

Biological Carbon Sequestration

Author: Timothy M. Beardsley

Source: BioScience, 60(9) : 671

Published By: American Institute of Biological Sciences

URL: <https://doi.org/10.1525/bio.2010.60.9.1>

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

MANAGING EDITOR

Laura C. Sullivan

PEER REVIEW / EXTERNAL RELATIONS

Jennifer A. Williams

EDITOR

James Verdier

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; Environmental Microbiology: Rita R. Colwell; Environmental Policy: Gordon Brown, J. Michael Scott; Evolutionary Biology: James Mallet; Genetics and Evolution: Martin Tracey; History and Philosophy: Richard M. Burian; Human Biology: David L. Evans; Invertebrate Biology: Kirk Fitzhugh; Landscape Ecology: Monica Turner; Mammalogy: David M. Leslie Jr.; 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; Remote Sensing and Computation: Geoffrey M. Henebry; Statistics: Kent E. Holsinger; Vertebrate Biology: Harvey B. Lillywhite.

BioScience (ISSN 0006-3568; e-ISSN 1525-3244) is published 11 times a year (July/August combined) by the American Institute of Biological Sciences, 1900 Campus Commons Dr., Suite 200, Reston, VA 20191, in collaboration with the University of California Press. Periodicals postage paid at Berkeley, CA, and additional mailing offices. **POSTMASTER:** Send address changes to *BioScience*, University of California Press, Journals and Digital Publishing, 2000 Center Street, Suite 303, Berkeley, CA 94704-1223, or e-mail customerservice@ucpressjournals.com.

Membership and subscription: Individual members, go to www.aibs.org/aibs-membership/index.html for benefits and services, membership rates, and back issue claims. Subscription renewal month is shown in the four-digit year-month code in the upper right corner of the mailing label. Institutional subscribers, go to www.ucpressjournals.com or e-mail customerservice@ucpressjournals.com. Out-of-print issues and volumes are available from Periodicals Service Company, 11 Main Street, Germantown, NY 12526-5635; telephone: 518-537-4700; fax: 518-537-5899; Web site: www.periodicals.com.

Advertising: For information about display and online advertisements and deadlines, e-mail adsales@ucpressjournals.com. For information about classified placements and deadlines, contact Jennifer A. Williams, AIBS (jwilliams@aibs.org).

Copying and permissions notice: Authorization to copy article content beyond fair use (as specified in sections 107 and 108 of the US Copyright Law) for internal or personal use, or the internal or personal use of specific clients, is granted by the Regents of the University of California on behalf of AIBS for libraries and other users, provided that they are registered with and pay the specified fee through the Copyright Clearance Center (CCC), www.copyright.com. To reach the CCC's Customer Service Department, call 1-978-750-8400 or e-mail info@copyright.com. For permission to distribute electronically, republish, resell, or repurpose material, and to purchase article offprints, use the CCC's Rightslink service on Caliber at <http://caliber.ucpress.net>. Submit all other permissions and licensing inquiries through the University of California Press's Rights and Permissions Web site, www.ucpressjournals.com/reprintInfo.asp, or e-mail journalspermissions@ucpress.edu.

Abstracting and indexing: For complete abstracting and indexing information, please visit www.ucpressjournals.com.

© 2010 American Institute of Biological Sciences. All rights reserved. Printed at Allen Press, Inc.

BioScience®

Organisms from Molecules to the Environment

American Institute of Biological Sciences

Biological Carbon Sequestration

The eminent mathematical physicist and writer Freeman Dyson is known for his optimism about technology and bold thinking. Dyson recognizes global warming caused by human activity as a challenge, but maintains that within a few decades we will be able to control it. Dyson has long argued, most recently in *The New York Review of Books*, that genetically engineered trees might, as well as producing biofuel, combat climate change. He notes that about 8 percent of the carbon dioxide in the atmosphere is temporarily converted into vegetation each year by photosynthesis. Capturing some of this with trees designed and harvested for the purpose could, he suggests, reduce the amount of that gas in the air rather quickly, and so ameliorate greenhouse warming.

Ecologists are apt to see enormous problems with Dyson's notion—for example, the loss of agricultural land that would presumably result from creating vast plantations of such trees; the energetic costs of planting, harvesting, and producing fertilizer for the trees; the amount of water needed for irrigation; and the large-scale disruption of existing ecosystems. It is also unclear how much potential for improving carbon fixation rates there may really be. Not least of all, the idea seems sociologically naive. Some 12 percent of the annual net increase in atmospheric carbon dioxide is the result of deforestation. If we can't prevent existing forests from being destroyed, how can we persuade people to plant forests of genetically modified trees?

Still, serious problems demand that attention be given to all possible solutions, and few biologists would rule out some future role for enhanced biological carbon sequestration, whether by trees or other organisms. Moreover, genetically engineered food crops are already widely grown, so planting crops engineered to sequester carbon seems hardly the most ambitious of the warming mitigation options now being discussed. *BioScience* therefore invited several scientists with relevant expertise to contribute to this issue's Special Section on biological carbon sequestration.

Our authors have a range of perspectives on the topic. They include some (Christer Jansson and colleagues, and Steven H. Strauss and his coauthors) who are pursuing the prospects for genetically engineered trees that might one day contribute to amelioration of global warming—if they can meet safety requirements for testing. Richard Sayre outlines the possibilities for cultivating algae as biofuel feedstock. Others (Robert B. Jackson and Justin S. Baker, and Rattan Lal) analyze the big-picture ecological and economic constraints on expanding sequestration in forests and in soil generally through agriculture. Emily Boyd discusses societal understanding of the choices that large-scale enhanced biological carbon sequestration would necessarily bring, and considers how they could play into economic development.

There are substantial impediments to using genetic engineering to increase carbon removal from the atmosphere on a significant scale, and there are dangers. It might at best be a partial solution. But the right combinations of technology and economic incentives have overcome daunting obstacles in the past. In light of the continuing lack of political progress toward reducing carbon emissions—and the dangers of inaction—the possibilities deserve thorough, continuing evaluation.

TIMOTHY M. BEARDSLEY

Editor in Chief

doi:10.1525/bio.2010.60.9.1