
MU researchers are using tree rings
to unwind the answers to questions
about the environmental history of the U.S.

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IF TREES COULD TALK

Story by Kelsey Allen * Photos by Nicholas Benner

See more stunning shots of trees that date back hundreds of years. *mizzoumagazine.com/summer2013*

Michael Stambaugh hums two notes. "Know what song that is?" he asks. "Of course not because you have a little bit of information."

He hums again, and this time it's clearly "The Star-Spangled Banner."

"You have enough information now not only to identify that song but also to tell me what part of that song I gave you. Was it the beginning? Was it the end? That's much like tree-ring dating. If you have enough information, you can place it perfectly in time."

Stambaugh, a research assistant professor, and Richard Guyette, a research professor, play an arboreal version of *Name That Tune* in the forestry department of the Anheuser-Busch Natural Resources Building. They use tree rings to answer questions that sit at the crossroads of scientific disciplines. Their work ranges from advising land managers on prescribed burns to predicting Missouri's drought cycles to chronicling climate change.

To date a tree, dendrochronologists — researchers who study the science of tree rings — first document ring patterns of many trees from the same area. They plot the ring widths on a graph to determine a single calendar year for every ring, starting with the known ring from the current year.

"Once you have a really good master pattern, you should be able to pick up any dead wood off the ground and measure that ring pattern," Stambaugh says. "Then you slide that ring pattern back and forth across the known, and it will only fit one place in time."

Ideally, the new tree will not only fit perfectly on part of the master but also extend it.

"That's really the dendrochronologist's dream — to make this pattern the longest possible," Stambaugh says. "Some of the longest records have revealed some of the unknown features of our planet."

FROM ART TO SCIENCE

Guyette, BA '79, MS '81, PhD '91, didn't intend to stick around the MU wood science department when he walked through the door in 1977. He was initially looking for information on old red cedar trees for a children's book he was creating. As an artist of line illustrations, Guyette was intrigued by inherent art in tree rings, and when he was offered an assistantship, he stayed. "Science paid more than art," Guyette says. "It's never been lucrative, but it's been fun. I've spent more than 35 years at it."

Stambaugh, BSF '96, MS '01, PhD '08, got interested when he was studying the shortleaf pine's disappearance from Missouri for his master's degree. "I needed to look back in time 150 years because that's when logging influenced pine," Stambaugh says.

Dendrochronology emerged in the late 1800s, and there are only about 15 major tree-ring labs in the U.S. Without written records or textbooks on the subject, Stambaugh reached out to Guyette and studied with him for about a year in what he calls an apprenticeship. "Every day was better than the previous, so I was hooked," Stambaugh says.

FROM PUZZLE PIECE TO MASTER PATTERN

A few years ago, Guyette and Stambaugh canoed a northern Missouri river. "It's not much of a canoe trip because you're dragging the canoe like a sled half the time, loaded with chainsaws and several hundred pounds of soaking wet oak," Guyette says. They were searching for "buried forests," as Stambaugh calls them, old logs that have been churned up along the river's twists and turns, gold mines for the researchers.

On one trip, the team pulled out of the river a piece of the oldest known oak tree on Earth. To date the tree, the researchers carted it 200 miles to the lab, sanded the sample to expose the rings and sent a piece of it to a radiocarbon lab. Although this particular piece couldn't be dated precisely because it's so old, they know it grew about 13,630 years ago, give or take 200 years.

"It's a huge puzzle that's 10,000 to 15,000 years long," Stambaugh says. "Even if I were working on it with five other people, I probably wouldn't complete it in my career. But it's very important for many people, not just in the research community but in agriculture, forestry and climate change."

FROM FIRE TO CLIMATE

When Smokey Bear was created in 1944 to educate the public about the dangers of forest fires, tree rings became an even more important record of fires in America's history. Although wildfires usually should be prevented, land managers sometimes use controlled burns as tools to reduce fire risk and encourage wildlife and herbaceous diversity. But in 2006, the Missouri Department of Conservation commissioned Guyette's lab to investigate the effects of prescribed fires on wood quality. Fire scars on trees and the tree rings showed researchers when fires had injured trees.

OAK • 1772-1871 • MISSOURI • CHRONOLOGY CONSTRUCTIONS

POST OAK • 1802-1996 • TEXAS • FIRE HISTORY

OAK • ~13,630 BEFORE PRESENT • MISSOURI • CLIMATE STUDY

BLACK OAK • 1933-2012 • MISSOURI • FIRE STUDY, TIMBER QUALITY

RED PINE • 1599-1872 • PENNSYLVANIA • FIRE HISTORY

OAK • ~3,950 BEFORE PRESENT • MISSOURI • CLIMATE STUDY

RED PINE • 1686-1813 • WISCONSIN • FIRE HISTORY

POST OAK • 1776-2005 • KENTUCKY • FIRE HISTORY

RED PINE • 901-1157 • ONTARIO • ECOLOGY STUDY

SUGAR MAPLE • 1952-1986 • MISSOURI • PROPERTY LINE DISPUTE COURT CASE

MU researchers discuss the science and art of tree-ring dating.
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← Richard Guyette, left, and Michael Stambaugh work in the Missouri Tree-Ring Laboratory, one of about 15 such labs in the U.S. The researchers use tree-ring data to predict drought cycles, chronicle climate change and advise land managers on prescribed burns.

The Department of Conservation wanted to determine how much the scarring devalued lumber to the logger.

On average, about 10 percent of the value of each log was lost to fire. This allows land managers to compare "value loss ... to the benefit of prescribed fire," says Joe Marschall, BS '97, a senior research specialist and master's student in the lab.

Guyette has spent most of his career studying historic fires across the U.S. and working with public and private land managers to provide information to educate them about their land.

"Climate and fire are all important in managing forests because you want them to grow fast," Guyette says. "What's this new climate going to do to my forest? If I burn it, what's going to happen? Did it used to burn? Did it never burn? Am I doing something that's different than what was done in the past?"

When Stambaugh talks about the past, he's not talking 100 years or even 1,000 years. "We are developing records of tree growth, which are really records of drought in many cases, that go back 10,000 years," he says. That is why the summer 2012 drought did not surprise Stambaugh. From the patterns compiled in the lab, they can see much more severe, prolonged droughts in the past and a strong 20-year cycle of drought in Missouri.

"It's like a beating drum on the record," Stambaugh says. "It's that reliable."

In a paper Stambaugh and Guyette published in 2011 in *Agricultural and Forest Meteorology Journal*, the researchers concluded that the information their tree-ring records provide about long-term climate variability should be used to predict and plan for drought.

"Who is to say the next 20-year cycle isn't going to happen when it's happened for 1,000 years?" Stambaugh says. "I'm betting it will."

But because dendrochronology is a relatively new field, Stambaugh says few have synthesized the information they're uncovering.

"We developed this really long drought record, but we haven't made the next step to what the agricultural implications are," he says. For now, the researchers in the Missouri Tree-Ring Laboratory are learning a long tune by getting the notes down in the right place. **M**

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