

Western Washington University Western CEDAR

Scholars Week

Conferences and Events

May 2019

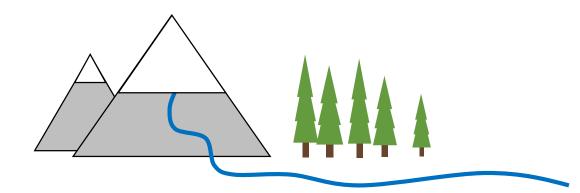
Finding climatologically teleconnected sites with a network of tree ring chronologies

Hannah LaGassey Western Washinton University

Follow this and additional works at: https://cedar.wwu.edu/scholwk Part of the <u>Higher Education Commons</u>

LaGassey, Hannah, "Finding climatologically teleconnected sites with a network of tree ring chronologies" (2019). *Scholars Week*. 39. https://cedar.wwu.edu/scholwk/2019/2019_poster_presentations/39

This Event is brought to you for free and open access by the Conferences and Events at Western CEDAR. It has been accepted for inclusion in Scholars Week by an authorized administrator of Western CEDAR. For more information, please contact westerncedar@wwu.edu.



Finding Hydrologically Teleconnected Sites With a Network of Tree Ring Chronologies

Hannah LaGassey | MA candidate, Environmental Studies: Geography | Advisor: Dr. Aquila Flower

Objective

• Identify existing tree ring chronologies that correlate with August streamflow of the North Fork Nooksack River.

Background

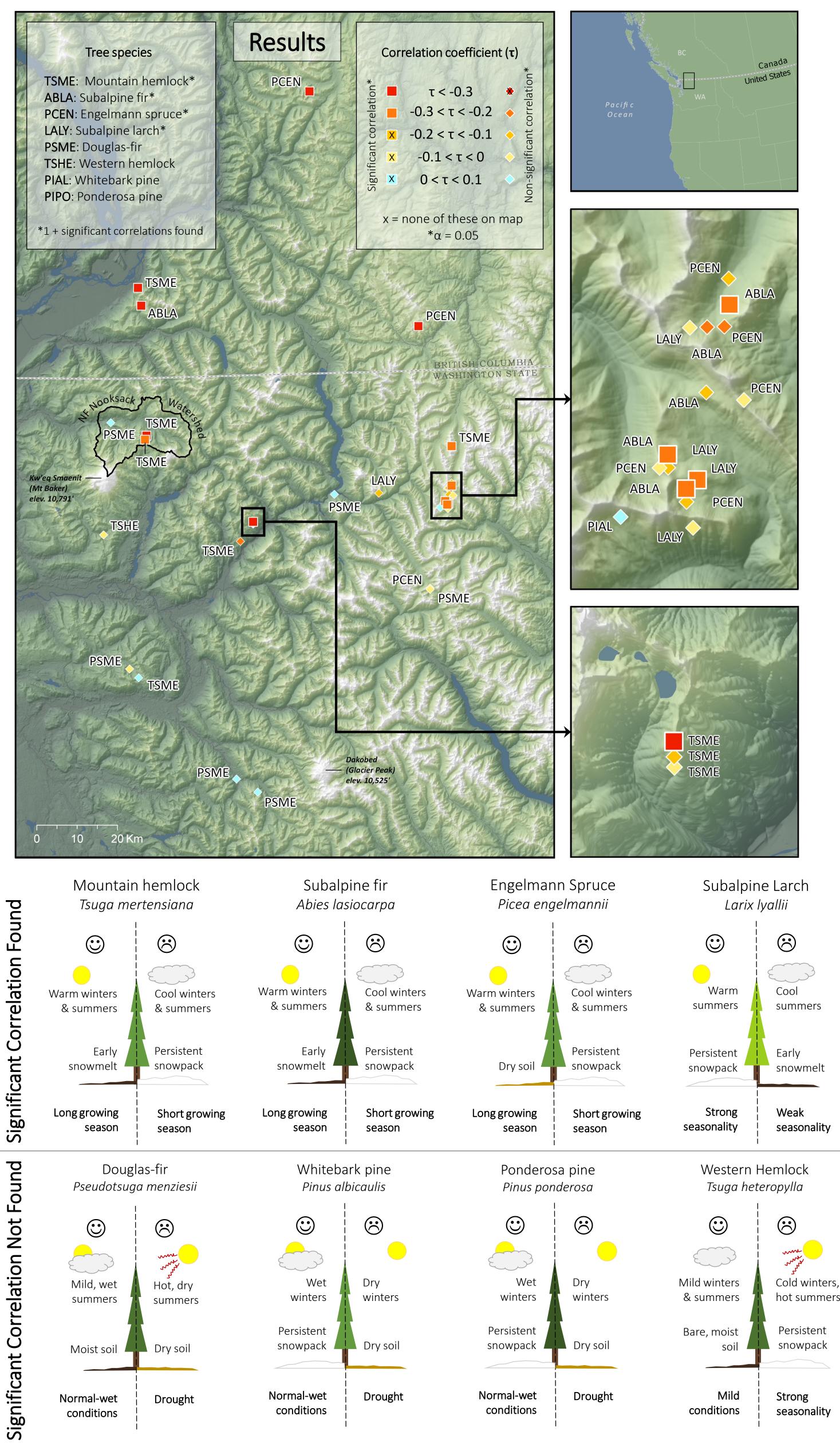
- Trees act as proxy climate records, allowing us to reconstruct past climate and climate-driven phenomena like streamflow. In the Pacific Northwest, dendrochronologists can extend records hundreds of years into the past, providing vital context for present and future conditions.
- Each tree species responds to climate fluctuations in a unique way.
 - Including multiple species in reconstruction models allows us to explain more variance in paleorecords, increasing the accuracy of these records.
- This study identifies existing tree ring chronologies within 100km of the North Fork Nooksack watershed and assesses their viability for dendrochronological reconstruction of North Fork Nooksack August streamflow.
 - I include 37 tree ring chronologies available from the International Tree Ring Data Bank, consisting of 8 tree species.

