



US Forest Service R&D PNW Research Station

Project Title: Role of Nurse Logs in Forest Expansion at Timberline

Project Personnel: Adelaide Johnson, U.S. Forest Service, Pacific Northwest Research Station and Alan Yeakley, Portland State University, Department of Environmental Sciences and Resources, Portland, OR

Project Contact: Adelaide Johnson, 907-586-8811, ajohnson03@fs.fed.us

Project Description: Nurse logs, known to be key sites of forest regeneration in lower elevation temperate forests, may also be important sites for seedling establishment at expanding timberline. To determine factors associated with seedling establishment and survival on nurse logs at timberline, 14 sites, located across a precipitation gradient in the Washington North Cascades Mountains, were examined. Site attributes including seedling type and height, disturbance process introducing downed wood, wood decay type, shading, slope gradient, aspect, and temperature and water content of wood and adjacent soil were determined along 60-m-long transects. Nurse logs were found at 13 out of 14 sites (shady sites typically associated with highly decayed downed wood). Downed wood originated from blowdown, snow avalanches, and forest fires. In total, 46 of 136 downed wood pieces observed served as nurse logs. Seedlings on nurse logs included mountain hemlock (*Tsuga mertensiana*), Pacific silver fir (*Abies amabilis*), yellow-cedar (*Chamaecyparis nootkatensis*), subalpine fir (*Abies lasiocarpa*), Engelmann spruce (*Picea engelmannii*), and western larch (*Larix occidentalis*). Nurse logs had significantly higher temperatures ($p = 0.015$) and higher moisture contents ($p = 0.019$) than the adjacent soil. Per equal volumes weighed, nurse logs had on average 23.8 g more water than the adjacent soil. Given predictions of climate warming and associated summer drought conditions in Pacific Northwest forests, the moisture provided by nurse logs may be critical for conifer survival and subsequent timberline expansion in some landscapes.

Project Deliverables: This work will form the basis of a Ph.D. dissertation and will result in papers published in peer-reviewed literature and presentations at scientific meetings.

Project Outcomes: Ecologists and geomorphologists will use information on landscape position and shading, moisture, and temperature status of the substrate to better predict conditions for suitable for seed germination in subalpine forests. Scientists and forest managers interested in predicting carbon sequestration in expanding alpine forests will be able to use this information as well.