Biodiversity Improves Water Quality through Niche Partitioning

Author: Bradley J Cardinale. University of Michigan, School of Natural Resources & Environment, Ann Arbor, Michigan 48109-1041, USA

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Excessive nutrient loading of water bodies is a leading cause of water pollution worldwide¹ ² ³, and controlling nutrient levels in watersheds is a primary objective of most environmental policy². Over the past two decades, much research has shown that ecosystems with more species are more efficient at removing nutrients from soil and water than are ecosystems with fewer species⁴ ⁵ ⁶ ⁷. This has led some to suggest that conservation of biodiversity might be a useful tool for managing nutrient uptake and storage⁸ ⁹ ¹⁰, but this suggestion has been controversial, in part because the specific biological mechanisms by which species diversity influences nutrient uptake have not been identified¹⁰ ¹¹ ¹². Here I use a model system of stream biofilms to show that niche partitioning among species of algae can increase the uptake and storage of nitrate, a nutrient pollutant of global concern. I manipulated the number of species of algae growing in the biofilms of 150 stream mesocosms that had been set up to mimic the variety of flow habitats and disturbance regimes that are typical of natural streams. Nitrogen uptake rates, as measured by using ¹⁵N-labelled nitrate, increased linearly with species richness and were driven by niche differences among species. As different forms of algae came to dominate each unique habitat in a stream, the more diverse communities achieved a higher biomass and greater ¹⁵N uptake. When these niche opportunities were experimentally removed by making all of the habitats in a stream uniform, diversity did not influence nitrogen uptake, and biofilms collapsed to a single dominant species. These results provide direct evidence that communities with more species take greater advantage of the niche opportunities in an environment, and this allows diverse systems to capture a greater proportion of biologically available resources such as nitrogen. One implication is that biodiversity may help to buffer natural ecosystems against the ecological impacts of nutrient pollution.

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Recent Research

Analysis of Federal and State Policies and Environmental Issues for Bioethanol Production Facilities


The purpose of this work was to investigate incentives and barriers to fuel ethanol production from biomass in the U.S. during the past decade (2000–2010). In particular, we examine the results of policies and economic conditions during this period by way of cellulosic ethanol activity in four selected states with the potential to produce different types of feedstocks (i.e., sugar, starch, and cellulosic crops) for ethanol production (Florida, California, Hawaii, and Iowa). Two of the four states, Iowa and California, currently have commercial ethanol production facilities in operation using corn feedstocks. While several companies have proposed commercial scale facilities in Florida and Hawaii, none are operating to date. Federal and state policies and incentives, potential for feedstock production and conversion to ethanol and associated potential environmental impacts, and environmental regulatory conditions among the states were investigated. Additionally, an analysis of proposed and operational ethanol production facilities provided evidence that a combination of these policies and incentives along with the ability to address environmental issues and regulatory environment and positive economic conditions all impact ethanol production. The 2000–2010 decade saw the rise of the promise of cellulosic ethanol. Federal and state policies were enacted to increase ethanol production. Since the initial push for development, expansion of cellulosic ethanol production has not happened as quickly as predicted. Government and private funding supported the development of ethanol production facilities, which peaked and then declined by the end of the decade. Although there are technical issues that remain to be solved to more efficiently convert cellulosic material to ethanol while reducing environmental impacts, the largest barriers to increasing ethanol production appear to be related to government policies, economics, and logistical issues. The numerous federal and state policies do not effectively give investors confidence to commit to the construction and long-term operation of facilities under current economic conditions. Additional changes in policy and breakthroughs in technology and logistics will be required to address these hurdles to increases in ethanol production in the U.S. in the next decade.

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Upcoming Events


- **Natural Areas Training Workshop– Plant Communities of Florida, May 3-5, 2011** at the Disney Wilderness Preserve, Kissimmee and Crystal River Preserve Park. To learn more go to [http://nata.snre.ufl.edu/registration.htm](http://nata.snre.ufl.edu/registration.htm)

- **Forest Stewardship Workshop / Hike: Tree / Plant Identification May 4, 2011** from 9 am - 3 pm ET, Morningside Nature Center, Gainesville, FL. This program will give landowners an opportunity to learn to identify some of the tree, shrub and herbaceous species on their forest properties. $10 fee includes lunch and materials. Details and registration online at: [http://fsp-workshop050411.eventbrite.com/](http://fsp-workshop050411.eventbrite.com/)
Upcoming Events

- **2011 Wildlife Expo, July 31, 2011** at UF-IFAS West Florida Research and Education Center, Milton, FL. For more information please contact Ms. Robin Vickers at (850) 983-5216 x 113 or rvickers@ufl.edu

- **2011 National Bobwhite Technical Committee Meeting, August 9-12, 2011** in Tallahassee, FL. The meeting will be held at the Doubletree Hotel in Tallahassee with a field trip into plantation community of the Red Hills. For more information please contact Charles McKelvy at Chuck.Mckelvy@MyFWC.com

- **Mark your calendars! – Natural Areas Conference on November 1-4, 2011.** An exceptional conference experience! Located in the Florida Panhandle, the unique landscapes will provide an exciting conference setting and diverse field trip opportunities. The Florida State University Conference Center offers a state-of-the-art venue to share research through numerous technical symposia as well as thought-provoking invited and contributed plenary and paper sessions on stewardship, management and research. The extensive program also features special sessions including an all-day Cogengrass workshop and State and Federal Natural Area Roundtables; our co-host NAEPPPC will feature dedicated tracks for sharpening-the-saw in invasive species management. View the call for papers at [http://www.naturalarea.org/NaturalAreasConferenceAnnouncement.asp](http://www.naturalarea.org/NaturalAreasConferenceAnnouncement.asp)

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Newsletter Contacts

*Melissa Kreye, School of Forest Resources and Conservation, CFEOR Coordinator,*

*mkreye@ufl.edu*

*Nancy Peterson, School of Forest Resources and Conservation, CFEOR Executive Director,*

*njp@ufl.edu*

*Phone 352.846.0848 · Fax 352.846.1277· PO Box 110410· Gainesville, FL*