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Growing Spruce Trees in Montana

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This publication contains extensive information about spruce trees best adapted to Montana's climate. It includes sections on types of spruce; advice on obtaining spruce cultivars; recommended techniques for planting, watering, fertilizing, pruning; and information about diseases and insect problems.

Spruce trees are rugged evergreens that can withstand extreme winter cold. These trees can live as long as 200 years and rank among the largest trees that can survive on the Montana prairies. Although not as drought tolerant as ponderosa pine, they grow reasonably well in partially protected locations.

Colorado spruce, Norway spruce, Black Hills white spruce and Engelmann spruce are common in Montana. Cultivars of each species also exist, providing many ornamental opportunities for different shapes, colors and mature sizes.

Spruces are most suited to large, open areas with full sun. The figures in this MontGuide depict trees grown in open, full sun conditions. Spruces also make superb components of windbreaks and privacy screens. Over many year, spruces can grow too big for average-sized yards. Slow-growing dwarf cultivars may be appropriate alternatives.

This MontGuide provides gardeners with information on selecting adapted spruces, planting and maintaining spruces, and combating common spruce problems.

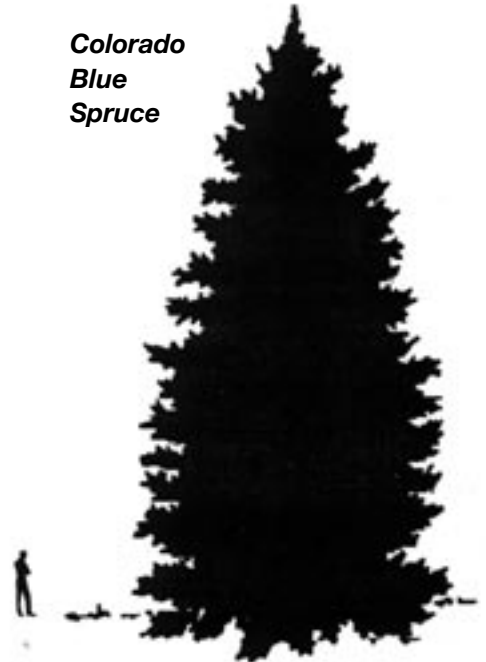
Types of spruce

Identifying spruces

At first glance, spruces, Douglas firs, and the true firs appear similar. However, they are easy to tell apart with closer inspection of the needles. Spruces have stiff, prickly, four-sided needles that are evenly arranged around the top, sides and bottom of twigs. Douglas fir and true firs have soft, flexible, flat needles that grow on the sides and sometimes the tops of twigs but rarely on the bottom. Cones of both spruce and Douglas-fir hang down from the branches, whereas true fir cones point towards the sky. Douglas fir cones have seed bracts shaped like pitchforks while spruce cones do not have bracts.

An easy way to distinguish between types of spruce is to examine their cones (see page 7).

**Colorado
Blue
Spruce**



Colorado blue spruce

(Picea pungens)

Colorado spruce is native to the mountains of Colorado, Utah, and Wyoming and grows reasonably well in yards and shelterbelts throughout Montana. It is very hardy and fairly drought tolerant. Most spruces, including Colorado spruce, prefer

mildly acidic soils (pH 5.5 to 7.0) and are slow growers in heavy clay or alkaline soils with pH above 8.0.

Growth rates vary considerably depending upon site conditions. Average growth rates may be only 3 to 4 inches per year on young trees, but may increase to 12 inches per year on good sites or with irrigation.

There are many Colorado spruce cultivars. Cultivar needle colors vary from silvery-blue to green to gold. Mature size ranges from less than one foot to 70 feet tall. Form can vary dramatically from large, pyramidal cultivars to dwarf cultivars that are ground-hugging, globe shaped, or even weeping.

Norway spruce

(Picea abies)

Norway spruce is native to Europe, where it is an important wood species. Its growth characteristics are similar to those of Colorado blue spruce. Norway spruces are reported to be more susceptible to spider mites than the other spruces listed here. The many cultivars of Norway spruce include 'Bird's Nest Spruce' which has a nest-like depression in the shrub center and may reach 3 feet high after many years. 'Little Gem' may reach 18 inches tall after 10 years.

