To aid utilities, researchers seek ancient floods near Tennessee River

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Matthew Gage, director of the UA Office of Archaeological Research, stands on a paleoflood deposit on a bluff of the Tennessee River. Credit: Dr. Lisa Davis

With funding from energy utilities, a team of researchers at The University of Alabama are collaborating with peers across the Southeast to understand the frequency and possible size of floods along the Tennessee River that pre-date reliable weather and streamflow records.

With a better understanding of floods from the past 10,000 years, utilities can better prepare for historic natural disasters that could threaten dams and nuclear plants in and around the Tennessee River, said Dr. Lisa Davis, UA associate professor of geography, who leads the research team on this project.

"You don't just predict the worst case scenario you potentially know about because that's based on the instrumented record, which is not that long," she said. "Instead, the mentality is to seek out information about rare events and use that information to lower risk."

Although modern weather and streamflow record keeping captures a wealth of data, it only reliably extends some 150 years into the past. Big natural events, though, such as floods, can go hundreds, if not thousands, of years between occurrences.

"If something happens on a timescale of every 2,000 years, it's not very likely, but it's a good idea to be prepared for it, if it does happen, where public safety is concerned," she said. "Even just adding a few data points, one or two events, drastically helps improve estimates of these rare events."

The work is one of three similar projects funded by the Electric Power

Research Institute, or EPRI, along the Tennessee River to find and gather information on paleofloods, or floods occurring before the historical record. The EPRI is a non-profit research institution supported by the energy industry.

The EPRI wants researchers to confirm enough paleoflood markers exist in the eastern United States—where a more humid climate and wetter soil could erode evidence of ancient floods—as opposed to the more arid and rocky western part of the country where this method has been employed the most by dam and utility managers.

Research into this area was spurred by events at the Fukushima Daiichi Nuclear Power Plant in Japan, which suffered a meltdown and radiation leaks after a tsunami flooded the plant in 2011.

"This new interest from the utilities and the federal agencies in using paleo-dating and environmental reconstruction approaches to help gather information that's not available in any other format for risk assessment of these dams and nuclear stations has renewed interest for this type of work in the eastern United States," Davis said.

Dr. Gary Stinchcomb, of Murray State University, right, and Dr. Matthew Therrell, of The University of Alabama, examine a paleoflood deposit trapped under a rock overhang on a bluff of the Tennessee River. Credit: Dr. Lisa Davis

At UA, Davis leads a team that includes Matthew Gage, director of the UA Office of Archaeological Research; Dr. Matthew Therrell, professor of geography; Dr. Elliot Blair, assistant professor of anthropology; Dr. Rebecca Minzoni, assistant professor of geological sciences; and Dr. Natasha Dimova, assistant professor of geological sciences.

The group also includes researchers from Murray State University, University of the South, Baylor University and the University of

Georgia.

The first phase of the work showed a multitude of sites in the Middle Tennessee Valley with preserved flood deposits in the vicinities of Florence, Huntsville, Guntersville and Buck's Pocket State Park in northeast Alabama. These deposits remain preserved because they are situated in backwater areas, which infrequently experience erosion, and also in caves or under cliff rock overhangs that provide shelter from wind and rain.

The researchers found preserved flood data in preliminary assessments, including new insights into a large flood in 1867 considered the flood of record for the Tennessee River. The height of the 1867 flood is only known at a few locations, meaning the preserved flood sediment could be used to validate modeled flood heights generated for locations where no measurements took place.

"Flood indicators older than 10,000 years exist in the Tennessee River Valley," Davis said, "but our project focuses on floods within the last 10,000 years to be more applicable to modern weather and climate."

Davis and her team are looking for changes in the sediment, packed like cake layers below the surface. Cores of sediment were pulled from some sites, and, generally, a change to larger sizes of sediment particles and a change in the elemental composition indicates a big flood laid down that layer of sediment, Davis said.

Also, Therrell examines tree rings, which can show past flooding, although not as far back as sediments.

The samples will be examined with x-ray fluorescence and dated with radiocarbon and optically stimulated luminescence techniques and compared across sites to develop a robust chronology of past flood activity along the river.

The data from this team will ultimately combine with similar projects further north conducted by other research groups. EPRI will share the information with utilities and federal agencies and communicate with them about how to use the data to inform flood risk assessments, Davis said.

"If it's found out that flood water has the potential to reach a location with no instrumented record of flooding, then this is very valuable information for minimizing risk, which cannot be obtained by any other means," she said.

Provided by University of Alabama in Tuscaloosa

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