

Rings reveal extensive yearly climate record

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Montezuma bald cypress at Barranca de Amealco, Queretaro, Mexico. Credit: David Stahle

A new study of the oldest trees in Mexico provides the first ever detailed, year-by-year look at the climate of Mesoamerica over a thousand-year span. The data, gathered from the annual growth rings in trees, supplies precise dates for the duration of three historically important droughts, including one that was previously unknown.

Droughts are an important factor in the rise and fall of civilizations. One such [drought](#), dated now by tree rings to the years A.D. 897-927, is thought to have hastened the decline of [Mayan culture](#).

David Stahle, a geoscientist at the University of Arkansas, refers to this as the "Terminal Classic Drought," since it is perhaps one of the most

significant milestones in the decline of what historians refer to as the Classic period in Mesoamerica -- a region that includes Mexico and Central America.

Tree rings are a sort of time capsule for climate since they reveal information about wetness for each year. Trees grow by adding new wood in a tiny outside layer each year. The width of each layer will depend on available moisture and soil nutrients. A dry year often results in a thin layer of growth, while a wet year results in a thicker layer. The cross section of a tree is in effect an album of past growth. The ring pattern --with the oldest layers at the center and newer layers at the outside edge -- tells the story of past wetness.

To make conclusions from the data, however, it's not enough to measure the width of the rings. Scientists calibrate the ancient tree-rings by comparing their width to [soil moisture](#) and growth data measurements from recent decades. This science of dating things using tree rings is called dendrochronology.

The trees used in the new study are called Montezuma bald cypresses. Not only are they the oldest trees in Mexico but they are considered the country's national tree. The researchers took samples from 30 different trees in the canyon of Amealco, Queretaro. The scientists only conclude that a drought occurred when a thin ring from one tree measured for the year 900, say, lined up with rings measured in other trees.

Some of the trees are more than 1,200 years old. The trees are not felled in order to view their complement of rings. Instead augers remove narrow 5-millimeter (about one-fifth of an inch) cores.

Tree rings provide an annual dating system but are only as good as the oldest trees you can find. By comparison, carbon-dating, a technique which measures the slightly radioactive emissions from formerly-living

objects, can only tell the age of a thing only to within an uncertainty of about 50 years. Carbon dating is good for looking at times from thousands of years ago, but not for the precision needed for more recent history.

The 10th century drought is as far back as this tree-ring study can go. Just a bit nearer in time is another drought, now precisely dated to the years 1149-1167. This era Stahle refers to as the "Toltec Drought," since it coincides with the decline of the powerful Toltec nation in central Mexico. A drought during this time was playing out in regions to the north now in the U.S.

"This was the worst drought in western North America that we know of over the last 1,200 years," said Stahle. "Our measurements are the first to tie this drought to one taking place in [Mesoamerica](#)."

A third drought, now dated to the years 1378-1404 by the tree-ring data, coincides with the years when the Aztecs were a relatively small power off to the side of more powerful, but weakening, nations in central Mexico. The drought, Stahle believes, might have worked to the Aztec's advantage in gaining more influence in the area.

The Aztecs eventually became paramount in Mexico. Later they were conquered by the Spaniards during still another dry period.

"This study is a landmark," said Edward R. Cook, the director of the Tree-Ring Laboratory at the Lamont-Doherty Earth Observatory of Columbia University in Palisades, N.Y. "All previous studies relating drought to the demise of those cultures have relied on less well resolved and less well dated sediment core records. Further north in the U.S., similar studies had been done, but it was not possible to extend those results into central Mexico until Stahle's results."

Cook reconstructs climate by poring over [tree rings](#). He is currently building an atlas of droughts using tree-ring records from places around the world.

The new tree ring study appears in the journal *Geophysical Research Letters*.

More information:

www.agu.org/pubs/crossref/2011/2010GL046472.shtml

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