

Between the lines: Tree rings hold clues about a river's past

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By analyzing centuries-old growth rings from trees in the Intermountain West, researchers at USU are extracting data about monthly streamflow trends from periods long before the early 1900s when recorded observations began. Credit: Matt Jensen/USU

Hydrologists are looking centuries into the past to better understand an

increasingly uncertain water future.

By analyzing centuries-old growth rings from trees in the Intermountain West, researchers at Utah State University are extracting data about monthly streamflow trends from periods long before the early 1900s when recorded observations began.

Their findings were published Jan. 6 in the *Journal of Hydrology* and, for the first time, show that monthly streamflow data can be reconstructed from annual tree-ring chronologies—some of which date back to the 1400s.

"By linking tree rings and flow during the past 100 years when we have recorded observations, we can use [trees](#) as a tool for measuring flow long before there were gauges on the rivers," said USU's Dr. James Stagge, a hydrologist and civil engineer who led the research. "Our study takes this one step further and uses different tree species and locations to reconstruct monthly flow, rather than annual flow."

Knowing monthly streamflow, the authors explain, is key to making better-informed decisions about [water](#) use and management. In Utah and around the world, populations in arid climates depend on seasonal and often inconsistent water supplies for agriculture and urban use.

"One data point per year gives a very limited picture," said co-author Dr. David Rosenberg, an associate professor of civil and environmental engineering at USU. "Decisions about water management happen much more frequently than just once per year. Water managers have to make decisions every month, every week, sometimes every day."

To fill in the missing monthly data, Stagge and co-authors built a model that reconstructs monthly streamflow for three rivers in Northern Utah. The reconstructions are available to the public at www.paleoflow.org and

show monthly streamflows dating back to 1605 for the Logan River and as far back as 1400 for the Bear and Weber rivers.

The team used tree-ring chronologies from seven species selected from a range of locations and elevations. Stagge says different tree species at different elevations respond to the changing seasons at different times of the year and in slightly different ways, recording unique parts of the seasonal flow. The model overlaps the tree-ring chronologies and combines annual streamflow information and climate data to arrive at a monthly streamflow estimate.

"Now we can get down into a monthly scale and pick up seasonal patterns within the streamflow," said Stagge. "It's the seasonality that determines drought, how reservoirs fill, and when there are shortages. Now that we have this method, we can start looking at what major droughts over the past 600 years would mean for today's water supply."



Hydrologists at USU have demonstrated that monthly streamflow data can be reconstructed from annual tree-ring chronologies. Credit: Matt Jensen/USU

More information: J.H. Stagge et al, Monthly paleostreamflow reconstruction from annual tree-ring chronologies, *Journal of Hydrology* (2017). [DOI: 10.1016/j.jhydrol.2017.12.057](https://doi.org/10.1016/j.jhydrol.2017.12.057)

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