

Pinus ponderosa
Ponderosa Pine

Ponderosa pine (*Pinus ponderosa*) is one of the most widely distributed pines in North America. Two varieties are recognized, Pacific ponderosa pine (*P. ponderosa* var. *ponderosa*) and Rocky Mountain ponderosa pine (*P. ponderosa* var. *scopulorum*). A number of races are recognized within each variety. The vast majority of the ponderosa pine within the state of Washington is classified as the north plateau race of Pacific ponderosa pine (Conkle and Critchfield 1988). This race is characterized by almost always having three needles per fascicle; relatively short, thick needles; purple male flowers and cones; and certain biochemical traits (Critchfield 1984).

In Washington, ponderosa pine occurs from sea level to 4000 feet, but is found mainly to the east of the Cascade Crest (Critchfield and Little 1966, and Oliver and Ryker 1990). A rich variety of tree species are associated with ponderosa pine; western juniper on the drier sites; trembling aspen in riparian areas; and lodgepole pine, Douglas-fir, grand fir, western larch, and western white pine on mesic sites (Franklin and Dyrness 1973). The primary range is along the east slopes of the Cascades, extending eastward throughout the Okanogan Highlands. The species is also found in the Blue Mountains of southeastern Washington and in a number of isolated populations to the west of the Cascades, including one near Fort Lewis, one in Mt. Rainier National Park and one in the North Cascades National Park. Local experts suspect the isolated population Little (1971) shows in the Olympic Mountains was planted (Ed Schreiner, personal communication, August 2000). The racial identity of these isolated west-side populations is not clear.

Average annual temperatures are similar throughout the large range of ponderosa pine and fall between 41 and 51° F, but annual extremes vary widely from minus 40° to 110° F. Soil moisture often limits growth of ponderosa pine, particularly during the dry summers that are characteristic of most of its range within the state of Washington (Oliver and Ryker, 1990).

Long-term information on range-wide variation is available for ponderosa pine because some of the earliest seed source tests in North America were established in 1911 at Priest River, Idaho, (Steinhoff 1970, and Weidman 1939) and in 1928 at 6 locations in Washington and Oregon (Munger 1947, and Squillace and Silen, 1962). These tests provided much of the information used to subdivide the species into varieties and races.

Details on adaptability within more limited geographic areas, particularly for the north plateau race were not identified until more recently. Sorensen (1994) found that along the east side of the Oregon Cascades, north to south movement of seed had to be limited by three to five seed zones to control the risk of maladaptation. Sorensen and Weber (1994) also found that seed zones limiting east to west movement of the seed were necessary on the east side of the Cascades in Oregon as well. Rehfeldt (1980, 1986a, 1986b, 1986c, 1988, and 1991) described genetic variation within northeast Washington, as well as nearby parts of Idaho and Montana. He found that two to three seed zones were necessary to limit seed movement in the northeastern part of Washington.

Both Sorensen and Rehfeldt found that adaptation among ponderosa pine populations reflected a balance between the need to grow rapidly in mild environments and to tolerate climatic insult in stressful environments. They found that elevation, which reflects variation in the length of the growing season, was closely related to genetic variation. Lower elevation populations tended to get taller because they grew for a longer period of time, but they were more susceptible to frost damage. Sorensen and Weber (1994) recommended that seed movement be limited to 1000 foot bands below 5000 feet in elevation and 700 foot bands above that point. Rehfeldt (1991) found that populations within a drainage that are separated by more than 1360 feet in elevation, or 35 days in the length of the growing season, tend to be genetically different. Randy Johnson and Nancy Mandel (personal communication, 1999) found that elevation accounted for most of the variation among populations of ponderosa pine on the Wenatchee National Forest. They recommended using 700 foot elevational bands to limit seed movement across all elevations on this Forest.

Isolated populations sometimes contain unique forms of genes. Some people believe the three isolated populations on the west side of the Cascades are remnants of a once widespread community. In any case, it would be prudent for the land managers responsible for these areas to stockpile local seed for future reforestation.

