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Resistance and mortality in tropical forest trees during experimental drought

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310, Baltimore Convention Center

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Background/Question/Methods

Severe drought has been shown repeatedly to lead to significant mortality in tropical forests, from SE Asia to Amazonia. The effects can be large, even for single severe droughts, sometimes switching the sign of net carbon flux to/from the land surface. Representing sensitivity to moisture availability remains a challenge for vegetation models, especially those used to represent vegetation change, with consequent uncertainty in predictions of the effects of increased frequency or severity of drought on the tropical forest carbon cycle. Part of the difficulty is that we have an insufficient understanding of the tree mortality process during drought; this is true for forests globally, but is especially true for tropical forests for which fewer data are available. Here, we use a uniquely long-running soil moisture manipulation study in Amazonia to address this question. A large-scale throughfall exclusion study has been maintained at an eastern Amazon forest site since 2002. We have previously reported empirical and modelling results for the response in productivity, growth and mortality to long term soil moisture deficit.

Results/Conclusions

Here we present new long term (13 yr) growth and mortality data to test whether the strong mortality response to drought at this forest continues under extended drought, or whether we see recovery; we also examine how growth rates behave in the context of potentially lethal drought stress. In addition, we divide groups of taxa previously observed to be vulnerable or resistant to drought in terms of their mortality risk and use the drought manipulation treatment to test for differences in key ecophysiological traits, such as gas exchange capacity, non-structural carbohydrate content, autotrophic respiration and plant hydraulics. Our results include evidence of some grouping by hydraulic parameters, surprisingly few differences in photosynthetic capacity, and notable differences in autotrophic respiration rates. We will use our results in combination with those from other studies to develop and test dynamic

vegetation model performance, with a particular focus on regional differences or similarities in tropical forest drought response characteristics.

See more of: The Ecological Impacts of Drought As Revealed Through Experimental Approaches
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When: August 09 - 14, 2015
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