

Glimpses of a Hidden Realm

Author: Beardsley, Timothy M.

Source: BioScience, 58(9) : 779

Published By: American Institute of Biological Sciences

URL: <https://doi.org/10.1641/B580901>

BioOne Complete (complete.BioOne.org) is a full-text database of 200 subscribed and open-access titles in the biological, ecological, and environmental sciences published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Complete website, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at www.bioone.org/terms-of-use.

Usage of BioOne Complete content is strictly limited to personal, educational, and non - commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

BioOne sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to critical research.

PUBLISHER
Richard T. O'Grady

EDITOR IN CHIEF
Timothy M. Beardsley

SENIOR EDITOR
Donna Daniels Verdier

PRODUCTION MANAGER / ART DIRECTOR
Herman Marshall

PEER REVIEW / EXTERNAL RELATIONS
Jennifer A. Williams

MANUSCRIPT EDITOR
Laura C. Sullivan

Editors: Eye on Education: Cathy Lundmark (educationoffice@aibs.org); Feature articles: Cathy Lundmark (features@aibs.org); Washington Watch: Robert E. Gropp (publicpolicy@aibs.org).

Editorial Board: Agriculture: Sonny Ramaswamy; Animal Behavior: Janice Moore; Animal Development: Paula Mabee; Botany: Kathleen Donohue; Cell Biology: Randy Wayne; Ecology: Scott Collins, Daniel Simberloff; Ecotoxicology: Judith S. Weis; Education: Gordon E. Uno; Environmental Policy: Gordon Brown, J. Michael Scott; Evolutionary Biology: James Mallet; Genetics and Evolution: Martin Tracey; History and Philosophy: Richard M. Burian; Invertebrate Biology: Kirk Fitzhugh; Landscape Ecology: Monica Turner; Microbiology: Edna S. Kaneshiro; Molecular Biology: David Hillis; Molecular Evolution and Genomics: David Rand; Neurobiology: Cole Gilbert; Plant Development: Cynthia S. Jones; Policy Forum: Eric A. Fischer; Population Biology: Ben Pierce; Professional Biologist: Jean Wyld; Sensing and Computation: Geoffrey M. Henebry; Statistics: Kent E. Holsinger; Vertebrate Biology: Harvey B. Lillywhite.

Editorial Correspondence: 1444 I Street, NW, Suite 200, Washington, DC 20005; telephone: 202-628-1500; fax: 202-628-1509; e-mail: bioscience@aibs.org. Instructions for preparing a manuscript for *BioScience* can be found at www.aibs.org/bioscience/resources/Info_for_contribs.pdf.

Advertising: For display advertisements, contact John Rasanen; telephone: 703-379-2480, ext. 224; fax: 703-379-7563; e-mail: jr@agiweb.org.

For classified advertisements, contact Jennifer A. Williams; telephone: 202-628-1500, ext. 209; fax: 202-628-1509; e-mail: jwilliams@aibs.org.

BioScience (ISSN 0006-3568) is published monthly except July/August combined by the American Institute of Biological Sciences. To subscribe, call 1-800-992-2427, ext. 29. Individual membership: sustaining, \$90/yr; individual, \$70/yr; family, \$90/yr (includes \$36 for *BioScience*); emeritus, \$50/yr; K-12 teacher/administrator, \$45/yr (includes \$22 for *BioScience*); graduate and postdoctoral students, \$40/yr (includes \$21 for *BioScience*); undergraduate and K-12 students, \$20/yr (includes \$15 for *BioScience*); lifetime, \$1400 (one-time fee). Institutional subscriptions: domestic, \$367/yr; foreign, \$440/yr. Single copies: \$14 plus shipping and handling for up to 20 copies; volume discounts available for more than 20 (call 1-800-992-2427, ext. 29). Subscription renewal month is shown in the four-digit year-month code in the upper right corner of the mailing label.

© 2008 American Institute of Biological Sciences. All rights reserved. Periodical postage paid at Washington, DC, and additional mailing offices.

POSTMASTER: Send address changes to *BioScience* Circulation, AIBS, 1313 Dolley Madison Blvd., Suite 402, McLean, VA 22101. Printed in USA. AIBS authorizes photocopying for internal or personal use, provided the appropriate fee is paid directly to the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923; telephone: 978-750-8400; fax: 978-750-4744; Web site: www.copyright.com. To photocopy articles for classroom use, request authorization, subject to conditions thereof, from the Academic Permissions Service at CCC. Each copy must say "© [year] by the American Institute of Biological Sciences." Statements and opinions expressed in *BioScience* are those of the author(s) and do not necessarily reflect the official positions of the American Institute of Biological Sciences, the editors, the publisher, or the institutions with which the authors are affiliated. The editors, publisher, and AIBS disclaim any responsibility or liability for such material.

BioScience

Organisms from Molecules to the Environment

American Institute of Biological Sciences

Glimpses of a Hidden Realm

Charismatic they are not, but fungi have a vastly larger impact on the flow of essential elements through ecosystems than do most more appealing organisms. Gaining an understanding of their diversity and spatial variability, and the implications of these for fundamental ecological processes such as decomposition, has to be a high priority if biologists are to predict the consequences of habitat and climate change.

Only in recent years have techniques existed to allow the systematic exploration of patterns of fungal diversity, as Kabir Peay, Peter Kennedy, and Thomas Bruns explain in the 21st Century Directions in Biology article that starts on p. 799. The often microscopic size and the generally cryptic nature of fungi have typically made it necessary to use biochemical techniques to differentiate them. This requirement has in turn hobbled efforts to chart even the number of fungi in different environments, let alone to assess critical matters such as the resilience of their ecological functions. The knowledge gap is sobering, considering the critical role of fungi in so much of the biosphere (in the case of plants, as symbionts as well as pathogens).

New techniques based on DNA sequencing are now making possible major explorations of fungal diversity. The results are startling: even though fungal species are much more stable than are bacteria, soil samples reveal levels of diversity so high that it is impossible to put an upper limit on it. Moreover, fungi exhibit very high spatial variability, the explanation for which is unknown. Species composition responds to influences such as temperature and nutrient availability, but not in any straightforward way.

DNA analysis also offers potentially useful ways to use this new information with ecosystem management in mind. Conservation cannot be based on trying to preserve unique sequences of DNA: there are too many, and the majority of species identified in this way are probably not vital in terms of larger-scale effects. Yet it should be possible, through the use of new high-throughput sequencing techniques, to assess the occurrence of fungal functions that do have broader significance. As this information emerges, it will allow mycologists to grade the plausible future importance for ecosystems not only of specific species but also of species assemblages. Emergent properties of such assemblages seem likely, because fungi profoundly affect their environment. Comprehending such emergent properties becomes a challenge with practical as well as academic implications, because some of those properties are likely to be causally salient at large scales.

What then? The level of detail that DNA sequence information brings is revelatory but also challenging. Not only can we not preserve everything unique, we cannot even preserve everything that looks beneficial. But the number-crunching capability and data resources now becoming available might, together with laboratory and field experiments, make it feasible to identify those changes in fungal communities that look the most dangerous to ecosystems or human populations. As Peay and his coauthors stress, building a knowledge base that might allow such an endeavor has hardly begun. But it seems like a goal worth working toward.

TIMOTHY M. BEARDSLEY
Editor in Chief

doi:10.1641/B580901
Include this information when citing this material.