

Biodiversity promotes multitasking in ecosystems

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The consumption of bryozoans atop an eelgrass blade by amphipods is one example of an ecological function. Credit: © Emmett Duffy/VIMS.

A new study of the complex interplay between organisms and their environment shows that biodiversity—the variety of organisms living on Earth—is even more important to the healthy functioning of ecosystems than previously thought.

The findings bolster the view that conservation of biodiversity benefits the plants and animals directly involved, and by extension the [human populations](#) that rely on these [organisms](#) and [ecosystems](#) for food, water, and other basic services.

Lead author on the study, to be published in the online journal *Nature Communications* on April 24, is Jonathan Lefcheck, a post-doctoral research associate and recent Ph.D. graduate at the College of William & Mary's Virginia Institute of Marine Science.

Co-authors of the international research effort hail from the University of Massachusetts Boston; the University of Minnesota; the University of Gothenburg, Sweden; Swansea University in Wales; the German Centre for Integrative Biodiversity Research (iDiv) Jena-Halle-Leipzig; the University of Leipzig; the University of Oxford; the University of Michigan; and the Smithsonian Institution.

"Many recent studies support the idea that greater biodiversity helps maintain more stable and productive ecosystems," says Lefcheck, "but this conclusion rests mostly on experiments that tested how losing species affects only a single ecosystem process, such as plant growth. "Our study," he says, "is the first systematic look at how biodiversity affects the suite of interconnected processes that keep ecosystems healthy and functioning."



These manipulations of grassland diversity were conducted in Jena in Germany.
Credit: © Dr. Nico Eisenhauer

The team examined the relationship between biodiversity and these various processes, termed "multifunctionality," by compiling and analyzing the results from 94 experiments conducted around the world. Each experiment involved manipulation of at least 3 different species and the monitoring of at least 2 and up to 12 distinct ecosystem functions—from the accumulation of soil nitrogen to the control of aquatic algae. The experiments were evenly divided between terrestrial and aquatic habitats.

The results of the team's synthesis were clear. "We found that biodiversity generally enhances multiple functions in experimental ecosystems," says Lefcheck. "In other words, as you consider more aspects of an ecosystem, biodiversity becomes more important: one

species cannot do it all."

Co-author Dr. Emmett Duffy, director of the Smithsonian's Tennenbaum Marine Observatory Network and co-leader on the project, says, "Our review of these experiments suggests that, contrary to some prior interpretations, we may have actually underestimated the importance of biodiversity to the functioning of ecosystems in nature."

To illustrate the team's findings, Lefcheck turns to the focus of his own field research—the seagrass meadows of Chesapeake Bay and the coastal ocean.



The team analyzed experiments conducted in both the field and the laboratory. This lab study manipulated the diversity of microscopic ciliates and algae. Credit: © Lars Gamfeldt.

"Seagrasses," says Lefcheck, "are home to a variety of small animals that perform different jobs. Some control algae that would smother seagrasses. Others keep out invasive species. Still others provide food for striped bass and blue crabs that are served on our dinner tables. By conserving this variety of animals we can we maximize the health of the grass bed, and the benefits to people."

Professor Nico Eisenhauer, a co-author from the German Centre of Integrative Biodiversity Research, adds "Only with this level of international, cross-system collaboration can we explore global patterns and understand the importance of [biodiversity](#) loss for all of humanity."

University of Michigan professor Bradley Cardinale, co-author and project co-leader, says, "People benefit from nature in many ways. Some extract goods like timber. Others recreate, hunt, or fish. Still others use the clean water. Our study suggests that species conservation helps sustain the variety of ecological processes that control the benefits people get from nature."

The scientists conducted the study as part of a working group established in 2010 at the National Center for Ecological Analysis and Synthesis in Santa Barbara, California. The group's overall goal is to translate the results of ecological experiments into applied knowledge that can be used to aid decisions in conservation and management.

Provided by Virginia Institute of Marine Science

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