

The Woods Hole Research Center
Annual Report 2009



A Letter from the Director

The year 2009 was a busy and productive one for the Woods Hole Research Center. The year began with the appointment of our director, John P. Holdren, as the Assistant to the President for Science and Technology and Director of the Office of Science and Technology Policy for the then newly-elected Barack Obama. We are concluding the year with the arrival of our new director in sight. In October, our Board of Directors appointed William Y. Brown to that position. He will begin his tenure on February 1, 2010.

But there is much to be said for what happened between those two markers. As Acting Director, it has been my pleasure to shepherd this institution along its path, and as I end my term, I reflect back on the past year with enormous appreciation for this fine institution, its staff, Board, and friends. While I have been a scientist at the Center for over 22 years, serving in this role has given me a perspective beyond the science of biogeochemistry and climate. I am impressed and proud that the Center is a world leader in defining the interactions among ecosystems, water and climate, the effect of humans on those interactions, and the types of management and behavior that will foster a healthy, productive environment.

We continue to do our part in reducing emissions of carbon dioxide and providing information that leads to policies that will reduce emissions elsewhere, most especially from reducing deforestation and degradation in developing nations. As the pages of this annual report and the 2010 calendar illustrate, we continue to focus on field studies in the Amazon, Central Africa, Alaska, New England and the great rivers of the north. We investigate the effect of the world's ecosystems on climate and the effect of climate on the world's ecosystems. Carbon, nitrogen, and water cycles are major topics of interest. The overall theme is to understand the biophysical functioning of the earth, document the changes in that functioning that result from human activities, and distinguish those types of activities that foster the sustainable functioning of the earth from those that run it down. Climatic disruption poses the major threat for the planet, and uses of land contribute to, and have the potential to help solve, the disruption underway.

In the course of the year, we added ten new staff, including one senior scientist, three assistant scientists, three post-doctoral fellows, two research assistants, and a development associate. Of particular note was the return of Dan Nepstad, back from the foundation world, who is beginning a new program here, one that will develop and refine a conceptual and scientific framework for reconciling the many competing demands upon the world's land, including food, fuel, feed, and fresh water. The work will engage many of the Center's scientists interested in these topics,

and will focus initially on the remarkable opportunities to lower deforestation rates in the Amazon region and the prospects of a Brazilian nation-wide low-emission land-use plan.

And because all of those new researchers must have desks at which to work, we have retained the firm of South Mountain to design and build/renovate our newly acquired 6000-square foot adjacent building, the Carriage House, to provide 20 more offices in the same fossil-fuel-free character as the George M. Woodwell Building. Deconstruction began in October. As the year ends we are midway through renovation and expect to occupy the newly refurbished building by May or June of 2010.

Also on our Gilman Ordway Campus, the Center succeeded in adding a wind turbine to our array of renewable energies. Completed in August and on line in October, our 100 kw machine is generating power. We continue to partner with the manufacturer to make certain that the machine operates as well and as efficiently as we envisioned. Overall, the installation of the wind turbine has enabled the Center to reduce its emissions, not by 5 percent as the U.S. was to have done if it had agreed to the Kyoto Protocol, but by 100 percent. We burn nothing on site, and on an annual basis, we expect to generate all of the energy we need from the combination of photovoltaics on the roof and wind turbine, even running the meter backwards on breezy days.

The coming year marks the 25th anniversary of the Woods Hole Research Center. The vision of our founder, George M. Woodwell, is still appropriate and still needed. The results of our research feed the policy and education activities of the Center. The interaction between science and policy is productive, and by its very nature, includes a healthy tension. Some at the Center believe that our message is a vision of a healthy and productive environment, and the types of activities and behaviors appropriate and inappropriate for living within the limitations of biophysical laws. Others counter that demands for the ideal are counterproductive, that perhaps the best way to save the world is to negotiate for more environmentally friendly ways of farming and forest management. These discussions and dialogues bode for another busy and productive year ahead.

I thank you for your support and look forward to your continuing interest in our work.



Photo courtesy of Diane Quaid.



Members of the Center's staff and board as well as neighbors and friends gathered on August 5 to watch the "flying of the rotor" for the Center's new 100 kw wind turbine (featured on the cover).

The Woods Hole Research Center is known for the rigor of our environmental science and the integration of that research with policy and educational outreach. At sites around the world, including the Amazon, the Arctic, Africa, New England, and the Mid-Atlantic – as well as through global-scale projects – we are working with local communities, regional and national governments and organizations, and the interna-

tional community to provide information and solutions to the environmental challenges before us.

In addition to the standard facts and figures inherent in an annual report, this publication also serves as a 2010 calendar. Each month touches on an aspect of our work, so that by year's end, we have provided an introduction to several of the on-going projects here at the Center.

Directors

Chair

Lawrence S. Huntington
New York, New York
Chairman Emeritus,
Fiduciary Trust International

Treasurer

Joseph R. Robinson
Summit, New Jersey
Managing Director, MidMark Capital

Directors

John H. Adams
New York, New York
Founding Director
Natural Resources Defense Council

Stephen T. Curwood
Nottingham, New Hampshire
Host, Living on Earth
World Media Foundation

Iris M. Fanger
Boston, Massachusetts
Dance and theater historian and critic

Joshua Goldberg
New York, New York
Co-Founder, Managing Director,
and General Counsel
Altamont Capital Partners

David Hawkins
Washington D. C.
Director, Climate Center
Natural Resources Defense Council

Joel Horn
Seattle, Washington
Conservationist

Lily Rice Hsia
Hamilton, Massachusetts
Mather & Hsia Consultants

Casey Lambert
Princeton, New Jersey
Environmentalist and political activist

Thomas E. Lovejoy
Washington, D.C.
Biodiversity Chair, H. John Heinz III
Center for Science, Economics and
Environment

Victoria H. Lowell
Falmouth, Massachusetts
Conservationist

Merloyd Ludington
Boston, Massachusetts
Publisher and Editor
Merloyd Lawrence Books

Wilhelm Merck
Hamilton, Massachusetts
Managing Member, Essex Timber Co.
President, Merck Family Fund

Mary Louise Montgomery
Walpole, New Hampshire
Conservationist

Amy H. Regan
Princeton, New Jersey
President, Harbourton Foundation

Constance R. Roosevelt
Brooklyn, New York
Conservationist

Gordon W. Russell
Portola Valley, California
Conservationist

Tedd R. Saunders
Boston, Massachusetts
President, Eco-Logical Solutions and
Chief Sustainability Officer,
The Saunders Hotel Group

Helen B. Spaulding
Manchester, Massachusetts
Community activist

George M. Woodwell
Woods Hole, Massachusetts
Director Emeritus and Senior Scientist,
Woods Hole Research Center

Honorary Directors

Anita W. Brewer-Siljeholm
Manchester, Massachusetts
Environmentalist

Sara Shallenberger Brown
Harrods Creek, Kentucky
Conservationist and farmer

John Cantlon
East Lansing, Michigan
Vice-President, emeritus,
Michigan State University

James MacNeill
Ottawa, Canada
Chairman, emeritus, International
Institute for Sustainable Development

Gilman Ordway
Wilson, Wyoming
Conservationist

Ross Sandler
New York, New York
Professor of Law, New York Law School

J.G. Speth
Strafford, Vermont
Former dean, Yale School of Forestry
and Environmental Studies

Robert G. Stanton
Fairfax Station, Virginia
Policy consultant, resource conservation;
Former director, U.S. National Park
Service

M.S. Swaminathan
Madras, India
Chairman,
M.S. Swaminathan Research
Foundation

Ola Ullsten
Burlington, Ontario
Former Prime Minister of Sweden

Counsel and Corporate Clerk

Neal A. Brown
New York, New York
Balber Pickard Maldonado
& Van Der Tuin, PC

Staff

This reflects those on staff between July 1, 2008, and June 30, 2009. Please visit www.wbrc.org for a current roster of staff.

Acting Director (December 2008–present)

Richard A. Houghton, Ph.D.

President and Director (until December 2008)

John P. Holdren, Ph.D.

Science and Policy Staff

Alessandro Baccini, Ph.D.

Adam Bausch, M.E.M.

Pieter Beck, Ph.D.

Jesse Bishop, M.S.

Maria S. Bowman, M.S.

I. Foster Brown, Ph.D.

Ekaterina Bulygina, M.S.

Leandro Castello, Ph.D.

Andrea Cattaneo, Ph.D.

Michael T. Coe, Ph.D.

Tina A. Cormier, M.S.

Eric A. Davidson, Ph.D.

Gregory J. Fiske, M.S.

Scott Goetz, Ph.D.

Nora Greenglass, M.E.M.

Joseph L. Hackler, M.A.

Robert Max Holmes, Ph.D.

Holly Hughes, B.S.

Tracy Johns, M.S.

Josef M. Kellndorfer, Ph.D.

Wendy Kingerlee, B.S.

Katie Kirsch, B.A.

Danielle Knight, B.A.

Nadine T. Laporte, Ph.D.

Paul A. Lefebvre, M.A.

Michael M. Loranty, Ph.D.

Frank D. Merry, Ph.D.

David G. McGrath, Ph.D.

Paulo Moutinho, Ph.D.

Virginie Palmeri, Ph.D.

Kilaparti Ramakrishna, Ph.D. (*on leave*)

Frederico Rosario

Administrative and Operating Staff

Robert M. Barry, M.B.A.

Elizabeth A. Braun, M.A.

Florence Langford Carlowicz, B.A.

Frank Carotenuto, M.A.

Michael Ernst, M.F.A.

Constance J. Johnson

Denise Kergo

Mary Loftus, M.B.A.

Joyce McAuliffe, B.S.

Lisa Strock O'Connell, B.S.

G. Fred Palmer

Kristin Powell, M.S.

Diane Quaid, B.A.

Camille M. Romano, C.P.A.

Allison B. White

Energy Systems Volunteer

Francis C. Lowell Jr., E.E.

Interns

Abigail Clarke

Stephan Englmaier

Anna Frankel, B.S.

Alexis Ukiyah Han Holdren

Ujwala Ramakrishna

Lydia Russell-Roy

Shannon Siart

Megan Starr

Anya Suslova

Chad Wagoner

Sudeep Samanta, Ph.D.

Kathleen Savage, M.Sc.

Karen Schwalbe

Jared Stabach, M.S.

Claudia Stickler, M.S.

Thomas A. Stone, M.A.

Mindy Sun, M.S.

Wayne S. Walker, Ph.D.

George M. Woodwell, Ph.D.

Adjunct Senior Scientist

Richard S. Williams, Ph.D.

Visiting Scholars

Samantha Camori, Brazil

Manuel Ferreira, Brazil

Marcia Macedo, Brazil

Henrique Oliveira Sawakuchi, Brazil

Nikita Zimov, Russia

Graduate Fellows

Andrea Azevedo, M.S. (*Brazil*)

Ane Alencar, M.S. (*Brazil*)

Paulo Brando, M.S. (*Brazil*)

At the Center ...



Dr. William Y. Brown

"I am thrilled that the Woods Hole Research Center has asked me to be its next Director. The Center is positioned at the cutting edge of ecological research, addressing key issues fundamental to the advancement of global environmental quality. It is a world leader in understanding the circulation of carbon, nitrogen and water in the global environment and in the use of remote sensing combined with investigation on the ground to assess and monitor large-scale landscape change. These activities combined have put the Center at the forefront of science and policy concerning ecology and climate change. I greatly look forward to helping the Center's research staff advance their work. I also look forward to drawing from my own background in science and law in securing science-based policies for a world whose environment sustains and enhances the lives of our species and the others who live here with us."

The Woods Hole Research Center Board of Directors has selected Dr. William Y. Brown as its next President and Director. Brown will begin his appointment at the Center on February 1, 2010.

Dr. Brown is currently the President and CEO of the Academy of Natural Sciences in Philadelphia, the nation's oldest natural history museum. His previous positions include service as President and CEO of the Bishop Museum in Honolulu, Hawaii, and Science Advisor to Interior Secretary Bruce Babbitt during the Clinton Administration.

Brown was born in Artesia, California. He graduated from high school in Brazil at the Escola Americana do Recife. He later graduated from the University of Virginia (BA, Biology, with highest distinction), Johns Hopkins University (MAT), the University of Hawaii where he was an NSF Graduate Fellow (PhD, Zoology), and Harvard Law School (JD). Brown is a member of several honorary societies and the District of Columbia Bar. He is a member of the Division on Earth and Life Studies advisory committee of the National Academies. He is Chairman of the Global Heritage Fund, President of the Natural Science Collections Alliance, a director of the Wistar Institute, and a trustee of the Academy of Natural Sciences. He is a former Chairman of the Ocean Conservancy, and a former director of various boards, including the Environmental and Energy Study Institute, Environmental Law Institute, U.S. Environmental Training Institute, and the U.S. Committee for the United Nations Environment Programme. Dr. Brown is married to Mary E. McLeod, who is the Legal Advisor to the United States Mission to the United Nations. They have two daughters, Julia and Emma Brown.

