles 5–10 in. long
   LL. Twigs more than ⅔ in. diameter, needles less than 6 in. long

M. Winter buds resinous, tips of bud-scales appressed
   MM. Winter buds not resinous, tips of bud-scales free

Haploxyylon (B) edulis
Diploxylon (J) aristata
N. Needles 3 in a fascicle
NN. Needles 2 in a fascicle
O. Needles 4–6 in. long
OO. Needles less than 4 in. long
P. Winter buds with the basal scales reflexed, needles slender and flexible, not breaking when bent
PP. Winter buds with the scales spreading, needles stout and stiff, breaking when bent
Q. Shrub with ascending branches, needles persistent for 5 years or more
QQ. Tree, with an erect trunk, needles persistent 2 to 3 years
R. Winter buds resinous, bark of upper portion of trunk reddish-brown
RR. Winter buds not resinous
S. Winter buds chestnut-brown, needles slender, flexible, bark of upper part of trunk reddish-brown
SS. Winter buds whitish, needles stout, stiff

Young branch tip of P. thunbergii.
**Pinus albicaulis** Englemann

White-bark pine

Tree to 10 m. (30 ft.) or a shrub at timberline. Twigs stout; bark reddish-brown with scattered stiff hairs. Bark on older branches and trunk broken by narrow fissures into thin, narrow, brown or creamy-white plate-like scales. Needles 5 in a fascicle, persistent 5 to 8 years, 5–7.5 cm. (2–3 in.) long, stout, rigid, curved, densely crowded on the twigs, directed forward. Cones subterminal, ovoid-cylindrical, 3.5–7.5 cm. (1½–3 in.) long, never opening. Seeds edible.

Grows in mountains above 1500 m. (5000 ft.) from SW Alberta and British Columbia south to NW Colorado, NE Nevada and the mountains of east central California.

It matures in about 150 to 200 years and is a very slow growing species. Some individuals only 5 feet tall are about 500 years old.

There is some doubt as to whether this pine is actually in cultivation here. Young trees (less than 50 years old) are very similar in appearance to *Pinus flexilis*. The surest identification is by the cones, which do not open in *P. albicaulis* but do in *P. flexilis*. We have had reputed *P. albicaulis* here, but on coning the trees have proved to be *P. flexilis*. 
**Pinus aristata** Engelmann  
**Hickory pine, Bristlecone pine**

Bushy tree to 15 m. (50 ft.) or a semiprostrate shrub at timberline. Twigs reddish-brown, smooth or hairy. Needles 5 in a fascicle, persistent 10 to 12 years, 2–4 cm. (3/4–1 1/2 in.) long, stout, stiff, curved, densely crowded on the twigs, directed forward the first year, spreading later, marked with one or more resin droplets. Cones subterminal, cylindric-ovate, 7.5–8.5 cm. (3–3 1/4 in.) long, each scale with a slender, curved spine to 6 mm. (1/4 in.) long.

Grows in mountains above 2300 m. (7,500 ft.) from Colorado to Arizona and New Mexico.

A very slow growing pine with an irregular habit. In the eastern United States it may be only 4 feet high in 16 years.

A closely related form, growing in Utah, Nevada and extreme eastern California, has recently been separated as *Pinus longaeva*. This includes the pines recently heralded as the “oldest living things.” The habit of the two species differs in that the branches of *P. aristata* are spreading or ascending, while the branches of *P. longaeva* are spreading and pendulous.
**Pinus banksiana** Lambert  

Small to medium-sized scrubby tree 8–18 m. (25–60 ft.). Twigs slender, greenish-yellow, smooth. Needles 2 in a fascicle, persisting for 2 to 3 years, 2–3.8 cm. (3/4–1 1/2 in.) long, stiff, curved or twisted. Cones lateral, bent, conical, 2.5–6 cm. (1–2 1/2 in.) long, sometimes opening at maturity, sometimes remaining closed for several years.

