



July 10, 2017

Students examine tree rings to identify effects of drought

PLATTEVILLE, Wis. – Five University of Wisconsin-Platteville students are researching the influence of extreme drought and its implications on the state’s ecology, groundwater resources and economy by studying tree rings from hundreds of trees throughout the Driftless Area of Southwest Wisconsin.

The newly launched, two-year Driftless Cedars project is being conducted through the university’s Tree-Ring, Earth, and Environmental Sciences Laboratory, known as the TREES Lab. The research represents a \$100,279 effort, with funding from the University of Wisconsin Water Resources Institute in Madison, the United States Geological Survey and matching funds from UW-Platteville’s College of Liberal Arts and Education and Department of Geography.

The project is led by Dr. Chris Underwood, assistant professor of geography at UW-Platteville and project lead principal investigator, and Dr. Evan Larson, associate professor of geography at UW-Platteville and project co-investigator. Student researchers will develop a network of tree-ring chronologies, or records of tree growth, across the Driftless Area in order to better understand patterns of drought and groundwater variability that will assist communities in designing adaptation strategies for water resources for the future.

“The research will enable analyses of long-term trends in hydrologic conditions that can be used to help develop adaptation strategies for businesses, farmers, public health officials, municipalities, resource managers and other stakeholders,” said Underwood.

Using the science of dendrochronology – the study of the annual growth rings of trees and their role as recorders of environmental history – to develop exactly-

dated records of tree growth, researchers will compare these records to modern, instrumentally recorded climate data. If a strong relationship exists between tree growth and instrumental climate data over recent years, the tree-ring data can be used to estimate climate conditions over the entire lifespan of the trees.

Student researchers include Greg Arther, a senior geography major from Spring Grove, Illinois; Tia Federman, a junior geography major from Mineral Point, Wisconsin; Jonathan Ley, a senior geography major from Platteville; April Barr, a junior broad field science education major from McFarland, Wisconsin; and Elissa Bahr, a junior elementary STEM education (grades 1-8) major from Platteville.

“Working in the TREES Lab is fun because not only does it push me to draw upon and apply knowledge I have learned in the classroom, but this experience has provided me with an incredible amount of new knowledge and understanding over a short period this summer,” said Arther.

Bahr said that in their research thus far, she has learned more than she ever thought she would about trees and the historical information they can provide.

“I thoroughly enjoy each day in the lab and field because I am constantly learning and making connections between the research we are doing and environmental history,” said Bahr.

Ley said it has been fascinating to learn that tree growth is reliant on growing conditions and size is often not the best indicator of age.

“We have a pretty big cedar cross section (collected from a remnant log) that has 378 rings, which is pretty impressive in and of itself, but we also have one about half the size that has almost twice as many rings,” Ley said. “The biggest diameter trees are typically found in places that have abundant resources, such as water and good soil, whereas stunted or deformed trees are usually much smaller because of the tough growing conditions. Such trees typically produce

much narrower rings, but can also be quite a bit older, as a result.”

This summer, for the first time, the TREES Lab is hosting two Science Educator Research Experience Fellows in Bahr and Barr. These competitive fellowships were developed by Larson and Underwood with the support of Dr. Melissa Gormley, dean of the College of LAE. The express purpose of SERE fellowships is to provide high-impact research experiences for future science educators to better inform their pedagogies and curriculum-development skills. The fellowships are supported by the College of LAE and the Department of Geography.

This summer’s research has two components. First, the student-researchers will take a deeper look at oak tree-ring samples previously collected in the Driftless Area by Larson; Sara Allen, former baccalaureate fellow in the TREES Lab; and 46 undergraduate student researchers from 2012–15. The annual growth rings of the oaks will be examined cell-by-cell to sharpen the window of climate response identified in tree growth and provide records of seasonal groundwater variability. Then, using field reconnaissance, digital elevation models and historical aerial photographs, students will identify and sample up to four sites in southwest Wisconsin that support long-lived, eastern red cedars. Chronologies from the cedars will be integrated with the Driftless Oaks network to develop a multi-species reconstruction of depth-to-groundwater for Southwest Wisconsin that spans multiple centuries.

The results of the research will be shared with all participating stakeholders through a project wrap-up event and will be disseminated through web- and print-based materials, including lesson plans developed by the SERE fellows and manuscripts written for publication in both popular and scientific media.

During the spring of 2018 and 2019, student-researchers will present their results at the annual meeting of the American Association of Geographers and the UW System Symposium for Undergraduate Research and Creative Activity. The geography majors will present a reconstruction of past climate conditions they

created from data they collected, while the education majors will design and present research-informed lesson plans to be used in their future positions as science teachers.

Larson noted that in addition to the scientific merit of the project, the proposed research will further cultivate relationships among scientists, managers and landowners throughout Southwest Wisconsin and provide extensive hands-on research experience for multiple undergraduate research assistants and dozens of students through projects integrated with geography coursework at UW-Platteville.

The Driftless Cedar project began in early June when Underwood, Larson and the student-researchers teamed up with Dr. John Peterson, assistant professor of biology at UW-Platteville, and Vikki Peterson, lecturer of biology at UW-Platteville, for a day of fieldwork and discussion of shared research interests in overlapping Driftless Area ecosystems. The geography student-researchers worked on the Driftless Cedars Project while the undergraduate biology class searched for rare ring-necked snakes. To view a video about their work, visit: <https://youtu.be/-On1YQQj2jE>.

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