Genes for the Planet

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Source: BioScience, 59(9) : 731

Published By: American Institute of Biological Sciences

URL: https://doi.org/10.1525/bio.2009.59.9.1

BioScience (ISSN 0006-3568; e-ISSN 1525-3244) is published 11 times a year (July/August combined) by the American Institute of Biological Sciences, 1444 I Street, NW, Suite 200, Washington, DC 20005, 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.

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BioScience

Organisms from Molecules to the Environment

American Institute of Biological Sciences

Genes for the Planet

Two articles in this issue of *BioScience* illustrate the power of new molecular techniques to give wings to very different types of biology. Both articles discuss, in part, how information from genetic sequences might guide urgently needed planetary ecological management.

In the article that begins on page 745, Christopher W. Dick and W. John Kress describe how DNA diagnostic tools can be used to achieve insights into the dynamics of tropical forests. The extraordinary biological diversity of tropical forests has become recognized in recent decades as one of the wonders of the world. The importance of the gargantuan amounts of carbon stored in these forests has also become more widely appreciated. Yet detailed scientific characterization of tropical forests has yet to be accomplished, largely because of the paucity of specimens from remote areas and a shortage of systematists.

Dick and Kress make a strong case for the value of plastid DNA barcodes to further the characterization of tropical forest diversity, knowledge that is essential for conserving such biological riches in the face of mounting pressures. Protocols for plant DNA barcoding are not as advanced as they are for animal barcoding, and Dick and Kress acknowledge that barcodes alone cannot fully inform the understanding needed for conservation. Yet although barcodes can identify only species that have already been described and named, they can speed progress by quickly yielding information to guide subsequent, more detailed study. In this way barcodes do help elucidate the diversity and relatedness of species in different regions, as well as the evolutionary processes that gave rise to them. Such insights can highlight priorities for protection.

In the article that begins on page 757, Anastasia Saade and Chris Bowler describe very different molecular tools that also are revealing evolutionary histories—in this case, of diatoms. That history is fascinating, and although these common algae are quadrillions of times smaller than a tree in a tropical forest, their collective importance in the global carbon cycle is comparable to that of tropical forests. Staggering numbers of diatoms in oceans and freshwater contribute more than 20 percent of global primary production, equivalent to the contribution of all terrestrial rainforests.

The studies Saade and Bowler describe are also revealing the details of diatoms' highly unusual metabolism, and their ability to nanoengineer silica-containing structures in a way that far surpasses the best efforts of human engineers. These characteristics suggest that diatoms may be able to teach scientists some valuable tricks. In particular, their photosynthetic efficiency and high lipid content make them a promising source of fuel oil. Several companies are developing ways to exploit diatoms in this way. Diatom-derived oil is still too expensive to compete with conventional hydrocarbon fuels, but work in progress might lower the cost of the manufactured product. At the same time, growing world demand for mined oil seems likely to drive its price upward in coming years, recessions notwithstanding. Studies of diatoms, then, may well help relieve some of the development pressure on tropical forests and ease humans' reliance on fossil fuels.

Studying genes can be consequential indeed.

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doi:10.1525/bio.2009.59.9.1