

Understanding columnar growth of western redcedar (*Thuja plicata*) in the Kitimat Valley

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In this study, we are combining morphological, physiological and anatomical approaches to better understand columnar growth of western redcedar (*Thuja plicata*) in the Kitimat valley. Both aerial emissions and geological maps of the area were superimposed for selecting the sample sites. Six different locations were chosen, three of them located along the aerial industrial emission corridor from Kitimat to Onion Lake (defined as high (7.6-10 ppb SO₂), mild (2.6-7.5 ppb SO₂) and low emissions (1-2.5 ppb SO₂)). The remaining three locations were paired with the above-mentioned sites and were chosen based on their geological similarities to their pairs, but located outside the aerial emissions corridor (defined as controls 1, 2 and 3 respectively). Leaf cell and branch development, physiological and growth traits, along with elemental analysis including aluminum, fluoride and sulphur concentrations in foliage and soil were measured in 10 trees per site, aged between 15- to 42-year old. Interesting findings include that: (1) columnar tree shape is very pronounced in redcedars in the high emission locations, and absence in lower emission locations. (2) A rotation in the growth axis in scaffold branches was identified in columnar trees. Density of foliage in the scaffold branches is not homogeneously distributed when compared to control trees. The inner side of branches from columnar trees had very few lateral branches contrasting with an overstated increment in the external side of the foliage. (3) Gas exchange was reduced in columnar trees when compared with the controls. (4) Water potential changes were associated with the geographical location of the trees rather than with the exposure to aerial emissions. These results suggest that columnar tree shape is related to aerial industrial emissions in redcedar and that it might be a useful indicator species in terms of its response to air quality in the Northwest coast forest. Further investigation regarding seed production and seed germination, along with susceptibility to biotic or abiotic stresses, might be necessary for ruling out possible detrimental effects of air pollutants in the fitness and survival of western redcedar.