LETTERS

edited by Jennifer Sills

Deep root systems. Perennials such as switchgrass deserve further study

Perennial Questions of Hydrology and Climate

THE POLICY FORUM BY J. D. GLOVER *ET AL.* ("INCREASED FOOD AND ecosystem security via perennial grains," 25 June, p. 1638) highlights environmental advantages of perennial relative to annual bioenergy crop systems but omits potentially important consequences related to hydrology and climate. They categorize greater perennial leaf area index and rooting depth (relative to annual crops) as "utiliz[ing] more precipitation," but the work cited provides no evidence for increased rainfall recycling.

The direct climate impact of land-use change associated with bioenergy expansion (such as a shift from annual to perennial cropping systems) has received little attention. The impacts of changing fundamental biogeophysical surface properties associated with bioenergy crops may have significant implications for local and regional climate (*1*). Changes to local hydrology caused by large-scale perennial systems may be complex, and thus require careful evaluation. For example, the drawdown of soil water (*2*) and enhanced evapotranspiration from perennial relative to annual cropping systems (*3*) could lead to long-term depletion of the soil-water column, as well as changes in clouds and rainfall in downwind locales. Quantifying local and remote consequences for hydrology and climate resulting from a shift from annual to perennial bioenergy crops is therefore required if long-term sustainability of biomass production is to be attained.

M. GEORGESCU[1]* AND D. B. LOBELL[2]

[1]School of Mathematical and Statistical Sciences and Center for Environmental Fluid Dynamics, Arizona State University, Tempe, AZ 85287, USA. [2]Department of Environmental Earth System Science and Program on Food Security and the Environment, Stanford University, Stanford, CA 94305, USA.

*To whom correspondence should be addressed. E-mail: Matei.Georgescu@asu.edu

References

1. M. Georgescu, D. B. Lobell, C. B. Field, *Geophys. Res. Lett.* **36**, L21806 (2009).
2. J. D. Glover *et al.*, *Agric. Ecosyst. Environ.* **137**, 3 (2010).
3. G. Hickman, A. VanLoocke, F. G. Dohleman, C. J. Bernacchi, *GCB Bioenerg.* **2**, 157 (2010).

Response

WE AGREE WITH GEORGESCU AND LOBELL THAT the effects of perennial bioenergy crops on hydrology and climate must be considered. However, our Policy Forum focused on the advantages of developing perennial grain crops (*1*), not bioenergy crops that can displace staple food crops.

We did not propose, as Georgescu and Lobell claim, a mechanism by which perennial crops utilize a greater portion of natural precipitation than annual crops. We also did not propose that perennial crops more efficiently produce biomass per amount of precipitation-derived water that is transpired. Shifting from annual to perennial food crops would likely have important consequences for how water is managed in agricultural landscapes, just as shifting from perennial-dominated native vegetation to annual crops has had dramatic, but generally detrimental, impacts. For example, the conversion of native forests to annual wheat production in southwest Australia disrupted the native hydrologic cycle, resulting in the rise of subsurface salts to the surface (*2*). Scientists there believe that perennial grain crops could correct hydrologic imbalances by using more subsurface water, thereby reducing salinization while producing high-value crops (*3*). In areas of the world where annual crops often use only 10 to 30% of precipitation for transpiration (*4*), a shift to perennial food crops could increase the infiltration of precipitation into the soil by improving soil surface conditions (*5*), increase moisture retention in the soil by improving soil physical characteristics, and increase soil moisture available to deep root systems (*6*).

Perennial grain crop adoption would likely be advantageous in terms of climate change as well. Greater soil carbon storage and reduced input requirements mean that perennials have the potential to mitigate global warming. For example, perennial cropping systems have been shown to have net negative greenhouse gas emissions, whereas annual cropping systems tend to result in net positive greenhouse gas emissions (*7*). With more of their reserves protected belowground and with access to more soil moisture, perennials may also be more resilient to temperature increases predicted by some climate change models (*8*).

Adding grains to the inventory of available perennial crops would give farmers more choices in what they can grow and where, while sustainably producing high-value food crops for an increasingly hungry planet (*9*).

