Alnus rubra
Red Alder

Red alder (*Alnus rubra*) is the most common and most important hardwood tree of the Pacific Northwest, where it occurs both in pure and mixed stands (Harrington *et al*. 1994). Generally it occurs no further inland than 100 miles and at elevations no higher than 2500 feet (Fowells 1965). In Washington, red alder is prevalent along the coast, throughout Puget Sound, and along the lower Columbia River. The best stands are found below elevations of 1500 feet. (Hibbs *et al*. 1994 and Harrington *et al*. 1994). Only rarely is red alder found east of the Cascade Range (Ager and Stettler 1994).

Conifers associated with red alder include western redcedar, western hemlock, grand fir, Sitka spruce, and Douglas-fir, while hardwoods include vine maple, bigleaf maple, and black cottonwood. Throughout the moist to wet sites of the coastal zone, red alder reproduces abundantly and grows rapidly on disturbed forest land (Franklin and Dyrness 1973).

Adams *et al*. (1996) summarized genetic knowledge of red alder by noting that while the species has considerable genetic diversity, there are conflicting reports about patterns of variation. For example, various researchers have identified different parts of Washington as the best place to obtain seed. Lester and DeBell (1989) found that the fastest growing sources of red alder were from Concrete and Sequim, Washington while Ager and others (Ager and Stettler 1994, and Ager *et al*. 1993) found that the fastest growing sources were from the lower Hoh River. Growth does seem to be influenced by elevation. Not only was each of the previously mentioned, fast growing sources from low elevation, but Ager and others (Ager and Stettler 1994 and Ager *et al*. 1993) found that the best growth within a drainage was always associated with sources from the lower elevations. Researchers in France found the best sources were from warm areas with low moisture demands (Hibbs *et al*. 1994) which are at low elevations in northwest Washington. For red alder from Washington and Oregon, latitude and growth were not consistently correlated (Ager and Stettler 1994). Xie *et al*. (1996) found the fastest growth for populations that were in the south, inland, and at low elevation, which was not consistent with results by Ager *et al*. 1993).

Ager *et al*. (1993) found that patterns of genetic variation were related to variation in local climate with annual temperature amplitude explaining the most variation. When seedlings from different sources were grown at a single location, high elevation and interior sources generally showed earlier leaf abscission than coastal and low elevation sources. Leaf abscission was also related to the average date of first fall frost at the seed source (Ager 1988). Coastal and northern sources leafed out earlier than more inland and southern sources, but source elevation and flushing were not correlated in a test of red alder that included only material from Washington and northern Oregon (Ager *et al*. 1993). Cannell *et al*. (1987) divided a collection of coastal red alder that extended from Washington to Alaska into three groups based upon bud set. He also found that the onset of frost hardening occurred two days earlier for each

degree of latitude northward that a seed source was obtained. Xie and others (1996) found spring bud flush was strongly controlled by latitude, with northern sources flushing earlier than southern sources. Frost damage became a problem when seed from a source at 50 feet in elevation was transferred to a planting site at 2500 feet in elevation (DeBell and Wilson 1978).

Ager and others (1993) found that variation in red alder was similar to, but slightly less than, its associated conifers; except that the amount of within population variation was much smaller. Xie and others (1996) found somewhat higher levels of within-population variation than was reported by Ager and others (1993), and concluded that the complexities of variation patterns result from adaptation to local climates. It is interesting to note that in natural stands, red alder and western hemlock have the same spring flushing pattern with coastal and high elevation stands flushing first and inland and low elevation stands flushing later.

New recommendations for seed transfer zone boundaries

HOH (Zone 1): Northern boundary is the Washington Coast from Cape Flattery east to Angeles Point; eastern and southern boundary is south from Angeles Point to Elwha and south to the edge of the gap in the species range around the Olympics, following the edge of the species range south along the west side of the Olympics to the southern boundary of the old 012 seed zone near Colonel Bob, then southwest along the old 012 line to the coast near Point Grenville; western boundary is the Washington coast from Point Grenville north to Cape Flattery. Consists primarily of old seed zones 011 and the western half of 012.

TWIN HARBORS (Zone 2): Northern boundary is Point Grenville east along the southern boundary of the old 012 seed zone to the edge of the gap in the species range around the Olympics near Colonel Bob, then east along the southern boundary of the species range to near Capitol Peak in the Olympics; western boundary is the western edge of the old 030 seed zone, approximately South Mountain, Elma, Weikswood, Doty, Huckleberry Ridge, circling around the headwaters of the Naselle River and then straight south along the western edge of Wahkiakum County to the Columbia River at Grays Bay. Consists of old seed zones 030 and western tip of 041.

NOOKSACK (Zone 3): Northern boundary is Washington-Canadian border from Blaine to the eastern edge of the species range east of Black Mountain; eastern boundary follows the edge of the species range south to near Grassmere; southern boundary starts at the edge of species range near Grassmere and goes west to Lyman, Sedro-Woolley, and Blanchard; western boundary follows coast north from Blanchard to Blaine. Consists of old seed zones 201, the northern half of 202, and the western half of 401.

PUGET SOUND (Zone 4): Northern boundary is Washington-Canadian Border at Point Roberts, southeast to Blanchard, Sedro-Woolley, Lyman and the edge of the species range near Grassmere; eastern boundary is eastern edge of the species range south along Cascade slopes to near Spar Pole Hill; southern boundary is westward from Spar Pole Hill to Graham, DuPont, and Olympia; western boundary is Olympia then west along the southern boundary of the old 231 and 222 seed zones to the edge of the gap in the species range in the Olympic Mountains near Capitol Peak, north along the western edge of the gap in the species range to near Mount Carrie, and north to Elwha and Angeles Point. Consists of old seed zones 211, 212, 221, 222, 231, and the northern portion of 232.

UPPER CHEHALIS (Zone 5): Northern boundary starts at the northern edge of the old 241 seed zone west of Dayton Peak and goes east to Olympia, Dupont, Graham and to the eastern edge of the species range near Spar Pole Hill; eastern boundary is south from Spar Pole Hill along edge of the species range to the southern boundary of the old 430 seed zone west of Goat Mountain; southern boundary follows the southern boundary of the old 430 and 241 seed zones west through Wolf Point and Castle Rock to Huckleberry Ridge; western boundary follows the western edge of the old 241 seed zone north through Doty and Elma to a point west of Dayton Peak. Consists of old seed zones 241, 242, western half of 422 and 430, and southern portion of 232.

LOWER COLUMBIA (Zone 6): Northern boundary is Huckleberry Ridge southeast along the southern boundary of the old 241 and 430 seed zones through Castle Rock and Wolf Point to the edge of the species range near Goat Mountain; eastern boundary is south along the edge of the species range from near Goat Mountain to a point near Silver Star Mountain, and then east to Trout Lake and Dallesport on the Columbia River; southern boundary is the Columbia River from Dallesport to Grays Bay; western boundary is north from Grays Bay along the western edge of Wahkiakum County, north and east along the southern boundary of the old 030 seed zone around the headwaters of the Naselle River to Huckleberry Ridge. Consists of old seed zones 042, eastern three-fourths of 041, the most western portion of 653 and western quarter of 440.

Elevation bands within geographic seed transfer zones

Within each seed movement zone, 1000-foot elevation bands should be established.