

ARTICLE PREVIEW

view full access options

NATURE CLIMATE CHANGE | LETTER

Climate-regulation services of natural and agricultural ecoregions of the Americas

Kristina J. Anderson-Teixeira, Peter K. Snyder, Tracy E. Twine, Santiago V. Cuadra, Marcos H. Costa & Evan H. DeLucia

Nature Climate Change 2, 177–181 (2012) doi:10.1038/nclimate1346

Received 26 August 2011 Accepted 24 November 2011 Published online 10 January 2012

Terrestrial ecosystems regulate climate through both biogeochemical (greenhouse-gas regulation) and biophysical (regulation of water and energy) mechanisms^{1, 2}. However, policies aimed at climate protection through land management, including REDD+ (where REDD is Reducing Emissions from Deforestation and Forest Degradation)³ and bioenergy sustainability standards⁴, account only for biogeochemical mechanisms. By ignoring biophysical processes, which sometimes offset biogeochemical effects^{5, 6}, policies risk promoting suboptimal solutions^{1, 2, 4, 7, 8, 9, 10}. Here, we quantify how biogeochemical¹¹ and biophysical processes combine to shape the climate regulation values of 18 natural and agricultural ecoregions across the Americas. Natural ecosystems generally had higher climate regulation values than agroecosystems, largely driven by differences in biogeochemical services. Biophysical contributions ranged from minimal to dominant. They were highly variable in space, and their relative importance varied with the spatio-temporal scale of analysis. Our findings reinforce the importance of protecting tropical forests^{7, 10, 12, 13}, show that northern forests have a relatively small net effect on climate^{5, 10, 13}, and indicate that climatic effects of bioenergy production may be more positive when biophysical processes are considered^{14, 15}. Ensuring effective climate protection through land management requires consideration of combined biogeochemical and biophysical processes^{7, 8}. Our climate regulation value index serves as one potential approach to quantify the full climate services of terrestrial ecosystems.

Subject terms: Agriculture Biogeochemistry and geochemistry Biology Biological sciences Ecology Conservation
Mitigation Sustainability

READ THE FULL ARTICLE

Subscribe to
*Nature Climate
Change* for full
access:
\$160

Subscribe

ReadCube
Access*

preview pdf

*printing and sharing
restrictions apply

Purchase article
full text and PDF:

\$32

Buy now

Already a subscriber? **Login** now or **Register** for online access.

Additional access options:

Use a document delivery service | Login via Athens | Purchase a site license | Institutional access

Author information

Affiliations

Energy Biosciences Institute, University of Illinois, Urbana, Illinois 61801, USA

Kristina J. Anderson-Teixeira & Evan H. DeLucia

Plant Biology, University of Illinois, Urbana, Illinois 61801, USA

Kristina J. Anderson-Teixeira & Evan H. DeLucia

Global Change Solutions, LLC, Urbana, Illinois 61801, USA

Kristina J. Anderson-Teixeira & Evan H. DeLucia

Soil, Water and Climate, University of Minnesota, St Paul, Minnesota 55108, USA

Peter K. Snyder & Tracy E. Twine

Department of Atmospheric Sciences, Federal Center of Technological Education Celso Suckow da Fonseca (CEFET/RJ), Rio de Janeiro, RJ 20271-110, Brazil

Santiago V. Cuadra

Federal University of Viçosa, Viçosa, MG 36570-000, Brazil

Marcos H. Costa

Ministry of Science, Technology and Innovation, Brasília, DF 70067-900, Brazil

Marcos H. Costa

Contributions

K.J.A-T., P.K.S. and E.H.D. conceived the experiment; K.J.A-T., P.K.S., T.E.T., M.H.C. and S.V.C. contributed models; K.J.A-T. compiled biogeochemical data and calculated GHGVs; P.K.S., T.E.T. and S.V.C. ran IBIS/AgroIBIS simulations; K.J.A-T. and P.K.S. analysed data and prepared figures; K.J.A-T. wrote the paper; all authors commented on the analysis and presentation of the data and revised the paper.

Competing financial interests

The authors declare no competing financial interests.

Corresponding author

Correspondence to: Evan H. DeLucia

Supplementary information

PDF files

1. Supplementary Information (1,1053KB)

Nature Climate Change ISSN 1758-678X EISSN 1758-6798 This journal is printed on recycled paper
Header image source: ESA/NASA

© 2012 Nature Publishing Group, a division of Macmillan Publishers Limited. All Rights Reserved.
partner of AGORA, HINARI, OARE, INASP, ORCID, CrossRef and COUNTER