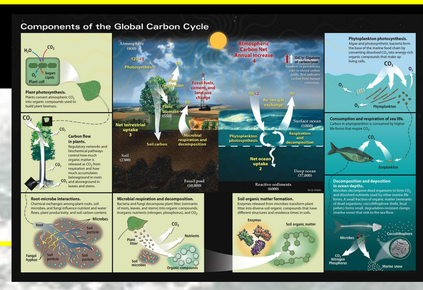
Coordinated carbon cycle research: achievements & opportunities for innovation

https://www.CarbonCycleScience.us

CCIWG discussing research coordination



The U.S. Carbon Cycle Science Program

The U.S. Carbon Cycle Science Program, in consultation with the Carbon Cycle Interagency Working Group (CCIWG), coordinates and facilitates activities relevant to carbon cycle science, climate and global change issues under the auspices of the U.S. Global Change Research Program (USGCRP) Interagency Committee or USGCRP Principals.

MISSION

To coordinate and facilitate federally funded carbon cycle research, and provide leadership to the USGCRP on carbon cycle science priorities.

What do we do?

Promote interagency cooperation and coordination;

Help secure funding, prepare individual & joint agency initiatives & solicitations; and

Involve the scientific community in providing the needed science to understand the carbon cycle.

Current & Emerging Themes of Interest

1- Carbon-critical systems – high latitude oceans and ecosystems, tropics, urban, terrestrial-aquatic interfaces, agriculture
2- Land use change and disturbance carbon
3- Subsurface/microbial/biogeochemistry of carbon
4- Carbon monitoring analysis incl. oil and gas lifecycles

To consider in near Future: Opportunities for Innovation

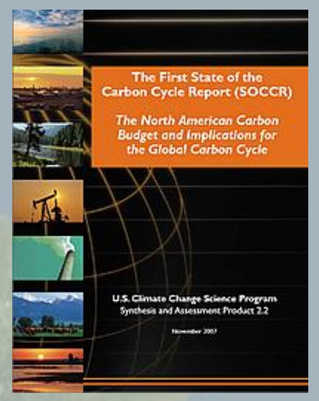
1- Emerging CCIWG/US Carbon Program Urban Initiative
2- Emerging second special Carbon Report (SOCCR-2) after 2007 SOCCR
3- Potential CCIWG/US Carbon Program Carbon Data Center/interface and workshop
4- Potential CCIWG/US Carbon Program Carbon in High Latitude (CIHL) Program

Major Programs, Activities & Achievements (in addition to funding programs by individual agencies)

A Core Element of the U.S. Global Change Research Program
North American Carbon Program
Continental Carbon Budgets, Dynamics, Processes, and Management

CarboNA — An international collaboration between Canada, Mexico, and the United States for carbon cycle science research throughout North America and adjacent ocean regions.

OCB Ocean Carbon & Biogeochemistry



United States Global Change Research Program → Different interagency working groups (IWGs)

U.S. Government level partnership

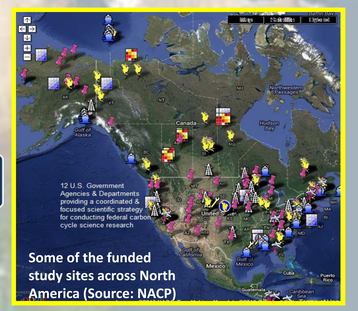
- Carbon Cycle Science Interagency Working Group (CCIWG)
- US Carbon Cycle Science Program http://www.carboncyclescience.gov

Programs/ activities with scientific community

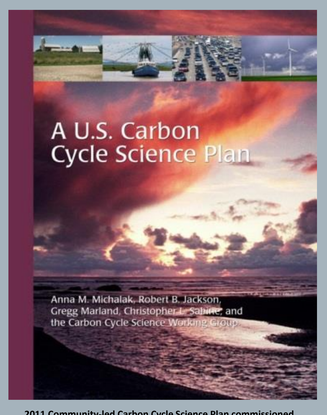
- North American Carbon Program (NACP)
- NACP SSG
- Carbon Cycle Science Steering Group (CCSSG)
- Ocean Carbon & Biogeochemistry (OCB)
- OCB SSG

