AGU Fall Meeting 2020 5/24/21, 9:48 AM

# B100-05 - Growth Decrease Linked to Warming Minimum Temperatures at Coastal Mountain Hemlock Sites, Gulf of Alaska

Tuesday, 15 December 2020

11:55 - 12:00

## **Abstract**

Long-lived trees that have spent the majority of their ontogenetic development under pre-historic climate conditions now need to acclimate to changing temperatures. High latitude trees, previously limited by summer air temperatures, are predicted to undergo enhanced growth as air temperatures rise. Here, we present dendrochronology-based tree growth patterns of a common species found in the Northeast Pacific Temperate Rainforest – Mountain Hemlock (Tsuga mertensiana). In particular, five ring-width chronologies were compared with observational climate variables from nearby stations across a range of elevations in College Fiord, Columbia Bay, Glacier Bay and Hoonah, Alaska. Tree growth in most previously-investigated stands of Mountain Hemlock track warming temperatures in the past century, but a subset of low-elevation stands exhibit growth declines in the 20th century. By comparing these ring-width patterns with local weather stations, we found that interannual, and long-term growth declines closely track increasing minimum summer temperatures. Primarily low elevation sites show a decrease in growth rates over the past several decades, although, in Columbia Bay were the recent extensive tidewater glacier has evacuated the fiord, the decline is evident at higher elevations. The more widespread growth decline at this site may be related to a higher rate of warming where the cold microclimate of the glacier is no longer present. We hypothesize that the observed growth declines may be the result of imbalances in these trees carbon budgets. Reduced diurnal photosynthesis; that may be attributed to increased cloud cover, and increased respiration at night due to higher nighttime temperatures, may contribute to a carbon deficit for trees, leading them to compromise growth rates in response to warming minimum temperatures. This hypothesized mechanism has also been applied to growth declines of shore pine (Pinus contorta subsp. contorta), which co-occurs with Mountain Hemlock in Southeast Alaska (Sullivan et al., 2015). This carbon-deficit hypothesis is in contrast to other mechanisms of growth decline in the region, which have been attributed to warming winters and the loss of insulating snowpack at low elevations (Buma, et al., 2017). Further investigations need to be done to test how these different climatic symptoms of global warming serve as physiological stressors of tree growth in the temperate rainforest biome.

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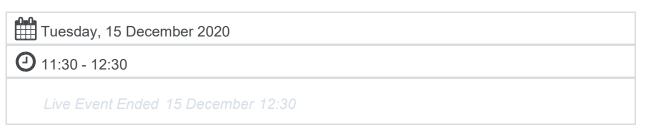
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