White spruce (*Picea glauca*) or Black Hills white spruce ('Densata')

White spruce is native to much of the northern United States. In Montana, it grows naturally in the Glacier Park area. It grows best in protected areas with well-drained, moist loam soils. Mature size averages 50 feet tall by 20 feet wide.

The dozens of cultivars include Black Hills spruce ('Densata'), a slower-growing form that is more compact and considered more drought tolerant than other species. 'Conica' (Dwarf Alberta spruce) is a popular dwarf with a dense cone shape that may reach 6 feet in 25 years. 'Conica' is excellent for small hedges and as a formal specimen tree. However, spider mite injury and early spring needle desiccation are common problems. Protected planting sites and early spring shading are important for successful growth. 'Rainbow's End' is similar to 'Conica,' but has striking yellow new growth in spring that resembles Christmas lights.

Engelmann spruce

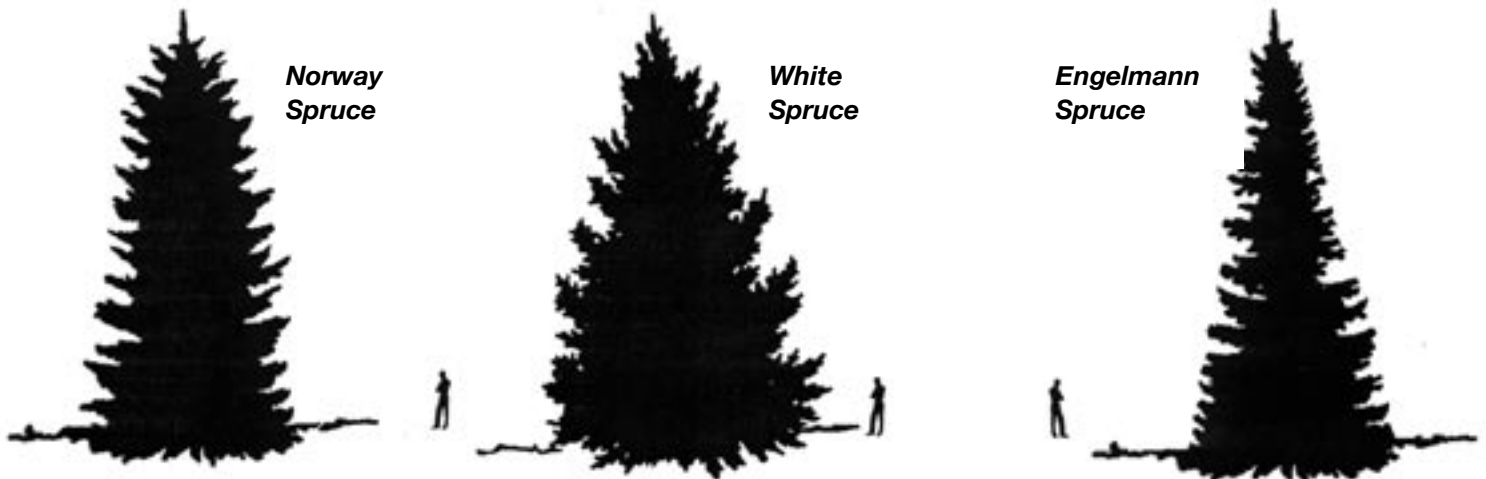
(Picea engelmannii)

Engelmann spruce is native to higher elevations of the Cascades and Rocky Mountains, including the mountains of western and central Montana. Compared to Colorado spruce, it is taller and more slender. Needles point towards the branch tip, making the branches softer to the touch. The needles have a distinctive, rank odor when crushed.

Engelmann spruce prefer deep, rich, loamy soils and ample moisture. These requirements make them fairly poor windbreak species, except at higher elevations. In central and eastern Montana, they grow slowly (25 feet high in 40 years). There are approximately eight cultivars which include 'Argentea' (silvery-gray needles), 'Glauca' (steel-blue needles), and 'Snake' (a bizarre, sparsely-branched upright form).

Obtaining spruce cultivars

Montana nurseries carry many full-sized spruce tree forms and some dwarf types. Very few dwarf conifers have been tested adequately under Montana conditions, although we expect many to



grow well here, especially in protected areas. For more information on dwarf conifer varieties, contact the American Conifer Society at P.O. Box 360, Keswick, VA 22947-0360 or at their World Wide Web site (www.pacificrim.net/~bydesign/acs.html).

