New Study: Ecosystem Disturbance and the Recovery Debt

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Ecological restoration is seen as a key tool for building back biodiversity and resilience in ecosystems that have been disturbed. But new research found that even if complete ecosystem recovery is reached, disturbed ecosystems typically incur decades of lost biodiversity and ecosystem function such as carbon and nitrogen cycling.

The study illustrates that while restoration is crucial to regaining ecosystem function, protecting ecosystems against human disturbance is ultimately the best way to ensure no interruption in these services. The study cautions against pursuing ecosystem management strategies, particularly compensation policies, that exclusively rely on restoration or recovery to reverse biodiversity and functional loss, because they will increase the quantity of less-functional and diverse ecosystems.

The study appeared on January 20th in the journal Nature Communications [2].

A multi-disciplinary team of researchers [3], brought together by the National Socio-Environmental Synthesis Center (SESYNC) at the University of Maryland, analyzed data from 3,035 sampling plots worldwide to quantify the interim reduction of biodiversity and functions occurring during the recovery process. They found that recovering ecosystems had, on average, half the amount of plants and animals, were one third less diverse, and had 40 percent lower cycling of carbon and nitrogen than undisturbed ecosystems.

The researchers included data across a variety of ecosystems that have experienced different kinds of disturbance. Ecosystems formerly mined for resource extraction had the greatest loss in species diversity (32 to 45 percent) and carbon cycling (39 to 62 percent) 11 years after disturbance.
David Moreno-Mateos, Ikerbasque research fellow at the Basque Center for Climate Change, who led the science team at SESYNC, said that the recovery of an ecosystem involves recovering multiple elements, not just plant species. “One of the things ecosystems need to recover are the interactions among organisms. These interactions are important because they are the essence of ecosystem functionality,” Moreno-Mateos said. “For example, the interactions between bees and flowers allows plant reproduction. Although known for a while, this approach has not been pursued so far in any restoration strategy, and so, in most cases, ecosystems today essentially recover on their own, no matter what we do.”

The effect of time may be restrictive in many, if not all, cases. He explained, “We expect recovery to happen in a few years or decades, but in many cases we believe that recovery of certain species or interactions may take centuries or more. For example, how long would it take for the marbled murrelet to go back to recovered redwood forests?”

Billions of dollars are spent on ecosystem recovery every year. The findings of Moreno-Mateos’ science team could be of interest to policy makers and decision makers who are developing and applying restoration strategies at national and international levels. “Recovery is slow and complex, but it does not mean that we should not restore; rather we should dramatically increase the investment on understanding what is needed to accelerate recovery.”

In addition to Moreno-Mateos, study co-authors include Edward B. Barbier, Peter C. Jones, Holly P. Jones, James Aronson, Jose A. Lopez-Lopez, Michelle L. McCrackin, Paula Meli, Daniel Montoya, and Jose M. Rey Benayas.

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About SESYNC

SESYNC's mission is to support synthetic, actionable team science on the structure, functioning and sustainability of socio-environmental systems. The center’s five core objectives are to: enhance the effectiveness of interdisciplinary collaborations among natural and social science research teams focused on environmental problems; build capacity and new communities of socio-environmental researchers; provide education programs to enhance interdisciplinarity and understanding of socio-environmental synthesis; enhance computational capacity to promote socio-environmental synthesis; and enhance relevance of socio-environmental research to decisions and behaviors via actionable scholarship. For more information on SESYNC and its activities, please visit www.sesync.org [4].

Associated Project:
A Restoration Synthesis [3]

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