Sponsored Programs

United States Agencies

National Aeronautics and Space Administration: Integration of Land Use, Fire and Carbon Flux in Critical Amazon Landscapes: the Xingu River Headwaters and the BR163 Highway Corridor, **Michael T. Coe**

National Aeronautics and Space Administration: Synthesis of Nutrient Interactions in Secondary Vegetation in Amazonia, **Eric A. Davidson**

National Aeronautics and Space Administration: Interactions of Edaphic and Land Use Factors on Water Budgets in the Cerrado Region of Brazil, **Eric A. Davidson**

National Aeronautics and Space Administration: A Proposal for LBA-ECO Project Scientist, 2008–2009, **Eric A. Davidson**

National Aeronautics and Space Administration: Urban Growth Impacts on Surface Hydrology in Mid-Atlantic and New England Watersheds, **Scott J. Goetz**

National Aeronautics and Space Administration: Quantifying Changes in Northern High Latitude Ecosystems and Associated Feedbacks to the Climate System, **Scott J. Goetz**

National Aeronautics and Space Administration: Carbon Management in the Northeastern US: Assistance to RGGI (Regional Greenhouse Gas Initiative), **R.A. Houghton**

National Aeronautics and Space Administration: Quantifying Effects of Land Use Change on Terrestrial Carbon Budgets in the Black Sea Region and China, **R.A. Houghton**

National Aeronautics and Space Administration: Sources and Sinks of Carbon from Land-Use Change, Management, and Disturbance in the U.S.: Steps Toward a Synthesis, **R.A. Houghton**

National Aeronautics and Space Administration: National Biomass and Carbon Dataset 2000: A High Resolution Baseline to Reduce Uncertainty in Carbon Accounting and Flux Modeling, **Josef M. Kellndorfer**

National Aeronautics and Space Administration: Ecosystem Structure Measurements from DESDynI: Studies of technological options and data fusion using IceSAT/GLAS, Airborne Lidar and LOS/PALSAR Datasets over Central Chile, **Josef M. Kellndorfer**

National Aeronautics and Space Administration: Integrating Earth Science Enterprise Results into Protected Areas Decision Support for the Albertine Rift (Protected Area Watch in the Albertine Rift (PAWAR), **Nadine T. Laporte**

National Oceanic and Atmospheric Administration: Carbon Implications of Ecosystem Responses to North American Climate Change, **Scott J. Goetz**

National Science Foundation: BE/CNH: Feedbacks among Forestry, Agriculture, and Fire in Amazonia, **Michael T. Coe**

National Science Foundation: Collaborative Research: Influence of Land Use on Watershed Hydrology and Biogeochemistry at the Amazon Agricultural Frontier, **Eric A. Davidson**

National Science Foundation: Collaborative Research. IPY: Observation and Modeling of Tundra Ecosystem Responses to Climate Change, **Scott J. Goetz**

National Science Foundation: Collaborative Research: Shifting seasonality of northern forest response to arctic environmental change, **Scott J. Goetz**

National Science Foundation: Collaborative Research. IPY: The Polaris Project: Rising Stars in the Arctic, **Robert M. Holmes**

National Science Foundation: Student-PARTNERS: A Pan-Arctic Science and Education Collaboration, **Robert M. Holmes**

National Science Foundation: Collaborative Research: IPY: Arctic Great Rivers Observatory (Arctic-GRO), **Robert M. Holmes**

National Science Foundation: Collaborative Research: ETBC: Controls on the Flux, Age and Composition of Terrestrial Organic Carbon Exported by Rivers to the Ocean, **Robert M. Holmes**

National Science Foundation: Collaborative Research: The Northeastern Carbon Sink: Enhanced Growth, Regrowth, or Both? **R.A. Houghton**

National Science Foundation: OPUS: Human Modification of the Terrestrial Carbon Balance, **R.A. Houghton**

National Science Foundation: The Role of Natural Resources in Mitigating Political, Environmental, and Health Shocks to Extremely Poor Households in Southeastern Africa, **Nadine T. Laporte**

National Science Foundation: Collaborative Research: Effects of Tropical Watershed Deforestation on Mangrove Ecosystem Function and Services, **Thomas A. Stone**

Sponsored Programs cont'd

U.S. Agency for International Development: Experiments in Environmental Governance in the MAP Region: Madre de Dios, Peru - Acre, Brazil - Pando, Bolivia, **I. Foster Brown**

U.S. Agency for International Development: Strengthening Environmental Management in the Brazilian Southwestern Amazon, **I. Foster Brown**

U.S. Department of Agriculture: Using Model Analyses and Surface-Atmosphere Exchange Measurements from the Howland Ameriflux Supersite in Maine, USA, to Improve Understanding of Forest Ecosystem Cycling, **Eric A. Davidson**

U.S. Department of Agriculture: Towards Spatially Explicit Quantifications of Carbon Flux (2000-2007) in Northeastern U.S. Forests Linking Remote Sensing with Forest Inventory Data, **Josef M. Kellndorfer**

U.S. Department of Energy: Economically Viable Forest Harvesting Practices That Increase Carbon Sequestration, **Eric A. Davidson**

U.S. Department of Energy / Penn State: Decadal-Scale Measurements of Decadal-Cycling Forest Soil Carbon, **Eric A. Davidson**

U.S. Department of Energy / Penn State: Reducing carbon emissions from the Brazilian Amazon: Technical support for governmental programs to slow deforestation and expansion of the Registry of Socio-environmental Responsibility, **Eric A. Davidson**

Foundations

Abelow Family Foundation: Competing Human Uses for Land, Soils, and Vegetation in a Climate-Challenged World, **John P. Holdren, Richard A. Houghton**

Abelow Family Foundation /Jewish Communal Fund: Amazon Program, **Daniel C. Nepstad, Michael T. Coe**

Barakat Foundation: Educational Trail at the Gilman Ordway Campus, **Eric A. Davidson**

Blue Moon Fund: Harnessing Globalization for Amazon Conservation, **Michael T. Coe**

Cape Cod Five Foundation: Mapping Cape Cod's Agricultural Heritage, **Thomas A. Stone**

Gregory C. Carr Foundation: Revitalization of Gorongosa National Park: Economic Effects and Implications for Surrounding Communities, **Frank Merry, Nadine Laporte**

Davis Conservation Trust: Mapping Rapid Land Cover Change in Southern Maine, **Thomas A. Stone**

Armand G. Erpf Fund: Lecture Series, **Richard A. Houghton**

Armand G. Erpf Fund: Library Collection, **Richard A. Houghton**

Goldman, Sachs & Co: Valuation and Marketing of the Sustainable Uses of Forests, **Richard A. Houghton**

Google Foundation: Pan-Tropical Mapping of Forest Cover and Associated Above-Ground Carbon Stock, **Josef M. Kellndorfer**

Island Foundation: Mapping Rapid Land Cover Change in Southern Maine, **Thomas A. Stone**

The Linden Trust for Conservation, Joseph H. Gleberman, and Summit Fund of Washington: Reducing Carbon Emissions and Conserving Tropical Forests, **Richard A. Houghton**

Henry Luce Foundation: Competing Human Uses for Land, Soils, and Vegetation in a Climate-Challenged World, **John P. Holdren, Richard A. Houghton**

Gordon and Betty Moore Foundation: US-Brazil Workshop: Interactions Between Climate, Forests, and Land Use in the Amazon Basin: Modeling and Mitigating Large-Scale Savannization, **Michael T. Coe**

Gordon and Betty Moore Foundation: Fire, Land Use, and the Savannization of Seasonally-Dry Amazon Forests, **Michael T. Coe**

Gordon and Betty Moore Foundation: Workshop on the Establishment of REDD Projects: Lessons Learned from Amazonas and the JUMA Project, **Tracy Johns**

Gordon and Betty Moore Foundation: Pan-Tropical Mapping of Forest Cover and Associated Above-Ground Carbon Stock, **Josef M. Kellndorfer**

National Environmental Education Foundation: Earth Gauge: Connecting Weather and the Environment, **Eric A. Davidson**

Orchard Foundation: Mapping Rapid Land Cover Change in Southern Maine, **Thomas A. Stone**

Overbrook Foundation: Caboclo Workshops of the Tapajós: Consolidating a Promising Strategy for Improving Community Livelihoods and Conserving Forest Biodiversity in the Brazilian Amazon, **David G. McGrath**

David and Lucille Packard Foundation: Reducing Carbon Emissions from the Brazilian Amazon: Technical Support for Governmental Programs to Slow Deforestation and Expansion of the Registry of Socio-environmental Responsibility, **Michael T. Coe**

David and Lucille Packard Foundation: An integrated science, people, and policy approach to supporting REDD across Scales: Brazil and the Forum on Readiness for REDD, **David McGrath**

David and Lucille Packard Foundation: Pan-Tropical Mapping of Forest Cover and Associated Above-Ground Carbon Stock, **Josef M. Kellndorfer**

Adelard A. and Valeda Lea Roy Foundation: Mapping Rapid Land Cover Change in Southern Maine, **Thomas A. Stone**

Sheehan Family Foundation: Mapping Cape Cod's Agricultural Heritage, **Thomas A. Stone**

Tinker Foundation: Policy and Institutional Frameworks for Smallholder Forestry in the Brazilian Amazon, **David McGrath**

Trust for Mutual Understanding: Russian Visiting Scholars Program, **Thomas A. Stone**

Winslow Foundation: Competing Human Uses in a Climate-Challenged World, **John P. Holdren, Richard A. Houghton**

Other

Colorado State University: African Carbon Exchange II: A Systems Approach for Diagnosis & Prediction of Carbon, Vegetation, and Disturbance, **Nadine T. Laporte**

Cornell University: Near-Source Atmospheric Deposition from Vehicle Exhaust as a Nitrogen Source to Coastal Lagoons, **Eric A. Davidson**

Harvard University: Interactions between Climate, Forests, and Land Use in the Amazon Basin: Modeling and Mitigating Large-scale Savannization, **Michael T. Coe**

Montana State University: Ecological Condition of US National Parks: Enhancing Decision Support through Monitoring, Analysis, and Forecasting, **Scott J. Goetz**

Rutgers University: Denitrification - Integrating Landscapes and Waterscapes, **Eric A. Davidson**

Sanborn Map Company: SRTM Derived Height/Biomass Dataset, **Josef M. Kellndorfer**

Union of Concerned Scientists: Evaluating the Opportunities for Enhanced Sequestration of GHG Emissions by Forests and Agriculture in the United States, **R. A. Houghton**

University of Maryland: Integrating Vegetation 3D Structure and Ecological Modeling for Continental Scale Assessments of Biodiversity, Biomass and Disturbance, **Scott J. Goetz**

University of Wisconsin: Against the Grain: The Effects of Widespread, Intensifying Agriculture on the Biosphere and Climate System, **Michael T. Coe**

World Bank: Emissions of Carbon from Land Management, **R. A. Houghton**

In the field ...



Above:

Overlooking the Polaris Project barge and the Kolyma River, Cherskiy, Siberia.

Photo © Chris Linder.

The Polaris Project, a month-long field course held in July 2009 in the Siberian Arctic, offered future leaders in arctic research and education first-hand insights into the impacts of climate change.

Dr. R. Max Holmes, a senior scientist at the Woods Hole Research Center and director of the Polaris Project, says, “The Arctic is central to the global climate change issue, and Russia has by far the largest share of the Arctic. Yet few western scientists, much less students, ever get the chance to work in the Siberian Arctic. This research experience is a unique collaboration among students, educators, and scientists from distinct cultures working together to address a critically important scientific challenge.”

Holmes adds, “The education and outreach aspects of this project are essential goals given the rapid and profound transformations underway in the Arctic in response to global warming.”

This was the second year of the Polaris Project field course. The focus of the students’ and scientists’ work was on the transport and transformations of carbon and nutrients as they move with water from terrestrial uplands to the Arctic Ocean, with an emphasis on the linkages among the different ecosystems, and how processes occurring in one component influence the others.

In addition to the field course, The Polaris Project includes research experience for undergraduate students in the Siberian Arctic, several new arctic-focused undergraduate courses taught by project co-primary investigators (PIs) at their home institutions, the opportunity for those co-PIs to initiate research programs in the Siberian Arctic, and a wide range of outreach activities.

Participating institutions include The Woods Hole Research Center, Carleton College, Clark University, Holy Cross College, St. Olaf College, University of Nevada – Reno, Western Washington University, and Yakustk State University. The project is supported by a grant from NSF.

