

# Too much water, fertilizer bad for plant diversity

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Too much of multiple good things -- water or nutrients, for example -- may decrease the diversity of plant life in an ecosystem while increasing the productivity of a few species, a UC Irvine scientist has discovered.

This finding provides a new explanation for why grasslands, lakes and rivers polluted with nitrogen and phosphorus, usually from agriculture, contain a limited number of plant species. For example, where the Mississippi River empties into the Gulf of Mexico, the water contains low levels of oxygen and high levels of nitrogen and phosphorus used in fertilizers resulting in reduced plant diversity.

"Our results show nutrient pollution can cause loss of plant species from a habitat that can persist for more than 100 years," said W. Stanley Harpole, postdoctoral researcher in ecology and evolutionary biology at UCI and first author of the study. "This means human actions that simplify habitats can lead to long-term loss of biodiversity."

This study appeared March 25 in the online edition of the journal *Nature*.

The findings are based on experiments conducted at the University of California's Sedgwick Reserve in the Santa Ynez Valley. Researchers applied combinations of water and nutrients -- including nitrogen, phosphorus and cations -- to plots of grassland and found that areas treated with all of the resources had the fewest number of species but the highest productivity of a select few plant types.

When the many resources that plants compete for become overly abundant, the environment simplifies, and an emphasis is placed on a single environmental factor such as space or sunlight. Only a few species best adapted to the new environmental conditions will thrive, Harpole said.

The experiment, combined with an analysis of a similar 150-year-old study, supports the scientists' theory that plant diversity is directly related to the number of limiting factors such as levels of nitrogen, phosphorus, potassium and water.

Source: University of California - Irvine

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