Graduate Students
Homesteading in Cebolla Canyon, New Mexico: Ethnicity Studies in Using Dendrochronology, Historical Documents, and Oral Histories

Rebecca Renteria

Laboratory of Tree-Ring Research

Cebolla Canyon, in the El Malpais National Conservation Area, New Mexico, was homesteaded extensively in the late 18th and early 19th centuries by Hispanic and Euro-American families. The local environment provided grazing resources for sheep and cows, and the ability to homestead in this area allowed families to pursue seasonal or year-round occupation. The regional histories of these migrants differ, but the exploitation possibilities of land and timber provided people with the promise of land ownership and sustainability with respect to their necessities and desires; these are strongly based on sociopolitical factors of the time. Focus here is on Hispanic and Euro-American homesteading sites, comparatively. Using dendrochronology we can provide target dates for felling events, and in combination with archaeological remains we can grasp the duration of occupation for homesteading sites. We can also identify methods in which ethnicity can be delineated in the historical archaeology record. Further insight is provided by historical documents, such as census records and homesteading patents that can give us an idea of how people institutionally- or self-identified as an ethnic group. Further, we can see how migrant groups were perceived by others by incorporating the use of oral histories.
Long-term records of hydroclimate for the Navajo Nation are acutely limited. Short records can fail to capture the full range of hydroclimatic variability while longer records illuminate more climate information. Without long-term records to document the natural variability of water resources in the Chuska Mountains, anticipating water availability for the Navajo Nation's most populated and economically productive areas is difficult. Recent decades are characterized by declining snow water equivalent in snowpack of northeastern Arizona. At the same time, tribal members report that snowmelt-fed lakes at the crest of the Chuskas which support Navajo agriculture, stock animals, wildlife, fish and community resources have begun to go dry from extended drought. In this study, we collaborate with the Navajo Nation Department of Water Resources (NNDWR) on use-inspired research guided by NNDWR management questions about surface water resources in the Chuskas. To address NNDWR management concerns, periods of cool-season drought during the instrumental record (1984-2016) are compared with output of a satellite-based lake area estimations algorithm to examine the relationship between lake levels and snowpack. We also developed a multi-century reconstruction of Chuska snowpack based on local, recently collected tree-ring chronologies from climatically sensitive tree species - Pseudotsuga menziesii, Pinus edulis, and Pinus ponderosa – and snow water equivalent from 12 SNOTEL and 14 snow course sites in the Chuska Mountains and the Mogollon Rim. This information reduces uncertainty around variability in the Chuska climate system and is intended to inform NNDWR evaluation of water scarcity implications, assisting with drought planning and decision-making.
Dendroclimatology in Bighorn Mountains, WY: towards reconstructing the Northern Pacific Jet Stream

Amy Hudson

Laboratory of Tree-Ring Research

Artic amplification lessens the forcings on atmospheric circulations such as the jet stream, creating wavier jets that hold weather patterns in place leading to extreme weather events. The Northern Pacific Jet Stream (NPJS) is of particular interest in the United States for its influence on temperature and the regional distribution of precipitation. The fluctuations in the NPJS are only quantified for the past 80 years through reanalysis data assimilated by observations from the past 40 years. Tree-ring datasets extend the observational record and are sensitive to climate variability as driven by atmospheric circulations. A 500+ year Engelmann spruce (Picea engelmannii) tree-ring chronology in Wyoming’s Bighorn Mountains is developed to reconstruct NPJS seasonal position variability at a location where the NPJS seasonal position influences regional climate. This chronology extends the temporal coverage of the network by 67 years, adding tree growth measurements from 1460 to 1495 and 1984 to 2014. The strong crossdating at the site reflects a cohesive and seasonal climate signal, and the potential to enhance reconstructions of past NPJS positions. When the NJPS shifts North in the spring over the Bighorn Mountains’ longitude, the Bighorn Mountains experience less spring precipitation and higher spring temperatures, and trees accumulate significantly less biomass for that growing season. Tree biomass is positively correlated with spring precipitation and inversely correlated with spring temperatures. Tree biomass also shows a strong positive correlation with regional summer temperature, and an inverse correlation with summer precipitation, consistent with high elevation sites around this location. This tree-ring dataset will add insight into how climate change impacts NPJS dynamics and trends in long-term seasonal influence of climate on vegetation.