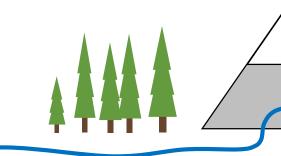
Construct master Detrend with a Tree ring chronology for 50-year spline chronologies each site Remove age-related Average series within a Raw ring width series site with Tukey's biweight growth trends (individual trees) mean, pre-whiten Key North Fork Input Tree ring variable **Nooksack August** chronologies streamflow Unitless ring width indices Average monthly (1 chronology per site) Output discharge in cfs variable Correlate Correlation Process chronologies with coefficient for August streamflow each chronology Non-parametric Kendall method Kendall's tau Map of chronology Symbolize points by network correlation correlation coefficient with August streamflow HUXLEY HUXLEY COLLEGE OF THE ENVIRONMENT

TREE RING LAB

Methods

WESTERN





seasonality

Conclusion

- Chronologies of certain species near the North Fork Nooksack watershed correlate with August streamflow inside the watershed.
 - These trees respond to the same large-scale climate conditions that drive streamflow of the North Fork Nooksack.
 - Significant correlations with August streamflow were found with mountain hemlock (Tsuga mertensiana) chronologies, subalpine fir (Abies lasiocarpa) chronologies, Engelmann spruce (*Picea engelmannii*) chronologies, and one subalpine larch (*Larix lyallii*) chronology.
 - All significant correlations were negative, meaning there was reduced growth in years of high August streamflow.

Snowcover is likely the major growth-limiting factor of these trees and the major factor driving August streamflow in the North Fork Nooksack.

Future Work

- Reconstruct August streamflow of the North Fork Nooksack and Sholes Glacier Mass Balance with tree ring chronologies identified in this project plus additional I collect this summer.
- Reconstructed streamflow and mass balance records will be inputs to the Distributed Hydrology Soil Vegetation Model, informing present and future hydrological conditions in the North Fork Nooksack watershed.

