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Michigan Tech News > 2014 > June

Will Climate Change Hurt Tropical Rainforests? Scientists Study the Effects of Warming on Puerto Rican Forest

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Three women scientists are spearheading a new study of climate change and tropical forests. From the left, Sasha Reed, Tana Wood and Molly Cavaleri. Photo: Alida Mau

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June 26, 2014—Did you know that there is a tropical rainforest in the United States? It's in Puerto Rico—the **El Yunque National Forest**—and Michigan Technological University researchers are joining U.S. Forest Service and U.S. Geological Survey scientists there to get a handle on the impact that climate change—particularly warming—is likely to have on the tropical forests of the world.

The **Tropical Response to Altered Climate Experiment (TRACE)** research project is supported by the U.S. Forest Service with an additional three-year, \$960,000 grant from the **US Department of Energy**.

Molly Cavaleri—a tree physiologist who studies how ecosystems are responding to climate change at Michigan Tech's School of Forest Resources and Environmental Science—is thrilled to be heading the study. "This is the first field experiment of its kind ever done in a tropical forest," she says. "We will be manipulating the environment, warming the leaves and branches of the canopy as well as the smaller plants on the forest floor, not just observing."

Forests of all kinds help control greenhouse gases, particularly carbon dioxide, in the atmosphere because trees take in and store more CO₂ than they put out. But unlike

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forests in temperate climates, where temperatures vary widely from season to season and trees have adapted to those changes, tropical forests grow in consistently warm climates, and no one knows how or even if they can acclimate if those climates get hotter.

And they are getting hotter and will continue to do so, climate experts say. "Within 20 years, the new minimum temperatures in the tropics will be hotter than the current maximums," says Cavaleri.

The Michigan Tech researcher and two other research ecologists are leading the study: Tana Wood, from the Puerto Rico Conservation Foundation and adjunct scientist with the **U.S. Forest Service International Institute of Tropical Forestry**, and Sasha Reed with the U.S. Geological Survey. Eoin Brodie from the Lawrence Berkeley National Laboratory will join them as a collaborator.

"It's unusual for three early-career women to be spearheading a project of this size and significance," Cavaleri noted.

Michigan Tech graduate student Alida Mau is already in Puerto Rico, taking measurements in the forest. Cavaleri and her colleagues will be heating the soil and small trees on the forest floor with infrared lamps and running warming cables under the leaves of the canopy of full-grown trees, then collecting data about the responses of leaves, roots, and soil.

"We want to know how sensitive tropical forests are to warming, what physiological changes it will cause, particularly how it affects the trees' ability to store CO₂," Cavaleri said. "If we tip them over a threshold where it's too warm, they may not be able to take up as much CO₂. They may even start giving off more CO₂, which could lead to more warming."

Once they have warmed the trees and measured the changes, Cavaleri, Reed and Wood plan to use the data to help develop better predictive models of the effects of climate change on tropical forests, an effort funded by the USGS Powell Center. "The data will help us understand what is happening globally and what is likely to happen in the future, Cavaleri explained.

She also added, "We don't know what we are going to find, so we are not advocating any particular policy."

Cavaleri said working in Puerto Rico is a pleasure, much easier than conducting research in other tropical locales. "There is electricity, no problem with permits, a Forest Service research station with dormitories," she said. "There aren't even any venomous snakes."

Michigan Technological University (www.mtu.edu) is a leading public research university developing new technologies and preparing students to create the future for a prosperous and sustainable world. Michigan Tech offers more than 130 undergraduate and graduate degree programs in engineering; forest resources; computing; technology; business; economics; natural, physical and environmental sciences; arts; humanities; and social sciences.

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