J. D. GLOVER,[1]* J. P. REGANOLD,[2] L. W. BELL,[3] J. BOREVITZ,[4] E. C. BRUMMER,[5] E. S. BUCKLER,[6] C. M. COX,[1] T. S. COX,[1] T. E. CREWS,[7] S. W. CULMAN,[8] L. R. DEHAAN,[1] D. ERIKSSON,[9] B. S. GILL,[10] J. HOLLAND,[11] F. HU,[12] B. S. HULKE,[13] A. M. H. IBRAHIM,[14] W. JACKSON,[1] S. S. JONES,[15] S. C. MURRAY,[14] A. H. PATERSON,[16] E. PLOSCHUK,[17] E. J. SACKS,[18] S. SNAPP,[8] D. TAO,[12] D. L. VAN TASSEL,[1] L. J. WADE,[19] D. L. WYSE,[20] Y. XU[21]

[1]The Land Institute, Salina, KS 67401, USA. [2]Department of Crop and Soil Sciences, Washington State University, Pullman, WA 99164, USA. [3]Sustainable Ecosystems-Agricultural Production Systems Research Unit, Commonwealth Scientific and Industrial Research Organization (Australia), Toowoomba, QLD 4350, Australia. [4]Department of Evolution and Ecology, University of Chicago, Chicago, IL 60637, USA. [5]Institute of Plant Breeding, Genetics, and Genomics, University of Georgia, Athens, GA 30602, USA. [6]U.S. Department of Agriculture-Agricultural Research Service (USDA-ARS) and Institute for Genomic Diversity, Cornell University, Ithaca, NY 14853, USA. [7]Environmental Studies, Prescott College, Prescott, AZ 86301, USA. [8]Kellogg Biological Station, Michigan State University, Hickory Corners, MI 49060, USA. [9]Department of Plant Breeding and Biotechnology, Swedish University of

Agricultural Sciences, Alnarp, Sweden. [10]Wheat Genetic and Genomic Resources Center, Kansas State University, Manhattan, KS 66506, USA. [11]USDA-ARS Plant Science Research Unit, North Carolina State University, Raleigh, NC 27695, USA. [12]Food Crops Research Institute, Yunnan Academy of Agricultural Sciences, Kunming 650205, China. [13]USDA-ARS Sunflower Research Unit, Northern Crop Science Laboratory, Fargo, ND 58105, USA. [14]Department of Soil and Crop Sciences, Texas A & M University, College Station, TX 77843, USA. [15]Department of Crop and Soil Sciences, Washington State University, Mount Vernon, WA 98273, USA. [16]Plant Genome Mapping Laboratory, University of Georgia, Athens, GA 30602, USA. [17]Cátedra de Cultivos Industriales, Facultad de Agronomía, Universidad de Buenos Aires, C1417DSE Buenos Aires, Argentina. [18]Department of Crop Sciences, University of Illinois, Urbana, IL 61801, USA. [19]Charles Sturt University, E. H. Graham Centre for Agricultural Innovation, Wagga Wagga, NSW 2678, Australia. [20]Department of Agronomy and Plant Genetics, University of Minnesota, St. Paul, MN 55108, USA. [21]Global Maize Program, International Maize and Wheat Improvement Center, Apartado 0660, Mexico D.F., Mexico.

*To whom correspondence should be addressed. E-mail: glover@landinstitute.org

References

1. National Research Council, *Toward Sustainable Agricultural Systems in the 21st Century* (The National Academies, Washington, DC, 2010).
2. E. C. Lefroy, R. J. Stirzaker, *Agrofor. Syst.* **45**, 277 (1999).
3. L. W. Bell *et al.*, *Crop Pasture Sci.* **61**, 679 (2010).
4. J. S. Wallace, *Agric. Ecosyst. Environ.* **82**, 105 (2000).
5. J. D. Glover *et al.*, *Agric. Ecosyst. Environ.* **137**, 3 (2010).
6. R. D. Connolly *et al.*, *Austral. J. Soil Res.* **36**, 1057 (1998).
7. G. P. Robertson *et al.*, *Science* **289**, 1922 (2000).
8. R. Brown *et al.*, *Agric. Ecosyst. Environ.* **78**, 31 (2000).
9. D. L. Van Tassel *et al.*, *Evol. Appl.* **3**, 434 (2010).

A Positive Review for *PLoS ONE*

IN HER NEWS FOCUS STORY "FREE JOURNALS grow amid ongoing debate" (20 August, p. 896), J. Kaiser cites unnamed critics who accuse PLoS journals, particularly *PLoS ONE*, of publishing nearly all submissions, regardless of scientific value, simply to make as much money as possible.

