Dendroecology of *Pinus ponderosa* in the Uinta Mountains, Utah

UROP Proposal

Example

Faculty: _____, Department of Geography

Student: _____, Department of Geography

Abstract

In Utah there are fragmented populations of *Pinus ponderosa* (ponderosa pine) with largely unknown biogeographical histories that have received limited research attention. I hypothesize that populations of ponderosa pine in both the Wasatch and Uinta Mountains are likely remnants of much older, widespread populations, and that their patchy distribution today is largely delineated by long-term trends of higher-than-average summer precipitation in particular areas. Through this research, I intend to build on previous work aimed at providing a biogeographic history of the range contraction and expansion of ponderosa pine in northern Utah before and after European settlement in the intermountain west.

Background

Range maps of ponderosa pine were first established by E.L. Little in 1971 in his *Atlas of United States Trees*. According to these forty-five year old mapped distributions, this species was likely more widespread in many of Utah's ecosystems, but has been heavily targeted by the logging industry. Despite the limited geographic range of ponderosa, these stands maintain an important ecological and economic niche in Utah. Surprisingly, fragmented populations appear to have survived over a century of harvesting and both natural and human disturbances to their habitats. However, the historical extent of ponderosa pine populations and what mechanisms (e.g. climate, disturbance, etc) control the distribution of this species remains unclear, particularly when considering the patchy distribution of ponderosa found in the Wasatch and Uinta Mountains. Previous research on ponderosa pine in the Wasatch Mountains suggests the insular stand in Big Cottonwood Canyon may be a result of waif dispersal, while evidence from stands of ponderosa in the Uinta Mountains likely points toward potential range contraction (e.g. Shaw and Long 2007). The establishment of insular populations of ponderosa pine suggests long-distance dispersal, potentially across barriers to migration.

Timeline

April 2018: Field collection
May 2018: Sample prep and lab analysis
June 2018: Statistical analysis of tree rings
July 2018: Regional comparisons

A large portion of my efforts will be spent collecting tree cores, prepping tree cores for microscopy, and measuring tree rings under magnification. When collecting new tree cores from these new sites, I will record their locations with GPS (decimal degree latitude and longitude), their circumference, and associated species. The stand age data, from counting tree rings, will be compared to the ages of trees from Big Cottonwood Canyon and elsewhere in Utah. I will also

analyze the ring widths to explore how precipitation may have influenced the various populations through the historical period (20th century).

Data will be analyzed using tree-ring software COFECHA and compared to climate data from the region over the reconstructed lifetimes of the trees. Between 20 and 40 tree cores will be collected from the Uinta Mountains research site. These data will be input into COFECHA software, providing me with an output file of summary statistics that can be used to explore potential linkages to past changes in moisture or temperature that influenced the population. This analysis will be compared to recent work on populations in Big Cottonwood.

In addition to evaluating the age and potential climate regime associated with each ponderosa pine population, I also intend to determine whether these populations were either part of a larger population that have now been isolated by human activities or by changes in climate, or if the current distribution is a result of random waif dispersal events. Ultimately, I hope to answer the question of how and/or when these different anomalous populations or outliers managed to establish themselves in each of these areas.

Relationship of Proposed Work to Faculty Mentor's Expertise

My goals in this project are to assist my UROP faculty mentor in ongoing research into the paleoecology of northern Utah, while developing a skillset of both field and laboratory methods that I can carry into my future career prospects. By the end of this project, I hope to have established a working knowledge of the methodology and applications of this branch of paleoclimate study. My faculty mentor has extensive experience conducting this form of research and applying subsequent data into larger models of paleoecology. As such, they are an ideal mentor for this project.

Relationship of Proposed Work to My Future Goals

This experience will be beneficial to my education in several ways. Paleoecology has emerged as a focal point of research interest for me, one that I hope to carry into my future endeavors. Participating in this project will be excellent preparation for graduate school applications, providing me with new experiences conducting fieldwork, laboratory analysis, and computational work, all geared towards peer-reviewed publication. Experience in these techniques provides me with a skillset that can be utilized in future career research, bolstering my employment prospects. Further, participating in the UROP student presentations will provide vital experience in collating data and disseminating information to a wider audience, essential skills in my prospective career path. My experience at the University of Utah suggests it is difficult for undergraduate majors to find opportunities for involvement throughout the entirety of a research project, from hands-on field experience followed by in depth laboratory research and finally to presentation of findings. As such, I believe this project has excellent educational potential for me. With support from the UROP, I hope to begin developing my own skills and research trajectories, shaping and enriching my future academic and career achievement goals.

References

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