Planting and maintaining spruce

Planting

Fall or spring are suitable for planting spruce. Dormant spruces usually transplant better than do actively growing spruces. Transplanting in hot, dry summer weather often results in drought stress and poor survival. In fall, plant after the first hard frost when the soil is still warm. Mulch around trees to avoid frost heaving of the roots. In spring, plant as soon as the soil is workable. Do not plant during chinooks.

Small seedlings can be obtained as either bareroot or container stock. Larger trees can be obtained with their root systems and soil enclosed in burlap wrapping (balled and burlapped). However, the roots must not be wrapped in burlap longer than six months or they will be severely root-bound and less likely to survive. If the burlap is biodegradable, prior to planting slice the material vertically the entire length of the root ball along every six inches of the circumference to encourage roots to grow outward. Remove plastic burlap and wires since these will not decompose.

Fine roots will dry out and die when exposed to the air for only a few minutes during transplanting. Keep roots moist by wrapping them in wet

burlap or dipping them in a slurry of clay or commercial equivalent (such as "Hydrosorce") until replanting.

Dig a large planting hole so that roots are not twisted or J-shaped (bent upwards). Prune aberrant roots to fit the hole. Plant trees with the soil surface approximately one inch above the upper roots. Planting spruces too deeply will cause the buried part of the stem to die.

Water after planting, since the small root systems of new transplants are less able than established trees to extract water from dry soil. Keep moisture such that the soil has the texture of a freshly baked cake. Overwatering in heavy clay soil can deplete soil oxygen and cause root death.

When transplanting young established spruces, prune the roots one year before transplanting, preferably in early spring. Root pruning causes trees to send out multiple rootlets at the point where the roots are cut, producing a denser rootball. Slice the roots spade-deep in a circle around the drip-line. Water well after root pruning or severe drought stress may occur.

The larger the root system taken with the tree, the better the chances for survival. Expect several years of recovery time following transplanting before optimal growth resumes. Larger trees may take longer to establish in the new site than seedlings.

Water

Watering frequency depends on soil type, air and soil temperature, and wind speed. Addition of 3 to 4 inches of mulch under the entire tree canopy (dripline) can conserve water and improve growing conditions. New

transplants generally need more frequent watering than established trees. A drip irrigation system generally provides the most effective deep watering. Shallow watering encourages shallow rooting and weaker plants.

Stop watering in mid-August to help trees harden-off for cold weather. If water is available in the fall, water evergreens thoroughly after leaves of deciduous trees have fallen. Fall watering helps trees tolerate drying winter conditions. Many Montana wells have high salt levels that actually can desiccate trees and shrubs. Test water from questionable sources to ensure suitable quality for irrigation.

Fertilizer

Unusually stunted needles, light green foliage, dead twigs on the ends of branches, and poor growth may indicate the need for fertilizer. However, other causes can mimic these same symptoms. A soil test can help detect nutrient problems.

At the time of planting, a slow release fertilizer pellet (designed for Christmas tree plantations) can be placed into the bottom of the planting hole, slightly deeper than the tree root system. Only use fertilizers with nitrogen designations less than "10" unless diluted with water. For example, 20-20-20 fertilizer diluted to 2 pounds per 100 gallons of water roughly equals "4-4-4." A general fertilizer recommendation for spruces is an application of not more than 0.15 pounds actual nitrogen for trees with diameters less than 6 inches and a maximum of 0.30 pounds for larger diameter trees. All applications should

be evenly distributed within a distance 1½ times the crown width.

Apply fertilizers in spring after the danger of severe frosts but no later than mid-June. Liquid mixtures ensure the best soil penetration. Apply dry fertilizers with a good watering. Distribute the fertilizer evenly in a circle one and a half times the width of the canopy.

Pruning

When planted where they have room to grow, spruces need little pruning because of their natural symmetry. Spruces will, however, respond well to light pruning by developing a denser crown. If an older spruce has outgrown its bounds, removing the lower branches can open up the canopy and make the tree appear less imposing. Never remove more than one-third of the total needle area. Do not remove the top of the tree.

