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NEWS RELEASE

July 27, 2012

Scientists report major carbon impacts of turn-of-century drought, worst of past millennium; study suggests dry 'new normal' for western North America

WORCESTER, Mass.—Findings from a new scientific study indicate a major carbon release from extreme turn-of-the-century drought in the North American West – the worst of the last millennium – with hint of even drier times ahead.

The study, titled "*Reduction in carbon uptake during turn of the century drought in western North America*" and published July 29 in Nature-Geoscience, was conducted by Clark University scientists who found that the major drought that struck western North America in 2000 to 2004 severely reduced carbon uptake and stressed the region's water resources.

Researchers were impressed by the magnitude of the drought impacts, finding significant declines in carbon uptake, reduced precipitation and soil moisture, lower river flows, and lower crop yields. The study also asks how common such an extreme event might be in the future.

"To our surprise, the drought, which was severe with respect to recent and past conditions, is forecasted to become the wetter end of a new climatology, and would make the 21st century climate akin to mega-droughts of the last millennium," said the study's lead author, Christopher Schwalm, of Northern Arizona University, formerly at Clark University.

The study was funded on a National Science Foundation (NSF) grant to study co-authors Clark Professor Christopher Williams, of the Graduate School of Geography, and Kevin Schaefer, of the National Snow and Ice Data Center, University of Colorado.

"In normal climate conditions North America absorbs carbon dioxide from the atmosphere, serving as an offset to anthropogenic, or human-produced, carbon emissions," Williams added. "Our study shows how this typical carbon uptake was severely impaired by a large-scale and persistent drought striking western North America from 2000 to 2004."

Williams noted, "The event was truly extreme, not only relative to the climate of recent decades but also when compared to climate reconstructed over the past 1000 years. Those longer-term records indicate that the 2000 to 2004 drought was the most severe region-wide event of its kind in the past 800 years."

Williams added that climate models are pointing to a continued trend toward a warmer planet. Global circulation patterns are expected to shift in a way that would create drier conditions across western North America, expanding the region that is already chronically dry and making today's drought conditions the new normal. If this comes to pass, he said, not only would carbon uptake be severely reduced, it also would trigger a whole host of significant water resource challenges, especially difficult for a region already subject to frequent water shortages.

The study relied on analysis of data from NASA satellite remote sensing products and a suite of ground-based monitoring stations that directly measure carbon uptake and release. Data from the monitoring stations are assembled by a global community of scientists participating in FLUXNET, comprising a network of micrometeorological tower sites that measure carbon, water, and energy exchanges. The instruments on these towers help to monitor ecosystem's plant productivity, evapotranspiration, and carbon and water budgets. These towers have become an important tool for Earth Systems Science, Williams said. Reduced precipitation and droughts are stressing ecosystems and these towers help understand and assess the consequences.

Williams' Biogeosciences Research Group at Clark University installed and maintains a flux tower at the Harvard Forest Long Term Ecological Research Site, since 2009, where his students have been in residence programs over the past four years, learning from experts, collecting data using cutting-edge research and state-of-the-art instruments and techniques. These undergraduate researchers continue on as master's students, often mentoring the new undergraduates, Williams noted. This method of hierarchical mentoring is a central element of Clark's development of communities of effective practice, and results in "a powerful use of expertise."

In June, Water Resources Research published another study by Williams that documents how vegetation and climate types influence water resource availability by regulating the amount of water that runs into rivers compared to how much is lost to the atmosphere through evaporation.

To learn more about the team's ongoing research, visit Professor William's Biogeosciences Research Group website.

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