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UCSB's Sedgwick Reserve Featured in International Journal

A new study of grasslands conducted at the University of California, Santa Barbara's Sedgwick Reserve in the Santa Ynez Valley sheds light on how humans are contributing to a decrease in biodiversity.

The study shows that human activities, such as adding water and nutrients, decrease the diversity of species in an ecosystem. The research is published in the March 25 online version of the journal Nature.

First author W. Stanley Harpole is a member of a working group at UCSB's National Center for Ecological Analysis and Synthesis (NCEAS) and a postdoctoral scholar at UC Irvine. He explained that the reduction in species diversity occurs because increasing the amounts of limiting resources, such as nitrogen and water, makes an ecosystem more homogeneous and consequently reduces the number of opportunities for competing species to coexist.

Put another way, the inputs reduce the number of niches, allowing a few species to dominate.

Jim Reichman, director of NCEAS, explained that the results are important scientifically because they reveal a distinctive biological mechanism to explain patterns of diversity in natural plant communities.

"The results are particularly important in habitats like California grasslands where the delicate balance between available resources and the ability of plant species to obtain those resources have been disrupted by past human activities," said Reichman.

The findings are based on experiments in which the researchers applied combinations of nutrients (nitrogen, phosphorous and cations) and water to plots of grassland. Plots that received all of the resources had the fewest species and highest productivity. The researchers combined this with analysis of the 150-year-old Rothamsted Park Grass Experiment, the oldest ecological experiment in existence. Both studies supported their hypothesis.

"Our results show that the loss of plant species from a habitat due to nutrient pollution can persist for more than 100 years," Harpole said.

"Thus human actions that simplify habitats can lead to long-term loss of biodiversity."

Co-author G. David Tilman, professor of ecology at University of Minnesota, said the data in the article "strongly supports a new explanation for why the world contains so many species. It shows that plant diversity is directly related to the number of limiting factors (such as soil moisture, nitrogen, phosphorus, potassium, and water)."

Harpole said the data helps explain why grasslands, lakes and rivers that are polluted with nitrogen and phosphorous (usually from agriculture) have fewer species. The reduction of species where the Mississippi River empties into the Gulf of Mexico, known as the "dead zone," is one of the best-known examples of this phenomenon.

Harpole said that his NCEAS group is now looking to see if an understanding of the process can be extended to a global scale. The group is comparing thousands of experiments in marine, freshwater and terrestrial ecosystems.

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