If some shaping is desired, prune new growth in early June. Most spruce buds form on the current year's growth with only a few buds on the second year twigs. Leave at least one live bud on each pruned branch or the branch will die. If two leading shoots develop on the tree top, remove the weaker one to maintain a structurally sound tree. Remove broken or dead branches regardless of the time of year by cutting them off flush with the main tree stem.

Common problems

Physiological causes of tree decline

Trees do not grow in many parts of Montana because of the harsh climate. Any trees planted in these areas will be stressed to some degree. Since spruces naturally have shallow root systems, they suffer from heat and drought stress. Protection from wind, partial shade at the base of trees on southern exposures, and watering during drought will benefit spruces and build their defenses against insects and diseases.

Certain stresses can impact trees for their entire life. These include the genetic makeup of the individual tree, improper planting, poor planting site, soil type, and climate. Stresses that persist from planting time often become visible many years later. For example, if a container-bound spruce with circling roots is planted, the roots often continue to grow in a circle near the trunk. As the tree grows tall without a solid root anchoring system, strong winds may uproot the tree. Other stresses may occur for only a short period of time but have long-lasting effects on the tree. These include drought, flooding, frost, deicing salts, nearby construction, and deer or rodent injury.

Winter burn

Shoot desiccation causes more winter injury to spruce than does cold temperature. Evergreens remain minimally active in winter and continually lose some water through the needles. When the needles lose more water than the roots can replenish,

needles turn brown starting at the tips. Usually, damage is most severe on the sunny, southwest-facing branches or on the windward side. Spruce survive best when protected on the windward or sunny side by several rows of deciduous trees or shrubs.

Cytospora canker

(Cytospora kunzei)

The fungal disease Cytospora canker is common in Montana and is most damaging on Colorado and Norway spruces. The first indications of Cytospora canker are dying lower branches with bluish-white-colored resin flowing from cankered areas. Upper branches die in subsequent years. Infected inner bark and the cambium tissue directly below the bark are brown, whereas healthy tissues are light-colored. Removal of outer bark slivers just beyond the resin soaking often exposes black pinhead-sized depressions (spore-producing fungal bodies).

Cytospora invades trees through wounds. Splashing rain, wind, insects, birds, rodents, and man spread disease spores to new branches or other spruces. Older trees weakened from drought and hail injury are most susceptible. Other environmental stresses such as insect or mechanical injury also favor Cytospora.

Remove and destroy infected branches. The best time to prune is in late winter before spores are released in the spring; however, it is acceptable to prune dead branches at any time of year

if the weather is dry. Prune 4 to 6 inches ahead of the canker, cutting back to the nearest living lateral branch or to the trunk. Disinfect tools between cuts to avoid spreading the disease. Fungicides are not effective against *Cytospora*.

Rhizosphaera needle cast

(Rhizosphaera kalkhoffii)

Rhizosphaera needle cast occurs sporadically in Montana on Colorado and Engelmann spruce. Prolonged spring rain is necessary for infection. While infection occurs in spring, symptoms are not visible until late fall or the following summer. Second year needles turn yellow and then purplish brown before dropping from the tree, leaving branches with current year needles only. Pinprick-sized black dots produced in rows on discolored needles indicate that Rhizosphaera is involved. These spore-producing bodies are visible through a magnifying lens.

Most Rhizosphaera spores survive on dead needles on the ground. Remove infected needles from under the tree and destroy them to minimize disease spread. In locations favorable for disease, control nearby weeds and debris and prune lower branches to increase air circulation. Two applications of fungicides such as chlorothalonil or Bordeaux mixture provide good disease control. The first application should occur when new needles are half developed with a second application two to three weeks later.

Cooley Spruce Gall Adelgid

(Adelges cooleyi)

Cooley spruce gall adelgids are sap-sucking insects that produce brown, pineapple-shaped growths on branch tips. The galls look unsightly, but usually cause little damage.

To reduce adelgid populations, prune galls when they are green or purple and still contain immature adelgids (spring or early summer). By the time galls turn brown, the insects have already migrated to other twigs or nearby trees.

Insecticides rarely are necessary. However, if many adelgids are present on needle bases, insecticidal soap used in early spring and early fall can reduce populations. Alternatively, apply a granular systemic insecticide over the root zone, then water in. Avoid wide-spectrum insecticides that also kill beneficial insects which control pests naturally.

