

## Biofuels Reassessed

Author: Beardsley, Timothy M.

Source: BioScience, 62(10) : 855

Published By: American Institute of Biological Sciences

URL: <https://doi.org/10.1525/bio.2012.62.10.1>

---

BioOne Complete ([complete.BioOne.org](http://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](http://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**  
James M. Verdier

**BOOK REVIEW EDITOR**  
**PEER REVIEW / PRODUCTION COORDINATION**  
Jennifer A. Williams

**MANUSCRIPT EDITOR**  
Nathan N. True

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

**Editorial Board:** Gordon Brown, Richard M. Burian, Catherine E. Carr, Joseph Cloud, Scott Collins, Rita R. Colwell, Charlene D'Avanzo, Kathleen Donohue, David L. Evans, Cassandra G. Extavour, Eric A. Fischer, Kirk Fitzhugh, Nick Haddad, Geoffrey M. Henebry, Cynthia S. Jones, Linda A. Joyce, Edna S. Kaneshiro, David M. Leslie Jr., Harvey B. Lillywhite, Alan C. Love, Paula Mabree, Marshall A. Martin, Janice Moore, Ben Pierce, J. Michael Scott, Daniel Simberloff, Martin Tracey, Monica Turner, Randy Wayne, Judith S. Weis, David S. Wilcove, Jean A. Wyld.

**BioScience** (ISSN 0006-3568; e-ISSN 1525-3244) is published 12 times a year 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](http://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](http://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](http://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](http://www.copyright.com). To reach the CCC's Customer Service Department, call 978-750-8400 or e-mail [info@copyright.com](mailto:info@copyright.com). For permission to distribute electronically, republish, resell, or repurpose material, use the CCC's Rightslink service on JSTOR at <http://www.jstor.org/r/ucal/bio>. Submit all other permissions and licensing inquiries through the University of California Press's Rights and Permissions Web site, [www.ucpressjournals.com/reprintInfo.asp](http://www.ucpressjournals.com/reprintInfo.asp), or e-mail [journalspermissions@ucpress.edu](mailto:journalspermissions@ucpress.edu).

**Abstracting and indexing:** For complete abstracting and indexing information, please visit [www.ucpressjournals.com](http://www.ucpressjournals.com).

© 2012 American Institute of Biological Sciences.

All rights reserved. Printed at Allen Press, Inc.

# BioScience®

**A Forum for Integrating the Life Sciences**

American Institute of Biological Sciences

## Biofuels Reassessed

It is understandable that biologists would hope to see their field put to use creating new sources of energy. The idea of fuels created by living organisms—while they take carbon dioxide out of the atmosphere!—has appeal. But thoughtful critics have pointed to a raft of problems that quickly arise, mainly because it takes a lot of land, a lot of water, and a lot of energy to produce biofuel crops and convert them into usable fuels. The displacement of food crops by biofuels has already increased food prices, and many have argued that such effects will put limits on the biofuel enterprise. Yet, enthusiasts hold out the hope that improved crop varieties and management techniques will allow for a major expansion of biofuels without the whole world having to be plowed over.

The enthusiasts are right that improvements are possible; few human endeavors cannot be made more efficient, and the seriousness of the looming energy crisis—only partly ameliorated, at substantial environmental cost, by fracking—argues for the continuation of such efforts. Still, viewing the world through rose-tinted glasses can obscure threats as well as improve mood. It is important to understand biofuels' limitations.

The study by W. Kolby Smith and his colleagues that starts on p. 911 provides some important answers. Smith and his coauthors address the question of how much biofuel can be produced globally. They avoid, however, following in the tracks of studies in which production rates were extrapolated from specific areas. Rather, they use satellite-derived net primary productivity data, together with some additional access and land-use constraints, to establish an upper limit of what might be possible under a variety of scenarios.

The results are, as a tabloid might put it, a shocker. The authors estimate maximum primary bioenergy potential to range from 35 percent to 108 percent of 2009 global primary energy consumption. But realistically, only a third of that is achievable, which means a bottom line roughly four times lower than several previously published estimates. All these numbers exclude losses due to manufacturing the fuel.

The chief source of the difference was that previous authors assumed generally improving biofuel yields and management practices (including an increased use of fertilizer and irrigation), but Smith and his colleagues argue persuasively that such improvements must be restricted to small, intensively farmed areas. Actual current global primary productivity suggests strongly that biofuels have less promise than many had thought.

It gets worse. According to an article published by James Hansen and two coauthors in the *Proceedings of the National Academy of Sciences* in August (doi:10.1073/pnas.1205276109), recent heat waves and extreme summers are increasing in frequency and area, most likely because of global warming. Given the devastation such events inflict on crop yields in the world's major bread baskets, it seems that even the sobering estimates of Smith and colleagues might be overoptimistic. Yields could fall from current levels, not increase, if the frequency of extreme weather events continues to grow.

Some new biofuels may yet alleviate the human predicament, but nobody should be under any illusions about the constraints that nature—ultimately, through the laws of thermodynamics—has put in the way.

TIMOTHY M. BEARDSLEY  
*Editor in Chief*

doi:10.1525/bio.2012.62.10.1