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Monoculture Could Worsen Vulnerability to Climate Change



The conversion of biodiverse landscapes to single-species farms alters the water cycle and makes the world more susceptible to ecological instability, according to recent research by international scientists published in *Nature Geoscience*.



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Land management policies are increasingly transforming natural ecosystems for agriculture worldwide. Roughly two-fifths of the planet's iceless terrestrial area has turned to farming and forestry, "reducing biodiversity to a few choice trees and crops," Irena Creed, co-author on the [study \(https://www.nature.com/articles/s41561-020-0641-y\)](https://www.nature.com/articles/s41561-020-0641-y), tells Food Tank.

In 2018, dozens of researchers from various fields met in Weimar, Germany, to examine how this could impact the water cycle, which is the constant flow of water between the atmosphere, ocean, and land.

The group determined that the land-cover change would decrease the amount of water taken up by soils, stored as groundwater, and returned to the sky and water bodies through evaporation and plant life.

"Landscapes with a more constrained cycling of water will be less likely to withstand disturbances," says Creed, environment and sustainability professor at the University of Saskatchewan in Canada.

Because vast [monocultures \(https://foodtank.com/news/2015/06/accounting-for-the-hidden-costs-of-monoculture-crops/\)](https://foodtank.com/news/2015/06/accounting-for-the-hidden-costs-of-monoculture-crops/) with identical plants lack varied leaves, barks, and roots, she says, they result in "a more vulnerable soil-vegetation-atmosphere system that is less able to withstand fires, pests, and extreme weather events."

While mixed vegetation's roots draw water from different soil depths, Creed explains that monocultures lack diversity in root length and get water from just one level in the ground. This places them at greater risk of drought. In fact, plant uniformity in sites that were once wetlands has been associated with a rise in the number and strength of droughts and floods as well as a decline in water quality.

Other scientists have come to similar conclusions from their own work.

In southwest [India \(https://www.currentscience.ac.in/Volumes/118/09/1379.pdf\)](https://www.currentscience.ac.in/Volumes/118/09/1379.pdf), the replacement of native forests with monoculture plantations has lowered the landscape's capacity to absorb rainwater, T.V. Ramachandra, Energy and Wetlands Research Group coordinator at the Indian Institute of Science's Centre for Ecological Sciences, tells Food Tank. This creates water scarcity in the dry period, he says. And with climate change exacerbating cycles of flooding and drought in the last couple years, the shift has made the region particularly vulnerable to disasters.

Monoculture has also made year-round streams there disappear for months, Ramachandra says. His team found that such land transformations slash farmers' revenues by almost 80 percent, partly



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because the diminished water shortens the growing season.

A watershed's vegetation type affects not only its hydrology but also its economy, Ramachandra says.

“Homogenization certainly will spell doom for the sustenance of natural resources and, more importantly, would threaten the livelihood of billions of people across the globe,” he says.

Creed and her colleagues suggest governments gather data to address the adverse effects of conventional land management on the water cycle. They stress that such action is needed to keep the water cycle and vital ecosystems resilient against pressures like climate change.

“The incorporation of smart design in forestry and agriculture to optimize plant structural and functional diversity would help to maintain the natural water cycle,” Creed tells Food Tank. “By recognizing, preserving or enhancing the diverse array of hydrological responses among plant species, we can provide better stewardship of the Earth’s finite water resources.”

Photo courtesy of Scott Goodwill, Unsplash

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Julia John (<https://foodtank.com/news/author/julia-john/>),

Julia is a Food Tank intern who recently graduated from Johns Hopkins University with a master’s degree in environmental science and policy. With a background in environmental journalism, she has written about sustainable food and conservation for various print and online publications, from a local Vermont paper to the international news site Mongabay. She’s especially interested in alternative proteins, waste reduction and wildlife protection. Her hobbies include playing sports, taking long walks and befriending indifferent alley cats.

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