Staff Publications

* indicates publication is in Portuguese

** indicates publication is in French

- *Almeida, O. T., **D. McGrath**, S. Rivero and K. Lorenzen. 2008. Impacto del co-manejo pesquero sobre la pesca en la Amazonia brasileña: caracterización, análisis multiagentes e interacciones. In *El Manejo de las Pesquerías en Ríos Tropicales de Sudamérica El Manejo de las Pesquerías en Ríos Tropicales de Sudamérica*, ed. D. Pinedo and C. Soria, 323-333. Instituto del Bien Común and IDRC, Lima, Peru.
- Baccini, A., N. Laporte, S.J. Goetz, M. Sun**, and H. Dong. 2008. A first map of tropical Africa's above-ground biomass derived from satellite imagery. *Environmental Research Letters* (3)045011, doi: 10.101088/1748-9326/3/4/045011.
- Balch, J.K., **D.C. Nepstad**, P.M. Brando, L.C. Curran, O. Portela, O. de Carvalho Jr., and **P. Lefebvre**. 2008. Negative fire feedback in a transitional forest of Southeastern Amazonia. *Global Change Biology* 14(10):2276-2287.
- Barra Martínez, F.P., A. Centellas Quezada, P. Zuidema, and **I.F. Brown**. 2009. Detection of Brazil nut trees (*Bertholletia excelsa*) in the Bolivian Amazon via satellite imagery. Anais XIV Simpósio Brasileiro de Sensoriamento Remoto, Natal, Brasil, 25-30 April. INPE. 2547-2554.
- Beck, P.S.A.**, T.J. Wang, A.K. Skidmore, and X.H. Liu. 2008. Displaying remotely sensed vegetation dynamics along natural gradients for ecological studies. *International Journal of Remote Sensing* 29(14):4277-4283.
- Brown, I.F.**, R. Salizar, and E. Borges. 2008. Human Rights and Climate Change. *A Gazeta* 10 December, 2.
- Brown, I.F.**, M. Silveira, and E. Mendoza. 2009. REDD, Climate and the Vulnerable Forests of Southwestern Amazonia. Op-Ed. *A Gazeta Rio Branco*. 28 May:C1-2.
- Canadell, J.G., M.R. Raupach, and **R.A. Houghton**. 2009. Anthropogenic CO₂ emissions in Africa. *Biogeosciences* 6:463-468.
- Cattaneo, A.** 2008. Regional Comparative Advantage, Location of Agriculture, and Deforestation in Brazil. *Journal of Sustainable Forestry* 27(1-2):25-42.
- Coe, M.T.**, M.H. Costa, and B.S. Soares-Filho. 2009. The Influence of Historical and Potential Future Deforestation on the Stream Flow of the Amazon River -- Land Surface Processes and Atmospheric Feedbacks. *Journal of Hydrology* 369:165-174.
- Cooper, L.W., J.W. McClelland, **R.M. Holmes**, P.A. Raymond, J.J. Gibson, C.K. Guay, and B.J. Peterson. 2008. Flow-weighted values of runoff tracers (d18O, DOC, Ba, alkalinity) from the six largest arctic rivers. *Geophysical Research Letters* L18606, doi: 10.1029/2008GL035007.
- Davidson, E.A.**, G.P. Asner, **T.A. Stone**, C. Neill, and R.O. Figueiredo. 2008. Objective indicators of pasture degradation from spectral mixture analysis of Landsat imagery. *Journal of Geophysical Research* 113: G00B03.
- Davidson, E.A.**, B.D. Dail, and J. Chorover. 2008. Iron interference in the quantification of nitrate in soil extracts and its effect on hypothesized abiotic immobilization of nitrate. *Biogeochemistry* 90:65-73.
- Davidson, E.A., D.C. Nepstad**, F.Y. Ishida, and P.M. Brando. 2008. Effects of an experimental drought and recovery on soil emissions of carbon dioxide, methane, nitrous oxide, and nitric oxide in a moist tropical forest. *Global Change Biology* 14: 2582-2590.
- DeFries, R.S., D.C. Morton, G.R. van der Werf, L. Giglio, G.J. Collatz, J.T. Randerson, **R.A. Houghton**, P.K. Kasibhatla, and Y. Shimabukuro. 2008. Fire-related carbon emissions from land use transitions in southern Amazonia. *Geophysical Research Letters* 35. L22705, doi: 10.1029/2008GL035689.
- Fonseca, P.A.M., **I.F. Brown**, H.L. Fuentes Ney, N. Dantas, E. Raelz Luna, A.W. Flores de Melo, and F. Quental. 2009. Monitoring hot pixels, fire risk, rainfall and weather forecasting in southwestern Amazonia: the experience of daily bulletins for the MAP Region (Madre de Dios-Peru, Acre-Brazil, Pando-Bolivia). Anais XIV Simpósio Brasileiro de Sensoriamento Remoto, Natal, Brasil, 25-30 April. INPE. 5227-5233.
- Goetz, S.**, and **G. Fiske**. 2008. Linking the diversity and abundance of stream biota to landscapes in the mid-Atlantic USA. *Remote Sensing of Environment* 112:4075-4085.
- Goetz, S.J.**, N. Gardiner, and J.H. Viers. 2008. Monitoring freshwater, estuarine and near-shore benthic ecosystems with multi-sensor remote sensing: An introduction to the special issue. *Remote Sensing of Environment* 112:3993-3995.
- Goetz, S., J. Kellndorfer**, and **T. Johns**. 2008. Getting over the satellite blues. *Trading Carbon* December.
- Goetz, S., A. Baccini, N. Laporte, T. Johns, W. Walker, J. Kellndorfer**, and **R.A. Houghton**. 2008. Mapping and monitoring carbon stocks with satellite observations: an update. A Report for the United Nations Framework Convention on Climate Change (UNFCCC), Conference of the Parties (COP), Fourteenth Session, 1-12 December 2008, Poznan, Poland. Woods Hole Research Center, Falmouth, MA. November.

Staff Publications cont'd

* indicates publication is in Portuguese

** indicates publication is in French

Goetz, S.J., A. Baccini, N.T. Laporte, T. Johns, W. Walker, J. Kellndorfer, R.A.

Houghton, and **M. Sun.** 2009. Mapping and monitoring carbon stocks with satellite observations: a comparison of methods. *Carbon Balance and Management* 4:2.

Goetz, S.J., P. Jantz, and C.A. Jantz. 2009. Connectivity of core habitat in the Northeastern United States: Parks and protected areas in a landscape context. *Remote Sensing of Environment* 113:1421–1429.

Gross, J.E., **S.J. Goetz,** and J. Cihlar. 2009. Application of remote sensing to parks and protected area monitoring: Introduction to the special issue. *Remote Sensing of Environment* 113:1343–1345.

Hajkowicz, S., K. Collins, and **A. Cattaneo.** 2008. Review of Agri-Environment Indexes and Stewardship Payments. *Environmental Management* July.

Holdren, J.P. 2008. Convincing the climate-change skeptics. *The Boston Globe* 4 August.

Holdren, J.P. 2008. Convincing the skeptics. *International Herald Tribune* 4 August.

Holdren, J.P. 2008. Foreword. In *Turning Numbers Into Knowledge: Mastering the Art of Problem Solving, Second Edition*, Jonathan Koomey. Analytics Press, Oakland, CA.

Holdren, J.P. 2008. The Future of Climate Change Policy: The U.S.'s Last Chance to Lead. *Scientific American 2008 Earth 3.0 Supplement* 13 October:20-21.

Holdren, J.P., and **G.M. Woodwell.** 2008. Meeting Cape Cod's Environmental Challenges. *The Enterprise* (Falmouth, MA) Green Special Supplement. September.

Houghton, R.A. 2008. Biomass. In *Encyclopedia of Ecology, 1st Edition*, ed. S.E. Jorgensen and B.D. Fath, 448-453. Elsevier, Oxford.

Houghton, R.A., and **S.J. Goetz.** 2008. New satellites help quantify carbon sources and sinks. *Eos* 89(43):417-432.

Ito, A., J.E. Penner, M.J. Prather, C.P. de Campos, **R.A. Houghton,** T. Kato, A.K. Jain, X. Yang, G.C. Hurtt, S. Frolking, M.G. Fearon, L.P. Chini, A. Wang, and D.T. Price. 2008. Can we reconcile differences in estimates of carbon fluxes from land-use change and forestry for the 1990s? *Atmospheric Chemistry & Physics* 8:3291-3310.

Johns, T., D. Nepstad, F. Merry, N. Laporte, and **S. Goetz.** 2008. A three-fund approach to incorporating government, public and private forest stewards into a REDD funding mechanism. *International Forestry Review* 10(3):458-464.

Kellndorfer, J.M., and K.C. McDonald. 2009. Active and Passive Microwave Systems. In *The SAGE Handbook of Remote Sensing*, ed. T.A. Warner, M.D. Nellis, and G.M. Foody, 179-199. Sage Publications Ltd., London

Khosla, V., T.D. Searchinger, and **R.A. Houghton.** 2008. Biofuels: Clarifying Assumptions. *Letters. Science* 322: 371-374.

Loranty, M. 2009. Taking the pulse of the forest. *LiveScience* March.

Laporte, N., W. Walker, J. Stabach, and F. Landsberg. 2008. Monitoring forest-savanna dynamics in Kibale National Park with satellite imagery (1989-2003): implications for the management of wildlife habitat. In *Science and Conservation in African Forests: The Benefits of Long-Term Research*, ed. R. Wrangham and E. Ross, 38-50. Cambridge University Press, Cambridge, UK.

Martelo, J, K. Lorenzen, M. Crossa, and **D.G. McGrath.** 2008. Habitat associations of exploited fish species in the Lower Amazon river-floodplain system. *Freshwater Biology* 53:2455–2464.

McClelland, J.W., **R.M. Holmes,** B.J. Peterson, R. Amon, T. Brabets, L. Cooper, J. Gibson, V. Gordeev, C. Guay, D. Milburn, R. Staples, P.A. Raymond, I. Shiklomanov, R. Striegl, A. Zhulidov, and T. Gurtovaya. 2008. Development of a Pan-Arctic Database for River Chemistry. *EOS* 89(24):217-218.

***McGrath, D.G.,** A. Cardoso, and O.T. Almeida. 2008. Evolución de un sistema de manejo de pesquerías en la llanura inundable de la baja Amazonia. In *El Manejo de las Pesquerías en Ríos Tropicales de Sudamérica El Manejo de las Pesquerías en Ríos Tropicales de Sudamérica*, ed. D. Pinedo and C. Soria, 357-382. Instituto del Bien Común and IDRC, Lima, Peru.

Pantoja, N.V., and **I.F. Brown.** 2009. Estimates of areas affected by fire in eastern Acre associated with the 2005 drought. Anais XIV Simpósio Brasileiro de Sensoriamento Remoto, Natal, Brasil, 25-30 April. INPE. 6029-6036.

Salimon, C.I., and **E.A. Davidson.** 2008. Heterotrophic components of soil respiration in forests and pastures of southwestern Amazonia, Acre, Brazil. *Revista Ambiente e Água* 3:20-27.

Samanta, S., M.K. Clayton, D.S. Mackay, E.L. Kruger, and B.E. Ewers. 2008. Quantitative comparison of canopy conductance models using a Bayesian approach. *Water Resources Research* 44 W09431, doi: 10.1029/2007WR006761.

Staff Publications cont'd

* indicates publication is in Portuguese

** indicates publication is in French

Savage, K., E.A. Davidson, and A.D. Richardson. 2008. A conceptual and practical approach to data quality and analysis procedures for high frequency soil respiration measurements. *Functional Ecology*, doi: 10.1111/j.1365-2435.2008.01414.x.

Soares Filho, B.S., L. Dietzsch, **P. Moutinho**, A. Falieri, H. Rodrigues, E. Pinto, C.C. Maretti, K. Suassuna, C.A.deM. Scaramuzza, M. Lanna, and F.V. de Araújo. 2008. Reducing carbon emissions from deforestation: the role of ARPA's protected Areas in the Brazilian Amazon. IPAM, Belém, Brazil.

Stabach, J., L. Dabek, R. Jensen, and Y.Q. Wang. 2009. Discrimination of dominant forest types for Matschie's tree kangaroo conservation in Papua New Guinea using high resolution remote sensing data. *International Journal of Remote Sensing* 30(1-2):405-422.

Steinberg, D.C., and **S.J. Goetz**. 2009. Assessment of canopy light harvesting in temperate forests of the eastern U.S. using MODIS data products. *International Journal of Remote Sensing* 30(19):169-187.

Stone, T.A. 2009. The price of CO₂. *Coastlines*. Chamber of Commerce, Falmouth, MA. February 5.

Stone, T.A. 2009. Avoiding the worst case of climate change. *The Cape Cod Times* 26 May.

Theobald, D.M., **S.J. Goetz**, J.B. Norman, and P. Jantz. 2009. Watersheds at Risk to Increased Impervious Surface Cover in the Conterminous United States. *Journal of Hydrologic Engineering* 14(4):362-368.

