

CARBON CYCLE SCIENCE

NRA 04-OES-01

**NASA EARTH SCIENCE ENTERPRISE
NASA Headquarters**

**OFFICE OF BIOLOGICAL AND ENVIRONMENTAL RESEARCH
OFFICE OF SCIENCE
U.S. DEPARTMENT OF ENERGY**

**COOPERATIVE STATE RESEARCH, EDUCATION, AND EXTENSION
SERVICE
U.S. DEPARTMENT OF AGRICULTURE**

This NASA Research Announcement (NRA) in partnership with the U.S. Department of Energy's Office of Biological and Environmental Research and with the U.S. Department of Agriculture Cooperative State Research, Education, and Extension Service offered opportunities for research to improve our understanding of changes in the distribution and cycling of carbon among the active land, ocean, and atmospheric reservoirs with emphasis on the factors that affect changes in atmospheric carbon dioxide concentrations and the impact of such changes on carbon management. NASA, DOE, and USDA carbon cycle research contributes toward the goals of the U.S. Climate Change Science Program (CCSP) and of the U.S. Climate Change Technology Program (CCTP) by providing critical scientific information about the movement of carbon in the environment and potential near- and long-term changes in the carbon cycle, including the role of and implications for societal actions. U.S. carbon cycle research addresses two broad questions:

- How large and variable are the dynamic reservoirs and fluxes of carbon within the Earth system, and how might carbon cycling change and be managed in future years, decades, and centuries?
- What are our options for managing carbon sources and sinks to achieve an appropriate balance of risk, cost, and benefit to society?

The NRA solicited research proposals in four topical areas: (1) studies to be conducted as part of the North American Carbon Program (NACP), (2) global carbon cycle modeling and analysis focusing on use of remote sensing data, (3) regional studies outside of North America that provide critical understanding of and offer to reduce major uncertainties

about the global carbon cycle, and (4) carbon management. NASA, USDA, and DOE participate in the North American Carbon Program, and in this solicitation, the agencies emphasized NACP goals to:

- Develop quantitative scientific knowledge, robust observations, and models to determine the emissions and uptake of CO₂, CH₄, and CO, changes in carbon stocks, and the factors regulating these processes for North America and adjacent ocean basins.
- Develop the scientific basis to implement full carbon accounting on regional and continental scales. This is the knowledge base needed to design monitoring programs for natural and managed CO₂ sinks and emissions of CH₄.
- Support long-term quantitative measurements of fluxes, sources, and sinks of atmospheric CO₂ and CH₄, and develop forecasts for future trends.

The specific topics and questions addressed by NRA 04-OES-01 are available at:
http://research.hq.nasa.gov/code_y/nra/current/NRA-04-OES-01/index.html.

In partnership with DOE and USDA, NASA selected 59 of 301 proposals responding to this NRA. The agency or agencies responsible for funding are indicated.

Aiken, Jim Plymouth Marine Laboratory, Plymouth, UK

Observation of Air-Sea Interactions & Fluxes of Carbon

Arrigo, Kevin Stanford University

Primary Production and Air-Sea CO₂ Exchange in the Northern Polar Seas
(NASA)

Asner, Gregory Carnegie Institute of Washington

Regional Carbon Storage Responses to Woody Encroachment in Western Pinyon-Juniper Systems (NASA)

Barrett, Damian CSIRO Co-Operative Research Center for Greenhouse Accounting, Canberra, Australia.

Carbon Dynamics of Tropical Savannas: Integrating Remote Sensing and Ground-Based Observations through Model-Data Assimilation

Behrenfeld, Michael NASA Goddard Space Flight Center

Ocean Productivity from Satellite-Derived Phytoplankton Physiology and Carbon Biomass (NASA)

Behrenfeld, Michael NASA Goddard Space Flight Center

The Equatorial Box Project (NASA)

Bennartz, Ralf University of Wisconsin

CO₂ Column Amount Over Clouds Using the Orbiting Carbon Observatory (NASA)

Birdsey, Richard USDA Forest Service

Linking Landscape-Scale Carbon Monitoring with Forest Management (NASA)

Bolstad, Paul University of Minnesota

Testing the Flux Tower Upscaling Hypothesis at a Regional Scale in a Complex Landscape (NASA)

Bowling, David University of Utah

Long-Term Assessment of Isotopic Exchange of Carbon Dioxide in a Subalpine Forest (Niwot Ridge AmeriFlux site) (DOE)

Conard, Susan USDA Forest Service

Wildfire Impacts on Carbon Stocks and Exchanges in Forests of Central Siberia: Quantifying Effects of Fire Intensity, Fire Severity, and Burning Conditions (NASA)