International partnerships

- Global Carbon Project — 'Future Earth' Component
- CarboNA — U.S., Mexico, Canada government level



Examples of 2013-2015 Coordinated Interagency Activities, with Coordinated Output	USGCRP Goal(s) Supported
Urban Carbon and Human Interactions (2013 -): First attempt at building and socializing an interdisciplinary research community of social and natural scientists in urban carbon human-interactions and decision-making feedbacks. See: International Workshop Summary, Papers for special thematic set and a Coordinated Urban Initiative	All 4 goals: Advance Science; Conduct Sustained Assessments; Inform Decisions; Communicate and Educate
Coastal Carbon Synthesis (2007-): Culminating activity of a North American coastal carbon budgeting effort of OCB Program and the NACP: included quantifying carbon budgets for North American gaps in sources, sinks, and fluxes; Science Plan for the North American Coastal Carbon Budget. See: Synthesis Workshop Summary and Presentations. Science Plan (in prep)	
4th Biennial North American Carbon Program (NACP) All Investigators' Meeting (2013) to review progress in understanding the dynamics of the carbon cycle of North America and adjacent oceans and to chart a course for a more integrative and holistic approach to future research. See: Summary of 4th NACP Regional meeting; -Data Management Workshop; "Progress and Future Directions in North American Carbon Cycle Science" Paper	
5th North American Carbon Program Principal Investigators Meeting (NACP PIM5) (2015) to support ongoing collaborations, coordination, and information sharing among federal and community scientists from Mexico, Canada, U.S. - Workshop on Multi-scale Synthesis and - Terrestrial Model Intercomparison Project (MsTMIP); - Data Management Workshop. See Call for abstracts.	
Interagency Carbon Cycle Solicitation (2013-) : Improve the understanding of changes in the distribution and cycling of carbon among the active land, ocean, and atmospheric reservoirs, to establish a scientific foundation for societal responses to global environmental change. Solicitation led by NASA with participation by DOE, USDA, NOAA members of CCIWG; 41 awards made.	3 goals: Advance Science; Conduct Sustained Assessments; Inform Decisions
Uncertainties in Representations of the Carbon Cycle in Earth System Models (2013) to develop a multi-disciplinary approach to global carbon cycle science by integrating knowledge from both land and ocean communities. Workshop with USDA, NCAR, US CLIVAR, NSF, OCB. Carbon-Climate Uncertainties Paper.	
Workshops on (1) Observations to foster the development of an Inter-Agency Carbon Monitoring System and a Global Carbon Monitoring System (2)Land Sector Carbon for history, projections and influence of history on projections of LULCC carbon; improving measurements (3) Carbon Cycle Management & Predictions to identify gaps in informing carbon cycle management and decisions.	
Multi-Scale Studies of CO2 and CH4 Emissions in Arctic Ecosystems: DOE Next-Generation Ecosystem Experiments (NGEE Arctic) ground-based CO_2 and CH_4 measurements comparison against airborne CO_2, CH_4, and ozone measurements from NASA Carbon in Arctic Reservoirs Vulnerability Experiment (CARVE) - Second State of the Carbon Cycle Report (SOCCR-2) (2015-2017) (Currently internal scoping/deliberative phase) – will be Input to Fourth National Climate Assessment - Urban Initiative (Currently internal scoping/deliberative phase) - See above for preliminary products.	