Torres-Cañabate, P., **E.A. Davidson**, **E. Bulygina**, R. García-Ruiz, and J.A. Carreira. 2008. Abiotic immobilization of nitrate in two soils of relic *Abies pinsapo*-fir forests under Mediterranean climate. *Biogeochemistry* 91:1-11.

Vano, J.A., J.A. Foley, C.J. Kucharik, and **M.T. Coe**. 2008. Controls of climatic variability and land cover on land surface hydrology of northern Wisconsin, USA. *Journal of Geophysical Research* 113, G04040, doi: 10.1029/2007JG000681.

Vasconcelos, S.S., **I.F. Brown**, and P. Fearnside. 2009. Hot pixels in southwestern Amazonia: indicators of land use change. Anais XIV Simpósio Brasileiro de Sensoriamento Remoto, Natal, Brasil, 25-30 April. INPE. 6353-6360.

Woodwell, G.M. 2008. The Ecologist's Calling. The *Enterprise* (Falmouth, MA). December.

In the Field ...



Above:
Holly Hughes and Kathleen Savage monitor carbon isotope (¹³C) data being collected from a Picarro Carbon Isotope Analyzer at Howland Forest, Maine. Monitoring carbon isotopes provides us with information on the physical, ecological and biogeochemical processes of the carbon cycle within the forest.

Photo courtesy of Tad Ryan.

In the Field ...



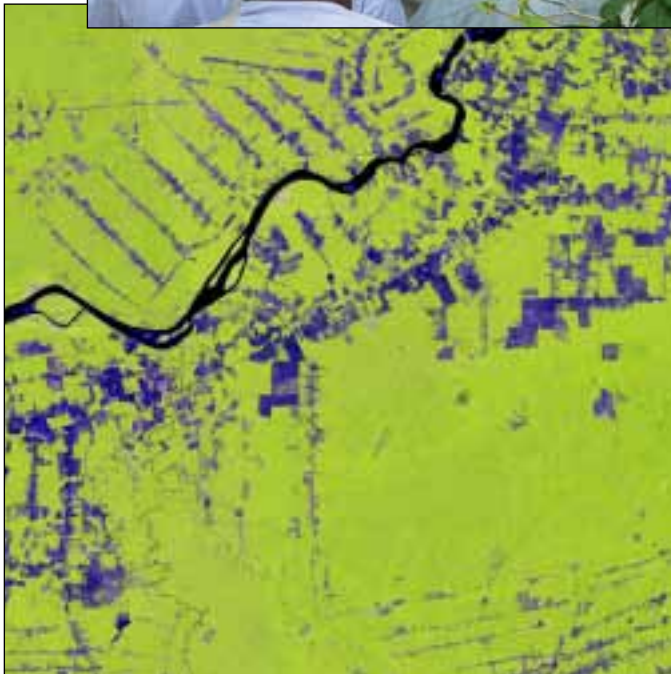
The Woods Hole Research Center has initiated a three-year project focused on pan-tropical mapping of forest cover and associated carbon stocks stored in above-ground biomass. This is accomplished through the generation of pan-tropical consistent data sets of year 2007 high-resolution, cloud-free radar imagery from the Japanese ALOS sensor, a forest cover map derived from radar imagery as a baseline for subsequent change monitoring, and a medium-resolution, pan-tropical biomass/carbon map based on the fusion of optical (MODIS), radar, and lidar (GLAS) data. The maps will be an invaluable reference against which changes in forest cover and carbon stock can be measured.

The spatial data sets generated by this project will provide forest cover distribution throughout the tropics in 2007 from cloud-free satellite radar circa 15 meter resolution, as well as the first pan-tropical map of above-ground biomass (at 500m resolution) derived from remote sensing and field surveys. Field surveys are being conducted in close collaboration with tropical forest nations through several capacity building initiatives. Through workshops, a visiting scholars program, and other related activities, new maps are being produced, assessed, disseminated and discussed with various stakeholders within these countries - including representatives from government, civil society, indigenous and traditional forest communities, and the private sector. An integral part of the project is to transfer knowledge and skills of forest and carbon mapping to those countries that are increasingly engaged in international efforts to slow deforestation and enable these countries to evaluate alternative options for management of their forest resources.

Support for this project is from The Gordon and Betty Moore Foundation, the David & Lucile Packard Foundation, and Google.org. Key project partners include Japan Aerospace Exploration Agency (JAXA), JAXA Kyoto and Carbon Initiative, Alaska Satellite Facility (ASF), NASA, SARMAP, and Boston University.

Top: Assistant Scientist Wayne Walker leads a field study at a workshop in Bolivia, October 2009. Photo courtesy of Tina Cormier.

At left: At 15-meter resolution, this image acquired by the ALOS satellite shows detailed patterns of deforestation in Rondonia, Brazil.

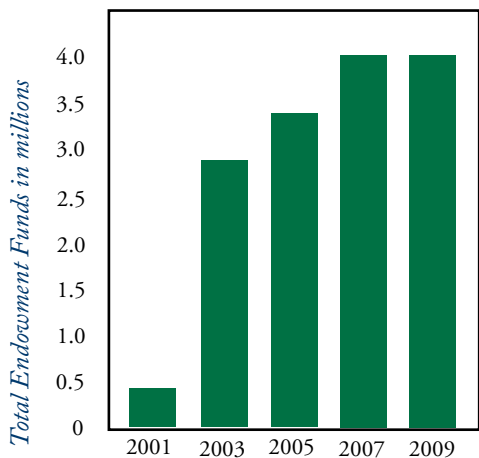
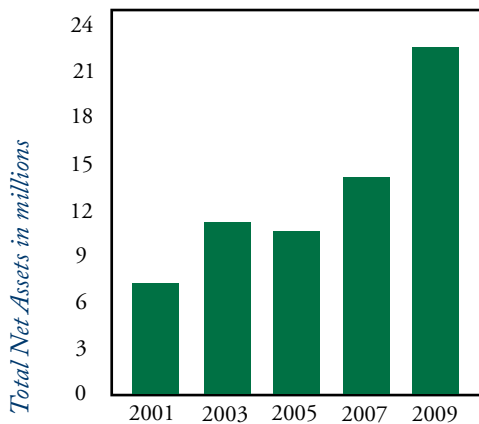


Financial Report

Statement of Activities

for the year ended June 30, 2009
(in thousands of dollars)

Ten-Year Financial Trends

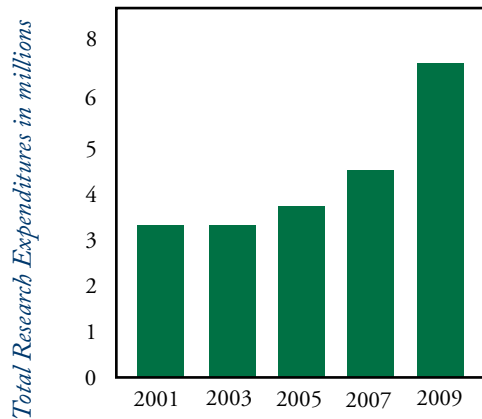
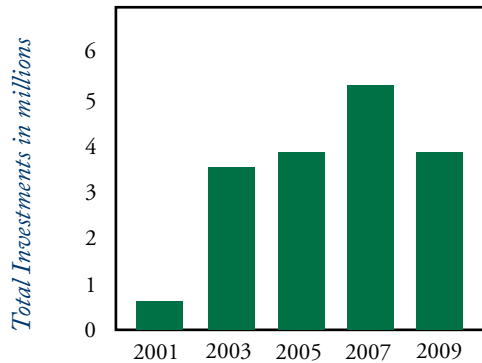


	Unrestricted	Temporarily Restricted	Permanently Restricted	2009	2008
SUPPORT AND REVENUE					
Government	\$ -	\$ 4,078	\$ -	\$ 4,078	\$ 3,540
Foundations & international agencies	-	14,011	21	14,032	2,963
Individual contributions	848	-	-	848	1,232
Investment income (Loss)	(610)	(389)	(34)	(1,033)	(236)
Other income	295	-	-	295	91
Net assets released	8,558	(8,558)	-	-	-
Total support and revenue	9,091	9,142	(13)	18,220	7,590
EXPENSES					
Research programs	6,869	-	-	6,869	5,420
General and administrative	2,442	-	-	2,442	2,241
Development and fundraising	381	-	-	381	501
Total expenses	9,692	-	-	9,692	8,162
CHANGE IN NET ASSETS	(601)	9,142	(13)	8,528	(572)
NET ASSETS					
Beginning of year	7,816	2,579	3,648	14,043	14,615
End of year	\$ 7,215	\$ 11,721	\$ 3,635	\$ 22,571	\$ 14,043

Statement of Financial Position

for the years ended June 30, 2009 and 2008

Ten-Year Financial Trends cont'd



Assets	2009	2008
<i>Current Assets</i>		
Cash and cash equivalents	\$ 5,794,403	\$ 2,970,868
Temporary investments	-	1,062,428
Contributions receivable, current portion	5,589,766	1,246,609
Prepaid expenses and other receivables	292,529	190,348
Total current assets	11,676,698	5,470,253
<i>Property and Equipment</i> (at cost)	7,765,383	6,926,138
<i>Other Assets</i>		
Endowment investments	3,992,987	4,008,001
Beneficial interest in real estate trust assets	212,651	212,651
Bond proceeds held in trust for debt retirement	19,277	20,152
Contributions receivable, net of current portion	1,765,721	66,611
Security deposits	-	-
Total assets	\$25,432,717	\$16,703,806
<i>Liabilities and Net Assets</i>		
<i>Current Liabilities</i>		
Accounts payable	\$ 276,326	\$ 220,687
Accrued expenses	546,783	301,407
Liability under charitable gift annuity	8,830	8,774
Mortgage payable, current portion	86,741	86,741
Refundable advances	25,717	34,754
Tenant security deposits	2,700	2,700
Total current liabilities	947,097	655,063
<i>Long-Term Debt</i>		
Liability under charitable gift annuity, net of current portion	73,976	77,160
Notes and loans payable, net of current portion	1,840,845	1,928,461
Total liabilities	2,861,918	2,660,684
<i>Net Assets</i>		
Unrestricted		
Operating	998,135	2,848,108
Board designated for quasi-endowment	360,000	360,000
Net investment in property and equipment	5,857,074	4,931,088
Total unrestricted	7,215,209	8,139,196
Temporarily restricted	11,721,058	2,255,925
Permanently restricted	3,634,532	3,648,001
Total net assets	22,570,799	14,043,122
Total liabilities and net assets	\$25,432,717	\$16,703,806

Donors

This report recognizes gifts and grants made during the Center's fiscal year beginning July 1, 2008, and ending June 30, 2009.

For individuals, the roster is listed by membership in the Center's giving clubs, which is based on annual contributions.

A listing of foundation, corporate and other support follows.

Members of the George Perkins Marsh Society are those who have made provisions for planned gifts.

Director's Circle

Anonymous
Brad Abelow and Carolyn Murray
Adam and Rachel Albright
Carter F. Bales
Gregory Cogan
John and Mary Cogan
Jesse and Elizabeth Fink
Bob and Randi Fisher
Joseph Gleberman
Spencer Glendon and Lisa Tung
Joshua Goldberg
Jeremy and Hannelore Grantham
Esmond Harmsworth and James Richardson
Francis and Serena Hatch
Lawrence and Caroline Huntington
Timothy and Joan Ingraham
Samuel and Casey Lambert
Lawrence and Dana Linden
Francis and Victoria Lowell
Merloyd Ludington and John Myers
Albert and Katharine Merck
Wilhelm and Nonie Merck
Abigail Norman
Gilman and Margaret Ordway
James and Amy Regan
Joseph and Marité Robinson
Connie and Ted Roosevelt
Gordon Russell
Roger and Victoria Sant
Fred and Alice Stanback
Rosalie Talbert
Helen Whitlock*
Anna Wiancko-Chasman
and Paul Chasman
Douglas and Barbara Williamson
George and Katharine Woodwell

