Researchers study 6,000-year-long record of drought in the Pacific Northwest

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A group of researchers have studied the history of drought in the Pacific Northwest during the last 6,000 years, a time that spans the mid-Holocene geological epoch to the present. The goal of the research was to improve the understanding of drought history because the instrumental record of drought only goes back a few hundred years and

at relatively few locations.

Their work extended the drought history of the Pacific Northwest back much longer than the tree ring record, which provides information in the region over the past 1,500 years. The team's research also indicates that during the time period they studied, the duration of the droughts has in general increased in response to decadal oscillations in the climate system driven by marine processes.

Dr. Joseph Ortiz, associate professor of geology at Kent State University and resident of Hudson, Ohio, has spent about four years working on this research project with Dr. Mark Abbott of the University of Pittsburgh and his team. Their work is funded by the National Science Foundation. Their research findings appear in the online Early Edition (EE) of the Proceedings of the National Academy of Sciences, one of the world's most-cited multidisciplinary scientific serials, during the week of Feb. 21.

"Climate scientists have developed several methods to evaluate changes in drought for times earlier than we have rain gauge record," Ortiz explained. "One approach is to use trees as an integrator of this signal. When there is plenty of water, trees will grow faster and develop thicker growth rings. But trees are not found in all locations, water is not the only factor that controls tree growth, and it can be hard to find trees older than a few hundred years, so we sought to employ a different approach using sediment records from lakes."

The researchers went out into the field and collected lake cores to measure properties of the sediment through time. For this study, they digitally photographed the lake cores to capture variations in the thickness and color of the thin layers of sediment deposited year by year at the bottom of the lake.

"We also extracted calcium carbonate from the lake to study variations in the oxygen isotopic composition of the carbonate minerals that precipitated from the surface water of the lake," Ortiz said. "Mark Abbott and his group at the University of Pittsburgh have pioneered these types of studies at locations throughout the Americas. The relative proportion of the O18 and O16 isotopes in the carbonate recovered from the lack reflect changes in the proportion of these isotopes in the water of the lake. We were able to relate changes in these two proxies to changes in the water balance of the lake through time.

"To make sure that we had the relationship right, we compared our results with tree-ring records and instrumental data for the parts of the records that overlapped in time. We had confidence that we were on the right track because the various methods provided essentially the same result."

Ortiz's role in the project was to assist with the statistical analysis of the data sets using quantitative methods that let the research team explore the inter-relationships between variables and how they changed through time.

"Mark and I complement each other very well because Mark has tremendous experience in terrestrial field work and limnology, while I bring expertise in marine climate studies and quantitative methods," Ortiz said. "Our complementary expertise turned out to be very important for this collaboration because we are able to effectively explore the relationships between what happens here on land and how oceanic processes are involved."

The researchers' work also has added support to the observation that the 20th century, when population in the western United States grew rapidly, was a relatively "wet" period in the West. "This has implications for public water policy because our perception of the availability of water is

tied to the limited window of our historical experience," Ortiz said. "Our work demonstrates that there can be surprises when we step back and look at variations in the climate system over a longer period. The connection to marine processes that create decadal oscillations in climate, such as El Niño, is also important because our work provides insights into how water availability in the Pacific Northwest will shift as El Niño responses to human-induced changes in the climate system."

Ortiz is excited that the team's work was selected to appear in the Proceedings of the National Academy of Science, allowing the research to reach a diverse audience.

"That should help bring our results to the attention of policy makers so that they can apply sound science while developing strategies to address future change," he said.

Provided by Kent State University