A 2129 Year Reconstruction of Precipitation in The Malpais in New Mexico

Ancient tree rings indicate the past two centuries have been unusually wet

This may be a desert, but new research suggests the past two centuries have been the wettest period of the past 1,500 years in New Mexico.

And the past 20 years have been the wettest of all, with rainfall 23 percent above the long-term New Mexico average, according to a study by University of Arizona scientist Henri Grissino-Mayer of more than 2,000 years of tree rings.

The implication of this and other long-term climate data is that the farms, cities and irrigation networks of the modern Southwest were built on rivers swollen by unusually wet weather.

"Climate has allowed us to do this," said Scott Stine, a geographer at California State University, Hayward.

And climate, Stine said, can change.

"That much water is not available long term," he said.

COURTESY HENRI GRISSINO-MAYER

University of Arizona scientist Henri Grissino-Mayer with an 1,800-year-old piece of Douglas fir in El Malpais National Monument.

Grissino-Mayer, who studied tree rings to build the New Mexico climate data, sees a warning in the numbers: What goes up most probably will come down, meaning the dry times could return.

"When it occurs we don't know, but we do know it will occur," Grissino-Mayer said. "That's what I've been trying to warn people about."

Climate researchers are cautious about using past averages to predict the future, saying scientists don't yet understand what is driving the year-to-year or century-to-century fluctuations in our weather.

But Stine, while acknowledging the uncertainty, said it's nevertheless prudent to look at the historic trends to try to understand what to expect in coming years.

"People are getting used to the wet period as being normal," agreed Charlie Liles, head of the National Weather Service office in Albuquerque. "We basically live in the desert."

One result is that what seems like a drought to us today often is a wetter period than the long-term average, according to Grissino-Mayer.

While the devastating New Mexico drought of the 1950s shows up as a legitimate dry spell compared with the long-term average, other lesser droughts of the 20th century don't.

1989, for example, qualified as a modest drought here, according to the federal government's National Drought Mitigation Center. But Grissino-Mayer's data show it was 20 percent wetter that year than the 2,000-year average.

Grissino-Mayer's research provides the first opportunity to make a statement like that, scientists say, because it is the first year-by-year record of rainfall in New Mexico during the past 2,000 years -- the period in which human civilization developed in New Mexico.

Modern meteorologists have accurate rainfall records going back more than a hundred years. And archaeologists, working with tree rings, have analyzed rainfall patterns for shorter periods of time, such as the famous droughts believed to have contributed to the end of the Anasazi culture in the Four Corners area.

But Grissino-Mayer's research, completed last year for his University of Arizona doctoral dissertation, is the first study to link historic rainfall to ancient tree rings to create a complete climate record for New Mexico.

He developed it using 248 Douglas fir and Ponderosa pine samples from El Malpais National Monument near Grants in west-central New Mexico.

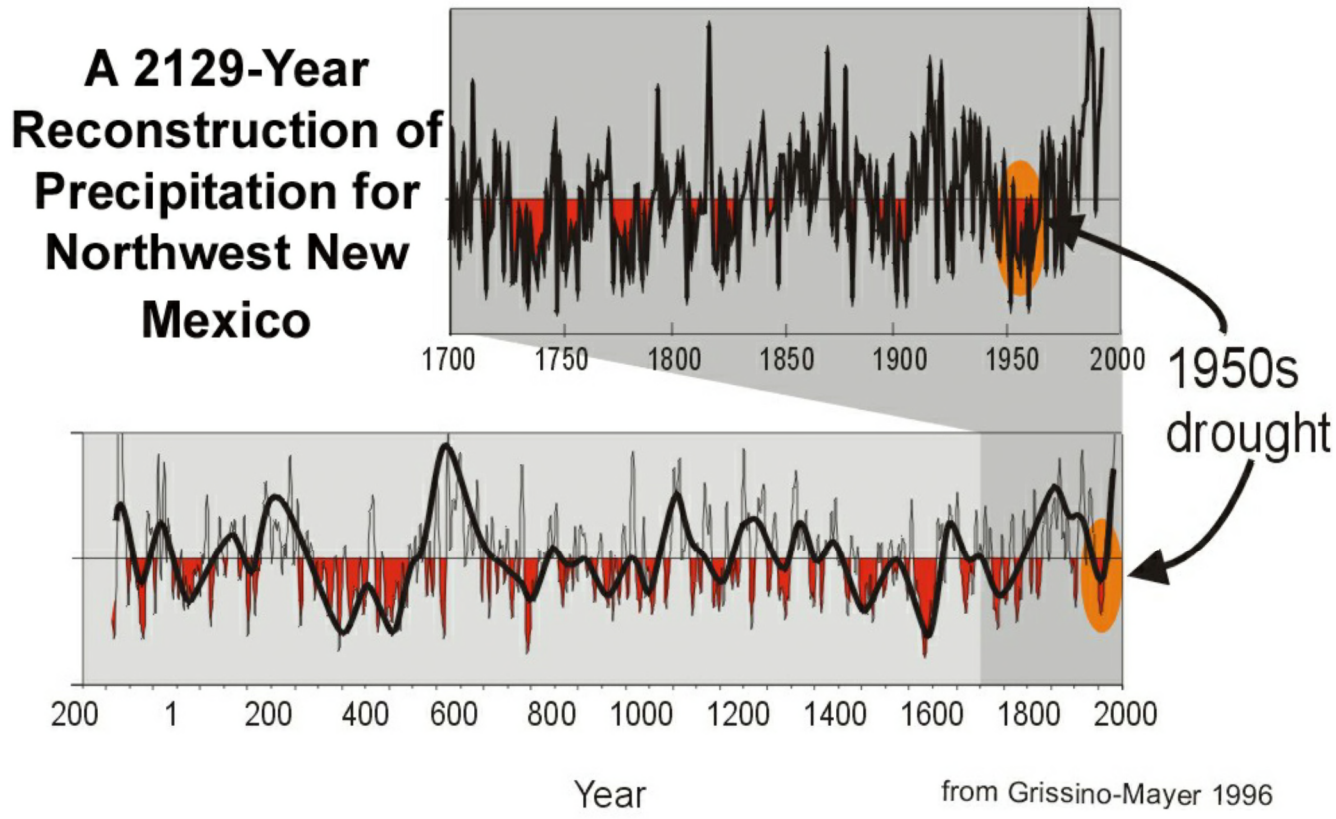
It took him seven field trips to the Malpais over a five-year period to collect the wood.

