

What can tree ring analysis tell us about pre-20th century floods and droughts?

A tree adds a new layer of wood every year called a tree rings. Scientists examine these rings to learn about past climate conditions. This field of research is known as dendrochronology. Scientists can use tree rings to measure the age of a tree and learn more about the local climatic conditions the tree experienced during its lifetime.

In temperate areas, like most of the United States, trees only grow during the part of the year called the growing season. The length of this growing season depends on the climate in a particular location. During each growing season, the trunk of the tree grows thicker, producing a layer of new wood called a tree ring. It's possible to see the boundary between one ring and the next because of differences in the color of the wood. Early in the growing season, trees grow relatively quickly and produce less-dense, paler wood. Near the end of the growing season, they produce more dense, darker wood.

Trees generally grow more during wetter growing seasons with favorable temperatures, forming wider rings. Narrow rings may be caused by stressful periods such as droughts. Although tree rings only record conditions during the growing season (in other words, not during the winter in most of the United States), droughts can build up over many months or even many years, so a lack of rain or snow in the winter can lead to poor growing conditions in the spring.

Source: EPA (United States Environmental Protection Agency)

Correlation of modern day ring widths with weather records has demonstrated that the ring width is strongly related to summer values of the so-called Palmer Drought Severity Index

or PDSI. The PDSI was developed as a simple measure of the moisture content of soil in the root zone. It makes sense that the tree ring width would correlate with this during summer since that is the growth season. Analysis of ring widths from living trees that have lived in North America for as long as two millennia, together with plenty of complex statistics, allows preparation of maps of summer PDSI for each year from 2BC to now. This data set was developed at the Tree Ring Laboratory at Lamont-Doherty Earth Observatory and is called the North American Drought Atlas (NADA). For the early centuries the coverage is limited to areas of the West with very long lived trees but by the beginning of the medieval droughts the coverage is pretty much all of the current United States.