Found in well-drained sandy or rocky soil at elevations from 30–400 m. (100–1200 ft.) from Nova Scotia to the Athabasca River southward to Maine and central Michigan.

It bears cones at 10 years of age, and practically stops growing at 80 years. Some of the cones remain closed for many years, opening in response to the heat of forest fires and shedding their seed over the burned land. The seedlings are very intolerant of shade.

Jack pine will grow on sterile, well-drained, soils. It is not an attractive tree.
Pinus cembra Linnaeus  
Swiss stone pine


Native to central European Alps from 1200–2400 m. (4,000–8,000 ft.) and in the Carpathian mountains.

A very hardy, but very slow growing pine, preferring a deep, moderately fertile soil for best growth. In Europe the wood is highly prized for wood carving.

It is related to P. sibirica and P. koraiensis.

Three plants received in the Arboretum in 1918 are only 20 to 25 feet tall today.
Pinus densiflora Siebold & Zuccarini  

Japanese red pine

Tree 20–36 m. (70–120 ft.). Twigs green, smooth. Needles 2 in a fascicle, persisting 2 to 3 years, 5–6 cm. (2–2½ in.) long, slender, soft, twisted. Cones subterminal, about 3.5 cm. (2 in.) long, slender, soft, twisted. Cones subterminal, about 3.5 cm. (2 in.) long, conic-oblong, opening at maturity.

In Japan it ranges from 150–900 m. (500–3,000 ft.). It also occurs in the Chinese provinces of Kiansu and Shantung.

The stems tend to be twisted. Like P. sylvestris the branches and upper part of the trunk are covered with thin, exfoliating, orange-brown bark.

P. densiflora is intolerant of shade, but grows well on heavy, moist, but not wet, soils.
Pinus edulis Engelmann

Short stout tree 4–15 m. (12–50 ft.). Twigs stout, orange-brown, smooth or very minutely hairy. Needles 2 to 3 in a fascicle, persistent for 3 to 9 years, 2.5–4 cm. (1–11/2 in.) long, rigid, curved. Cones subterminal, ovate, 2.5–3.5 cm. (1–11/2 in.) long, opening to release the edible seeds.

Native to mountains and foothills 1500–2400 m. (5,000–9,000 ft.) from S Wyoming and N Colorado south to W Oklahoma, W Texas, and San Bernardino County, California. A dominant component of the juniper-pinyon pine woodland of Utah, Colorado, Arizona and New Mexico.

Pinyon nuts were an important food for the Indians of the Southwest. They are still important commercially and are, after pecans, the most important nut crop in the United States.

Pinyon pine is extremely slow growing; trees 25 years old may be only 3–4 feet tall. They grow at the rate of only 2–4 inches per year.

At the Arnold Arboretum there is a single tree grown from seed received from Utah in 1927. In 48 years it has reached a height of about 10 feet.
Pinus flexilis James  

Short stout tree 12–25 m. (40–80 ft.), or a shrub at timberline. Twigs stout, orange-brown, hairy at first. Needles 5 in a fascicle, persistent 5 to 6 years, 3.8–7 cm. (1½–3 in.) long, stout, rigid, curved. Cones subterminal, subcylindric, 7.5–13 cm. (3–5 in.) long, opening at maturity.

Native to mountains 1500–3600 m. (5,000–12,000 ft.) from S Alberta and British Columbia south to W Texas and S California.

The slow growing trees virtually stop increasing in size at about 200 years of age, but may live to be 400.

Young plants are very similar in appearance to P. albicaulis and form a rounded, bushy tree.

At the Arnold Arboretum three young grafted plants received in 1951 are now 15 to 20 feet tall.
Pinus jeffreyi A. Murray  
Jeffrey's pine

Tree 30–60 m. (100–200 ft.). Twigs massive; buds non-resinous, with an odor of pineapple when crushed. Needles 3 in a fascicle, persisting for 5 to 9 years, 12–25 cm. (5–10 in.) long, stout, stiff, elastic. Cones broadly oval, 13–30 cm. (5–12 in.) long, opening at maturity.