2011 Community-led Carbon Cycle Science Plan commissioned and accepted by US Carbon Cycle Science Program

Carbon Science Goals for the next Decade (2011-2021)

(1) Provide clear & timely explanation of **past & current variations** observed in atmospheric CO_2 & CH_4 & the **uncertainties** surrounding them;

(2) Understand & quantify the **socioeconomic drivers of carbon emissions**, & **develop transparent methods to monitor & verify those emissions**;

(3) Determine & evaluate the **vulnerability of carbon stocks & flow**s to future climate change **& human activities**, emphasizing potential **positive feedbacks to sources or sinks** that make climate stabilization more critical or more difficult;

(4) **Predict** how ecosystems, biodiversity, & natural resources will change **under different CO_2 & climate change scenarios**;

(5) Determine the likelihood of **success & the potential for side effects of carbon management pathways** that might be undertaken to **achieve a low-carbon future**; &

(6) Address **decision maker needs** for current & future **carbon cycle information** & provide **data & projections** that are **relevant, credible, & legitimate** for their decisions.

Guiding Questions

(1) How do **natural processes & human actions** affect the carbon cycle on land, in the atmosphere, & in the oceans?

(2) How do **policy & management decisions** affect the levels of the primary carbon-containing gases in the atmosphere?

(3) How are ecosystems, species, & natural resources impacted by increasing GHG concentrations, the **associated changes in climate, & by carbon management decisions?**

Emphasis on

(1) Critical nature of long-term commitments to research & observation

(2) Role of humans in global carbon cycle

(3) Need for interdisciplinary research

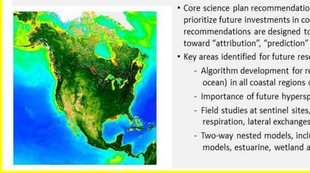
(4)Importance of dealing with & communicating role of uncertainty.

Other Highlights

Observations |Process studies | Modeling | Prediction | Synthesis | Communication

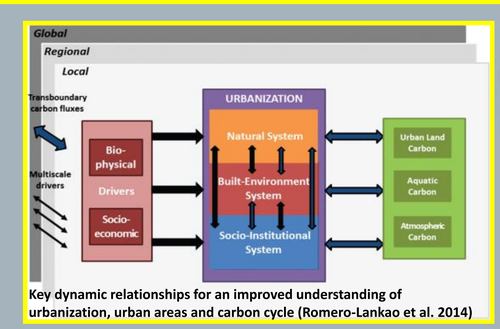
The Development of an Interdisciplinary Science Plan for North American Coastal Carbon Research

- The Coastal CARbon Synthesis (CCARS) Workshop was held August 19-21, 2014 in Woods Hole, MA and brought together ~60 researchers with representation and support from multiple federal agencies (NASA, USGS, NOAA, NSF).
- The CCARS activity brings together scientists involved in two core elements of the USGCRP: the North American Carbon Program (NACP) and the Ocean Carbon and Biogeochemistry Program (OCB).
- Outcomes of past regional activities directed toward "diagnosis" were discussed; major uncertainties in fluxes and gaps in observational coverage were highlighted.
- Science plan deliverable to USGCRP Carbon Cycle Interagency Working Group expected early 2015



- Core science plan recommendations were outlined, designed to help agencies prioritize future investments in coastal carbon cycle research. These recommendations are designed to help the community move from "diagnosis" toward "attribution", "prediction" and "decision support".
- Key areas identified for future research include:
  - Algorithm development for relevant satellite products (terrestrial and ocean) in all coastal regions of North America.
  - Importance of future hyperspectral/geostationary satellites
  - Field studies at sentinel sites, including observations of difficult fluxes, e.g. respiration, lateral exchanges.
  - Two-way nested models, including coupled biogeochemical-hydrodynamic models, estuarine, wetland and benthic models.

CCIWG and SSG members (2013)



Key dynamic relationships for an improved understanding of urbanization, urban areas and carbon cycle (Romero-Lankao et al. 2014)

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United States Carbon Cycle Science Program

An Interagency Partnership

Providing a coordinated & focused scientific strategy for conducting federal carbon cycle research