How a Forest Responds to the Threatening Heat of 2100

(revised)

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EL YUNQUE RAINFOREST, Puerto Rico—Large yellow cables marked “danger” carry electricity through the rainforest. The cables go into a building that holds six large space heaters. The heaters, however, are not working. At the control center building half a mile away, Tana Wood, a biologist with the Forest Service, checks the control box. She pushes a reset button and the large generators roar to life.

Wood, 40, is responsible for the daily operations of this unique experiment, where scientists are raising the heat by 4 degrees Celsius to see what happens to new trees and other small plants growing here. This is as hot as our planet may be in 2100 if countries continue to produce carbon dioxide at current rates. The scientists want to see how tropical forests will do in that warmer world.

Tropical forests are major carbon sinks. They absorb 30 percent of the carbon dioxide that humans produce every year, which means 30% of the CO2 from every power plant, car, train, ship and other source captured and stored in trees. Some climate models show these forests declining in the next century, while others show the opposite. It is important to know because, without large rainforest trees, the Earth would warm much faster than it does now.

El Yunque mountain, crowned by the only tropical rainforest under the control of the US Forest Service, is a cloud-covered peak on the northwestern edge of the Puerto Rican island. Wood began working there as a young scientist, but she sometimes found that her study areas would disappear because of logging and fires. In the five years ending in 2015, nearly 6 million hectares of tropical forests around the world have been cleared, and logging and fires have added nearly as much carbon to the atmosphere as tropical forests absorb. In addition, there was pressure from local people who were poor and depended on logging.

Climate scientists, who make models of the Earth to try to understand its future, have come to understand that forests play an important yet poorly understood role. Although forests absorb huge amounts of CO2, they might weaken as the climate warms. Moreover, most research in this area has been done on forests in temperate regions such as the Canada and the continental US. Tropical forests are distinct and mostly unstudied.

Since 2007, Wood has been working in Puerto Rico with Ariel Lugo of the U.S. Department of Agriculture, who suggested that she set up a global warming experiment. Puerto Rico was the site of some early research projects in the 1960s in which a piece of forest was enclosed in giant plastic sheets that resembled shower curtains. A huge fan moved air into and out of the enclosure as the forest’s CO2 was measured. Other experiments looked at the effect of X-rays on trees, and still other experiments were conducted on the effects of chemicals on the forest.

However, problems arose. Many residents consider the mountain to be a holy place, and male workers were sometimes reluctant to work with a female boss. In addition, research money was a challenge to obtain.

Lugo and Wood persisted, however. In 2009, Wood invited scientists to a workshop in the city of San Juan in Puerto Rico, and in 2014 they received a grant to conduct their research. In spite of many challenges from working in a tropical rainforest, the research project is nearly ready to begin. The scientists have funding to run their experiment for three years, but “we would like to keep the experiment going as long as we can afford to keep the lights on,” Wood said.

The scientists will use their data in climate models to improve their understanding of the tropical sink. The experiment will help scientists understand how tropical forests, from those in Borneo to the rainforests in Libera and the Amazon, will change in the next century. Such research in the tropics is critical, for without these efforts, the models will begin to become more and more unrealistic as the climate changes.

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