Occurs in mountains between 1000–3100 m. (3,500–10,000 ft.), in SW Oregon to Baja California, generally at higher elevations than P. ponderosa, which it resembles.

This species begins cone formation at 8 years of age. Individual trees fruit at 4- to 8-year intervals. Individuals mature at 150 years and live to 500 years.
Pinus koraiensis Siebold & Zuccarini  
Korean pine

Slow growing tree 30–45 m. (100–150 ft.). Twigs densely rusty-brown, hairy. Needles 5 in a fascicle, persistent for 2 to 5 years, 6–12.5 cm. (2½–5 in.) long, straight. Cones sub-terminal, becoming lateral by the growth of the shoot in the summer, cylindric or conic-oblong, 10–15 cm. (4–7 in.) long, opening when mature, but so encrusted with pitch that the seeds are retained.

Grows on well-drained hillside and mountain slopes ranging from near sea level to 2500 m. (8,000 ft.) in E Russia, Man-churia, Korea and the mountains of central and S Japan.

An important timber tree with uses similar to P. strobus. The seeds are edible.

Two plants grown from seed received in 1918 are now about 25 feet tall at the Arnold Arboretum.
Pinus mugo Turra  
Dwarf mountain pine

A shrub with ascending branches to 3.5 m. (11 ft.). Twigs dark greenish-brown, smooth. Needles 2 in a fascicle, persisting 5 to 10 years, 2–8 cm. (¾–3 in.) long, stout, crowded on the twigs. Cones subterminal, 2–5 cm. (¾–2 in.) long, conical.

Grows on mountains of central and southern Europe.

Part of a variable complex of forms that range from prostrate shrubs to erect, single-stemmed trees. The forms in cultivation are useful for mass plantings on slopes and rocky areas, as well as for foundation plantings.
**Pinus nigra** Arnold  
*Black pine, Austrian pine*

Fast growing tree, 36–45 m. (120–150 ft.). Twigs stout, yellowish-brown, smooth. Needles 2 in a fascicle, persisting about 4 years, 10–15 cm. (4–6 in.) long, stiff, stout, straight or curved. Cones subterminal, 5–8 cm. (2–3 in.) long, ovoid-conic, opening at maturity.

It is native to SE Europe.

Widely planted as a windbreak, it is tolerant of poor and alkaline soils. It survives wind and heavy snow, also salt spray, but is damaged by atmospheric pollutants. Although the stem is usually straight, it is so full of knots that it is useless for timber.
**Pinus parviflora** Siebold & Zuccarini  
**Japanese white pine**

Tree 6–15 m. (20–50 ft.). Twigs slender, grayish, with minute scattered hairs. Needles 5 in a fascicle, persistent for 2 to 5 years, 2–7.5 cm. (3⁄4–3 in.) long, slender, curved and twisted. Cones subterminal, ovoid or oblong-ovoid, 5–10 cm. (2–4 in.) long, opening when mature.

Grows on elevations of from 60–2500 m. (200–8,000 ft.) throughout Japan.

In cultivation this is a relatively short, spreading tree, and may be recognized by its sometimes tufted needle clusters and small cones which are borne even on young trees. It is much used in Japan as a subject for Bonsai.
**Pinus ponderosa** Douglas ex Lawson

**Western yellow pine, Ponderosa pine**

Tree 45–70 m. (150–230 ft.). Twigs stout, orange-brown, smooth; buds resinous, with an odor of turpentine when crushed. Needles 2 to 5, usually 3, in a fascicle, persistent about 3 years, 12–26 cm. (5–10 in.) long, stout, rigid, curved. Cones subterminal, 8–15 cm. (3½–6 in.) long, ovoid-oblong, opening at maturity.

