

AN ABSTRACT OF THE DISSERTATION OF

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The tree species and size structure of 91 old-growth forests dominated by Douglas-fir in central western Oregon was characterized using complete inventories of all trees larger than 20cm dbh over a mean area of 17.1ha at each site. Douglas-fir accounted for over 75% of the total average basal area (39.1 of 49.2 m²/ha) at each site. Conventional and multivariate analysis indicated that the non-Douglas-fir component accounted for most of the structural variation between sites. Multivariate analysis characterized six groups based on the similarities and differences among sites in basal area of small (20-50cm dbh), medium (50-100cm dbh), and large (>100cm dbh) western hemlock, western red cedar, incense-cedar, grand fir, red alder, and bigleaf maple.

The hypothesis that large-diameter, old-growth Douglas-fir in central western Oregon developed at low stand densities was supported by patterns of long-term diameter and basal area growth of trees, wide mean within-site age ranges (95% CI for mean = 134-214yr), and stem and crown characteristics. The diameters of the old-growth trees at ages 100 to 300yr were strongly, positively, and linearly related to their diameters at age 50yr and, more importantly, to their basal area growth rates as young, 50 year-old trees. Rapid and sustained growth by age 50yr was strongly correlated with large diameters at older ages, particularly at ages 100-200yr. Average periodic basal area increments (PAI_{BA}) of all trees increased for the first 30-40yr and then plateaued, remaining

relatively high and constant from age 50 to 300yr. Over a third of the trees ≥ 300 years old had not reached culmination of mean annual basal area increment (MAI_{BA}) by age 300yr. Low heights to live and dead meristematic branches suggest that many of the old-growth trees grew at low stand densities. Live branches occurred on over 50% of the bole, on average. Average height to diameter ratios of the old-growth trees were below 50 (unitless), indicating high mechanical stability. Compared to young-growth trees in high-density stands, young-growth trees in low-density stands have crowns and height-to-diameter ratios more similar to old-growth trees.