Royal Palm Club

Robert and Alison Ament
Tim Barclay and Beth Taylor
Steve Bernier and Constance Messner
Peter and Helena Bienstock
Neal Brown and Judy LaBelle
Darryl and Janet Buckingham
Priscilla Case
James and Ruth Clark
Ferdinand and Susanna Colloredo-Mansfeld
Eric Davidson and Jean Talbert
Robert Epstein and Amy Roth
Robert and Iris Fanger
Henry Finch and Patricia Robinson
Kenneth Foreman and Anne Giblin
Geoffrey Freeman and Marjorie Findlay
Dan and Bunny Gabel
Avram and Carol Goldberg
Sibyl Golden
Thomas and Virginia Gregg
John and Polly Guth
Bayard and Julie Henry
Harry Hintlian
John Hirschi
Joel Horn and Susan McGrath
Richard and Susan Houghton
Lily Rice Hsia
Woody and Elizabeth Ives
Hamilton and Edith Kean
Robert Kirsch and Anne Renner
Nancy Lassalle
Marta Jo Lawrence
Sara Lawrence-Lightfoot and Irving Hamer
Marcia and Alan Leifer
Adam Levesque
Mary and Bill Lunt
Dan Martin
Nawrie Meigs-Brown and David Brown
Mary Louise and Charles Montgomery
William and Margot Moomaw
William and Mary Sue Morrill
Judith Nadai
Elizabeth Odell
Tom and Carol Odell
Martin and Joan Person
Eugene and Diana Pinover
Jonathan Prudhomme
Godfrey Rockefeller
Laurance and Wendy Rockefeller
David and Edith Ross
Tedd Saunders
Anne Sawyer
Samuel Slade and Susan Coughlin
Helen Spaulding
Gerald and Margaret Steinberg
Robert Stenson and Kate Stenson-Lunt
Gerard and Mary Swope
Curtis Tamkin
Mark and Amy Tercek
Gerry Tuten
Redwood and Mary Wright
Arthur and Charlotte Zitrin

* *deceased*

Donors cont'd

Sequoia Club

Martha Adams
Robert and Nancy Barry
Charles and Christina Bascom
Robert and Lois Baylis
John and Georgiana Becker
Christopher Bett
Anita Brewer-Siljeholm
Molly Cornell
Sally Cross
Michael and Dudley Del Balso
Griswold Draz
Michael Fanger and Linda Sattel
Arthur and Linda Gelb
Arthur and Eloise Hodges
Richard and Marjy Horton
Gordon and Elizabeth Hughes
David Isenberg and Paula Blumenthal
David and Dana Lee
Laurence and Katherine Madin
David and Sheila Manischewitz
Kai and Marion Marcucelli
John Ordway, Jr.
David and Laurie Reed
Ross and Alice Sandler
Roger and Norma Saunders
Nancy Soulette
Louisa Spencer
Gilbert and Sally Steward
Richard Verney
E. Andrew Wilde
Roger Williams
Robert and Blaikie Worth
Ron Zweig and Christina Rawley

Charter Oak Club

Frances Beinecke and Paul Elston
William and Elizabeth* Beinecke
Rodney and Liz Berens
Donald and Alpine Bird
Joan Bolling
Francis and Margaret Bowles
John and Elaine Brouillard
Barry and Sylvia Bunshoft
Tom and Rachel Clafin
Thomas and Ann Coe
Drew Days and Ann Langdon
Lawrence and Regina DeVecchio
John and Toni Doggett
Donald and Sheila Evans
Jerome and Barbara Fanger
Michael and Lynne Farlow
Kimball and Nancy Faulkner
Richard and Constance Giesser
Donald and Ruth Glotzer
Benjamin and Sue Graham
Melinda Hall
Alan and Judith Hoffman
David Hoover and Carol Swenson
Mary Janney
Betsy Jewett
Jon and Barbara Kaufman
Dennis and Joanne Keith
Sandra Kinet
Thomas Lovejoy
Wallace and Nancy McCurdy
Mary McDonough
Harriet Meiss
Eliot Merrill and Elizabeth Andrews

Pete and Sara Merrill
Elwynn Miller
Katharine Morgan
Angela Hart Morris
Carol O'Neil
Jeffrey and Susan Parker
Margaret Richardson
Deborah and Stephen Senft
John Swope
Jared and Heather Tausig
Edward and Penny Thomas
Christiana Walford
Linda Whitney
Richard and Mary Ellen Williams

Friends

Anonymous
Jonathan Aibel and Julie Rohwein
Philip Alatalo and Heather Shepley
Herbert and Catherine Allard
Compton Allyn
Robert and Helen Alsop
Forrest and Hester Ames
Hoyt and Ashley Ammidon
Peggy Andretz
Ronald and Helene Arehart
Kenneth Arnold
Elizabeth Arthur
Dollie Ash
Brian and Maria Aspinwall
Duncan and Dorothy Aspinwall
Kathleen Avery
Richard and Denise Backus
William Barina
Anne Barnes
David and Laurie Barrett
Paul and Eileen Bartek
Robert Beeber
Helen Belcher
Ralph and Joyce Berger
Eugene Bergeron and Lynn Dudley
Howard and Deborah Bernstein
Alden and Barbara Besse
Lee Best
Olive Beverly
Ronald and Carol Beyna
Anthony and Lisa Bienstock
Richard and Mary Bierly
John and Marion Bierwirth
Mary Biggar
Stephen and Barbara Billings
Jordan and Barbara Ann Birger
James and Barbara Birney
Linda Black
Milton and Sandra Blackington
Deborah Blanchet

Walter Bobo
Elizabeth Borden
Dwight Boston
Peter and Suzanne Bowman
Kintan Brahmhatt
Sierra Bright
Eleanor Bronson-Hodge
Helen Brooks
Celia Brown and Richard Zajchowski
Thomas and Kathryn Brown
Vernon and Barbara Brown
David Browning
Lawrence and Margaret Bruce
Stanley and Helen Burd
Bradford Butman
Richard and Jean Butterworth
Harold Butz and Darlene Clark
Ellen Cabot
George and Yara Cadwalader
Carla-Lisa Caliga
John and Irene Cantlon
Patricia Carey
Ben Carnevale and Joanne Blum-Carnevale
Robert and Myra Carrier
John and Helaine Carroll
Benjamin Chadwick
Charles and Margaret Chase
George and Dorothea Chidester
Frank and Julia Child
Jane Chrisfield
Robert Christy
Eleanor Cirillo
Arthur Clark
Peter Clark and Ellen Barol
Alden Clayton
James and Ann Cleary
John and Holly Cobb
Bruce Cohen
Ellen Coldren
Claudette Columbus
Peter and Susan Connolly
Bernie and Dionne Cooper

Bruce Cornish
Michael and Marcia Corrigan
Jack Cottrell
Joseph Crimmins
Paul and Mavise Crocker
Irene Crosby
Patricia Crosthwait
Robert M. Cuddy
Don and Patricia Cushing
Edla Cusick
Joel Cyr
Joseph Day
William and Patricia Day
Malcolm Decker and Rosamond Shannon
Jack Dennis
Elizabeth Desaulniers
Louise Devine
Nicholas and Bitten Dill
Patricia Donahue
Richard and Jean Doub
Toni Dove
David Dow
Martha Drummond
Kevin and Carol Early
Virginia Edgcomb and Richard Sperduto
David W. Edge
Frank and Nancy Egloff
Dave and Frances Einhorn
Alfred and Mary Eipper
Marilyn Elie
Joseph and Miriam Elmaleh
Harry and Elinor Emlet
John English
Edward and Susan Epes
Giuseppe Erba
John Eustis
William Falcheck
Alison Farrar
David and Doris Fausch
Harley Featherston
Warren Felt and Dolores Arond
David and Barbara Fink

Donors cont'd

Daphne Fisher
Gordon Fitzgerald
John and June Fletcher
David and Janet Folger
Elvin Fowell
Alan and Anita Frank
Ann Freedberg
Willard and Constance Galliard
Robert Gannett
David and Andrea Garber
Stephen Gardner and Mary Voce
Michael and Mary Garfield
Peter and Jean Garrison
David Gengler
Carl and Nancy Gewirz
Elaine Goldman
Raymond and Dorothy Goodman
Richard and Kerry Goodson
Marc and Carol Gordon
Christine Goreczny and Mark Sewhuk
Bonnie Gossels
Alan and Elizabeth Green
Frederic and Jocelyn Greenman
John and Jane Griffith
Robert and Virginia Guaraldi
Lorraine Gyauch
E. Flinn and Marisa Hackett
Charles and Ethel Hamann
Albert and April Hamel
Daniel and Caroline Hamlin
Megan Hanawalt
Margaret Hand
Robert and Karin Hardy
John and Maureen Harrington
Robert Harrington
Lynn Harrison
Lee and Rose Hartman
Robert Hassey
Robert and Patricia Hauver
David and Betsy Hawkins
William and Lucile Hays

Joan Hazard and John Dabrowski
James Heasley
Jill Heathman
Stanley and Marie Hecht
Bonnie Heidel
Kurt and Ruthann Hellfach
George Helmholz
Barbara Herbst
David and Joan Herschfeld
Carl and Nora Hevert
Philip and Ann Heymann
Elizabeth Hills
Franklin and Marge Hobbs
Alexander and Marion Hoffman
Hanna Hopp
John and Marilyn Howard
Mary Jean Howard
Robert and Marion Howard
Anthony Howell and Patricia Benner
Gene and Harriet Hower
William Hull
Fred Humphreys and Andrea Kusko
Sarah Hunnewell
Richard Hunt
Jane Iafrate and Barbara Stephens
Lynn Jackson
Raymond and Carrol Jacob
Carolyn Jacobs
Stanley and Dee Jacobs
Gary and Sue Jacobson
Charles and Joyce Johnson
David and Kathleen Johnson
Raymond and Lola Johnson
Susan Johnson
Wade Johnson
Anthony and Elisabeth Jones
Barbara Jones
Dewitt and Megan Jones
Beverly Kamaitis
Leah Karpen
Jane Holtz Kay

Fred and Whitney Keen
Kenneth Keller
Mr. and Mrs. Brooks Kelley
Eleanor Kenyon
Stephen King
Eugene and Ethel Kinsella
Peter Kivy and Joan Pearlman
Lewis and Lucie Kleinhans
Lorraine Komar and Randall Bennett
James and Debra Krasnow
Rick and Kelly Krause
Calvin and Ilene Kunin
Alex and Andrea Kusko
Albert and Sonia Kutzin
John and Diana Lamb
Marjorie Lange
Jessica Langsam
Lawrence and Hannah Langsam
Rowena Lauterbach
Charles and Patricia Lawrence
Carl and Joanne Leaman
Henry and Mary Lee
Julia Lee
Victoria LeFevre and Gerald Fine
Marian LeFevre
Thomas and Sarah Leggat
Joy Leif
Edwin and Judith Leonard
Melvin and Katherine Levine
William and Louise Lidicker
Frances Lightsom
Jason and Linda Lillegraven
Vito Lipari
Douglas and Kim Livolsi
William and Noelle Locke
Mary Loftus
Jean Lootz
John and Nancy Lovejoy
Sandra Lovell
Allen Luke
Weyman Lundquist and Kathryn Taylor

Maija Lutz and Peter Tassia
Raymond and Blanche Lutz
Patrick and Dorothy Lynch
Pamela P. Machold
Fred and Judith Mackenzie
Donald and Ruth MacVean
Douglas Maitland
Wayne and June Malary
Charles and Susanne Mann
Merle Ann Marion
Jeffrey and Kimberly Markuns
Natalie Mather
Willis Matson
Robert Matthew
John and Nancy McAloon
Frederick and Barbara McAlpine
Edmund McCann
Paul McCree
Sylvia McLaughlin
Cornelia McMurtrie
Melissa McTague
Patricia Meaney and Richard Eckaus
Jonathan and Jane Meigs
Maryellen Meleca and Christine Graziano
Roger Mellem
Frederick Menkello
Cathryn Michelini
Robin Milburn
Dwight Miller
Frances Miller
Randy and Debra Miller
Elizabeth Molodovsky
Donald and Sandra Moncevicz
Allan and Maria Moniz
Henriette Montgomery
Mary Ann Moore
Charles and Sarah Morgan
Reyko and Kona Mori
Kirstin Moritz and Rod Hinkle
Yvette Morrill
John and Fredrica Morris
Kenneth and Laura Morse
Thomas and Elizabeth Moseley
Day and Kathie Mount
Marylyn Mullen

Allen Myers
Lewis and Phyllis Nassikas
Mark Nault
Ernest Nickole
John E. Noble
John Noel
Edmund and Ann Nolan
John and Vivian Novado
Edward W. Noyes
MacArthur Noyes
Robertta Odell
William and Donna Marie Oglesby
Julie Okon
Pauline O'Leary
John M. Olson
John and Karen O'Neil
Rudy and Maya Opavska
Renee Bennett and Kimberley O'Sullivan
James Ottos
Gary and Naomi Palmer
N.J. and Mary Paola
John and Monica Parks
Alexander and Patricia Pastein
Walter and Ruth Paul
Herta Payson
Joan Pearlman
Kay Pechilis
Robert and Pamela Pelletreau
Russell and Antoinette Pells
Braulio and Diane Pena
Murray and Nadja Pendleton
Gail Perrin
Susan Peterson
Henry and June Pfeiffer
Donald and Susan Pickering
Ann Pilch
Paul and Sandra Pimentel
Warren and Kathleen Pinches
Dan and Joan Pinck
Theodore and Maria Pitas
Roland and Sheila Place
The Place Family
Robert Plunkett
Arthur and Linda Polishuk
Priscilla Porter