Grows at altitudes ranging from sea level to 3350 m. (10,000 ft.), from SW Oregon and NW California to North and South Dakota, Nebraska, and extreme W Oklahoma, and from British Columbia south to central Mexico.

Ponderosa pine was first recorded by Lewis and Clarke, who saw it on the upper Missouri River in 1804. It is very sensitive to air pollutants.
Pinus resinosa Aiton

Tree, 21–36 m. (70–120 ft.). Twigs stout, orange-brown, smooth. Needles 2 in a fascicle, persisting 4 to 5 years, 10–15 cm. (4–6 in.) long, slender, flexible. Cones subterminal, ovoid-conic, 5–6 cm. (2–2½ in.) long, opening at maturity.

Grows from Nova Scotia to the valley of the Winnipeg River, south to Pennsylvania.

Red pine is a valuable timber tree. It grows more rapidly than white pine, but is less tolerant of shade. It is resistant to salt spray, but suffers breakage from ice, and is sensitive to air pollutants.
**Pinus rigida** P. Miller  

*Pitch pine*

Tree, 15–18 m. (50–60 ft.). Twigs stoutish, green, becoming brownish-orange, smooth. Needles 3 in a fascicle, persistent 2 years, 7.5–12 cm. (3–5 in.), stout, rigid, slightly curved and twisted. Cones lateral, ovoid, 2.5–9 cm. (1–3½ in.).

Occurs in poor, sandy or rocky soils, Maine to SE Ontario, south to N Georgia and E Tennessee.

Remarkable for the adventitious buds on stems and branches that produce short, scrubby, branches. Unique in its ability to sprout from cut or burned stumps. It was widely planted on Cape Cod in the 1840s and 1850s on abandoned farm land. These plantations were the basis for the extensive pine woodlands there now.
Pinus strobus Linnaeus  
White pine

A fast growing tree 24.5–45 m. (80–150 ft.). Twigs thin, greenish, hairy at first. Needles 5 in a fascicle, persistent 2 to 2½ years, 7.5–10 cm. (3–4 in.) long, slender, soft, drooping. Cones subterminal, cylindrical, curved, 10–15 cm. (4–6 in.) long, resinous.

Common tree of second growth ranging from Newfoundland to Manitoba, south to Georgia.

It grows best on moist, well-drained, sandy soil; is easily transplanted, and unlike many other pines may be sheared. It is the largest growing native conifer east of the Mississippi. Old growth trees found in early colonial times were up to 6 feet in diameter at the butt. Subject to snow and ice breakage, P. strobus survives temperatures to 94° below 0° F. It is very sensitive to salt damage.

The wood is white to light brown. It is used for boxes and crates; for patterns, millwork, building construction and matches. Wood from trees less than 50 years old is usually so full of knots that it can be used for nothing save crates and knotty pine panelling.
Pinus sylvestris Linnaeus  
Scots pine

Tree, 20–30 m. (70–100 ft.). Twigs slender, orange-brown, smooth. Needles 2 in a fascicle, persistent 2 to 3 years, 2.5–10 cm. (1–4 in.) long, stiff and twisted. Cones subterminal, ovoid-conic, 2.5–7.5 (1–3 in.) long, opening at maturity. Rows of scale-like leaves on the upper parts of the branches, 4 in a column.

Occurs in north and central Europe, extending south in the mountains to Spain, N Italy, and Macedonia, eastward in N Asia to the Pacific coast of Siberia.

Widely grown and valued for timber in Europe, where it has a long history of use. The forms that have been commonly cultivated in this country have not made straight trunks and have been short-lived. Requires a well-drained soil and sometimes self-sows. It is more or less tolerant of salt spray, ice, drought, and wind, but less so than P. nigra.