Pine needle scale

(Chioaspis pinifoliae)

Spruce, pine, and fir all are susceptible to pine needle scale. This insect forms what looks like white paint splatters on needles. The "paint" is a protective armor over the insect body. Scales suck sap from needles, resulting in discolored spots and sometimes needle drop.

Insecticides applied during the crawler stage are effective when infestations are severe. Unarmored crawlers emerge in May and again in early August. Shake infested branches over white paper and look for very small, reddish purple crawling insects. Crawlers are present for one to two weeks before maturing to sedentary,

armored nymphs and adults that resist insecticides. Several contact insecticides and horticultural oils are effective on crawlers that have been settled for only two to three weeks. Dormant oils provide fairly good control, but they must be applied before spruce become active in the spring (February or March), and they turn blue needles green temporarily.

Red spider mite and other sucking insects

(Oligonychus ununguis)

Spider mites suck sap from spruce needles and reduce tree vigor. They also cause fine yellow speckling, "dusty dirt," and silk webbing on needles. Severe symptoms include curled, brown, or bleached needles that drop from the tree.

Eggs and adults overwinter in bark crevasses or in ground debris, emerging in early spring. Huge population increases occur each season. Their small size allows spider mites to blow great distances by wind.

Monitor for new infections by holding a sheet of white paper under the needles and tapping the branch firmly with a stick. Use a magnifying glass to view the crawling spider mites which may be yellow, red, or green and are approximately the size of a grain of salt ($\frac{1}{50}$ " long).

Beneficial insects, dormant oils, and insecticidal soaps often can keep low level mite infestations under control. Natural populations of beneficial

insects that feed on mites generally are present on spruces and other trees. Information on commercial sources of beneficial insects to supplement natural populations are available from your county MSU Extension agent. Dormant oils sprayed in February or March can kill overwintering spider mite eggs. After removing ground debris under spruce trees, applying a ground drench of insecticidal soaps also can help reduce mite populations.

Often by the time spider mite infestations become noticeable, mite numbers are so great that beneficial insects and insecticidal soaps are ineffective. Several insecticides provide very good control against spider mites. Since pesticide registrations change frequently, ask your county MSU Extension agent which insecticides currently are registered for spider mite control.

Spruce needleminer

(Taniva albolineana)

Webbed masses of loose, dead needles clinging to spruce twigs indicate the presence of spruce needleminer. Needleminer larvae overwinter in cocoons within webbed needles. Adult moths emerge and lay eggs on the needles in early summer. The larvae mine into and sever needles from their base, attaching them to twigs with webbing. Larvae feed until the onset of cold weather.

Jet sprays of water in early spring before the buds open can knock the nests from the tree. Destroy the infested needle debris to kill the larvae. Alternatively, systemic insecticides labelled for needleminer can be applied as eggs are starting to hatch in June.

White pine weevil

(Pissodes strobi) and ***Western pine shoot borer*** *(Eucosma sonomana)*

The white pine weevil and pine shoot borer cause leader shoots of spruce to become crooked and die, forming a characteristic “shepherd’s crook.” Larvae cause most of the damage by boring out the center of the terminal leader. Consequently, spruce trees become multiple-stemmed and bushy. Young trees can be killed.

Shoot borer larvae have legs, whereas pine weevil larvae are legless. Shoot borer adults are gray moths (³/₄ inches long) with copper colored bands on the wings. Adult weevils are mottled brown and white, have a long curved snout, and are about ¹/₄ to ³/₈ inches long. Adults emerge in late summer and overwinter in the ground. In the spring, adults of both species lay eggs on the bark of the terminal leader. Larvae emerge in 7 to 10 days and tunnel downward between the bark and wood of shoots.

Pruning and destroying infected shoots as soon as they are noticed is the best control for both pests. Spring control of adults may be accomplished by spraying terminal leaders with a systemic insecticide, although spraying must be timed with adult weevil or moth activity, a tricky proposition. When severe infestations occur, pheromone strips that disrupt the mating cycle are available through Pherotech (sales@pherotech.com).

Note:

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*Colorado
Blue
Spruce*



*Engelmann
Spruce*



*White
Spruce*



*Norway
Spruce*

Spruce cones are very distinctive, according to species.
Cones are shown here at approximately actual average size.



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