Harnessing the ecological data revolution
August 3 - August 6, 2020

From chronic warming to acute heat waves: An under-appreciated threat for tree mortality?

Abstract

Background/Question/Methods

Forests around the globe are changing rapidly in response to warming climate, resulting in large scale tree die-off events that are interrelated with pest and pathogen outbreaks and wildfire. Research on tree mortality has progressed from focusing on drought; to “hotter drought”, where warmer average temperatures make the impacts of drought worse; to understanding the importance of vapor pressure deficit in exacerbating tree mortality; to estimating the consequences of progressive warming conditions - all the while working on trying to address the underlying physiological mechanisms of mortality. Each stage in this progression has signaled increased risk of tree mortality events. However, recent studies suggest another factor is being overlooked: heat waves occurring during such events - “heat-wave compounded drought”. Here we highlight new experimental results on tree seedlings using growth chambers to evaluate the potential importance of “heat wave compounded drought”.

Results/Conclusions

Our results reinforce prior results related to warmer temperatures hastening drought-induced mortality of tree species, while also providing experimental support of the importance of heat waves in “heat-wave compounded drought” in further hastening tree mortality. We present a new conceptual framework factoring this concept in. Because heat waves will increase in frequency and spatial extent much more than mean warming, these results highlight that despite ever-increasing estimates of risk of tree mortality, estimates of future tree mortality are likely still be underestimated.

Authors

David Breshears
University of Arizona

Jason P. Field
University of Arizona

Darin Law
University of Arizona

Greg Barron-Gafford
University of Arizona

Kierstin Acuna
University of Maryland

Mallory L. Barnes
Indiana University

Xiao Feng
Florida State University/University of Arizona

Katinka Ruthrof
Department of Biodiversity, Conservation and Attractions

Joseph B. Fontaine
Murdoch University

Robbie Burger
University of Kentucky

Abigail L. S. Swann
University of Washington

Scott C Stark
Michigan State University

Scott R. Saleska
University of Arizona

Juan Camilo Villegas
Universidad de Antioquia

Angelina Martinez-Yrizar
Instituto de Ecologia, Universidad Nacional Autonoma de Mexico

Alberto Búrquez
Instituto de Ecologia, Universidad Nacional Autonoma de Mexico

Jatin Kala
Murdoch University

Giles E. St.J. Hardy
Murdoch University

View Related

OOS 9 - The Fate of Forests in a Rapidly Changing World

Organized Oral Sessions ›