References

Bunn, A., Korpela, M., Biondi, F., Campelo, F., Mérian, P., Qeadan, F., Zang, C., Pucha-Cofrep, D., Wernicke, J. (2018). dplR: Dendrochronology Program Library in R. R package version 1.6.9. Chen, P., Welsh, C., Hamann, A. (2010). Geographic variation in growth response of Douglas-fir to interannual climate variability and

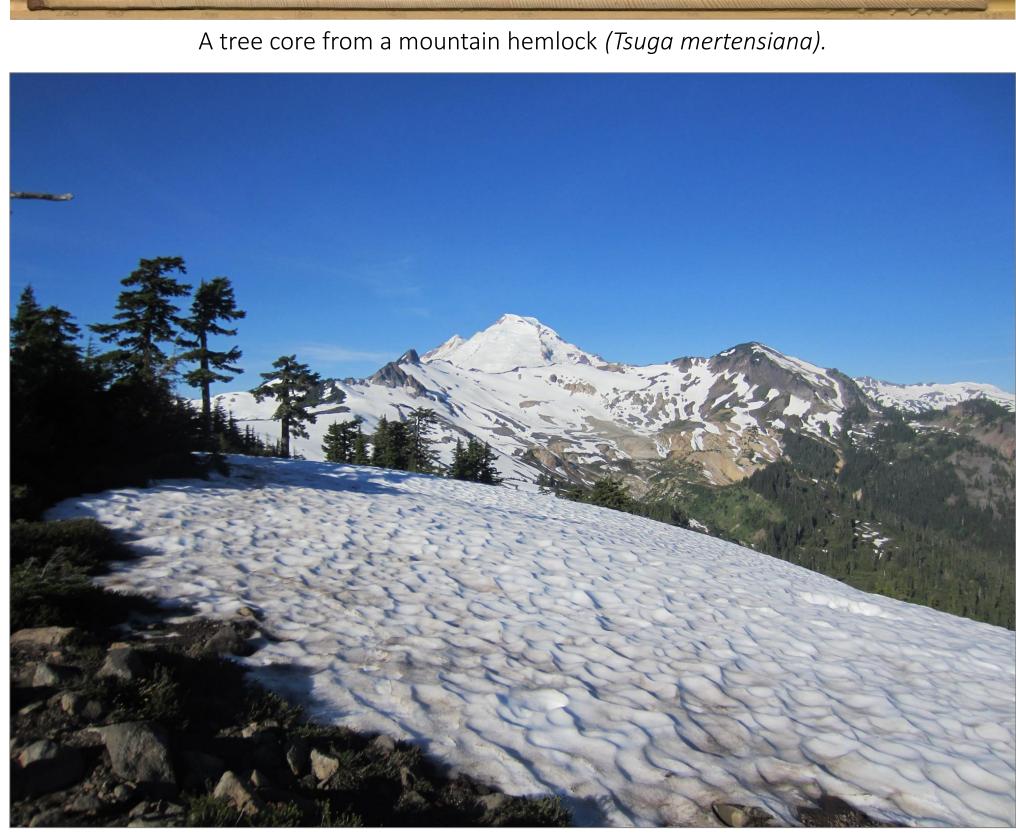
projected climate change. Global Change Biology, 16, 3374-3385. Dannenburg, M.P., Wise, E.K. (2016). Seasonal climate signals from multiple tree ring metrics: A case study of *Pinus ponderosa* in the upper

Columbia River Basin. Journal of Geophysical Research: Biogeosciences, 121, 1178-1189. Heikkinen, O. (1984). Dendrochronological Evidence of Variations of Coleman Glacier, Mount Baker, Washington, U.S.A. Arctic and Alpine Research, 16:1, 53-64.

Peterson, D.L. Arbaugh, M.J., Robinson, L.J., Berg, R.D. (1990). Growth Trends of Whitebark Pine and Lodgepole Pine in a Subalpine Sierra Nevada Forest, California, U.S.A. Arctic and Alpine Research, 22:3, 233-243. Peterson, D.W., Peterson, D.L. (1994). Effects of climate on radial growth of subalpine conifers in the North Cascade Mountains. Canadian Journal of Forest Research, 24:9, 1921-1932.

Peterson, D.W., Peterson, D.L. (2001). Mountain Hemlock Growth Responses to Climate Variability at Annual and Decadal Time Scales. Ecology, 82:12, 3330-3345.

U.S. Geological Survey. (2018). National Water Information System [stream gauge data available on the World Wide Web].



Mount Baker from Ptarmigan Ridge, near Heather Meadows Tsuga mertensiana chronology.

