Effects of interannual climate variability on tropical tree cover

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Tree cover in the tropics will likely change in surprising ways as climate change increases the frequency of extreme rainfall events, according to a study by scientists from Wageningen University published today in *Nature Climate Change*.

The study shows that increasing year-to year variability in rainfall is associated to lower tree cover in the moist tropical forests worldwide but it can open windows of opportunity for tree expansion in some tropical drylands.

"Understanding how ecosystems respond to climate variability is a priority in a fast changing globe" says Marten Scheffer, who leads the research program on tipping points. "Climate events can open windows of opportunity for abrupt changes in ecosystems. We are starting to glimpse on the complexity of these patterns" says Scheffer.

"The overall effects of climate variability are puzzling. On one hand, severe drought can produce massive tree mortality, but there is also evidence of episodic tree recruitment during extreme rainy years" says Milena Holmgren, leading author of the study and a specialist on plant ecology.

Satellite data

The authors used satellite data to look at large scale patterns of tree

cover across the tropics of Africa, Australia and South America. They show that increasing rainfall variability is associated to lower tree cover in the moist tropical forests of all continents. In the dry tropics, however, the effects of higher year-to year variability in rainfall depend on the specific continent. Higher overall inter-annual variation in rainfall has positive (South America), negative (Australia) or neutral effects (Africa) on tree cover in dry-lands. "The effects of climate variability in tropical drylands seem to depend on the balance between wet and dry extreme events, as well as on the opportunities trees have to grow during rainy events," says Milena Holmgren. "We knew from small scale experiments in South America and observations in Australia that rainy years can be essential for tree recruitment in drylands. During extreme rainy years there is massive tree germination and if these young seedlings grow fast enough to escape from herbivores, then woodlands can expand. With our analysis of satellite data, we could now assess how general this response is. We found out that the positive effect of extreme rainy events is localized and can be offset in certain conditions, as in Australia, by negative effects of extreme dry years," explains Holmgren.

"Understanding potential impacts of climate change on the Amazon forest and the savannas surrounding it is one of the major challenges for scientists in the region today," explains author Marina Hirota who came to work with the Wageningen team after her studies in Brazil to analyze forest resilience. "Our study shows that the forest is fragile to increasing climate variability within a year but also between years. This kind of information shows the risks and opportunities that are inherent to the stability properties of these ecosystems that still cover massive parts of the Earth."

More information: Holmgren, M. et al. Effects of interannual climate variability on tropical tree cover, *Nature Climate Change*. (Advance Online Publication 2 June 2013) DOI: 10.1038/NCLIMATE1906