4-23-2014

Lasting Effects of Drought

University of Dayton, Ohio (url: http://www.udayton.edu/index.php)

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04.23.2014 | Science, Research, Faculty, Energy and Environment

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This spring, more than 40 percent of the western U.S. is in a drought the U.S. Department of Agriculture deems "severe" or "exceptional." The same was true in 2013. In 2012, drought even spread to the humid east.

It's easy to assume a three-year drought is an inconsequential blip on the radar for ecosystems that develop over centuries to millennia. But new research just reported in *Ecological Monographs* shows how short-lived but severe climatic events can trigger cascades of ecosystem change that last for centuries.

Ryan McEwan, assistant professor of biology at the University of Dayton, and co-author on the paper, notes the findings challenge existing paradigms in the field.

"We tend to think of these forests as being governed by local processes, this work suggests that a unique sequence of climate events can link forests across a region."

Some of the most compelling evidence of how ecosystems respond to drought and other challenges can be found in the trunks of our oldest trees. Results from an analysis of tree rings spanning more than 300,000 square miles and 400 years of history in the eastern U.S. — led by scientists at Columbia's Lamont-Doherty Earth Observatory, the Harvard Forest, University of Dayton and elsewhere — point to ways in which seemingly stable forests could abruptly change over the next century.

The tree records show that just before the American Revolution, across the broadleaf forests of Kentucky, Tennessee, North Carolina, and Arkansas, the simultaneous death of many trees opened huge gaps in the forest — prompting a new generation of saplings to surge skyward.

There's no historical evidence the dead trees succumbed to logging, ice storms, or hurricanes. Instead, they were likely weakened by repeated drought leading up to the 1770s, followed by an intense drought from 1772 to 1775. The final straw was an unseasonable and devastating frost in 1774 that, until this study, was only known to historical diaries like Thomas Jefferson's Garden Book, where he recounts "a frost which destroyed almost every thing" at Monticello and was "equally destructive thro the whole country and the neighboring colonies."

The oversized generation of new trees that followed — something like a baby boom — shaped the old-growth forests that still stand in the Southeast today.

"Many of us think these grand old trees in our old-growth forests have always been there and stood the test of time," says Neil Pederson of the Lamont-Doherty Earth Observatory, lead author of the new study. "What we now see is that big events, including climatic extremes, created large portions of these forests in short order through the weakening and killing of existing trees."

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