William Porter
Stephen Pratt
Debra Pruitt
Alan and Margaret Ranford
Maridale Ray
Samuel and Mary Raymond
Mark and Diana Remlinger
Robert Richard
Walter Richards
Randolph Richardson
Frances Ricketson
Barbara Riddoch
Mary Ring
James and Derreth Roberts
Mr. and Mrs. Dan Robertson
Eric Roccario
Peter and Jane Roda
James and Dianne Roderick
Dana and Alison Rodin
Joan Rodriguez
Edward and Wendy Rose
Robert Rose
Sue Rose
Dennis and Kathryn Rosenfeld
Priscilla Roslansky
Perry Ross
Nicholas Rossettos
Harry Rowe
Edward and Earline Rubel
Ellen Russas
Dorothy Ryder
Richard Sailor and Mary Johnston
R. Keith and Susan Salisbury
Lillian Sanders
S. Jacob Scherr and Carole Dickert-Scherr
Rhoda Schlamm
Larry Schur
John and Lois Schuyler
Katherine Scott
Dorothy Sebesta
Richard and Lucille Seeley
Joseph and Randee Seiger
Michael and Amy Shaw
Peter and Anne Sheldon
Peter and Margaret Sherin

Donors cont'd

Daniel and Joanne Shively
Martin and Judith Shore
Thomas and Heidi Sikina
Evelyn Silvus
Peter Sinclair
A. Homer Skinner
Leo and Nancy Lee Skinner
Paul and Mary Louise Smith
Peter and Anne Smith
Wesley and Nancy Smith
Wilson and Mary Jane Smith
Emma-Marie Snedeker
May Soll
Ann Sprayregen
Kenneth Stasney
Stuart Stearns
Peter Stern and Joan Johnston-Stern
Michael and Daphne Stevens
Wesley and Patricia Stimpson
Stephen Stimson and Jill Neubauer
George and Dorothy Stone
Sanford and Callie Storm
Howard and Malvina Stroh
Caren Sturges
Margaret Sturtevant
Meg Swinton and Bella Calderon
James Torson
Timothy and Janet Trask
Robert and Dorothy Troller
Marian Trotter
Leo Tugan-Baranovsky
Joseph Tulchin
Elinore Tushner
John and Frederica Valois
Jack and Uta Valpey
Vera Van Atta

Mathias and Cornelia Van Thiel
Demetrios and Lynn Vardakis
Susan Veeder
Richard and Catherine Viagrande
Phillip and Ellen Viereck
Frances Villiers-Fisher
Al and Jackie Vnencak
Karen Vogt
Arthur and Joanne Voorhis
Jeptha* and Emily Wade
Stephen and Carol Ann Wagner
Esther Walker
Robert Walker
Marian Ware
Virginia Watkinson
Frances Weiffenbach
Robert and Elizabeth Weinstock
Larry Wentworth
Andreas and Denise Wesslerle
Robert and Nettie West
Howard and Dorothy Westley
Ruth Whipple
Stuart and Matilda White
Susan White and Ellen Corcoran
Tamzen White
Joan Wickersham
Susan Wigley
Joanie Wiinblad
Anne Wild
Elizabeth Williams
Robert Williams
Russell and Hope Williams
Jeff Williams
Benjamin and Ann Williamson
Thomas and Dorothy Wilson
Robert and Margaret Wineman

Frederic and Susan Winthrop
Michael and Mindi Wiviott
Eric and Sandra Wolman
David and Julianne Worrell
Erik and Linda Zettler
Michael Zimmermann
Edward and Carol Zuccaro

George M. Woodwell Chair in Conservation

Anonymous
John and Patricia Adams
Adam and Rachel Albright
Duncan and Dorothy Aspinwall
Patricia Bauman and John Bryant
Anita Brewer-Siljeholm
Neal Brown and Judy LaBelle
Gene and Meredith Clapp
Eric Davidson and Jean Talbert
Robert and Iris Fanger
Bennett and Roe Ferguson
Dan and Bunny Gabel
Thomas and Virginia Gregg
Jacques and Mary Harlow
Francis and Serena Hatch
John and Cheryl Holdren
Lily Rice Hsia
Lawrence and Caroline Huntington
Timothy and Joan Ingraham
Jane Holtz Kay
Hamilton and Edith Kean
William and Elizabeth King
Anthony* and Monique Liuzzi
Thomas Lovejoy
Francis and Victoria Lowell
Merloyd Ludington and John Myers
James and Phyllis MacNeill
Wilhelm and Nonie Merck
Charles and Mary Louise Montgomery
Judith Nadai
Foster Nichols
Mike Nichols and Diane Sawyer
Edward and Audrey Noyes
Martin and Joan Person
Nathaniel and Alita Reed

James and Amy Regan
David and Edith Ross
Gordon Russell
Tedd Saunders
Anne Sawyer
Helen Spaulding
Gus and Cameron Speth
Thomas and Judith Stetson
The Donald Sohn Foundation
Thomas and Barbara Tomasi
Barbara Van Dusen
John Woodwell
Ron Zweig and Christina Rawley

Gifts in Honor of

Edward and Marion Adelberg
from Jonathan Aibel and Julie Rohwein

George and Yara Cadwalader
from Benjamin and Ann Williamson

Kelly B. Ellis
from Robert Matthew

Iris Fanger
from Barry and Sylvia Bunshoft
Alan and Elizabeth Green

Joe Hackler
from Kirsten Moritz and Rod Hinkle

John Holdren
from Kirsten Moritz and Rod Hinkle

R.T. Hunt
from Edla F. Cusick

Kira Lawrence
from Charles and Patricia Lawrence
Maridale Ray

Merloyd Ludington
from Bayard and Julie Henry

Maryellen Meleca and Christine Graziano
from Roland and Sheila Place

Barack Obama
from Edla Cusick

Marjorie F. Obrotka
from Richard and Catherine Viagrande

Charles T. Russell
from Anne Wild

Wilson, Cathy, and Colette Snyder
from Alan and Judith Hoffman

Helen Spaulding
from Franklin and Marge Hobbs

Thomas Stone
from Ronald and Carol Beyna

John and Nancy Todd
from Joan Pearlman

Allison White
from Angela Hart Morris

George Woodwell
from Sally Cross
Malcolm Decker and Rosamond Shannon

Iris and Robert Fanger
Jerome and Barbara Fanger
Richard and Constance Giesser
Hamilton and Edith Kean

Jessica Langsam
Dan Martin
Richard and Mary Ellen Williams
Ron Zweig and Christina Rawley

* *deceased*

Gifts in Memory of

Edwin Lee Allen
from Elizabeth Williams

Harry Carey
from Patricia Carey

Scott Case
from Priscilla Case
Russell and Antoinette Pells

Ruth Finch
from Harold Finch and Patricia Robinson

Malcolm Hobbs
from Demetrios and Lynn Vardakis

Frank W. Hoch
from Robert and Karin Hardy

Chris Keller
from Kenneth Keller

Joseph A. Miller
from Frances Miller

Audrey Noyes
from Edward W. Noyes

Caroline C. Olson
from John M. Olson

John E. Rice
from Michael and Daphne Stevens

Joan B. Ross
from Perry Ross

Owen Roth
from Frederick and Barbara McAlpine

Jack Swimmer
from Elinore Tushner

Kate H. Tulchin
from Joseph Tulchin

Andre Wesserle
from Andreas and Denise Wesserle

George Perkins Marsh Society

Born in 1801, George Perkins Marsh was the first to draw attention to the notion that the natural menace to nature was humans themselves. He published his ideas in a book called Man and Nature in 1864, to wide acclaim. Still in print, it continues to influence our vision of the natural world.

The Society, named in his honor, recognizes friends who have elected to partner in the Center's future by supporting the Center through a life income gift, retirement plan, life insurance policy, or bequest. Please let the Development Office know that you have included the Center in your estate plans by calling Kristin Powell at 508 540 9900, ext 121 or by sending an email to kpowell@whrc.org.

Deborah Cernauskas
Margaret Cornman
Robert Downs
Denny Emory
John Eustis
Iris and Robert Fanger
David and Edith Ross
David Hoover and Carol Swenson
Rosalie Talbert
E. Andrew Wilde
George and Katharine Woodwell
Redwood and Mary Wright

Foundations

The Abelow Family Foundation
Adelard A. and Valeda Lea Roy Foundation
ARIA Foundation
The Armand G. Erpf Fund
The Baldwin Foundation Trust
Barakat Foundation
Bartol Charitable Foundation, Inc.
Betsey and Jesse Fink Foundation
Blue Moon Fund
The Boston Foundation
Charlotte and Arthur Zitrin Foundation
Cogan Family Foundation
Combined Jewish Philanthropies
The Community Foundation for
Greater New Haven
Community Foundation of Collier County
The David and Lucile Packard Foundation
Davis Conservation Foundation
Ernst and Elfriede Frank Foundation
Esmond Harmsworth 1997 Charitable
Foundation
Fidelity Investments Charitable Gift Fund
Fiduciary Charitable Foundation
Foundation for the Carolinas
The Goldberg Family Foundation
Golden Family Foundation
Google Foundation
Gordon and Betty Moore Foundation
The Grantham Foundation for the
Protection of the Environment
Gregory C. Carr Foundation
Harken Foundation
The Henry Luce Foundation
IBM International Foundation
Island Foundation, Inc.
The Ives Family Charitable Trust
John D. and Catherine T. MacArthur
Foundation
Korein Foundation
Linden Trust for Conservation
Little Harbor Foundation

Mad River Foundation
Margaret Evans Tuten Foundation
Marvin and Annette Lee Foundation
Mary A. H. Rumsey Foundation
National Environmental Education
and Training Foundation
The New York Community Trust
Normandie Foundation
The Orchard Foundation
The Overbrook Foundation
Pisces Foundation
The Prospect Hill Foundation
Renaissance Charitable Foundation Inc.
Schwab Fund for Charitable Giving
The Seiger Family Foundation
Shawangunk Valley Conservancy
Sheehan Family Foundation
Sidney and Esther Rabb Charitable
Foundation
The Sidney R. Rabb Charitable Trust
Silicon Valley Community Foundation
The Summit Fund of Washington
The Trust for Mutual Understanding
William P. Wharton Trust
The Winslow Foundation
Tinker Foundation
Whalesback Foundation
Wiancko Charitable Foundation
Wichita Falls Area Community Foundation
The William and Flora Hewlett Foundation

Corporations

American International Group, Inc
Becton, Dickinson and Company
The Bunbury Company
ESRI
Garmin
GE Foundation
Goldman Sachs & Company
Google
Johnson and Johnson
Microsoft Matching Gifts Program
Morgan Environmental LLC
New Balance Athletic Shoe, Inc
Sanborn Map Company

Others

Brandeis University
Open Space Institute
Union of Concerned Scientists
Quashnet K-Kids Club
Sea Education Association
Woods Hole Oceanographic Institution

International Agencies

Norwegian Agency for
Development Cooperation
World Bank

United States Agencies

National Aeronautics and Space
Administration
National Oceanic and Atmospheric
Administration
National Science Foundation
U.S. Agency for International Development
U.S. Department of Agriculture
U.S. Department of Energy

Please note:

*This report was prepared with great care,
but if errors have occurred, please contact:*

*Kristin Powell
Development Associate
The Woods Hole Research Center
149 Woods Hole Road
Falmouth, MA 02540-1644
508 540 9900, x121
kpowell@whrc.org*



JANUARY 2010

Much of the discussion surrounding REDD (Reduced Emissions from Deforestation and Forest Degradation) has focused on establishing an effective mechanism for compensating forest peoples for their role in conserving forests. To a large extent, differences in opinion regarding the impact of REDD policies for forest peoples are related to concerns about the security of rights to traditional lands and forests. Building on the successes created in the management strategies for fisheries, Associate Scientist David McGrath and his colleagues are partnering with communities, organizations, and government agencies in the Brazilian Amazon to address central structural issues including secure land tenure, effective forest governance, and availability of viable economic alternatives, all of which are crucial to helping REDD succeed.

