Megadroughts in sub-Saharan Africa normal for the region

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Winston Wheeler, a researcher at the University of Arizona, collecting tree cores from a partially submerged tropical tree at Lake Bosumtwi, Ghana. A submerged forest in the lake provides evidence for severe and long-lasting droughts in West Africa just a few centuries ago. This tree grew at a time of prolonged drought when the lake level was tens of meters lower than today. Tree rings in the core sample were used to date the age of the tree and provide an additional line of evidence about megadroughts in the past. Credit: Jonathan T. Overpeck.

Devastating droughts worse than the infamous Sahel drought are part of the normal climate regime for sub-Saharan West Africa, according to new research.

For the first time, researchers have developed an almost year-by-year record of the last 3,000 years of West Africa's climate. In that period, catastrophic droughts occurred every 30 to 65 years, and the pattern can be expected to continue in the future, the team reports.

"What's disconcerting about this record is that it suggests that the most recent drought was relatively minor in the context of the West African drought history," said first author Timothy M. Shanahan, who conducted the research while he was a doctoral student at The University of Arizona in Tucson.

The Sahel drought, which began in the late 1960s and continued for several decades, killed at least 100,000 people and displaced many more.

"What's really striking about droughts in this area is that they last such a long time," he said. "You have droughts that last 30 to 60 years, and then some that last four times as long."

The region has undergone multicentury droughts, most recently from 1400 A.D. to 1750 A.D., the researchers found.

"If we were to switch into one of these century-scale patterns of drought, it would be a lot more severe, and it would be very difficult for people to adjust to the change," said Shanahan, now an assistant professor of geosciences at the University of Texas at Austin.

Changes in the North Atlantic sea-surface temperatures have a significant effect on the West African monsoon, which is a climate pattern of alternating wet-and-dry periods, the scientists found.

"This area switched between very long wet periods and long, very severe dry periods," he said.

This sediment core taken from Lake Bosumtwi, Ghana has annually deposited layers. These layers provide a high-resolution chronology for the sediments and a means of reconstructing past climate variations. A meter stick lies alongside the core for scale. Credit: T.M. Shanahan and W. Wheeler.

As global warming progresses, the increases in temperature may exacerbate the normal climate pattern, producing even more severe and prolonged droughts than those of the past, said co-author Jonathan T. Overpeck, a UA professor of geosciences.

"We also know that global warming will make these droughts a lot hotter. This could be devastating," said Overpeck, co-director of UA's Institute for Environment and Society.

The research team figured out the region's past climate by analyzing the annual layers of sediment deposited in Ghana's Lake Bosumtwi, geological records of the lake level and other climate indicators.

Paul Filmer, the National Science Foundation program director who funded the study, said, "This project is a good example of how work in the tropics on sediment records provides more detailed insight into climate patterns that affect millions of people in a highly vulnerable area of the world."

Shanahan, Overpeck and their colleagues will publish their paper, "Atlantic forcing of persistent drought in West Africa," in the April 17

issue of the journal *Science*. A complete list of authors is at the bottom of this release. The National Science Foundation funded the research.

Many of the Earth's climate patterns are influenced by sea-surface temperatures.

Climate scientists have proposed that temperatures in the North Atlantic rise and fall naturally in an approximately 60-year cycle called the Atlantic Multidecadal Oscillation. Some computer models and tree-ring data from around the North Atlantic support this hypothesis.

If it exists, the oscillation should have a strong effect on the West African monsoon.

But an accurate annual record of Atlantic sea-surface temperatures exists only for the last 80 to 100 years, and the tree-ring data going farther back in time is patchy. Therefore, up until now, it has been hard to tell whether there is a long-term cyclical pattern or only a shorter-term trend.

The new reconstruction of the West African Monsoon by Shanahan and his colleagues shows a close match between the 350-year-old paleoclimate record of sea-surface temperatures and the wet-dry cycles of the monsoon.

"This paper provides a long-term context suggesting that the Atlantic Multidecadal Oscillation does actually exist," says Shanahan.

"Our rainfall records are strongly related to these really distant sea-surface temperature reconstructions, at least on this multidecadal time scale. It suggests that the rainfall patterns are being generated by the sea-surface temperature patterns and not by some other influence."

Some current climate models have forecast a wetter climate for West

Africa, while others have forecast a drier one. Armed with this new information, scientists who create climate models will be better equipped to sort out some of the conflicting climate predictions for West Africa.

More information: "Atlantic forcing of persistent drought in West Africa" *Science*, April 17, 2009.

Source: University of Arizona (news : web)