The Cascade Range in Washington is divided into northern and southern physiographic regions at Snoqualmie Pass (Franklin and Dyrness, 1973). The northern portion is comprised of ancient sedimentary rocks while the southern portion is primarily andesite and basalt flows. Mean annual precipitation is fairly uniform at a constant elevation along the entire eastern slope, but decreases rapidly from west to east. Temperature is also fairly constant at a given elevation throughout the northern two-thirds of the Cascades, but becomes warmer south of Mount Adams. Summer aridity divides the eastern slopes into a drier area south of Ellensburg. These north to south differences, while not large, suggest that the area be divided into northern and southern seed zones. The eastern half of the Okanogan Highlands is slightly wetter than the western half. Temperature is mostly influenced by mountains and valleys with no general east to west pattern (St. Clair and Vance-Borland, 1998).

New recommendations for seed transfer zone boundaries

PUGET (Zone 1): An isolated population occurs near Tacoma on the grounds of Fort Lewis. There is only one elevation band.

RAINIER (Zone 2): An isolated population occurs on the east side of Mount Rainier. There is only one elevation band.

ROSS (Zone 3): An isolated population occurs to the east of Ross Lake on the west side of the Cascade Crest. There is only one elevation band. Seed from nearby westside populations in Canada could be used if no seed is available from this population.

CHELAN (Zone 4): Northern boundary starts at the western edge of the ponderosa pine range along Sawtooth Ridge, follows the northern boundary of old seed zone 621 to Goat Mountain and east to Bridgeport. Eastern boundary is the edge of the ponderosa pine range from Bridgeport to the Wenatchee Mountains, approximately 10 miles south of Wenatchee. Southern boundary follows the southern boundary of the old 622 seed zone along Wenatchee Mountain, northwest to Three Brothers and the western edge of the species range. Western boundary follows the edge of the species range north to Sawtooth Ridge.

YAKIMA (Zone 5): The portions of the ponderosa pine range on the east slope of the central Washington Cascades between the Chelan and White Salmon seed zones. Includes parts of old seed zones 631, 632, and 641.

WHITE SALMON (Zone 6): The portions of the ponderosa pine range on the east slope of the southern Washington Cascades. Northern boundary follows the line between Cowiche Mountain and Darland Mountain. Includes portions of old seed zones 042, 440, 651, 652, 653, and 642.

OKANOGAN (Zone 7): Northern boundary is the Canadian border from the western limit of the species range to the Okanogan River. Eastern boundary is the Okanogan River from the Canadian border to the Columbia River, and along the Columbia River to near Bridgeport. Southern boundary proceeds west from Bridgeport to Goat Mountain and follows the northern boundary of old seed zone 621 along Sawtooth Ridge to the western limit of the ponderosa pine range. Western boundary is the western limit of ponderosa pine range near Lake Chelan north to the Canadian border.

KETTLE (Zone 8): Northern boundary is the Canadian border from Okanogan River to Columbia River. Eastern and southern boundaries are the Columbia River from the Canadian border to Grand Coulee Dam, and then west along the southern limit of the ponderosa pine range to Bridgeport. Western boundary is the Columbia River from Bridgeport to the Okanogan River and north along the Okanogan River to the Canadian border.

PEND OREILLE (Zone 9): Northern boundary is the Canadian border from the Columbia River east to the Washington/Idaho border; eastern boundary is the Washington/Idaho border south to Highway 2 at Newport; southern boundary is west from three miles south of Newport to north side of Deer Lake, south to Loon Lake, west along Chamokane Creek to a point northeast of Blue Mountain, then north and west along the Stevens County line to near Cedonia on the Columbia River; western boundary is the Columbia River north to the Canadian border. Consists of the old seed zones 811, 812, 813, 821, and 822.