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24/31	25	26	27	28	29	30

DECEMBER

S	M	T	W	T	F
		1	2	3	4
6	7	8	9	10	11
13	14	15	16	17	18
20	21	22	23	24	25
27	28	29	30	31	

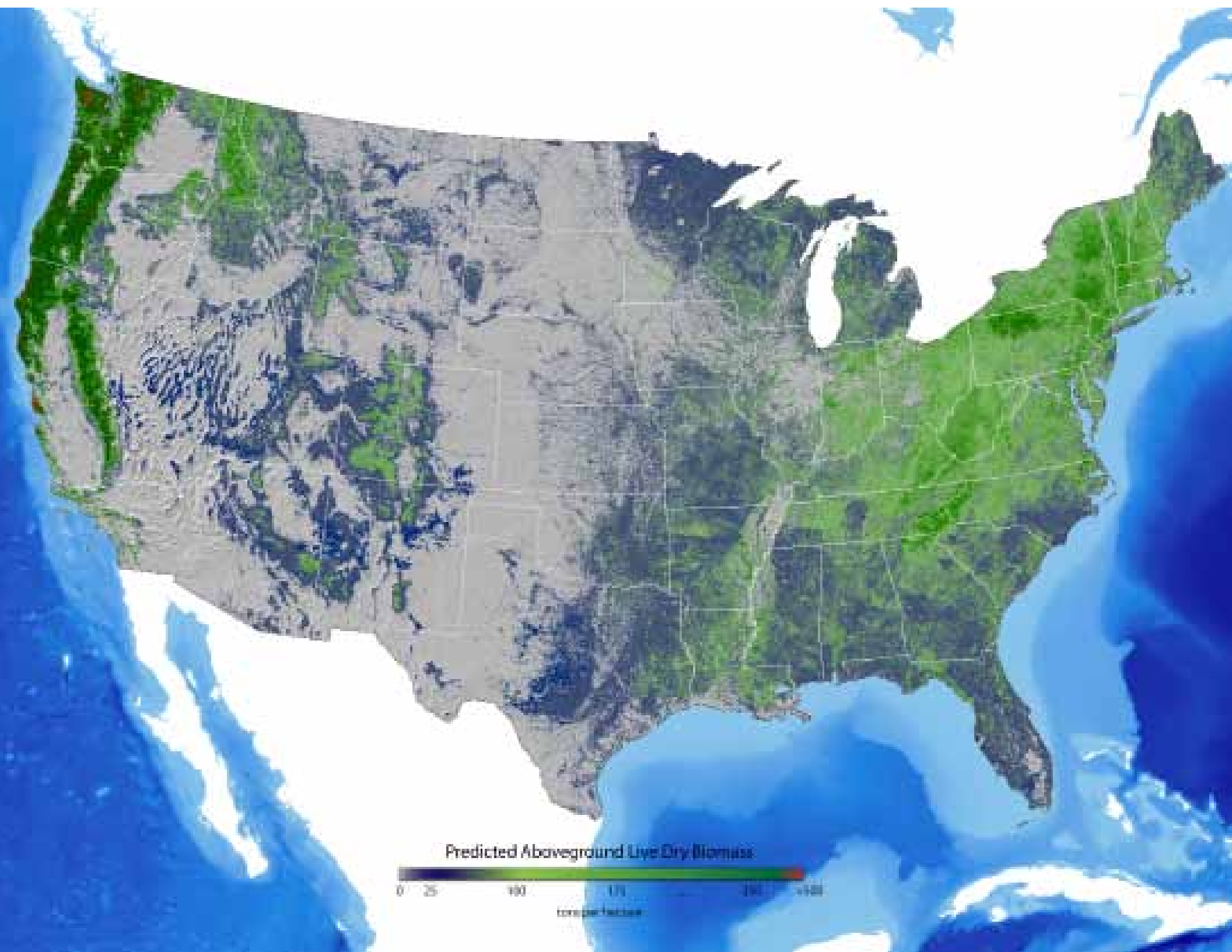
FEBRUARY

S	M	T	W	T	F	S
	1	2	3	4	5	6
	7	8	9	10	11	12
	13	14	15	16	17	18
	19	20	21	22	23	24
	25	26	27	28	29	30



The Woods Hole Research Center
whrc.org

*Above: Smallholder residence, Amazon floodplain.
 Image courtesy of David McGrath*



Predicted Aboveground Live Dry Biomass



FEBRUARY 2010

Under the direction of Associate Scientist Josef Kelldorfer, scientists at the Woods Hole Research Center have completed the production of the “National Biomass and Carbon Dataset for the Year 2000” (NBCD2000), the first ever spatially explicit inventory at high-resolution scale (30 m). The dataset provides a year-2000 estimate of basal area-weighted canopy height, aboveground live dry biomass, and standing carbon stock for the conterminous United States. NBCD 2000 was produced in collaboration with the U.S. Department of Agriculture Forest Service’s Forest Inventory and Analysis (FIA) program, and funded under NASA’s Terrestrial Ecology Program with additional support from the Landscape Fire and Resource Management Planning Tools Project (LANDFIRE).

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28						



The Woods Hole Research Center
whrc.org

S	M	T	W	T	F	S	S	M	T	W	T	F	S	
		JANUARY				1	2	1	MARCH				5	6
3	4	5	6	7	8	9	7	8	9	10	11	12	13	
10	11	12	13	14	15	16	14	15	16	17	18	19	20	
17	18	19	20	21	22	23	21	22	23	24	25	26	27	
24/31	25	26	27	28	29	30	28	29	30	31				

Above: Map produced by Josef Kelldorfer, Wayne Walker, Katie Kirsch, Jesse Bishop, Greg Fiske, and Liz LaPointe.



MARCH 2010

Central Africa has the second largest unfragmented block of tropical rain forest remaining in the world, making it one of the largest reservoirs for carbon and biodiversity. These forest stocks are threatened by deforestation and degradation, pressures that are due in large part to logging practices that are not well-managed or sustainable. In combination with population growth and economic needs of developing nations, the region is poised to undergo extensive land use change. Center scientists are using remote sensing technologies coupled with on-the-ground fieldwork to map and monitor habitat alteration, support biodiversity conservation, and promote better land use planning and forest management in this crucial region of the world.

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

S	M	T	W	T	F	S	S	M	T	W	T	F	S
	1	2	3	4	5	6		4	5	6	7	8	9
7	8	9	10	11	12	13	4	5	6	7	8	9	10
14	15	16	17	18	19	20	11	12	13	14	15	16	17
21	22	23	24	25	26	27	18	19	20	21	22	23	24
28							25	26	27	28	29	30	



The Woods Hole Research Center
whrc.org

Above: Emergent canopy tree, Budongo Forest Reserve, Uganda. Photo courtesy of Wayne Walker.



APRIL 2010

Center scientists and researchers working in the Brazilian Amazon are addressing one of the world's greatest conservation challenges. This vast equatorial ecosystem is home to nearly one fifth of the planet's plant and animal species, more than 200 indigenous cultures, and 30 million people in search of sustenance and wealth. Carbon stocks equivalent to more than a decade of global fossil fuel emissions are stored in the wood of its trees. The forest also releases enough water to the atmosphere via evapotranspiration and to the ocean via river outflow to influence world climate and ocean circulation systems; and in doing so it also sustains the regional climate on which it depends. Through studies on riparian restoration, drought, flood, deforestation and savannization trends, sustainable livelihoods, and other areas, a broad and thorough understanding of this key system how this key ecosystem functions and how it is being modified by human action.

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

S	M	T	W	T	F	S	S	M	T	W	T	F	S
	1	2	3	4	5	6							1
7	8	9	10	11	12	13	2	3	4	5	6	7	8
14	15	16	17	18	19	20	9	10	11	12	13	14	15
21	22	23	24	25	26	27	16	17	18	19	20	21	22
28	29	30	31				23/30	24/31	25	26	27	28	29



The Woods Hole Research Center
whrc.org

Above: Record Flooding along the Tapajós River, Santarém, Brazil, May 2009. Image courtesy of David McGrath.



MAY 2010

An integral component of the work underway at the Woods Hole Research Center is the transfer of knowledge and skills to representatives of tropical nations, equipping them to engage more fully in international efforts to slow deforestation and enabling them to better evaluate alternative forest management options. Through capacity building initiatives as part of the pantropical mapping project and through the Center's work with the Forum on Readiness for REDD, a series of workshops in locations throughout South America, Africa, and Asia are bringing together stakeholders. The first of these were held in 2009 and will continue into 2011. In addition, workshops and seminars will be held at the Center to share information on both field and remote sensing techniques.

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23/30	24/31	25	26	27	28	29

S	M	T	W	T	F	S	S	M	T	W	T	F	S
		APRIL							JUNE				
		1	2	3	4	5			1	2	3	4	5
4	5	6	7	8	9	10	6	7	8	9	10	11	12
11	12	13	14	15	16	17	13	14	15	16	17	18	19
18	19	20	21	22	23	24	20	21	22	23	24	25	26
25	26	27	28	29	30		27	28	29	30			



The Woods Hole Research Center
whrc.org

*Above: Deforestation and fire, Bolivia.
 Image courtesy of Tina Cormier.*



JUNE 2010

Deforestation in Brazil, driven in part by increased global and regional demand for food crops and bio-fuels, leads to many ecological consequences. Tropical forests, with deep roots and dense dark green canopies, capture a large amount of incoming sunlight for photosynthesis and, in the process, evaporate water. The large amount of water vapor that is pumped into the atmosphere provides one-third to one-half of the water that returns to the ground as rainfall. Replacing that forest with grasses and crops greatly reduces the amount of water cycled between land and atmosphere and has complex impacts for regional climate and stream flow, potentially altering the pattern of where and how much rain falls over the Amazon. Center projects led by Associate Scientist Michael T. Coe are addressing the complex way in which deforestation affects the water balance of even large river systems, thus providing a more comprehensive understanding of how human activities are altering these key ecosystems.

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

S	M	T	W	T	F	S	S	M	T	W	T	F	S	
						1						1	2	3
2	3	4	5	6	7	8	4	5	6	7	8	9	10	
9	10	11	12	13	14	15	11	12	13	14	15	16	17	
16	17	18	19	20	21	22	18	19	20	21	22	23	24	
23/30	24/31	25	26	27	28	29	25	26	27	28	29	30	31	



The Woods Hole Research Center
whrc.org

*Above: Rain over soy fields, Mato Grosso, Brazil
 Image courtesy of Michael T. Coe*



JULY 2010

In the Arctic, vast amounts of carbon are locked up in permafrost (“permanently” frozen soil). Though plant growth rates are low, frigid temperatures result in even slower decomposition rates, leading to massive accumulations of organic carbon that is thousands of years old. As the earth warms due to increasing greenhouse gas concentrations in the atmosphere, permafrost is beginning to thaw, and the ancient carbon it contains is beginning to rot. This rotting, or decomposition, produces carbon dioxide and methane, both powerful greenhouse gases that lead to more warming. Senior Scientist R. Max Holmes is investigating this positive feedback — warming causes permafrost thaw, which produces more greenhouse gases, which causes more warming, and so on — illustrating why it is essential to keep the carbon in the ground.

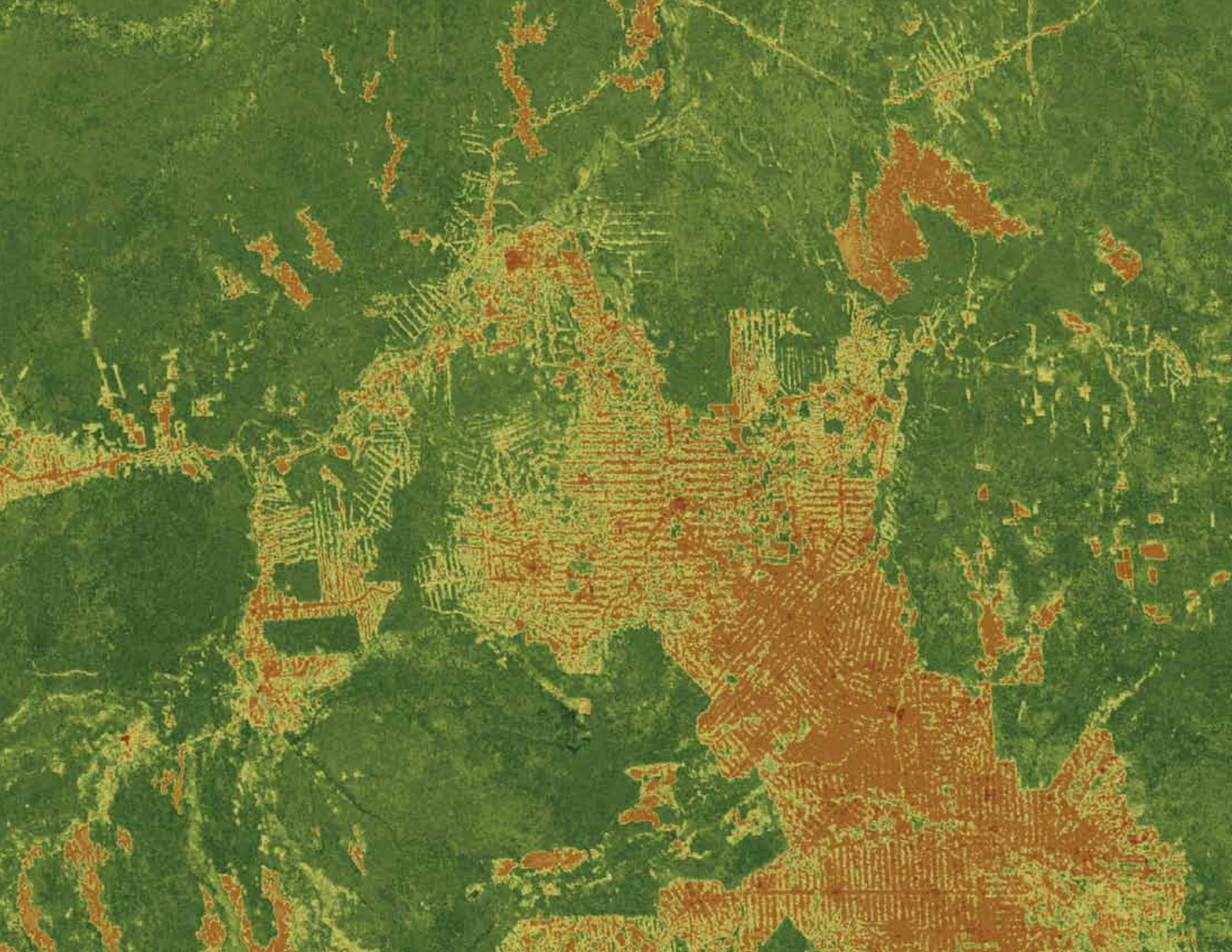
SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