Curran, Lisa Yale University

Effects of Logging, Plantation Conversion, Biomass Burning and Regrowth on Carbon Dynamics in Bornean Peat and Diptocarp Forests: Implications for Global Carbon Cycle (NASA)

DeFries, Ruth University of Maryland, College Park

Reducing Uncertainties of Carbon Emissions from Land Use-Related Fires with MODIS Data: From Local to Global Scale (NASA)

Denning, Scott Colorado State University

Mesoscale Carbon Data Assimilation for NACP (NASA)

Doney, Scott Woods Hole Oceanographic Institution

Hindcasting Seasonal to Interannual Variability in Air-sea CO₂ Flux for the North American Carbon Project (NASA)

Doraiswamy, Paul USDA Agricultural Research Service

Decision Support Systems for Carbon Management Across the U.S. Corn Belt Using NASA Remote Sensing Data Products (NASA)

Eluskiewicz, Janusz Atmospheric and Environmental Research Inc.

Estimating Carbon Budget for North America Using Satellite and In Situ Data (NASA)

Fung, Inez University of California, Berkeley

Towards Detection and Attribution of North American Carbon Sources and Sinks by Synthesis of In-Situ FluxNet and CO₂ Observations and Satellite Observations in Coupled Carbon-Climate Models (NASA)

Goulden, Michael University of California, Irvine

Mechanisms Controlling Annual, Interannual, and Decadal Changes in California's Carbon Budget (NASA)

Goward, Samuel University of Maryland, College Park

North American Forest Disturbance and Regrowth since 1972: Empirical Assessment with Field Measurements and Satellite Remotely Sensing Observations. (NASA)

Gurney, Kevin Colorado State University

High-Resolution Fossil Fuel Emission Estimates in Support of NACP CO₂ Measurements and Assimilation System (NASA, DOE)

Hales, Burke Oregon State University

Development of Algorithms for Prediction of Coastal CO₂ Air-Sea Fluxes Using Remote Sensing (NASA)

Hao, Wei Min USDA Forest Service

Daily, Weekly, Seasonal and Interannual Variability of CO₂, CO and CH₄ Emissions from Biomass Burning in North America and Their Impact on Atmospheric Chemical Composition (NASA)

Kasischke, Eric University of Maryland, College Park

Wildfire Consumption of Ground-Layer Organic Matter in North American Boreal Forests and Peatlands: Implications for Atmospheric Trace Gas Emissions and Long-Term Soil Carbon Storage (NASA)

Kawa, Stephan NASA Goddard Space Flight Center

Constraining the CO₂ Missing Sink (NASA)

Kellendorfer, Josef University of Michigan

The National Biomass and Carbon Dataset 2000: A High Spatial Resolution Baseline to Reduce Uncertainty in Carbon Accounting and Flux Modeling (NASA)

King, Anthony Oak Ridge National Laboratory

Linking Remote Sensing with the Ecology of Forest Succession in Regional Carbon Cycle Modeling (USDA)

Kolb, Thomas Northern Arizona University

Carbon Dioxide And Methane Fluxes In Disturbed Southwestern Ponderosa Pine Forests (USDA)

Law, Beverly Oregon State University

Synthesis of Remote Sensing and Field Observations to Model and Understand Disturbance and Climate Effects on the Carbon Balance of Oregon and N California (DOE)

Laporte, Nadine Woods Hole Research Center

Forest Biomass and Land-Use Change in Central Africa: Reducing Regional Carbon Cycle Uncertainty (NASA)

Lettenmaier, Dennis University of Washington

Diagnosis and Prognosis of Changes in Lake and Wetland Extent on the Regional Carbon Balance of Northern Eurasia (NASA)

Liang, Shunlin University of Maryland, College Park

Mapping High-Resolution Incident Photosynthetically Active Radiation Product for the North American Carbon Program (NASA)

Li, Changsheng University of New Hampshire

Quantifying CO₂ Fluxes from Boreal Forests in Northern Eurasia: An Integrated Analysis of Flux Tower Data, Remote Sensing Data and Biogeochemical Modeling (NASA)

Lohrenz, Steven University of Southern Mississippi

Satellite Assessments of Regional pCO₂ Distributions and Air-Sea Fluxes of Carbon Dioxide in a River-Dominated Margin (NASA)

Matrai, Patricia Bigelow Laboratory for Ocean Science

Organic Matter Metabolism in a Coastal Ocean Ecosystem (NASA)