These claims constitute a serious attack against open access publishing in general and against *PLoS ONE* in particular. As a member of the editorial board of *PLoS ONE*, I must say that, at least in my field (immunology), it is simply not true that the journal accepts bad science. Most of the papers I handle as an academic editor are of high quality and could qualify for acceptance by more conventional high-impact journals. At times, negative results are published, as they could be very important for other scientists in the field. If I am an expert in the field and totally convinced by the data of a manuscript, then I act as the reviewer and accept it (with any relevant suggestions for improvement). If I have doubts, I send it out for peer review. If the paper is too weak, I reject it. This is exactly what editors of conventional journals do. *PLoS ONE* is a serious journal that aims to render well-performed science accessible to everybody.

JACQUES ZIMMER

Laboratory of Immunogenetics and Allergology, CRP-Santé, Luxembourg, L-1526, Luxembourg. E-mail: jacques.zimmer@crp-sante.lu

HIV/AIDS: Use Existing Funds Effectively

THE ARTICLES IN THE SPECIAL SECTION ON HIV/AIDS: Eastern Europe (9 July, p. 159) omitted one important point: Considering the current economic downturn and limited resources available, it is particularly important to optimally use existing funds for HIV prevention and treatment. Economic studies such as cost-effectiveness analyses can inform decisions regarding the best resource allocation between available interventions. Research analyzing the public health and economic impacts of diseases and their interventions has become an essential tool for decision-makers; these results help them choose the

most effective epidemic control programs while considering budget constraints.

To date, only a few scholarly articles have evaluated the cost-effectiveness of HIV interventions in Russia and Ukraine, in marked comparison to the scores of studies published on HIV in Africa. Scarce scientific information may lead to inappropriate use of limited resources and further hamper efforts to contain the threat of a generalized HIV epidemic. Sound scientific evidence for the cost-effectiveness of debated interventions (such as opioid substitution therapy) could be a strong argument to accelerate adoption of these programs. Studies on scaling up antiretroviral therapy, such as the case of injection drug users in Saint Petersburg, Russia (*1*), show that the interventions that reach injection drug users also prevent a substantial number of infections in the general population.

More attention from the research community should be directed toward studies of HIV in Eastern Europe.

SABINA STEFANIA ALISTAR

Department of Management Science and Engineering, Stanford University, Stanford, CA 94305, USA. E-mail: ssabina@stanford.edu

Reference

1. E. F. Long *et al.*, *AIDS* **20**, 2207 (2006).

TECHNICAL COMMENT ABSTRACTS

Comment on "The Human K-Complex Represents an Isolated Cortical Down-State"

Florin Amzica

Cash *et al.* (Reports, 22 May 2009, p. 1084) argue that the human K-complex, a defining characteristic of slow-wave sleep, is a unipolar electroencephalogram (EEG) wave reflecting a simple neuronal hyperpolarizing event. We disagree with this conclusion and point to several confounding aspects of the study.

Full text at www.sciencemag.org/cgi/content/full/330/6000/35-a

Response to Comment on "The Human K-Complex Represents an Isolated Cortical Down-State"

Sydney S. Cash, Eric Halgren, Nima Dehghani, Andrea O. Rossetti, Thomas Thesen, ChunMao Wang, Orrin Devinsky, Ruben Kuzniecky, Werner Doyle, Joseph R. Madsen, Loránd Erőss, Péter Halász, George Karmos, Richárd Csercsa, Lucia Wittner, István Ulbert

Our study confirmed the hypothesis of Amzica and Steriade that the human K-complex (KC) shares neural mechanisms with so-called slow oscillation between periods of intense neuronal firing and silence but found that the KC can occur independently of this oscillatory activity. We agree with Amzica that the KC often has multiple components but contend that the major component is surface-negative and corresponds to the cortical down-state.

Full text at www.sciencemag.org/cgi/content/full/330/6000/35-b

Letters to the Editor

Letters (~300 words) discuss material published in *Science* in the previous 3 months or issues of general interest. They can be submitted through the Web (www.submit2science.org) or by regular mail (1200 New York Ave., NW, Washington, DC 20005, USA). Letters are not acknowledged upon receipt, nor are authors generally consulted before publication. Whether published in full or in part, letters are subject to editing for clarity and space.