S	M	T	W	T	F	S	S	M	T	W	T	F	S
		1	2	3	4	5	1	2	3	4	5	6	7
6	7	8	9	10	11	12	8	9	10	11	12	13	14
13	14	15	16	17	18	19	15	16	17	18	19	20	21
20	21	22	23	24	25	26	22	23	24	25	26	27	28
27	28	29	30				29	30	31				



The Woods Hole Research Center
whrc.org

*Above: Eroding permafrost cliff along the Kolyma River, Duvanyi Yar, Near Cherskiy, Siberia
Image © Chris Linder*



AUGUST 2010

The ability to estimate the distribution and total amount of carbon stored in woody biomass across the tropics is key to compensation mechanisms for REDD. Because systematic surveys are sparse, plot-level measurements of biomass density (thus carbon) are extended to large areas using a variety of methods including classification of land cover types, calculation of biomass density from regressions based on gridded environmental variables such as mean annual temperature and precipitation, and determination of relationships between in situ biomass density and remote sensing characteristics that can be consistently mapped over large regions. Maps derived using the latter approach are a substantial departure from the other more traditional methods, and have the advantage of providing robust, spatially consistent and continuous values of the magnitude (amount) of carbon stock at any given location. Assistant Scientist Alessandro Baccini and others at the Center are developing these products, thereby also providing a basis for monitoring stock changes through time.

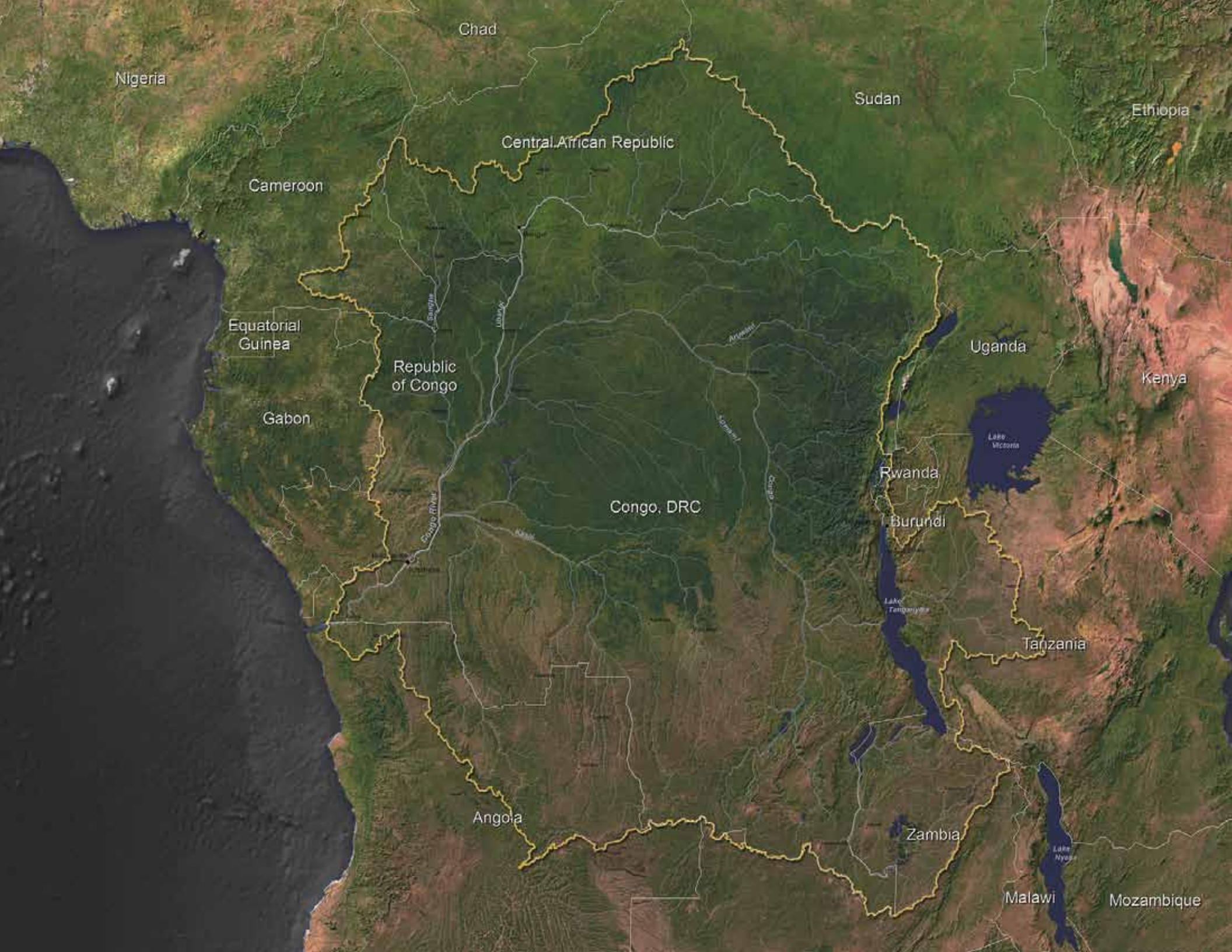
SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				



The Woods Hole Research Center
whrc.org

JULY						SEPTEMBER							
S	M	T	W	T	F	S	S	M	T	W	T	F	S
				1	2	3				1	2	3	4
4	5	6	7	8	9	10	5	6	7	8	9	10	11
11	12	13	14	15	16	17	12	13	14	15	16	17	18
18	19	20	21	22	23	24	19	20	21	22	23	24	25
25	26	27	28	29	30	31	26	27	28	29	30		

Above: From the first pantropical map of forest carbon derived from satellite (GLAS and MODIS) data sets, combined with coordinated field measurements, an image focused on the western Amazon Basin. Deforestation (herringbone road pattern) is visible in the map.



Nigeria

Chad

Sudan

Ethiopia

Central African Republic

Cameroon

Equatorial
Guinea

Republic
of Congo

Gabon

Congo, DRC

Uganda

Kenya

Rwanda

Burundi

Tanzania

Angola

Zambia

Malawi

Mozambique

SEPTEMBER 2010

A new initiative at the Woods Hole Research Center will characterize the sources, pathways and timescales of riverine export of carbon from land to the ocean. The project, known as the Global Rivers Project, will conduct studies on the Congo, Yangtze, Brahmaputra, Ganges, Lena, Kolyma, and Frazer Rivers. Such a holistic approach to river basin studies is urgently needed to assess the surficial organic carbon subcycle that connects – via rivers - terrestrial primary productivity with long-term carbon sinks in the ocean. In collaboration with the Woods Hole Oceanographic Institution and colleagues around the world, this study will yield a unique dataset, and serve as a benchmark for future studies aimed at tracking the impact of environmental change on carbon transport from land to the oceans.

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		



The Woods Hole Research Center
whrc.org

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

S	M	T	W	T	F	S
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24/31	25	26	27	28	29	30

Above: Image composition and cartography by Greg Fiske. Components include ESRI's MODIS composite (NASA - Visible Earth), WWF's Hydrosheds elevation and stream network data, and the National Parks service Natural Earth relief data.



OCTOBER 2010

Few things better illustrate the changes that have occurred in rural New England over the last three centuries than a stonewall in the forest. One hundred and seventy years ago, almost all of New England, except Maine, was cleared to provide farmland, pasture, and fuel wood to homes. Because the region's better soils had been largely scraped off during the last glaciation, an abundance of rocks and boulders were left to be piled to the side by farmers. When railroads and the opening of the Midwest in the middle of the 19th century led to large-scale abandonment of fields and farms, the ensuing recovery of the forest began. Senior Research Associate Thomas Stone and others at the Center study land use and land use change as a means to understanding ecosystems and ecosystem services. Recently, forest loss has resumed in New England, due to widespread residential and commercial development.

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24/31	25	26	27	28	29	30

S

SEPTEMBER

S	M	T	W	T	F
			1	2	3
5	6	7	8	9	10
12	13	14	15	16	17
19	20	21	22	23	24
26	27	28	29	30	

S

NOVEMBER

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				



The Woods Hole Research Center
whrc.org

Above: A crumbling stone wall at the Harvard Forest in Petersham, Massachusetts. Image courtesy of Kathleen Savage.



NOVEMBER 2010

As a result of human activities during the last 150 years, the amount of nitrogen that is made usable for living creatures each year has nearly doubled. Two positive outcomes are made possible by this increase: food and energy production. While positive outcomes of increased nitrogen include a high capacity for food production enabled by the use of fertilizers that support expanded agriculture, many regions of the world are now grappling with the significant problems of nitrogen excesses. In coastal regions, these problems often include coast eutrophication, or algal blooms, which can destroy healthy eel grass habitat and cause fish die-off. At the same time, other regions, such as sub-Saharan Africa, still have access to too little affordable nitrogen fertilizer, resulting in the inability for local agriculture to adequately provide for human nutrition. Senior Scientist Eric Davidson and others at the Center are leading studies of the nitrogen cycle and its many impacts.

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

S M T W T F

		1			
3	4	5	6	7	8
10	11	12	13	14	15
17	18	19	20	21	22
24/31	25	26	27	28	29

S M T W T F

5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	



The Woods Hole Research Center

whrc.org

Above: An eelgrass bed that is susceptible to pollution of excess nitrogen, Cape Cod, Massachusetts. Image courtesy of Thomas Stone.



DECEMBER 2010

High latitudes have experienced systematically greater warming in the last decades than the rest of our planet. Senior Scientist Scott Goetz and his team are addressing how this affects and interacts with terrestrial ecosystems, both in the arctic tundra, which is characterized by an absence of trees, and in the boreal forest, which is the largest forest biome in the world. A legacy of low temperatures have built both in the arctic tundra and the boreal forest; stocks of soil carbon in permafrost and peatland are increasingly volatilizing in the form of greenhouse gasses as a warmer climate promotes soil microbial activity. Simultaneously, the change in climate promotes shifts in vegetation composition, by relieving temperature limitations on productivity in the coldest areas of the arctic and by introducing drought-stress in the warmer areas of the arctic. The biome-wide adaptation to an altered climate comes in addition to a marked intensification of the disturbance regime, with the frequency and extent of both fire and insect attacks on the rise. All of these changes impact wildlife, such as caribou, and subsequently the native people who rely on them.

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

S

M	T	W	T	F
1	2	3	4	5
7	8	9	10	11
14	15	16	17	18
21	22	23	24	25
28	29	30		

S

S	M	T	W	T	F	S
6						1
13	2	3	4	5	6	7
20	9	10	11	12	13	14
27	16	17	18	19	20	21
	23/30	24/31	25	26	27	28



The Woods Hole Research Center
whrc.org

*Above: Caribou climb a ridge
near Toolik Lake Field Station, Alaska.
Image courtesy of Michael Loranty.*



A special thanks to Connie Johnson, Kristin Powell, and Allison White for their eagle-eye proofreading abilities and to Diane Quaid for her keen photographic skills.



The Woods Hole Research Center

149 Woods Hole Road
Falmouth, MA 02540-1644

Telephone 508.540.9900
Telefax 508.540.9700
info@whrc.org
www.whrc.org

Cover Image

View of the Woods Hole Research Center's Gilman Ordway Campus, including the George M. Woodwell Building and the new 100 kw wind turbine.

Photo by

Diane Quaid
Manager, System Administration

The Woods Hole Research Center
uses recycled paper and vegetable-based inks.

A true thing of beauty

As I pedal home along the path before night
I look to the left and see with delight
Three blades spinning freely atop a sleek mount
A true thing of beauty by my account
This sight brings me hope that our world can change
May its beauty have a far-reaching range
Encouraging others to do what they can
For we all have a role and must act on our plan
Three cheers to the Center* for doing their bit
Collectively we can make the world fit.

**Woods Hole Research Center*

S. E. Wigley
Falmouth
October 2009