McGillicuddy, Dennis Woods Hole Oceanographic Institution

A Regional Eddy-Resolving Carbon Cycle Model Surrounding the Bermuda Atlantic Time-Series Study (BATS) Site: Analysis of Remotely Sensed and In Situ Observations (NASA)

McKinley, Galen University of Wisconsin

Air-Sea CO₂ Flux Variability in the North Atlantic: Estimating Magnitudes, Understanding Mechanisms (NASA)

Middleton, Elizabeth NASA Goddard Space Flight Center

Direct Satellite Inference of Ecosystem Light Use Efficiency for Carbon Exchange Using MODIS on Terra and Aqua (NASA)

Nelson, Ross NASA Goddard Space Flight Center

A Realistic Analysis of the Variability of Carbon Estimates Using Airborne and Space LiDAR (NASA)

Ogle, Stephen Colorado State University

CO₂ Fluxes Between Agricultural Lands and the Atmosphere: Towards More Complete Accounting by Integrating Remote Sensing with Simulation Modeling (USDA, NASA)

Ojima, Dennis Colorado State University

Northern Eurasian C-Land Use Climate Interaction in the Semi-Arid Regions (NASA)

Ollinger, Scott University of New Hampshire

Scaling and Evaluation of Ecosystem Carbon Uptake Through Integration of Multi-Scale Remote Sensing with AmeriFLUX and NACP Field Observations for the Studies of Earth, Oceans and Space (NASA)

Qi, Jianguo Michigan State University

Land Use and Land Cover Dynamics of China in Support of GOFCC/GOLD and NEESPI Sciences (NASA)

Rahman, Abdullah Ball State University

Using MODIS Ocean Bands to Augment Direct Satellite Estimation of Terrestrial Carbon Flux: A Novel Approach (NASA)

Rinsland, Curtis NASA Langley Research Center

CO₂, CH₄, and CO Retrievals from Simultaneous Atmospheric Chemistry Experiment High Resolution Solar Occultation Spectra (NASA)

Roberts, Dar University of California, Santa Barbara

Multi-Site Integration of LIDAR and Hyperspectral Data for Improved Estimation of Carbon Stocks and Exchange (NASA)

Schmid, Hans Peter Indiana University

Scaling up of Carbon Exchange Dynamics from AmeriFlux Sites to a Super-Region in the Eastern United States (DOE)

Shugart, Herman University of Virginia

Modeling the Carbon Dynamics of the Eurasian Boreal Forest (NASA)

Smith, Steven Pacific Northwest National Laboratory

Projections of Land-Use Change and the Carbon-Cycle Atmospheric and Policy Consequences (NASA)

Subramaniam, Ajit Lamont Doherty Earth Observatory

Mapping Dissolved Organic Carbon in Eastern U.S. Coastal Waters Using Ocean Color Satellite Data (NASA)

Sun, Guoqing University of Maryland, College Park

Comparative Studies on Carbon Dynamics in Disturbed Forest Ecosystems: Eastern Russia and Northeastern China (NASA)

Townsend, Phillip University of Maryland

Effects of Insect Defoliation on Regional Carbon Dynamics of Forests (NASA)

Tubiello, Francesco NASA Goddard Institute for Space Studies

Carbon, Climate and Managed Land in Ukraine: Integrating Data and Models of Land Use for NEESPI (NASA)

Tucker, Compton NASA Goddard Space Flight Center

Identifying and Understanding Carbon Cycle Implications of North American Natural and Anthropogenic Disturbances: 1982-2005 (NASA)

Wang, Xiujun University of Maryland, College Park

Seasonal to Decadal Variations of the Oceanic $p\text{CO}_2$ and Air-Sea Flux of CO_2 in the Equatorial Pacific (NASA)

Wennberg, Paul California Institute of Technology

Integrated Measurement and Modeling of Remotely-Sensed, Vertical Column-Averaged Mixing Ratios of CO_2 , CO , and CH_4 (NASA)

West, Tristram Oak Ridge National Laboratory

Development of a Framework and Modeling Tool for Spatially-Explicit Full Carbon and Greenhouse Gas Accounting at the Regional to National Scale: Estimating Net C-Equivalent Flux from U.S. Agriculture (NASA)

Williamson, Derek University of Alabama

Assessment of Meteorological, Seasonal, and Land Management Influences on Spatial Representativeness and Ecosystem-Level Scaling of Tower-Based CO_2 Fluxes Using the UA Sky Arrow ERA Aircraft, University of Alabama Civil and Environmental Engineering (DOE)

Woodcock, Curtis Boston University

Quantifying the Effects of Land Use Change on Carbon Budgets in the Black Sea Region and China (NASA)