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Which trees face death in drought?

Two hundred-twenty-five million trees dead in the southwest in a 2002 drought. Three hundred million trees in Texas in 2011. Twelve million this past year in California. Throughout the world, large numbers of trees are dying in extreme heat and drought events. Because mass die-offs can have critical consequences for the future of forests and the future of Earth's climate, scientists are trying to understand how a warming climate could affect how often tree mortality events occur – and how severe they could become.

A University of Utah biologist may be able to help. William Anderegg and his colleagues looked for patterns in previous studies of tree mortality and found some common traits that characterized which species lived and which died during drought. The results, published today in *Proceedings of the National Academy of Sciences*, can help chart the future of forests.

"There are some common threads that we might be able to use to predict which species are going to be more vulnerable in the future," Anderegg says.

Forests in crisis

Worldwide, forests absorb carbon dioxide equivalent to about a quarter of the carbon dioxide emissions produced by humans. So

PHOTO CREDIT: William Anderegg

Trembling aspen trees killed by severe drought near Fairplay, Colorado, August 2009.

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large-scale tree die-offs not only shut down a forest's ability to sequester greenhouse gases, but also release some of those gases back into the atmosphere as the dead trees decompose.

Climate scientists have had difficulty accounting for these changes in carbon dioxide storage in climate models, because the effect of drought on various species' mortality rates has been, historically, difficult to predict. "That launched this search to understand what about a tree's physiology predisposes it to die during a severe drought," Anderegg says.

He and his colleagues combed through 33 published studies of tree mortality that included 475 tree species and more than 760,000 individual trees. The team noted the mortality rates for each species, then compared those to 10 tree physiological traits, searching for commonalities. The traits included typical tree characteristics, such as wood density, rooting depth and basic leaf characteristics, such as whether the species was an evergreen or a deciduous tree. Other traits concerned the hydraulics of how water moves through trees.

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Dry tree image via Shutterstock.

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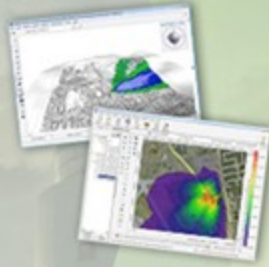
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