P. sylvestris and P. densiflora are unique in having thin, red-brown, scaling bark on the upper parts of the trees.
Pinus thunbergii Parlatore

Japanese black pine

Tree, 30–36 m. (100–120 ft.). Twigs light brown, smooth. Needles 2 in a fascicle, persisting 2 to 3 years, densely crowded on the twigs, 6–11 cm. (2½–4½ in.) long, rigid, twisted. Cones terminal, ovoid, 4–6 cm. (1¾–2¾ in.) long, opening at maturity.

Occurs in coasts and lowlands of the islands of central and S Japan, and the coast of S Korea, sea level to 950 m. (3,100 ft.).

A common plant that has been extensively used for Bonsai.
**Pinus wallichiana** A. B. Jackson

*Bhutan pine*

Tree 15–45 m. (50–150 ft.). Twigs greenish or greenish-brown, smooth. Needles 5 in a fascicle, persisting 3 to 4 years, 12.5–20 cm. (5–8 in.) long, slender, drooping. Cones subterminal, cylindrical, 15–30 cm. (6–12 in.) long, resinous, opening at maturity.

Grows on mountains from 1600–3200 m. (6,000–12,000 ft.) in Afghanistan to Nepal.

An important timber tree and a source of rosin and turpentine. It is fast growing, but in cultivation has a tendency to branch near the base, forming a bushy tree. In Boston it has been damaged by winter cold and severe winds. It is reputed to be resistant to atmospheric pollution, and to white pine blister rust, but is susceptible to white pine weevil which damages the buds and deforms the stems.
## Insect Pests *

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<tr>
<td>Branch tips die and break off.</td>
<td>Bark of twigs and branches of most pines. Adults emerge between June and August to lay eggs.</td>
<td>dimethoate</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Based on information taken from "The 1975 Insect and Disease Control Guide for Trees and Shrubs" by Clifford S. Chater and Francis W. Holmes, published by the Cooperative Extension Service, University of Massachusetts, Amherst, Mass. 01002.
### Diseases *

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Name</th>
<th>Treatment</th>
</tr>
</thead>
</table>
| Death of leaves and twigs. | Blight Caused by various fungi and bacteria | A. In dry weather clip out and destroy affected parts. Disinfect tools between cuts.  
B. Spray with appropriate fungicide or bactericide early in the growing season (April, May), starting just before the shoots emerge and continuing until the foliage has reached mature size. Check with county agent or professional arborist for identification of blight and appropriate fungicide or bactericide. |
| Cankers on branches and trunk. | Blister Rust *Cronartium ribicola* | Prune off and destroy infected branches.  
Remove currant and gooseberry bushes (the alternate hosts of the fungus) for a radius of one mile. |
| Dead spots on surface of tree trunk or branch; many enlarge each year. Ridge of healing growth ("callus") forms at margin each year. | Cankers Caused by various fungi and bacteria | Appropriate feeding, watering, mulching, protection from other diseases and pests, and avoidance of all wounding. During dry weather, cankered branches should be pruned out of the tree and burned. Pruning tools should be sterilized between cuts, for example with a 10% solution of household bleach or 70% alcohol. All pruning cuts should be promptly treated by shaping to oval pointed in direction of sap flow and painting 3 to 4 times a year with a tree wound paint. |
| Wood inside trunk or branch or root is softened and may rot away, leaving a hollow place. | Decay Caused by various fungi | Decay organisms cannot enter except through wounds, so take all precautions to avoid wounding. If the softened wood or cavity is in a branch, cut off the branch flush with the next larger branch or trunk, and promptly treat the resulting wound (see wounds); renew wound paint several times a year to keep decay sealed out. Efforts to gouge out rot or decay in trunks generally do not succeed, but there is recent evidence that decay usually does not later extend into tissues laid down in years subsequent to the original infection. Therefore, efforts to clean out decayed wood from cavities may actually do harm by breaking this internal protection |
A state of gradually worsening ill health. Dieback implies a symptom pattern where there are more and more dead twigs and small branches in the top of a tree year after year.