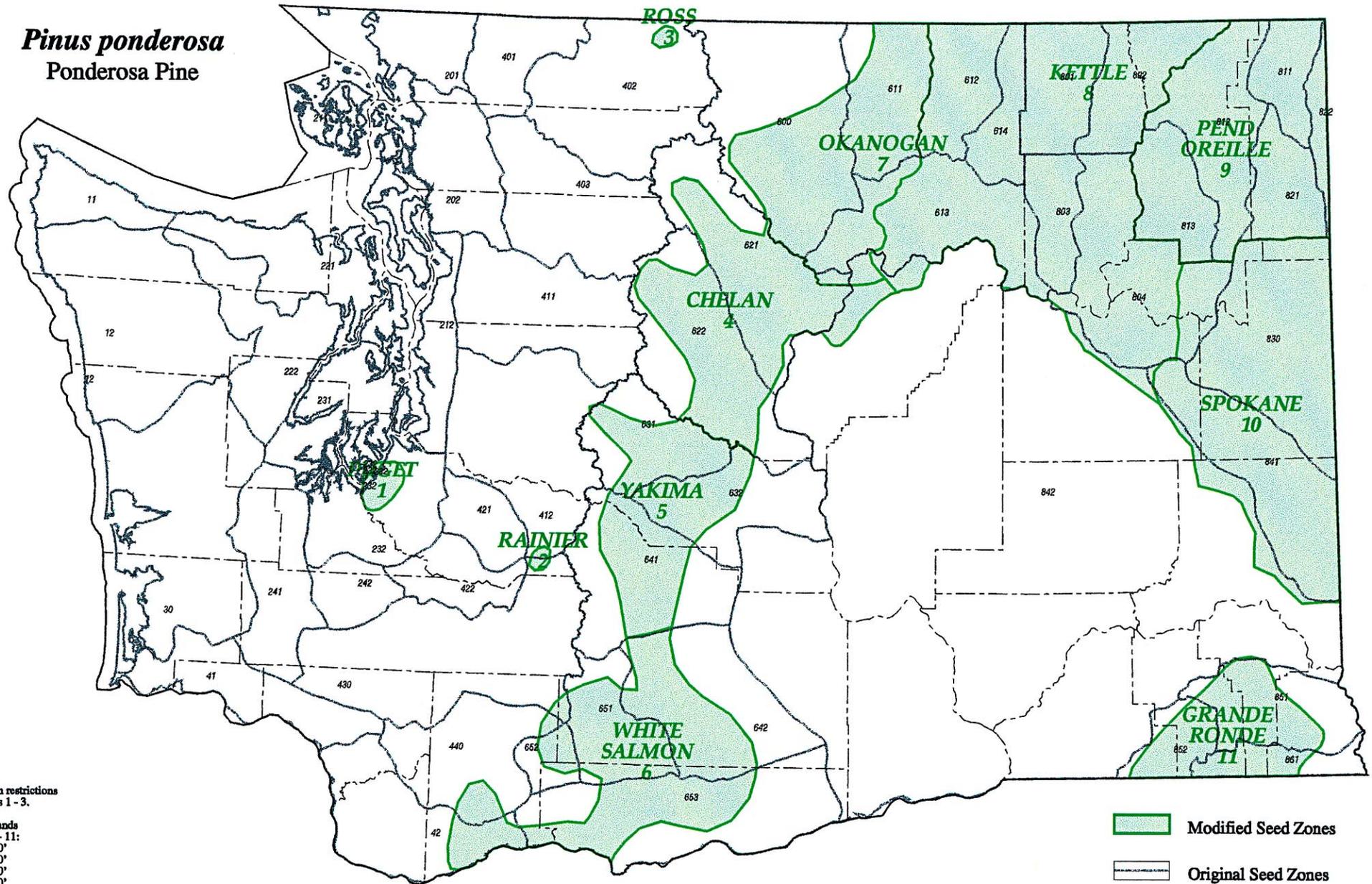
SPOKANE (Zone 10): Northern boundary is east from the north edge of Deer Lake to three miles south of Newport; eastern boundary is Washington/Idaho border south to Highway 3, six miles east to Pullman; southern boundary follows the edge of the species range (including an isolated population in Whitman County) approximately from Washington/Idaho border at Idaho's Highway 3 northwest to Mockonema, Saint John, Rodna, Blue Stem, and Davenport; western boundary is from Davenport to a point between Mondovi and Reardan, and north to Chamokane Creek. Consists of the old seed zones 830, 841, and a portion of 804.

GRANDE RONDE (Zone 11): All portions of the natural range of ponderosa pine in the Blue Mountains. Includes parts of old seed zones 851, 852, and 861.

Elevation bands within geographic seed transfer zones

Puget, Rainier and Ross: a single elevation in each of these zones. In all other seed movement zones, 1000-foot elevation bands should be established.

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No elevation restrictions
within zones 1 - 3.

Elevation bands
for zones 4 - 11:
0' - 1000'
1000' - 2000'
2000' - 3000'
3000' - 4000'
4000' - 5000'

-  Modified Seed Zones
-  Original Seed Zones
-  County Boundaries

Modified Seed Zones