The individual rings in a cross-section of a tree can be used to measure its growth year by year. In wetter years, the tree grows more, so the ring is fatter.

The wet spell of the past 15 years, for example, shows up as fat bands of growth.

"You can actually see that in the tree rings," Grissino-Mayer said.

The 2,129-year average in the Malpais calculated by Grissino-Mayer suggests 14.6 inches of rain a year, compared with 18 inches a year between 1978 and 1992.



Arizona astronomer Andrew Douglass developed tree ring techniques shortly after the turn of the century in an attempt to study the relationship between tree growth, rainfall and sunspot cycles.

Scientists soon realized the value of the technique for dating archaeological sites. If they could match overlapping patterns between live trees and dead wood, they reasoned, they could work their way back in time to identify the date trees in prehistoric ruins had been felled.

Matching up fat and thin growth bands in various trees, scientists have developed a chronology of tree rings that in some areas of the Southwest dates back nearly 2,000 years.

But those archaeological tree ring records aren't precise enough to record long-term climate trends, Grissino-Mayer said.

For that, he went to the Malpais, which has old live trees and fallen dead wood that hasn't been disturbed by firewood collection and other human activity.

Scientists say tree records are one of the best tools available for reconstructing climate records, but they aren't perfect.

They can miss the heaviest rainfall, said Julio Betancourt, an ecologist with the U.S. Geological Survey Desert Laboratory in Tucson.

Once the soil is saturated, extra rain will run off, with no effect on tree growth, Betancourt explained.

But tree ring data are especially effective at detecting droughts, Betancourt said.

Droughts have mattered in the history of human civilization in New Mexico, and Grissino-Mayer's data document several that have been dramatic.

The state was plagued by below-average rainfall for 200 years between 300 and 500, and again between 1400 and 1600.

But the most famous drought, that which some scientists believe brought down the Anasazi culture, shows up as a minor blip in Grissino-Mayer's data.

Drought was part of the problem then, said University of Arizona archaeologist Jeff Dean.

"If you have a prolonged drought it's going to affect people who are farmers because they're not getting enough water for their crops," Dean said.

The bigger problem, Dean believes, was wild weather fluctuation from year to year and decade to decade.

On the Colorado Plateau, Dean said, "the pattern just went berserk for two centuries."

Compounding the problem was that the Anasazi population had undergone unprecedented growth, leaving little flexibility to adapt to the changing situation by moving.

"Populations were enormous because it's a very long, wet period," Grissino-Mayer said.

"It was definitely a complicated phenomenon, but they had painted themselves into an adaptive corner," said John Ware, an archaeologist at the Museum of New Mexico in Santa Fe.

Ware points to the effect of climate changes on earlier populations in the Animas Valley of southern Colorado. Those people, he said, had the flexibility to move around in response to climate changes, moving to higher, wetter ground in response to drought.

Grissino-Mayer's data appear to support that idea, showing the Anasazi drought was far more mild than the dramatic drought that lasted from 300 to 500.

Grissino-Mayer and his colleagues are continuing to gather more tree ring data on New Mexico's climate. They'll return to the Sandia Mountains this summer to a site near Sandia Crest that has ancient trees similar to those found at the Malpais.

And they are paying special attention to the explosive tree growth in the past 20 years, which is well recorded in the Sandia trees, said Tom Swetnam, one of Grissino-Mayer's colleagues at the University of Arizona's Laboratory of Tree-Ring Research.

"It is really just off the scale," Swetnam said.

There is some evidence, he said, that spring is arriving earlier in the Northern Hemisphere.

"The growing season is lengthening," Swetnam said.