

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 Fjord, 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 where the recent extensive tidewater glacier has evacuated the fjord, 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.

Authors

Mazvita Marilyn Chikomo

College of Wooster

Gregory C Wiles

The College Wooster

Benjamin Gaglioti

University of Alaska, Fairbanks

[Nicholas Wiesenber](#)

College of Wooster

[Wenshuo Zhao](#)

The College of Wooster

View Related

[B100 - The Resilience and Vulnerability of Arctic and Boreal Ecosystems to Climate Change I](#) [V](#) [>](#)

Abhishek Chatterjee, NASA Goddard Space Flight Center, GMAO, Greenbelt, MD, United States, **Natalie Boelman**, Lamont-Doherty Earth Observ., Palisades, NY, United States, **Michelle C Mack**, Northern Arizona University, Flagstaff, AZ, United States, **Peter C Griffith**, NASA/GSFC, Greenbelt, MD, United States, **Scott J Goetz**, Northern Arizona University, SICCS, Flagstaff, AZ, United States and **Elisabeth K Larson**, NASA, Washington, DC, United States



Tuesday, 15 December 2020



11:30 - 12:30

Live Event Ended 15 December 12:30

[Biogeosciences](#)



Similar

[How Does the Proximity of Mountain Glaciers Affect the Microclimates of Adjacent Forests in Southeast Alaska?](#)

Julia Pearson, College of Wooster, Wooster, OH, United States, **Benjamin Gaglioti**, University of Alaska, Fairbanks, Institute of Northern Engineering, Fairbanks, AK, United States, **Daniel H Mann**, University of Alaska Fairbanks, Geosciences, Fairbanks, AK, United States and **Gregory C Wiles**, The College Wooster, Earth Sciences, Wooster, OH, United States

[How Does Whole-Ecosystem Warming Alter Plant Fine-Root and Fungal Mycelium Dynamics in a Boreal Peat Bog?](#)

Camille Defrenne¹, **Joanne Childs**¹, **Christopher W. Fernandez**², **Michael C Taggart**³, **William R Nettles IV**¹, **Michael F Allen**⁴, **Paul J Hanson**¹ and **Colleen M. Iversen**¹, (1)Oak Ridge National Laboratory, Climate Change Science Institute and Environmental Sciences Division, Oak Ridge, TN, United States, (2)University of Minnesota, Plant and Microbial Biology, St. Paul, MN, United States, (3)RhizoSystems LLC, Camas, WA, United States, (4)University of California Riverside, Center for Conservation Biology, Riverside, CA, United States

! " # \$ % &

© 2021 American Geophysical Union. All Rights Reserved.