<table>
<thead>
<tr>
<th>A state of gradually worsening ill health. Dieback implies a symptom pattern where there are more and more dead twigs and small branches in the top of a tree year after year.</th>
<th>Decline and dieback</th>
<th>Precise cause unknown. May be a combination of unfavorable environmental causes.</th>
</tr>
</thead>
</table>

No particular treatment known. Efforts should be made through feeding, watering, pruning and spraying to restore vigorous growth.

<table>
<thead>
<tr>
<th>Needles on the older portions of the twigs turn brown.</th>
<th>Fall browning</th>
</tr>
</thead>
</table>

No disease is involved. The only reason a plant is green the year round is that it bears more than one year's set of leaves. In the spring it adds a new set of leaves and in the fall it drops the oldest set. If only the innermost, i.e. oldest, foliage has turned yellow or brown in September or October and the same thing is happening on other individuals of the same species in that locality at about the same time, that process is normal and routine for a healthy plant.

<table>
<thead>
<tr>
<th>Browning confined to needles.</th>
<th>Leaf spot caused by various fungi</th>
</tr>
</thead>
</table>

Treatment is needed only when a large portion of the tree is affected. A fungicide should be applied at bud break (April, May), and two to four times later at 7-14 day intervals.

Check with county agent, tree warden or professional arborist for identification of leaf spot and appropriate fungicide.

<table>
<thead>
<tr>
<th>Orange pustules on the needles.</th>
<th>Needle rust Coleosporium spp.</th>
</tr>
</thead>
</table>

Destroy wild asters and golden rods (the alternate hosts) growing near pines.

Spray or dust young pines with sulphur early in the season (April, May).
<table>
<thead>
<tr>
<th>Symptoms</th>
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<tbody>
<tr>
<td></td>
<td><em>Peridermium harknessii</em></td>
<td></td>
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<tr>
<td>Yellowed or browned fleck-like spots or</td>
<td>Air pollution</td>
<td>Control can be achieved only by a community-wide effort to reduce levels</td>
</tr>
<tr>
<td>reduction of growth of the whole plant.</td>
<td></td>
<td>of pollutants in the air.</td>
</tr>
<tr>
<td>Yellowing of leaves or stunting of growth</td>
<td>Soil pollution (Oil,</td>
<td>Efforts should be made, through fertilization, watering and pruning to</td>
</tr>
<tr>
<td>resembling drought injury.</td>
<td>grease, salt)</td>
<td>restore vigorous growth.</td>
</tr>
<tr>
<td>Symptoms of drought injury due to death and</td>
<td>Root rot</td>
<td>Affects plantation (not wild) trees on poor soils.  Plant on good</td>
</tr>
<tr>
<td>decay of roots and of the stem at ground</td>
<td><em>Fomes annosus</em></td>
<td>soils or improve the soil and encourage vigorous growth by fertilization</td>
</tr>
<tr>
<td>level.</td>
<td></td>
<td>and watering. When pines are cut to thin a plantation, immediately apply</td>
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<tr>
<td></td>
<td></td>
<td>to the stumps borax powder or a solution of 2 pounds technical-grade</td>
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<tr>
<td></td>
<td></td>
<td>urea per gallon of water.</td>
</tr>
<tr>
<td>Death of the base of the tree and roots.</td>
<td>Shoestring rot</td>
<td>Encourage vigorous growth. If the soil is already infected with</td>
</tr>
<tr>
<td></td>
<td><em>Armillaria mellea</em></td>
<td>armillaria it should be replaced to a depth of 18 inches with new</td>
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<tr>
<td></td>
<td></td>
<td>soil, or fumigated.</td>
</tr>
<tr>
<td>Gradual decline in vigor of the tree.</td>
<td>Smothering</td>
<td>Prevention. Prevent soil compaction. Do not place fill over roots. Do</td>
</tr>
<tr>
<td></td>
<td></td>
<td>not paint trunks and branches with oil or paint.</td>
</tr>
</tbody>
</table>

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Garden planting of Vaccinium vilisidaea minus.