

# FUTURITY

## How dead trees help forests tolerate drought

31 March 2020

Researchers used the US Forest Service Forest Inventory and Analysis database to study how the traits of tree communities have shifted across the contiguous United States.

The results indicate that communities, particularly in more arid regions, have become more drought tolerant, primarily through the death of less hardy trees.

To understand what might drive changes in forests' ability to cope with [climate change](#), the researchers considered two main physiological traits: a species' average tolerance to water stress and how close this was to its maximum tolerance (essentially how much wiggle room it had when dealing with water stress).

"We basically put a number on what species composition means in terms of their ability to deal with water stress," says Anna Trugman, an assistant professor in the geography department at the University of California, Santa Barbara and lead author of the paper in the [Proceedings of the National Academy of Sciences](#).

Fortunately for the team, the US Department of Agriculture tracks tree species, size, and abundance in more than 160,000 forest plots randomly distributed across the country.

What's more, the US Forest Service Forest Inventory and Analysis database includes over 200 different types of ecosystems including dry pinyon pine forests, cypress swamps, Atlantic hardwood forests, and the temperate rainforests of the Pacific Northwest.

## HARDY FORESTS

Trugman and colleagues matched the traits they were interested in to the species abundance in these plots. Then they used this to calculate a weighted average value for the community of trees in each plot, which essentially corresponded to the community's [drought tolerance](#).

Since scientists survey these plots every five to 10 years, the researchers could track shifts in community trait composition and relate these to tree mortality, recruitment, and climate.

There are two ways a community can become more drought tolerant: Less hardy trees can die or more resilient trees can grow faster. Both result in a community that is hardier overall.

Trugman found that it was primarily the death of less robust trees that drove the shifts toward greater drought tolerance, though she notes that the effects of sapling recruitment have been less evident over such a short time span.

She also noticed that the scope of traits in a given plot didn't automatically correlate with the number of species present. "You don't necessarily have a larger range in strategies if you have more species," she says.

For instance, the eastern US doesn't experience as much routine drought stress as its western counterpart, but it has relatively high species diversity. As a result, most of the trees have similar strategies to cope with water stress.

Compare that to the Southwest, where species live together that have a range of strategies for dealing with drought, despite many plots having relatively low species diversity overall.

### **TRAIT VELOCITY, CLIMATE VELOCITY**

Maps of plant traits are useful to scientists because they inform the models that forecast how climate change will affect the landscape, Trugman explains. The trait maps help researchers assess the mismatch between climate suitability and the community's current trait composition.

Trugman's study refers to this change in a community's traits as the "trait velocity." The quicker the change, the faster the velocity. Similarly, scientists who study the change in an area's climatic conditions refer to the change over time as the "climate velocity."

Intuitively, the two rates ought to be related, with communities and ecosystems changing to adapt to the changing climate in the region.

"But you could actually have a mismatch between these two," Trugman says. "Your trait velocity could be much slower than your climate velocity, in which case the trees in that particular location are not going to be very suitable for the new climate."

In other words, the trees may survive for now, but they won't grow or reproduce.

It's possible that scientists could see no shift in traits at all, Truman says. And while this might sound more hopeful, in reality it would indicate that something was preventing the communities from adapting—perhaps a loss of species or genetic diversity, or simply the absence of more resilient species nearby that can provide seeds.

On the other hand, Trugman saw accelerated trait velocities in more arid regions. This study was a first pass; she plans to further investigate the relationship between trait and climate velocities in future research.

Overall, the results indicate that forests are shifting to communities that can cope with greater average water stress as well as more variability in water stress. This should buffer forests against some of the effects of climate change, at least in the short term, Trugman says.

"Ultimately, we want to put trait velocities and climate velocities in some comparable context to understand how mismatches between the two will affect our forests."

Source: <https://www.futurity.org/forests-and-drought-trees-climate-change-2321412-2/>